Public Works and
Government Services Canada

Requisition No. EZ899-152420/A

MERX I.D. No. _____

SPECIFICATIONS
For
SANDSPIT AIRPORT SAND SHED REPLACEMENT
Sandspit Airport
Sandspit, BC

Project No. R.063974.001

REGISTERED ARCHITECT
CHRISTOPHER J.F. ROWE
BRITISH COLUMBIA
150306

APPROVED BY:

_____ 2015-03-17
Regional Manager, A&E Services Date

_____ 2015 03 13.
Construction Safety Co-ordinator Date

TENDER:

_____ 15/03/18
Project Manager Date

Real Property Services Branch, Professional and Technical Services, Pacific Region
#641 B 800 Burrard Street, Vancouver, B.C. V6Z 2V8

REGISTERED ARCHITECT
CHRISTOPHER J.F. ROWE
156325
BRITISH COLUMBIA

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1.1 CODES

.1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments up to the TENDER closing date.

1.2 DESCRIPTION OF WORK

.1 Demolition of existing 12m x 14m steel-framed metal-clad industrial building and associated floor slab and footings and existing below-slab services. The existing building is similar in size, construction, and configuration to proposed new building and occupies the same location."

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 TIME OF COMPLETION

.1 Complete the project facility ready for use within 25 weeks after Contract Award.

1.6 HOURS OF WORK

.1 Restrictive as follows:

.1 Schedule deconstruction, removal and construction work after normal working hours of the building and during the day on weekends and/or holidays. Normal weekday working hours of the building are 7:30am to 4:30pm.

.2 Notify Departmental Representative of all after hours work, including weekends and holidays.

1.7 WORK SCHEDULE

.1 Carry on work as per indicated "PHASES" and as follows:
- .1 Within 10 working days after Contract award, provide a "phasing bar chart" and a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:
  - .1 Submission of shop drawings, product data, MSDS sheets and samples.
  - .2 Commencement and completion of work of each section of the specifications as outlined.
  - .3 Final completion date within the time period required by the Contract documents.
- .2 Do not change approved Schedule – without notifying Departmental Representative.
- .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

1.8 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.

1.9 CODES, BYLAWS, STANDARDS

.1 Perform work in accordance with the National Building Code of Canada 2010 (NBC), and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application, including Manual of Uniform Traffic Control Devices for Streets and Highways.

.2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.

.3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.

.4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

1.10 DOCUMENTS REQUIRED

.1 Maintain 1 copy each of the following at the job site:
- .1 Contract drawings.
- .2 Contract specifications.
- .3 Addenda to Contract documents.
- .4 Copy of approved work schedule.
- .5 Reviewed/approved shop drawings.
- .6 Change orders.
- .7 Other modifications to Contract.
- .8 Field test reports.

.9 Reviewed/approved samples.
.10 Manufacturers' installation and application instructions.
.11 One set of record drawings and specifications for "as-built" purposes.
.12 National Building Code of Canada 2010.
.13 Current construction standards of work quality listed in technical Sections.
.14 Health and Safety Plan.

1.11 REGULATORY REQUIREMENTS

.1 Provide inspection authorities with plans and information required for issue of acceptance certificates.

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

1.12 CONTRACTOR'S USE OF SITE

.1 Perform work in accordance with Contract documents.

.2 Use of site is limited to area indicated on the drawings. Do not unreasonably encumber site with material or equipment.

.3 Do not disrupt airport business except as permitted by the Departmental Representative.

.4 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way. Do not leave equipment on travelled way overnight.

.5 Do not close any lanes of road without approval of the Departmental Representative. Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in Part D of UTCD.

.6 Provide temporary protection for safe handling of public, personnel, pedestrians and vehicular traffic. Provide barricades and lights where directed.

.7 Open flames and inflammable fuels are not permitted.

.8 Park equipment not in use and stockpile materials so that stockpile tops are below 50 to 1 ratio from ends of useable landing strip and below 20 to 1 ratio from sides of aircraft traffic areas. Mark tops with red lights as directed by the Departmental Representative.

.9 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual condition resulting from Project Work which requires road user response.

.10 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in Part D, Temporary Conditions Sign and Devices, of UTCD Manual. Place signs and other devices in locations recommended in UTCD Manual.

.11 Meet with the Departmental Representative prior to commencement of Work to prepare list of signs and other device required for project. If the situation on site changes, revise list to approval of the Departmental Representative. Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.12 Removing or covering signs which do not apply to conditions from day to day.

.13 Access to the operational areas of the airport will be restricted. Equipment and travel by the contractor in executing the work will be under an escort provided by the airport.

1.13 EXAMINATION

.1 Examine site and be familiar and conversant with existing conditions likely to affect work

1.14 EXISTING SERVICES

.1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Departmental Representative.

.2 The Departmental Representative will stake or indicate location of underground facilities such as cables, pipes and ducts. Notify the Departmental Representative of work areas sufficient advance of operations so that underground facilities can be located

1.15 LOCATION OF EQUIPMENT AND FIXTURES

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

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

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

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

1.16 SETTING OUT OF WORK

.1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.

.2 Provide devices needed to lay out and construct work.

.3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

1.17 ACCEPTANCE OF SUBSTRATE

.1 Each trade shall examine surfaces prepared by others and job conditions which may affect work, and shall report defects to the Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.18 QUALITY OF WORK

.1 Ensure that the work is performed through use of skilled trade

.2 The work quality, erection methods and procedures to meet minimum standards set out in the National Building Code of Canada 2010.

.3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

1.19 WORKS COORDINATION

.1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.

.2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
- .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.

.3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.

.4 Work coordination:
- .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
- .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
- .3 Ensure any disputes between workers are resolved.

.5 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.

1.20 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 In accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.

.2 Allow sufficient time for the following:
- .1 Review of product data.
- .2 Approval of shop drawings.
- .3 Review of re-submission.
- .4 Ordering of approved material and/or products.

1.21 SECURITY CLEARANCES

.1 The work of this contract is within the limits of an active Airport.

.2 Personnel employed on this project will be subject to security check. Obtain requisite clearances, as instructed, for each individual required to enter the site.

.3 Personnel will be checked at start of work shift and provided with pass which must be worn at all times.

.4 Contractor shall be fully responsible for securing the premises and its contents throughout the construction period.

.5 Departmental Representative to provide (1) one commissionaire to be present at the work site during construction of the project.

1.22 PROJECT MEETINGS

.1 Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.23 TESTING AND INSPECTION

.1 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:
- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.

.2 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of correct work.

.3 Contractor shall furnish labour and facilities to:
- .1 Notify Departmental Representative 24 hours in advance of planned testing.

.4 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.5 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.

.6 The Departmental Representative may require, and pay for, additional inspection and testing services not specified herein.

.7 Provide Departmental Representative with 2 copies of testing reports as soon as they are available.

1.24 AS-BUILT DOCUMENTS

.1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for "as-built" purposes.

.2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.

.3 Refer to Section 01 78 30 Closeout Submittals.

1.25 CLEANING

.1 Daily conduct cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.

.2 Ensure cleanup of the work areas each day after completion of work.

.3 Clean interior building areas when ready to receive finish painting and continue cleaning on an as-needed basis until building is sufficiently completed or ready for occupancy.

.4 In preparation for interim and final inspections:
- .1 Examine all sight-exposed interior and exterior surfaced and concealed spaces.
- .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces, including glass and other polished surfaces.

.5 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.

1.26 ENVIRONMENTAL PROTECTION

.1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.

.2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.

.3 Ensure proper disposal procedures in accordance with all applicable provincial regulations.

1.27 MAINTENANCE MATERIALS, SPECIAL TOOLS AND SPARE PARTS

.1 Specific requirements for maintenance materials, tools and spare parts are listed in technical Sections.

1.28 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.

.2 Upon request, Departmental Representative may furnish up to a maximum of 10 sets of Contract documents for use by the Contractor at no additional cost. Should more than 10 sets of documents be required the Departmental Representative will provide them at additional cost.

1.29 BUILDING SMOKING ENVIRONMENT

.1 Smoking within the building is not permitted.

1.30 SYSTEM OF MEASUREMENT

.1 The metric system of measurement (SI) will be employed on this Contract.

1.31 FAMILIARIZATION WITH SITE

.1 Before submitting tender, visit site – as indicated in tender documents and become familiar with all **conditions likely to affect the cost of the work**.

1.32 SUBMISSION OF TENDER

.1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1.1 RESTRICTED OR SECURE AREA

.1 Any area on airport property to which access is restricted by sign and/or monitored is a secure or restricted area.

.2 In general, access to the airside of the Airport is restricted to the access points indicated on the drawings or as subsequently approved by the Airport Manager. All personnel and vehicles entering or leaving the construction site must follow prescribed access routes and be under escort or surveillance.

.3 Security measures shall be taken at the Contractor's expense to meet the Airport's security requirements.

.4 The Departmental Representative or Airport Manager may, for security reasons, remove all of the Contractor's workforce from the Airport at any time. No assessment for temporary "Stop Work" periods will be payable by Transport Canada.

1.2 CONTRACTOR'S RESPONSIBILITY

.1 General Contractor and subcontractor shall be responsible for construction, personnel and vehicles employed on project and requiring access to restricted areas.

.2 All Contract personnel and equipment must remain within designated work areas at all times.

.3 Contractors shall be responsible for the security of their own equipment and materials.

1.3 PASSES AND KEYS

.1 Passes are mandatory on airside and other restricted areas for all personnel engaged in work and are subject to AIRPORT RESTRICTED AREA ACCESS CLEARANCE.

.2 Passes for personnel requiring access to restricted area will be made available on application to the Airport Manager.

.3 Temporary passes will be issued at beginning and returned at end of each working day. Their safekeeping will be responsibility of Contractor.

.4 On completion of project, passes will be returned to Airport Manager. A charge of $500.00 will be issued for each pass not returned.

1.4 RESPONSIBLE PERSONNEL

.1 Provide the Departmental Representative and the Airport Manager with a list of responsible personnel and phone numbers, and those of subcontractors, who may be contacted after working hours in case of emergency.

1.5 DELIVERIES

.1 Any delivery vehicle required to encroach on aircraft movement/manoeuvring areas must be coordinated with the Departmental Representative.

.2 Escort vehicle and trained escort personnel must be provided by Contractor.

1.6 EXISTING SECURITY BARRIERS

.1 Security barriers, such as doors, fences, gates, locks, or door hardware, which are required to be removed, must be replaced, if practicable, at the end of each work day. If it is necessary to remove barriers for an extended period, enclose unprotected areas with temporary hoarding. Where the possibility exists that the restricted area may be left unprotected at the end of the work day, inform Airport Manager immediately.

.2 Failure to restore such security barriers when required will result in their restoration by other forces and the cost of such restoration being recovered from the Contractor.

1.7 DAILY SECURITY

.1 Ensure that access to the restricted area is secured at the end of each work day.

.2 When work is to be done within the restricted area after scheduled working hours, notify the Airport Manager of area and times.

.3 The Contractor shall follow the Airport Manager's instructions to maintain airport security during all phases of construction. Any work required to restore airport security will be carried out at the Contractor's expense.

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1.1 GENERAL

.1 This Section specifies general requirements and procedures for the Contractor's submissions of shop drawings, product data, samples and other requested submittals to Departmental Representative for review. Additional specific requirements for submissions are specified in individual technical sections.

.2 Present shop drawings, product data and samples in SI Metric units.

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

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

.5 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract documents and stating reasons for deviations.

.6 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by Departmental Representative's review of submission unless Departmental Representative gives written acceptance of specific deviations.

.7 Make any changes in submissions which Departmental Representative may require consistent with Contract documents and resubmit as directed by Departmental Representative.

.8 Notify Departmental Representative in writing, when resubmitting, of any revisions other than those requested by Departmental Representative.

.9 Do not proceed with work until relevant submissions are reviewed and approved by the Departmental Representative.

1.2 SUBMISSION REQUIREMENTS

.1 Coordinate each submission with the requirements of the work and the Contract documents. Individual submissions will not be reviewed until all related information is available.

.2 Allow 5 days for Departmental Representative's review of each submission, unless noted otherwise.

.3 Accompany submissions with transmittal letter, in duplicate, containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.4 Submissions shall include:
- .1 Date and revision dates.

.2 Project title and number.
.3 Name and address of:
  .1 Subcontractor.
  .2 Supplier.
  .3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract documents.

.5 Details of appropriate portions of work as applicable.
  .1 Fabrication.
  .2 Layout, showing dimensions (including identified field dimensions: and clearances.
  .3 Setting or erection details.
  .4 Capacities.
  .5 Performance characteristics.
  .6 Standards.
  .7 Operating weight.
  .8 Wiring diagrams.
  .9 Single line and schematic diagrams.
  .10 Relationship to adjacent work.

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

1.3 SHOP DRAWINGS

.1 Shop drawings: original drawings or modified standard drawings provided by Contractor to illustrate details of portion of work which are specific to project requirements.

.2 Submit shop drawings for each requirement requested in the specification sections and/or as requested by the Departmental Representative.

.3 Cross-reference shop drawing information to applicable portions of the Contract documents.

.4 Shop Drawings may be submitted in electronic format and via email.

1.4 SHOP DRAWINGS REVIEW

.1 Review of shop drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with the general concept.

.2 This review shall not mean that Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same.

.3 This review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract documents.

.4 Without restricting the generality of the foregoing, the Contractor is responsible for:
- .1 Dimensions to be confirmed and correlated at the job site.
- .2 Information that pertains solely to fabrication processes or to techniques of construction and installation.
- .3 Coordination of the work of all sub-trades.

1.5 PRODUCT DATA

.1 Product data: manufacturers' catalogue sheets, MSDS sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products or any other specified information.

.2 Delete information not applicable to project.

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

.4 Cross-reference product data information to applicable portions of Contract documents.

.5 Submit 6 copies of product data.

1.6 SAMPLES

.1 Samples: examples of materials, equipment, quality, finishes and work quality.

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

.3 Reviewed and accepted samples will become the standard of work quality and material against which installed work will be verified.

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1 GENERAL

1.1 REFERENCES

.1 Manual on Uniform Traffic Control Devices for Streets and Highways - 2009

1.2 RELATED SECTIONS

.1 Section 01 32 19 Security

.2 Section 01 35 33 Health and Safety Requirements.

1.3 GENERAL PROTECTION

.1 Do not disrupt airport business except as permitted by the Departmental Representative.

.2 Provide temporary protection for safe handling of public, personnel, pedestrians, and vehicular traffic.

.3 Provide barricades and lights where directed.

.4 Comply with requirements of Acts, Regulations, and By-laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

.5 When working on travelled way:

.1 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.

.2 Do not leave equipment of travelled way overnight.

.6 Do not close any lanes of road without approval of Departmental Representative. Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in Part D of UTCD.

.7 Open flames and flammable fuels are not permitted.

.8 Park equipment not in use and stockpile materials so that the stockpile tops are below 50 to 1 ratio from ends of useable landing strip and below 20 to 1 ratio from sides of aircraft traffic areas. Mark tops with red lights as directed by the Departmental Representative.

1.4 UNDERGROUND FACILITIES

.1 The Departmental Representative will stake of indicate location of underground facilities such as cables, pipes, and ducts.

.2 Notify the Departmental Representative of work areas sufficiently in advance of operations so that underground facilities can be located.

1.5 INFORMATION AND WARNING DEVICES

.1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.

.2 Supply and erect signs, delineators, barricades, and miscellaneous warning devices as specified in Part D, Temporary Conditions Signs and Devices of UTCD manual.

.3 Place signs and other devices in locations recommended in UTCD manual.

.4 Meet with the Departmental Representative prior to commencement of the Work to prepare list of signs and other devices required for the project. If the situation on site changes, revise list to approval of the Departmental Representative.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability, and location. Clean, repair, or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to condition existing from day to day.

1.6 MOVEMENT OF EQUIPMENT AND PERSONNEL

.1 Access to the operational areas of the airport will be restricted. All travel by the contractor in executing the Work will be under an escort provided by the airport.

2 PRODUCTS

NOT USED

3 EXECUTION

NOT USED

END OF SECTION

1.1 REFERENCES

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

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

.3 Canadian Standards Association (CAN/CSA): as amended:
- .1 CAN/CSA Z797-2009 Code of Practice for Access Scaffold.
- .2 CAN/CSA-S269.3M92 (R2013) – Concrete Formwork.
- .3 CAN/CSA S269.1-1975 (R2003) Falsework for Construction Purposes.
- .4 CAN/CSA-S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.4 Fire Protection Engineering Services, HRSDC:
- .1 FCC No. 301, Standard for Construction Operations.
- .2 FCC No. 302, Standard for Welding and Cutting.

.5 American National Standards Institute (ANSI):
- .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.6 Province of British Columbia:
- .1 Workers Compensation Act Part 3 - Occupational Health and Safety.
- .2 Occupational Health and Safety Regulation.

1.2 RELATED SECTIONS

.1 All Sections Refer to Table of Contents

1.3 WORKERS' COMPENSATION BOARD COVERAGE

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

.2 Maintain WorkSafe BC coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

.1 The Departmental Representative may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of the Departmental Representative, refuses to comply with a requirement of WorkSafe BC.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by WorkSafe BC Regulations.

1.5 SUBMITTALS

.1 Submit to Departmental Representative submittals listed for review.

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

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

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

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

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

1.6 RESPONSIBILITY

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

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

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

1.7 GENERAL CONDITIONS

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

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
- .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
- .2 Secure site at night time as deemed necessary to protect site against entry.

1.8 REGULATORY REQUIREMENTS

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

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

1.9 WORK PERMITS

.1 Obtain specialty permits related to project before start of work.

1.10 FILING OF NOTICE

.1 The Contractor is to complete and submit a Notice of Project as required by Provincial authorities.

.2 Provide copies of all notices to the Departmental Representative.

1.11 HEALTH AND SAFETY PLAN

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

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

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
.3 List hazardous materials to be brought on site as required by work.
.4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
.5 Identify personal protective equipment (PPE) to be used by workers.
.6 Identify personnel and alternates responsible for site safety and health.
.7 Identify personnel training requirements and training plan, including site orientation for new workers.

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

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

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

1.12 EMERGENCY PROCEDURES

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

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

.3 Provide written rescue/evacuation procedures as required for, but not limited to:
.1 Work at high angles.
.2 Work in confined spaces or where there is a risk of entrapment.
.3 Work with hazardous substances.
.4 Underground work.
.5 Work on, over, under and adjacent to water.
.6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

.5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.13 HAZARDOUS PRODUCTS

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

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

- .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00 Shop Drawings, Product Data, and Samples.
- .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
- .3 Provide adequate means of ventilation in accordance with Section 01 51 00 Temporary Facilities.

1.14 AMMONIA GAS

.1 Excavation activities in areas adjacent to aprons and taxiways of certain airports have resulted in encounters with ammonia gas.

- .1 Ammonia gas results from decomposition of urea, used for de-icing purposes, which seeps through surface pavement joints and cracks to become trapped in sometimes heavily concentrated pockets in underlying and adjacent soil.

.2 Advise all workers, before any such excavation work, that should the smell of ammonia be detected at any time when working in excavations, then the workers must immediately leave the excavation area until such time as the volume of ammonia can be measured and appropriate safety measures are taken.

.3 Ensure that all workers are aware that, at certain levels of concentration, unprotected exposure to ammonia can result in nose and throat irritation, breathing difficulty, and eye and skin irritation. Prolonged exposure without adequate protection could result in serious and permanent damage to personal health.

.4 Notify Departmental Representative immediately upon detection of ammonia.

.5 The Departmental Representative will act to have the ammonia gas concentration measured immediately and, depending upon the results, will direct procedures to be adopted for the safety of all personnel in adjacent areas.

1.15 ELECTRICAL SAFETY REQUIREMENTS

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

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

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

1.16 ELECTRICAL LOCKOUT

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

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

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

1.17 OVERLOADING

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

1.18 SCAFFOLDING

.1 Design, construct and maintain scaffolding (mobile or fixed) in a secure and safe manner, in accordance with CSA Z797-2009 and WorkSafe BC Regulations.

1.19 CONFINED SPACES

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

1.20 POWDER-ACTUATED DEVICES

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

1.21 FIRE SAFETY AND HOT WORK

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

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

1.22 FIRE SAFETY REQUIREMENTS

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

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

1.23 FIRE PROTECTION AND ALARM SYSTEM

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

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

1.24 UNFORESEEN HAZARDS

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

1.25 POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:

- .1 Health and Safety Plan.
- .2 Sequence of work.
- .3 Emergency procedures.
- .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
- .5 Notice of Project.
- .6 Floor plans or site plans.
- .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
- .8 Workplace Hazardous Materials Information System (WHMIS) documents.
- .9 Material Safety Data Sheets (MSDS).
- .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

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

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

1.26 MEETINGS

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

1.27 CORRECTION OF NON-COMPLIANCE

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

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

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

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1.1 ACCESS AND DELIVERY

.1 Only the designated entrance may be used for access to building.
- .1 Maintain for duration of Contract.
- .2 Make good damage resulting from Contractor's use.

1.2 STORAGE FACILITIES

.1 Storage space will be limited to the area of construction.

1.3 POWER

.1 Electrical power at existing site may be used for deconstruction and construction purposes at no extra cost.

1.4 WATER SUPPLY

.1 Water supply is available at existing building and may be used for construction purposes at no cost.

1.5 SANITARY FACILITIES

.1 Provide and maintain washroom facilities on a daily basis for use of persons working at site, in compliance with requirements of the authorities having jurisdiction.
- .1 Portable toilets will be provided and maintained at a minimum.

1.6 SCAFFOLDING

.1 Contractor's choice of rigid or movable scaffolding conforming to WorksafeBC requirements.

1.7 REMOVAL OF TEMPORARY FACILITIES

.1 Remove temporary facilities from site when directed by the Departmental Representative.

1.8 SIGNS AND NOTICES

.1 Signs and notices for safety and instruction shall be in both official languages or graphic symbols conforming to CAN/CSA-Z321-96 (R2006).

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

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1.1 PRODUCTS/MATERIAL AND EQUIPMENT

.1 Use NEW products/material and equipment unless otherwise specified. The term "products" is referred to throughout the specifications.

.2 Use products of (1) one manufacturer for material and equipment of the same type or classification unless otherwise specified.

.3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

.5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.
- .1 Prevent electrolytic action between dissimilar metals.
- .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.

.6 Fastenings which cause spalling or cracking are not acceptable.

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

.8 Use heavy hexagon heads, semi-finished unless otherwise specified.

.9 Bolts may not project more than 1 diameter beyond nuts.

.10 Types of washers as follows:
- .1 Plain type washers: use on equipment and sheet metal.
- .2 Soft gasket lock type washers: use where vibrations occur.
- .3 Resilient washers: use with stainless steel.

.11 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.

.12 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.

.13 Store products in accordance with suppliers' instructions.

.14 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction:
- .1 Use primer or enamel to match original.
- .2 Do not paint over nameplates.

1.2 QUALITY OF PRODUCTS

.1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.

.2 Defective products will be rejected regardless of previous inspections.

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

.3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.

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

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

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

1.3 AVAILABILITY OF PRODUCTS

.1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items.

.2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.

.3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

1.4 MANUFACTURER'S INSTRUCTIONS

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

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

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

1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

.1 Products are specified by **"Prescriptive" specifications**: select any product meeting or exceeding specifications.

.2 Products specified under **"Acceptable Products"**: select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.

.3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.

.4 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer and independent laboratory report showing that the product meets or exceeds the specified requirements.

1.6 SUBSTITUTION AFTER CONTRACT AWARD

.1 No substitutions are permitted without prior written approval of the Departmental Representative.

.2 [Sentence Deleted]

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

.4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

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

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1.1 RELATED WORK

.1 Refer to each individual technical section for additional waste management and disposal requirements related to the work of that section.

1.2 DEFINITIONS

.1 Waste Audit (WA): relates to projected waste generation. Involves controlled separation of waste.

.2 Waste Reduction Workplan (WRW): a written report which addresses opportunities for reduction, re-use or recycling of materials.

.3 Materials Source Separation Program (MSSP): consists of a series of ongoing activities to separate re-usable and recyclable waste material into material categories from other types of waste at point of generation.

1.3 MATERIALS SOURCE SEPARATION

.1 Before project start-up, prepare Materials Source Separation Program. Provide separate containers for re-usable and/or recyclable materials of the following:
- .1 Gypsum board.
- .2 Metals.
- .3 Wood.
- .4 Plastics
- .5 Other materials as indicated in technical sections.

.2 Implement Materials Source Separation Program 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.

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

1.4 DIVERSION OF MATERIALS

.1 Create a list of materials to be separated from the general waste stream and stockpiled in separate containers, to the approval of the Departmental Representative and consistent with applicable fire regulations.
- .1 Mark containers.
- .2 Provide instruction on disposal practices.

1.5 STORAGE, HANDLING AND APPLICATION

.1 Do work in compliance with Waste Reduction Workplan.

.2 Handle waste materials not re-used, salvaged, or recycled in accordance with appropriate regulations and codes.

.3 Materials in separated condition: collect, handle, store on site, and transport off-site to an approved and authorized recycling facility.

.4 Materials must be immediately separated into required categories for re-use or recycling.

.5 Unless specified otherwise, materials for removal become the Contractor's property.

.6 On-site sale of salvaged/recyclable material is not permitted.

.7 **Provide Departmental Representative with receipts** indicating quantity of material delivered to landfill.

.8 **Provide Departmental Representative with receipts** indicating quantity and type of materials sent for recycling.

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1.1 SUBMISSION

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

.2 Revise content of documents as required before final submittal.

.3 Phasing of submission:

.1 2 weeks before substantial performance of the work for Phase 1 construction, submit to Departmental Representative 4 final copies of operation and maintenance manuals.

.2 2 weeks before substantial performance of the work for Phase 2 construction, submit to Departmental Representative 4 final copies of Phase 2 supplements to operation and maintenance manuals.

.4 Ensure spare parts, maintenance materials and special tools provided are new, neither damaged nor defective, and of same quality and manufacture as products provided in work.

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

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

1.2 FORMAT

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

.2 Binders: vinyl, hard covered, 3 "D" ring, loose leaf 219x279 mm with spine and face pockets.

.3 Cover: identify each binder with typed or printed title "Project Record Documents"; list title of project and identify subject matter of contents.

.4 Arrange content by systems under section numbers and sequence of Table of Contents.

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

.6 Text: manufacturer's printed data, or typewritten data.

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

1.3 CONTENTS, EACH VOLUME

.1 Table of contents – provide the following:

.1 Title of project.
Date of submission.

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

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

.2 For each product or system, 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 products and component parts, and data applicable to installation. Delete inapplicable information.

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

1.4 AS-BUILT DOCUMENTS

.1 **Contract drawings** and shop drawings: legibly mark each item to record actual construction, including:
- .1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .2 Field changes of dimension and detail.
- .3 Changes made by change orders.
- .4 Details not on original Contract drawings.
- .5 References to related shop drawings and modifications.

.2 **Contract Specifications**: legibly mark each item to record actual "Workmanship of Construction", including;
- .1 Manufacturer, trade name, and catalogue number of each "Product/Material" actually installed, particularly optional items and substitute items.
- .2 Changes made by addenda and change orders.

.3 As-built information:
- .1 Record changes in red ink.
- .2 Mark on 1 set of drawings, specifications and shop drawings at completion of project and, before final inspection, neatly transfer notations to second set.
- .3 Provide 1 set of CDs in AutoCAD dwg. file format with all as-built information on the CDs.
- .4 Submit all sets for the Departmental Representative.

1.5 EQUIPMENT AND SYSTEMS

.1 Operating procedures – include the following:
- .1 Start-up, break-in, and routine normal operating instructions and sequences.
- .2 Regulation, control, stopping, shutdown, and emergency instructions.
- .3 Summer, winter, and any special operating instructions.

.2 Provide servicing and lubrication schedule, and list of lubricants required.

.3 Include manufacturer's printed operation and maintenance instructions.

.4 Include sequence of operation by controls manufacturer.

.5 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.6 Provide installed control diagrams by controls manufacturer.

.7 Provide Contractor's coordination drawings with installed colour coded piping diagrams.

.8 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.9 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.10 Additional requirements: as specified in individual specification Sections.

1.6 MANUFACTURER'S DOCUMENTATION REPORTS

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

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

1.7 SPARE PARTS

.1 Provide spare parts in quantities specified in individual specification Sections.

.2 Provide items of same manufacture and quality as items in work.

.3 Deliver to on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to the Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.8 MAINTENANCE MATERIALS

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

.2 Provide items of same manufacture and quality as items in work.

.3 Deliver to on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to the Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.9 SPECIAL TOOLS

.1 Provide special tools in quantities specified in individual specification Sections.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items:
- .1 Submit inventory listing to the Departmental Representative.
- .2 Include approved listings in maintenance manual.

1.10 WARRANTIES, BONDS, TEST REPORTS, INSPECTION REPORTS

.1 Separate each Document with index tab sheets keyed to Table of Contents listing.

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

.3 Obtain Warranties, Bonds, Test Results, Inspection Reports executed in duplicate by subcontractors, suppliers, manufacturers, and inspection agencies within 10 days after completion of the applicable item of work.

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

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

.6 Co-execute submittals when required.

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

1.11 COMPLETION

.1 Submit a written certificate that the following have been performed:
- .1 Work has been completed and inspected for compliance with the Contract documents.
- .2 Defects have been corrected and deficiencies have been completed.
- .3 Equipment and systems have been tested, adjusted and balanced, and are fully operational.
- .4 Certificates required by the Boiler Inspection Branch, Fire Commissioner of Canada, and utility companies have been submitted.
- .5 Operation of systems has been demonstrated to the personnel indicated by the Departmental Representative.
- .6 Work is complete and ready for final inspection.

2 PRODUCTS

.1 NOT USED

3 EXECUTION

.1 NOT USED

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

.1 All Sections Refer to Table of Contents

1.2 CODES, REFERENCES, and STANDARDS

.1 Government of British Columbia
- .1 British Columbia Building Code (BCBC)
  - .1 Part 8 - Safety Measures at Construction and Demolition Sites.
- .2 Worker's Compensation Board (WCB)

.2 Canadian Standards Association (CSA)
- .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structure.

1.3 DEFINITIONS

.1 Alternate Disposal: reuse and recycling of materials by designated facility, user or receiving organization which has valid Certificate of Approval to operate. Alternative to landfill disposal.

.2 Deconstruction: systematic dismantling of structure to salvage materials for reuse. What cannot be reused is considered subsequently for recycling. Ultimate objective is to recover potentially valuable resources while diverting from landfill what has traditionally been significant portion of waste stream.

.3 Demolition: rapid destruction of structure with or without prior removal of hazardous materials.

.4 Disassembly: physical detachment of materials from structure and may include: prying, pulling, cutting, un-screwing.

.5 Hauler: company (possessing appropriate and valid Certificate of Approval) contracted to transport waste, reusable or recyclable materials off site to designated facility, user or receiving organization.

.6 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or well-being or environment if handled improperly.

.7 Processing: tasks which are subsequent to disassembly and may include: moving materials, de-nailing, cleaning, separating and stacking.

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

.9 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

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

.11 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.12 Salvaging reusable materials from remodelling projects before the demolition stage, for resale, reuse on current project or for storage for use on future projects.

.13 Returning reusable items may include pallets and unused products to vendors.

.14 Salvage: removal of structural and non structural structure materials from industrial, commercial and institutional structure deconstruction/disassembly projects for purpose of reuse or recycling.

.15 Source Separation: acts of keeping different types of waste materials separate beginning from first time they become waste.

.16 Used Building Material Receipt: receipt issued at end destination for materials designated for alternate disposal.

.17 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying (by volume or weight) amounts of materials and wastes generated during deconstruction. Indicates quantities of reuse, recycling and landfill.

.18 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.19 Waste Reduction Workplan (WRW): written report which outlines actions to be taken to reduce, reuse and recycle materials during course of deconstruction. Actions based on finding of the Waste Audit (WA).

.20 Weigh Bill: receipt received from recycling facility indicating weight and content of each load/bin of material.

1.4 PROJECT CONDITIONS

.1 Accept the site as it exists and be responsible for all demolition work as shown on the drawings and as specified herein.

.2 Existing Conditions:

.1 Should materials resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of deconstruction, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received.

.2 Structures to be deconstructed on their condition on date of contract award at time of site visit during Bid period. Be responsible for provision of services required for deconstruction.

.3 Make arrangements through the Departmental Representative to visit the site prior to submission of a bid and take whatever time is required to ascertain the site conditions and surrounding features related to the proposed demolition and new construction work and ensure that conditions are suitable for execution of the work. No additional sums of money will be allowed for after acceptance of bid for any items resulting from lack of understanding and familiarity with the site conditions, and failing to report immediately to the Departmental Representative any discrepancies observed on site that are in conflict with the intent of drawings and specifications.

.4 Maintain public safety and traffic control precautions at all times during the demolition work, using properly trained qualified persons to control all Contractor's activities, vehicles, equipment, traffic and all public pedestrian and vehicles traffic that are coming to and from the site or passing along the vicinity of the site access locations.

.5 Provide and maintain necessary perimeter protection including hoarding, guard railing, screen cover, lights and warning signs during execution of the work to fully protect all persons.

.6 Maintain unobstructed safe site access for personnel and removal of materials.

.7 Take precautions to guard against movement, settlements, collapse and damage to adjacent structures, services, utilities, streets, lanes, crosswalks, curbs, paving, landscaping and construction designated to remain.

.8 Prevent debris from accumulating and blocking surface drainage systems and blocking safe exit passage to adjoining streets and property.

.9 Location of existing site utilities are not guaranteed nor is their existence confirmed. Verify the existence of all known service utilities by site examination and review of applicable site servicing engineering drawings available from the municipality, the Owner and utility companies prior to submission of a bid and prior to the commencement of the Work to identify exact locations.

.10 Protect and maintain existing active services designated to remain or as required to facilitate the Work.

.11 Suppress all dust and dirt. Prevent the occurrence of unsanitary conditions, flooding or leaking.

.12 Do not allow dirt, debris or discarded materials to accumulate on site. Remove promptly.

.13 Keep fire extinguishing suppression equipment on hand at all times.

.14 Provide illumination for safe demolition and working conditions, but in no case less than prescribed by WorkSafe BC regulations in areas where Work is being done.

1.5 SUBMITTALS

.1 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.

1.6 CLOSEOUT SUBMITTALS

.1 Receipts from Recycling, Waste Disposal Facilities showing recycling or disposal of materials in compliance with all Provincial and Federal Government Regulations.

1.7 WASTE MANAGEMENT

.1 Separate and handle waste materials in accordance with Section 01 74 19 Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Coordinate with Departmental Representative for any recovery of existing materials, fittings, fixtures and equipment to be salvaged during the demolition operation. All materials forming part of this section of the Work shall become the Contractor's property and shall be removed entirely from the site and disposed of in a legal manner to an approved disposal site as applicable.

3 EXECUTION

3.1 EXAMINATION

.1 Examine the Work and notify the Departmental Representative of any conditions affecting the performance of the Work. Review the drawings and determine the total content of Work to follow.
  .1 Develop strategy for deconstruction to facilitate optimum salvage of reusable and recyclable materials.

.2 Site verify and locate all existing services, utilities and facilities affecting the Work:
  .1 Ensure all services, whether built-in or exposed, are properly located and marked as to position, type of service, size, direction of flow.
  .2 When working in the vicinity of services and utilities, clearly mark, locate and expose all existing utilities using hand labour as required. Maintain and protect all services and utilities encountered in the work.

.3 Inspect materials, equipment, components to be reused or turned over to the Department. Note their conditions and advise the Departmental Representative in writing of any defects or conditions which would affect removal and reuse.

3.2 DEMOLITION

.1 Remove Building as indicated on the drawings.

.2 Salvage existing sliding doors and hardware and turn over to Transport Canada on site.

.3 Breakup large pieces of demolished material for handling and to prevent overloading and damage to existing construction.

.4 Schedule and execute all work in a careful manner with all necessary consideration to prevent injury or damages to persons and to surrounding property. Do not interfere with the use of and passage to and from adjoining buildings, driveways, sidewalks and other facilities.

.5 Demolish in a manner as to minimize dusting. Keep dusty materials, areas or site wetted down thoroughly as applicable to prevent dust and dirt rising. Provide temporary waterline where required for this purpose and remove upon completion of this work.

.6 Salvage and Reuse:

- .1 Carefully remove existing materials and equipment to be retained for future use.
- .2 Where any material, component, or assembly is indicated for retention or reuse, removal shall be by a trade that normally provides or installs such an item.
- .3 Store such items being reused in a protected area until ready to be reinstalled into the new construction proposed.
- .4 Salvaged items designated for turnover to the Department at a location on the site as directed by the Departmental Representative.

.7 Do not let piled material endanger structure or persons at any time.

.8 Remove stockpiled material when it interferes with operations of project.

.9 Prevent debris from blocking any existing surface drainage catch basins or systems.

.10 Ensure that partial or incomplete demolished structures are stable upon completion of each day's work by taking requires safety measures such as temporary shoring if required to ensure the structures are and will remain in a stable condition for a normal or extended period of inactivity should a delay be caused to the progress of the work.

.11 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving,

.12 Stockpile topsoil for final grading and landscaping.

3.3 REVIEW

.1 Contractor to notify Departmental Representative at least 24 hours in advance of any necessary reviews of the work.

3.4 CLEANING

.1 Upon completion of demolition, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1. General

1.1 DOCUMENTS

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

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment, access, cooperation, coordination and services to allow the testing of concrete and concrete reinforcement to be carried out by a Testing Agency responsible to the Owner.

.2 The scope of the required quality assurance testing is described in this section to inform the Contractor of the type and scope of testing on the project and to allow the Contractor to make appropriate allowances. The costs for the testing described in this section is not the responsibility of the Contractor. It will be paid for by the Owner. It is the responsibility of the Contractor to schedule the testing described, to coordinate construction schedules with the Testing Agency, and to cooperate with the Testing Agency in the execution of this work.

.3 The scope of the required quality assurance testing is described in this section to inform the Contractor of the type and scope of testing on the project and allow the Contractor to make appropriate allowances.

.4 Testing required by the Contractor for his own quality control will be paid for by the Contractor.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 03 20 00 - Concrete Reinforcement

.2 Section 03 31 00 - Structural Cast-in-Place Concrete

1.4 REFERENCE STANDARDS

.1 Testing of concrete and reinforcement shall conform to the requirements of the following Standards unless otherwise required by this specification:

.1 B.C. Building Code – 2012.

.2 CSA-A23.1-04 - Concrete Materials and Methods of Concrete Construction.

.3 CSA-A23.2-04 - Methods of Test and Standard Practices for Concrete.

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause, and their referenced Standards.

.3 A copy of A23.1 and A23.2 shall be kept on site by the Contractor for the duration of the work and be made available for reference.

1.5 DEFINITIONS - FOR THIS SECTION

.1 "Owner", "Contractor", "Consultant", as per the General Conditions and Definitions.

.2 "Specialty Engineer" is a Professional Engineer registered in B.C. responsible for components designed by the Contractor and who seals and signs shop drawings.

.3 "Testing Agency" shall mean the testing agency responsible to the Owner.

.4 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

1.6 APPOINTMENT OF TESTING AGENCY

.1 The Owner shall hire a CSA-approved Testing Agency who shall test concrete, reinforcement and grout as per this specification.

.2 Testing paid for by the Owner.

.1 Review of initial mix designs.

.2 Testing as outlined in Section 3.0, except for testing required by the Contractor for stripping of formwork.

.3 Testing paid for by the Contractor.

.1 Review of Contractor-requested mix design changes.

.2 Any waiting time incurred by the Testing Agency in excess of 1/2 an hour.

.3 Any additional costs due to overtime, shift work, holiday or weekend work, except that the Owner will pay for holiday or weekend pickup when the concrete was placed on a regular workday.

.4 Costs for testing required by the Contractor for stripping of formwork, such as field cure cylinders etc.

.5 Cost for retesting or additional testing of concrete or reinforcement where tests have failed to meet the specified requirements.

2. Duties

2.1 RESPONSIBILITY OF THE CONTRACTOR

.1 The Contractor shall cooperate fully with the Testing Agency.

.2 The Contractor shall give the Testing Agency at least four (4) hours prior notice of concrete placement.

.3 It is the Contractor's responsibility to provide a finished product that meets the specification. If initial tests indicate that the concrete failed to meet the specification, the Consultant shall decide if any additional testing is necessary. This testing shall be done by a CSA-approved Testing Agency, but need not be the Owner's agency. The proposed additional testing shall have prior approval of the Consultants.

.4 Strengths of cored samples must equal the specified strength if tested dry or 85% of specified if tested wet, with wet or dry tests as per the Standard.

2.2 RESPONSIBILITY AND DUTIES OF THE TESTING AGENCY

.1 The Testing Agency is responsible to the Owner and has the authority to, and is expected to, reject any concrete not meeting the specifications.

.2 If the Testing Agency becomes aware that concrete is being placed without their notification, or if insufficient notice is received, then the Testing Agency shall notify the Consultant immediately.

.3 Low 7-day, 28-day, and 56-day strength tests shall be brought immediately to the

attention of the Consultant and the Contractor.

3. Testing - Concrete And Reinforcement

3.1 GENERAL

.1 All strength tests shall be numbered consecutively and the cylinders marked as follows:

.1 7-Day Test: Marked "A".

.2 28-Day Test: Two (2) cylinders marked "B" and "C".

.2 All tests reports shall record:

.1 Name of Project

.2 Date and time of sampling

.3 Name of supplier

.4 Delivery truck number

.5 Batch time and discharge time

.6 Identification of sampling and testing technicians

.7 Exact location in the structure of the concrete sampled

.8 Design strength of concrete sampled

.9 Admixtures, cement type, maximum aggregate size

.10 Air and concrete temperature

.11 Slump, and air content

.3 All field cured cylinders shall be marked "F".

.4 Slump tests shall be performed prior to the addition of superplasticizers.

.5 Tests for slump and air content shall be taken with each strength test and as required by the specifications and drawings.

3.2 REGULAR TESTING - CONCRETE

.1 To conform to the Standard, except each test shall consist of three (3) cylinders - one (1) for 7-day strength and two (2) for 28-day strength.

.2 Regular testing applied to all elements not listed in Clause 3.3 - Full Time Testing.

3.3 FIELD CURED CYLINDERS

.1 Field cure cylinders shall be protected against wind and be stored on the floor immediately below the slab they represent unless the floor below is heated. In that case they shall be stored on top of the slab but covered with a plywood box. The cylinders are to be undisturbed at this location until picked up by the Testing Agency. Field core cylinders are not to be stored in temperature controlled containers.

3.4 TESTING REINFORCEMENT

.1 The Testing Agency shall, over the duration of the project, perform at least one (1)

tensile and bend test for each bar size and mill stamp used on the project. Such testing shall comply with the applicable CSA documents. Further testing may be requested at the Consultant's discretion.

.2 The Testing Agency will select the bars to be tested from the reinforcing supplied to the construction site, not from the suppliers' yard. The Contractor shall cut the bars to the required length and replace the shortened bars without cost to the Owner.

.3 The Contractor shall supply mill certificates of chemical analysis in accordance with CAN/CSA G30.18R and G30.18W for all bar supplied to site.

END OF SECTION 03 00 50

1. General

1.1 DOCUMENTS

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

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services necessary to supply, erect, and strip all formwork and falsework for poured-in-place concrete shown or indicated on the contract drawings and specifications.

.2 Install all anchor bolts, embedded metal, inserts, hangers, reglets, dovetail anchors etc. supplied by applicable trades for casting into concrete and assume responsibility for correct positioning within the agreed tolerance and in accordance to drawings supplied by the trade.

.3 Install all openings, sleeves, blockouts, etc. required by other trades and assume responsibility for correct positioning within the agreed tolerance and in accordance to drawings supplied by the trade.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 03 20 00 - Concrete Reinforcement

.2 Section 03 31 00 - Structural Cast-in-Place Concrete

1.4 REFERENCE STANDARDS

.1 Concrete formwork shall conform to the requirements of the following Standards unless otherwise required by this specification:

.1 B.C. Building Code – 2012.

.2 CSA-A23.1-04 - Concrete Materials and Methods of Concrete Construction.

.3 CSA-A23.3-04 - Code for the Design of Concrete Structures for Buildings.

.4 CSA-S269.3 – Concrete Formwork

.5 Workers' Compensation Board of B.C. (WCB) – Sections 20.17 to 20.26.

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

.3 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.5 DEFINITIONS - FOR THIS SECTION

.1 "Owner", "Contractor", "Consultant" as per the General Conditions and Definitions.

.2 "Specialty Engineer" is a Professional Engineer registered in B.C. responsible for components designed by the Contractor and who seals and signs shop drawings.

.3 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

2. Products

2.1 GENERAL

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

2.2 MATERIALS

.1 Form Material

.1 Exposed surfaces - metal, plywood or plywood lined. Plywood to conform to the Standard.

.2 Unexposed surfaces - metal, plywood, or wood lumber to conform to the Standard.

.3 Plywood and wood formwork materials shall, conform to the Standard, be free from warp and sawn straight so that lines and shapes will be accurately retained.

.4 Un-lined forms for unexposed surfaces shall be made with a good grade of lumber or plywood and fitted so that there will be no leakage of mortar.

.5 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be GIS exterior grade fir plywood with waterproof glue.

.6 Proprietary and/or modular forming systems shall be designed such that they do not interfere with the specified placement of reinforcement or other embedded hardware and must be pre-approved by the Consultant.

.2 Ties And Spreaders

.1 Use metal form ties that are adjustable in length to permit tightening of forms. Use only the snap-off type of form ties which will permit no metal within 25mm (1") of the concrete surface after removal. Twisted wire form ties will not be accepted.

.2 Wood spreaders inside wall forms will not be permitted.

.3 Form Release Agent

.1 Use a non-staining form release agent that is compatible with any finishes specified elsewhere in the contract documents.

.4 Void Form

.1 Void form shall be of a deteriorating material.

3. Execution

3.1 GENERAL

.1 All phases of concrete formwork construction shall be in accordance with the Standard unless otherwise specified herein or on the drawings. Only workers who are skilled and experienced in their trade shall do the work.

3.2 LINES AND LEVELS

.1 Verify lines, levels and column centres before proceeding with work and ensure that dimensions agree with drawings.

.2 Co-ordinate and co-operate with all other trades in forming and setting of recesses, chases, sleeves, inserts, bolts, and hangers.

3.3 DESIGN OF FORMWORK, FALSEWORK AND RESHORING

.1 Conform to the Standard.

.2 The Contractor shall assume full responsibility for the structural adequacy of the forms to withstand all concrete, environmental, and construction loads.

.3 As a minimum, the work shall conform to CSA-A23.1, Section 6.5 for regular work and Section 8.3.4 for architectural concrete.

.4 Where concrete is exposed to view, forms are to be laid out so that joints are kept to a minimum and located in an orderly and symmetrical arrangement wherever possible. Form ties shall be evenly spaced and located in straight horizontal and vertical lines. Spacing and location of form tie holes shall be detailed by the Contractor and approved by the Consultant. See also the architectural drawings and specifications for any special requirements for architectural concrete.

.5 The strength and rigidity of forms shall be such that they will not leak mortar or result in visible irregularities in the finished concrete. In addition the deflection of facing materials between studs, as well as the deflection of studs and whalers, shall not exceed 0.0025 times the span.

.6 Forms shall be so constructed that the finished concrete will conform to the shape, dimensions and tolerances as specified in the Standard or on the structural drawing, whichever is most rigorous. They shall also incorporate the cambers specified on the structural drawings. Movement resulting from form support deflection, closure of form joints, and elastic shortening of forms and shoring, must be calculated and added to the cambers indicated on the drawings.

.7 Construct forms so that they may be dismantled and removed without damaging the concrete.

.8 The Contractor shall submit details of the sequence and extent of formwork removal and re-shoring to the Consultant for review. Such details shall include magnitude of loads and location of all reshores at each level. Forms shall not be removed or adjusted until the review is complete. Such review does not relieve the Contractor of responsibility for formwork and safety during construction.

.9 Set shores on wedges or use adjustable shores so they may be removed without causing undue strains in the concrete.

.10 Do not exceed the safe capacity of the structure with any construction or shoring loads. The safe capacity of the structure may be taken as the design live load, as indicated on the structural drawings, multiplied by the ratio of the concrete strength at the time of loading to the specified concrete strength, but not greater than 1.0.

3.4 ERECTION

.1 Sleeves and openings shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings. Any discrepancies are to be reported to the Consultant.

.2 Sleeves and openings not shown on the structural drawings must be approved by the Consultant.

.3 Keep all untreated forms moist to prevent shrinkage prior to placing of concrete and wet the surface at time of placing.

.4 Treated formwork surfaces shall have the approved form coating applied in accordance with the manufacturer's recommendations, prior to placing reinforcing steel. Remove any excess form coating.

3.5 TOLERANCES

.1 The tolerances for all concrete work shall conform to the requirements of the Standard and Drawings.

3.6 PRODUCT HANDLING

.1 Protect formwork materials before, during and after installation and protect installed work and materials of other trades.

.2 In the event of damage, immediately make required repairs or replacements necessary to the approval of the Consultant at no extra cost to the Owners.

3.7 REMOVAL OF FORMWORK

.1 Forms shall not be removed until concrete has attained sufficient strength that no damage to strength or continuity of concrete will occur when forms are removed. Time for formwork removal of suspended concrete shall be approved by the Consultant. See also the requirements of Section 3.3.

.2 Prying against face of concrete to remove forms is not allowed, only wooden wedges shall be used.

.3 Removal of form ties shall be done carefully to avoid marking concrete and to allow for patching. Grout bottom of form tie hole to prevent rust staining.

End of Section 03 11 00

1. General

1.1 DOCUMENTS

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

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services necessary to supply and install reinforcing steel work shown or indicated in all the contract drawings and specifications including accessories such as hanger bars, spirals, wire ties, support bars, chairs, spacers supports or other devices required to position reinforcing properly.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 03 00 50 - Testing of Concrete and Reinforcement

.2 Section 03 11 00 - Concrete Formwork

.3 Section 03 31 00 - Structural Cast-in-Place Concrete

1.4 REFERENCE STANDARDS

.1 Concrete reinforcing shall conform to the requirements of the following Standards unless otherwise required by this specification:

.1 B.C. Building Code – 2012.

.2 CSA-A23.1-04 - Concrete Materials and Methods of Concrete Construction.

.3 CSA-A23.2-04 - Methods of Test and Standard Practices for Concrete.

.4 CSA-A23.3-04 - Code for the Design of Concrete Structures for Buildings.

.5 CSA G30.5M - Welded Steel Wire Fabric for Concrete Reinforcement.

.6 CSA G30.15M - Welded Deformed Steel Wire for concrete reinforcement.

.7 CAN/CSA G30.18 - Billet Steel Bars for Concrete Reinforcement

.8 CSA-W47.1 - Certification Of Companies For Fusion Welding Of Steel Structures

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

.3 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.5 DEFINITIONS FOR THIS SECTION

.1 "Owner", "Contractor", "Consultant" as per the General Conditions and Definitions.

.2 "Specialty Engineer" is a Professional Engineer registered in B.C. responsible for components designed by the Contractor and who seals and signs shop drawings.

.3 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

1.6 TESTING

.1 As per Section 03 00 50 - Testing of Concrete and Reinforcement.

2. Products

2.1 GENERAL

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

2.2 MATERIALS

.1 Reinforcing bars shall conform to the Standard unless otherwise specified herein or on the drawings.

.2 Reinforcing bars to be welded shall conform to the Standard, G30.18W.

.3 Welded wire fabric shall conform to the Standard, size and gauges as shown on the drawings.

.4 Welded wire fabric for slabs shall be delivered in flat sheets.

.5 In suspended parking slabs, bar support chairs shall be plastic or plastic coated.

3. Execution

3.1 GENERAL

.1 All phases of concrete reinforcement work shall be in accordance with the Standards unless otherwise specified herein or on the drawings. The Contractor shall ensure that the work is executed only by workers skilled and experienced in their trade.

.2 The Contractor shall notify the Consultant at least 24 hours before any concrete is placed in order that the Consultant may review the work.

3.2 **FABRICATION**

.1 Fabricate all reinforcing to the Standard and contract documents.

.2 Reinforcing bars shall be cold bent. Bars shall not be straightened or re-bent.

.3 Splices in reinforcing bars at locations not shown on the drawings must be submitted for review by the Consultant. Such splices shall conform to the Standards.

3.3 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Store reinforcement in a manner to prevent excessive rusting and fouling with dirt, grease, form-oil and other bond-breaking coatings

.2 Reinforcement at the time concrete is placed shall be free from excessive rusting, mud, oil or other coatings that adversely affect its bonding capacity

3.4 PLACING

.1 Reinforcing of size and shapes shown on the structural drawings shall be accurately placed in accordance with the drawings and the requirements of the Standard.

.2 Reinforcement shall be adequately supported by chairs, spacers, support bars, hangers or other accessories, and secured against displacement within the

tolerances permitted in the Standard. Support devices contacting surfaces exposed to the exterior shall be non-corroding.

.3 Bars that are not part of the structural design or drawings, and whose only function is supporting other reinforcing in lieu of other support accessories, shall be considered as accessories.

.4 In suspended parking slabs, uncoated metal ties shall not extend more than 5.0 mm (3/16") into the concrete cover.

.5 All rebar shall be adequately tied and chaired to maintain it in the specified location during pouring. Lifting of reinforcing or welded wire mesh into specified position during the concrete pour will not be allowed.

.6 Tolerances for bar placement shall be as per the Standard. Tolerances shall not be used to justify the use of chair, bolsters, or chair/support combinations which result in improper cover.

3.5 WELDING

.1 Any welding of reinforcing steel shall be in accordance with the Standard.

.2 Welding of concrete reinforcement shall be performed by workmen who are approved by the Canadian Welding Bureau in accordance with the Standard. Copies of the Canadian Welding Bureau approved welding procedure and certificate of current operator qualification shall be submitted to the Consultant prior to commencement of welding.

3.6 CONSTRUCTION REVIEW

.1 No concrete shall be placed until the Consultant has completed a review of reinforcing in place. The Contractor shall provide a minimum of 24 hours notice of the time when the reinforcement will be substantially in place and ready for the Consultants review. A minimum of 6 hours is to be provided for review and any required remedial work prior to concrete placement.

End of Section 03 20 00

1. General

1.1 DOCUMENTS

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

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services necessary to supply and install cast-in-place concrete work shown or indicated in all the contract drawings and specifications including concrete toppings, bases, sumps, curbs, posts, manholes, pits, paving, sidewalks, equipment bases or curbs, grouting of baseplates, etc.

.2 Coordinate concrete placement fully with other trades. Ensure other related work such as inserts, dowels, sleeves, reinforcement, etc. is complete before placing concrete.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 03 00 50 - Testing of Concrete and Reinforcement

.2 Section 03 11 00 - Concrete Forming

.3 Section 03 20 00 - Concrete Reinforcement

1.4 REFERENCE STANDARDS

.1 Concrete work shall conform to the requirements of the following Standards unless otherwise required by this specification:

.1 B.C. Building Code – 2012.

.2 CSA-A23.1-04 - Concrete Materials and Methods of Concrete Construction.

.3 CSA-A23.2-04 - Methods of Test for Concrete.

.4 CSA-A23.3-04 - Code for the Design of Concrete Structures for Buildings.

.5 CSA-S413 - Parking Structures.

.2 Where the Standard is referenced in this specification it shall mean the documents specified in this clause and their referenced documents.

.3 A copy of A23.1 and A23.2 shall be kept by the Contractor on site for the duration of the work and be made available for reference.

1.5 DEFINITIONS FOR THIS SECTION

.1 "Owner", "Contractor", "Consultant" as per the General Conditions and Definitions.

.2 "Specialty Engineer" is a Professional Engineer registered in B.C. responsible for components designed by the Contractor and who seals and signs shop drawings.

.3 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

1.6 SUBMITTALS

.1 Keep a record at the job site showing time and place of each pour of concrete, together with a transit-mix delivery slip certifying contents of pour. Make the record available to the Owner for his inspection upon request. Upon completion of this portion of work, submit placing records and delivery slips to the Owner.

.2 Submit details of proposed methods of concrete curing and provisions for weather protection to the Consultant for review

.3 Submit plan locations and details of construction joints for the Consultants review

2. Products

2.1 GENERAL

.1 Products shall satisfy the requirements of the Standard unless otherwise specified herein or on the drawings.

.2 Provide samples of materials on request

2.2 MATERIALS

.1 Cement for S-1, S-2, and S-3 concrete shall be as per Table 3 A23.1 and conform to the Standard.

.2 Mixing water shall conform to the Standard.

.3 Air entraining admixtures to the Standard.

.4 Calcium chloride, either as a raw material or as a constituent in other admixtures, shall not be used unless approved in writing by the Consultant.

.5 Curing compounds shall conform to the specification and shall also be compatible with specified floor hardeners, covering adhesives and waterproofing compounds.

.6 Grout shall be preapproved, premixed, non-shrink conforming to the Standard. Exposed grout shall be non-staining cement grey in colour.

3. Execution

3.1 GENERAL

.1 All phases of concrete work shall be in accordance with the Standard unless otherwise specified herein or on the drawings. The work shall be executed only by experienced and skilled workers.

.2 The Contractor shall notify the Consultant at least 30 hours before any concrete is placed to allow the Consultant to review the work.

3.2 MIX DESIGNS

.1 Concrete mixes shall be proportioned by the supplier to meet the compressive strength, exposure class, and other performance specifications noted in the contract documents. In addition, concrete mix design shall satisfy the transport, placing, and finishing requirements of the Contractor. All concrete

shall be normal weight unless noted otherwise. Concrete types are specified in accordance with CSA-A23.1 Table 5, Alternate 1.

.2 Concrete mix design is the responsibility of the supplier, including the use of admixtures, alone or in combination. The supplier is also responsible for ensuring the plastic and hardened properties of the concrete meet the construction and specified requirements. This includes the long term performance of the hardened mix.

.3 Pump mix slumps shall also conform to the above.

.4 Water/Cement ratios and air contents for exposure class shall be as per the Standard.

.5 The proposed mixes shall be submitted to the Consultant and Testing Agency for review.

.6 The mix designs shall note the constituents by weight, the properties required by the structural drawings, and the structural elements for which the mix is to be used.

3.3 PRODUCTION

.1 Production shall conform to the Standard.

3.4 TESTING

.1 As per Section 03 00 50 - Testing of Concrete and Reinforcement

3.5 PLACING OF CONCRETE

.1 Conveying and placing of concrete is to conform to the Standard.

.2 All concrete shall be consolidated by means of vibrators of appropriate size operated by experienced workers.

.3 The use of vibrators to transport concrete shall not be permitted.

.4 Cement slurry used to prime concrete pumps shall be discarded and not placed in the project.

3.6 OPENINGS AND INSERTS

.1 The Contractor shall notify all trades sufficiently in advance to ensure that provision is made for openings, inserts and fasteners. The Contractor shall cooperate with all trades in the forming and setting of all slots, sleeves, bolts, dowels, hangers, inserts, conduits, clips, etc. Any embedded hardware may be subject to review by the Consultant.

.2 Openings and sleeves shown on the structural drawings must be confirmed with mechanical, electrical and architectural drawings.

.3 Openings and sleeves not shown on the structural drawings must be approved by the Consultant.

3.7 CONSTRUCTION AND CONTROL JOINTS

.1 Construction joints shall conform to the Standard except that for horizontal joints in walls it will be sufficient to place fresh concrete on a clean rough

surface unless directed otherwise by the Consultant or otherwise noted on the structural drawings.

.2 Joints in slabs on grade shall be located as indicated on the structural and/or architectural drawings. Unless noted otherwise on the drawings a joint in the slab on grade may be a pour joint, trowelled joint, saw cut, or other pre-approved method. The depth of joints shall be a minimum of ¼ of the thickness of the slab. Saw cut joints are to be completed within 24 hr. of placing. Alternative joint details are to be submitted in writing to the Consultant.

.3 For vertical joints in walls below grade, see standard detail on structural drawings. For locations, see architectural and structural drawings.

.4 Construction joints in walls and columns shall occur at the top of slab and at the underside of slab/beam systems unless noted otherwise on the structural drawings.

.5 Construction joints not shown in the drawings or specifications shall be subject to the approval of the Consultant. The Consultant may require keys, or extra reinforcing to be provided at the Consultant's discretion with associated costs borne by the Contractor.

.6 The existing concrete surface at construction joints shall be wetted thoroughly immediately prior to placement of concrete.

.7 Construction joints exposed to view may be subject to non-structural review by Consultant.

.8 Unless noted otherwise on the drawings, control joints in walls are to be located at a maximum spacing of 9m (30') on centre and detailed as indicated on the structural drawings.

.9 Supply and install pre-molded water-stops in construction joints where indicated on the drawings. Weld joints to make watertight. Install waterstops in accordance with manufacturer's specifications and recommendations. Water stop procedures require approval of Consultant.

3.8 CURING AND PROTECTION

.1 Curing procedures shall be in accordance with the Standard. Alternate methods with Consultants approval, may be used providing they produce concrete that meets the contract documents.

.2 Cold and hot weather protection shall comply with the Standard or the requirements on the structural drawings, whichever are more rigorous.

.3 Concrete place during extreme drying conditions shall satisfy clause 7.4.2.2 of A23.1.

3.9 PATCHING

.1 Honeycomb, exposed reinforcement and other defects shall be repaired and patched by the Contractor at the Contractor's cost using a procedure preapproved by the Consultant. Exposed patching must also be approved by the Consultant.

.2 Immediately after the removal of forms, all bolts, ties, nails or other metal not specifically required for construction purposes shall be removed or cut back to a depth of 25 mm (1") from the surface of the concrete.

3.10 TOLERANCES

.1 Tolerances shall conform to the Standard or the requirements on the structural or architectural contract documents, whichever are more rigorous.

3.11 FINISHING - FLOORS

.1 Finishing shall conform to CSA-A23.1 - Section 7.5 as a minimum. Care shall be taken during finishing to maintain the cambers specified on the structural drawings. See also the architectural drawings and specifications for additional finish requirements.

.2 Unless noted otherwise, floor finishes shall be Class A "institutional and commercial floors" and have gaps less than or equal to 8.0 mm (5/16") under a 3000 mm (10'-0") straight edge. Only a single curvature within this distance is allowed.

3.12 FINISHES - FORMED SURFACES

.1 All formed surfaces shall be treated in accordance with CSA A23.1, Section 7.7 as a minimum. See also architectural drawings and specifications for additional finish requirements.

3.13 ARCHITECTURAL CONCRETE

.1 See architectural drawings and specifications for any requirements. Conform to CSA-A23.1 - Section 8.3 as a minimum.

3.14 OPENINGS THROUGH STRUCTURAL WORK

.1 If, after any part of the structural work has been completed, it is required that additional openings be made through the structure, the Consultant shall be so informed. No opening, including cored sleeves, shall be made through completed work without authorization in writing from the Consultant.

3.15 REJECTION OF DEFECTIVE WORK

.1 In the event that concrete tests do not conform to the requirements of this specification, or when conditions are such to cause doubt about the safety of the structure, testing of the structure will be undertaken at the direction of the Consultant. This may entail further concrete tests, coring or load testing as per the Standard, or any other test the Consultant deems suitable. Such test shall be made at the expense of the Contractor and to the satisfaction of the Consultant.

.2 Where, in the opinion of the Consultant, material or workmanship fails to meet the requirements of the specification, such work may be rejected. Work rejected shall be replaced or repaired to the approval of the Consultant and at no additional cost to the Owner.

End of Section 03 31 00

1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 01 33 00 - Shop Drawings, Product Data, and Samples

.3 Section 01 35 33 - Health and Safety Requirements

.4 Section 01 51 00 - Temporary Facilities

.5 Section 01 60 00 - Product Requirements

.6 Section 01 74 19 - Waste Management and Disposal

.7 Section 01 78 00 - Closeout Submittals

.8 Section 13 34 19 – Metal Building Systems

1.2 REFERENCE DOCUMENTS

.1 American Wood Protection Association (AWPA).
- .1 AWPA M2-01, Standard for Inspection of Treated Wood Products.
- .2 AWPA M4-06, Standard for the Care of Preservative-Treated Wood Products.

.2 Canadian Standards Association (CAN/CSA).
- .1 CAN/CSA B111, Wire Nails, Spikes and Staples.
- .2 CAN/CSA O80 Series, Wood Preservation.
- .3 CAN/CSA O121, Douglas Fir Plywood.
- .4 CAN/CSA O141-05, Softwood Lumber.
- .5 CAN/CSA O151-04, Canadian Softwood Plywood.

.3 National Lumber Grades Authority (NLGA).
- .1 Standard Grading Rules for Canadian Lumber.

1.3 SUBMITTALS

.1 Product Data.
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 Submittal Procedures.
  - .1 Indicate worker cautions to be observed whenever cutting preservative treated material.

.2 Manufacturer's Instructions.
- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 Submittal Procedures.

.3 Closeout Submittals.

.1 Provide operation and maintenance data for products of this section for incorporation into the maintenance manual, in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements, in accordance with Section 01 11 55 General Instructions.
- .1 For Products treated with ACQ (Alkaline copper quaternary).

.2 Sequencing.
- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.5 PROJECT/ SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 Temporary Utilities.

.3 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 60 00 Product Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 Waste Management And Disposal.

1.8 WARRANTY

.1 12 month warranty period specified in the General Conditions.

2 PRODUCTS

2.1 COMPONENTS

.1 Lumber: softwood, S4S. Moisture content: maximum 19% for exterior locations and maximum 12% for interior locations. Refer to drawings for member sizes, profiles and lengths.

.2 Plywood: Douglas Fir (interior not treated).

.3 Nailers, plates, blocking, liners: DFP – Douglas Fir Plywood or CSP – Canadian Softwood Plywood material, "Sheathing" grade.

.4 Ardox Spikes or Wood Screws 3 ½".

.5 Bolts: 12.5 mm dia. unless indicated otherwise, complete with nuts and washers.

.6 Screws: self-tapping and self-drilling case-hardened cadmium plated or epoxy coated wafer-head type.

.7 Use stainless steel fasteners where in contact with ACQ treated lumber.

3 EXECUTION

3.1 COMPLIANCE

.1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

.2 Construct continuous members from pieces of longest practical length.

.3 Align and plumb faces of lumber and panel materials to tolerances of 1:600.

.4 Install wood and plywood components to other building components rigidly secure in place and well anchored.

.5 Secure in place as follows, unless detailed/indicated otherwise.
- .1 To concrete and masonry: screws in conjunction with drilled-in inserts at maximum 200 mm spacing.
- .2 To structural steel members: purpose-made bolts at maximum 200 mm spacing.

.6 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.7 Install exposed items with care and skill producing best fit and appearance of each installed item.

.8 Install back-up/blocking built into wood framing for support of surface-mounted wall items including but not limited to wall stops, cabinets, shelving, bathroom accessories and Owner-supplied equipment. Coordinate locations and spacing to suit surface-mounted wall items. Install minimum 38 x 240 mm size wood blocking fixed in between framing/studs.

.9 Equipment backboards:

.1 Use full size sheets of 19 mm thick plywood.
.2 Mount on 19 mm x 38 mm size wood furring running around full perimeter with continuous furring positioned vertically 300 mm o.c. intervals to board fields.
.3 Fix backboards to furring using drywall screws spaced 300 mm o.c. around board perimeters and 400 mm o.c. along intermediate furring. Set screw heads flush with plywood face without tearing face veneers.
.4 Have backboards back-primed prior to installing. Co-ordinate with painting trade.
.5 Where surface-mounted equipment boards not detailed/indicated install full size sheets of 19 mm thick plywood wall back-up direct to stud framing behind gypsum board wall finishes.

3.3 WOOD PRESERVATIVES

.1 Treat wood to CSA O80.34 (borate treatment) or with alkaline copper quaternary type B (ACQ-B), to obtain minimum net retention of 4 kg/m3 of wood.

.2 All plywood/wood in contact with concrete and set into concrete to be preservative treated (P.T.).

.3 Following water-borne preservative treatment, dry material to maximum moisture content of 19%.

.4 Re-treat surfaces of pressure treated components exposed by cutting, trimming and boring using surface-applied wood preservative compatible with original treatment.

.5 Re-treat surfaces before installation. Apply by dipping or by brush to completely saturate and maintain wet film on surfaces for minimum 3 minute soak on lumber and one minute soak on plywood, unless recommended otherwise by treatment plant.

3.4 PROTECTION OF WORK

.1 Protect finished Work in accordance with Section 01 60 00 Product Requirements.

.2 Ensure finished Work is protected from climatic conditions.

3.5 REVIEW

.1 Contractor to notify Departmental Representative at least 24 hours prior to review(s) required per scope of work.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 55 General Instructions

.2 Section 01 32 19 Security

.3 Section 01 33 00 Shop Drawings, Product Data, and Samples

.4 Section 01 35 33 Health & Safety Requirements

.5 Section 01 51 00 Temporary Facilities

.6 Section 01 61 10 Product Requirements

.7 Section 01 74 19 Waste Management and Disposal

.8 Section 01 78 30 Closeout Submittals

1.2 REFERENCE DOCUMENTS

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM D1227-13, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

1.3 SUBMITTALS

.1 Product Data.
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples, for each type of metal building system components. Indicate VOC's for adhesives and sealants.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples.

.2 Manufacturer's Instructions.
- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples, for each type of metal building system components.

.3 Closeout Submittals.
- .1 Provide operation and maintenance data for products of this section for incorporation into the maintenance manual, in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples.

1.4 QUALITY ASSURANCE

.1 Sequencing.
- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.5 PROJECT/ SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 Temporary Facilities.

.3 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 10 Product Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 Waste Management And Disposal.

1.8 WARRANTY

.1 12 month warranty period specified in the General Conditions.

2 PRODUCTS

2.1 COMPONENTS

.1 Asphaltic, water based emulsion dampproofing, asbestos free, designed for application to exterior side of below grade foundations and walls, containing no solvents in accordance with ASTM D1227 and as follows:
- .1 Application Temperature: 10°C
- .2 Grade: Type II, Class 1
- .3 VOC Content: Maximum 30 g/L (less water and exempt solvents).

.2 Primer: As acceptable to waterproofing membrane system manufacturer.

3 EXECUTION

3.1 COMPLIANCE

.1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Examine the areas and conditions under which work of this Section will be performed.
  .1 Verify conformance with manufacturer's requirements,
  .2 Report unsatisfactory conditions in writing to Departmental Representative.

3.3 PREPARATION

.1 Clean substrates of substances, including oil, grease, rolling compounds, incompatible primers, and/or loose mill scale that impair bond of applied materials.

.2 Prime surfaces in accord with manufacturer's instructions.

.3 Install detail coats, joint and crack treatments, elastomeric flashing and reinforcing fabric in accord with manufacturer's instructions.

3.4 APPLICATION

.1 Mask off adjoining surfaces not to receive membrane system.

.2 Apply membrane uniformly and allow to cure in accordance with manufacturer's instructions.

.3 Install drainage panels in accordance with manufacturer's instructions.

3.5 PROTECTION OF WORK

.1 Protect finished Work in accordance with Section 01 61 10 Product Requirements.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished Work is protected from climatic conditions.

3.6 REVIEW

.1 Contractor to notify Departmental Representative at least 24 hours in advance of any necessary reviews of the work.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 01 33 00 - Shop Drawings, Product Data, and Samples

.3 Section 01 35 33 - Health and Safety Requirements

.4 Section 01 51 00 - Temporary Facilities

.5 Section 01 60 00 - Product Requirements

.6 Section 01 74 19 - Waste Management and Disposal

.7 Section 01 78 00 - Closeout Submittals

.8 Section 06 10 00 - Rough Carpentry

.9 Section 13 34 19 – Metal Building Systems

1.2 REFERENCE DOCUMENTS

.1 Master Painters Institute (MPI).
  .1 Architectural Painting Specifications Manual (MPI Manual)

.2 Society for Protective Coatings (SSPC).
  .1 SSPC Painting Manual, and Systems and Specifications Manual (2012) (SSPC manual)

.3 Refer to Section 01 11 55 – General Instructions and the specific References, Codes and Standards of each individual Specification Section.

1.3 DESIGN CRITERIA

.1 Departmental Representative will select paint colours where colours have not been listed on drawings. Do not commence painting until receipt of colour selections.

1.4 SUBMITTALS

.1 Product Data.
  .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's.
  .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's Instructions.
  .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.3 Samples.
.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
.1 Submit duplicate 300 x 300 mm sample panels of each paint or stain finish, on piece of material to be finished with colour and degree of sheen selected.

.4 Submit an invoice list of all painting materials ordered for project work to Departmental Representative indicating manufacturer, types and quantities for verification and compliance with specification and design requirements.

.5 Closeout Submittals.
.1 Provide operation and maintenance data for products of this section for incorporation into the maintenance manual.
.2 Extra Materials: Provide minimum one 3.45 litre (US gallon) size can of each type and colour of finish coating for Department's later use in maintenance.
.1 Include name, address and telephone number of local distributor to assist the Department in obtaining additional matching stock.

1.5 QUALITY ASSURANCE

.1 Materials.
.1 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

.2 Sequencing.
.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.6 PROJECT/ SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

.3 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 60 00 - Product Requirements.

.2 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Paint shall be regarded as a hazardous product. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.

1.9 WARRANTY

.1 12 month warranty period specified in the General Conditions.

2 PRODUCTS

2.1 MATERIALS

.1 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.2 Use no less than MPI 'Premium Grade' applications throughout, unless noted otherwise.
- .1 Interior Dimension Lumber: INT 6.2D - G4

.3 MPI Gloss and Sheen Standards are as follows: Gloss@60° Sheen@85°
- .1 Confirm Gloss Level with Departmental Representative, for each area and product, prior to application.
- .2 Gloss Level 1 - matte finish - flat max. 5 units, and max. 10 units.
- .3 Gloss Level 2 - high side sheen flat, 'velvet-like' max.10 units, and 10-35units.
- .4 Gloss Level 3 - eggshell 10-25 units, and 10-35 units.
- .5 Gloss Level 4 - satin 20-35 units, and min. 35 units.
- .6 Gloss Level 5 - semi-gloss 35-70 units.
- .7 Gloss Level 6 - gloss 70-85 units.
- .8 Gloss Level 7 - high gloss more than 85 units.

3 EXECUTION

3.1 COMPLIANCE

.1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

3.2 EXAMINATION

.1 Inspect all surfaces requiring painting and notify the Departmental Representative in writing of any defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate.

3.3 PREPARATION

.1 Ensure adequate continuous ventilation and sufficient heating and lighting are in place.

.2 Prepare surfaces to receive paint in accordance with requirements and procedures described in MPI Manual.

.3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

.4 Receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator/ supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

3.4 INSTALLATION / APPLICATION

.1 Sand and dust between each coat to remove defects visible from 1525 mm distance.

.2 Finish closets and alcoves to match adjoining rooms.

.3 Continue paint finishes through behind wall-mounted items.

.4 Spray, roll and brush apply as required.

3.5 PROTECTION OF WORK

.1 Protect finished Work in accordance with Section 01 60 00 Product Requirements.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished Work is protected from climatic conditions.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 GENERAL

1.1 SYSTEM DESCRIPTION

.1 Type: beam and column structural frame as indicated.

.2 Roof Slope: minimum 3/12 (14°).

.3 Wall System: through fastened single skin panels, semi-rigid insulation, sub-girts, and liner panel air/vapour barrier.

.4 Roof System: standing seam single skin panels, semi-rigid insulation, sub-girts, and liner panel air/vapour barrier.

.5 Overhead Doors: vertically rolling sectional overhead doors, 4 000 mm width x 4 300 mm height as shown.

.6 Steel Doors and Frames: insulated core steel doors in steel frames.

1.2 RELATED SECTIONS

.1 Section 01 11 55 General Instructions

.2 Section 01 32 19 Security

.3 Section 01 33 00 Shop Drawings, Product Data, and Samples

.4 Section 01 35 33 Health & Safety Requirements

.5 Section 01 51 00 Temporary Facilities

.6 Section 01 61 10 Product Requirements

.7 Section 01 74 19 Waste Management and Disposal

.8 Section 01 78 30 Closeout Submittals

.9 Mechanical

.10 Electrical

1.3 REFERENCE DOCUMENTS

.1 American Architectural Manufacturers Association (AAMA)
  .1 AAMA 2604-05, High Performance Organic Coatings

.2 American Society of Mechanical Engineers (ASME).
  .1 ASME B18.6.x, American Standard Slotted And Recessed Head Screws.

.3 American Society for Testing and Materials (ASTM).
  .1 ASTM A36-12, Standard Specification for Carbon Structural Steel.

.2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
.3 ASTM A325M-04b, Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
.4 ASTM A475-03(2009)e1, Standard Specification for Zinc-Coated Steel Wire Strand.
.5 ASTM 490M-04a, Specification for High- Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
.6 ASTM A500/A500M-10a, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
.7 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated.(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.8 ASTM A755/A755M-11, Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
.9 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
.10 ASTM A992/A992M-11, Standard Specification for Structural Steel Shapes.
.11 ASTM A1011/A1011M-12b, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
.12 ASTM C991-08e1, Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.
.13 ASTM C1136-12, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

.4 Canadian Environmental Protection Act, 1999 (CEPA)

.5 Canadian General Standards Board (CAN/CGSB)
.1 CAN/CGSB-12.8-97, Insulated Glazing Units

.6 Canadian Institute of Steel Construction/Canadian Paint Manufacturers Association (CSIC/CPMA)
.1 CISC/CPMA 1-73a. Quick Drying, One-Coat Paint for use on Structural Steel.

.7 Canadian Sheet Steel Building Institute (CSSBI)
.1 CSSBI S17-05, Guide Specifications for Steel Building Systems.
.2 CSSBI 30M-06, Standard for Steel Building Systems.

.8 Canadian Standards Association (CAN/CSA).
.1 CAN/CSA-A660-10, Certification of Manufacturers of Steel Building Systems
.2 CAN/CSA-B111-1974(R2003), Wire Nails, Spikes, and Staples
.3 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
.4 CAN/CSA-S16-09, Design of Steel Structures
.5 CAN/CSA-S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members
.6 CAN/CSA-W47.1-09, Certification of companies for fusion welding of steel
.7 CAN/CSA-W55.3-08, Certification of companies for resistance welding of steel and aluminum

.8 CAN/CSA-W59-R2008, Welded Steel Construction (Metal Arc Welding).

.9 North American Insulation Manufacturer's Association (NAIMA)
- .1 NAIMA Standard 202, Standard for Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.

.10 Society for Protective Coatings (SSPC).
- .1 SSPC SP-1, Solvent Cleaning
- .2 SSPC SP-2, Hand Tool Cleaning

.11 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
- .1 SMACNA Architectural Sheet Metal Manual.

.12 Transportation of Dangerous Goods Regulations (TDG regulations)

.13 Underwriters Laboratories (UL).
- .1 UL580, Tests for Wind Uplift Resistance of Roof Assemblies.

.14 Underwriters Laboratories of Canada (CAN/ULC).
- .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

1.4 DESIGN CRITERIA

.1 Comply with the requirements of the National Building Code 2010 and as specified. Design and engineer the work accordingly.

.2 Provide a complete, integrated set of components and assemblies that form a metal building system capable of withstanding wind and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior. Include primary and secondary framing, roof and wall panels, and accessories complying with requirements as indicated.
- .1 Design Conformance:
  - .1 Design all structural steel sections and built-up welded-plate members in accordance with CAN/CSA-S16
  - .2 Design light-gauge, cold-formed structural members and panels in accordance with CAN/CSA-S136
- .2 Snow and Rain Load, Wind Load, Seismic Loads, and Dead Loads
  - .1 In conformance with applicable code requirements.
- .3 Collateral Load (mech, elec, ceiling, sprinklers, etc.).
  - .1 Refer to mechanical and electrical drawings and specifications.
- .4 Load Combinations:
  - .1 Designed to withstand load factors in conformance with applicable code requirements.
- .5 Deflection Limits:
  - .1 Purlins and Rafters, vertical deflection max 1/180 of the span.
  - .2 Girts, horizontal deflection max 1/180 of the span.
  - .3 Roof Panels, vertical deflection max 1/180 of the span.
  - .4 Wall Panels, horizontal deflection max 1/180 of the span.
- .6 Thermal Movement:

.1 Metal roof and wall panel systems to allow for thermal movement resulting from the following range in surface temperature without buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
.2 Temperature Change (range): 100 °C

.7 Wind Uplift Resistance:
.1 Design for wind uplift resistance in accordance with applicable code requirements.

1.5 DEFINITIONS

.1 Dead Load: includes the self-weight of the structure and all permanent materials of the building construction.

.2 Collateral Loads: includes mechanical and electrical equipment, sprinkler systems, suspended ceilings and all other removable parts of the structure.

.3 Live Loads: includes superimposed loads on the structure due to the following:
.1 Use and occupancy loads
.2 Snow, rain, and ice effects.
.3 Maintenance and construction loads.
.4 Wind loads.
.5 Earthquake loads.
.6 Thermal loads.
.7 Differential foundation settlement.

1.6 SUBMITTALS

.1 Product Data.
.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples, for each type of metal building system components. Indicate VOC's for adhesives and sealants. Indicate recycled percentage for metals where it is readily available.
.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples.

.2 Manufacturer's Instructions.
.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples, for each type of metal building system components.

.3 Shop Drawings.
.1 Submit shop drawings in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples, Sealed and Signed by a Professional Structural Engineer, registered in the province of BC, Canada:
.1 Indicate compliance with the structural performance requirements identified under DESIGN CRITERIA.
.2 Include location and diameter of Anchor Bolts required to attach metal building to foundation. Indicate column reactions at each location.

.3 Show complete fabrication of framing: indicate welds and bolted connections, distinguish between shop and field applications. Include transverse cross-sections.

.4 Show layout of panels on support framing, details of edge conditions, joints, panel profiles, corners and custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work.

.5 Provide elevations and details for door, overhead door, and door hardware installation.

.6 Submit Schedule B by Structural Engineer with submission of sealed and signed shop drawings by the same Engineer.

.4 Samples.

.1 Submit samples in accordance with Section 01 33 00 Shop Drawings, Product Data, and Samples.

.2 Samples for Initial Selection:

.1 Provide manufacturer's colour charts showing full range of colours available for each type of the following products with factory applied finishes:

.1 Roof and fascia panels

.2 Wall panels

.3 Liner and soffit panels

.4 Trim and closures

.3 Samples for Verification: provide samples of the same material to be used for the work.

.1 Roof Panels: 300 x 300 sample of panel material; include clips, caps, fasteners, closures and other exposed accessories.

.2 Wall Panels: 300 x 300 mm sample of panel material; include clips, caps, fasteners, closures and other exposed accessories.

.3 Trim and Closures: 300 mm length. Include fasteners and other exposed accessories.

.4 Insulation faced with Vapour Retarder: 300 x 300 mm sample of material.

.5 Liner Panels: 300 x 300 mm sample of panel material; include clips, caps, fasteners, closures and other exposed accessories.

.6 Glazing: 300 x 300 mm sample of each glazing type.

.7 Door Hardware samples as requested by Departmental Representative.

.5 Closeout Submittals.

.1 Provide operation and maintenance data for products of this section for incorporation into the maintenance manual, in accordance with Section 01 78 30 Closeout Submittals.

.1 Note Overhead Door hardware, lubrication requirements and frequency, periodic adjustments required.

.2 At completion of installations and adjustments turn over to Departmental Representative all tools supplied by hardware manufacturers with hardware items installed for Department's later use in hardware maintenance. Seal tools together with respective hardware data/installation sheets supplied with hardware in clear plastic bags.

.2 Schedule: C-B after completion of installations (or when requested en-route by the Coordinating Registered Professional) and before the established date of Substantial Performance for the Project.

1.7 QUALITY ASSURANCE

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

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

.3 Sequencing.

.1 Sequence work to permit installation of materials in conjunction with related materials and seals, including but not limited to:

.1 Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings.

.2 Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.8 PROJECT/ SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 Temporary Facilities.

.3 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 10 Product Requirements.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 Waste Management And Disposal.

1.11 WARRANTY

.1 12 month warranty period specified in the General Conditions.

2 PRODUCTS

2.1 MATERIALS

.1 Structural steel: to ASTM A992/A992M, 340 MPa (50 ksi) minimum yield strength, shop primed.

.2 Structural Chanel and Angle Sections: to ASTM A36, 248 MPa (36 ksi) minimum yield strength, shop primed.

.3 Hollow Steel Sections: to ASTM A500, Grade B
- .1 Round sections: 290 MPa minimum yield strength.
- .2 Square and Rectangular sections: 317 MPa minimum yield strength.

.4 Bolts: hex head bolts to ASTM A307, Grade A for secondary structural connections, heavy hex head bolts to ASTM A325M, Type 1, for primary structural connections, minimum 12mm diameter, galvanized complete with nuts and washers.

.5 Welding Materials: to CAN/CSA-W59.

.6 Shop Primer Paint: to CISC/CPMA-1-73a, 1.5 to 2 mils film thickness.

.7 Purlins, Girts, and Sub-Framing: hot rolled sheet steel conforming to ASTM A1011/A1011M, 340 MPa (50 ksi) minimum yield, zinc coated (galvanized) to Z275 per ASTM A653/A653M.

.8 Rod: to ASTM A992/A992M, 300MPa (44ksi) minimum yield strength, shop primed.

.9 Cable: Galvanized strand to ASTM A475, extra-high-strength grade, Class A zinc coating. Design strength based on manufacturer's published breaking strengths.

.10 Eye bolts: ASTM 1030 carbon steel, hot-dip galvanized. Design strengths based on manufacturers published breaking strengths.

.11 Prefinished Steel Sheet for Wall and Roof Panels, Flashings, and Trim:
- .1 Sheet Steel, metallic coated by the hot-dipped process, prepainted by the coil-coating process to ASTM A755/A755M, and having the following properties:
  - .1 Material: zinc coated sheet steel, structural quality, to ASTM A653/A653M, class Z275 coating, Grade 230, mill finish.
  - .2 Finish, Exposed: 50% Polyvinylidene Fluoride (PVDF) two-coat system to AAMA 2604.
  - .3 Colour and Gloss: as selected by the Architect from Manufacturer's standard range.

.12 Prefinished Steel Sheet for Interior Liner Panels:
- .1 Material: zinc coated sheet steel, structural quality, to ASTM A653/A653M, class Z275 coating, Grade 230, mill finish.
- .2 Finish, Exposed: White Silicone Modified Polyester (SMP) two-coat system to AAMA 2604.

.13 Insulation:
- .1 Semi-rigid acoustical fiberglass insulating board to ASTM C612, Type 1B, and having the following properties:
  - .1 Flame Spread Classification (CAN/ULC-S102): 25 max.
  - .2 Smoke Developed Classification (CAN/ULC-S102): 50 max.

.14 Steel Doors and Frames:
- .1 Steel Frames:
  - .1 1.63 mm (16 gauge) sheet steel thickness, non-rated, ZF75 zinc coating. Internal plates and bars of structural quality 300W steel, free of scaling, pitting and other surface blemishes.
- .2 Steel Doors:
  - .1 1.22 mm (18 gauge) sheet steel facing with ZF75 zinc coating. Internal plates and bars of structural quality 300W steel, free of scaling, pitting and other surface blemishes.
  - .2 Insulated core of 16 to 32 kg/m^3 density expanded polystyrene.
  - .3 Adhesive of heat resistant, spray grade, resin reinforced neoprene/rubber based, low viscosity, contact cement compatible with core material.
- .3 Door Silencers: single stud neoprene/rubber type.
- .4 Filler: polyester type automotive body spot filler compound.
- .5 Primer: Zinc rich, ready mix primer.

.15 Electric Operated Slatted Overhead Rolling Door:
- .1 Vertical lift coiling overhead door of steel construction Grade 40 steel, ASTM A 653 steel.
- .2 Electric motor, horsepower as recommended by manufacturer to suit door type and size.
- .3 Design doors of standard construction for normal use of up to 20 cycles per day maximum.
- .4 Components:
  - .1 Door slats 3" high and manufactured with not less that 22 gauge sheet steel. Insulate core full thickness of panel, RSI 1.10. Covered on the inside with sheet steel, not less than 22 gauge. Pre-finished powder coated standard white colour.
  - .2 Bracing of horizontal and vertical structural sections to adequately stiffen the door panels, consisting of structural sections welded to stiles, rails, and bracing members from the inside.
  - .3 Fabricate guides with structural steel angles bolted together with 3/8" fasteners to form a channel for the curtain to travel. The wall angle portion shall be continuous and fastened to the surrounding structure with either minimum 1/2" fasteners or welds, both on 36" centers, Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar. Stiles and rails of structural steel sections, no smaller that three inch channels, with all joints welded and ground smooth.

.5 Weather-stripping:
- .1 Provide neoprene weather stripping to door top, bottom and sides. Provide compressible bulb type EPDM or neoprene air lock to door bottom.

.6 Manual Chain Hoist (override): Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide.

.7 Operation switches: Provide pushbutton operation for each door with "UP", "DOWN", and "STOP" positions.

.16 Door Hardware:
- .1 Use one manufacturer's product only for all similar items.
- .2 All hardware of heavy duty, industrial type.
- .3 To be free from imperfections in manufacture and finish.
- .4 Lever handles are required on all lock and latch sets.
- .5 Keying:
  - .1 Final keying to be performed by Departmental Representative.
- .6 Finishes:
  - .1 #626 Satin Chromium Plated, unless noted otherwise. All finishes, on hardware of like kind, shall match throughout the project.

2.2 COMPONENTS

.1 Obtain each type of Metal Building System component through one source, from a single manufacturer.

.2 Primary Framing: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural steel shapes, with tapered type columns and rafters.
- .1 End Walls: fabricate end-wall interior columns, corner columns, and rafters for field-bolted assembly, from structural-steel shapes or shop-welded, built-up steel plates.

.3 Secondary Framing: secondary framing members, including purlins, girts, eave struts, flange bracing, gable angles, clips, headers, jambs, and other miscellaneous structural members; composed of cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, having the following properties:
- .1 Purlins and Girts:
  - .1 C-shaped sections formed with stiffening lips angled 90 degrees to flange and minimum 90 mm wide flanges.
  - .2 Z-shaped sections formed with stiffening lips angled 45 to 50 degrees to flange and with minimum 65 mm wide flanges.
  - .3 Material Thickness: according to engineering requirements.
  - .4 Framing Member Depth: according to engineering requirements.
- .2 Sub-Framing:
  - .1 C-shaped sections formed with stiffening lips angled 90 degrees to flange and minimum 90 mm wide flanges.
  - .2 Z-shaped sections formed with stiffening lips angled 45 to 50 degrees to flange and with minimum 65 mm wide flanges.
  - .3 Material Thickness: according to engineering requirements.
  - .4 Framing Member Depth: according to engineering requirements.

.3 Eave Struts:
- .1 Unequal-flange, C-shaped sections; fabricated from 1.6 mm (16 ga) thick steel sheet to provide adequate backup for both roof and wall panels. The bottom flanges shall be 65 mm wide, minimum. The web depth, top flange width, and flange and lip angles shall be dictated by the roof slope. The stiffening lips shall be parallel to the web.

.4 Lateral Bracing: 25 x 25 mm structural-steel angles, with a minimum thickness of 3 mm, to stiffen primary frame flanges.

.5 Base or Sill Angles: Minimum 75 x 50 x 1.5 mm (16 ga) galvanized structural steel.

.6 Purlin and Girt Connection Clips: minimum 1.5 mm (16 ga), galvanized structural steel.

.7 Framing for Openings: C-shaped sections formed with stiffening lips angled 90 degrees to flange and minimum 90 mm wide flanges; fabricated from 1.5 mm (16 ga) steel sheet, for framing head and jambs of door openings, and head, jambs, and sill of other openings.

.8 Roof Curbs: 1.5 mm (16 ga) galvanized structural steel, with welded top box and bottom skirt, and integral full-length cricket/water-diverter. Finish roof curbs to match roof panels unless otherwise indicated.

.9 Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed structural steel; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

.10 Bracing:
- .1 Cable Bracing: 9 mm diameter cable with eye-bolt end anchors.
- .2 Rigid Portal Frames: shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

.4 Bolts: provide shop-painted bolts unless structural-framing components are in direct contact with roof and wall panels. Provide zinc-plated bolts when structural-framing components are in direct contact with roof and wall panels.

.5 Prefinished Metal Liner Panels:
- .1 Prefinished steel sheet, 0.55 mm (26 ga), lap-seam wall panels, factory formed to provide 900 mm coverage, with 32 mm high recessed trapezoidal major valleys at 300 mm o.c., and two (2) intermediate stiffening valleys symmetrically spaced between adjacent major ribs for full length of panel. Panels designed for mechanical attachment to structure using exposed fasteners, lapping major ribs at panel edges.

.6 Prefinished Metal Wall Panels and Soffit Panels:
- .1 Prefinished steel sheet, 0.70 mm (24 ga), lap-seam wall panels, factory formed to provide 900 mm coverage, with 32 mm high recessed trapezoidal major valleys at 300 mm o.c., and two (2) intermediate stiffening valleys symmetrically spaced between adjacent major ribs for full length of panel. Panels designed for mechanical attachment to structure using exposed fasteners, lapping major ribs at panel edges.

.7 Standing Seam Roof Panels:
- .1 Prefinished steel sheet, 0.70 mm (24 ga), double-folded mechanically seamed vertical-rib roof panels, factory formed to provide 450 mm coverage; with 50 mm high inverted-L vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between major ribs for full length of panel.
  - .1 Provide snow guards.

.8 Flashings and Trim: prefinished steel sheet, 0.70 mm (24 ga)
- .1 Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent roof or wall panels.

.9 Gutters: prefinished steel sheet, 0.70 mm (24 ga)
- .1 Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in 5 m and/or 6 m long sections. Furnish gutter supports spaced 610 mm fabricated from same metal as gutters. Finish gutters to match roof fascia and rake trim. Provide leaf screens.

.10 Downspouts: prefinished steel sheet, 0.70 mm (24 ga)
- .1 75 x 100 mm or 100 x 125 mm, 3 m long sections, complete with formed 75-degree elbows and offsets. Finish downspouts to match wall panels.

.11 Metal Closures: Provide closures at eave and ridge for the following applications:
- .1 Outside closure for ridge condition of standing seam roof systems, fabricated from 0.70 mm (24 ga) prefinished sheet steel.
- .2 Inside closure for eave condition of standing seam roof systems, fabricated from 1.3 mm (18 ga) prefinished sheet steel.

2.3 ACCESSORIES

.1 Panel Sealants:
- .1 Sealant Tape: isobutyl tripolymer sealant tape as acceptable to Metal Building System manufacturer.
- .2 Joint Sealant: non-skidding butyl sealant as acceptable to Metal Building System manufacturer.
- .3 Miscellaneous Sealants: as acceptable to by Metal Building System manufacturer.

.2 Foam Closures: closed-cell, laminated polyethylene; minimum 1-inch-thick, flexible closure strips; pre-molded to match roof and wall panel profile. Provide closure strips where indicated or necessary to ensure weather tight construction.
- .1 Outside closure for ridge condition of roofs.

.3 Isolation coating: alkali resistant bituminous paint.

.4 Fasteners:

.1 Screws: self-tapping, hot dipped galvanized, to ASME B18.6 series, of length and thickness suitable for application and for anchorage to substrate.
  .1 for Roof and Wall Panels: hex-head painted to match prefinished metal panel, EPDM sealing washer.
  .2 for Flashings and Trim: hex-head painted to match prefinished metal panel.
.2 Nails: to CSA B111, hot dipped galvanized, of length and thickness suitable for application and for anchorage to substrate.
.3 Staples: to CSA B111, minimum 6 mm leg x 12 mm wide.

2.4 FABRICATION

.1 Fabricate structural members in accordance with shop drawings and to CAN/CSA-S16. Tolerance not to exceed those specified in CAN/CSA-S16.

.2 General: Design components and field connections required for erection to permit easy assembly and disassembly.
  .1 Fabricate components in a manner that once assembled in the shop, they may be disassembled, repackaged, and reassembled in the field.
  .2 Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  .3 Fabricate framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Cold-formed members shall be free of cracks, tears, and ruptures.

.3 Primary Framing: shop-fabricated framing components to indicated size and section with base plates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
  .1 Make shop connections by welding or by using high-strength bolts.
  .2 Join flanges to webs of built-up members by a continuous submerged arc-welding process.
  .3 Brace compression flange of primary framing by angles connected between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
  .4 Weld clips to frames for attaching secondary framing members.
  .5 Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 1 and SSPC-SP 2. Shop prime primary structural members with standard primer after fabrication.

.4 Secondary Framing: Shop-fabricate framing components to indicated size and section by roll-forming or break-forming, with base plates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing. Make shop connections by using non-high-strength bolts.

.5 Reinforce openings to maintain design strength.

.6 Factory Priming: Prime primary steel framing members with standard primer to a minimum dry film thickness of 1 mil.

.7 Tolerances: to CSSBI 30M.

.8 Steel Door Fabrication:
- .1 Fabricate doors with flush faces.
- .2 Fabricate doors square and free of distortion and twists. Form and fit components and sections accurately, to close fitting tolerances.
- .3 Form each face sheet for doors from sheet steel with insulation slab cores laminated under pressure to face sheets.
- .4 Use one full sheet of sheet steel per door face, formed accurately at longitudinal edges to wrap around and meet at strike and hinge edges.
  - .1 Mechanically interlock face sheets together along door vertical edges. Tack weld at top, bottom and at 300 mm intervals. Fill, sand smooth and flush to produce invisible seams.
- .5 Blank, reinforce, drill and tap for mortised/templated hardware.
- .6 Reinforce where required for surface mounted hardware. Indicate clearly on shop drawings exact location of internal hardware reinforcing within door to ensure proper alignment of surface mounted hardware.
- .7 Install all reinforcing plates using full perimeter spot welding with welds spaced maximum 50 mm o.c. to prevent plates from breaking loose throughout life of door.
- .8 Drill holes 13 mm dia. and larger in size for hardware, except mounting and through-bolt holes which will be placed at time of hardware installation.
- .9 Drill holes less than 13 mm dia. when required for function of hardware (for knobs, levers, cylinders, thumb pieces or turn pieces) or when these holes overlap function holes.
- .10 Equip doors with permanent installed flush-set top caps.
- .11 Equip following doors with 3.5 mm anti-intrusion plate welded to latch side of door, unless directed otherwise.
  - .1 Single leaf doors: length required to conceal/protect latch/lock.
  - .2 Door pairs: full height astragal plate welded to latch side of active leaf.

.9 Steel Door Frame Fabrication:
- .1 Fabricate frames using welded construction.
- .2 Fabricate frames square and free of distortion and twists. Form and fit corners and interconnecting sections accurately to close fitting tolerances.
- .3 Mitre or mechanically join sections and securely weld on inside of frame profiles.
- .4 Cope accurately and weld securely butt joints of mullions, centre rails and sills.
- .5 Grind welded joints smooth, to uniform finish, flush with adjacent surfaces. Grind, fill, sand smooth and flush to produce invisible seams.
- .6 Blank, reinforce, drill and tap for mortised, templated hardware. Protect mortised cut-outs with leak proof steel mortar boxes. Protect tappings from becoming blocked by grout/mortar fill by applying strips of rigid insulation or sprayed-in place foam to inside of frame.
- .7 Provide steel mortar boxes enclosures for strike, latch and bolt cut-outs on all frames. Applicable to grout filled frames to protect cut-outs and applicable to non-grout filled frames to provide lined cut-out openings free of frame voids.
- .8 Reinforce where required for surface mounted hardware. Indicate clearly on shop drawings exact location of internal hardware reinforcing within frames to ensure proper alignment of surface mounted hardware.

.9 Install all reinforcing plates using full perimeter spot welding with welds spaced maximum 50 mm o.c. to prevent plates from breaking loose throughout life of frame.

.10 Frame anchors:

.1 Provide for appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 For frame heights up to and including 1520 mm provide 2 anchors plus an additional anchor for each additional 760 mm of height or fraction thereof.

.4 Attach floor anchors securely to inside of each jamb profile.

.5 Prepare each door opening for door silencers, 3 for single door openings and 2 for double door openings.

.6 Shop install door silencers. Painting trade is to remove silencers prior to painting and handover to installer for re-installation after painting is completed.

.7 Weld in 2 temporary jamb spreaders at bottom of each door frame opening, to maintain alignment during shipment and building in place.

.10 Steel Door and Frame Finishing:

.1 After fabrication, fill and sand all tool marks and surface imperfections and dress smooth exposed faces of all welded joints, to be invisible under semi-gloss painted finishes.

.2 Prime paint steel reinforcements using shop coat primer.

.3 Touch up welded, grinds and damaged galvanized surfaces using zinc primer.

3 EXECUTION

3.1 COMPLIANCE

.1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Do work in accordance with CSSBI 30M and SMACNA manual (most stringent will apply) and as specified.

.3 Erect structural frame in accordance with shop drawings and to CAN/CSA-S16. Erection tolerances not to exceed those specified in CSSBI 30M.

3.2 EXAMINATION

.1 Before erection proceeds, survey elevations and locations of concrete and masonry bearing surfaces, base plates, and anchor bolts to receive structural framing. Verify compliance with requirements and metal building system manufacturer's tolerances.

.1 Engage land surveyor to perform surveying.

3.3 PREPARATION

.1 Clean substrates of substances, including oil, grease, rolling compounds, incompatible primers, and/or loose mill scale that impair bond of erection materials.

3.4 INSTALLATION / APPLICATION

.1 Erect metal building system as shown and as specified.

.2 Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

.3 Set structural framing in locations and to elevations indicated. Maintain structural stability of frame during erection.

.4 Base plates, Leveling Plates, and Bearing Plates:
- .1 Set base plates and bearing plates for structural members on wedges, shims, or setting nuts.
- .2 Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate or bearing plate before packing with grout.
- .3 Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow grout to cure.

.5 Align and adjust framing members before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Make adjustments to compensate for discrepancies in elevations and alignment.
- .1 Level and plumb individual members of structure.
- .2 Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

.6 Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level base plates to a true even plane with full bearing to supporting structures and set elevations by installing shims and tightening anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
- .1 Make field connections using high-strength bolts. Tighten bolts by turn-of-the-nut method.

.7 Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using bolts indicated on erection drawings. Hold rigidly to a straight line temporary supports until permanent supports, i.e., panel and/or bracing angles, are installed.
- .1 Provide rake or gable purlins with rake angle and fasciae.
- .2 Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

.8 Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
- .1 Tighten rod and cable bracing to avoid sag.

.2 Locate interior end bay bracing only where indicated.

.9 Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

.10 Liner Panel Installation:
- .1 Field cutting by torch is not permitted.
- .2 Fasten flashing and trim around openings and similar elements with self-tapping screws.
- .3 Apply sealant continuously between panel joints and at all perimeters and penetrations to form a continuous air/ vapour barrier.

.11 Standing Seam Roof Panel Installation: Fasten roof panels to purlins with concealed clips at each standing-seam joint. Install clips over top of insulation at each purlin.
- .1 Field cutting by torch is not permitted.
- .2 Locate and space fastenings in true vertical and horizontal alignment.
- .3 Locate standing seam panel splices and lap seam panel expansion splices over, but not attached to, structural supports.
- .4 Crimp standing seams with manufacturer-approved motorized seamer tool so clip, panel, and factory-applied side-lap sealant are completely engaged.
- .5 At panel splices, nest panels with minimum 3-inch end lap, sealed with sealant tape and fastened together by interlocking clamping plates.

.12 Wall Panel Installation:
- .1 Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints.
- .2 Unless otherwise indicated, begin panel installation at corners with center of rib lined up with line of framing.
- .3 Field cutting by torch is not permitted.
- .4 Fasten flashing and trim around openings and similar elements with self-tapping screws.
- .5 When building height requires two rows of panels at gable ends, align lap of gable panels over wall panels at eave height.
- .6 Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes when required by the specified fastener.
- .7 Flash and seal wall panels with weather closures under eaves and rakes, along lower panel edges,
- .8 and at perimeter of all openings.
- .9 Apply sealant continuously between metal base channel or sill angle and concrete, and elsewhere as necessary for waterproofing.
- .10 Locate and space fastenings in true vertical and horizontal alignment.

.13 Fascia and Soffit Panel Installation:
- .1 Field cutting by torch is not permitted.
- .2 Locate and space fastenings in true vertical and horizontal alignment.
- .3 Fasten flashing and trim around openings and similar elements with self-tapping screws.

.14 Board Insulation Installation: Install boards straight and true, friction fit, on impaling pins secured to metal liner panel.

.15 Install gutters, downspouts, ventilators, louvers, and other accessories, with positive anchorage to building and weather tight mounting. Coordinate installation with flashings and other components.

.16 Flashing and Trim: comply with SMACNA Architectural Sheet Metal Manual, with positive anchorage to building and weather tight mounting.

.17 Gutters: Join sections with lapped and riveted joints. Attach gutters to eave with gutter hangers spaced not more than 610 mm o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant.

.18 Downspouts: Join sections with 38 mm telescoping joints. Provide fasteners designed to hold downspouts securely away from walls; locate fasteners at top and bottom and at approximately 1500 mm o.c. in between.
- .1 Provide elbow at base of downspout to direct water away from building.
- .2 Tie downspouts to underground drainage system.

.19 Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports according to manufacturer's written instructions.

.20 Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

.21 Steel Door and Frame Installation:
- .1 Steel Door Frame Installation:
  - .1 Set frames plumb, square, level and at correct elevation. Set in place with maximum diagonal distortion of 2.0 mm and maximum 1.0 mm out of plumb measured on face of frame.
  - .2 Secure anchorages and connections to adjacent construction.
  - .3 Make allowances for deflection to ensure structural loads are not transmitted to frames.
  - .4 Fill installed exterior frames with low rise expanding foam insulation to improve thermal performance and to seal airtight to adjacent wall construction.
- .2 Steel Door Installation:
  - .1 Provide even margins between doors and jambs, between door bottoms and finished floor and between door bottoms and thresholds as follows.
    - .1 Hinge side: 1.0 mm.
    - .2 Latch side and head: 1.5 mm.
    - .3 Finished floor and thresholds: 13 mm.
  - .2 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
  - .3 Adjust operable parts for correct clearances and function.
  - .4 Touch up damaged galvanized finish using zinc primer, smooth and ready for site-applied finish painting.

.22 Overhead Door Installation:
- .1 Rigidly support rail and operator and secure to supporting structure.
- .2 Touch-up steel doors with primer where galvanized finish damaged during fabrication.
- .3 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.
- .4 Adjust weatherstripping to form a weather tight seal.
- .5 Adjust doors for smooth operation.

.23 Door Hardware Installation:
- .1 Verify under work of this Section that installed door hardware functions properly and adjust accordingly to ensure satisfactory operation.
- .2 Locate hardware accurately and adjust to meet manufacturer's instructions. Use special tools and jigs as recommended.
- .3 Secure hardware into place using companion fasteners in accordance with hardware installation instructions. Use proper fitting screw drivers. Do not burr screw heads or damage plated screw finishes.
- .4 Install hardware and trim square and plumb to doors and frames.
- .5 Replace wrappings for hardware provided by manufacturer after installation to protect hardware finishes from subsequent building painting operations.
- .6 Adjust hardware so that latches and locks operate smoothly and without binding and so that closers act positively with least possible resistance in use. Lubricate hardware if required by manufacturer instructions.

3.5 PROTECTION OF WORK

.1 Protect finished Work in accordance with Section 01 61 10 Product Requirements.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished Work is protected from climatic conditions.

3.6 REVIEW

.1 Contractor to notify Departmental Representative at least 24 hours in advance of any necessary reviews of the work.

3.7 CLEANING and ADJUSTING

.1 Ventilators and Louvers: After completing installation, lubricate, test, and adjust units to operate easily, free from warp, twist, or distortion.
- .1 Adjust louver blades to be weathertight when in closed position.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

2.0 Products

2.1 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 Standard of Acceptance: Canron Cellular Core ABS Schedule 40 DWV pipe marked "BC-W".
  - .3 Joints: solvent weld to ASTM D2235.
- .3 Polyvinyl Chloride (PVC) Drain Waste and Vent Pipe and Pipe Fittings:
  - .1 Conforming to CSA B181.2.
  - .2 Joints: solvent weld to ASTM D2564.
- .4 Additional requirements:
  - .1 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab; 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 Additional requirements:
- .1 Class 4000 mechanical joint cast iron soil pipe and mechanical joint couplings shall be of one manufacturer.
- .2 Plastic (PVC or 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.

3.0 Execution

3.1 INSTALLATION

.1 Install in accordance with BC Building Code and local Authority Having Jurisdiction.

.2 Install pipe work in accordance with Section 23 05 01, 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.

.4 An air test in accordance with the Building Code may be used during freezing conditions.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for all plumbing specialties and accessories.

.2 Closeout Submittals
- .1 Provide maintenance data for incorporation into Operational and Maintenance manual specified in Section 01 78 00 - Closeout Submittals.

2.0 Products

2.1 AREA DRAIN

.1 To CSA B79.

.2 Area Drain AD-1:
- .1 Cast iron floor drain with anchor flange and adjustable collar. 305 x 305 nickel bronze grate, vandal proof.
- .2 Pipe size to be 75 mm, provide sediment bucket.

2.2 OIL INTERCEPTOR (OI-1)

.1 The interceptor shall consist of a minimum of two chambers by internal baffling. Wastewater shall enter the first chamber through a drop tube. An air gap shall be provided between all chambers. Water shall exit the interceptor through a drop tube in the final chamber, with 50 mm [2"] invert differential between inlet and outlet. Each chamber shall be provided with a minimum 75 mm [3"] vent port. A minimum 600 mm [24"] diameter access way shall be provided to the top of the interceptor for inspection and cleaning, with access ring extensions to grade and a traffic loading rated, gasketted frame and cover.

.2 Wall construction shall be fiberglass. Interceptor fabrication material shall be inert, non-corrosive and impervious to retained wastes. System backed by 30 year manufacturer warranty.

.3 With coalescing filter for small diameter oil globules (>20 µm).

.4 Custom drop tubes, inlet and outlet connection sizes: 100 mm [4"] diameter.

.5 Interceptor shall be suitable for underground outdoor installation and shall be installed as per the manufacturer's recommendations with anti-buoyancy slab base.

.6 Total liquid capacity: 189 L [50 USgal].

.7 Standard performance flow rating: 0.3 L/s [5 USgpm].

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.
.1 Standard of Acceptance: Zurn Z1500.
.2 Acceptable Product: RTS, Enpoco, Watts.

.7 Unfinished concrete area cleanouts shall be of heavy duty construction and have a fully exposed scoriated cover.
.1 Standard of Acceptance: Zurn Z1500.
.2 Acceptable Product: Zurn Z1500, RTS, Enpoco, Watts

3.0 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 BC Building Code and local Authority Having Jurisdiction.

3.2 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 Base of soil or waste stacks and rainwater leaders.
.5 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.

3.3 INTERCEPTORS

.1 Install in accordance with manufacturer's recommendations.

.2 Install with sufficient space for ease of maintenance.

3.4 TESTING AND ADJUSTING

.1 General:
.1 In accordance with Section 01 91 00, Commissioning: General Requirements, supplemented as specified.

.2 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm [118"] for 8 hours.
.3 An air test in accordance with the Building Code may be used during freezing conditions.

.2 Cleanouts:
.1 Verify covers are gas-tight, secure, yet readily removable.

.3 Commissioning Reports:
.1 In accordance with Section 01 91 00 - Commissioning: Reports, supplemented as specified.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

.1 These common works apply for Divisions 22 and 23. 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.

1.2 DEFINITIONS

.1 Provide means supply and install.

.2 Work means material and labour.

.3 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.

1.3 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 Consultant.

.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.

1.4 SCOPE OF WORK

.1 Drainage
- .1 Provide an area drain in the new slab.
- .2 Provide a new oil interceptor, piped between the area drain and the existing slab drainage.
- .3 Allow for 32m of 75mm diameter piping.

.2 Radiant Heating
- .1 Provide liquid petroleum gas radiant heating system with burners, control panel, vacuum pump, hangers, thermostat, wall thimble, gas flex connector, shut off valve, ducted combustion air, and vent terminal. Size the heaters to maintain the space temperature above freezing (minimum 8.8 kW [30,000 Btu/hr]).
- .2 Allow for 32m of 20mm diameter piping.
- .3 The existing propane tank is a 500 lb tank, rented from Coastal Propane. Verify the tanks size with the owner and rental agency as appropriate for the new equipment.
- .4 Provide propane piping, PRV, isolation valves, and unions.

.3 Humidity Control
- .1 Provide a wall exhaust fan, controlled by a humidistat, to exhaust air from the shed at a rate of at least 3 Air Changes per hour (minimum 800 L/s [1700 cfm]). Provide neoprene-coated fiberglass backdraft damper.

1.5 CODES, REGULATIONS AND STANDARDS

.1 Mechanical work shall conform to the following codes, regulations and standards, and all other codes in effect at the time of award of Contract, and any others having jurisdiction. The 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 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings
- .2 Bylaws:
  - .1 Local Building Bylaws.
- .3 Canadian Standards Association
  - .1 CSA B149.1, Natural Gas and Propane Installation Code.
  - .2 CSA B149.2, Propane Storage and Handling Code.
- .4 National Research Council of Canada
  - .1 National Building Code of Canada.
  - .2 National Fire Code of Canada.
- .5 SMACNA Publications
  - .1 SMACNA - 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 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 Prices for the Proposed Changes shall be submitted broken down sufficiently for the Departmental Representative's review and shall show mark-ups.

.3 Submit any further breakdown as determined by the Departmental Representative as necessary to allow assessment of Progress Claims or Proposed Changes.

.4 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 HVAC Piping Systems:
  - .1 Material
  - .2 Labour
- .6 Air Handling Equipment
  - .1 Material
- .7 Commissioning, Testing, Balancing

.8 Contract Close Out (Record Drawings, Maintenance Manuals, Submissions).
.9 Total Mechanical Contract Price.

1.8 PROGRESS CLAIMS

.1 Submit a single figure for a Progress Claim showing total contract, previous approved claims total, amount of current claim and remaining amount, all both in dollar value and as a percent of the total.

.2 To assist and enable the Departmental Representative to review the Progress Claim amount, provide along with the claim a separate breakdown of the claim in the same categories as required under Price Breakdown showing the total, previous, current and remaining amounts in dollars and percent for each category. Also show the claims for each Change Order being progressed.

.3 The Departmental Representative's review is of the single figure total claim-to-date only. The Departmental Representative bears no responsibility for review of the breakdown portions.

.4 Progress Claims beyond 95% of the mechanical work may not be certified for payment until the commissioning is complete. This is to allow for holdback for deficiencies which are identified during commissioning.

1.9 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.

1.10 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.

1.11 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.

1.12 SUBMITTALS

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

.2 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.
.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 Motor efficiencies on motors 1 HP and larger.
.6 List of the manufacturers and figure numbers for all valves, traps and strainers.
.7 Detailed drawings of bases, supports and anchor bolts.
.8 Control explanation and internal wiring diagrams for packaged equipment.
.9 Electrical control system drawings.
.10 Interlock wiring and pneumatic control schematic diagrams including details of all component parts in order that the function of each is displayed.
.11 A written description of control sequences relating to the schematic diagrams.
.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 Larger drawings may be submitted with space for stamps and signatures - master set plus one working copy.
.3 An assembly of related components, e.g. grilles, registers and diffusers or radiation with sheet metal cabinets, etc. between covers with the contents [identified by model number] listed on the front cover with item identification numbers.
.4 A brochure for plumbing fixtures between covers with the contents named with model numbers listed on the front cover with item identification numbers

.4 Number of copies:
.1 Provide number of copies indicated in Section 01 33 00 with a minimum of one electronic copy 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.
.8 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.3 Closeout Submittals:
.1 Operation and Maintenance Manuals:
.1 Provide maintenance data for incorporation into Operational and Maintenance manual specified in Section 01 78 00 - Closeout Submittals.
.2 Provide one suitably sized 3-ring binder with suitable label with all required materials inside to the Departmental Representative as a draft copy for review. Make all required changes and resubmit the one binder to the Departmental Representative. Repeat until accepted. Then submit three manuals identical to the accepted copy to the Owner. Obtain a receipt and send a copy to the Departmental Representative.
.3 Provide an index and tab each section.

.4 The manual shall include:
- .1 Commissioning report.
- .2 Copy of any required approvals, certifications and acceptance by Authorities Having Jurisdiction.
- .3 All shop drawings.
- .4 List of local source of supply.
- .5 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.

2.0 Products

2.1 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Obtain signed receipt from the Owner when spare parts are handed over.

.3 Provide the following spare parts:
- .1 One set of bearings.

.4 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.5 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

2.2 PRODUCT QUALIFICATION

.1 Standard of Acceptance means that the item named and specified by manufacturer and/or model or catalogue number forms part of the specification and sets standards regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 The product indicated Standard of Acceptance was used in preparing the design. Tenders may be based on the Standard of Acceptance or on any Acceptable Product provided that they meet every aspect of the drawings and specifications including efficiency and energy consumption.

.3 Where multiple manufacturers and or models are named but no single one is indicated as Standard of Acceptance, any one of those named shall be acceptable provided they meet the specified requirements.

.4 Where other than the Standard of Acceptance is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

.5 Multiple items of equipment material of the same type shall be of the same manufacturer.

.6 Install and test all equipment and material in accordance with the detailed instructions and recommendations of the manufacturer.

.7 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 If any existing asbestos containing material not identified in the Contract Documents is discovered and it will be disturbed or affected by the work of the Contract or if it poses a health concern, do no further work involving risk due to the asbestos until the Departmental Representative has been notified and until all notifications, arrangements and approvals with the Authorities Having Jurisdiction are in place.

.3 All work related to existing asbestos shall be handled and/or removed in accordance with the requirements of Ministry of Environment, WorkSafeBC and any other Authorities Having Jurisdiction.

.4 All work performed on systems with asbestos containing material must be reported in advance to WCB.

.5 If instructions concerning asbestos are specified elsewhere in the Contract Documents then the most stringent specified requirements shall be followed.

2.4 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.
- .4 Pipe anchor and/or support posts.
- .5 Ceiling ring bolts - secure to structure or steel supports.

.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.

3.0 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 to the Owner, 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 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.

3.3 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 Align equipment, rectangular cleanouts and similar items with building lines wherever possible.

.4 Ensure that equipment does not transmit noise or vibration to other parts of the building as a result of poor installation practices.

3.4 ANCHORS AND TEMPLATES

.1 Supply anchors and templates for installation by other Divisions.

3.5 CUTTING, PATCHING, DIGGING, CANNING AND CORING

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions. 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 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the mechanical services.

.3 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.

.4 Openings through structural members of the building shall not be made without the approval of the Departmental Representative.

3.6 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.

3.7 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.

3.8 CLEANING AND FINAL ADJUSTMENT

.1 Clean and refurbish all equipment and leave in first class operating condition including replacement of all filters in all air and piping systems.

.2 Balance and adjust all systems and each piece of equipment to operate efficiently.

3.9 EXISTING SERVICES

.1 Protect existing services from the work of this contract. Where the location of existing services was known they have been shown. However, the removal of concealing surfaces may reveal different locations or other existing services. Work with the Owner's staff to trace to the originating source and to all points served. Obtain instructions from the Departmental Representative when existing services must be relocated or modified, except where shown in the Contract Documents.

.2 The Contractor is responsible for any damages to existing services by this work.

3.10 DEMOLITION

.1 All piping, ducting and equipment which becomes redundant and is no longer required due to the work shall become the property of the Contractor and shall be completely removed from the site.

3.11 SALVAGE

.1 The items listed here shall be carefully removed to avoid damaging them and shall remain the property of the Owner. Provide a temporary protected location on site and move the items to that location. Arrange with the Owner for the Owner to remove the items from the site. Obtain a written receipt from the Owner for each item.
  .1 Propane Storage Tank
  .2 Radiant Heating units.

.2 All piping, ducting and equipment that is not salvaged, becomes redundant and is no longer required due to the work shall become the property of the Contractor and shall be completely removed from the site.

3.12 RE-USED EQUIPMENT

.1 Where existing equipment is being relocated and reused check and report on the condition before removal to the Departmental Representative. Any damage by the work of this contract is the responsibility of the Contractor.

3.13 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 Architect.

3.14 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 temperature/humidity control devices.
- .2 Operation and maintenance requirements of all equipment and systems under each mode of operation including:
  - .1 Fans.
  - .2 Radiant heating system.

.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.

3.15 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.

3.16 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

.1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and hold-back will be established equal to at least twice the Departmental Representative's cost estimate of completing that work.

.2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of the mechanical work have been met and verified.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

2.0 Products

.1 Not Used.

3.0 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 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.

.5 Standard of Acceptance: Capital, Walter Vallet, EPCO.

3.4 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 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Ream pipes, remove scale and other foreign material before assembly.

.10 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.11 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 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Shop Drawings:
- .1 Submittals: in accordance with Section 01 33 00, Submittal Procedures.
- .2 Shop drawings shall be stamped and signed by Professional Engineer registered or licensed British Columbia for seismically rated hangers and supports.
- .3 Submit shop drawings and product data for:
  - .1 Bases, hangers and supports.
  - .2 Connections to equipment and structure.
  - .3 Structural assemblies.
- .4 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 specified in Section 01 78 00 - Closeout Submittals.

1.3 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 Base maximum load ratings on allowable stresses prescribed by ANSI B31.1 or MSS SP58.
- .3 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.
- .4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.
- .5 Where possible use cast-in-place concrete inserts.
- .6 Support from structural members, not from metal decking.

.2 Design for Seismic Events
- .1 Design supports platforms, catwalks, and hangers, to withstand seismic events of the magnitude prescribed for the area in the BC Building Code.

2.0 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 Upper attachment structural:
.1 Suspension from lower flange of steel beam channel or angle.
.1 Cold piping 50 mm [2"] and smaller:
.1 Ductile iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip Grinnell Fig. 61 for steel beam, Grinnell Fig. 86 for steel channel or angle.
.2 Cold piping 65 mm [2-1/2"] or larger all hot piping:
.1 Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, to MSS-SP58 and MSS-SP69. Grinnell Fig. 229 for steel beam, Fig. 226 for steel channel or angle.
.2 Suspension from upper flange of steel beam, channel or angle.
.1 Cold piping 50 mm [2"] and smaller:
.1 Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, to MSS-SP69. Grinnell Fig. 61
.2 Cold piping 65 mm [2-1/2"] or larger, all hot piping:
.1 Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut. Grinnell Fig. 227.

.3 Attachment to steel joist:
.1 Cold piping 50 mm [2"] and smaller:
.1 Steel washer plate with double locking nuts. Grinnell Fig. 60.
.2 Cold piping 65 mm [2-1/2"] and larger and all hot piping:
.1 Steel washer plates with double locking nut, carbon steel clevis and malleable iron socket. Grinnell Fig. 60, 66 and 290.

.4 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.

.5 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 Do not use 22 mm or 28 mm rod.
.4 Grinnell Fig. 146 or Myatt Fig. 434.

.6 Pipe attachments:
.1 Material to MSS-SP58.
.2 Attachments for steel piping: carbon steel.
.3 Attachments for copper piping: copper plated black steel.
.4 Use insulation shields for cold piping and oversize pipe hangers to surround the insulation on cold piping.

.7 For piping with less than 25 mm [1"] movement or more than 300 mm [12"] long hanger rod length, use adjustable clevis:
.1 Material to MSS-SP69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis. For steel or cast iron pipe, Grinnell Fig. 260. For copper pipe, Grinnell Fig. CT-65 (copper plated).

.8 For piping with more than 25 mm [1"] movement or hot piping with less than 300 mm [12"] long hanger rod length:
.1 Use pipe rollers with cast iron roll and roll stands with carbon steel rod to MSS-SP69.
.2 Up to 150 mm [6"] - Grinnell Fig. 174 or 181

.3 Over 150 mm [6"], Grinnell Fig. 171.

.9 For floor supported hot piping use Grinnell Fig. 271.

2.3 WALL SUPPORTS

.1 Welded angle for iron brackets with hangers as specified for horizontal pipe.

.2 Manufactured channel supports (Cantruss, Unistrut) for vertical pipe support.

.3 For lateral movement restraint of exposed vertical piping, Grinnell Fig. 262 or 263.

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 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 12 mm [1/2"] minimum, 50 mm [2"] maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm [2"]: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibrations for each hanger.

.4 Steel allow springs: to ASMT A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.5 Grinnell Fig. 171 with Fig. 178.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.7 EQUIPMENT SUPPORTS

.1 Provide stands and supports for equipment and materials supplied.

.2 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23, Structural Steel for Buildings.

.3 Submit calculations with shop drawings.

3.0 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:
- .1 Manufacturer's instructions and recommendations
- .2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .3 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 12 mm [1/2"] or more.
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .4 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variations in supporting effect do not exceed 25% of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of BC Building Code, Canadian Plumbing Code or Authority Having Jurisdiction.

.2 Gas piping to CAN/CGA-B149.1, Natural Gas and Propane Installation Code.

.3 Within 300 mm [12"] of each horizontal elbow.

.4 Rod Diameter:
- .1 10 mm [3/8"] for 50 mm [2"] and smaller.
- .2 12 mm [1/2"] for 65 mm to 100 mm [2-1/2", 3", 4"].
- .3 22 mm [7/8"] for 125 mm to 200 mm [5", 6", 8"].

.5 Maximum spacing for
- .1 Steel pipe:
  - .1 1.8 m [6 ft] for 12 mm [1/2"].
  - .2 2.4 m [8 ft] for 20 mm, 25 mm [3/4", 1"].
  - .3 3.0 m [10 ft] for 30 mm [1-1/4"] and larger.
  - .4 Pipework larger than 300 mm [12"]: to MSS-SP69.
- .2 Maximum spacing for copper pipe.
  - .1 1.5 m [5 ft] for 12 mm [1/2"].
  - .2 1.8 m [6 ft] for 20 mm, 25 mm, 30 mm, 40 mm [3/4", 1", 1-1/4", 1-1/2"].
  - .3 3.0 m [10 ft] for 50 mm [2"] and larger.

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

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00, Submittal Procedures.
- .2 Submit shop drawings and product data for all vibration isolators and of all seismic restraint components, assemblies, and attachments.
- .3 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 and location requirements (e.g., 3.0 g for vibration isolated equipment in Victoria) or 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.
- .4 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.
- .5 Shop drawings shall include the colour coding for all seismic anchor bolts for installation in concrete.
- .6 Where specific restraints are to be installed to the SMACNA Guidelines include a list of all such points of restraint and reference the appropriate SMACNA detail including attachments. No further shop drawing submittal for those specific points of restraint will be required.
- .7 Shop drawings shall include the Seismic Engineer's requirements for any additional members required for attachment to the structure.
- .8 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 specified in Section 01 78 00, Closeout Submittals.

1.3 REGULATORY CODES, GUIDELINES

.1 British Columbia Building Code referred to in this section as the BC Building Code.

.2 SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems" referred to in this section as SMACNA Guidelines.

1.4 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 BC Building Code design magnitude for the specific location.

1.5 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 seismic restraints for the piping and ductwork systems and all equipment specified in Mechanical Division to meet the requirements of the BC Building Code, to be in general conformance to SMACNA Guidelines, 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 where specifically designated as "post-disaster" to maintain the systems and equipment in service after a seismic event. Do not provide seismic restraint where it is identified in the SMACNA Guidelines as not required.

1.6 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 Model Schedule's S-B and S-C to the Registered Professional of Record 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 for Seismic Level A. (e.g., 9.1 m [30 ft] between the transverse pipe restraints instead of 12.2 m [40 ft]).

.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 (e.g., 3 g in Victoria) 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. The magnification shall be 10 or less. In "post disaster" designation, coordinate with the equipment fragility levels to ensure they are not exceeded during a seismic event.

1.7 EQUIPMENT REQUIREMENTS

.1 The requirements of this section shall apply to vibration isolation and seismic restraints that are factory supplied integral with the equipment.

.2 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 Where designated as "post-disaster", the equipment will 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.
- .4 Where not designated "post-disaster", the equipment has sufficient integral strength to ensure that all components will remain attached after a seismic event.

2.0 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 Acceptable Products: Mason WMW, Mason Super W, Vibron Vibropad VSV.

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 Acceptable Products: Mason BR, Trelleborg RAEM.

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 Acceptable Products: Mason SSLFH, Vibron VMR-2.

.3 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 SEISMIC SNUBBERS

.1 All directional interlocking steel components with minimum 6 mm [1/4"] thick replaceable one-piece neoprene. Design impact shall not exceed 7000 kPa [1000 psi]. Air gap of 6 mm [1/4"] in all directions.

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 Slack cable restraints may be as detailed in the SMACNA Guidelines or as provided by Vibra-Sonic Control, Mason SCB and accessories.

.2 Rigid restraints may be as detailed in the SMACNA Guidelines for the appropriate Seismic Hazard Level.

.3 SMACNA Guidelines restraints modified by the Seismic Engineer.

.4 Custom restraints designed by the Seismic Engineer.

3.0 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 GENERAL

.1 All work shall be in accordance with manufacturer's instructions and recommendations and shall be done by workers experienced in the installation of vibration isolation and seismic restraint.

.2 Fill any space between anchor bolt and the attachment bolt hole with Mason 0.5 Fast Epoxy Putty to prevent movement.

.3 Hangers shall not buckle under vertical seismic movement. Where the rod length is 50 times or more than the rod diameter it shall be reinforced in accordance with SMACNA Guidelines or with Mason SRC clamps.

.4 Where threaded nuts secure vibration isolators or seismic restraints use double nuts, locking nuts or Loctite.

.5 Ensure vibration from piping and ductwork does not transfer to floors, structure or walls. Provide resilient protection as required.

.6 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.

3.3 PIPING AND DUCTWORK ISOLATION AND RESTRAINT

.1 Provide flexible pipe and ductwork connectors where indicated in other Sections and/or on drawings.

.2 Where connected to vibration isolated equipment the first three supports on 100 mm [4"] or smaller pipe (four supports on 150 and 200 mm [6" and 8"] pipe, six supports on 250 mm [10"] and larger pipe shall be Type 4A or 4B isolators with static deflection equal to or greater than that specified for the equipment.

.3 Restraint of propane or natural gas piping shall be in accordance with this section or National Standard of Canada CAN/CGA-B149.1-00 whichever is more restrictive. For example, gas piping 30 mm to 65 mm [1-1/4" to 2-1/2"] shall be seismically restrained as for 65 mm [2-1/2"] piping in the SMACNA Guidelines.

.4 Piping and ductwork exempted by the SMACNA Guidelines for restraint does not need to be seismically restrained.

.5 Provide seismic restraint of all sizes of flues as per ductwork of equivalent weight.

.6 Provide transverse and longitudinal restraints as per SMACNA Guidelines except that maximum spacings shall be 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.

3.4 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. If the equipment is subject to resonances (e.g., internal isolation, partially filled tanks) increase the seismic acceleration to 9 times the ground acceleration.

.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.

3.5 EQUIPMENT ISOLATION AND RESTRAINT

.1 Isolate and seismically restrain equipment mounted on the floor, on housekeeping pads or on the roof with Type 3A or Type 3B isolators. Actual static deflection shall be 25 mm [1"] minimum unless otherwise specifically indicated.

.2 Isolate and seismically restrain all equipment mounted on slab on grade on Type 2 isolators. Provide seismic snubbers if the Type 2 isolators do not have adequate seismic restraint capacity.

.3 Isolate and seismically restrain suspended equipment with Type 4B isolators and slack cable restraint. Actual static deflection shall be 25 mm [1"] minimum unless otherwise specifically indicated.

.4 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.

3.6 INSPECTION

.1 Refer to clause in this Section, SEISMIC RESTRAINT GENERAL, for inspection, certification and submittals required from the Seismic Engineer.

.2 The vibration isolation supplier's representative shall inspect the completed installation, issue instructions to the Contractor for any required correction or adjustment, re-inspect until satisfactory and submit a signed declaration to the Engineer stating that the final installation meets the specified performance and that the installation is in accordance with the instructions and recommendations of the isolation manufacturer.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to the Engineer within 90 days after award of the Contract.

.2 Provide documentation confirming qualifications, successful experience.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate 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.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by Codes, Standards to satisfaction of Authority Having Jurisdiction.

1.5 TESTS

.1 Scope of Tests:
- .1 The pressure testing of piping systems shall be the responsibility of the installing trade. The tests are specified under the appropriate specification section.
- .2 The pressure/leakage testing of air handling systems shall be the responsibility of the installing trade. The tests are specified under the appropriate specification section.
- .3 The performance testing of equipment shall be the responsibility of the supplying trade. For certain larger, or complex or specialized equipment the start-up and/or testing shall be performed by a manufacturer's qualified representative. The tests are specified under the appropriate specification section.
- .4 The testing of fire dampers and fire/smoke dampers shall be the responsibility of the Balancing Agency responsible for balancing. The tests are specified in this section of the specification.

.2 General Requirements:
- .1 Give written minimum 48 hour notice of date for tests to Engineer and to any Authorities Having Jurisdiction.
- .2 Do not externally insulate or conceal work until tested and reviewed.
- .3 Make good and retest as required until test is successful.
- .4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.
- .5 Tests shall be to applicable codes, to the requirements of Authorities Having Jurisdiction and in accordance with recognized industry standards.
- .6 Obtain and provide certificates of approval where applicable from Authorities Having Jurisdiction.

1.6 TESTING AND BALANCING

.1 Submit a report to the Engineer indicating final fan speed, motor operating amperages, and final air quantities obtained.

1.7 COMMISSIONING AND DEMONSTRATION

.1 Be responsible for the performance and commissioning of all equipment supplied under the 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 ASHRAE Standard 1 "Guideline for Commissioning of HVAC Systems".

.3 Commissioning is concluded when the installation is in full working order and acceptable for use. The work will include the following:
- .1 Set up constant volume and variable volume fans.
- .2 Adjust vibration isolators and earthquake restraints for optimum performance.
- .3 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.
- .4 Verification of water tightness of all roof and exterior wall penetrations.
- .5 Set up all automatic control valves/dampers and automatic temperature/humidity control devices.

.4 At the conclusion of commissioning, demonstrate the operation of the systems to the Owner's Operating Staff.

.5 The verification process shall include the demonstration of the following:
- .1 The ease of access that has been provided throughout for servicing mechanical equipment.
- .2 Operation of all automatic temperature/humidity control devices.
- .3 Operation of all equipment and systems under each mode of operating, and failure, including:
  - .1 Fans.
  - .2 Radiant heating units.

.6 At the completion of the commissioning, testing, balancing and demonstration submit the following to the Engineer and Consultant:
- .1 A letter certifying that all work specified under this Contract is complete, clean and operational in accordance with the specification and drawings.
- .2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.
- .3 Record Drawings, as specified.
- .4 BC Gas Inspection Dept. approval.
- .5 A list of all alarm and protective devices tested, with the final operating settings.

1.8 MAINTENANCE PROGRAM

.1 Employ the agency, which is preparing the operating and maintenance manuals, to prepare a Preventative Maintenance Program.

.2 The maintenance program shall include maintenance schedules and an equipment record card system.
- .1 Maintenance Schedules
  - .1 The maintenance schedules shall be made up of card stock to detail preventative maintenance procedures and their required frequency (daily, weekly, monthly, quarterly, half yearly, yearly and seasonally) for each system, such as glycol/hot water heating, chilled water, condenser water, heat pump water, steam and refrigeration systems.
  - .2 Major items of equipment shall be listed on individual cards.
- .2 Equipment Maintenance Record Cards

.1 A record card shall be prepared for each piece of equipment stating its identifying name, unit number, manufacturer, model number, local supplier, serial number and all data relative to its operation and maintenance. Adequate space must be provided on each card for recording service details.

.3 After substantial performance has been declared, the agency shall visit the site, to explain and instruct the representative designated by the Owner on the use of the maintenance program.

2.0 Products

.1 NOT APPLICABLE

3.0 Execution

.1 NOT APPLICABLE

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for all petroleum products.

.2 Closeout Submittals:
- .1 Provide maintenance data for incorporation into Operational and Maintenance manual specified in Section 01 78 00 - Closeout Submittals.

1.3 GAS INSPECTION

.1 Submit to the Provincial Gas Inspection Department, drawings, applicable sections of specifications and detailed drawings as required to obtain approval for the installation before the work commences.

.2 Approvals must be received prior to commencing work.

2.0 Products

2.1 PIPE

.1 Above Ground Piping
- .1 Schedule 40 seamless Carbon Steel to ASTM A53/A53M and CSA B63.

.2 Copper tube to ASTM B837.

2.2 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:
- .1 Malleable iron: screwed, banded, Class 150.
- .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
- .3 Welding: butt-welding fittings.
- .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
- .5 Bolts and nuts: to ASME B18.2.1.
- .6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:
- .1 Cast copper fittings: to ASME B16.18.
- .2 Wrought copper fittings: to ASME B16.22.

2.3 JOINTING MATERIAL

.1 Screwed fittings: Pulverized lead paste.

.2 Teflon tape is unacceptable.

.3 Welded fittings: to CSA W47.1.

.4 Flange gaskets: Full faced gasket materials, flanged steel weld neck, raised face type, carbon steel (ASTM A307) square headed bolts with hexagon nuts, bolts bull diameter of bolt holes.

2.4 VALVES

.1 Provincial Gas Department approved and suitable for temperature to which they are exposed.

.2 Acceptable Products: Homestead 601, Emco, Huber, Mueller, Newman-Milliken, Rockwell, Wallaceburg.

2.5 PRESSURE REGULATOR

.1 Constant pressure type, ductile iron, with ss trim.

.2 Corrosion resistant.

.3 High performance reducing pounds to inches.

3.0 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 PIPING

.1 Install in accordance with Section 23 05 05, Installation of Pipework, BC Building Code, CAN/CSA B149.1, CAN/CSA B149.2 and Authorities Having Jurisdiction.

.2 Install drip points:
- .1 At low points in piping system.
- .2 At connections to equipment.

3.3 ABOVE GROUND EXTERIOR PIPING

.1 Allow for expansion with suitable anchors, guides and expansion loops to prevent undue stress on any part of the system. Such anchors and guides shall be rigidly fastened to structural members through the roof deck. Supports shall be set in sheet metal gum pans wrapped into the roofing. Coordinate with roofing subtrade.

.2 All piping shall be welded with approved flexible connectors at point of connection to gas fired equipment.

.3 Apply one coat of Rust-Oleum 769 damp proof red primer, one coat of Rust-Oleum 960 zinc chromate and one finish coat of Rust-Oleum 850 grey to piping.

3.4 PIPE JOINTING

.1 Interior petroleum service - screw or weld up to 50 mm [2"], weld 65 mm [2-1/2"] and larger.

.2 Interior petroleum service in unvented space, in supply or return air ceiling plenum, or operating at 35 kPa [5 psi] pressure - weld all sizes.

.3 Exterior petroleum service - weld all sizes except for polyethylene pipe which shall have no joints other than those allowed in NSC CAN/CGA-B149.1.

.4 All branch connections except those less than half diameter of main shall be made with welding tees.

.5 Branch connections less than half diameter of main may be made with weldolets or threadolets.

.6 Remake all leaking joints.

.7 Do not paint dielectric isolating couplings.

.8 Provide pressure regulator and lockable shut-off at discharge of propane tank before entry into the building.

.9 Heat shrink factory extruded polyethylene sleeves over bare metallic pipe at weld.

3.5 INDOOR INSTALLATION

.1 Install to approval of authority having jurisdiction.

.2 Take most direct route possible or practicable.

.3 Support overhead.

.4 Install overhead piping close to ceiling or beams or along walls, where possible. Support from building structure at least 1800 mm from floor.

.5 Steel frame buildings: use bolted clips or pipe hangers attached to flanges with retaining strap.

.6 Concrete ceilings: use through bolts or poured-in-place expansion shields.

.7 Hanger spacing:
- .1 Up to NPS11/4, 3700 mm.
- .2 NPS 1 1/2 and over, 4600 mm.
- .3 Design to prevent lateral movement.

.8 Exposed risers: protect against mechanical damage by installing:
- .1 Adjacent to walls or pilasters.
- .2 Between flanges of steel columns.
- .3 Guards.

.9 Pipework above floor level inside buildings from above-ground outdoor storage tanks: cover with "anti-sweat" insulation.

.10 Install loops or swing connections to compensate for pipe movement.

.11 Install heating systems for piping systems in accordance with Part 4 of the National Fire Code of Canada, subsection 4.4.9, "Heating of Piping Systems".

.12 Do not jeopardize fireproofing of structural elements or fire separations.

3.6 VALVES

.1 Install valves to control flow and to isolate equipment at following locations:
- .1 Fill and withdrawal connections of above-ground tanks.
- .2 At the service entry point to the building immediately prior to entry.
- .3 At each branch to an individual item of equipment or appliance.

.2 All building isolation valves shall possess locking lugs.

3.7 EQUIPMENT CONNECTIONS

.1 Install unions or flanges in connections to all equipment and specialty components.

.2 Arrange piping connections to allow ease of access and for removal of equipment.

.3 Align and independently support piping connections to prevent piping stresses being transferred to equipment.

3.8 VENT TERMINALS

.1 Terminate vent outlets to atmosphere at the following minimum lateral distances:
- .1 1.5 m [5 ft] from any door, operable window or building opening.
- .2 3.0 m [10 ft] from any forced air intake.

3.9 PIPING TESTS

.1 In accordance with the National Standard of Canada "Natural Gas and Propane Installation Code" CAN/CGA-B149.1.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for dampers.

.2 Closeout Submittals:
- .1 Provide maintenance data for incorporation into Operational and Maintenance manual specified in Section 01 78 00 - Closeout Submittals.

2.0 Products

2.1 BACKDRAFT DAMPERS - MEDIUM DUTY

.1 Frame shall be 16 gage galvanized steel or aluminum channel with windstops to reduce back flow all around.

.2 Blades shall be non-combustible neoprene coated fiberglass mechanically locked into blade edge for low noise operation. Resistance to moisture, mildew, and rot as well as to most oils, chemicals, and grease.

.3 Each blade shall operate independently without bearings or linkage. Quiet operation with no metallic noises.

.4 Dampers shall be designed for maximum 1200 fpm spot velocities and up to 4" w.g. back pressure depending on damper size.

.5 Maximum blade length of 760 mm [30"], use multiples for larger dimensions.

.6 Acceptable Manufacturers: Ruskin NMS, Airolite, Penn.

3.0 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 BACKDRAFT DAMPER INSTALLATION

.1 Take care to install damper square with no deformation to the frame.

.2 Test installed damper to ensure movement is free without any binding.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for all fans.
- .3 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 specified in Section 01 78 00 - Closeout Submittals.

1.3 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 Engineer. 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.

.6 If fan power levels exceed design levels, provide the location of a similar existing fan installation with Tender. Coordinate with Engineer to obtain access for acoustical measurements. These measurements, with corrections for volume, static pressure, efficiency, blade passage tone and room effect will form a basis of evaluation of the fans. The corrections will be based on the ASHRAE Guide and an ILG RSS comparison of room effect. Approval will be based on fans being similar to the fans evaluated, not on submitted fan sound power levels.

1.4 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Obtain signed receipt from the Owner when spare parts are handed over.

.3 Provide the following spare parts:
- .1 Bearings and seals.
- .2 List of specialized tools necessary for adjusting, repairing or replacing.

2.0 Products

2.1 WALL EXHAUST

.1 Direct drive, axial type sidewall fan.

.2 Propellers shall be constructed with fabricated steel, fabricated aluminum, or cast aluminum blades and hubs. A standard square key and set screw or tapered bushing shall lock the propeller to the motor shaft. All propellers shall be statically and dynamically balanced to AMCA Standard 204-05.

.3 Motors shall be permanently lubricated, heavy duty type, carefully matched to the fan load and furnished at the specified RPM, voltage, phase, and enclosure.

.4 Motor drive frame assemblies and fan panels shall be galvanized steel or painted steel.

.5 Drive frame assemblies shall be welded wire or formed channels and fan panels shall have prepunched mounting holes, formed flanges, and a deep formed inlet venturi.

.6 Accessories:
- .1 Vibration isolators.
- .2 Wiring post.
- .3 Head mounted disconnect switch.
- .4 Discharge birdscreen.
- .5 45° Weatherhood.
- .6 Wall Housing
- .7 Neoprene-coated fiberglass backdraft damper.

.7 Acceptable Products: Greenheck, Cook, Twin City.

3.0 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.

END OF SECTION

1.0 General

1.1 RELATED SECTIONS

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

.2 Section 23 0300 - Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for heaters.

.2 Closeout Submittals:
- .1 Provide maintenance data for incorporation into Operational and Maintenance manual specified in Section 01 78 00 - Closeout Submittals.

2.0 Products

2.1 GENERAL

.1 Provide CGA approved, packaged factory assembled components consisting of heat exchangers, burners, controls, air filters, vacuum generators, reflectors, fans.

2.2 RADIANT INFRARED HEATERS - LIQUID PETROLEUM GAS FIRED

.1 General
- .1 Provide a radiant heating system complete with all necessary components and connections to achieve the specified functions. System shall be complete with burners, control panel, vacuum pump, hangers, thermostat, wall thimble, gas flex connector, shut off valve, ducted combustion air, and vent terminal.
- .2 Submitted shop drawings shall include design calculations and layout for each radiant heater and burner.
- .3 CGA approved.
- .4 Provide a written parts and labour warranty covering all components for a period of 3 years and covering the heat exchanger for 7 years, and the burner/gas mix apparatus for 10 years.
- .5 Approved stainless steel flexible connectors shall be provided.
- .6 The burner unit shall operate at an inlet gas pressure of 11 in w.c. at 120 V, 1 phase, 60Hz.
- .7 No condensation shall be formed after system reaches operating temperature.
- .8 System shall operate under negative pressure for maximum safety.

.2 Equipment Components
- .1 Ignition shall be with a direct spark with the following control:
  - .1 Provide pre-purge of 30 seconds before ignition attempt.
  - .2 Make 3 ignition attempts before lockout, with purge before each attempt.
  - .3 Recycle again in one hour with 3 ignition attempts.
  - .4 Have a lighted diagnostic display capability.
  - .5 Have openly accessible sense current contacts within the housing.
- .2 Vacuum pump motor shall be totally enclosed, requiring no oiling, and shall be equipped with a thermal overload switch.
- .3 The burner shall be equipped with a clearly visible RUN light.
- .4 Gas valve shall include safety shutoff, a manual valve, two magnetic operators and a standard gas pressure regulator.
- .5 Burner housing shall be constructed of 18 ga. corrosion resistant steel coated with powder epoxy paint.

.6 Burner shall be equipped with a flame sight port safely useable when the unit is running during service.
.7 Burner shall be equipped with a zero governor to balance fuel flow with combustion airflow regardless of vacuum draw.
.8 Burner body shall be cast iron.
.9 Combustion air shall be filtered by means of a removable air filter provided in each burner.
.10 All burner-operating components shall be enclosed in a sealed burner housing.
.11 The burner shall be serviceable from either side while in operation.
.12 Reflectors shall be bright aluminum, ASTM 1100, with 10 reflective surfaces. 100% efficient – zero impingement of infrared energy reflected back into the radiant tubing.
.13 Reflector material shall be at least 0.024 inches thick (per CGA code).
.14 Reflector end caps shall be fitted to the end of each reflector run to reduce convected heat loss.
.15 Reflectors shall extend below the bottom surface of the radiant tube.
.16 Directing of radiant pattern shall be accomplished through the use of side shields, or bottom shields.
.17 Couplings shall be of aluminized steel (16 ga) with high tensile bolt connectors.
.18 Radiant heat exchanger tubing shall be seamless welded 16 ga thick hot rolled steel with a heat treated aluminized combustion tube.
.19 System shall incorporate a vacuum-proving switch capable of shutting off gas flow in the event of flue blockage, or failure of vacuum pump.

.3 Vacuum Pumps
.1 Vacuum pumps shall be heavy duty steel construction connected to the system by means of a high temperature flexible connector, TENV sealed ball bearings and thermally protected.

.4 Control Panel
.1 A Burner Control panel incorporating pre-purge and post purge function shall be provided with provision for 3 zones of burners controlled by the 24-volt thermostats.
.2 Provide night setback operation.
.3 Provide a high/low variable burner operation controller.
.4 Control panels shall be CGA certified as part of the radiant heating system.

.5 General
.1 Burner Controller, Vacuum Pump Speed Controller, vacuum switch and the thermostat shall be provided by the heater supplier.
.2 Mount the Burner Controller, the Vacuum Pump Speed Controller and the thermostat.
.3 Wire from each thermostat to the Burner Controller.
.4 Wire from the Burner Controller to the Vacuum Pump Speed Controller.
.5 Wire from the vacuum switch to the Burner Controller.

.6 Installation
.1 Install in accordance to manufacturer's instructions and all applicable Codes.
.2 Heater units shall be suspended in accordance with manufacturer instruction with chain and turnbuckles exceeding 150 lb. pull test.
.3 Manufacturer shall supervise the installation of the heating system and provide startup service for each vacuum pump and each burner complete with written report.

.7 Standard of Acceptance: Superior Radiant Products model Premier VS-VH.

3.0 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 RADIANT INFRARED HEATERS INSTALLATION

.1 Install liquid petroleum gas fired infrared radiant system in accordance with CSA-B149.1, as recommended by manufacturer and as indicated.

.2 Provide grading of radiant pipe as required.

.3 Make provision for pipe movement caused by normal operation and expansion.

.4 Maintain required clearances from combustibles.

.5 Follow manufacturer's detailed installation, testing, operation and maintenance instructions.

.6 Install thermostats where indicated. Supply heat shields where recommended by manufacturer.

.7 Test radiant system as recommended by manufacturer and required by authorities having jurisdiction. Air test piping for leaks. Check burner safety controls.

.8 Arrange equipment, including burners, vacuum generators, to facilitate removal without dismantling pipe, reflectors, or associated apparatus.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-2015, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

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

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit for review single line electrical diagrams under plexiglass and locate as indicated.

.1 Electrical distribution system in Main Electrical Room.

.3 Shop drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.4 Submit copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.

.5 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Quality Control: in accordance with Section 01 45 00 - Quality Control. Provide CSA certified equipment and material.

.1 Where CSA certified material is not available, submit such material to authority having jurisdiction for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

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

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid "FSR-A" Contractor license or apprentices in accordance per the conditions of Provincial Act respecting manpower vocational training and qualification.

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

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 SYSTEM STARTUP

.1 Instruct Departmental Representative in 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 will aspects of its care and operation.

1.8 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.2 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities.

.2 Decal signs, minimum size 175 x 250 mm.

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core.

.2 Sizes as follows:

NAMEPLATE SIZES

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

.2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.5 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.7 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment light gray to EEMAC 2Y-1.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems.

.5 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Megger 5001-25kV circuits, feeders and equipment with a 5000 V instrument.

.4 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.7 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 31 19 – Project Meetings.

.2 Section 01 33 00 – Submittal Procedures.

.3 Section 01 35 43 – Environmental Procedures.

.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.5 Section 01 74 11 – Cleaning.

1.2 REFERENCES

.1 CSA International

.1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.2 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.

.3 Canadian Environmental Protection Act (CEPA), 1999, C.33.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section:

.1 01 33 00 - Submittal Procedures.

.2 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 01 35 43 - Environmental Procedures.

.2 Submit demolition drawings for existing retaining wall:

.1 Submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional engineer registered or licensed in the Province of BC, Canada, showing proposed method.

1.4 SITE CONDITIONS

.1 Review "Designated Substance Report" and take precautions to protect environment.

.2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous is encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Proceed only after receipt of written instructions have been received from Departmental Representative.

.3 Notify Departmental Representative before disrupting building access or services.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 EXAMINATION

.1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 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.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.

.2 Protection of In-Place Conditions:

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.5 Do Work in accordance with Section 01 35 33 - Health and Safety Requirements.

.3 Demolition/Removal:

.1 Remove items as indicated.

.2 Removal of Pavements, Curbs and Gutters:

.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.

.2 Protect adjacent joints and load transfer devices.

.3 Protect underlying and adjacent granular materials.

.3 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

3.3 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 Refer to demolition drawings and specifications for items to be salvaged for reuse.

.4 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 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 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

- .1 EEMAC 1Y-2, latest edition, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 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.

.4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 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.

1.2 GENERAL REQUIREMENTS

.1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) 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 in concealed locations.

.4 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.5 Refer to Equipment Schedule(s) for detailed responsibilities.

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 RW90XLPE 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 recessed tee bar luminaire drops from ceiling mounted outlet boxes. Use anti-short connectors. Cable from luminaire to luminaire is discouraged. Allow nominally 900mm extra cable looped and supported in the ceiling space to permit fixture relocations of one tile space.

.7 TBS90 #14 AWG stranded shall be used in all switchgear assemblies. Current transformer secondary wiring shall be #12 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes.

.8 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

2.3 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: solid annealed copper conductors sized as indicated, with TWH over each conductor and overall covering of PVC jacket.

.3 600 V type: stranded copper conductors, sizes as indicated with R90 (x-link) ethylene-propylene rubber insulation type over each conductor and overall covering of PVC jacket.

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.

.2 In cable trays for electrical systems in accordance with Section 26 05 36.

.3 In underground ducts in accordance with Section 26 05 34.

.4 In trenches in accordance with Section 26 05 34.

.5 In wireways and auxiliary gutters in accordance with Section 26 05 37.

.6 All wires are to be pulled in together in a common raceway, using liberal amounts of lubricant.

.7 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.

.8 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.

3.2 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Install cable in trenches in accordance with Section 26 05 34.

.3 Lay cable in cable trays for electrical systems in accordance with Section 26 05 36.

.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF CONTROL CABLES

.1 Control cable and conduit will be supplied and installed by Mechanical Contractor. Controls wiring must be installed in conformance with Electrical Specifications. Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.2 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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.4 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.

.3 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.4 Insulated grounding conductors: green, copper conductors, size as indicated.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process or permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.8 Connect building structural steel and metal siding to ground by welding copper to steel.

.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.3 MAINTENANCE HOLES

.1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each maintenance hole.

.2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

3.4 ELECTRODES

.1 Install rod electrodes and make grounding connections as indicated.

.2 Bond separate, multiple electrodes together.

.3 Use size 3/0AWG copper conductors for connections to electrodes.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.5 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral.

3.6 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

.2 Ground all metallic piping systems including gas, water, sanitary and compressed gases and air greater than 3 meters in length.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.8 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

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 hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1.5m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 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 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.

2.2 CABINETS

.1 Sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard (if required) for surface or flush mounting as required.

.2 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

Part 3 Execution

3.1 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.

3.2 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

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 347V outlet boxes for 347V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. Larger 102 mm square x 54mm deep outlet boxes to be used when more than one conduit enters one side. Provide extension and plaster rings as required.

.2 For larger boxes use GSB solid type as required.

.3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.

.4 Lighting fixture outlets: 102 mm square outlet boxes or octagonal outlet boxes.

.5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

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 Ceiling outlet boxes to be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.

.4 Fill open boxes with paper, sponges, foam or similar approved material to prevent entry of construction material. Remove upon completion of work.

.5 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.6 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not to be used.

.7 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.

.8 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.

.9 No sectional or handy boxes to be installed.

.10 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.

.11 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.

.12 Outlets installed back to back in party stud walls to be off-set by one stud space.

.13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.

.14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.

.15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.

.3 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit (FMC): to CSA C22.2 No. 56.

1.2 BASIC WIRING METHODS

.1 Underground or in concrete exterior to building:

.1 All wiring shall be in Schedule 40 RPVC conduit.

.2 Concrete walls and slabs interior to building:

.1 All wiring shall be in Schedule 40 RPVC conduit.

.3 Partition walls and ceilings:

.1 All wiring to be run in EMT conduit for:

.1 Branch circuits.

.2 Fire alarm.

.3 Low voltage systems.

.4 Distribution feeders and sub-feeders.

.5 Surface wiring in electrical and mechanical rooms.

.4 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.

.5 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.

.6 Surface raceways - exterior:

.1 All surface raceways shall be UV compensated Schedule 40 RPVC conduit, protected from damage and excessive heating to the Departmental Representative's satisfaction.

1.3 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 Departmental Representative prior to rough-in. Relocate any item installed without architectural confirmation as required by the Departmental Representative at no cost to the owner as long as the relocation is within 3m of the location originally shown on the electrical drawings.

.5 Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door.

.6 All outlets located on exterior walls to be complete with moulded plastic vapour barriers to maintain integrity of wall vapour barrier system.

.7 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.

.8 All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be flush mounted unless indicated otherwise.

.9 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Departmental Representative for any and all junction boxes that, due to the building design, cannot be concealed.

.10 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 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.

2.3 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.

2.4 FLEXIBLE ELECTRIC NON-METALLIC (ENT) TUBING

.1 Flexible electrical non-metallic tubing (ENT) **shall not** be used on this project.

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 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.

2.7 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. Set-screws are not acceptable.

2.8 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 electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.

.4 Use rigid PVC conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.

.5 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.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Minimum conduit size for lighting and power circuits: 19mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.10 Install fish cord in empty conduits.

.11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.12 Dry conduits out before installing wire.

.13 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.

.14 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.

.15 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.

.16 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).

.17 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.

.18 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.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

.8 Do not install conduits in slabs/concrete floors in lab areas.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

.2 Do not install conduits in slabs/concrete floors in lab areas.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 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 Lighting and power panelboards

1.2 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.

1.3 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.

1.4 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 Departmental Representative 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 600Y/347V.

.3 Tin plated 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.

.9 Provide two keys for each panelboard and key similar voltage and system panelboards alike.

.10 Panel tubs to be typically 600mm wide.

.11 All surface mounted enclosures to be complete with sprinkler drip cover.

.12 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 Bolt on type molded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/208V or 347/600V and with trip free position separate from "On" or "Off" positions.

.2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard.

.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.

.6 Provide breaker type Ground Fault Interrupter(s) (GFI) as indicated.

.7 Provide Lock-on devices as indicated and for Fire Alarm circuits, Security Equipment circuits, 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.

.6 Provide spare breakers as indicated on panelboard schedules and on single line diagram.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CSA-C22.2 No.42.1, Cover Plates for Flush Mounted Wiring Devices.
- .3 CSA-C22.2 No.55, Special Use Switches.
- .4 CSA-C22.2 No.111, General Use Snap Switches.

Part 2 Products

2.1 COLOUR

.1 All devices to be Decora style white.

2.2 SWITCHES

.1 Heavy duty specification grade.

.2 20 A, 120 V, single pole, double pole, three-way, four-way switches as indicated.

.3 Manually-operated general purpose ac switches as indicated and with following features:

- .1 Terminal holes approved for No.10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine molding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle (red toggle for emergency power circuits).

.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rating capacity of motor loads.

.5 Switches of one manufacturer throughout project.

2.3 RECEPTACLES – GENERAL

.1 Heavy duty specification grade.

.2 Duplex receptacles, CSA type L5-15 R, 125 V, 15 A, U ground, with following features:

- .1 White nylon molded housing (red for emergency power circuits)
- .2 Suitable for No.10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and non riveted grounding contacts.

.3 Receptacles of one manufacturer throughout project.

2.4 RECEPTACLES – PARTICULAR APPLICATION

.1 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button.

.2 20 Amp Receptacles (Housekeeping) Duplex receptacles – T-slot type CSA type L5-20R 125V. 20 Amp u ground with features matching 15 Amp rated Receptacles.

.3 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

2.5 COVER PLATES

.1 Stainless steel: Type 302 or 304, No. 4 finish, 1mm thick, accurately die cut, protective cover for shipping. Outlets in labs or as indicated in the drawings or specifications.

.2 Steel: sheet steel hot dip galvanized with rolled edges for surface mounted utility boxes.

.3 Wall plates to be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.

.4 All plates to be beveled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.

.5 Cast metal: die cast profile, ribbed for strength, flash removed, primed with grey enamel finish and complete with four mounting screws to box for special purpose wiring devices.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for wiring devices as indicated. Double doors for standard duplex receptacles. Cover plates to fasten to box by four screws.

.7 Gaskets: resilient rubber or close cell foam urethane.

.8 Cover plates for all wiring devices to be from one manufacturer throughout project.

.9 Surface mounted boxes with devices shall utilize tight fitting, formed covers meant for use with surface mounted boxes and devices.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.

.2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.

.3 All plates to be installed parallel or perpendicular to building lines.

INSTALLATION PARTICULAR

.4 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.5 Receptacles:

.1 Install all receptacles in the vertical plane unless otherwise noted.

.2 Generally install the L5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.

.3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.

.4 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.

.6 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.144- latest edition, Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2-latest edition, Application Guide for Ground Fault Protection Devices for Equipment.

1.2 PRODUCT DATA

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

.2 Submit product data and shop drawings.

.3 Submit test report for field testing of ground fault equipment to Departmental Representative and a certificate that system as installed meets criteria specified herein.

Part 2 Products

2.1 MATERIALS

.1 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

.1 Single pole ground fault circuit interrupter for indicated voltage c/w test and reset facilities.

2.3 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

.1 Solid state ground sensing device.

.2 Facility for testing and reset.

.3 CSA Enclosure Type 2, flush mounted with face plate, or as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Do not ground neutral on load side of ground fault relay.

.2 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.

.3 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

.3 Section 26 23 00 - Low Voltage Switchgear.

.4 Section 26 28 20 - Ground Fault Circuit Interrupters - Class 'A'.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SUBMITTALS

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

.2 Include time-current characteristic curves for breakers with ampacity of 100A and over.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

.2 Separate for recycling all waste in accordance with Waste Management Plan.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips as noted.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating or as noted in drawings or panel schedules.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers in switchboard or panel board assemblies as noted in drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-latest edition, Enclosed Switches.

.2 CSA C22.2 No.39-latest edition, Fuseholder Assemblies.

1.2 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure type 2 or as indicated.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

.8 Provide auxiliary Form-C contacts on switch operating mechanism where noted in drawings.

.9 Provide mechanical key interlocking scheme were noted in drawings.

.10 Exterior mounted disconnect switches shall be NEMA 4X rated.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN/CSA C22.1-09, Canadian Electrical Code, Part I.

.2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

1.2 PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.

1.3 INTENT

.1 Provide lighting fixtures and accessories for all outlets as listed in the Luminaire Schedule and as shown on drawings.

.2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.

.3 Ground all lighting equipment to grounding system.

.4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering fixtures.

.5 Fixtures of the same or similar type shall be supplied by the same manufacturer.

Part 2 Products

2.1 BALLASTS

.1 All ballasts shall be supplied with a rated voltage matching the supply voltage indicated on the drawings. Ballast output current and voltage shall match the current and voltage ratings of the lamp or lamps they are designed to operate. All ballasts to be built to CSA Standard C22.2 No.74.

.2 Ballasts shall comply with FCC and NEMA limits covering EMI and RFI and shall not interfere with operation of other normal electrical equipment.

.3 Minimum requirements for electronic ballasts:

- .1 Sound rating of 'A'.
- .2 High frequency operation (25 KHz or higher).
- .3 Total harmonic distortion to be less than 10%.
- .4 Current crest factor to be less than 1.7.
- .5 Rated lamp life shall be maintained.
- .6 High power factor of 90% or higher.
- .7 High efficiency ballasts for linear fluorescent lamps.
- .8 Input voltage as indicated on drawings.
- .9 Ballasts used in exterior luminaires to have minimum starting temperature of -18°C.

.4 Minimum requirements for electromagnetic ballasts:

.1 Pulse start type for metal halide.

.2 Current crest factor to be less than 1.7.

.3 Epoxy encased "super quiet" ballast assemblies for all interior fixtures ballast.

.4 Ballasts used in exterior luminaires to have minimum starting temperature of -30°C.

2.2 LAMPS

.1 Provide and install lamps in all fixtures in the project.

.2 Install fluorescent lamps with the same Watt rating as indicated. Refer to schedule for lamp colour and colour rendering index.

.3 High Pressure Sodium lamps to be coated. Metal Halide lamps to be coated unless otherwise noted.

.4 Compact fluorescent lamps shall be 3000K colour temperature or as indicated.

2.3 SOLID STATE LIGHTING

.1 Solid state lighting rated correlated colour temperature (CCT) shall be with four (4) MacAdam ellipses of the specified CCT in the luminaire schedule. Colour consistency between lamps in the same fixture type shall be within four (4) MacAdam ellipses of the rated CCT.

.2 Solid state lighting shall have a CRI greater or equal to the value listed in the luminaire schedule. In addition the lamps shall have an R9 value greater then 50 measured under the same conditions as the CRI.

.3 Solid state lighting systems (including required drivers) shall have a power factor greaten then 90 at full rated output.

.4 Solid state lighting lumen maintenance data shall be provided for L70 testing.

2.4 SOCKETS

.1 Sockets for incandescent fixtures shall be standard medium base.

.2 Sockets for fluorescent fixtures shall be standard medium bi-pin unless otherwise noted.

2.5 FIXTURES

.1 Accessories and components shall comply with relevant CSA Standards.

.2 Except where otherwise noted in the Luminaire Schedule, depth of recessed fluorescent fixtures shall not exceed 150 mm, including mounting yokes, or bridges. Design of reflector and lamp position shall be to provide high efficiency, even brightness and lack of lamp lines.

.3 All metal parts shall be thoroughly cleaned and finished in high reflectance baked enamel over corrosion-resistant primer. Finish as indicated in luminaire schedule.

.4 All internal fixture diffusers, lens panels, lens frames, etc., shall be securely and adequately supported and shall be removable without the use of tools for cleaning.

.5 Fixtures shall incorporate adequate gasketting, stops and barriers to form light traps and prevent light leaks.

.6 Fixtures shall be designed for adequate dissipation of ballast and lamp heat to avoid short ballast life, nuisance thermal tripping and decreased lamp output. Heat test reports by independent laboratories shall be provided where required by the Departmental Representative.

.7 Construction of all fixtures shall be such as to provide a rigid well aligned fixture. Formed or ribbed backplates, end plates, reinforcing channel, heavy gauge sockets, straps, etc., shall be used where required to accomplish this.

.8 The construction and performance of all fluorescent fixtures shall be subject to the acceptance of the Departmental Representative.

2.6 Luminaire Schedule

.1 **See drawings.**

Part 3 Execution

3.1 INSTALLATION AND SUPPORTS

.1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.

.2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.

.3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.4 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Fixture Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.

.5 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.

.6 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.

.7 Wiring from outlet boxes to fluorescent fixtures and wiring through fluorescent fixture channels shall be rated for 90 degrees C.

.8 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985 (R1999), Unit Equipment for Emergency Lighting.

1.2 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: 120VAC.

.3 Output voltage: 24 V dc.

.4 Operating time: **60** 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 remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: tungsten, 12 W.

.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 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 TYPES

.1 All exit signs shall comply with CAN/CSA C860 (latest edition), CSA 22.2 #141 and National Building Code, 2010.

.2 Exit signs shall be complete with 10 year warranty.

.3 Exit signs shall have a compliant green "Running Man" pictogram complete with directional arrows as noted on drawings.

.4 Exit sign with integral emergency lighting heads, as noted in drawings. Emergency lighting specification shall be as noted in 26 52 01 – Unit Equipment for Emergency Lighting.

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 Recessed wall mounted
- .4 Ceiling mounted single face
- .5 Ceiling mounted double face

.2 Exit signs to have direction arrows where indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install exit signs as shown on plans complete with double face units where indicated.

.2 Connect to dedicated circuit as indicated on the plans.

.3 Exit signs must be clear of all visual obstruction.

.4 Contractor to confirm locations before final installation.

.5 Where applicable, aim emergency lighting heads to provide most effective egress lighting.

3.2 LOCATION

.1 Review locations of exit signs with Departmental Representative 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

1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 55 General Instructions

.2 Section 01 32 19 Security

.3 Section 01 33 00 Shop Drawings, Product Data, and Samples

.4 Section 01 35 33 Health & Safety Requirements

.5 Section 01 51 00 Temporary Facilities

.6 Section 01 61 10 Product Requirements

.7 Section 01 74 19 Waste Management and Disposal

.8 Section 01 78 30 Closeout Submittals

1.2 QUALITY ASSURANCE

.1 Sequencing.

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 Waste Management And Disposal.

2 PRODUCTS

.1 NOT USED

3 EXECUTION

3.1 PREPARATION

.1 Verify that existing plant life designated to remain is tagged or identified.

.2 Contractor is responsible to restore the site to its original condition, prior to completion of the work.

3.2 CUT OUTS AND REMOVAL

.1 Remove debris, rock, and extracted plant life from site.

3.3 CLEANING

.1 Clear areas required for access to site, undergrowth and deadwood, without disturbing subsoil.

3.4 TOPSOIL EXCAVATION

.1 Remove excess topsoil not intended for reuse, from site.

.2 Stockpile in area designated on site and protect from erosion.

3.5 PROTECTION

.1 Ensure that items to remain are scheduled or indicated on drawings. Protect utilities that remain, from damage.

.2 Protect trees, plant growth, and features designated to remain, as final landscaping.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 01 33 00 - Shop Drawings, Product Data, and Samples

.3 Section 01 35 33 - Health and Safety Requirements

.4 Section 01 51 00 - Temporary Facilities

.5 Section 01 60 00 - Product Requirements

.6 Section 01 74 19 - Waste Management and Disposal

.7 Section 01 78 00 - Closeout Submittals

.8 Section 31 11 00 - Clearing and Grubbing

.9 Section 31 23 13 - Site Grading.

1.2 REFERENCE DOCUMENTS

.1 Refer to Section 01 11 55 – General Instructions and the specific References, Codes and Standards of each individual Specification Section.

1.3 EXCAVATION REQUIREMENTS

.1 Furnish all labour, material, services and equipment necessary for completion of excavation, backfill and grading as indicated on the drawings and hereinafter specified.

- .1 The breaking up and removal from the site to an approved disposal dump, any remaining concrete footings, slabs, asphalt paving, curbs, light bases, trees, shrubs, etc. and leave site ready for excavation.
- .2 Bulk excavation of site to elevations indicated, all to within tolerances specified.
- .3 Excavation for concrete footings to elevations indicated, all to within tolerances specified.
- .4 Excavation of trenches and pits for plumbing and electrical services, foundation storm water drains and under slab drainage to elevations indicated.
- .5 Removal of excavated materials and debris from the site and transportation to an approved disposal dump.
- .6 Providing and maintaining temporary roads and access ramp(s) as required within the excavation and removal of temporary access ramp(s) at completion.
- .7 Rough grading of site to final sub-grade for finished surfaces as indicated.

.2 Include supply and placing of drain gravel and filter fabric around footing drains, outside services and under-slab drainage, as detailed on the drawings and as specified herein.

.3 Include supply and placing of heavy-duty polyethylene vapour barrier below slabs-on-grade.

1.4 SUBMITTALS

.1 Submit to the Departmental Representative a proposed excavation schedule and procedure prior to commencing work on the site.

.2 Do not proceed with any stage of the excavation until written confirmation is provided by the Departmental Representative, that the Contractor's proposed methods and sequencing are in general agreement with the intent of the excavation design.

1.5 STREET MAINTENANCE

.1 Be responsible for the cleaning of vehicle tires and cost of any street cleaning necessary for the duration of this Contract to the satisfaction of the Departmental Representative.

1.6 DUST CONTROL

.1 Be responsible for the adequate control of dust for the duration of this Contract. Such control shall be to the approval of the Departmental Representative and shall be adequate to avoid inconvenience and complaints adjacent users.

1.7 SITE ACCESS

.1 Obtain approval from the applicable regulatory authorities for proposed haul routes to the disposal areas. Comply with all regulatory requirements for such routing.

.2 Be responsible for traffic control to the satisfaction of authorities having Jurisdiction.

.3 Maintain access at all times to existing roads and properties adjacent to the site.

.4 Provide and maintain adequate warning signs, flashing lights, barricades, etc.

1.8 PROTECTION and INTERRUPTION OF EXISTING SERVICES & UTILITIES

.1 Prior to commencing any excavation work, establish as near as possible the location and state of use of any existing active buried utility or service lines, including service entry points. Mark these locations clearly on site to prevent accidental disturbance during the work.

.2 Any utility or service which is presently in use, or not definitely established as abandoned but which must be moved or otherwise disturbed, shall be referred to the utility or service company concerned, so that they may advise on, coordinate, inspect and carry out the necessary operations.

.3 Costs incurred by any disturbance of existing active utilities and service lines, which are required to be maintained at all times, shall be borne by the Contractor.

.4 Any damage done, settlement or collapse to existing active services caused by inadequate measures being taken by the Contractor to prevent same, shall be made good immediately, at no additional cost to the Contract.

.5 Make good any damage caused by excavation equipment and remove debris spilled on roadways, lanes, sidewalks, etc. as required.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 Waste Management And Disposal.

2 PRODUCTS

2.1 MATERIALS/PRODUCTS

.1 Backfill & fill: Shall be free draining granular fill material 76 mm minus, containing not more than 5%, by dry weight, passing #200 sieve and having no organic content.

.2 Native Material: Native material gained from excavation may be used for backfill, under the direction on site of the Departmental Representative.

.3 Granular Base: Under concrete and asphalt paving shall be clean crushed 19 mm minus well graded draining free granular material containing not more than 5% passing a #200 sieve and having no organic content. Under interior slabs-on-grade, the granular base shall be a 150 mm layer of 19 mm clear, crushed gravel.

.4 Drain Gravel: Shall be clean 19 mm round drain rock with no fines, or 150 Birds Eye gravel.

.5 Filter Fabric: Around drain gravel at footing drains, shall be heat bonded woven polypropylene fabric.

.6 Pipe Bedding & Surround:

Sieve	Percent Passing
16 mm	90 - 100
13 mm	65 – 85
10 mm	50 – 75
5 mm	25 – 50
2.36 mm	10 – 35
0.85 mm	5 – 20
0.425 mm	0 – 15
0.075 mm	0 - 5

3 EXECUTION

3.1 PREPARATION

.1 Set out all grid lines, elevations and levels for buildings. Maintain all stakes and witness points.

3.2 EXCAVATION

.1 Prior to commencing excavation the Contractor shall:
- .1 Verify locations of all underground services that may be affected.
- .2 Notify the Departmental Representative forty-eight (48) hours before commencing excavation.

.2 Excavate to elevations and dimensions indicated or required by the work, plus sufficient space to permit erection of forms, footing drains, and all other work required, including inspection of foundations. Excavation shall be made to clean lines to minimize quantity of fill required.

.3 Remove any existing abandoned underground service lines encountered during excavation, as indicated and as discovered.

.4 At any cut faces, the Contractor shall phase operations so that a stable slope is maintained as the excavation progresses. The Contractor shall examine the excavation as it progresses and shall provide all additional protective work as may be required to maintain a stable excavation.

.5 All exposed faces shall be protected from weather as soon as possible after being cut.

.6 The Final excavation for foundation bearing will be reviewed by the Departmental Representative to ensure proper bearing soil has been reached and surface is undisturbed and free from loose or water softened material.

.7 Correct excavations to greater than required depth in a manner as directed by the Departmental Representative. Protect unintentionally over-excavated bearing surfaces as necessary and leave unaltered until after review by the Departmental Representative. Bring bearing surface elevation back to that required by the drawings, or as directed by the Departmental Representative at no additional cost to the Contract.

.8 Level and clean excavation bottoms free from loose material and debris.

.9 Be totally responsible for safety on the Work and meet the requirements of all regulatory bodies.

.10 No additional compensation will be paid for any changes due to deterioration or over-excavation or excavations caused by activities or neglect of the Contractor.

.11 Protect excavations against freezing; where frozen material occurs, it shall be thawed out and protected from further frost until subsequent work has been completed.

3.3 ROCK EXCAVATION

.1 Remove any boulders and concrete encountered during excavation. Removal of boulders and concrete one (1) cubic metre and under in size shall be included in the Contract Price. Removal of boulders and concrete over one (1) cubic metre in size will be paid for at Unit Prices rates.

.2 Excavate all rock to produce clean undisturbed surfaces.

3.4 EXCAVATION FOR UTILITIES

.1 Excavate as necessary for installation of foundations, storm drains, mechanical ducts, plumbing services, concrete encased electrical ducts and pipe trenches.

.2 Excavate trenches and pits to the depths, alignments and grades as shown on the drawings.

.3 Excavate trenches only so far in advance of pipe laying as safety, access or as the Consultant recommends.

.4 Width of excavations at the bottom shall be sufficient to allow pipes to be properly laid or appurtenances properly constructed. Width of excavations at the top shall be kept to the minimum consistent with the depth and natural angle of repose. Width of all pipe trenches at the pipe shall not exceed 914 mm for pipe up to and including 610 mm diameter.

.5 Provide all shoring and bracing of trenches and excavations as indicated on the drawings, to meet the applicable health and safety regulations, and as may be directed by the Departmental Representative.

.6 Every precaution shall be taken to prevent slips and falls of earth. If any should occur, the Contractor shall make good at their own expense. If any slip or fall affects, or if in the Departmental Representative's opinion, may affect the stability of permanent work, the Contractor shall execute such remedial work as is considered necessary, including filling with compacted earth, sand gravel or concrete. All such remedial work shall be at the Contractor's expense.

.7 Pile all excavated material in a manner that will not endanger the work and will avoid obstructing surface drainage.

.8 If any excavation is taken out to a greater width or depth than is required, the Contractor shall refill and make good at their own expense the excess excavation as directed by the Departmental Representative, with approved granular material as the Departmental Representative may consider necessary for the safety or stability of the work.

.9 Where the bottom of the excavations are disturbed, damaged or puddle as the result of the Contractor's work, carry out further excavation and filling as specified above.

3.5 SHORING & BRACING

.1 Provide all shoring, bracing, etc. necessary to prevent caving in of excavations, trenches and pits, etc.

.2 All shoring and bracing must be independent of all footings and foundations. Leave in position until forms have been removed and approval given to proceed with backfilling.

.3 All damage done or disturbance, settlement or collapse caused due to inadequate measures being taken by the Contractor to prevent same, shall be made good immediately at no additional cost to the Contract.

.4 Take all necessary precautions to prevent caving in of pits and trenches. Provide shoring and bracing as detailed and as required by the applicable Health and Safety regulations.

.5 Remove all shoring, bracing or sheeting prior to backfilling trenches.

3.6 BACKFILLING & FILL

.1 Prior to backfilling, concrete for foundations and footings shall have reached its specified strength.

.2 Prior to backfilling, all excavations shall be subject to review by the Departmental Representative.

.3 All backfill materials shall be approved by the appointed testing agency prior to placement. Each layer of backfill material shall have been approved by the testing agency and tested for compaction density.

.4 Place all backfill and fill in uniform 150 mm maximum layers, and mechanically compact each layer from grade to 914 mm below grade to 100% maximum Standard Proctor Density. Below a depth of 914 mm, mechanically compact each layer to firm bearing to 95% maximum Standard Proctor Density. Backfill to walls below grade shall be a minimum of 610 mm between concrete walls and shoring face.

.5 All materials used for backfill shall be at a moisture content suitable for compaction. The Contractor shall moisten or facilitate drying of the backfill as required.

.6 Compaction methods shall be subject to approval by the appointed testing agency. Motorized compaction equipment shall be used with extreme caution to prevent any undue pressure on foundation work. Under no circumstances shall such equipment be used to compact fill in the immediate vicinity of concrete work.

.7 Where backfill is required on both sides of foundation walls, it shall be placed and tamped simultaneously on both sides of the wall. Layer thickness shall be 305 mm maximum. Lateral depth shall be 610 mm minimum from face of wall.

.8 Undisturbed sub-grade shall be compacted to 95% maximum Standard Proctor Density under concrete slabs and asphalt paving. Soft spots shall be cut out to such depths as necessary to obtain the required compaction.

3.7 TRENCH BACKFILLING

.1 Backfill material shall be well graded and free from organic debris. This material must be able to be mechanically compacted.

.2 Each layer of backfill material shall be compacted to 95% Standard Proctor Density, subject to review by the Departmental Representative.

.3 The initial lift of backfill over pipe bedding shall be placed and tamped by hand in 150 mm layers to a minimum depth of 610 mm above the top of the pipe. All other backfill shall be mechanically compacted at 305 mm lifts.

3.8 SLABS ON GRADE – PREPARATION and GRAVEL FILL

.1 Excavate under slabs on grade to allow for compacted granular base material.

.2 Compact sub-grade under slabs-on-grade material. Remove all loose fill and soft spots and replace with compacted granular fill. Granular fill shall be placed and compacted as required by Departmental Representative.

3.9 RAMPS & ROAD SURFACES

.1 Provide and maintain temporary ramps and road surfaces within the excavation as required during excavation. Ramps shall be an un-excavated ramp with gradient to suit. Use suitable gravel road base material for ramp travel surfaces. Maintain ramp surface until completion of the excavation. Remove temporary ramps at completion of excavation.

3.10 WATER IN SITE

.1 Pump out or otherwise remove continuously all water that may accumulate in excavation during the progress of the Work. Do not divert water onto adjacent property.

3.11 CLEAN UP

.1 Promptly, as the Work proceeds and on completion, clean up and remove from the site any debris and wasted material or rubbish resulting from the Work.

.2 On completion of the excavation work, all rubble and dirt shall be completely removed and the sub-grades be left clean for later operations. Temporary sumps or pits shall be free of rubble and pumped dry.

.3 During excavation, observe all anti-dust, air pollution and noise regulations of the City. Stage and carry out operations in accordance with such regulations.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 55 General Instructions

.2 Section 01 32 19 Security

.3 Section 01 33 00 Shop Drawings, Product Data, and Samples

.4 Section 01 35 33 Health & Safety Requirements

.5 Section 01 51 00 Temporary Facilities

.6 Section 01 61 10 Product Requirements

.7 Section 01 74 19 Waste Management and Disposal

.8 Section 01 78 30 Closeout Submittals

1.2 PROJECT RECORD DOCUMENTS

.1 Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 Waste Management And Disposal.

2 PRODUCTS

2.1 MATERIALS

.1 Fill: To better or match existing.

.2 Topsoil: To better or match existing.

3 EXECUTION

3.1 EXAMINATION

.1 Verify site conditions.

.2 Verify that survey benchmark and intended elevations for the Work are as indicated.

3.2 PREPARATION

.1 Identify required lines, levels, contours, and datum.

.2 Stake and flag locations of known utilities.

.3 Protect above and below grade utilities that remain.

.4 Protect plant life, lawns, and other features that are to remain, in addition to those features specifically noted to be protected for the duration of the work.

3.3 SUBSOIL EXCAVATION

.1 Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.

.2 Rough grade site under concrete paving, asphalt paving and other areas to final sub-grade for finished surfaces.

.3 Rough grade areas within building under slabs-on-grade to final sub-grade for finished surfaces.

.4 Provide uniform slopes between noted elevations.

.5 Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

.6 When excavating through roots, perform work by hand.

.7 Remove subsoil from site or stockpile in area designated on site.

.8 Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 FILLING

.1 Fill areas to contours and elevations as indicated.

.2 Place fill material on continuous layers and compact.

.3 Maintain optimum moisture content of fill materials to attain required compaction density.

.4 Slope grade away from building minimum 2%.

.5 Make grade changes gradual. Blend slope into level areas.

.6 Remove surplus fill materials from site.

END OF SECTION

1. Note that there is no current Geotechnical report for the project site.

2. A Geotechnical Engineer engaged by the Project Representative will inspect test pits during the site preparation and excavation phase of the work, and advise the Project Representative as to any remedial work required to prepare the subgrade for construction work.

3. To allow this inspection, the Contractor is required as part of the work of this contract to excavate four (4) test pits adjacent to the building site as directed by the Project Representative.

4. The Contractor must provide advance notice of the test pit excavation to the Project Representative to allow scheduling of the Geotechnical inspection.

5. Following the completion of inspections, the Contractor is to backfill and grade the test pit locations to original levels.

END OF SECTION

PHOTO 1: exterior view from east

PHOTO 2: exterior view from northeast

PHOTO 3: interior view

PHOTO 4: interior view

END OF SECTION