



PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
CSC-FEDERAL TRAINING CENTER
REPLACEMENT OF MAIN EMERGENCY POWER GENERATOR (LOT 1)

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SPECIFICATIONS

Building services

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PWGSC/Ref. : R.061196.800

CSC/Ref. : 320-4204

BPR/Ref. : 18307

■ ■ ■

Issued for tender

November 21, 2013

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2500, Blvd. Daniel-Johnson, office 810
Laval (QC) H7T 2P6

Prepared by:



René Boudreau, eng.
Electricity



Christine Boudreau, eng.
Structure

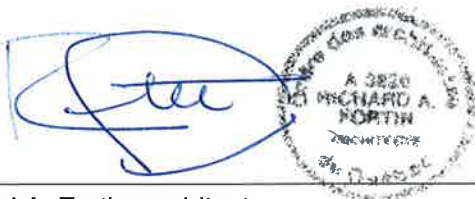


Guillaume Lapointe, eng.
PA LEED BD+C, Mechanical

November 21, 2013/ Issued for tender

ARCHITECTURAL SPECIFICATIONS
Issued for tender 21st of November 2013

ARCHITECTS : BISSON FORTIN AND ASSOCIATES ARCHITECTS
 2555, boul. Le Corbusier, bureau 200
 Laval (Québec) H7S 1Z4



Richard A. Fortin, architect

END OF SECTION

Section 00 01 10	Table of contents
Section 00 01 15	List of Drawings
Section 01 11 01	Work Related General Information
Section 01 32 16.07	Construction progress schedule - bar (GANTT) chart
Section 01 33 00	Submittal procedures
Section 01 35 13	Special Project Procedures for Correctional Service Canada Security Requirements
Section 01 35 29.06	Health and safety requirements
Section 01 35 43	Environmental procedures
Section 01 45 00	Quality control
Section 01 47 15	Sustainable requirements : Construction
Section 01 52 00	Construction facilities
Section 01 61 00	Common product requirements
Section 01 74 11	Cleaning
Section 01 74 21	Construction/demolition waste management and disposal
Section 01 78 00	Closeout submittals
Section 01 79 00	Demonstration and training
Section 01 91 13	General commissioning (CX) requirements
Section 01 91 41	Commissioning : training
Section 02 41 13	Selective site demolition
Section 02 41 16.01	Structure demolition - short
Section 02 41 99	Demolition for minor works
Section 02 50 13	Management of toxic waste
Section 02 81 01	Hazardous materials
Section 03 10 00	Concrete forming and accessories
Section 03 20 00	Concrete reinforcing
Section 03 30 00	Cast-in-place concrete
Section 04 04 99	Masonry for minor works
Section 05 12 23	Structural steel for buildings
Section 05 51 29	Metal stairs and ladders
Section 07 24 10.03	Exterior finish – Direct applied
Section 07 61 00	Sheet metal roofing

Section 07 62 00	Sheet metal flashing and trim
Section 08 11 00	Metal doors and frames
Section 08 71 00	Door hardware
Section 09 91 99	Painting for minor works
Section 21 05 01	Common work results for mechanical
Section 21 05 05	Common work results for fire suppression
Section 21 12 01	Standpipe and hose assembly
Section 22 05 00	Common work results for plumbing
Section 22 11 18	Domestic Water Piping Copper
Section 22 13 17	Drainage waste and vent piping – cast iron and copper
Section 23 05 00	Common work results for HVAC
Section 23 05 13	Common motor requirements for HVAC equipment
Section 23 05 17	Pipe welding
Section 23 05 48	Vibration and seismic controls for HVAC piping and equipment
Section 23 05 93	Testing, adjusting and balancing for HVAC
Section 23 07 13	Thermal Insulation for Ducting
Section 23 08 01	Performance verification mechanical piping systems
Section 23 08 02	Cleaning and start-up of mechanical piping systems
Section 23 09 33	Electric and electronic control system for HVAC
Section 23 11 13	Facility fuel-oil piping
Section 23 34 25	Packaged roof and wall exhausters
Section 23 37 20	Louvres, intakes and vents
Section 25 30 02	EMCS: Field Control Devices
Section 26 05 00	Common work results for electrical
Section 26 05 20	Wire and box connectors 0-1000 V
Section 26 05 21	Wires and cables (0-1000V)
Section 26 05 28	Grounding – secondary
Section 26 05 29	Hangers and supports for electrical systems
Section 26 05 31	Splitter, junction, pull boxes and cabinets

Section 26 05 32	Outlet boxes, conduit boxes and fittings
Section 26 05 34	Conduits, conduit fastenings and conduit fittings
Section 26 05 43.01	Installation of cables in trenches and in ducts
Section 26 05 48	Anti-vibration and Aseismic Systems and Devices for Electrical Systems
Section 26 09 23.01	Metering and switchboard instruments
Section 26 12 16.01	Dry type transformers up to 600 V primary
Section 26 22 19	Control and signal transformers
Section 26 24 16.01	Panelboards breaker type
Section 26 27 26	Wiring devices
Section 26 28 16.01	Air circuit breakers
Section 26 28 16.02	Moulded case circuit breakers
Section 26 28 23	Disconnect switches – fuses and non-fused
Section 26 29 03	Control devices
Section 26 29 10	Motor starters to 600 V
Section 26 32 13.03	Installation of electric power generating equipment
Section 26 32 13.05	Diesel electric generating units (air cooled)
Section 26 33 16	Battery racks
Section 26 33 43	Battery chargers
Section 26 50 00	Lighting – central emergency system
Section 26 52 01	Unit equipment for emergency lighting
Section 26 53 00	Exit signs
Section 28 23 00	Video surveillance
Section 28 31 00.02	Multiplex fire alarm and voice communication systems
Section 31 23 33.01	Excavating, trenching and backfilling
Section 32 12 16.02	Asphalt paving for building sites
Section 32 31 13	Chain link fences and gates
Section 32 92 23	Sodding
Section 33 56 13	Aboveground fuel storage tanks

NUMBER	TITLE
R_061196_800_A01:	Architecture - Building C-15 – Ground Floor
R_061196_800_A02:	Architecture - Building C-15 – Ground Floor – Construction Plan
R_061196_800_A03:	Architecture - Building C-15 – Ground Floor – Details
R_061196_800_E01:	Electrical – Site plan and list of drawings
R_061196_800_E02:	Electrical – Legend and lighting fixture schedule
R_061196_800_E03:	Electrical – Building C-15 – Ground floor- Lighting demolition
R_061196_800_E04:	Electrical - Building C-15 – Ground floor - Services demolition
R_061196_800_E05:	Electrical - Building C-15 –Ground floor – Lighting new layout
R_061196_800_E06:	Electrical - Building C-15 –Ground floor – Services new layout
R_061196_800_E07:	Electrical - Building C-15 – Distribution demolition
R_061196_800_E08:	Electrical - Building C-15 –Distribution new layout
R_061196_800_E09:	Electrical – Details
R_061196_800_E10:	Electrical – Details
R_061196_800_M01:	Mechanical - Site plans and drawings
R_061196_800_M02:	Mechanical - Building C-15 –French legend
R_061196_800_M03:	Mechanical - Building C-15 –English legend
R_061196_800_M04:	Mechanical - Building C-15 – S-S&R-D-C Mechanical Demolition
R_061196_800_M05:	Mechanical - Building C-15 – S-S&R-D-C Fire Protection
R_061196_800_M06:	Mechanical - Building C-15 –Ground floor – Mechanical new arrangement
R_061196_800_M07:	Mechanical - Building C-15 –Mechanical – Connection diagram
R_061196.800_M08:	Mechanical - Building C-15 –Control – Specifications & details
R_061196_800_S01:	Structure - Building C-15 – General Notes
R_061196_800_S02:	Structure - Building C-15 – Ground Floor – Plan, sections and details
R_061196_800_S03:	Structure - Building C-15 – Plans, elevations and details
R_061196_800_S04:	Structure - Building C-15 – Sections and details

1 GENERAL

1.1 WORK BY OTHERS

- .1 Cooperate with other Contractors in carrying out their respective works and carry out instructions from the Departmental Representative.
- .2 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to the Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
- .3 In a second future work phase, in building C15, tunnels and establishment, other contractors will intervene in same areas of C15 as the contractors for the replacement of main emergency power generator (phase 1). Those contractors will install their site trailers in building C15 sector. Foresce two (2) coordination site meetings for the new generator (phase 1) and phase 2 work, new main distribution panel.

1.2 FUTURE WORK

- .1 Insure that Work avoids encroachment into areas required for future work.

1.3 WORK SEQUENCE

- .1 Construct Work in stages to accommodate the Departmental Representative's use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with the Departmental Representative Occupancy during construction.
- .3 Required stages:
 - .1 Preparation and execution of the Civil Works.
 - .2 Preparation and execution of temporary measures in order to maintain emergency power service continuity including level supply.
 - .3 Refurbishing of fuel storage room.
 - .4 Delivery and installation of new generator and fuel reservoir.
 - .5 Connection and commissioning of new generator.
 - .6 Dismantling and removal of existing generator and temporary measures for emergency power continuity.
 - .7 Installation of site trailers and hoarding of work area to the satisfaction of the Departmental Representative.
- .4 Construct Work in stages to provide for continuous Departmental usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.
- .5 Maintain fire access/control.

- .6 Submit shop drawing for long delivery equipment (generator, walk-in enclosure, reservoir) at the beginning of work.

1.4 CONTRACTOR USE OF PREMISES

- .1 Unrestricted use of site until Substantial Performance.
- .2 Limit use of premises for Work, for storage, and for access, to allow:
 - .1 The Departmental Representative occupancy.
- .3 Co-ordinate use of premises under direction of Departmental Representative.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .7 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.5 OCCUPANCY BY THE DEPARTMENTAL REPRESENTATIVE

- .1 The Departmental Representative will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with the Departmental Representative in scheduling operations to minimize conflict and to facilitate the Departmental Representative usage.

1.6 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.7 EXISTING UTILITY SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities.
- .3 Provide alternative routes for personnel and vehicular traffic.

- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by Departmental Representative to maintain critical building and establishment electrical loads.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.

1.8 REQUIRED DOCUMENTS

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

2 PRODUCTS

2.1 NOT USED

3 EXECUTION

3.1 NOT USED

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 01 11 01 - Work Related General Information.

1.02 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.03 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within 14 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.05 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.
 - .1 Excavation completed within 20 working days of Award of Contract date.
 - .2 Substructure completed within 60 working days of Award of Contract date.
 - .3 Installation of new generator walk-in enclosure assembly completed within 90 working days of Award of Contract date.
 - .4 Reservoir enclosure closed-in and weatherproofed within 60 working days of Award of Contract date.
 - .5 Removal of existing generator, and associated mechanical, and electrical work completed within 120 working days of Award of Contract date.
 - .6 Interim Certificate (Substantial Completion) within 120 working days of Award of Contract date.

1.06 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.07 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.

- .6 Backfill.
- .7 Slab on grade.
- .8 Structural Steel.
- .9 Siding and Roofing.
- .10 Interior Architecture (Walls, Floors and Ceiling).
- .11 Plumbing.
- .12 Lighting.
- .13 Electrical.
- .14 Piping.
- .15 Controls.
- .16 Fire Systems.
- .17 Testing and Commissioning.
- .18 Supplied equipment long delivery items.

1.08 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on monthly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.09 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings (by two weeks), identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Not Used.

1.03 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.04 SHOP DRAWINGS AND PRODUCT DATA

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

- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec of Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 10 days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 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.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .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.

- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit six (6) copies and one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit six (6) copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit six (6) copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit six (6) copies and one electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit six (6) copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit six (6) copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

- .21 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.05 SAMPLES

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

1.06 MOCK-UPS

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

1.07 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic and hard copy of colour digital photography in jpg format, monthly with progress statement and as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 2 locations.
 - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: as directed by Departmental Representative.

- .1 Upon completion of: excavation, foundation, framing and services before concealment, of Work, and as directed by Departmental Representative.

1.08 CERTIFICATES AND TRANSCRIPTS

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

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 PURPOSE

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

1.02 DEFINITIONS

- .1 "Contraband" means:
 - .1 an intoxicant, including alcoholic beverages, drugs and narcotics,
 - .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
 - .3 an explosive or a bomb or a component thereof,
 - .4 currency over any applicable prescribed limit \$25,00,
 - .5 any item not described in paragraphs (a) to (d) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 "Unauthorized Smoking Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing or snuffing tobacco, cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Director" means Director or Warden of the Institution as applicable or their representative.
- .6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.
- .8 "Construction zone" means the area as shown on the contract drawings where the contractor will be allowed to work. This area may or may not be isolated from the security area of the institution.
- .9 Construction zone is located outside the secured detention perimeter and includes building C15 (electrical room and diesel storage area) as well as the exterior area north of building C15.

1.03 PRELIMINARY PROCEEDINGS

- .1 Prior to the commencement of work, the contractor shall meet with the Director to:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.

- .2 The contractor will:
 - .1 Ensure that all construction employees are aware of the CSC security requirements.
 - .2 Ensure that a copy of the CSC security requirements is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

1.04 CONSTRUCTION EMPLOYEES

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

1.05 VEHICLES

- .1 All unattended vehicles on CSC property shall have windows closed; doors and trunks shall be locked and keys removed. The keys shall be securely in the possession of the Departmental Representative or an employee of the company that owns the vehicle.
- .2 The director may limit at any time the number and type of vehicles allowed within the Institution.
- .3 Drivers of delivery vehicles for material required by the project shall not require security clearances but must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or Commissionaires while in the Institution. Delivery personal are subject to security investigation.

- .4. If the Director permits trailers to be left inside the secure perimeter of the Institution, these trailer doors will be locked at all times. All windows will be securely locked when left unoccupied. All trailer windows shall be covered with expanded metal mesh. All storage trailers inside and outside the perimeter must be locked when not in use.

1.06 PARKING

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

1.07 SHIPMENTS

- .1 All shipments of project material, equipment and tools shall be addressed in the Contractor's name to avoid confusion with the institution's own shipments. The contractor must have his own employees on site to receive any deliveries or shipments. CSC staff will NOT accept receipt of deliveries or shipments of any material equipment or tools for the contractor.

1.08 TELEPHONES

- .1 There will be no installation of telephones, Facsimile machines and computers with Internet connections permitted within the perimeter of the institution unless prior approval of the Director is received.
- .2 The Director will ensure that approved telephones, Facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.
- .3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, BlackBerries, telephone used as 2-way radios, are not permitted within the perimeter of the Institution unless approved by the Director. Wireless cellular telephones are permitted within vehicles for the contractor's supervisor, the user will not permit their use by any inmate.
- .4. The Director may approve but limit the use of two way radios.
- .5 Cellular and digital telephones and two-way radios are permitted under certain conditions only. For example, their usage may be banned in areas accessible to prisoners.

1.09 WORK HOURS

- .1 Work hours within the Institution are: Monday to Friday 7 h a.m. to 16 h p.m.
- .2 Work will not be permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Director.

1.10 OVERTIME WORK

- .1 No overtime work will be allowed without permission of the Director. Give a minimum forty-eight (48) hours advance notice when overtime work on the construction project is necessary and approved. If overtime work is required because of an emergency such the completion of a concrete pour or work to make the construction safe and secure, the contractor shall advise the Director as soon as this condition is known and follow the directions given by the Director. Costs to Canada for such events may be attributed to the contractor.
- .2 When overtime work, weekend statutory holiday work is required and approved by the Director, extra staff members may be posted by the Director or his designate, to maintain the security surveillance. The actual cost of this extra staff may be attributed to the contractor.

1.11 TOOLS AND EQUIPMENT

- .1 Maintain on site a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required.
- .2 Obtain from the establishment a list of restricted and prohibited equipment.
- .3 Throughout the construction project maintain an up-to-date list of tools and equipment specified above.
- .4 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .5 Store all tools and equipment in approved secure locations.
- .6 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor.
- .7 Scaffolding shall be secured and locked when not erected and when erected, shall be secured in a manner agreed upon with the director.
- .8 All missing or lost tools or equipment shall be reported immediately to the Director.
- .9 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
 - .1 At the beginning and conclusion of every construction project.
 - .2 Weekly, when the construction project extends longer than a one week period.
 - .3 Remove tools and equipment from work area every day.
- .10 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day.
- .11 If propane or natural gas is used for heating the construction, the institution will require that an employee of the contractor supervise the construction site during non-working hours.

1.12 KEYS

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

1.13 SECURITY HARDWARE

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

1.14 PRESCRIPTION DRUGS

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

1.15 SMOKING RESTRICTIONS

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

1.16 CONTRABAND

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

1.17 SEARCHES

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

1.18 ACCESS TO AND REMOVAL FROM INSTITUTIONAL PROPERTY

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

1.19 MOVEMENT OF VEHICLES

- .1 Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:
 - .1 07:45 hrs. to 11:00 hrs.
 - .2 13:00hrs to 15:30 hrs.
- .2 Construction vehicles shall not leave the Institution until an inmate count is completed.
- .3 The contractor shall advise the Director twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .4 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or Commissionaires working under the authority of the Director.
- .5 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.

- .6 Vehicles shall be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution.
- .7 Private vehicles of construction employees will not be allowed within the security perimeter of medium or maximum security institutions without the authorization of the Director.
- .8 With prior approval of the Director, a vehicle may be used in the morning and evening to transport a group of employees to the work site. This vehicle will not remain within the Institution the remainder of the day.
- .9 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another fixed object.

1.20 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

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

1.21 SURVEILLANCE AND INSPECTION

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

1.22 STOPPAGE OF WORK

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

1.23 CONTACT WITH INMATES

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

1.24 COMPLETION OF CONSTRUCTION PROJECT

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

END OF SECTION

1 GENERAL

1.1 HEALTH AND SAFETY REQUIREMENTS

- .1 Contractor shall manage his operations so that safety and security of the public and of site workers always take precedence over cost and scheduling considerations.

1.2 REFERENCES

- .1 Canada Labour Code - Part II, Canadian Occupational Safety and Health Regulations.
- .2 Canadian Standards Association (CSA)
- .3 Workplace Hazardous Materials Information System (WHMIS)
- .4 Act Respecting Occupational Health and Safety, R.S.Q. Chapter S-2.1.
- .5 Construction Safety Code, S-2.1, r.4.

1.3 SUBMITTALS

- .1 Submit the documents required according to section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative, the CSST and the Association paritaire en santé et sécurité du secteur de la construction (ASP Construction) the site-specific safety program, as outlined in 1.8 at least 10 days prior to start of work. The Contractor must review his program during the course of the project if any change occurs in work methods or site conditions. The Departmental Representative may, after receiving the program or at any time during the project, ask the Contractor to update or modify the program in order to better reflect the reality of the construction site and activities. The Contractor must make the required changes before work begins.
- .3 Submit to Departmental Representative the site inspection sheet, duly completed, at the intervals indicated in 1.13.1.
- .4 Submit to Departmental Representative within 24 hours a copy of any inspection report, correction notice or recommendation issued by federal or provincial inspectors.
- .5 Submit to Departmental Representative within 24 hours an investigation report for any accident involving injury and any incident exposing a potential hazard.
- .6 Submit to Departmental Representative all safety data sheets for hazardous material to be used at the site at least three days before they are to be used.
- .7 Submit to Departmental Representative copies of all training certificates required for application of the safety program, in particular:
 - .1 General construction site safety and health courses;

- .2 Safety officer attestations;
 - .3 First aid in the workplace and cardiopulmonary resuscitation;
 - .4 Work likely to release asbestos dust;
 - .5 Work in confined spaces;
 - .6 Lockout procedures;
 - .7 Wearing and fitting of individual protective gear;
 - .8 forklift truck;
 - .9 positioning platform;
 - .10 Any other requirement of Regulations or the safety program.
- .8 Medical examinations : Wherever legislation, regulations, directives, specification or a safety program require medical examinations, Contractor must:
- .1 Prior to start-up, submit to Departmental Representative certificates of medical examination for all concerned supervisory staff and employees who will be on duty when the site opens.
 - .2 Thereafter, submit without delay certificates of medical examination for any newly hired concerned personnel as and when they start work at the site.
- .9 Emergency plan : The emergency plan, as defined in 1.8.3, shall be submitted to Departmental Representative at the same time as the site-specific safety program.
- .10 Notice of site opening : Notice of site opening shall be submitted to the Commission *de la santé et de la sécurité du travail* before work begins . A copy of such notice shall be submitted to Departmental Representative at the same time and another posted in full view at the site. During demobilization, a notice of site closing shall be submitted to the CSST, with copy to Departmental Representative.
- .11 Plans and certificates of compliance : Submit to the CSST and to Departmental Representative a copy signed and sealed by Departmental Representative of all plans and certificates of compliance required pursuant to the Construction Safety Code (S-2.1, r. 6), or by any other legislation or regulation or by any other clause in the specifications or in this contract. Copies of these documents must be on hand at the site at all times.
- .12 Certificate of compliance delivered by the CSST: The certificate of compliance is a document delivered by the CSST confirming that the contractor is in rule with the CSST, i.e. that he had pay out all the benefits concerning this contract. This document must be delivered to Departmental Representative at the end of the work.

1.4 HAZARDS ASSESSMENT

- .1 The contractor must identify all hazards inherent in each task to be carried out at the site.

- .2 The contractor must plan and organize work so as to eliminate hazards at source or promote mutual protection so that reliance on individual protective gear can be kept to a minimum. Where individual protection against falling is required, workers shall use safety harness that meets standard Can - CSA- Z-259.10 - M90. Safety belts shall not be used as protection against falling.
- .3 Equipment, tools and protective gear which cannot be installed, fitted or used without compromising the health or safety of workers or the public shall be deemed inadequate for the work to be executed.
- .4 All mechanical equipment shall be inspected before delivery to the site. Before using any mechanical equipment, submit to Departmental Representative a certificate of compliance signed by a qualified mechanic. Whenever he suspects a defect or accident risk, Departmental Representative may at any time order the immediate shut-down of equipment and require a new inspection by a specialist of his own choosing.
- .5 For use of equipment for lifting persons or materials, ensure that the inspections required by the standards are met and be able to provide a copy of certificates of inspection upon request of Representative of the Ministry.

1.5 MEETINGS

- .1 Contractor decisional representative must attend any meetings at which site safety and health issues are to be discussed
- .2 Set up a site safety committee, and convene meetings every in accordance with the Construction Safety Code (S-2.1, r.4).

1.6 LEGAL AND REGULATORY REQUIREMENTS

- .1 Comply with all legislation, regulations and standards applicable to the site and its related activities.
- .2 Comply with specified standards and regulations to ensure safe operations at site containing hazardous or toxic materials.
- .3 Regardless of the publication date shown in the construction safety code, always use the most recent version.

1.7 SITE-SPECIFIC CONDITIONS

- .1 At the site, the contractor must take account of the following specific conditions:
 - .1 Restricted access to workers and authorized personal by the CSC (see section 01 35 13 – Special Project Procedures for Correctional Service Canada Security Requirements).
 - .2 Keep work area fenced-in and secure at all times.

- .3 Supply adequate temporary lighting for work area to facilitate area supervision by guards and security patrol.

1.8 SAFETY AND HEALTH MANAGEMENT

- .1 Acknowledge and assume all the tasks and obligations which customarily devolve upon a principal Contractor under the terms of the Act Respecting Occupational Health and Safety (R.S.Q., chapter S-2.1) and the Construction Safety Code (S-2.1, r.4).
- .2 Develop a site-specific safety program based on the hazards identified and apply it from the start of project work until close-out is completed. The safety program must take account of all information appearing in 1.7 and must be submitted to all parties concerned, in accordance with the provisions set forth in 1.3. At a minimum, the site-specific safety program must include :
 - .1 Company safety and health policy.
 - .2 A description of the work, total costs, schedule and projected workforce curve.
 - .3 Flow chart of safety and health responsibility.
 - .4 The physical and material layout of the site.
 - .5 First-aid and first-line treatment standards.
 - .6 Identification of site-specific hazards.
 - .7 Risk assessment for the tasks to be carried out, including preventive measures and the procedures for applying them.
 - .8 Training requirements.
 - .9 Procedures in case of accident/injury
 - .10 Written commitment from all parties to comply with the prevention program.
 - .11 A site inspection schedule based on the preventive measures.
- .3 The contractor must draw up an effective emergency plan based on the characteristics and constraints of the site and its surroundings. Submit the emergency plan to all parties concerned, pursuant to the provisions of 1.3. The emergency plan must include:
 - .1 Evacuation procedure;
 - .2 Identification of resources (police, firefighters, ambulance services, etc.);
 - .3 Identification of persons in charge at the site;
 - .4 Identification of those with first-aid training;
 - .5 Training required for those responsible for applying the plan;
 - .6 Any other information needed, in the light of the site characteristics.

1.9 RESPONSIBILITIES

- .1 No matter the size of the construction site or how many workers are present at the workplace, designate a competent person to supervise and take responsibility for health and safety. Take all necessary measures to ensure the health and safety of persons and property at or in the immediate vicinity of the site and likely to be affected by any of the work.
- .2 Take all necessary measures to ensure application of and compliance with the safety and health requirements of the contract documents, applicable federal and provincial regulations and standards as well as the site-specific safety program, complying without delay with any order or correction notice issued by the Commission de la santé et de la sécurité du travail.
- .3 Take all necessary measures to keep the site clean and in good order throughout the course of the work

1.10 COMMUNICATIONS AND POSTING

- .1 Make all necessary arrangements to ensure effective communication of safety and health information at the site. As they arrive on site, all workers must be informed of their rights and obligations pertaining to the site specific safety program. The Contractor must insist on their right to refuse to perform work which they feel may threaten their own health, safety or physical integrity or that of other persons at the site. The Contractor must keep and update a written record of all information transmitted with signatures of all affected workers.
- .2 The following information and documents must be posted in a location readily accessible to all workers:
 - .1 Notice of site opening;
 - .2 Identification of principal Contractor;
 - .3 Company OSH policy;
 - .4 Site-specific safety program;
 - .5 Emergency plan;
 - .6 Data sheets for all hazardous material used at the site;
 - .7 Minutes of site committee meetings;
 - .8 Names of site committee representatives;
 - .9 Names of those with first-aid training;
 - .10 Action reports and correction notices issued by the CSST.

1.11 UNFORESEEN CIRCUMSTANCES

- .1 Whenever a source of danger not defined in the specifications or identified in the preliminary site inspection arises as a result of or in the course of the work, immediately suspend work, take appropriate temporary measures to protect the workers and the public and notify Departmental Representative, both verbally and in writing. Then the Contractor must modify or update the site specific safety program in order to resume work in safe conditions.

1.12 HEALTH/SAFETY/HYGIENE/ENVIRONMENTAL SPECIALISTS

- .1 As soon as work starts, hire a safety officer, pursuant to the provisions of sections 2.5.3 and 2.5.4 of the Construction Safety Code (S-2.1, r. 6) and give him/her/them the necessary authority to carry out the duties of this position, including authority to stop work on safety and health grounds.
- .2 As of work starts, hire a qualified person whose duties will be to ensure compliance with and application of all legislation, regulations and standards and all contractual requirements pertaining to multidisciplinary works.
- .3 Provide this person with the authority, resources and tools needed for performance of his/her duties.
- .4 The person selected shall meet the following requirements:
 - .1 Obtain security clearance from CSC.
 - .2 Possesses a qualified certification for construction site security.
- .5 The person selected shall:
 - .1 have in-depth knowledge of legislation and regulations applicable to the site pertaining to multidisciplinary works.
 - .2 develop and disseminate a safety orientation program for all site workers.
 - .3 ensure that no worker is admitted to the site without having taken the safety orientation program and met all the training requirements of the applicable legislation and the site-specific safety program (see section 01 35 13- Special Project Procedures for Correctional Service Canada Security Requirements).
 - .4 inspect the work and ensure compliance with all regulatory requirements and those of the contract documents or the site-specific safety program.
 - .5 keep a daily log of actions taken and submitting a copy to Departmental Representative each week.

1.13 INSPECTION OF SITE AND CORRECTION OF HAZARDOUS SITUATIONS

- .1 Inspect the work site and complete the site inspection sheet at least once a day.
- .2 Immediately take all necessary measures to correct any lapses from legislative or regulatory requirements and any hazards identified by a government inspector, by the Departmental Representative, by the site safety and health coordinator or during routine inspections.
- .3 Submit to Departmental Representative written confirmation of all measures taken to correct lapses and hazardous situations.
- .4 Give the safety officer or, where there is no safety officer, the person assigned to safety and health responsibilities, full authority to order interruption and resuming of work as and when deemed necessary or desirable in the interests of safety and health. This person should always act so that the safety and health of the public and site workers and environmental protection take precedence over cost and scheduling considerations.

- .5 Without limiting the scope of sections 1.8 and 1.9, Departmental Representative may order cessation of work if, in his/her view, there is any hazard or threat to the safety or health of site personnel or the public or to the environment.

1.14 BLASTING

- .1 Blasting and other use of explosives are forbidden unless authorized in writing by Departmental Representative.
- .2 Any operation involving explosives must be carried out under the supervision of a qualified shot firer.
- .3 The purchase, carriage, storage and use of explosives must comply with all applicable federal and provincial legislation:
 - .1 Canada: Explosives Act (E-17), Explosives Regulations (C.R.C. CH. 599), Standard for Storage of Blasting Charges and Detonators, Transportation of Dangerous Goods Act and Regulations.
 - .2 Quebec: Explosives Act (E-22), Explosives Regulations (E-22, r.1), Safety Code for the Construction Industry (S-2.1, r.4), Transportation of Dangerous Goods Regulations.
- .4 Contractor shall obtain all permits required pursuant to the legislation and regulations referred to above and keep copies on hand at the site.
- .5 Contractor shall facilitate inspection of the site, stored explosives and vehicles used to transport explosives by any government representatives or police officers whose jurisdiction encompasses explosives.

1.15 POWDER ACTUATED DEVICES

- .1 Use of power hammers and other explosive-actuated devices must be authorized by Departmental Representative.
- .2 Any person using a power hammer shall hold a training certificate and meet all requirements of Section 7 of the Construction Safety Code (S-2.1, r. 6).
- .3 Any other explosive-actuated device shall be used in accordance with the manufacturer's directions and applicable standards and regulations

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Definitions:
 - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
 - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- .2 Reference Standards:
 - .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005-92, Storm Water Management for Construction Activities, Chapter 3.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Prior to commencing construction activities or delivery of materials to site, provide Environmental Protection Plan for review and approval by Departmental Representative.
- .2 Ensure Environmental Protection Plan includes comprehensive overview of known or potential environmental issues to be addressed during construction.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .4 Include in Environmental Protection Plan:
 - .1 Name of person responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Name and qualifications of person responsible for manifesting hazardous waste to be removed from site.
 - .3 Name and qualifications of person responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.

- .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations, EPA 832/R-92-005, Chapter 3 requirements.
- .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Ensure plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
- .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Ensure plan includes measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .9 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .13 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
- .15 Pesticide treatment plan to be included and updated, as required.

1.04 FIRES

- .1 Fires and burning of rubbish on site not permitted.
- .2 Provide supervision, attendance and fire protection measures as directed.

1.05 DRAINAGE

- .1 Provide Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls provided. Ensure plan includes monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations, EPA 832/R-92-005, Chapter 3 requirements.

- .2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.06 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.

1.07 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.08 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Provide historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

1.09 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative and Departmental Representative.
 - .1 Do not take action until after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Not Used.

1.03 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, code or authority governing.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.04 INDEPENDENT INSPECTION AGENCIES

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

1.05 ACCESS TO WORK

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

1.06 PROCEDURES

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

1.07 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.08 REPORTS

- .1 Submit 4 copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested.

1.09 TESTS AND MIX DESIGNS

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

1.10 MILL TESTS

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

1.11 EQUIPMENT AND SYSTEMS

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

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 PRECEDENCE

- .1 For Federal Government Projects, Division 1 Sections take precedence over technical specifications in other Divisions of this Project Manual.

1.02 RELATED REQUIREMENTS

- .1 Section 02 41 13 – Selective Site Demolition.

1.03 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 62-2001, Ventilation for Acceptable Indoor Air Quality.
 - .2 ASHRAE 52.2-1999, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.
 - .3 ASHRAE 129-1997, Measuring-Air Change Effectiveness.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-92.1-1989, Sound Absorptive Prefabricated Acoustical Units.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A440.1-2000, Windows - User Selection Guide.
- .4 Environmental Choice Program
 - .1 CCD-016-97, Thermal Insulation.
 - .2 CCD-017-98, Acoustical Products.
 - .3 CCD-025-01, Commercial Modular Carpet.
 - .4 CCD-026-01, Commercial Non-modular Carpet.
 - .5 CCD-029-95, Water Conserving Products.
 - .6 CCD-045-95, Sealant and Caulking Compounds.
 - .7 CCD-046-95, Adhesives.
 - .8 CCD-047-98, Surface Coatings.
 - .9 CCD-048-95, Surface Coatings - Recycled Water-Bourne.
- .5 National Air Duct Cleaners Association (NADCA)
 - .1 NADCA ACR-2002, Assessment Cleaning and Restoration.
 - .2 NADCA 05-1997, Requirements for the Installation of Service Openings in HVAC Systems.
- .6 Sheet Metal and Air Conditioning National Contractors Association (SMACNA)
 - .1 SMACNA IAQ Guideline for Occupied Buildings Under Construction, 1995.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Material Safety Data Sheets (MSDS)
 - .1 Submit Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures for the following products. Indicate VOC emissions, prior to installation or use:
 - .1 Adhesives.
 - .2 Caulking compounds.
 - .3 Sealants.
 - .4 Insulating materials.
 - .5 Fireproofing or fire stopping materials.
 - .6 Paints.
 - .7 Floor and wall patching or levelling materials.
 - .8 Lubricants.
 - .9 Clear finishes for wood surfaces.
 - .2 MSDS sheets to comply with Occupational Health and Safety requirements.
- .3 Construction Schedule
 - .1 Submit schedule of construction in accordance with Section 01 33 00 - Submittal Procedures, prior to start of work, in coordination with scheduling requirements, including:
 - .1 Sequence of finish applications and allowances for curing times.
 - .2 Identification of finish types. See Table A
 - .3 Schedule and duration of proposed temporary ventilation.
 - .4 Delivery schedules of manufactured materials which are anticipated to off-gas in timely manner, which will allow for airing of those materials prior to their scheduled installation.
 - .5 Indicate and schedule commissioning procedures and temporary usages of building mechanical systems, identifying types of filtration and schedule for filter replacement.
- .4 IAQ Management Plan
 - .1 Submit Indoor Air Quality (IAQ) Management Plan in accordance with Section 01 33 00 - Submittal Procedures, for construction and preoccupancy phases of building.
- .5 EcoLogo Labelled Products
 - .1 Submit of list of EcoLogo products and services proposed for this project in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit list of proposed non-endorsed products and services to Departmental Representative for review.

1.05 HAZARDOUS MATERIALS

- .1 Follow methods and procedures specified in Section 02 81 01 - Hazardous Materials; Section 02 50 13 - Management of Toxic Waste .
- .2 Take measures to ensure chemical spills do not enter drains.
- .3 Provide proper storage and containment of hazardous Materials.

- .1 Design and construction of storage spaces for hazardous materials in accordance with NBC and local building and fire codes.
- .2 Provide ventilation of areas, which contain potential sources of air contamination. Comply with standards for storage of flammable, combustible and hazardous materials, explosives, compressed gas cylinders, and reactive, corrosive and oxidizing materials.
- .3 Storage conditions, ventilation requirements, construction materials storage areas, containers, drums and tanks, compatibility issues, and labelling: in accordance with federal and municipal guidelines supplemented as follows:
 - .1 Confine storage of chemicals and hazardous wastes to designated areas with security of access.
 - .2 Provide access to hose bib and water for mixing concentrated chemicals.
 - .3 Provide containment to prevent spills from entering drains.
 - .4 Provide venting to exterior.
 - .5 Keep storage areas under negative pressure, where possible.

1.06 EROSION AND SEDIMENTATION CONTROL

- .1 Follow methods and procedures specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Establish long-term soil stabilization program as indicated.
- .3 Take measures to prevent loss of soil by storm water runoff.
- .4 Protect stockpiled topsoil.

1.07 REDUCING SITE DISTURBANCES

- .1 When building is to be on previously undeveloped site comply with following requirements:
 - .1 Avoid major alterations to sensitive topography, vegetation and wildlife habitat in areas indicated.
 - .2 Create traffic patterns, that cause minimum site disruptions, as per Departmental Representative's approval.
- .2 Minimize disturbances to watershed using site water management measures to ensure that watersheds and groundwater will be preserved.
- .3 Construct and erect erosion barriers to locations indicated and as directed by Departmental Representative.
- .4 Take measures to avoid soil compaction.
- .5 Re-grade and plant vegetation.

1.09 BUILDING ENVELOPE

- .1 Provide insulation to optimize reduction of heat losses or heat gains through building envelope.
 - .1 Insulation to levels specified in Model National Energy Code (MNEC).

- .2 Maintain integrity of building envelope using air barriers and vapour retarders and avoid thermal bridging to provide thermal comfort and prevent condensation.
 - .1 Air barrier: to NBC 1990, Article 5.3.
 - .2 Air leakage through air barrier system within roof area: not to exceed $0.15 \text{ l/s}\cdot\text{m}^2$ @ 75 Pa.
 - .3 Air leakage through air barrier system within roof area: not to exceed $0.15 \text{ l/s}\cdot\text{m}^2$ @ 75 Pa.
 - .4 Air leakage through air barrier system within area of exterior walls (excluding window): not to exceed $0.30 \text{ l/s}\cdot\text{m}^2$ @ 75 Pa.
 - .5 Air leakage through floor: not to exceed $0.10 \text{ l/s}\cdot\text{m}^2$ @ 75 Pa.
 - .6 Air leakage through windows: not to exceed limits specified in CSA-A440.1.

1.10 INDOOR AIR QUALITY

- .1 Provide moisture control methods within building to prevent mould growth.
- .2 IAQ Performance
 - .1 Comply with following minimum indoor air performance requirements. Total volatile organic compounds level requirements include formaldehyde:
 - .1 Total Volatile Organic Compounds Emissions Rate Standard:
 - .1 Product emission rate measured in mg/m^2 /hr.
 - .2 Indoor air concentration levels greater than $0.5 \text{ mg}/\text{m}^3$ of total volatile organic compounds at anticipated loading 30 days after installation.
 - .3 4-Phenyl Cyclohexene (4-PC) Emission Rate Standard:
 - .1 Product emission rate measured in mg/m^2 /hr.
 - .2 Indoor air concentration levels greater than 1 ppb at anticipated loading 30 days after installation.
 - .2 Provide ventilation rates in accordance with ASHRAE 62.
 - .3 Indoor Environmental Quality
 - .1 Reduce quantity of indoor air contaminants that are odorous or potentially irritating to provide installer and occupant health and comfort as indicated.
 - .2 Avoid exposure of building occupants to potentially hazardous chemicals that adversely impact air quality.
 - .3 Minimize cross-contamination of regularly occupied occupancy areas by chemical pollutants.
 - .1 Provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs.
 - .2 Comply with recommended measures in MSDS sheets to protect health and safety of personnel.
- .3 Construction IAQ Management Plan
 - .1 Develop and implement Indoor Air Quality (IAQ) Management Plan for construction and preoccupancy phases of building as follows:
 - .1 During construction: meet or exceed minimum requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.
 - .2 Protect stored on-site or installed absorptive materials from moisture damage.
 - .3 Replace filtration media immediately prior to occupancy.

- .1 Filtration media: in accordance with ASHRAE 52.2, Minimum Efficiency Reporting Value (MERV) of 13.
- .4 Conduct minimum 2 week building flush-out with new filtration media at 100% outside air after construction ends and prior to occupancy.
 - .1 Test contaminant levels in building.
- .5 Adopt IAQ management plan during construction procedures, including:
 - .1 Protection of HVAC system during construction to control pollutant sources, and interrupt pathways for contamination.
 - .2 Sequencing of materials installation to ensure dissipation of high emissions from finishes that off-gas unacceptably high quantities of potentially harmful materials during curing to avoid contamination of absorptive materials.
 - .3 Apply Type 1 interior finishes and allow these finishes to completely cure according to intervals and times stated in respective finish manufactures printed instructions before commencing installation of any Type 2 materials in same area.
 - .4 Do not store any Type 2 materials in areas where installation or curing of Type 1 materials is in progress.
 - .5 Table A

Type 1 – Materials

Type 1 materials and and Finishes finishes include, Materials and but are not limited finishes which have to the following: potential for short term levels of off-gassing from chemicals inherent in their manufacturing process, or which are applied in a form requiring vehicles or carriers for spreading which release a high level of particulate matter in the process of installation and/or curing Composite wood products, including particleboard and plywood from which millwork, wood paneling, doors or furniture may be fabricated. Adhesives, sealants and glazing compounds. Wood preservatives, wood finishes, primers and paints and paint like wall finishes. Control and/or expansion joint fillers, firestopping materials and caulking. Hard finishes requiring adhesives installation including, but not limited to plastic laminate, linoleum and rubber tile. Gypsum board and associated finish processes and products.

Type 2 – Materials

Type 2 materials and and Finishes Soft finishes include, materials and but are not limited finishes which are to the following: woven, fibrous, or porous in nature and may absorb chemicals off-gassed by Type 1 materials and finishes, or may be adversely affected by airborne particulate. These materials have the potential to become 'sinks' for deleterious substances which may be released much later, or act as collectors of contaminants that may promote subsequent bacterial growth. Carpet and underpadding, and other woven or fibrous floor finishes. Fabric wall coverings. Insulation materials exposed to the airstream. Acoustic ceiling materials. Furnishings with fabric coverings.

- .6 Erect appropriate noise and dust barriers where demolition or construction procedures are to occur adjacent to occupied space.
 - .1 Take necessary steps to minimize interference with occupants.
- .4 Environmental Tobacco Smoke (ETS) Control
 - .1 Smoking will be permitted in building.
 - .2 Provide designated smoking room as indicated.
 - .1 Exhaust directly to outdoors.
 - .2 Enclose with impermeable structural deck-to-deck partitions.
 - .3 Provide negative pressure minimum 7 Pa when compared with surrounding spaces.
 - .4 Provide fresh air ventilation: to ASHRAE 129, rate of 24-32 litres/second/person.
- .5 Carbon Dioxide (CO₂) Monitoring
 - .1 Provide carbon dioxide detectors to assess and monitor air quality and ventilation rates.
 - .1 Acceptable levels:
 - .1 Average concentration of 600-800 parts per million (PPM) CO₂.
 - .2 Maximum continuous exposure limit of 1000 ppm.
 - .2 Provide 8 L/s of fresh air per person in open areas and 10 L/s of fresh air per person in closed offices to maintain CO₂ concentration at 1000 parts CO₂ per million parts of air or less.
- .6 Indoor Chemical and Pollution Storage
 - .1 Locate and install cooling towers as indicated.

1.12 GENERAL CONSTRUCTION MATERIALS/PRACTICES

- .1 Materials and Resources
 - .1 Use uncontaminated demolition materials for fill and hardcore and/or granular base.
 - .2 Incorporate reused building materials as indicated.
 - .3 Use products and services that meet criteria of EcoLogo guidelines.
 - .4 Provide list of non-endorsed products and services, provided the green labelled product or services are capable of meeting specified performance requirements.
- .2 Storage and Collection of Recyclables
 - .1 Provide separate storage/handling facilities for consumer recyclables including used paper, newspaper, newsprint, cardboard, glass, metal and plastic.
 - .1 Storage space area:
 - .1 Where building is more than 5,000 m² in area, provide minimum of 10 m².
 - .2 Provide on-site centralized area for composting organic waste as indicated.
 - .3 Provide area for waste compactor, size and location as indicated.
- .3 Construction Waste Management
 - .1 Follow recommendations and requirements of this projects construction, renovation and demolition (CRD) waste management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .2 Local/Regional Materials

- .1 Use systems and materials having 25% of total percentage of products or materials manufactured within 1600 kilometers of project site.
- .3 Rapidly Renewable Materials
 - .1 Use systems and materials that originate from renewable sources.
- .4 Wood
 - .1 Use lumber sourced from independently certified well-managed forests in accordance with CSA or Forestry Stewardship Council.
 - .2 Materials made from composite wood materials or agricultural products: not contain urea-formaldehyde resins.
- .5 Durability
 - .1 Use durable building systems and materials:
 - .1 Requiring low maintenance (painting, retreatment, and waterproofing).
 - .2 Having minimal environmental impact.

1.13 INSULATION

- .1 Utilize insulation materials meeting following requirements:
 - .1 Board-type thermal insulation materials must contain, when calculated on 12-month rolling basis:
 - .1 Over 35% recycled material by weight of finished product if made from glass fibre.
 - .2 Over 45% recycled material by weight of finished product if made from mineral composition.
 - .2 Loose-fill and spray-on thermal insulation materials must contain, when calculated on 12-month rolling basis:
 - .1 Over 75% recycled material by weight of finished product, if made from cellulose fibre.
 - .2 Over 35% recycled material by weight of finished product if made from glass fibre.
 - .3 Over 50% recycled material by weight of finished product, if made from mineral wool.
- .3 Use insulation materials manufactured or installed that do not include CFC's.

1.14 PAINTS, STAINS, AND VARNISHES

- .1 Use paints and coatings that meet or exceed VOC limits established by Environmental Choice Programs guideline for water borne surface coatings CCD-047 and CCD-048.

1.15 SEALANTS, ADHESIVES AND COMPOUNDS

- .1 Use adhesives that meet or exceed VOC limits established by Environmental Choice Programs guideline for adhesives CCD-046.
- .2 Use sealant products that meet or exceed VOC limits established by Environmental Choice Programs guideline for sealants, CCD-045.

1.16 LIGHTING

- .1 Lighting Fixtures
 - .1 Provide high efficiency lamps and luminaries with electronic ballasts. Lamps and luminaries to have following requirements:
 - .1 Fit electronic ballasts to luminaries.
 - .2 Provide task lighting as indicated.
 - .3 Provide personal controls as indicated.

1.17 ACOUSTIC CONTROL

- .1 Use methods indicated to reduce noise levels including:
 - .1 Sound isolation.
 - .2 Building services noise and vibration control.

1.18 EXTERIOR SITE

- .1 Storm water Management
 - .1 Take measures to prevent soil erosion before, during, and after construction by controlling storm-water runoff and wind erosion. Use:

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 01 11 01 – Work Related General Information.

1.02 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.

1.03 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation as well as waste dumpster areas.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.04 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, platforms and temporary stairs.

1.05 HOISTING

- .1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists cranes to be operated by qualified operator.

1.06 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.07 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

1.08 SECURITY

- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.09 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
- .4 Departmental Representative's, Clerk of Works' Site office.
 - .1 Provide temporary office for Departmental Representative, Departmental Representative and Clerk of Works.
 - .2 Inside dimensions minimum 3.6 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4 50% opening windows and one lockable door.
 - .3 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
 - .4 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component.
 - .5 Provide private washroom facilities adjacent to office complete with maintain supply of paper towels and toilet tissue.
 - .6 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.
 - .7 Maintain in clean condition.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate only acceptable and permitted materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.11 SANITARY FACILITIES

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

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

1.12 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Dust control: adequate to ensure safe operation at all times.
- .11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.
- .12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .13 Provide snow removal during period of Work.
- .14 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.13 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.

- .4 Stack stored new or salvaged material not in construction facilities.

2 PRODUCTS

2.01 NOT USED

- .1 Not Used.

3 EXECUTION

3.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Conform to reference standards, as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be born in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.03 QUALITY

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

1.04 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.05 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .5 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .6 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .7 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .8 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.06 TRANSPORTATION

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

1.07 MANUFACTURER'S INSTRUCTIONS

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

1.08 QUALITY OF WORK

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

1.09 CO-ORDINATION

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

1.10 CONCEALMENT

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

1.11 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.13 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.15 PROTECTION OF WORK IN PROGRESS

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

1.16 EXISTING UTILITIES

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

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Not Used.

1.03 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including other than that caused by Departmental Representative or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.04 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than including that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish hardware, stainless steel and mechanical and electrical fixtures.
- .8 Remove stains, spots, marks and dirt from electrical and mechanical fixtures, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .12 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .15 Sweep and wash clean paved areas.
- .16 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .17 Remove snow and ice from access to building.

1.05 WASTE MANAGEMENT AND DISPOSAL

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

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Departmental Representative Waste Management Plan and Goals.
- .2 Departmental Representative Waste Management Goal 75 percent of total Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling#g, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Accomplish maximum control of solid construction waste.
- .4 Preserve environment and prevent pollution and environment damage.

1.02 RELATED REQUIREMENTS

- .1 Not Used.

1.03 REFERENCES

- .1 Not Used.

1.04 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.
- .3 Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .4 Inert Fill: inert waste - exclusively asphalt and concrete.
- .5 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

- .8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .11 Separate Condition: refers to waste sorted into individual types.
- .12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .14 Waste Management Co-ordinator (WMC) : contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.05 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit.
 - .2 Waste Reduction Workplan.
 - .3 Material Source Separation Plan.
 - .4 Schedules A, B, C, D and E completed for project.

1.06 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
 - .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
 - .3 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.
 - .4 Submit 2 copies of Cost/Revenue Analysis Workplan (CRAW): Schedule D.

- .5 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .3 Submit before final payment summary of waste materials salvaged for recycling or disposal by project using deconstruction/disassembly material audit form.
 - .1 Failure to submit could result in hold back of final payment.
 - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
 - .3 For each material reused, sold or recycled from project, include amount in tonnes quantities by number, type and size of items and the destination.
 - .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.07 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Schedule A.
- .3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.08 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.09 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA: Schedule C.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.10 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

- .1 Prepare CRAW: Schedule D.

1.11 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated material in area which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility to users of material for recycling.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Ship materials to site operating under Certificate of Approval.
 - .2 Materials must be immediately separated into required categories for reuse or recycling.

1.12 WASTE PROCESSING SITES

- .1 Province of: _____.
 - .1 Name: _____.
 - .2 Telephone: _____.
 - .3 Fax: _____.

1.13 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Separate and store materials produced during dismantling of structures in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.

1.14 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.15 USE OF SITE AND FACILITIES

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

- .2 Maintain security measures established by existing facility provide temporary security measures approved by Departmental Representative.

1.16 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 APPLICATION

- .1 Do Work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.02 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.03 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged, recovered, reusable, recyclable materials is not permitted.

.3	Demolition Waste:		
	Material Type	Recommended Diversion %	Actual Diversion %
	Acoustic Tile	50	
	Acoustical Insulation	100	
	Doors and Frames	100	
	Electrical Equipment	80	
	Mechanical Equipment	100	
	Metals	100	
	Rubble	100	
	Wood (uncontaminated)	100	
	<u>Other</u>		
.4	Construction Waste:		
	Material Type	Recommended Diversion %	Actual Diversion %
	Cardboard	100	
	Plastic Packaging	100	
	Rubble	100	
	Steel	100	
	Wood (uncontaminated)	100	
	Other	100	

3.04 WASTE AUDIT (WA)

.1 Schedule A - Waste Audit (WA):

Material Category	Material Quantity (unit)	Estimated Waste %	Total Quantity of Waste (unit)	Generation on Point	% Recycled	% Reused
Wood and Plastic Material						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Doors and Windows Materials						
Painted Frames						
Glass						
Wood						
Metal						
Other						

3.05 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B:

Material Category	Persons Responsible	Total Quantity of Waste (unit)	Reused amounts Projected (units)	Recycled amounts Projected (units)	% Waste	Material Destination
Wood and Plastic Material						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Doors and Windows Materials						
Painted Frames						
Glass						
Wood						
Metal						
Other						

3.06 DEMOLITION WASTE AUDIT (DWA)

.1 Schedule C - Demolition Waste Audit (DWA):

Material Description	Quantity	Unit	Total	Volume (cum.)	Poids (Cum.)	Remarks and Assumptions
Wood						
Wood Stud						
Plywood						
Baseboard-wood						
Door Trim-wood						
Wood Cabinet						
Doors and Windows						
Panels Regular						
Slab Regular						
Wood Laminate						
Byfold-Closet						
Glazing						

3.07 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Schedule D - Cost/Revenue Analysis Workplan (CRAW):

Material Description	Total Quantity (Unit)	Volume (cum.)	Weight (Cum.)	Disposal Cost/Credit \$(+/-)	Category Sub-total \$(+/-)	Cost \$(-)/ Revenue \$(+)
Wood						
Wood Stud						
Plywood						
Baseboard-wood						
Door						
Trim-wood						
Wood Cabinet						
Doors and Windows						
Panels Regular						
Slab Regular						
Wood Laminate						
Byfold-Closet						
Glazing						

3.08 MAIN FEDERAL AND PROVINCIAL ENVIRONMENTAL AUTHORITIES

Québec : Ministère de l'Environnement et de la Faune,
 Siège social,
 150, boul. René-Lévesque Est,
 Québec QC
 G1R 4Y1
 418-646-5974 800-561-1616

Conseil de conservation et de l'environnement
800, place d'Youville,
19e étage
Québec
G1R 3P4
418-643-3127
418-643-3818

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Canadian Environmental Protection Act (CEPA)
 - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.03 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Departmental Representative to:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English and French.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.05 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.

- .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD.

1.06 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.07 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.

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

1.08 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of blue line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.09 FINAL SURVEY

- .1 Submit final site survey certificate, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.10 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - General Commissioning (Cx) Requirements.

- .15 Aboveground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
- .16 Additional requirements: as specified in individual specification sections.

1.11 MATERIALS AND FINISHES

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

1.12 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.13 DELIVERY, STORAGE AND HANDLING

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

1.14 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month, 9 month, 12 month, 16 month and 21 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:

- .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
- .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include the new generator.
- .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.15 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.

- .5 Warranty period.
- .6 Inspector's signature.
- .7 Construction Contractor.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative 's personnel two weeks prior to date of interim completion.
- .2 Departmental Representative: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .4 Ensure testing, adjusting, and balancing has been performed [in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 Division 26 - Electrical System: 8 hours of instruction.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.

- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.04 QUALITY ASSURANCE

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

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Requirements
 - .1 Section 01 78 00 – Closeout Submittals.
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.02 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.03 COMMISSIONING OVERVIEW

- .1 Cx to be a line item of Contractor's cost breakdown.

- .2 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .3 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .4 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.04 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.05 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.

- .10 Ensure "As-Built" system schematics are available.
- .11 Ensure that a standby emergency power supply is available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.06 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.07 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.08 COMMISSIONING DOCUMENTATION

- .1 Provide Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.09 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Contractor, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.
- .2 Departmental Representative to witness of start-up and testing.
- .3 .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.

- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document required tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be removed from site and replaced with new.

- .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual or accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

- .1 Departmental Representative to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

- .1 Laboratory areas:
 - .1 Provide manpower and instrumentation to verify up to 100 % of reported results.
- .2 Elsewhere:
 - .1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.
- .3 Number and location to be at discretion of Departmental Representative.
- .4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .5 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .6 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Commissioning proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Commissioning to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Commissioning to Departmental Representative in writing. Stop Commissioning until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Commissioning leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Commissioning specifications, complete Commissioning prior to issuance of Interim Certificate of Completion.

- .3 Commissioning to be considered complete when contract Commissioning deliverables have been submitted and accepted by Departmental Representative.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 TRAINING

- .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.36 DEPARTMENTAL REPRESENTATIVE'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

1.37 REQUIREMENT BEFORE THE FIRST TRANSFERT OF PETROLEUM PRODUCTS

- .1 The Departmental Representative of the equipment must ensure compliance with the prerequisites of the federal standard DORS/2008-197 - Storage tank systems for petroleum products and allied petroleum products regulations. The contractor will work with the Departmental Representative to that meeting these prerequisites.
- .2 Without limitation, the Departmental Representative of the equipment must:
 - .1 Submitting to the Minister, the information set out in schedule (article 28 (2)) and receive an identification number (article 28 (3)).
 - .2 Must ensure that the emergency plan is ready to be implemented (article 30 (3b)).
 - .3 Must ensure that as-built drawings are prepared (article 34 (2)).

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 This Section specifies roles and responsibilities of Commissioning Training.

.2 Related Requirements

.1 Section 01 91 13 - General Commissioning (Cx) Requirements.

1.02 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Property Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.03 INSTRUCTORS

.1 Departmental Representative will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.04 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.05 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.
 - .5 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Property Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.06 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.07 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.08 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.

- .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.
 - .8 Trouble-shooting diagnosis.
 - .9 Inter-Action among systems during integrated operation.
 - .10 Review of O&M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.09 VIDEO-BASED TRAINING

- .1 Manufacturer's videotapes to be used as training tool with Departmental Representative's review and written approval 3 months prior to commencement of scheduled training.
- .2 On-Site training videos:
 - .1 Videotape training sessions for use during future training.
 - .2 To be performed after systems are fully commissioned.
 - .3 Organize into several short modules to permit incorporation of changes.
- .3 Production methods to be professional quality.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 Methods and procedures for demolishing, salvaging, recycling and removing sitework items designated to be removed in whole or in part, and for backfilling resulting trenches and excavations.
 - .2 Sustainable requirements for construction and verification.
- .2 Related Requirements
 - .1 Not Used.
- .3 Measurement Procedures.
 - .1 Measure removal of asphaltic concrete pavement in square metres for each thickness specified.
 - .2 Measure removal of Portland cement concrete pavement in square metres for each thickness specified.
 - .3 Measure removal of concrete and masonry foundations in cubic metres.
 - .4 Measure removal of fences in metres.
 - .5 Payment for salvage, disposal, alternative disposal, recycling, excavating backfilling and restoration will be included in above removal items.
 - .6 Measure removal of waste, materials designated for alternate disposal from the site in tonnes.

1.02 REFERENCES

- .1 Canadian Council of Ministers of the Environment (CCME).
 - .1 PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act, 1999 (CEPA), c. 33.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

1.03 DEFINITIONS

- .1 Demolition: rapid destruction of building following removal of hazardous materials.

- .2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's 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.
- .3 Waste Audit (WA): detailed inventory of materials in building. Indicates quantities of reuse, recycling and landfill.
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
 - .2 Indicates quantities of reuse, recycling and landfill.
- .4 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .5 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Coordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials and Section 01 47 15 - Sustainable Requirements: Construction.
- .4 Shop drawings.
 - .1 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
 - .2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Quebec, Canada.
- .5 Hazardous Materials: provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
- .6 Waste Reduction Workplan: prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tipping.
 - .5 Name and address of haulers, waste facilities, waste receiving organizations.

- .7 Certificates: submit copies of certified weigh bills, bills of lading, receipts from authorized disposal sites and reuse and recycling facilities for material removed from site on weekly basis upon request of Departmental Representative.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers, facilities, receiving organizations listed in Waste Reduction Workplan.

1.05 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, TDGA and applicable Provincial regulations.
- .2 Site Meetings.
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.
 - .3 Hold project meetings every week.
 - .4 Ensure key personnel, site supervisor, project manager, subcontractor representatives, WMC attend.
 - .5 Reporting Requirements: WMC to complete.
 - .6 WMC must provide written report on status of waste diversion activity at each meeting.
 - .7 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.
- .3 Health and Safety.
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .4 Sustainable Requirements.
 - .1 Construction: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Perform Work in accordance with Section 01 35 43 - Environmental Procedures.
- .2 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Storage and Protection.
 - .1 Protect in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

- .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative.
- .3 Remove and store materials to be salvaged, in manner to prevent damage.
- .4 Store and protect in accordance with requirements for maximum preservation of material.
- .5 Handle salvaged materials as new materials.
- .4 Waste Management and Disposal.
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .2 Divert excess materials from landfill to site approved by Departmental Representative.
 - .3 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.
 - .4 Place materials defined as hazardous or toxic in designated containers.
 - .5 Handle and dispose of hazardous materials in accordance with CEPA Regional and Municipal, regulations.
 - .6 Label location of salvaged material's storage areas and provide barriers and security devices.
 - .7 Ensure emptied containers are sealed and stored safely.
 - .8 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt, and gypsum.
 - .9 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

1.07 SITE CONDITIONS

- .1 Site Environmental Requirements.
 - .1 Perform work in accordance with Section 01 35 43 - Environmental Procedures.
 - .2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .3 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout the project.
 - .4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
 - .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities as directed by Departmental Representative.
 - .6 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .2 Existing Conditions.
 - .1 Remove contaminated or hazardous materials as defined by authorities having jurisdiction as directed by Departmental Representative from site, prior to start of demolition Work, and dispose of at designated disposal facilities in safe manner in accordance with TDGA and other applicable regulatory requirements and Section 02 81 01 - Hazardous Materials.

1.08 SCHEDULING

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
- .1 Notify Departmental Representative in writing when unforeseen delays occur.

2 PRODUCTS

2.01 SUSTAINABLE REQUIREMENTS

- .1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.02 EQUIPMENT

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

3 EXECUTION

3.01 PREPARATION

- .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.

3.02 REMOVAL OF HAZARDOUS WASTES

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.03 REMOVAL OPERATIONS

- .1 Remove items as indicated.
- .2 Do not disturb items designated to remain in place.
- .3 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.

- .4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.
- .5 Stockpile topsoil for final grading and landscaping.
 - .1 Provide erosion control and seeding if not immediately used.
- .6 Disposal of Material.
 - .1 Dispose of materials not designated for salvage or reuse on site as instructed by Departmental Representative at authorized facilities approved in Waste Reduction Workplan.
- .7 Backfill.
 - .1 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.04 STOCKPILING

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.05 REMOVAL FROM SITE

- .1 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .3 Transport material designated for alternate disposal using approved haulers, facilities, receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers, facilities, receiving organizations listed in Waste Reduction Workplan.
- .4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal Facilities: approved and listed in Waste Reduction Workplan.
 - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

3.06 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work and/or match condition of adjacent, undisturbed areas.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.07 FIELD QUALITY CONTROL

- .1 Verification requirements include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Wood.
 - .8 Low-emitting materials.

3.08 CLEANING

- .1 Remove debris, trim surfaces and leave work site clean, upon completion of Work
- .2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 02 41 99 – Demolition for minor work.

1.02 REFERENCES

- .1 Canadian Council of Ministers of the Environment (CCME)
 - .1 PN 1326-July 2005, Environmental Code of Practice for aboveground and underground tank systems containing petroleum products and allied petroleum products.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Provide shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Before proceeding with demolition of load bearing walls or of other walls and where required by authority having jurisdiction submit for review by Departmental Representative shoring and underpinning drawings prepared by qualified professional engineer registered or licensed in the Province of Quebec in Canada showing proposed method.
- .4 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tippage.
 - .5 Name and address of waste facilities and waste receiving organizations.

1.04 DELIVERY, STORAGE AND HANDLING

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

1.05 SITE CONDITIONS

- .1 Review designated substance report and take precautions to protect environment.

- .2 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
 - .1 Do not proceed until written instructions have been received from Departmental Representative.
- .3 Notify Departmental Representative.

2 PRODUCTS

2.01 EQUIPMENT

- .1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.
- .2 Demonstrate that tools and machinery are being used in manner which allows for salvage of materials in best condition possible.

3 EXECUTION

3.01 PREPARATION

- .1 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Protection:
 - .1 Prevent movement, settlement, or damage to adjacent structures, utilities, and parts of building to remain in place. Provide bracing and shoring required.
 - .2 Keep noise, dust, and inconvenience to occupants to minimum.
 - .3 Protect building systems, services and equipment.
 - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
- .3 Post warning signs on electrical lines and equipment which must remain energized to serve other products during period of demolition.
- .4 Locate and protect utility lines. Do not disrupt active or energized utilities traversing premises and designated to remain undisturbed.

3.02 DEMOLITION SALVAGE AND DISPOSAL

- .1 Remove parts of existing building to permit new construction. Sort materials into appropriate piles for reuse and recycling.
- .2 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .3 Remove items to be reused, store as directed by Departmental Representative, and re-install under appropriate section of specification.
- .4 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

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

3.03 PARTIAL DEMOLITION OF STRUCTURES

- .1 As per indications.

3.04 STOCKPILING

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.05 REMOVAL FROM SITE

- .1 Transport material designated for alternate disposal to approved facilities and receiving organizations listed in waste reduction workplan and in accordance with applicable regulations. Do not deviate from facilities and receiving organizations listed in waste reduction workplan without prior written authorization from Departmental Representative.
- .2 Dispose of materials not designated for alternate disposal in accordance with applicable regulations. Disposal facilities must be approved of and listed in waste reduction workplan. Do not deviate from disposal facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

3.06 CLEANING AND RESTORATION

- .1 Keep site clean and organized throughout demolition procedure.
- .2 Upon completion of project, reinstate areas parking surfaces, affected by Work to condition which existed prior to beginning of Work, match condition of adjacent, undisturbed areas.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition.

1.02 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.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and 01 74 21 - Construction/Demolition Waste Management Disposal.
- .2 Submit demolition drawings:
 - .1 Submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional Departmental Representative registered or licensed in the Province of Quebec, showing proposed method.
- .3 Before commencing work on site, submit a detailed waste reduction plan in accordance with section 01 74 21 – Construction/Demolition Waste Management and disposal, which includes the following information.
 - .1 Nature and quantity of waste material and material to be recuperated, reused, recycled or disposed of.
 - .2 Selective demolition work schedule.
 - .3 Number and location of recuperation dumpsters.
 - .4 Frequency of waste material removal.

1.04 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 be 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.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 EXAMINATION

- .1 Inspect building and 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.

3.02 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 29.06 - 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 Remove parts of existing building to permit new construction.
 - .4 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

3.03 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 and 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

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Canadian Environmental Protection Act, 1999 (CEPA 1999).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Fire Code of Canada, 2005.
- .4 Transportation of Dangerous Goods Act (TDGA), 1999 c. 34.
- .5 Transportation of Dangerous Goods Regulations (TDGR), T-19.01-SOR/2003-400.
- .6 Storage of PCB Material Regulations, SOR/92-507.
- .7 PCB Waste Export Regulations, 1996, SOR/97-109.
- .8 Ozone-Depleting Substances Regulations, SOR/99-07.
- .9 Environmental Code of Practice on Halons, July 1996.
- .10 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems, March 1996.

1.03 DEFINITIONS

- .1 Toxic: substance is considered toxic if it is listed on Toxic Substances List found in Schedule 1 of CEPA.
- .2 List of Toxic Substances: found in Schedule 1 of CEPA, lists substances that have been assessed as toxic. Federal Government can make regulations with respect to a substance specified on List of Toxic Substances. Column II of this list identifies type of regulation applicable to each substance.
- .3 PCBs: includes chlorobiphenyls referred to in Column I of item 1 of the List of Toxic Substances in Schedule I of Canadian Environmental Protection Act.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Product Data:
 - .1 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
 - .2 Submit photocopy of shipping documents and waste manifests and export notices to Departmental Representative when shipping toxic wastes off site.
 - .3 Maintain 1 copy of product data in readily accessible file on site.

1.05 DELIVERY, STORAGE, AND HANDLING

- .1 Store and handle toxic wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
- .2 Store and handle flammable and combustible wastes in accordance with current National Fire Code of Canada requirements.
- .3 Co-ordinate storage of toxic wastes with Departmental Representative and follow internal requirements for labelling and storage of wastes.
- .4 Observe smoking regulations, smoking is prohibited in area where toxic wastes are stored, used, or handled.
- .5 Only certified persons who have successfully completed Environment Canada Environmental Awareness Course for Environmentally Safe Handling of Refrigerants are permitted to work on refrigeration and air conditioning systems.
- .6 Report spills or accidents involving toxic wastes immediately to Departmental Representative and to appropriate regulatory authorities. Take reasonable measures to contain the release while ensuring health and safety is protected.
- .7 Transport toxic wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .8 Use authorized/licensed carrier to transport toxic waste.
- .9 Co-ordinate transportation and disposal of toxic wastes with Departmental Representative.
- .10 Notify appropriate regulatory authorities and obtain required permits and approvals prior to exporting toxic waste.
- .11 Dispose of toxic wastes generated on site in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .12 Ensure toxic waste is shipped to authorized/licensed treatment or disposal facility and that liability insurance requirements are met.
- .13 Minimize generation of toxic waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

- .14 Identify and evaluate recycling and reclamation options as alternatives to land disposal in compliance with LEED credit MR 2, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Definitions:
 - .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
 - .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
 - .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .2 Reference Standards:
 - .1 Canadian Environmental Protection Act, 1999 (CEPA 1999)
 - .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
 - .2 Department of Justice Canada (Jus)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDG Act) 1992, (c. 34).
 - .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
 - .3 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
 - .2 GS-36-00, Commercial Adhesives.
 - .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .5 National Research Council Canada Institute for Research in Construction (NRC-IRC)
 - .1 National Fire Code of Canada-2005.
- .3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.03 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 hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
- .3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
 - .1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.
- .4 Storage and Handling Requirements:
 - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
 - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
 - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
 - .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
 - .7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
 - .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
 - .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
 - .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.

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- .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
 - .11 When hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with Departmental Representative.
 - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
 - .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.
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- .5 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section.
 - .6 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.01 MATERIALS

- .1 Description:
 - .1 Bring on site only quantities hazardous material required to perform Work.
 - .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

3 EXECUTION

3.01 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
 - .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
 - .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
 - .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
 - .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
 - .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
 - .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
 - .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 20 00 – Concrete reinforcing.
- .2 Section 03 30 00 – Cast-in-place concrete.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121-M1978(R2003), Douglas Fir Plywood.
 - .4 CSA O151-04, Canadian Softwood Plywood.
 - .5 CSA O153-M1980(R2003), Poplar Plywood.
 - .6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
 - .7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.03 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling.
 - .2 Place materials defined as hazardous or toxic in designated containers.
 - .3 Divert wood materials from landfill to a recycling facility.
 - .4 Divert plastic materials from landfill to a recycling facility.
 - .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by to Departmental Representative.

2 PRODUCTS

2.01 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
 - .3 Rigid insulation board: to CAN/ULC-S701.
- .2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.
- .3 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .4 Form release agent: low VOC.
- .5 Form stripping agent: colourless mineral oil, low VOC, free of kerosene.
- .6 Falsework materials: to CSA-S269.1.

3 EXECUTION

3.01 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .9 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .10 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Construct forms for architectural concrete, and place ties as indicated and as directed.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .13 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .14 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.02 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 2 days for walls and sides of beams.
 - .2 2 days for columns.
 - .3 12 hours for footings and abutments.
- .2 Remove formwork when concrete has reached 75 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 30 00 – Cast-in-place concrete.

1.02 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
- .2 ASTM International
 - .1 ASTM A 82/A 82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A 143/A 143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .3 ASTM A 185/A 185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .4 ASTM A 775/A 775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 CSA International
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.
 - .3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec of Canada.
 - .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.

- .2 Lists.
- .3 Quantities of reinforcement.
- .4 Sizes, spacings and locations of reinforcement, with identifying code marks to permit correct placement without reference to structural drawings.
- .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3.
 - .1 Provide type B tension lap splices.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A 82/A 82M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A 82/A 82M.
- .6 Welded steel wire fabric: to ASTM A 185/A 185M.
 - .1 Provide in flat sheets only.

- .7 Welded deformed steel wire fabric: to ASTM A 82/A 82M.
 - .1 Provide in flat sheets only.
- .8 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
 - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
 - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - .1 In this case, no restriction applies to temperature of solution.
 - .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
 - .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .9 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

2.02 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain to Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

3 EXECUTION

3.01 PREPARATION

- .1 Galvanizing to include chromate treatment.
 - .1 Duration of treatment to be 1 hour per 25 mm of bar diameter.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.

3.02 FIELD BENDING

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

- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.03 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
 - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
 - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

3.04 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

3.05 CLEANING

- .1 Leave Work area clean at the end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.

1.02 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Cast-in-place concrete will not be measured but will be paid for as fixed price item.
 - .2 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.
 - .3 Measure supply and installation of waterstops in lineal metres installed.

1.03 REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.
 - .2 Type MS or MSb - Moderate sulphate-resistant cement.
 - .3 Type MH or MHb - Moderate heat of hydration cement.
 - .4 Type HE or Heb - High early-strength cement.
 - .5 Type LH or LHb - Low heat of hydration cement.
 - .6 Type HS or HSb - High sulphate-resistant cement.
 - .2 Fly ash:
 - .1 Type F - with CaO content less than 8%.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
 - .3 Type CH - with CaO greater than 20%.
 - .3 GGBFS - Ground, granulated blast-furnace slag.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C 260-06, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C 309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C 494/C 494M-08a, Standard Specification for Chemical Admixtures for Concrete.

- .4 ASTM C 1017/C 1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .5 ASTM D 412-06ae1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- .6 ASTM D 624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .7 ASTM D 1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .8 ASTM D 1752-04a, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
 - .1 CSA A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.04 QUALITY ASSURANCE

- .1 Provide Departmental Representative, minimum 2 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .2 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
- .2 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from laboratory representative and concrete producer as described in CSA A23.1/A23.2.

- .2 Deviations to be submitted for review by the Departmental Representative.
- .3 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

2 PRODUCTS

2.01 DESIGN CRITERIA

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

2.02 PERFORMANCE CRITERIA

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

2.03 MATERIALS

- .1 Cement: to CSA A3001, Type GU or HS.
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.
- .4 Admixtures:
 - .1 Air entraining admixture: to ASTM C 260.
 - .2 Chemical admixture: to ASTM C 494 Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.04 MIXES

- .1 Performance Method for specifying concrete: to meet Departmental Representative's performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

3 EXECUTION

3.01 PREPARATION

- .1 Obtain Laboratory representative written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 – Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.

- .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain laboratory representative approval of proposed method for protection of concrete during placing and curing.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.02 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative t before placing of concrete.
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
 - .2 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
- .4 Grout under base plates [and machinery] using procedures in accordance with manufacturer's recommendations which result in [100] % contact over grouted area.
- .5 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
- .6 Waterstops:
 - .1 Install waterstops to provide continuous water seal.

- .2 Do not distort or pierce waterstop in way as to hamper performance.
- .3 Do not displace reinforcement when installing waterstops.
- .4 Use equipment to manufacturer's requirements to field splice waterstops.
- .5 Tie waterstops rigidly in place.
- .6 Use only straight heat sealed butt joints in field.
- .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.

3.03 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.

3.04 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by the Departmental Representative for review to CSA A23.1/A23.2.
- .3 The Departmental Representative will pay for costs of tests.
- .4 Laboratory representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .6 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM A 496/A 496M-07, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
- .2 CSA International
 - .1 CAN/CSA-A82-06, Fired Masonry Brick Made From Clay or Shale.
 - .2 CAN/CSA-A165 SERIES-04(R2009), CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3.
 - .3 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
 - .4 CAN/CSA-A370-04(R2009), Connectors for Masonry.
 - .5 CAN/CSA A371-04(R2009), Masonry Construction for Buildings.
 - .6 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .7 CSA S304.1-04(R2009), Design of Masonry Structures.
- .3 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.

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 masonry products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures].
 - .1 Indicate VOC's in g/L for epoxy coatings and galvanized protective coatings and touch-up products to be applied within building envelope.
- .3 Shop Drawings:
 - .1 Shop drawings consist of bar bending details, lists and placing drawings.
 - .2 Placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

1.3 DELIVERY, STORAGE AND HANDLING

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

- .2 Delivery and Acceptance Requirements : deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements :
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect masonry products from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MASONRY UNITS

- .1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1).
 - .1 Classification: H/15/C/0.
 - .2 Size: modular.
 - .3 Special shapes: provide square bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.
- .2 Special fire resistant concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1) as modified below.
 - .1 Classification: H/15/B/M except as modified by fire resistance requirements specified below.
 - .2 Fire resistant characteristics: aggregate used in units and equivalent thickness of units to National Building Code of Canada 2005, for fire-resistance ratings indicated.
 - .3 Size: modular.
 - .4 Special shapes: provide square bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams and provide additional shapes as indicated.

2.2 REINFORCEMENT AND CONNECTORS

- .1 Bar reinforcement: to CAN/CSA-A371 and CSA G30.18, Grade 400.
- .2 Wire reinforcement: to CAN/CSA-A371 and ASTM A 496/A 496M, truss type.
- .3 Connectors shall be corrosion resistant: to CAN/CSA-A370 and CSA S304.1.

2.3 MORTAR AND GROUT

- .1 Mortar: to CAN/CSA-A179.
 - .1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
 - .2 Colour: ground coloured natural aggregates or metallic oxide pigments.
- .2 Mortar Type: S based on property specifications,
- .3 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: type M based on property specifications.
- .4 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for stonework: type N based on property specifications.
 - .2 Mortar for grouted reinforced masonry: type S based on property specifications.
- .5 Grout: to CAN/CSA-A179, Table 3.

2.4 ACCESSORIES

- .1 Nailing Inserts: 0.5 mm minimum thickness, galvanized.
- .2 Bolts: 12 mm diameter x 150 mm long with ends bent 50 mm at 90 degrees.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Ministerial representative.
 - .2 Inform Ministerial 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 Ministerial representative.

3.2 INSTALLATION

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
 - .1 Bond: running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.
 - .2 Coursing height: 200 mm for one block and one joint for three bricks and three joints.
 - .3 Jointing: tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface cut joints flush.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

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

3.3 CONSTRUCTION

- .1 Exposed masonry:
 - .1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.
 - .2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.
- .2 Building-in:
 - .1 Install masonry connectors and reinforcement where indicated on drawings.
 - .2 Build in items required to be built into masonry.
 - .3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
 - .4 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
 - .5 Install loose steel lintels over openings where indicated.
- .3 Concrete block lintels:
 - .1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
 - .2 End bearing: not less than 200 mm as indicated on drawings.
- .4 Support of loads:
 - .1 Use grout to CAN/CSA-A179 where grout is used in lieu of solid units.
 - .2 Install building paper below voids to be filled with grout; keep paper 25 mm back from faces of units.
- .5 Provision for movement:
 - .1 Leave 5 mm space below shelf angles.
 - .2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
 - .3 Built masonry to tie in with stabilizers, with provision for vertical movement.
- .6 Interface with other work:
 - .1 Cut openings in existing work as indicated.
 - .2 Openings in walls: approved Ministerial representative.
 - .3 Make good existing work. Use materials to match existing.
- .7 Build in flashings in masonry in accordance with CAN/CSA-A371.
 - .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.

.2 Lap joints 150 mm and seal with adhesive.

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

3.4 REINFORCING AND CONNECTING

- .1 Install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371 and CSA S304.1 unless indicated otherwise.
- .2 Prior to placing concrete mortar grout, obtain Ministerial representative's approval of placement of reinforcement and connectors.

3.5 BONDING AND TYING

- .1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA-A371, CSA S304.1 and as indicated.
- .2 Tie masonry veneer to backing in accordance with NBC, CAN/CSA-A371, CSA S304.1 and as indicated.

3.6 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CAN/CSA-A179, CAN/CSA-A371 and CSA S304.1.

3.7 GROUTING

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

3.8 ANCHORS

- .1 Seismic siding masonry fasteners suitable for insulation thickness as indicated
 - .1 One T anchor plate, galvanized steel 2.7mm gauge with two openings for anchor bolts.
 - .2 One galvanized steel ankle L gauge with 3.1 mm notch incorporated to receive a reinforcing rod
 - .3 Continuous galvanized steel rebar 5mm gauge, length 3000 mm.

3.9 LATERAL SUPPORT AND ANCHORAGE

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

3.10 SITE TOLERANCES

- .1 Tolerances of CAN/CSA-A371 apply.

3.11 FIELD QUALITY CONTROL

- .1 Inspection and testing will be carried out by Testing Laboratory designated by Ministerial representative.

3.12 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and 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.

3.13 PROTECTION

- .1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .2 Repair damage to adjacent materials caused by masonry products installation.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-in-Place Concrete.
- .2 Section 05 51 29 – Metal Stairs and Ladders.

1.02 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM A 36/A 36M-08, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A 193/A 193M-08, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
 - .3 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A 325-07a, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM A 325M-08, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength Metric.
 - .6 ASTM A 490M-04ae, Standard Specification for High-Strength Steel Structural Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints Metric.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
 - .1 Handbook of the Canadian Institute of Steel Construction.
 - .2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16-01(R2007), Limit States Design of Steel Structures.
 - .4 CAN/CSA-S136-07, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .5 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W55.3-1965(R2003), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .8 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .5 Master Painters Institute
 - .1 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.

- .2 MPI-EXT 5.1-08, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
 - .1 NACE No. 3/SSPC SP-6-06, Commercial Blast Cleaning.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .2 Erection drawings:
 - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
- .3 Fabrication drawings:
 - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Quebec, Canada.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

2 PRODUCTS

2.01 DESIGN REQUIREMENTS

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

- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

2.02 MATERIALS

- .1 Structural steel: to CSA-G40.20/G40.21 Grade as indicated on general notes.
- .2 Anchor bolts: to CSA-G40.20/G40.21
- .3 Bolts, nuts and washers: to ASTM A 325M.
- .4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .5 Shop paint primer: see general notes.
- .6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².

2.03 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16.

2.04 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with general notes.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.
- .3 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .4 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

3 EXECUTION

3.01 APPLICATION

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

3.02 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.03 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

3.04 MARKING

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.05 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with approved erection drawings.
- .2 Field cutting or altering structural members: to approval of the Departmental Representative.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.06 FIELD PAINTING

- .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-In-Place Concrete and Section 05 12 23 – Structural Steel For Buildings.

1.02 REFERENCES

- .1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)
 - .1 ANSI/NAAMM MBG 531-00, Metal Bar Grating Manual.
- .2 ASTM International
 - .1 ASTM A 53/A 53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength Metric.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .4 CSA International
 - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 National Association of Architectural Metal Manufactures (NAAMM)
 - .1 AMP 510-92, Metal Stair Manual.
- .7 The Society for Protective Coatings (SSPC)
 - .1 Systems and Specifications Manual, Volume 2, 2008 Edition.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for stairs and landings and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Indicate construction details, sizes of steel sections and thickness of steel sheet.

1.04 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect stairs from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- .1 Design Requirements as specified plans:
- .2 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.
- .3 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

2.02 MATERIALS

- .1 Steel sections: to CSA G40.20/G40.21 Grade 300 W.

- .2 Steel plate: to CSA G40.20/G40.21, Grade 260 W.
- .3 Floor plate: to CSA G40.20/G40.21, Grade 260 W.
- .4 Steel pipe: to ASTM A 53/A 53M, standard weight, schedule 40 seamless black.
- .5 Steel tubing: to CSA G40.20/G40.21, sizes and dimensions as indicated.
- .6 Metal bar grating: to ANSI/NAAMM MBG 531, galvanized steel, Type W-19-4, with abrasive nosings.
- .7 Welding materials: to CSA W59.
- .8 Bolts: to ASTM A 307.
- .9 High strength bolts: to ASTM A 325M.

2.03 FABRICATION

- .1 Fabricate in accordance with NAAMM, Metal Stair Manual.
- .2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
- .3 Accurately form connections with exposed faces flush:
 - .1 Make mitres and joints tight.
 - .2 Make risers of equal height.
- .4 Grind or file exposed welds and steel sections smooth.
- .5 Shop fabricate stairs in sections as large and complete as practicable.

2.04 PLATE/GRATING STAIRS

- .1 Form treads and landings from thick steel plate to profile indicated, and secure to stringers.
- .2 Form steel grating treads and landings from metal bar grating to profile indicated and secure to stringers and supports as indicated. Form landings of steel grating and reinforce as required.
- .3 Form stringers as indicated as the plans.

2.05 PIPE/TUBING BALUSTRADES

- .1 Construct balusters and handrails from steel pipe.
- .2 Cap and weld exposed ends of balusters and handrails.
- .3 Terminate at abutting wall with end flange.

2.06 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.
- .2 Shop coat primer: to CAN/CGSB-1.40.
- .3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.07 SHOP PAINTING

- .1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2.
- .2 Apply one coat of shop primer except interior surfaces of pans.
- .3 Apply two coats of primer of different colours to parts inaccessible after final assembly.
- .4 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7 degrees C.
- .5 Do not paint surfaces to be field welded.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal stairs and ladders installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.02 INSTALLATION OF STAIRS

- .1 Install in accordance with NAAMM, Metal Stair Manual.
- .2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.
- .3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .4 Do welding work in accordance with CSA W59 unless specified otherwise.
- .5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.03 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.

3.04 CLEANING

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 Clean and wax plastic handrails immediately prior to final inspection.
- .3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.05 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal stairs and ladders installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM B 117-03, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - .2 ASTM C 67-05, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 - .3 ASTM C 144-04, Standard Specification for Aggregate for Masonry Mortar.
 - .4 ASTM D 968-05, Standard Test Methods for Abrasion Resistance of Organic Coatings by the Falling Abrasive.
 - .5 ASTM D 2247-02, (U.S. Federal Test 141A 6201), Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - .6 ASTM E 72-05, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 - .7 ASTM E 96/E 96M-05, Standard Test Methods for Water Vapor Transmission of Materials.
 - .8 ASTM E 695-03, Standard Method for Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading.
 - .9 ASTM G 154-05, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.162-2004, Emulsion Coating for Stucco and Masonry.
 - .2 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
- .4 Health Canada (HC)
 - .1 Workplace Hazardous Materials Information System (WHMIS).
 - .2 Material Safety Data Sheets (MSDS).
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN-ULC-S101-04, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN-ULC-S102-03, Standard Methods for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN-ULC-S134-92, Standard Method of Fire Test of Exterior Wall Assemblies.

1.2 DEFINITIONS

- .1 Aesthetic joint: joint for appearance or installation ease. Also known as reveals grooves and reglets used to provide starting and stopping points during application of finish coat.
- .2 Base coat adhesive: adhesive used in base coat. Polymer modified, polymer based or cementitious material, typically mixed with Portland cement.
- .3 Base coat: base coat consists of 2 components; base coat adhesive and reinforcing mesh.
- .4 Direct-Applied: direct-applied systems use EIFS-like coatings applied directly to rigid sheathing boards. Insulation is not used in these systems, thus, they are not EIFS.
- .5 Lamina: base coat reinforcing mesh and finish.
- .6 Reinforcing mesh: woven glass fibre reinforcement to base coat providing impact resistance.

1.3 SYSTEM DESCRIPTION

- .1 Performance requirements: ensure installed modified polymer (soft) coat wall system has following performance properties:
 - .1 Comply with CAN-ULC-S134.
 - .2 Finish abrasion resistance: falling sand method to ASTM D 968, no deleterious effects.
 - .3 Finish salt spray resistance: to ASTM B 117, after 300 hours exposure to 5 % salt spray solution - no effects.
 - .4 Finish moisture resistance: to ASTM D 2247 (U.S. Federal test 141 A6201), after 14 days exposure - no deleterious effects.
 - .5 Accelerated weathering: to CAN/CGSB-1.162, ASTM G 154, 2000 hours - no effect.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials. WHMIS acceptable to Labour Canada, and Health and Welfare Canada for exterior finish - direct applied materials. Indicate VOC content.
 - .3 Submit product data sheets for system materials. Include product characteristics, performance criteria, limitations and colours.

- .3 Shop Drawings: submit shop drawings and indicate wall layout, details, connections, expansion joints, finish system, installation sequence, including interface with fascias, walls, air barriers, vapour retarders and other components.
- .4 Samples:
 - .1 Submit samples.
 - .1 Submit one 300 x 300 mm sample of each colour of finished soffit system prior to fabrication of mock-up.

1.5 QUALITY ASSURANCE

- .1 Quality Assurance:
 - .1 Installer: company or person specializing in application of exterior finish system (direct applied) with 5 years documented experience approved by manufacturer.
 - .2 Installation of exterior finish system by applicators certified by manufacturers of system used.
 - .3 Submit certification to Ministerial representative prior to commencement of work.
- .2 Mock-ups:
 - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
 - .2 Construct mock up of complete exterior finish system on typical exterior soffit 300 mm long x 300 mm wide incorporating:
 - .1 Joints to demonstrate aesthetic, control and expansion joint construction.
 - .2 Construction at changes in substrate.
 - .3 Construction at fascias.
 - .4 Construction at both large and small penetrations.
 - .5 Colour, texture and finish as per existing.
 - .3 Construct mock-up where directed.
 - .4 Allow 24 hours for inspection of mock-up by Ministerial representative before proceeding with work.
 - .5 When accepted, mock-up will demonstrate minimum standard for work, and may remain as part of finished work.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in accordance with manufacturer's instructions.
- .3 Protect and]base finish materials from freezing.
- .4 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of insulation, adhesive and caulking materials.

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

1.7 AMBIENT CONDITIONS

- .1 Temperature, relative humidity, moisture content.
 - .1 Apply exterior finish system components at temperatures, relative humidity, and substrate moisture content and substrate temperature in accordance with manufacturer's written instructions.
 - .2 Maintain ambient temperature above 4 degrees C during base coat application and until cured minimum 24 hours.
 - .3 Maintain ambient temperature above 4 degrees C during finish coat application and until cured minimum 24 hours.

1.8 WARRANTY

- .1 Contractor warrants that exterior finish system will not leak or delaminate.

Part 2 Products

2.1 SURFACE PREPARATION

- .1 Conditioner: water based or acrylic, clear conditioner/sealer compatible with system materials, recommended by system manufacturer.
- .2 Leveller: polymer-modified, cement-based, reinforced levelling compound.

2.2 BASECOAT

- .1 Modified polymer: non-cementitious, fibre reinforced, premixed base coat system, colour and texture as per existing.
- .2 Modified, cementitious base coat system: cement, silica sand aggregate, acrylic liquid admixture, 13.2 % acrylic to cement ratio, texture and colour as per existing.
- .3 Acrylic: non-cementitious, fibre reinforced base coat system, texture and colour as per existing..

2.3 REINFORCING MESH

- .1 Balanced, woven glass fibre fabric made from twisted multi-end strands, treated, alkali resistant, compatible with chemical bonding system base coat and finish coat, weight standard - 163 g/m².

.2 Speciality mesh:

- .1 Detail mesh: flexible, symmetrical, woven glass fibre fabric made from twisted multi-end strands, treated, alkali resistant, compatible with chemical bonding system base coat and finish coat, weight 153 g/m².
- .2 Corner mesh: pre-creased, non-woven glass fibre fabric made from twisted multi-end strands, treated, alkali resistant, compatible with chemical bonding system base coat and finish coat, weight 212 g/m².

2.4 FINISH COAT

- .1 Modified polymer finish coat system: acrylic resins in dispersion, silica aggregate, integral mineral pigmentation and additives, colour as per existing.
- .2 Modified finish coat system: synthetic stucco, acrylic type, cement, silica sand aggregate, integral mineral pigmentation and additives, colour and texture as per existing.

2.5 PRIMER

- .1 Acrylic based or silicone enhanced primer.

2.6 ACCESSORIES

- .1 Accessories: galvanized corner beads, casing beads, stop beads, and accessories, as recommended by exterior finish system manufacturer to suit system components.

2.7 EXPANSION JOINTS

- .1 Expansion joints: galvanized.
- .2 Ensure expansion joints are back wrapped.
- .3 Joint Cleaner: non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .4 Sealant primer: as recommended by sealant manufacturer.
- .5 Joint filler: extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 - 200 kPa, outsized 30 to 50%.
- .6 Sealant: in accordance with Section 07 92 10 - Joint Sealing asbestos-free sealant, compatible with systems materials, recommended by system manufacturer.
 - .1 Weather seals: multi-component, chemical curing to CAN/CGSB-19.24, Type 2, Class B.
 - .2 Panel joints: multi-component, chemical curing to CAN/CGSB-19.24, Type 2, Class B.

2.8 MATERIALS: SITE MIX

- .1 Cement: to CSA-A3001, Type GU.
- .2 Sand: dry bag.
 - .1 For white cement: silica sand, 30-50 mesh.
 - .2 For grey cement: mortar sand to ASTM C 144.
- .3 Water: potable.

2.9 MIXES

- .1 General:
 - .1 Mixer: high speed, clean and rust free.
 - .2 Mixing pail: clean and rust free.
 - .3 Mixes: additive free.
- .2 Conditioner: mix in accordance with manufacturer's written instructions.
- .3 Leveller: mixed to uniform consistency in accordance with manufacturer's written instructions.
- .4 Basecoat: mixed to uniform consistency in accordance with manufacturer's written instructions.
- .5 Finish coat: mixed to uniform consistency in accordance with manufacturer's written instructions.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Inspect and verify condition of existing substrate surfaces for contamination, surface absorption, chalkiness, cracks, damage, deterioration, moisture content, moisture damage, and tolerances.
 - .1 Substrate tolerance not greater than 6 mm in 2500 mm design deflection no greater than 1/240 in accordance with manufacturer's written instructions.
- .2 Report deviations from specified requirements or other conditions that might adversely affect exterior finish system installation in writing to Ministerial representative.
- .3 Proceed with Work only after receipt of written approval from Ministerial representative.

3.3 PREPARATION

- .1 Protection:
 - .1 Protect adjacent surfaces from damage resulting from Work of this section.
 - .2 Protect finished Work from water penetration at end of each day or on completion of each section of Work.
 - .3 Protect installation from moisture for 48 hours minimum after completion of each portion of Work.
- .2 Surface preparation:
 - .1 Ensure environmental and site conditions are suitable for installation of system.
 - .2 Prepare new and existing surfaces in accordance with manufacturer's written instructions.
 - .3 Conditioner: water based or acrylic, clear conditioner/sealer compatible with system materials, substrate and as recommended by system manufacturer.
 - .1 Add water and mix.
 - .2 Apply to clean, dry substrate surfaces ensuring complete even coverage in accordance with manufacturer' written instructions.
 - .4 Leveller: polymer-modified, cement based, reinforced levelling compound.
 - .1 Add water and mix.
 - .2 Allow set time.
 - .3 Apply to existing substrate, 6 mm thick maximum.
 - .4 Allow time to fully cure.

3.4 INSTALLATION

- .1 Install system in accordance with CAN-ULC-S134.
- .2 Accessories:
 - .1 Install required accessories as detailed and as required by exterior finish system manufacturer, and in accordance with CAN-ULC-S134.
- .3 Joints:
 - .1 Reveals and Aesthetic Grooves.
 - .1 Cut reveals and aesthetic grooves with appropriate tool in locations indicated in accordance with details.
 - .2 Expansion joints:
 - .1 Install expansion joints in locations indicated and to manufacturers written instructions.
 - .2 Install expansion joints at isolation joints in substrate where new construction abuts existing construction at locations where movement is expected to be greater than 6 mm.

- .4 Mesh and Base Coat Application:
 - .1 Apply 225 x 300 mm diagonal strips of detail mesh at corners, lights, grilles and penetrations through system.
 - .1 Embed strips in wet base coat and trowel from centre to mesh edge to avoid wrinkles.
 - .2 Apply detail mesh at reveals.
 - .1 Embed mesh in wet base coat and trowel from base of reveal to mesh edges.
 - .3 Apply corner mesh at inside and outside corners.
 - .1 Embed mesh in wet base coat and trowel from corner of mesh edges.
 - .4 High impact mesh application: apply base coat over substrate to uniform thickness of approximately 3 mm.
 - .1 Work horizontally or vertically in 1000 mm strips, and immediately embed mesh into wet base coat by troweling from centre to mesh edge.
 - .2 Butt mesh at seams.
 - .3 Mechanically fasten mesh.
 - .4 Allow basecoat to dry.
 - .5 Standard mesh application:
 - .1 Apply base coat over substrate, including areas with high impact mesh to uniform thickness of approximately 3 mm.
 - .2 Work horizontally or vertically in 1000 mm strips, and immediately embed mesh into wet base coat by troweling from centre to mesh edge.
 - .1 Mechanically fasten mesh.
 - .3 Overlap mesh 64 mm minimum at mesh seams and overlaps of detail mesh.
 - .4 Feather seams and edges.
 - .5 Double wrap inside and outside corners with minimum 64 mm overlap in each direction.
 - .1 Embed corner mat in wet base coat, allow to dry, then overlap up to corner with standard reinforcing mesh embedded in base coat.
 - .6 Avoid wrinkles in mesh.
 - .7 Fully embed mesh so that no mesh colour shows through basecoat when dry.
 - .8 Ensure minimum base coat thickness of 1,6 mm when dry.
 - .1 Re-skim base coat if 1,6 mm thickness not achieved during initial application.
 - .2 Allow base coat to thoroughly dry before applying primer or finish coat.

.5 Finish Coat Application

- .1 Apply finish coat in accordance with manufacturer's written installation instructions.
- .2 Prime dry base coat and allow to dry thoroughly before applying finish coat.
- .3 Apply finish coat directly over base coat, or primed basecoat, only after base coat or primer has thoroughly dried.
- .4 Apply finish by spray or trowel as recommended by manufacturer.
- .5 Apply finish in continuous application, and work towards wet edge.
- .6 Do not install separate batches of finish coat side by side.
- .7 Do not apply finish into or over sealant joints.
 - .1 Apply finish to outside of wall only.
- .8 Do not apply finish over irregular or unprepared surfaces.
- .9 Apply textured or aggregate finishes to wall areas as indicated and in accordance with manufacturer's written instructions.

3.5 CLEAN UP

- .1 Upon completion of installation remove excess materials, droppings and debris, tools and equipment barriers.
- .2 Clean surface and adjacent work area of foreign materials resulting from installation procedures.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal procedures.
- .2 Section 01 74 21 – Construction/demolition waste management and disposal.
- .3 Section 02 81 01 – Hazardous materials.
- .4 Section 01 45 00 – Quality control.
- .5 Section 07 62 00 – Sheet metal flashing and trim.

1.2 REFERENCES

- .1 Aluminum Association (AA).
 - .1 AA DAF-45-R03, Designation System for Aluminum Finishes - 9th Edition.
 - .2 AA ASM-35-October 2000, Specifications for Aluminum Sheet Metal Work in Building Construction, Section 5.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A 240/A 240M-02a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A 653/A 653M-02a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A 792/A 792M-02, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
 - .5 ASTM B 32-00e1, Standard Specification for Solder Metal.
 - .6 ASTM B 370-98, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .7 ASTM D 523-89(1999), Standard Test Method for Specular Gloss.
 - .8 ASTM D 822-01, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
 - .2 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.
 - .3 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .4 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .4 Canadian Standards Association (CSA International).

- .1 CAN/CSA A123.3-98, Asphalt Saturated Organic Roofing Felt.
- .5 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .7 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC).
 - .1 CCMC-2002, Registry of Product Evaluations.
- .8 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit proof of manufacturer's CCMC Listing and listing number to Ministerial representative.
- .2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures
- .3 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .5 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .6 Indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame.
- .7 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .8 Submit[300 x 300mm samples of each sheet metal material.

1.4 QUALITY ASSURANCE

- .1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.
- .2 Fabricate 300 x 300 mm sample roofing panel using identical project materials and methods to include typical seam.
- .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.

- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock-up by Ministerial representative before proceeding with sheet metal flashing work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers Steel waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Ensure emptied containers are sealed and stored safely.
- .8 Divert unused metal materials from landfill to metal recycling facility as approved by Ministerial representative.
- .9 Unused paint, caulking, and sealing compound materials must be disposed of at an official hazardous material collections site as approved by Ministerial representative.
- .10 Unused paint, caulking, and sealing compound materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .11 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: to ASTM A 653/A 653M, commercial quality, copper steel, with Z275 coating, regular spangle, extra smooth surface, prefinish on bolt sides as specified in 2.2.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied polyvinylidene fluoride.
 - .1 Class F1S.
 - .2 Colour to be chosen by architect from manufacturer's standard range.
 - .3 Specular gloss: 30 units +/-5 to ASTM D 523.
 - .4 Coating thickness: not less than 22 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D 822 as follows:
 - .1 Outdoor exposure period 2500 hours.
 - .2 Humidity resistance exposure period 5000 hours.
 - .6 Profile : 1000 mm x 34 mm in depth with ground of 34 mm and in depth at 333 mm.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5.
- .3 Slip sheet: reinforced sisal paper or a heavy felt kraft paper.
- .4 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer.
- .5 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.
- .6 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide, same as sheet metal being secured.
- .7 Fasteners: exposed.
- .8 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .9 Solder: to ASTM B 32, alloy composition Sn.
- .10 Flux: rosin, cut muriatic acid, or commercial preparation suitable for materials to be soldered.
- .11 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.4 FABRICATION

- .1 Fabricate aluminum sheet metal in accordance with AA ASM-35.
- .2 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.

- .3 Hem exposed edges on underside 12 mm, mitre and seal.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.
- .6 Protect metals against oxidization by backpainting with isolation coating where indicated.
- .7 Tin edges of copper sheets to be soldered for width of 40 mm both sides with solder.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide underlay under sheet metal roofing. Secure in place and lap joints 100 mm minimum.
- .2 Apply slip sheet over asphalt felt underlay to prevent bonding between sheet metal and felt. Secure with minimum anchorage and lap joints 50 mm minimum in direction of waterflow.
- .3 Install sheet metal roof panels using cleats spaced as recommended by supplier.
- .4 Secure cleats with two fasteners each and cover with cleat tabs.
- .5 Align transverse seams in adjacent panels.
- .6 Flash roof penetrations with material matching roof panels, and make watertight.
- .7 Form seams in direction of water-flow and make watertight.
- .8 Perform soldering with well heated coppers, heat seam thoroughly and sweat solder through its full width.
- .9 Clean and flux metals before soldering.
- .10 Follow sheet metal manufacturer's recommendations for soldering procedures.
- .11 As work progresses, neutralize excess flux with 5% to 10% washing soda solution, and thoroughly rinse. Leave work clean and free of stains.

3.2 FINISH

- .1 Let copper roof weather through two heavy rains after final cleaning.
- .2 Rub exposed surfaces with clean rags soaked in boiled linseed oil until desirable shade of brown is obtained.

.3 Touch up solder with copper bronze.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 62 00 – Sheet metal flashing and trim.

1.2 REFERENCES

- .1 The Aluminum Association Inc. (AAI)
 - .1 AAI-Aluminum Sheet Metal Work in Building Construction-200].
 - .2 AAI DAF45-03, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 167-99(2004), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A 240/A 240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A 606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .4 ASTM A 653/A 653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM A 792/A 792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .6 ASTM B 32-04, Standard Specification for Solder Metal.
 - .7 ASTM B 370-03, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .8 ASTM D 523-89(1999), Standard Test Method for Specular Gloss.
 - .9 ASTM D 822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual 1997.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.

- .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .6 Green Seal Environmental Standards
 - .1 Standard GS-03-93, Anti-Corrosive Paints.
 - .2 Standard GS-11-97, Architectural Paints.
 - .3 Standard GS-36-00, Commercial Adhesives.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .8 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule #1113-04, Architectural Coatings.
 - .2 SCAQMD Rule #1168-05, Adhesives and Sealants.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .4 Samples:
 - .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colours.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
 - .2 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:

- .1 Materials and Resources Credit MRc2.1 Construction Waste Management: Divert 50% From Landfill and MRc2.2 Construction Waste Management: Divert 75% From Landfill.

Part 2 Products

- .1 Zinc coated steel sheet: 24 caliber, commercial quality to ASTM A 653/A 653M, with Z275 designation zinc coating.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied polyvinylidene fluoride.
 - .1 Class F1S.
 - .2 Colour selected by architect and Ministerial representative from manufacturer's standard range.
 - .3 Specular gloss: 30 units +/- in accordance with ASTM D 523.
 - .4 Coating thickness: not less than 22 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D 822 as follows:
 - .1 Outdoor exposure period 2500 hours.
 - .2 Humidity resistance exposure period 5000 hours.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
 - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168 to GSES GS-36.
- .3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32 asphalt laminated 3.6 to 4.5 kg kraft paper No. 15 perforated asphalt felt to CSA A123.3.
- .4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide same as sheet metal being secured.
- .5 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .7 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.
- .8 Touch-up paint: as recommended by prefinished material manufacturer.
 - .1 Maximum VOC limit 50 g/L to Standard GS-11 to SCAQMD Rule 1113.

2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- .3 Form pieces in 2400 mm maximum lengths.
 - .1 Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm.
 - .1 Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

- .1 Form flashings, copings and fascias to profiles indicated of 0,48 mm thick galvanized prefinished.

2.6 REGLETS AND CAP FLASHINGS

- .1 Form recessed and surface mounted reglets, metal cap flashing sheet metal to be built-in concrete masonry work for base flashings as detailed in accordance with CRCA FL series details.
 - .1 Provide slotted fixing holes and steel/plastic washer fasteners.
 - .2 Cover face and ends with plastic tape.

2.7 EAVES TROUGHS AND DOWNPIPES

- .1 Form eaves troughs and downpipes from 22 caliber galvanized prefinished steel.
- .2 Sizes and profiles as indicated.
- .3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA FL series details, FL AAI-Aluminum Sheet Metal Work in Building Construction as detailed.
- .2 Use concealed fastenings except where approved before installation.
- .3 Lock end joints and caulk with sealant.
- .4 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .5 Insert metal flashing into reglets under cap flashing to form weather tight junction.
- .6 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .7 Caulk flashing at reglet cap flashing with sealant.
- .8 Install pans, where shown around items projecting through roof membrane.

3.3 EAVES TROUGHS AND DOWNPIPES

- .1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough screws through spacer ferrules.
 - .1 Slope eaves troughs to downpipes as indicated.
 - .2 Solder or seal joints watertight.
- .2 Install downpipes and provide goosenecks back to wall.
 - .1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 653/A 653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B 29-03, Standard Specification for Refined Lead.
 - .3 ASTM B 749-03, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).
 - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .5 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- .6 National Fire Protection Association (NFPA)
 - .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.
- .7 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .8 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

- .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
- .5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
 - .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
 - .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 NFPA 252 for ratings specified or indicated.
 - .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E 152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province, Territory of Quebec, Canada.
 - .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware and fire rating and finishes.
 - .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing fire rating finishes.
 - .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
 - .5 Submit test and engineering data, and installation instructions.
- .4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
- .5 Submit one 300 x 300 mm corner sample of each type of frame.
 - Show butt cutout 300 mm long removable mullion connection snap-on trim with clips.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, ROBUSTE steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 Stiffened: face sheets welded, insulated core:
 - .1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m³.
- .2 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E 152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
 - .1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.
 - .1 Maximum VOC limit 50 g/L to GC-03.

2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Section 09 91 99 – Painting for minor works. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
 - .1 Maximum VOC emission level 50 g/L to GS-11 to SCAQMD Rule 1113.

2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma steel.
- .3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Door bottom seal.
- .5 Metallic paste filler: to manufacturer's standard.
- .6 Fire labels: with accordance of door/frame manufacturer.
- .7 Sealant :
 - .1 Sealants, except those described in CAN/ONGC-19.1 CAN/ONGC-19.18 standards and shall appear on the list of approved products, published by the Commission for the approval of products sealing of ONGC (CGSB). When it comes to sealing that were registered with a primary product, only the primer should be used with sealant. All products must be low VOC (LEED)
 - .2 Product n° 1 :
 - .1 Terpolymer sealant polyurethane epoxy three components, chemical polymerization. Colors to be choose by the architect and in accordance with standard CAN/ONGC-19.24-M90. Product acceptable TREMCO LTD 240 or Approved equivalent.
 - .1 Joints between exterior door frames and access doors, windows, shutters or other and exterior masonry walls.
 - .2 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 12 caliber welded thermally broken type construction.
- .4 Interior frames: 12 caliber welded type construction.

- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Protect mortised cutouts with steel guard boxes.
- .7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .8 Manufacturer's nameplates on frames and screens are not permitted.
- .9 Conceal fastenings except where exposed fastenings are indicated.
- .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .11 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile, with a continuous weld on full length of joint.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

- .2 Exterior doors: galvanized steel, insulated construction.
- .3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E 330.
- .5 Blank, reinforce, drill doors and tap for mortised, templated hardware.
- .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104, ASTM E 152, NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .10 Manufacturer's nameplates on doors are not permitted.

2.11 THERMALLY BROKEN DOORS AND FRAMES

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break. The top and bottom profile of the exterior doors must be closed with a U, thickness of metal 1,9 mm or more according to the steel door and must be of the same metal, and all joint welded filled and sanded flush towards the exterior.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, non combustible sill and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 08 11 00 – Metal doors and frame.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.3-2001, Exit Devices.
 - .4 ANSI/BHMA A156.4-2000, Door Controls - Closers.
 - .5 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
 - .6 ANSI/BHMA A156.6-2005, Architectural Door Trim.
 - .7 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.
 - .8 ANSI/BHMA A156.10-1999, Power Operated Pedestrian Doors.
 - .9 ANSI/BHMA A156.12-2005, Interconnected Locks and Latches.
 - .10 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.
 - .11 ANSI/BHMA A156.14-2002, Sliding and Folding Door Hardware.
 - .12 ANSI/BHMA A156.15-2006, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
 - .13 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
 - .14 ANSI/BHMA A156.17-2004, Self-closing Hinges and Pivots.
 - .15 ANSI/BHMA A156.18-2006, Materials and Finishes.
 - .16 ANSI/BHMA A156.19-2002, Power Assist and Low Energy Power - Operated Doors.
 - .17 ANSI/BHMA A156.20-2006, Strap and Tee Hinges and Hasps.
- .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
 - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .4 After approval samples will be returned for incorporation in Work.
- .4 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.5 MAINTENANCE MATERIALS SUBMITTALS

- .1 Extra Stock Materials:
 - .1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Tools:
 - .1 Supply 2 sets of wrenches for door closers locksets and fire exit hardware.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

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

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping strippable coating.
 - .4 Replace defective or damaged materials with new.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Locks and latches:
 - .1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2.
 - .2 Interconnected locks and latches: to ANSI/BHMA A156.12.
 - .3 Mortise locks and latches: to ANSI/BHMA A156.13.
 - .4 strikes: box type, lip projection not beyond jamb.
 - .5 Cylinders: key into keying system as per existing to coordinate with CSC.
 - .6 Finished stainless.
- .2 Butts and hinges:
 - .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.

- .3 Door Closers and Accessories:
 - .1 Door controls (closers): to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1.
 - .2 Door controls - overhead holders: to ANSI/BHMA A156.8, designated by letter C and numeral identifiers listed in Hardware Schedule.
 - .3 Closer/holder release devices: to ANSI/BHMA A156.15, designated by letter C and numeral identifiers listed in hardware schedule.
 - .4 Door co-ordinator: surface for pairs of doors with overlapping astragal.
- .4 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene weather seal, recessed in door bottom with drip cap recessed in door face, closed ends, adjustable automatic retract mechanism when door is open, clear anodized finish.
- .5 Thresholds: extruded aluminum mill finish, plain surface, with thermal break of rigid PVC, with lip and vinyl door seal insert.
- .6 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and solid closed cell neoprene nylon brush pile vinyl insert, clear anodized finish.
 - .2 Door bottom seal:
 - .1 Extruded aluminum frame and closed cell neoprene nylon brush vinyl sweep, clear anodized finish.
- .7 Astragal: adjustable compensating overlapping, extruded aluminum frame with vinyl pile insert, finished to match doors.

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Prepare detailed keying schedule in conjunction with Departmental Representative.

- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply construction cores.

Part 3 Execution

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Install key control cabinet.
- .7 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores locks when directed by Departmental Representative.
 - .1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

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 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and 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.

3.4 DEMONSTRATION

- .1 Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
 - .3 Use, application and storage of wrenches for door closers, locksets and fire exit hardware.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- Repair damage to adjacent materials caused by door hardware installation.

3.6 SCHEDULE

- .1 Double Doors 001 – Reuse existing hardware.
- .2 Door 002

3	Robust stainless steel hinge prison SF204FMSS	630	Southern Folger
1	Double cylinder dead lock prison 86-6 x 80-4DB x HM x 2 / x 2 keys 2CS		
2	Pull handle prison No. 2	630	Southern Folger
1	Security door closer with adjustable sturdy and robust parallel arm, stopping and holding open selective CPS-7570-T x SRI (Arm door closer installed off the seal at the head of the frame, do not cut it)	689	Norton
1	Robust stainless plate steel protection K1062-10" x 34" x Tork	630	Rockwood
1	Aluminum threshold with thermal break, lock and seal 525A x 36"	719	Zero International
1	Adhesive waterproofing silicone trims		Zero

	488S-BK x 1/36" (Head) + 2/84" (jambs)	Noire	International
1	Water tight trims with rigid neoprene inserts. 31AA x 1/36" (Head) + 2/84" (jambs)	628	Zero International
1	Door broom with robuste neoprene / and water tight trims. 539AA x 36" x Tork	628	Zero Internrtional

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 08 11 00 – Metal doors and frames.

1.2 REFERENCES

- .1 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .2 Maintenance Repainting Manual - current edition.
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store painting materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- .4 Fire Safety Requirements:
 - .1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .2 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .5 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section.
- .6 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .2 Co-ordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
 - .3 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
 - .2 Test concrete, masonry and plaster surfaces for alkalinity as required.
 - .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

- .3 Additional application requirements:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

- .1 Supply paint materials for paint systems from single manufacturer.
- .2 Conform to latest MPI requirements for painting work including preparation and priming.
- .3 Materials in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual "Approved Product" listing.
 - .1 Use MPI listed materials having E2 and E3 rating where indoor air quality requirements exist.
 - .2 Primer: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.
 - .3 Paint: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.
- .4 Colours:
 - .1 Base colours are existing.
- .5 Mixing and tinting:
 - .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Ministerial representative for tinting of painting materials.
 - .2 Use and add thinner in accordance with paint manufacturer's recommendations.
 - .1 Do not use kerosene or similar organic solvents to thin water-based paints.
 - .3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.
 - .4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.
- .6 Gloss/sheen ratings:
 - .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60	Sheen @ 85
Gloss Level 1 – Matte finish	Max. 5	Max. 10

- | | | | |
|--|-----------------------------------|--------------|----------|
| | Gloss Level 2 – Velvet finish | Max.10 | 10 to 35 |
| | Gloss Level 3 – Eggshell finish | 10 to 25 | 10 to 35 |
| | Gloss Level 4 – Satin finish | 20 to 35 | min. 35 |
| | Gloss Level 5 – Semi-Gloss finish | 35 to 70 | |
| | Gloss Level 6 – Gloss finish | 70 to 85 | |
| | Gloss Level 7 – High gloss finish | More than 85 | |
- .2 Gloss level ratings of painted surfaces as indicated.
- .7 Exterior painting:
- .1 Concrete Vertical Surfaces: (including horizontal soffits)
- .1 EXT 3.1A - Latex colour and finish as per existing.
- .2 Concrete Masonry Units: smooth and split face block and brick
- .1 EXT 4.2A - Latex colour and finish as per existing.
- .3 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.
- .1 EXT 5.1D – Alkyd colour and finish as per existing.
- .4 Galvanized Metal: high contact/high traffic areas (doors, frames, etc.).
- .1 EXT 5.3B - Alkyd colour and finish as per existing.
- .5 Exterior re-painting:
- .1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.
- .1 REX 5.1D - Alkyd gloss level as per existing.
- .2 Galvanized Metal: high contact/high traffic areas (doors, frames, etc.).
- .1 REX 5.3B - Alkyd gloss level as per existing.

Part 3 Execution

3.1 GENERAL

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual except where specified otherwise.

3.2 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Ministerial representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Ministerial representative.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.
- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress.
 - .4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.
 - .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
 - .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
 - .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
 - .8 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
 - .9 Touch up of shop primers with primer as specified.

3.4 APPLICATION

- .1 Paint only after prepared surfaces have been accepted by Ministerial representative.

- .2 Use method of application approved by Ministerial representative.
 - .1 Conform to manufacturer's application recommendations.
- .3 Apply coats of paint in continuous film of uniform thickness.
 - .1 Repaint thin spots or bare areas before next coat of paint is applied.
- .4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .5 Sand and dust between coats to remove visible defects.
- .6 Mechanical/Electrical Equipment:
 - .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
 - .2 Do not paint over nameplates.
 - .3 Keep sprinkler heads free of paint.
 - .4 Paint fire protection piping red.
 - .5 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
 - .6 Paint natural gas piping yellow.
 - .7 Paint both sides and edges of backboards for telephone and electrical equipment before installation.
 - .1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Place paint, stains and primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

1 GENERAL

1.01 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 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.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.

- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.02 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.03 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.

- .4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
 - .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- 1.04 DELIVERY, STORAGE, AND HANDLING**
 - .1 Waste Management and Disposal:
 - .1 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.
- 2 PRODUCTS**
- 2.01 MATERIALS**
 - .1 Not Used.
- 3 EXECUTION**
- 3.01 PAINTING REPAIRS AND RESTORATION**
 - .1 Prime and touch up marred finished paintwork to match original.
 - .2 Restore to new condition, finishes which have been damaged.
- 3.02 CLEANING**
 - .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.
- 3.03 FIELD QUALITY CONTROL**
 - .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .2 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.

3.04 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Oil Pump Systems.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.05 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1 GENERAL

1.01 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 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.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.

- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-Built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.02 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.03 DEVIS DE PERFORMANCE

- .1 This Section shall be considered a performance specification regarding the following :
 - .1 Calculations and design of protection systems against fire. It is obligatory to appoint an engineer for these purposes. Refer to the section « Services of an engineer ».

1.04 QUALIFIED SERVICE ENGINEER

- .1 Retain the services of an engineer and the mandate to :
 - .1 Oversee dynamic tests on the water source and the network building and to be present at these tests. Refer to the article « Dynamic tests on the water source and network building ».
 - .2 Make calculations and the complete design of fire protection systems in accordance with all requirements of this Division.
 - .3 Produce detailed plans and specifications, complete and final to be used in the construction based on the simplified Engineer plans. See « Interpreting protection plans against fire Engineer » for guidelines on the interpretation of these simplified plans.
 - .4 Produce, assemble and provide shop drawings, specifications and other documents relating to the calculation, design and products and in accordance with the specific requirements of Sections of this Division.
 - .5 Conduct periodic visits as often as necessary to check :
 - .1 The quality of the implementation.
 - .2 Facility compliance against the plans and specifications for construction, hydraulic calculations and subject sheets.
 - .3 Compliance with regulations, codes and standards.
 - .4 Compliance with the requirements of jurisdictional authorities.
 - .6 Oversee quality control on site and be present during these activities. Refer to the article « Quality Control in place ».
 - .7 Produce and sign a certificate of compliance.
 - .1 Refer to the Section « Elements for submission to completion ».
- .2 Qualifications
 - .1 Engineer, hereinafter called the « Qualified Engineer » must be a member of the OIQ specialized and recognized in the field of fire protection. He must be familiar with codes, standards, and regulations referenced in this Section.
 - .2 Provide resumes of qualified Engineer.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.02 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.03 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

3.04 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Fire Alarm.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.05 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 Materials and installation for standpipe and hose systems.

1.02 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 14-03, Standard for the Installation of Standpipe and Hose Systems.

1.03 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Submit complete plans to Authority of Jurisdiction for review and approval before commencement of work.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit samples of:
 - .1 Firehose nozzles.
 - .2 Section of hose.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Test reports:
 - .1 Submit certified test reports for packaged fire pumps from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

- .5 Closeout Submittals:
 - .1 Provide maintenance data for standpipe and hose system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.04 SYSTEM DESCRIPTION

- .1 Design system to NFPA 14 and following parameters:
 - .1 Stand alone: hydraulic.

1.05 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in packaged fire pump installations with 5 years documented experience.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
- .2 Storage and Protection:
 - .1 Store materials in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

2 PRODUCTS

2.01 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: to NFPA 14.
- .2 Fittings and joints to NFPA 14:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed ends, OS&Y gate.
 - .3 NPS 2 1/2 and over: cast iron, flanged ends, indicating butterfly valve.
 - .4 Check valves: swing type, composition disc.

- .4 Pipe hangers:
 - .1 ULC listed for fire protection services.
- .5 Drain valve: NPS 1, complete with hose end, cap and chain.
- .6 Inspector's test connections: NPS 1 gate valve.

2.02 CABINETS

- .1 To NFPA 14 and ULC listed: type as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with hinge same side as water supply and latching device.
- .2 Cabinets to maintain fire resistive rating of construction in which they occur.
- .3 Cabinet door: with 5 mm full glass panel.
- .4 Large enough to accommodate angle valve, hose rack, fire hose nozzle and spanner and NPS 2 1/2 fire department valve.

2.03 HOSE RACK

- .1 ULC listed, stationary-type rack with pins designed for 180 degrees movement. Locking device shall prevent flow of water into hose until last fold is removed from rack. Complete with hose, nozzle and angle valve.

2.04 FIRE HOSE AND NOZZLE

- .1 Hose: ULC listed, 38 mm nominal diameter, 23 m long, synthetic jacket, synthetic rubber lined.
- .2 Nozzle: ULC listed, 38 mm nominal diameter, forged brass adjustable combination fog-straight stream with shut-off.

2.05 ANGLE VALVES

- .1 ULC listed for fire service. NPS 1 1/2 cast or forged brass complete with hand wheel, open or drip connections, or hydrolator valve. Where water pressure exceeds 690 kPa, provide ULC listed pressure reducing device.

2.06 SWINGING HOSE REEL

- .1 ULC listed, designed so hose can be removed from reel when water is flowing, and with 38 mm nominal diameter hose 23 m long, and nozzle.

2.07 PRESSURE GAUGES

- .1 90 mm diameter.

2.08 FINISHES

- .1 In finished areas, chrome plate valves, nozzles, fittings and hose rack, and spanner.
- .2 Cabinets.
 - .1 Tub: prime coated.
 - .2 Door and frame: No. 4 satin finish stainless steel.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install and test to acceptance in accordance with NFPA 14.
- .2 Install pipework in accordance with supplemented as specified.
 - .1 Run inspectors test connections to sight glass.
 - .2 Install drain pipes and valves to drain parts of systems and so arranged that any one standpipe riser can be drained without shutting down any other parts of systems.
 - .3 Install 90 mm diameter pressure gauge at top of risers, in accordance with NFPA 14.
 - .4 The source of the water supply shall be reliable and capable of providing the required supply for not less than 30 minutes.

3.03 FIELD QUALITY CONTROL

- .1 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.

3.04 SITE TEST

- .1 General:
 - .1 In accordance with NFPA 14, supplemented as specified.
 - .2 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified.
- .2 Testing witnessed by authority having jurisdiction.

- .3 Disposal of water used in flushing and testing:
 - .1 Discuss appropriate measures with Departmental Representative.
- .4 Timing:
 - .1 Connect fire hoses when flushing out and pressure tests have been completed.
 - .2 Charge system with water when there is no possibility of freeze-up.
 - .3 Perform tests after pressure booster pumps have been tested.
- .5 Co-ordination:
 - .1 Co-ordinate tests with performance verification of:
 - .1 Fire alarm systems specified Section 28 31 00.02 – Multiplex Fire Alarm and Voice Communication Systems.
- .6 Procedures:
 - .1 Verify that system is complete prior to start-up and testing procedures.
 - .2 Verify that ULC labels are visible.
 - .3 Fill system with water for pressure. Record water supply pressure.
 - .4 Pressure test piping system as required by authority having jurisdiction.
 - .5 Verify flow switches are operational.
 - .6 Verify valves in system are visible and monitored.
 - .7 Flushing: Fill with water, let stand at operating pressure for 1 week. Drain risers separately, then drain main.
 - .8 Perform flow tests, including tests of pre-action systems, as required by:
 - .1 Authority having jurisdiction.
 - .2 Applicable NFPA standards such as 13, 14, 20, 1273.
 - .3 Local building codes.
 - .9 Record incoming pressure to building for 10 days prior to activating system.
- .7 Identification:
 - .1 Verify devices are properly labelled, identifying area served, etc.
- .8 Report:
 - .1 Refer to Section 01 91 13 - General Commissioning (Cx) Requirements, reports supplemented as specified.
 - .2 In addition to reports required by NFPA 14, include the following:
 - .1 Copy of schematic and valve schedule.
- .9 Posted Instructions:
 - .1 Prepare schematic, mount behind glare-free glass and install where directed.
 - .2 Prepare valve schedule, mount behind glare-free glass and install where directed.
- .10 Training:
 - .1 Refer to Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O&M Personnel.

- .11 Documentation:
 - .1 Provide written certification to Departmental Representative that system was installed, flushed and tested in accordance with appropriate codes, approved plans and calculations.
 - .2 Certificate to include:
 - .1 Contractors name.
 - .2 Contractors address.
 - .3 Contractors license number.
 - .4 List of approved materials and devices installed.
 - .5 Description of system test conducted.
 - .6 Dates of flushing and testing.
 - .7 Certification that connections and welding conform to acceptable standards.
 - .8 Certification that system is complete and in service.
 - .9 Approved signage has been provided and attached as appropriate.
 - .10 Hose threads of system and test connections match those of responding fire department.

3.05 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 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.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.

- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 The Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.02 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.03 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.

- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

2 PRODUCTS

2.01 Not Used

3 EXECUTION

3.01 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.02 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.03 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .2 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.

3.04 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Oil Pump Systems.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.05 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1 GENERAL

1.01 DOMESTIC WATER PIPING COPPER

- .1 Materials and installation for copper domestic water service used in the following:
 - .1 Hard drawn copper domestic hot and cold water services inside building.

1.02 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 35 29.06 - Health and Safety Requirements.
- .4 Section 01 78 00 - Closeout Submittals.
- .5 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .6 Section 21 05 01 - Common Work Results for Mechanical.
- .7 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.03 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-02, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 307-03, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B 88M-03, Standard Specification for Seamless Copper Water Tube (Metric).
 - .3 ASTM F 492-95, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.
- .3 American Water Works Association (AWWA).
 - .1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International).
 - .1 CSA B242-M1980(R1998), Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-02, Butterfly Valves.
 - .2 MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-97, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.
- .9 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.04 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data for following: valves.
- .3 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.05 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 PRODUCTS

2.01 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L : to ASTM B 88M.

2.02 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: roll grooved to CSA B242.

2.03 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A 307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F 492, complete with thermoplastic liner.

2.04 GLOBE VALVES

- .1 NPS2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.
- .2 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.

2.05 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .2 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .3 NPS 2-1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 150, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap.

2.06 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle.
- .2 NPS 2 and under, soldered:
 - .1 To ANSI/ASME B16.18, Class 150.

- .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

3 EXECUTION

3.01 INSTALLATION

- .1 Install in accordance with Province Plumbing Code and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ANSI standards.
- .3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.02 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves.

3.03 PRESSURE TESTS

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.04 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Federal potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.

3.05 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.06 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction approval of Departmental Representative.

- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

3.07 START-UP

- .1 Timing: Start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .4 Rectify start-up deficiencies.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 The installation of drainage waste and vent piping.
- .3 Related Sections:
 - .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .2 Section 01 47 15 - Sustainable Requirements: Construction.
 - .4 Section 01 35 29.06 - Health and Safety Requirements.

1.02 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B 32-03, Specification for Solder Metal.
 - .2 ASTM B 306-02, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C 564-03a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125-01, Plumbing Fittings.

1.03 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- .1 Above ground vent Type DWV to: ASTM B 306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.
 - .2 Wrought copper: to CAN/CSA-B125.
 - .2 Solder: tin-lead, 50:50, type 50A, to ASTM B 32.

2.02 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary and storm and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.
 - .1 Joints.

- .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C 564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.
- .2 Hub and spigot.
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.
- .2 Above ground sanitary and storm and vent: to CAN/CSA-B70.
 - .1 Joints.
 - .1 Hub and spigot.
 - .1 Caulking lead: to CSA B67.
 - .2 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

3 EXECUTION

3.01 INSTALLATION

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

3.02 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.03 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION

1 GENERAL

1.01 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 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.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.

- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 The Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur..
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.03 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.04 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.

- .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.02 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.03 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

3.04 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Oil Pump Systems.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.05 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .4 Closeout Submittals
 - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.04 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:

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

2 PRODUCTS

2.01 GENERAL

- .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.03 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 1/2 HP: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40]degrees C, 3 phase, 575 V, unless otherwise indicated.

2.04 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 Correct size of sheave determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.06 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives;
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.

- .3 38 mm dia holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension. -
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

3.03 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests [in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .2 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 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
 - .1 Materials and resources.

- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Certified wood.
- .8 Low-emitting materials.

3.04 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.02 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-1998, Power Piping.
 - .2 ANSI/ASME B31.3-2000, Process Piping Addenda A.
 - .3 ANSI/ASME B31.3-2001, Process Piping Addenda B.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206-97, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1-2000, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1-1999, Safety Welding, Cutting and Allied Process.
 - .3 AWS W1-2000, Welding Inspection Handbook..
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA W47.2-M1987(R1998), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48 series-01, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-97, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2-01, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-02, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-01, Certification of Welding Inspectors.

1.03 QUALIFICATIONS

- .1 Welders
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Furnish welder's qualifications to Departmental Representative.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
- .2 Inspectors
 - .1 Inspectors qualified to CSA W178.2.

1.04 QUALITY ASSURANCE

- .1 Registration of welding procedures in accordance with CSA B51.
- .2 Copy of welding procedures available for inspection.
- .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

2 PRODUCTS

2.01 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

3 EXECUTION

3.01 WORKMANSHIP

- .1 Welding: in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, applicable requirements of provincial authority having jurisdiction.

3.02 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.03 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 Vibration isolation materials and components, seismic control measures and their installation.

1.02 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC) – 2005.
- .4 CSA S832-06
 - .1 Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit [two] copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Provide system shop drawings complete with performance and product data.
 - .3 Provide detailed drawings of seismic control measures for equipment and piping.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Manufacturer's Field Reports: manufacturer's field reports specified.

1.04 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

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

2 PRODUCTS

2.01 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

2.02 ELASTOMERIC PADS

- .1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.
- .2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.03 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.04 SPRINGS

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for outdoor installations.
- .4 Colour code springs.

2.05 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
- .6 Performance: as indicated.

2.06 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with precompression washer and nut.
- .6 Performance: as indicated.

2.07 HORIZONTAL THRUST RESTRAINT

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.08 STRUCTURAL BASES

- .1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.
- .2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.
- .3 Bases to clear housekeeping pads by 25 mm minimum.

2.09 SEISMIC CONTROL MEASURES

- .1 General:
 - .1 Following systems and/or equipment to remain operational during and after earthquakes:
 - .1 Generator.
 - .2 Oil Pump Systems.
 - .3 Fire Ose.
 - .2 Seismic control systems to work in every direction.
 - .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .4 Drilled or power driven anchors and fasteners not permitted.
 - .5 No equipment, equipment supports or mounts to fail before failure of structure.
 - .6 Supports of cast iron or threaded pipe not permitted.
 - .7 Seismic control measures not to interfere with integrity of firestopping.
- .2 Static equipment:
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Suspended equipment:
 - .1 Use one or more of following methods depending upon site conditions and or [as indicated:
 - .1 Install tight to structure.
 - .2 Cross brace in every direction.
 - .3 Brace back to structure.
 - .4 Cable restraint system.
 - .3 Seismic restraints:
 - .1 Cushioning action gentle and steady.
 - .2 Never reach metal-like stiffness.
- .3 Vibration isolated equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.

- .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.
- .3 As indicated.
- .4 Piping systems:
 - .1 Fire protection systems: to NFPA 13.
 - .2 Piping systems: hangers longer than 300 mm; brace at each hanger.
 - .3 Compatible with requirements for anchoring and guiding of piping systems.
- .5 Bracing methods:
 - .1 Approved by Departmental Representative.
 - .2 Structural angles or channels.
 - .3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.
 - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .5 Where isolation is bolted to floor use vibration isolation rubber washers.
- .6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.03 FIELD QUALITY CONTROL

- .1 Inspection and Certification:
 - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .2 Provide Departmental Representative with notice 72 h in advance of commencement of tests.
 - .3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
 - .4 Submit complete report of test results.

3.04 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.02 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 30 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.03 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.

1.04 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.05 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.06 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.07 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.08 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.09 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 10 %, minus 0 %.
 - .2 Hydronic systems: plus or minus 10 %.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in both official languages in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, SMACNA, ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .3 Qualifications: personnel performing TAB qualified to standards of AABC or NEBB.
- .4 Quality assurance: perform TAB under qualified direction supervisor, to standards of AABC or NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 HYDRONIC SYSTEMS

- .1 TAB operations must be performed in accordance with the most stringent requirements in this section or in the relevant standards and documents of the AABC , NEBB , SMACNA of of ASHRAE.
- .2 Perform testing, adjusting and balancing of systems, equipment, components and control devices / control prescribed in Division 23.
- .3 Persons responsible for carrying out TAB operations must be authorized to provide the services prescribed by the standards of AABC or NEBB .
- .4 The operations test, control and balancing systems must be performed under the direction of an ability to provide monitoring services prescribed by the standards of AABC or NEBB .
- .6 Measurement points , in the case of devices will include in the following locations , as appropriate :
 - .1 At the inlet and at the outlet of the pump.

- .7 Test the network in accordance with the standards and CAN/CSA-B139 CAN/CSA-B140.0 and the requirements of the competent authorities .
- .8 Isolate tanks from network during piping pressure testing.

1.21 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.02 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B 209M-02, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C 335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C 411-97, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C 449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C 547-00, Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C 553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C 612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C 795-92, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
 - .9 ASTM C 921-92(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88(R2000), Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.03 DEFINITIONS

- .1 For purposes of this section:

- .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

1.04 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.05 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.06 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures used, and installation standards achieved.

1.07 QUALIFICATIONS

- .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.

1.08 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

2 PRODUCTS

2.01 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.02 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24° C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C 612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C 553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C 553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C 553.

2.03 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .2 Lagging adhesive: Compatible with insulation.

2.04 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .7 Contact adhesive: quick-setting
- .8 Canvas adhesive: washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Fasteners: 2 or 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

3 EXECUTION

3.01 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.02 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

3.03 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:
- .2 HERE Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
 - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

- .1 Finishes: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E 202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.02 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.03 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

- .1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.
- .2 When systems are operational, perform following tests:
 - .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
 - .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
 - .1 Pump operation.

1.04 HYDRONIC SYSTEM CAPACITY TEST

- .1 Perform hydronic system capacity tests after:
 - .1 TAB has been completed
 - .2 Verification of operating, limit, safety controls.
 - .3 Verification of primary and secondary pump flow rates.
 - .4 Verification of accuracy of temperature and pressure sensors and gauges.
- .2 Calculate system capacity at test conditions.
- .3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.
- .4 When capacity test is completed, return controls and equipment status to normal operating conditions.

1.05 FUEL OIL SYSTEMS

- .1 Environmental protection systems:

- .1 Test oil storage tank leakage detection system using manufacturer's recommended procedures.
- .2 Test spill protection and over-fill protection systems using manufacturer's recommended procedures.
- .2 Fuel oil pumps:
 - .1 Check strainers on pump inlet, relief valve on pump outlet with discharge to oil return piping, pressure gauge on strainer inlet, pump inlet and pump discharge.
 - .2 Verify pump performance.
 - .3 Pump performance within plus 20% and minus 0% of design.
- .3 Operational Tests:
 - .1 Timing: perform at same time as 100% and 105% boiler PV tests.
 - .2 Charge system and verify operation.
 - .3 Verify adequacy of flow rates and pressure from storage facilities to burners.
 - .4 Verify accurate metering of fuel to burners.
 - .5 For further details refer to relevant sections of Division 23.
- .4 Notify authorities having jurisdiction to enable witnessing of tests as required.
- .5 Cathodic protection systems:
 - .1 Test oil storage tank and oil fill, vent, suction and return piping cathodic protection systems.

1.06 POTABLE WATER SYSTEMS

- .1 When cleaning is completed and system filled:
 - .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
 - .2 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

1.07 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

- .1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.
- .2 Verification of controls, detection devices, alarm devices is specified Division 26.
- .3 Demonstrate that fire hose will reach to most remote location regardless of partitions, and obstructions.
- .4 Verify operation of interlocks between HVAC systems and fire alarm systems.

1.08 REPORTS

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E 202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions: submit manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.03 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

2 PRODUCTS

2.01 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.03 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

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

1.05 PERFORMANCE REQUIREMENTS

- .1 Perform design, installation, programming and commissioning of new components of building automation. Connect to existing systems manufacturer Delta.
- .2 Supply and install all equipment and accessories specified and required to make a complete and operational integrated automation system.

- .1 Description of integrated automation systems in the quote and charts plans to achieve defined outcomes. All equipment and accessories necessary for a complete job are not necessarily listed or shown. Supply and install all equipment and accessories required so that the system operation is consistent with the sequence of operations described in the plans and specifications.
- .2 The location of the equipment shown on plans are approximate and should be checked on site before commencing work.
- .3 Interface language
 - .1 Design system to allow to operator to use the language of their choice (French or English).
 - .2 Use symbols for graphics.
 - .3 All documentation must be in French and English.
 - .4 All messages, commands and alarms are displayed on the screen or the printer in the language chosen by the operator.

2 PRODUCTS

2.01 CONTROL

- .1 All work and components must be compliant and compatible with this existing network from Delta manufacturer.
- .2 The main connection to existing automatic control of the complex and / or facility via a manufacturer-authorized installer and / or the new control facility will be 100% compatible with the existing control system without system medium by various data translation.
- .3 See components description in section 25 30 02 - EMCS: Field control devices.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install control devices.
- .2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

3.03 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 Related Sections:
 - .1 Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Section 01 45 00 - Quality Control.
 - .3 Section 01 47 15 - Sustainable Requirements: Construction.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 02 81 01 - Hazardous Materials.
 - .7 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.
 - .8 Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

1.02 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-B16.3-98, Malleable-Iron Threaded Fittings.
 - .2 ASME-B16.9-01, Factory-Made Wrought Steel Buttwelding Fittings.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 53/A53M-04, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B 61-02, Standard Specification for Steam or Valve Bronze Castings.
 - .4 ASTM B 75M-99, Standard Specification for Seamless Copper Tube.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-B139-04, Installation Code for Oil Burning Equipment.
 - .2 CSA-B140.0-03, Oil Burning Equipment: General Requirements.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
 - .1 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .6 American Petroleum Institute (API)
 - .1 API-607, Fire Test for Soft-Seated Quarter Turn Valves

1.03 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Indicate on manufacturer's catalogue literature the following: valves.

- .2 Submit WHMIS MSDS in accordance with Section . Indicate VOC's for adhesive and solvents during application and curing.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.04 QUALITY ASSURANCE

- .1 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Co-ordination with other building subtrades.
 - .3 Review manufacturer's installation instructions and warranty requirements.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 PRODUCTS

2.01 FILL VENT AND CARRIER PIPE

- .1 Steel: to ASTM A 53/A53M, Schedule 40, continuous weld or electric resistance welded, screwed.

2.02 STEEL PIPE COATING

- .1 Bituminous paint: in accordance with manufacturer's recommendations.

2.03 JOINTING MATERIAL

- .1 Screwed fittings: pulverized lead paste.
- .2 Soldered fittings: to CSA 47.1.

2.04 FITTINGS

- .1 Steel:
 - .1 Malleable iron: screwed, banded, Class 150 to ASME-B16.3.
 - .2 Welding: butt-welding to ASME-B16.9.
 - .3 Unions: malleable iron, brass to iron, ground seat, screwed, to ASTM A 47/A47M.

- .4 Nipples: Schedule 40, to ASTM A 53/A53M.

2.05 BALL VALVES

- .1 NPS 2 and under:
 - .1 Steel Bronze body, screwed ends, TFE seal, hard chrome ball, 4 MPa, WOG.
 - .2 To API-607.
 - .3 SPEC as indicates on drawings .

2.06 SWING CHECK VALVES

- .1 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, renewable composition disc suitable for oil service, screw in cap, regrindable seat.

2.07 OIL FILTER

- .1 Duplex type replaceable cartridge type as recommended by oil burner manufacturer.
- .2 Furnish spare filter cartridge.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 PIPING

- .1 Install oil piping system in accordance with CSA-B139 and CSA-B140.0.
- .2 Slope piping down in direction of storage tank unless otherwise indicated.
- .3 Apply two coats of bituminous paint to buried steel outer casing, fill and vent piping.
- .4 Suction and return piping inside building:
 - .1 Elsewhere: steel, with screwed fittings.
- .6 Fill, vent, suction and return outside building:
 - .1 Steel piping welded throughout except at tanks where use electrically isolating fittings.
 - .2 Grading: slope piping at 1% minimum back to tanks.
- .7 Install suction and return buried piping in outer casings in accordance with provincial regulations.

3.03 VALVES

- .1 Install valves with stems upright or horizontal unless approved otherwise by Departmental Representative.

.2 Install swing check valves on discharge of pumps and as indicated.

.3 Install plug cocks as indicated.

3.04 OIL TRANSFER PUMPS

.1 Install as indicated.

.2 Install gate valves on inlet and discharge connections.

.3 Install pressure gauge at pump discharge, compound gauge on pump inlet connection.

.4 Install relief valve in pump discharge piping with relief valve discharge pipe to return line to tank as indicated.

3.05 OIL FILTERS

.1 Install as indicated.

.2 At time of acceptance, replace filter cartridge with new.

3.06 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

- .1 Test system in accordance with CSA-B139 and CSA-B140.0 and authorities having jurisdiction.
- .2 Isolate tanks from piping pressure tests.
- .3 Maintain test pressure during backfilling.

.2 Manufacturer's Field Services:

- .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
- .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, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

.4 Performance Verification:

- .1 Refer to Section 23 08 01 - Performance Verification Mechanical Piping System.

3.07 CLEANING

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems, supplemented as specified herein.
- .2 Flush after pressure test with number 2 fuel oil for a minimum of two hours. Clean strainers and filters.
- .3 Dispose of fuel oil used for flushing out in accordance with requirements of authority having jurisdiction.
- .4 Check vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.
- .5 Check entire installation is approved by authority having jurisdiction.
- .6 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 Wall exhausters.

1.02 REFERENCES

- .1 Air Movement and Control Association (AMCA)
 - .1 AMCA Publication 99-2003, Standards Handbook (Revised 2003).
 - .2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.
 - .3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute (ANSI)
 - .1 ANSI/AMCA 210-99, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.03 SYSTEM DESCRIPTION

- .1 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. Provide confirmation of testing.
 - .2 Capacity: flow rate, static pressure Pa, r/min, bhp W, model and size and sound ratings as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed to AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, unit to bear AMCA certified rating seal.
- .5 Bearings: sealed lifetime heavy duty grease lubricated ball or roller bearings of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Include :
 - .1 Fan performance curves showing specified point of operation.
 - .2 Sound rating data.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .4 Closeout Submittals
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.05 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
 - .1 Bearings and seals.
 - .2 Addresses of suppliers.
 - .3 List of specialized tools necessary for adjusting, repairing or replacing.

2 PRODUCTS

2.01 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.02 WALL EXHAUSTERS

- .1 Centrifugal backward inclined or Axial fan units, direct driven.
 - .1 Spun aluminum, complete with resilient mounted motor and fan.
 - .2 12 mm mesh 2.0 mm diameter aluminum birdscreen.
 - .3 Automatic gasketed aluminum backdraft dampers.
 - .4 Disconnect switch within fan housing.
 - .5 Cadmium plated stainless steel securing bolts and screws.
- .2 Housings:
 - .1 Provide with rubber or neoprene grommets for wiring passages, integral attachment collar, or angle ring mounted to mating flanged wall sleeve with full gasketting.
 - .2 Discharge pattern: away from building.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.

3.03 ANCHOR BOLTS AND TEMPLATES

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in section.

3.04 FIELD QUALITY CONTROL

- .1 Verification requirements include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Low-emitting materials.

3.05 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
 - .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E 90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .5 Society of Automotive Engineers (SAE)

1.03 SYSTEM DESCRIPTION

- .1 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.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria and limitations.
 - .1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.

- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Departmental Representative will make available one (1) copy of systems supplier's installation instructions.
- .3 Test Reports:
 - .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

1.05 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

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

2 PRODUCTS

2.01 FIXED LOUVRES - ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 100 mm deep onwe piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm maximum centres.

- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: factory applied enamel, anodized colour: to Departmental Representative Representative's approval.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.03 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 Control devices integral to the Building Energy Monitoring and Control System (EMCS).

1.02 REFERENCES

- .1 American National Standards Institute (ANSI).
 - .1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B 148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.
- .3 National Electrical Manufacturer's Association (NEMA).
 - .1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .4 Air Movement and Control Association, Inc. (AMCA).
 - .1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.
- .5 Canadian Standards Association (CSA International).
 - .1 CSA-C22.1-02, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

2 PRODUCTS

2.01 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight.
- .3 Operating conditions: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.
- .8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.02 TEMPERATURE SENSORS

- .1 Room temperature sensors and display wall modules.
 - .1 Room temperature sensors.
 - .1 Wall mounting, in slotted type covers having brushed stainless steel finish, with guard as indicated.
 - .2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2 degrees C.

2.03 TEMPERATURE TRANSMITTERS

- .1 Requirements:
 - .1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.
 - .2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.
 - .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
 - .4 Input and output short circuit and open circuit protection.
 - .5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.
 - .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.
 - .7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
 - .8 Integral zero and span adjustments.
 - .9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 degrees C.
 - .10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.
 - .11 Transmitter ranges: select narrowest range to suit application from following:
 - .1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.
 - .2 0 to 100 degrees C, plus or minus 0.5 degrees C.
 - .3 0 to 50 degrees C, plus or minus 0.25 degrees C.
 - .4 0 to 25 degrees C, plus or minus 0.1 degrees C.
 - .5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.04 ELECTROMECHANICAL RELAYS

- .1 Requirements:
 - .1 Double voltage, DPDT, plug-in type with termination base.
 - .2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
 - .3 Contacts: rated at 5 amps at 120 V AC.
 - .4 Relay to have visual status indication

2.05 ELECTRONIC CONTROL DAMPER ACTUATORS

- .1 Requirements:

- .1 Direct mount proportional type as indicated.
- .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
- .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
- .4 Power requirements: 5 VA maximum at 24 V AC.
- .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
- .6 For VAV box applications floating control type actuators may be used.
- .7 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.06 WIRING

- .1 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.
- .2 Wiring must be continuous without joints.
- .3 Sizes:
 - .1 Field wiring to digital device: 20AWG stranded twisted pair.
 - .2 Analog input and output: shielded #20 minimum stranded twisted pair.

3 EXECUTION

3.01 INSTALLATION

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .3 Fire stopping: provide space for fire stopping.
- .4 Electrical:
 - .1 Complete installation in accordance with Section 26 05 00 - Common Work Results - Electrical.
 - .2 Refer to electrical control schematics included as part of control design schematics. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work.
 - .3 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
 - .4 Install communication wiring in conduit.
 - .1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).
 - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
 - .3 Maximum conduit fill not to exceed 40%.
 - .4 Design drawings do not show conduit layout.
 - .5 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise.

3.02 TEMPERATURE

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

3.03 IDENTIFICATION

- .1 Identify field devices.

3.04 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.10.10, Québec Construction Code, Chapter V-Electricity Canadian Electrical Code, Part I (21st edition) with Québec Amendments (2010).
 - .2 CSA C22.2 188-M1983 (R1999), Splicing Wire and Cable Connectors.
 - .3 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.

1.02 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.

1.03 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 and French.
- .4 Use one nameplate or label for both languages.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials.
- .3 Submit for review single line electrical diagrams under plexiglass and locate as indicated.
 - .1 Electrical distribution system in main electrical room.
 - .2 Electrical power generation and distribution systems in power plant rooms.

- .4 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.
- .5 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
 - .7 Test reports.

1.05 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 Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.06 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.

1.07 SYSTEM STARTUP

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

1.08 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.

2 PRODUCTS

2.01 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 are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

- .3 Factory assemble control panels and component assemblies.

2.02 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.03 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.04 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.05 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
- .1 Nameplates: lamicoid 3 mm melamine, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.
- .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 6 mm 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 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO." as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.06 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 C22.10.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.07 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	Green	Blue
Communication Systems		
Fire Alarm	Red	
Emergency Voice	Red	Blue

Other
Security
Systems

Red

Yellow

2.08 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC 2Y-1.
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

3 EXECUTION

3.01 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.10 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.02 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.03 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.04 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.

3.05 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 Above top of counters or counter splash backs: 175 mm.
 - .3 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted telephone and interphone outlets: 1500 mm.
 - .6 Fire alarm stations: 1500 mm.
 - .7 Fire alarm bells: 2100 mm.
 - .8 Television outlets: 300 mm.

3.06 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.07 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 and dry-core transformers, 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 generation and 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 where applicable.
 - .5 Systems: fire alarm system communications.

- .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 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.

3.08 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

1 GENERAL

1.01 WIRE AND BOX CONNECTORS

- .1 Wire and box connectors, materials and accessories including their installation.

1.02 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.03 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65-93(R1999), Wire Connectors.
- .2 National Electrical Manufacturers Association (NEMA)

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Governing Authorities.

2 PRODUCTS

2.01 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper 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, round, copper, conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.

- .5 Sized for conductors, bars as indicated.
- .4 Clamps or connectors for armoured cable, mineral insulated cable, flexible conduit as required to:
CAN/CSA-C22.2 No.18.

3 EXECUTION

3.01 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.02 REFERENCES

- .1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.03 PRODUCT DATA

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

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600, 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90, RWU90. Use RWU90 conductors in underground and exterior installations.

2.02 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Circuit conductors: copper, ACM alloy, aluminum, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600, 1000 V.

- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat, interlocking, galvanized steel, aluminum.
- .6 Overall covering: polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 50 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight approved for TECK cable.

2.03 ARMoured Cables

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel or aluminum strip.
- .4 Type: ACWU90 - PVC flame retardant jacket over thermoplastic armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.
- .5 Connectors: anti-short-circuit.

2.04 CONTROL Cables

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket, and armour of closely wound aluminum wire.
- .2 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with polyethylene insulation, and aluminum strip or copper strip.

3 EXECUTION

3.01 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.02 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.

- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.03 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.04 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)
- .3 CAN/CSA Z32-1999, Electrical Safety and Essential Electrical Systems in Health Care Facilities.
- .4 CSA C22.2, no 41-M1987 (R2003) Grounding and Bonding Equipment.

1.02 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material [in appropriate on-site bins] for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Governing Authorities.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .3 Insulated grounding conductors: green, type RW 90.
- .4 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.

- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

3 EXECUTION

3.01 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 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Ground secondary service pedestals.

3.02 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 120/208 V system.
- .2 Ground new generator grounding to existing building C15 grounding (electrical room).

3.03 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 and escalators, distribution panels, outdoor lighting.

3.04 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.05 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.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.02 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Governing Authorities.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended.

3 EXECUTION

3.01 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole malleable iron, 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.

- .5 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.
- .6 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .11 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

1 GENERAL

1.01 REFERENCE

- .1 CSA C22.2 no 40 m1999 (R1999), Cutout, Junction and Pull Boxes.
- .2 CSA C22.2 no 76 m92 (R2002), Splitters.

1.02 RELATED REQUIREMENTS

- .1 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.03 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.02 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.

2.03 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm G1S plywood backboard for surface flush mounting.

3 EXECUTION

3.01 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.02 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 block as indicated in Type T cabinets.
- .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.

3.03 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Association canadienne de normalization (CSA)/CSA International.
 - .1 CSA C22.10.10-2010, Code canadien de l'électricité, Première partie et modifications du Québec.
- .2 CSA C22.2 no 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

1.02 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

2 PRODUCTS

2.01 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.10.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.02 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single gang flush device boxes for flush installation, minimum size 76 x 50 x 63 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.03 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.04 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

3 EXECUTION

3.01 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 05 21 – Wires and Cables (0-1000V).
- .2 Section 26 05 29 – Hangers and Supports for Electrical Systems.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981 (R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985 (R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984 (R2003), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

2 PRODUCTS

2.01 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.

2.02 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings, with expanded ends.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, steel, liquid-tight flexible metal.

2.03 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 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 1.5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.04 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.05 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .2 Weatherproof expansion fittings for linear expansion at entry to panel.

2.06 FISH CORD

- .1 Polypropylene.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 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] [in unfinished areas].
- .3 Use electrical metallic tubing (EMT) except in cast concrete and when above 2.4 m and not subject to mechanical injury.
- .4 Use rigid pvc conduit underground and in cast concrete.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to surface or recessed fluorescent fixtures, 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 Install conduit sealing fittings in hazardous areas.
 - .1 Fill with compound.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.

3.03 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 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.

3.04 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.

3.05 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 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.

3.06 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

3.07 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .3 Section 26 05 00 – Common Work Results for Electrical.

1.02 REFERENCES

- .1 Canadian Standards Association, (CSA International).
- .2 Insulated Cable Engineers Association, Inc. (ICEA).

1.03 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .6 Do not dispose of preservative treated wood through incineration.
- .7 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
- .8 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative.
- .9 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated with clear, coloured or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

3 EXECUTION

3.01 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
 - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.
- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

3.02 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at original factory test voltage in accordance with manufacturer's ICEA recommendations.
- .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

1 GENERAL

1.01 RELATED DOCUMENTS

- .1 The General Conditions of the Contract are applicable to this section, including General Clauses and Technical Clauses, as well as the specifications sections of Division 01.

1.02 SUMMARY

- .1 This section involves the following items:
 - .1 Pad-type isolators (vibration dampers) for seismic restraint.
 - .2 Seismic spring isolators.
 - .3 Seismic movement limiters.
 - .4 Brace and cable restraints.
 - .5 Suspension rod stiffeners.
 - .6 Anchor sockets and washers.

1.03 PERFORMANCE ESTIMATES

- .1 This section is performance specification for the following items:
 - .1 Calculations, design and verification of the seismic restraint devices for the overall work in Division 26. It is obligatory to appoint an engineer for these purposes. Refer to the section “Engineer Services”.

1.04 ENGINEER SERVICES

- .1 Retain the services of an engineer and commission him/her to:
 - .1 Perform the calculations, complete design and verification of the seismic restraints and systems necessary for the overall work in Division 26, in compliance with all of the requirements of this section. The calculations for the exterior equipment must take into account the wind load.
 - .2 Produce, assemble and provide shop drawings, technical files, design notes, and other documents related to calculations, design and products. Refer to the section “Items to be Submitted for Action” and “Quality Assurance”.
 - .3 Assemble the information necessary for equipment calculations described in other sections, for example:
 - .1 Equipment dimensions.
 - .2 Location of the equipment’s gravitational center.
 - .3 Location of the mounting and anchoring devices.

- .4 Perform periodic visits in order to verify the quality of the implementation. Refer to the section “Onsite Quality Control” in Section 3.
 - .5 Supervise the trial activities and inspections mentioned in the section “Onsite Quality Control” in Section 3.
 - .6 Produce and sign the Certificate of Conformity.
 - .7 Refer to the section “Items to be Submitted at Work Completion”.
- .2 Qualifications
- .1 The Engineer, hereinafter referred to as the “Qualified Engineer”, must be a member in good standing of the “Ordre des ingénieurs du Québec” or OIQ (Quebec corporation of engineers) specialising in and recognized in the field of seismic protection of functional and operational building components. He should be well versed in the standards referenced in that section and the provisions in Section 4 of the “Code de la construction du Québec” or CCQ (Quebec Building Code) related to the calculations for seismic restraint devices.
 - .2 Provide, on demand, the Qualified Engineer’s *Curriculum vitae*.

1.05 REFERENCES

- .1 AASHTO: American Association of State Highway and Transportation Officials.
- .2 ASTM: American Society for Testing and Materials.
 - .1 ASTM A36/A36M-05: Standard Specification for Carbon Structural Steel
 - .2 ASTM E 488-96 (2003): Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
 - .3 ASTM A492-95 (2004): Standard Specification for Stainless Steel Rope Wire
 - .4 ASTM A603-98 (2003): Standard Specification for Zinc-Coated Steel Structural Wire Rope
- .3 AWS: American Welding Society
 - .1 AWS D1.1/D1.1M, Structural Welding Code - Steel.
- .4 CCQ: Code de construction du Québec (Quebec building code) – “Chapitre 1, Bâtiment, et Code national du bâtiment – Canada 2010 (modifié) (*Chapter 1, building and national code for building*) – Canada 2010 (*modified*)).
- .5 CSA: Canadian Standards Association.
 - .1 CAN/CSA W47.1-03: Certification of Companies for Fusion Welding of Steel.
 - .2 CAN/CSA W59-03: Welded Steel Construction (Metal Arc Welding).

- .3 CSA C22.10-F10: "Code de construction du Québec" (Quebec building code), "Chapitre V – Électricité - Code canadien de l'électricité, Première partie (Vingt et unième édition) et Modifications du Québec (*Chapter V – "Electricity – Canadian Electrical Code, Part One (21st Edition) and Modifications by Quebec*)".
- .4 CSA S832-06: "Diminution des risques sismiques concernant les composants fonctionnels et opérationnels des bâtiments (CFO) » (*Seismic risk reduction concerning functional and operation building components*)" (CFO))
- .6 FEMA: Federal Emergency Management Agency
 - .1 FEMA-413/January 2004: Installing Seismic Restraints for Electrical Equipment.
- .7 ICC-ES: ICC Evaluation Service.
- .8 MFMA: Metal Framing Manufacturers Association.
 - .1 MFMA-4: Metal Framing Standards Publication.
- .9 OIQ: "Ordre des ingénieurs du Québec" (Quebec corporation of engineers).
- .10 OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.06 PERFORMANCE ESTIMATES

- .1 Loads and effects caused by earthquakes:
 - .1 Location categories, as per the CCQ definition: Determine the seismic location category (A, B, C, D, E or F) in accordance with paragraph 4.1.8.4 of the CCQ.
 - .1 Unless otherwise directed by the Qualified Engineer, in the absence of existing geotechnical data that would help to determine the seismic location category, use Category E, unless there is a possibility it could be a Category F. If there is any doubt about whether it could be Category E or F, use F.
 - .2 Risk category assigned as per the CCQ definition: Determine the risk category assigned to the building (i.e. "Low", "Normal", "High", or "Civil Protection") in accordance with paragraph 4.1.2.1 of the CCQ.
 - .3 Coefficients for electrical elements and components:
 - .1 For each element or component, determine the seismic coefficient (Cp), the response modification coefficient (Rp), and the force amplification coefficient (Ar) in accordance with paragraph 4.1.8.17 of the CCQ.
 - .4 The coefficient categories and values used to perform the calculations must be present in the shop drawings and be justified in the design notes submitted.
- .2 Existing buildings: install seismic protection devices for new equipment as if they were part of a new building.

1.07 ITEMS TO BE SUBMITTED FOR ACTION

- .1 Conform to the requirements in Section 01 33 00 – Submittal Procedures.
- .2 Product data as follows:
 - .1 Give the rated load, nominal deformation, and the overload capacity for each vibration damper.
 - .2 Illustrate and indicate the model, materials, resistance, fixation means, and finish for each type and component size for the seismic restraint device used.
 - .1 In table format, indicate the types and sizes of the restraints, and add the numbers of the test reports and the nominal values of tensile strength and shear that have been evaluated by an evaluation service member of the ICC-ES, OSHPD, or an agency certified by authorities in that jurisdiction.
 - .2 Make annotations to indicate the function of each proposed product and its compliance with the estimate.
 - .3 Travel limiters for all directions: indicate the nominal characteristics for the horizontal, vertical and combined loads.
- .3 Documents concerning the design as follows: For the details of the vibration dampers and seismic restraints before complying with performance requirements and design criteria, including analysis data signed by the Qualified Engineer responsible for their preparation.
 - .1 Design calculations: Calculate the static and dynamic loads due to weight and equipment function, and seismic forces determining the choice of vibration isolators and seismic restraint devices.
 - .2 Seismic restraint device details:
 - .1 Design analyses: Corroborate the choice and the layout of the anchors of the seismic restraint devices. Include the tensile strength and combined shear calculations
 - .2 Details: Manufacturing and layout details. Provide details of the selected anchors for the seismic restraint devices, the components and the structure. Show the placement of the anchors, their spacing, and installation methods. Identify the components, list their resistance, and indicate the direction and values transmitted to the structure during an earthquake. Demonstrate their association with the vibration dampers.
 - .3 Evaluation documentation and prior approval: By an evaluation service member of the ICC-ES, OSHPD, or an agency certified by authorities in that jurisdiction, displaying the maximum amount of characteristics for each restraint device and the items on which approval (tests or calculations) are based.

- .4 Coordination drawings: Demonstrate the coordination between the pipe seismic reinforcement devices and the electrical equipment with the other systems and instruments situated in proximity, including other supports and devices for seismic restraints.

1.08 ITEMS TO BE SUBMITTED FOR INFORMATION

- .1 Welding certificates.
- .2 Qualification data: for the Qualified Engineer; refer to the section “Engineering Services”.

1.09 ITEMS TO BE SUBMITTED AT THE COMPLETION OF WORK

- .1 The documents/items must be submitted before the provisionnal acceptance of the work.
- .2 Provide the operation and maintenance records for incorporation into the specified manual in Section 01 78 00 – Closeout Submittals.
- .3 Verification and onsite quality control test reports. Refer to section “*Onsite Quality Control*” in Section 3.
- .4 Certificates of conformity.
 - .1 The Qualified Engineer will produce and sign the certificates of conformity at the following stages:
 - a. At the completion of all concealed works.
 - b. At the completion of all work.
 - .1 The certificate needs to attest that:
 - .1 All of the work of Division 26 complies with the requirements of the CCQ in terms of protection against seismic loads (and wind loads).
 - .2 All of the seismic restraint devices comply with the requirements of this section, as well as the shop drawings submitted and reviewed.

1.10 QUALITY ASSURANCE

- .1 Conform to all of the CCQ and FEMA-413 requirements related to seismic protection, except in cases where the requirements of the present section are more stringent.
- .2 Welding: Determine the procedures and empower the personnel as per the AWS D1.1/D1.1M, “Structural Welding Code – Steel”.

- .3
The seismic restraint devices must undergo horizontal and vertical load tests and analysis, and their OSHPD anchors must display an OPA approval number and have received approval from the ICC-ES, or prior approval from an agency certified by authorities in that jurisdiction, displaying the maximum amount of characteristics for each seismic restraint device. The characteristics based on independent testing are preferable to those based on calculations. In the case where pre-approved characteristics are not available, data based on independent testing is preferable. The calculations (including calculations of combined tensile and shear loads) that support the seismic restraint device designs must be signed by the Qualified Engineer.
- .4
Comply with the requirements in the CSA C22.10 standards.

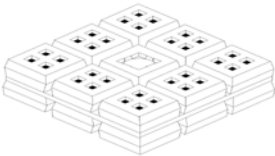
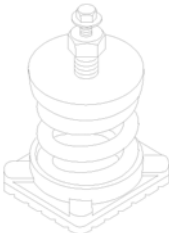
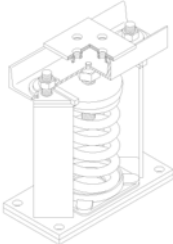
2- PRODUCTS

2.01 VIBRATION DAMPERS

- .1
Manufacturers: Subject to compliance with the specifications, the products will be provided by one of the following manufacturers:

.1 Ace Mountings Co., Inc.
.2 Amber/Booth Company, Inc.
.3 California Dynamics Corporation.
.4 Isolation Technology, Inc.
.5 Kinetics Noise Control.
.6 Mason Industries.
.7 Vibration Eliminator Co., Inc.
.8 Vibration Isolation.
.9 Vibration Mountings & Controls, Inc.
- .2
CE-1 model: pad-type isolators: arranged in single or multiple layers of sufficient rigidity so that the load is uniformly distributed on the surface of the isolators, molded with a non-slip texture and equipped with base plates of galvanized steel, and cut at the factory to match the characteristics of the supporting equipment.

.1 Resilient materials: Neoprene, rubber, or compressed fiberglass that is resistant to oil and water.

		
CE-1 Model	IR-1 Model	IR-2 Model

- .3 IR-1 model: Spring isolators: Freestanding isolator springs, laterally stable.
 - .1 Diameter outside of the springs: Must not be inferior to 80% of the height of the compressed spring under the rated load.
 - .2 Minimum additional travel: 50% of the specified deflection under the rated load.
 - .3 Lateral rigidity: Superior to 80% of the rated vertical rigidity.
 - .4 Overload capacity: Must be able to withstand 200% of the rated load, fully compressed, without deformity or failure.
 - .5 Base plate: Factory-pierced for bolting to the structure and glued to the rubber vibration damper with a thickness of 6 mm (1/4 inch), secured to the underside of the base plate. The base plates should reduce the load on the floor at 3,447 kPa (500 psig).
 - .6 Top plate and adjustable bolt: Threaded top plate with an adjustable bolt with a clamping screw to secure and upgrade the equipment.
- .4 IR-2 model: Seismic spring isolators: Open steel spring isolators, freestanding, with seismic restraints or snubber.
 - .1 Housing: made of steel with vertical elastic snubbers to prevent the spring from stretching when the load is removed, factory-pierced base plate glued to a vibration damper made of neoprene or rubber 6 mm (1/4 inch thick), secured to the underside of the base plate, and adjustable mounting the equipment and leveling bolts that will lock it during installation.
 - .2 Clamping device: Seismic device or snubber as required for the equipment and authorities in the jurisdiction.
 - .3 Outside diameter of the spring: Must not be less than 80% of the height of the compressed spring under the rated load.
 - .4 Minimum additional travel: 50% of the specified deflection under the rated load.
 - .5 Lateral rigidity: Superior to 80% of the rated vertical rigidity.
 - .6 Overload capacity: Must be able to withstand 200% of the rated load, fully compressed, without deformity or failure.

2.02 SEISMIC RESTRAINT DEVICES

- .1 Manufacturers: Subject to compliance with specifications, the products will be provided by one of the following manufacturers:
 - .1 Amber/Booth Company, Inc.
 - .2 California Dynamics Corporation.
 - .3 Cooper B-Line, Inc.; a division of Cooper Industries.
 - .4 Hilti, Inc.
 - .5 Kinetics Noise Control.

- .6

Loos & Co.; Cableware Division.
- .7

Mason Industries.
- .8

TOLCO Incorporated; a brand of NIBCO INC.
- .9

Unistrut; Tyco International, Ltd.
- .2

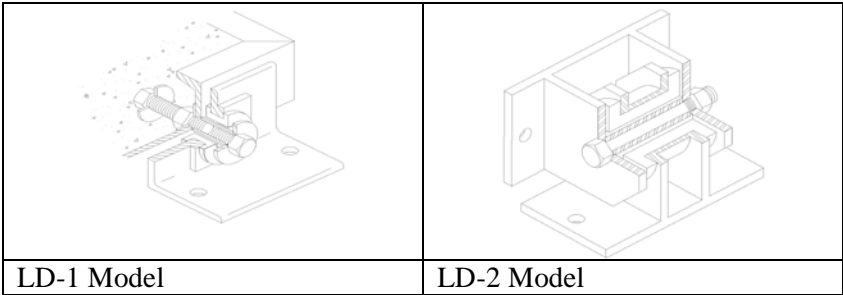
General requirements for the restraints: the nominal resistance, characteristics and applications must be those that are defined in the reports from the evaluation service member of the ICC-ES, OSHPD, or an agency certified by authorities in that jurisdiction.
- .3

LD-1 and LD-2 models: seismic snubbers: Factory made from profiles and welded steel sheets, anchor bolts, and washers and resilient and replaceable insulating sleeves.
- .1

The anchoring bolts used to anchor them to the concrete must be seismic-rated, pre-drilled, with a bevelled stud or female cone.
- .2

Rings and insulating bushings: made from resistant oil and water resistant neoprene
- .3

Maximum air gap of 6 mm (1/4 inch), and elastic cushion of a minimal thickness of 6 mm (1/4 inch).

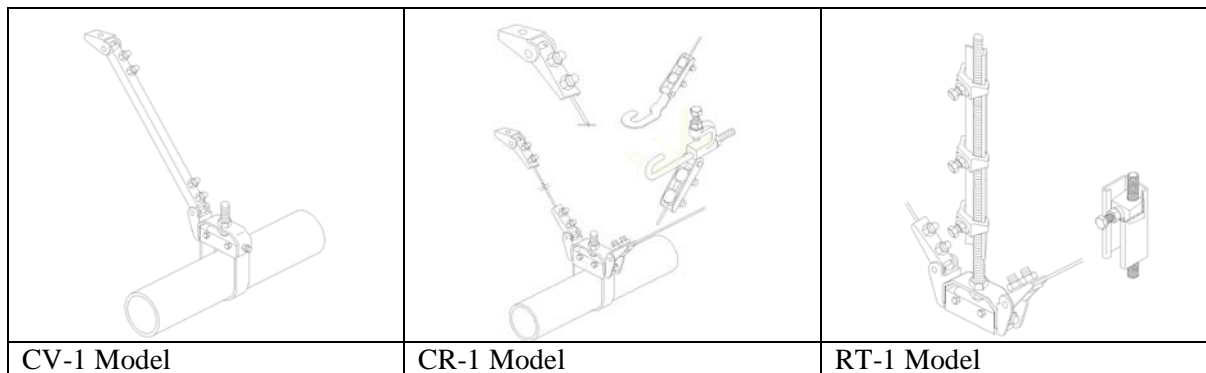


- .4

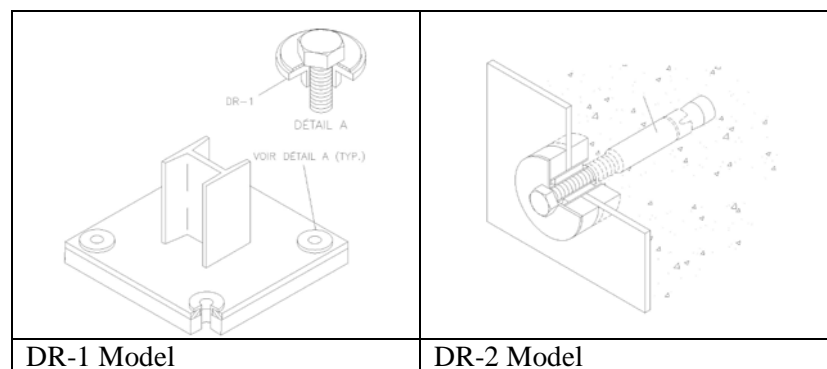
CV-1 model: U-profile brace: brace made in a factory or onsite, in accordance with the MFMA-4 standard, made in a U-profile with steel slots. At one end, the brace will be anchored to a brace component, while the other and will be anchored to the building structure, as well as other assorted components. The supports are protected by corrosion-resistant coating and must be resistant to tension, compression and specified torsion.
- .5

CR-1 model: Cable brace consisting of ASTM A 603 galvanized steel when installed indoors and of ASTM A 492 stainless steel for exterior or corrosive environments – steel cables with end fittings made of steel comprising lug sets, fasteners, joints, and bolts designed to work with retaining cables, and containing at least two clamping bolts for attached the cable.
- .6

RT-1 model: Hanger rod stiffener: steel pipe or support sleeve with slot bolted to the hanger rod, or a steel reinforced bracket attached to the hanger rod.



- .7 DR-1 model: Sleeves for stem anchor (floor mounts): Neoprene sleeves for rigid support of the equipment and assorted types and dimensions of bolts and studs.
- .8 DR-2 model: Sleeves for wall anchors: Neoprene elements and steel sleeves for the rigid equipment supports and assorted types and dimensions for the fastener devices used.
- .9 Washers and resilient insulating sleeves: one-piece, moulded, made of water and oil resistant neoprene, with a flat flange.



- .10 Mechanical anchoring bolts: pre-drilled, bevelled stud or female cone, made of galvanized steel to be used indoors, and stainless steel for use outside. Select the anchoring bolts with the strength required for anchoring tests according to ASTM E 488. Minimum length must be equal to 8 times the diameter.
- .11 Chemical anchor bolts: Pre-drilled anchorage system, with a capsule containing polyvinyl resin or a base of methacrylate urethane and an accelerator, or a polymeric adhesive or mortar injected hybrid system. Provide anchoring bolts and accessories in galvanized steel for indoor use and stainless steel for outdoor use. Select the anchoring bolts with the strength required for anchoring tests according to ASTM E 488.

2.03 FACTORY FINISH

- .1 Finish: Standard manufacturer paint applied before the equipment is shipped and factory testing.
 - .1 Powder coating on springs and housings.
 - .2 The accessories must be galvanized. Components for use outdoors must be hot-dipped galvanized.
 - .3 Baked enamel coating or powder for the metal components used in the isolators used indoors.
 - .4 Use color codes or other types of identification for the vibration isolators and seismic restraints to indicate their range of capacities.

3 EXECUTION

3.01 INSPECTION

- .1 Inspect the areas and equipment that will be receiving the vibration isolators and seismic restraints in order to verify compliance with the requirements in regards to installation tolerances and other conditions that could affect the behavior of the isolators and restraints.
- .2 Inspect the primary installation of the reinforcements and the cast-in-place anchors in order to verify the actual locations before installation.
- .3 Do not proceed with installation if unsatisfactory conditions have not been addressed.

3.02 APPLICATIONS

- .1 Cable ducts and multiple cables: Fix the cable ducts and cables to trapezoidal frames with clamps approved for application by an evaluation service member of the ICC-ES, OSHPD, or an agency certified by authorities in that jurisdiction.
- .2 Rod stiffeners: Install the rod stiffeners where required in order to prevent the rods from buckling during seismic activity.
- .3 Strength of the seismic restraints and supports: When there is no indication, choose component sizes that will have sufficient strength to support the current and future static and seismic loads within the specified loads.

3.03 INSTALLATION OF THE VIBRATION DAMPENING DEVICES AND SEISMIC RESTRAINTS

- .1 Comply with the requirements of Division 07 for the installation of roof-mounted rails, support equipment, and components crossing the roof.
- .2 Seismic restraint equipment:

- .1 Install seismic snubbers on the electrical equipment mounted on the vibration isolators. Install snubbers as closely as possible to the vibration isolators and the bolts at the base of the equipment and on the support structure.
- .2 Install resilient insulation washers on the equipment's anchorage bolts when the space between the anchors and the adjacent surface is greater than 3.2 mm (0.125 inches).
- .3 Install the seismic restraints using the methods approved by an evaluation service member of the ICC-ES, OSHPD, or an agency certified by authorities in that jurisdiction and by submitting for verification the required documents for the component. Refer to the section "Items to be Submitted for Action".
- .3 Restraints for lighting fixtures:
 - .1 Comply with the requirements in FEMA-413, notably for appliances installed in suspended ceilings: Follow steps 1 to 4, found on pages 149 and 150 of the said document.
- .4 Install the cables so that they do not bend at the corners of the adjacent equipment or building structure.
- .5 Install the seismic restraints using the methods approved by an evaluation service member of the ICC-ES, OSHPD, or an agency certified by authorities in that jurisdiction and by submitting for verification the required documents for the component. Refer to the section "Items to be Submitted for Action".
- .6 Install the sleeves for the anchoring bolts for the equipment installed at ground-level in such a way that it is possible to install a resilient material between the anchoring bolt and the attachment hole in the concrete base.
- .7 Install sleeves for the wall-mounted equipment bolts in such a way as to allow for the installation of resilient materials in the area where the equipment or the mounting profiles are attached to the wall.
- .8 Anchoring to the structure: if a specific type of anchor is not indicated, secure the brace to the beam flanges, the upper chords of the trusses, or to the concrete elements.
- .9 Pre-drilled anchorages:
 - .1 The anchor-type expansion bolts are not authorized for non-isolated power equipment of more than 10 hp (7.46 kW).
 - .2 Identify the position of the steel reinforcements or of all built-in elements prior to the anchorage holes being drilled. Do not damage the reinforced steel or built-in items during coring or drilling. Advise the structural Departmental Representative if you encounter reinforcing steel or other embedded items during drilling. Locate and avoid pre-stressed reinforcements, electrical and telecommunication conduits, as well as gas lines.
 - .3 Do not drill holes into the concrete or masonry until the concrete, mortar or grout has reached is full design strength.

- .4 Expansion bolts: Protect the threads against damage during the installation of the anchor. Install the reinforced anchor shells by fully engaging the shell in the structural element to which the anchor is to be attached.
- .5 Chemical anchors: Clean the holes to remove any foreign material and drilling dust before applying the adhesive. Put the adhesive into the holes starting from the bottom and working upwards to the surface, to avoid the formation of air pockets.
- .6 Tighten the anchors using the torque recommended by the manufacturers, using a torque wrench.
- .7 Install galvanized anchors indoors, and use stainless steel anchors for exterior applications.

3.04 ABSORPTION OF SEISMIC DIFFERENTIAL DISPLACEMENTS

- .1 Install flexible connections in the sections of cable ducts, cables, wireways, and busways at places where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and when the last connection from a device anchored to an element different from the supporting structure ahead of the equipment.

3.05 ONSITE QUALITY CONTROL

- .1 Periodic visits by the Qualified Engineer:
 - .1 The Qualified Engineer must perform periodic visits to the work site in order to verify the following (but not limited to):
 - .1 Quality of the implementation.
 - .2 That the facilities are in compliance with his/her instructions, plans, quotes and calculations.
 - .3 That the anchorage points on the structure are in compliance with his/her instructions.
 - .4 That the products used correspond to the technical sheets submitted.
 - .5 That the installations are in compliance with codes and standards.
 - .2 The frequency of visits by the Qualified Engineer must be at his/her own discretion, however at a minimum, performed at the following stages:
 - .1 Once the products are delivered and stored at the site.
 - .2 Once the preparatory work and other previous work has been completed, but before installation begins.
 - .3 Twice during the course of the work, in other words, once work completion has reached 25% and 60%.
 - .4 Upon the completion of all of the concealed work.
 - .5 Upon completion of all of the work.

- .6 During the tests and inspections that need to be supervised. Refer to the sub-section "Tests and Inspections".
- .2 Tests and Inspections:
 - .1 Perform the tests and inspections under the supervision and presence of the Qualified Engineer.
 - .2 Provide evidence that the test apparatus has recently been calibrated by an agency certified by authorities in that jurisdiction.
 - .3 Schedule the tests with the Departmental Representative, through the engineer intermediary, before connecting an anchor that holds the component (unless the test after connection has been approved), and that, after notice has been given seven days in advance.
 - .4 Obtain the approval of the Qualified Departmental Representative before applying load tests to the structure. Provide temporary braces to distribute the loads.
 - .5 Conduct tests on at least four anchors and fasteners of each installed type and size, at the discretion of the Engineer.
 - .6 Perform tests up to 90% of the rated load of each device.
 - .7 Measure the clearance of the restraint's isolating device.
 - .8 Measure insulator deflections.
 - .9 Verify the minimum clearances for the spacers.
 - .10 In the case where one of the devices fails, modify all of the installations of the same type and conduct further tests until satisfactory results are achieved.
 - .11 The Qualified Engineer must prepare test and inspection reports and submit them to the Engineer.

3.06 SETTINGS

- .1 Adjust the isolators once the isolated equipment has reached its working order weight.
- .2 Adjust the snubbers on the spring insulators so that the equipment can be installed at its normal operating height. After installing the hardware, adjust the snubbers so that they do not come into contact during normal operation.
- .3 Set the active operating height of the spring isolators.
- .4 Adjust the retainers so that the equipment can move freely during normal operation.

TECHNICAL SCHEDULE OF VIBRATION DAMPERS AND SEISMIC RESTRAINT DEVICES – ELECTRICAL INSTALLATION

TECHNICAL SCHEDULE OF VIBRATION DAMPERS AND SEISMIC RESTRAINT DEVICES: ELECTRICAL INSTALLATION									
Equipment Identification	Location of Equipment	Vibration Dampers			Isolators		Base		Comments
		Type	Thickness (mm)	Number	Type	Minimum static deflection (mm)	Type	Minimum static deflection (mm)	
Generator	Outdoor shelter								
Distribution Panel	Outdoor shelter								
Transformer	Outdoor shelter								
1 : 2 : 3 : 4 :									

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 22 19 – Control and Signal Transformers.

1.02 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C39.1-1981, Requirements, Electrical Analog Indicating Instruments.
- .2 Canadian Standards Association, (CSA International)
 - .1 CAN3-C17-M84 (R1999), Alternating - Current Electricity Metering.

1.03 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate meter, instrument, outline dimensions, panel drilling dimensions and include cutout template.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 METER

- .1 Polyphase meter, 2 element kilowatt meter, kilowatthour meter, frequency meter, integrator, indicator, maximum value register, in conformance with CAN3-17.
- .2 Meters and energy and maximum recorders : in conformance with CAN3-17.
- .3 Accuracy : 1 %.

- .4 Interior use, flush mounted.
- .5 Nominal characteristic : as indicated.
- .6 Register: self-contained instrument transformer, operated, clock, cyclometer, range 0-1500 kW, pulse contacts for transmitting signal.
- .7 Modbus interface for remote operation with RS-485 Cable.
- .8. Model : Schneider serie PM870MG.

2.02 METERING INSTRUMENT TRANSFORMER CABINET

- .1 Section within generator control panel complete with mounting back-plate to house potential and current transformers, fuses, testing and accessory terminal blocks, factory-prewired and fully pre-installed.

2.03 TEST TERMINAL BLOCKS

- .1 Test terminal blocks: as required.

2.04 SHOP INSTALLATION

- .1 Ensure adequate spacing between current transformers installed on each phase.
- .2 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

3 EXECUTION

3.01 METERING INSTALLATION

- .1 Install meters and instruments in location free from vibration and shock.
- .2 Make connections in accordance with diagrams.
- .3 Connect meter and instrument transformer cabinets to ground.

3.02 FIELD QUALITY CONTROL

- .1 Conduct tests in accordance with Section 26 05 00 - Common Work Results - Electrical and in accordance with manufacturer's recommendations.
- .2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.
- .3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

- .4 Perform tests to obtain correct calibration.
- .5 Do not dismantle meters and instruments.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 05 28 – Grounding - Secondary.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.47-M90(R2001), Air-Cooled Transformers (Dry Type).
 - .2 CSA C9-M1981(R2001), Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

1.03 PRODUCT DATA

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

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal ,paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 TRANSFORMERS

- .1 Use transformers of one manufacturer throughout project and in accordance with recommended products.
 - .1 Type : ANN - K13
 - .2 Three phase rating as indicated, primary voltage 600 V, secondary voltage 120/208 V, 3 phases, 4 wire, 60 Hz.
 - .3 Taps : 2x2.5% FCAN et 2 x2.5% FCBN.
 - .4 Insultation : class 220C, temperature rise.
 - .5 BIL : standard.
 - .6 Dielectric strength : standard.
 - .7 Sound rating : standard.

- .8 Impedance at 17 degree Celsius : standard.
- .9 Enveloppe : type CSA, front accessible panel.
- .10 Installation : suspended or floor mounted.
- .11 Finish in accordance with section 26 05 00 – Common Work Results for Electrical.
- .12. Products : Delta, Hammond, Square D.

2.02 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Label size: 7.
- .3 Nameplate wording: as indicated.

3 EXECUTION

3.01 INSTALLATION

- .1 Mount dry type transformers up to 75 kVA as indicated.
- .2 Mount dry type transformers above 75 kVA on floor.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.

END OF SECTION

1 GENERAL

1.01 CONTROL AND SIGNAL TRANSFORMERS

- .1 Materials and voltage and current transformers as well as their installation.

1.02 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 21 – Construction/Demolition Waste Management And Disposal.

1.03 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN3-C13-M83(R1998), Instrument Transformers.

1.04 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate dimensions and connection details.

1.05 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 POTENTIAL TRANSFORMERS

- .1 Potential transformers: to CAN3-C13, dry type for indoor use, with following characteristics:
 - .1 Nominal voltage class: as indicated.
 - .2 Rated frequency: 60 Hz.
 - .3 Basic impulse level: 10 kV.
 - .4 Voltage ratio: 600 up to 120 V.

- .5 Accuracy rating: 0.3B0.1.
- .2 Potential transformers equipped with fuse holder and fuses. Fuses: 0.3B0.1.

2.02 CURRENT TRANSFORMERS

- .1 Current transformers: to CAN3-C13, dry type for indoor use with following characteristics:
 - .1 Nominal voltage class: 600 V.
 - .2 Rated frequency: 60 Hz.
 - .3 Basic impulse level: 10 kV.
 - .4 Metering accuracy rating: 0.3B0.1.
 - .5 Rating : 1500 à 5A.
- .2 Positive action automatic short-circuiting device in secondary terminals.

2.03 MOUNTING BRACKETS

- .1 Potential transformers with channel type mounting brackets.
- .2 Mounting brackets factory installed by the generator control panel manufacturer.

3 EXECUTION

3.01 INSTALLATION

- .1 Install instrument transformers and ensure accessibility.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.03 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

2 PRODUCTS

2.01 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity or as indicated; nameplate must show fault current that panel including breakers has been built to withstand.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.

- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Isolated ground bus.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges, (door-in-door).
- .10 Trim and door finish: baked grey enamel .

2.02 BREAKERS

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

2.04 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

3 EXECUTION

3.01 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on metallic « U » type channels. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Connect isolated grounds to isolated ground bus.

- .7. Connect bonding and non-isolated grounds to non-isolated ground bus

END OF SECTION

1 GENERAL

1.01 WIRING DEVICES

- .1 Switches, receptacles, cover plates and other wiring devices and their installation.

1.02 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management And Disposal.
- .3 Section 26 05 00 - Common Work Results – Electrical.
- .4 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.

1.03 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.5732 2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.
 - .4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.04 SHOP DRAWINGS AND PRODUCT DATA

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

1.05 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

2 PRODUCTS

2.01 SWITCHES

- .1 20 A, 120 V, single pole, three-way or four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.
- .5 Acceptable materials: Hubbell serie HBL 1201I and HBL 1203I or approved equivalent.

2.02 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Eight back wired entrances, four side wiring screws.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Red urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Height back wired entrances, 2 side wiring screws.
 - .4 Break-off links for use as split receptacles.
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable materials: Hubbell serie HBL 5252R or approved equivalent.

2.03 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.

- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Stainless steel, vertically brushed, 1 mm thick for wiring devices mounted in flush-mounted outlet box.
- .5 Sheet metal cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

3 EXECUTION

3.01 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height [in accordance with Section 26 05 00 - Common Work Results - Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 32 13.05 – Diesel Electric Generating units (Air cooled).

1.02 REFERENCES

- .1 American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE C37.13-1993, Low Voltage AC Power Circuit Breakers Used in Enclosures.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.03 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include time-current phase protection co- ordination characteristic curves for breakers.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

2 PRODUCTS

2.01 AIR CIRCUIT BREAKER

- .1 Air circuit breaker to: to ANSI/IEEE C37.13 and CSA C22.2 No.5.
- .2 Fixed type, 600 V class.
 - .1 Continuous current rating : 1 600 A.
 - .2 Trip rating: 1 600 A.
 - .3 Interrupting rating: 65 kA, rms symmetrical.

- .3 Solid-state tripping system consisting of 1 current sensor per pole, 1 solid-state trip unit and self-powered trip actuator. Equipped with long, short, instantaneous, ground fault, function and phase overload, ground fault indication.
- .4 Breakers with motor charged, stored energy, quick-make, closing mechanism with emergency manual spring charging handle and isolating switch to isolate power supply to spring charging motor.
- .5 Interlocks to prevent circuit breaker drawout when in closed position and to prevent closing unless fully engaged or in test position.

2.02 OPTIONAL FEATURES

- .1 Shunt trip.
- .2 Auxiliary switches: 2 N.O., 2 N.C.
- .3 Undervoltage tripping device with time delay.
- .4 Alarm switch.
- .5 Pilot light.
- .6 Reverse power relay.
- .7 Control relay
- .8 Electric interlock.
- .9 Remote close.
- .10 Lockout devices.
- .11 Padlocking provision.
- .12 Operation counter.

3 EXECUTION

3.01 INSTALLATION

- .1 Install air circuit breakers as indicated.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 24 16.01 – Panelboards Breaker Type.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.03 ACTION AND INFORMATIONAL SUBMITTALS

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

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

2 PRODUCTS

2.01 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, and Accessory high-fault protectors: 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.
- .5 Circuit breakers to have minimum 10 kA symmetrical rms interrupting capacity rating.

2.02 THERMAL MAGNETIC BREAKERS [DESIGN A]

- .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.

3 EXECUTION

3.01 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

1 GENERAL

1.01 DISCONNECT SWITCHES – FUSED AND NON-FUSED

- .1 Materials and fused and non-fused switches materials and their installation.

1.02 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.03 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

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

1.05 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.06 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 DISCONNECT SWITCHES

- .1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure 1, to CAN/CSA C22.2 No.4 size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.
- .6 Product : Square D, serie FS or approved equivalent.

2.02 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

3 EXECUTION

3.01 INSTALLATION

- .1 Install disconnect switches complete.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.14-95(R2001), Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 1-2001, Industrial Control and Systems: General Requirements.

1.03 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include schematic, wiring, interconnection diagrams.

1.04 QUALITY ASSURANCE

- .1 Submit to Departmental Representative one copy of test results.

1.05 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

2 PRODUCTS

2.01 PUSHBUTTONS

- .1 Heavy duty. Operator extend, mushroom type. Red, with 1-NO and 1-NC, labels as indicated. Stop pushbuttons coloured red, provision for padlocking in depressed position labelled "emergency stop".

2.02 INDICATING LIGHTS

- .1 Standard, LED type, lens colour: red and green as indicated, supply voltage: 24 V, lamp voltage: labels as indicated.

2.03 CONTROL AND RELAY PANELS

- .1 CSA Type 1 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.04 CONTROL CIRCUIT TRANSFORMERS

- .1 Single phase, dry type.
- .2 Primary: 600 V, 60 Hz ac.
- .3 Secondary: 120 V, AC.
- .4 Rating: 250 VA.
- .5 Secondary fuse: 3 A.
- .6 Close voltage regulation as required by magnet coils and solenoid valves.

3 EXECUTION

3.01 INSTALLATION

- .1 Install pushbutton stations, control and interconnect.

3.02 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - Electrical.

1.02 REFERENCES

- .1 C22.2 no. 14-F95 (2001), Industrial Control Equipment.

1.03 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.04 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include operation and maintenance data for each type and style of starter.

1.05 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.06 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

2 PRODUCTS

2.01 MATERIALS

- .1 Starters: to NEMA standard.

2.02 MANUAL MOTOR STARTERS

- .1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One overload heater, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch labelled as indicated.
 - .2 Indicating light: standard type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.
- .3 Product : Square D, class 2510 or approuved equivalent.

2.03 FULL VOLTAGE MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Wiring and schematic diagram inside starter enclosure in visible location.
 - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:
 - .1 Locking in "OFF" position with up to 3 padlocks.
 - .2 Independent locking of enclosure door.
 - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
 - .1 Pushbuttons, Selector switches : labelled as indicated.
 - .2 Indicating lights: standard type and color as indicated.
 - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
 - .4 Product : Square D, class 8538 or approved equivalent.

2.04 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.05 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.06 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

3 EXECUTION

3.01 INSTALLATION

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

3.02 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 32 13.05 – Diesel Electric Generating units (Air cooled).

1.02 PAYMENT

- .1 Provide payment for services of qualified diesel electric technician.

1.03 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B139-00(October 2001), Installation Code for Oil-Burning Equipment.
- .2 Transport Canada - Marine Safety (TCMS)
 - .1 Approved Products Catalogue Index (APCI) - Structural Fire Prevention Item.
 - .1 Non-Combustible Material - Cloth and Paper.
- .3 Underwriters' Laboratories of Canada (ULC)
- .4 U.S. Coast Guard Equipment List (USCG)
 - .1 164.009-May 2002, Non-Combustible Materials.

1.04 QUALIFICATIONS

- .1 Provide proof of diesel electric technician qualification to Departmental Representative.

1.05 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

1.06 START-UP

- .1 Preparation: before starting unit, carry out thorough mechanical and electrical inspection of equipment, and perform following checks and adjustments:
 - .1 Disconnect battery cables from batteries to prevent accidental starting.
 - .2 Turn engine several revolutions by means of hand-barring devices to ensure parts are free and there are no obstructions to its running.
 - .3 Check engine/generator alignment readings to ensure they match readings attained at time of manufacture.

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- .4 Check fluid levels and top up as necessary. Pre-lubricate engine and turbochargers as recommended by engine manufacturer. Install drip pan beneath engine.
 - .5 Ensure cooling system antifreeze is effective to at least minus 40 degrees C.
 - .6 Check belts for correct tension and adjust as necessary.
 - .7 Check and grease grease points.
 - .8 Check and tighten properly nuts, bolts, etc.
 - .9 Ensure safety guards are in place and properly secured.
 - .10 Check linkages for damage and freedom of movement.
 - .11 Check fuel supply system for leakage.
 - .12 Ensure fuel supply and fuel injection systems are properly primed.
 - .13 Check and tighten properly electrical connections.
 - .14 Check starting battery electrolyte level specific gravity and for proper installation.
 - .15 Check battery charger for proper operation and adjust as necessary.
 - .16 Carry out generator winding insulation resistance test. If reading is unacceptable, carry out recognized drying procedure. Do not start unit until satisfactory reading has been achieved.
 - .17 Check jacket coolant heater for proper operation.
 - .18 Complete additional preparations deemed necessary.
- .2 Performance verification: on completion of start-up preparations, take following action:
- .1 Have at hand, during initial start-up, means for choking off air supply to engine air induction manifold in event of engine run away or other emergency.
 - .2 Reconnect starting battery cables to starting battery.
 - .3 Start unit only in presence of Departmental Representative and allow to warm up. Stop unit if abnormal conditions are encountered.
 - .4 Check for and correct leakage from exhaust system, fuel system, cooling system, and lubricating oil system.
 - .5 Adjust vibration isolators.
 - .6 Observe and ensure that lubricating oil pressure and coolant temperature are within limits and no harmful vibration or sounds are evident.
 - .7 Ensure voltage is within operating parameters and automatic voltage regulator is operating correctly.
 - .8 Ensure manual voltage control is operating correctly.
 - .9 Ensure frequency is within operating parameters and electronic governor is operating correctly.
 - .10 Check engine air ventilation system for proper operation.
 - .11 Check operation of engine-mounted protective sensing devices and adjust as necessary.
 - .12 Check phase sequence of normal power supply and ensure emergency power supply are in same sequence.
 - .13 Check operation of electronic controller protection, transfer, timing, metering, and annunciator functions and adjust as necessary.
 - .14 Check operation and calibration of analog metering and adjust as necessary.
 - .15 Apply electrical load, read the metres, and correlate these readings.
 - .16 Demonstrate:

- .1 Unit start, transfer to load, retransfer to normal power, unit shutdown, on "automatic" control.
- .2 Unit start, transfer to load, retransfer to normal power, unit shutdown, on "full load test" control. Unit start and shutdown, on "no load test" control.
- .3 Run unit on load for minimum period of 8 hours to show load-carrying capability, stability of voltage and frequency, and satisfactory performance of engine ventilating system to provide adequate cooling.
- .4 Every 1/2 hour carry out and record readings on Test Chart.
- .17 Perform additional tests as required by Departmental Representative to ensure unit is operating satisfactorily.

1.07 PERSONNEL TRAINING

- .1 Provide instruction to site operation and maintenance staff for proper care, operation, and maintenance of equipment.

1.08 COMMISSIONING

- .1 Provide commissioning report included time delay settings, operational set points and adjustment ranges.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 LOCATING AND MOUNTING

- .1 Locate unit within "Walk-in" enclosure as indicated.
- .2 Fit and adjust isolators in accordance with manufacturer's installation and adjustment instruction bulletin contained in unit manual.

3.02 ALIGNMENT CHECK

- .1 Since Engine-generator shaft alignment is adjusted at factory, check to ensure that no change has occurred due to shipment and handling.
- .2 Where engine and generator housings are close coupled and instruments at hand are not suitable for measuring alignment within confines of housings, just loosen engine and generator hold down bolts and ensure that each foot is carrying proportionate amount of weight and feet are level on base plate.

3.03 FUEL SUPPLY SYSTEM

- .1 Connect to main fuel reservoir.

3.04 CONTROL AND TRANSFER PANEL

- .1 Connect to existing main electrical distribution panelboard.

3.05 DEMONSTRATION AND TRAINING

- .1 Provide familiarization training of operating and maintenance staff.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.
- .3 Provide fuel required for performing diesel-generator site test and top-up after acceptance test completion.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 32 13.03 – Installation of Electric Power Generating Equipment.

1.02 REFERENCES

- .1 Canadian Environmental Protection Act (CEPA)
 - .1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .2 CSA International
 - .1 CSA-B139-09, Installation Code for Oil Burning Equipment.
 - .2 CAN3-Z299.3-85(R2006), Quality Assurance Program - Category 3.
 - .3 CSA C282-09 Emergency electrical power supply for buildings.
- .3 International Organization for Standardization (ISO)
 - .1 ISO 3046-1-2002, Reciprocating internal combustion engines - Performance - Part I: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.
 - .2 ISO 3046-4-1997, Reciprocating internal combustion engines - Performance - Part 4: Speed governing.
- .4 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1-2006(R2007), Motors and Generators.
- .5 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S601-07, Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and data sheets for generating units and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Include following in accordance with Section 26 06 31 - Diesel Electric Generating Units Appendix A - Technical Data Form.
 - .1 Engine: make, model, rating and performance curves.
 - .2 Starter motor, make, model.

- .3 Generator: make, model and rating complete with generator saturation curves, heat damage curves, reactive capability and special data.
 - .4 Voltage Regulator: make, model, type.
 - .5 Governor: type, model.
 - .6 Battery: make, type, voltage, capacity.
 - .7 Charger: make, model, input and output rating.
 - .8 Submit general outline drawing of complete assembly showing engine and generator mounting, exhaust, recirculating and intake air louvre arrangement, exhaust gas silencer and pipe arrangement, locations of fuel and lubricating oil filters, fuel supply and return line connections, lubricating oil drain valve, air cleaner, engine instrument panel, starting motor, power and control junction boxes, engine and generator mounting feet. Indicate on drawings:
 - .1 Horizontal and vertical dimensions.
 - .2 Minimum door opening required for moving unit.
 - .3 Head room required for removal of piston and connecting rod.
 - .4 Weight of engine, generator, baseplate and exhaust silencer.
 - .9 Identify exact locations and details where necessary of interconnecting services to permit final engineering by Departmental Representative.
 - .10 Baseplate construction details and materials.
 - .11 Transfer and bypass system: make, model, type.
 - .12 Type and layout of panels.
 - .13 Schematic and wiring diagrams of engine, generator, control panel, automatic transfer and bypass panels complete with interconnecting wiring diagrams.
 - .14 Single line diagram showing breakers, switches, metering and protective relays.
 - .15 Field wiring diagrams.
 - .16 Complete bill of materials, including manufacturer's name, catalogue numbers and capacity.
 - .17 Details for a "Walk-in" type, watertight and weatherproof enclosure to house the generator.
- .3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Canada.
- .4 To facilitate shop drawing analysis, the supplier shall submit the following table with his drawings:

Requirement	Comment	Compliance Yes/No
1.2 Stakeholders' responsibilities, skills and performances		
24-hour service, not by a third party		
technicians on the road	Number of technicians:	
ISO-9001 distributor		
RBQ licence	Licence #:	
CMEQ licence	Licence #:	

Requirement	Comment	Compliance Yes/No
	Number of units	
1.3 Standards		
CSA C282 and B139 compliant		
1.6 Manufacturer's Production Tests		
According to the MIL-STD-705 method		
1.7 Factory Tests at the Distributor		
1000 kW test for 1 hour and 900 kW for 23 hours		
Transient performance curves		
Sound level survey after tests		
1.9 Guarantee		
2-year guarantee on the generator		
2.1 Engine		
1495 BHP rating	BHP:	
Tier 3 EPA compliant emissions		
NOx + NMHC emissions not exceeding 4.59 g/hp-hour	Value:	
CO emissions not exceeding 0.35 g/hp-hour	Value:	
PM emissions not exceeding 0.02 g/hp-hour	Value:	
2.2 Capacity		
85% load factor	Load factor:	
Major overhaul every 6000 hours	Number of hours:	
1000 kW of power available at an ambient temperature of 50°C and altitude of 300 m.		
2.3 Cooling System		
Radiator for an ambient temperature of 50°C		
Separate reserve tank		
2.4 Engine Block Heater		
Block heater cut-off valves		
Circulating pump		
2.5 Lubrication		
Drain pan under the unit		
2.6 Oil Mist Recovery Unit		
Enclosed type oil mist recovery unit		
2.7 Fuel System		
Pump with a suction capacity of 3 m	Suction capacity:	
Water sensing probe connected to the engine		
UL-842 valve		
Auxiliary Tank		
ULC-S602 tank	Capacity:	
Analog level signal to control		
Leak, high level and low level alarms		
Overflow outlet		
Flexible drainage tube and valve		
Tank dimensions	Dimensions:	

Requirement	Comment	Compliance Yes/No
Analog level signal to control		
Duplex Control		
NEMA 4-12 case		
Programmable logic controller		
12 visual indicators	Number of indicators:	
1½ hp contactors	Capacity in hp:	
Control logic as described		
CSA		
3 alarm dry contacts		
Pumps with a flow rate of 15 L/min	Flow rate:	
ULC C536 approved flexible metallic hose		
UL-842 valves		
Pressure relief valve on each pump		
Pressure gauge		
Check valves		
Tested for leaks		
Assembled by petroleum products contractor		
2.9 Starter System		
1900 CCA batteries	CCA:	
LEAD ACID-CALCIUM type batteries		
Transparent, flameproof container		
10A Charger	Capacity:	
120 input		
Load factor of 4		
Standards: ULc, UL-1236, CSA C22.2 #107.2		
Tropicalized electronic cards		
Voltmeter and ammeter		
9 status indicator lights		
5 fault contacts		
Reverse polarity protection		
Temperature compensation		
Output regulation of $\pm 0.5\%$		
Operation at temperatures from -40°C to +60°C		
2.12 Unit Mounting		
Spring insulators		
2.13 Alternator		
1375 kVA alternator	Capacity:	
3200 SKVA @ 35% voltage drop	SKVA:	
13.1% sub-transient reactance	Reactance: %	
Permanent magnet, brushless excitation		
2.14 Power Circuit Breakers		
1600-A air circuit breakers		
Type ILL electronic protection circuit breakers		

Requirement	Comment	Compliance Yes/No
Shunt trip breakers		
Circuit breaker safety managed by the generating unit's PLC		
Cabinet with doors on the cam-lok sections and opening switches		
Male and female cam-loks		
Demonstration of main circuit breaker coordination with the alternator in this shop drawing		
2.15 Control Panel		
Information displayed in French		
CSA C282, CSA C22.2, and UL-508 compliant panel		
Backlit display unit		
64 x 128 pixel display unit		
Modbus and RS-485 port communication		
Main circuit breaker open alarm		
Low ambient temperature alarm		
CB circuit closed alarm		
Changeover alarm in bypass mode		
Control featuring a PLC		
KVAR reading		
PF reading		
Reverse power relay (32) connected to the output circuit breaker		
16 programmable digital inputs	Number of inputs:	
15 output contacts	Number of contacts:	
Redundant engine speed reading		
2.17 "Walk-in" Type Enclosure		
Minimum dimensions: 492" x 144" x 132"	Dimensions:	
Sound level of 70 dBA @ 7 m with a seal from an OIQ engineer or acoustician	Sound level:	
One single door and one double door		
Fail-safe damper motors		
Air recirculation system		
Max. allowable water penetration into the building: 0.01 oz./ft ² per 15 minute period	Water penetration:	
Insulated inlet and outlet dampers		
Thermally insulated exhaust system		
Panel: 200A @ 120/208V/3ph/48		
45 kVA transformer		
Lights in compliance with brands and models specified on the drawings		
Forced air heater in compliance with specified capacity		
Exterior emergency stop mushroom pushbutton		
EMT conduit		
Emergency lighting: 50 lux for 2 hours		

Requirement	Comment	Compliance Yes/No
2.18 Annunciator Panel		
Communication with Modbus protocol		
Communication possible with 4000' of wire		
8 alarm indicators	Number of alarms:	
7 pre-alarm indicators	Number of pre-alarms:	
Piezoelectric sensor: 80 dBa @ 0.6 m		
Key selector switch for remote start-up		
3.2 Commissioning		
Supply of load bank		
Thermographic report		
3.3 Training		
Training in compliance with CSA C282, tables 2 to 4		

1.04 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for diesel generating units for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Provide following in French and English for incorporation into instruction manuals:
 - .1 Complete set of reviewed shop drawings.
 - .2 Factory test data of engine, generator, exciter, control logic, metering and other pertinent test data.
 - .3 Maintenance and operation bulletins for:
 - .1 Engine and Accessories.
 - .2 Alternator.
 - .3 Voltage Regulator and Accessories.
 - .4 Battery charger.
 - .5 Speed Governor.
 - .6 Starting Motor.
 - .7 Batteries.
 - .8 Ventilating Equipment.
 - .9 Timers, Relays, Meters.
 - .10 Power Circuit Breakers.
 - .11 Controller, Contactors.
 - .12 Other Accessories.
 - .13 "Walk-in" Type Enclosure.
 - .4 Submit original brochures; photocopies are not acceptable. Include technically relevant data.
 - .5 Complete sequence of system operation.
 - .6 Complete bill of materials including nameplate data of equipment and accessories.
- .3 Forward, two weeks prior to factory tests, one copy of instruction manual for each unit of different rating to Departmental Representative.

- .4 Forward, within two weeks after factory tests, three copies of instruction manuals, with updated drawings, for each unit of different ratings, to Departmental Representative.

1.05 EXTRA MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Extra Material/Spare Parts; provide the following:
 - .1 One spare control circuit breaker per rating.
 - .2 Twenty-four spare indicating light bulbs per rating.
 - .3 One spare control relay and socket per rating and contact arrangement.
 - .4 One spare contactor operating coil.
 - .5 One set of contacts (3) for transfer contactor.
 - .6 Six fuel filter elements for each type of fuel filter/water separator.
 - .7 Six lubricating oil filter elements.
 - .8 Three air cleaner elements.
- .3 Tools:
 - .1 Supply suitable engine barring device and battery manufacturer's standard set of tools for battery service.
 - .1 Battery service tools to include hydrometer, one plastic bottle for topping up purposes and one insulated battery terminal wrench.
 - .2 Provide complete set of specialized tools required for adjustment and maintenance of equipment supplied.
 - .3 Where metric size nuts and bolts are used, provide one set of sockets complete with ratchet handle and set of combination wrenches, to fit sizes used.

1.06 QUALITY ASSURANCE

- .1 Do work in accordance with CAN3-Z299.3

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 Prepare, crate and protect equipment against shipping and storage damage.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- .1 Provide an automatic, unattended, emergency power supply system consisting of:
 - .1 Air cooled low voltage diesel electric generating unit with control panel.
 - .2 Accessories and equipment specified in this specification.
- .2 Provide design, fabrication, testing, transportation, demonstration and equipment warranty.

2.02 DESIGN CRITERIA

- .1 Design equipment suitable to meet the following requirements:
 - .1 Total load: 1000 kW.
 - .2 Voltage: 600/347 V.
 - .3 Frequency: 60 Hz.
 - .4 Phase/Wire.
 - .5 Power factor: 0.8 lag.
 - .6 Duty Rating: Backup/standby use;
 - .7 Performance: automatic;
 - .8 Ambient temperature : 50 degree C at an altitude of 300 m.
 - .9 Relative humidity: 60%.
- .2 Design unit capable of starting, attaining settled voltage and frequency limits and accepting 80% full rated load with voltage and frequency settling to specified steady state bands, with 15 seconds for any temperature between 0 degree C to 40 degree C.
- .3 Description of generating set operation:
 - .1 Automatic starting on abnormal or loss of normal voltage: voltage sensing relays to sense three phases of hydro supply. If voltage on any one phase should drop below preset limits (adjustable) for adjustable period of time, close engine start contact and start engine.
 - .2 When emergency supply has reached settled voltage and frequency preset limits (adjustable) transfer switch will transfer load to emergency supply.
 - .3 Continue to supply load until hydro supply returns or set is shut down manually or under failure conditions.
 - .4 On hydro restoration, confirmed by three phase sensing of voltage above adjustable preset, for time period in excess of three minutes (adjustable), transfer switch will transfer load to hydro supply.
 - .5 Provide adjustable time delay relay to allow engine to run unloaded to cool down and subsequently to shut down, ready for next cycle.
 - .6 Automatic shut down on:
 - .1 Overcranking.
 - .2 Overspeed.
 - .3 High Engine Temperature.
 - .4 Low lubricating oil pressure.
 - .5 Over and under frequency.
 - .6 Emergency breaker failure.
 - .7 Electrical fault lock-out on short circuit and generator over and [under] voltage.

2.03 ASSEMBLY

- .1 Provide following items plus such other items as necessary to make unit complete:
 - .1 Diesel Engine.
 - .2 Diesel Engine Accessories.
 - .3 Baseplate and Drip Pan.
 - .4 Vibration isolators.
 - .5 Governor.
 - .6 Engine Exhaust System.
 - .7 Engine Cooling System.
 - .8 Engine Ventilating System.
 - .9 Alternator.
 - .10 Batteries and Rack.
 - .11 Battery Charger.
 - .12 Control.
 - .13 Transfer and By-pass Panel (power).
 - .14 Spares and Accessories.
 - .15 Enclosure for the AC emergency lighting system, distribution, services and heating.
 - .16 Fuel Supply System.

2.04 MOUNTING

- .1 Connect engine flywheel housing rigidly to generator stator housing with SAE adapter.
 - .1 The engine-generator unit shall be mounted on a structural steel baseplate; entire unit shall rest on spring anti-vibration type springs installed between the steel baseplate and enclosure floor.
 - .2 Anti-vibration springs shall have adjustable lateral absorbers.
- .2 Baseplate: rigid material to maintain alignment of engine-generator shafts and frames under to shipping, installation and service conditions.
- .3 Install machine engine-generator feet and baseplate sole plates parallel and true.
 - .1 Shimming to be steel type and only permitted underneath the generator feet.

2.05 DIESEL ENGINE

- .1 Full diesel, heavy duty, cold start, air cooled by a built-in radiator, and current manufacture of type and size that has been serviced as a prime mover with a power factor of 0.8 at 60 Hz and sprinkler-proof, for electric power generation for not less than two years.
 - .1 Turbo supercharged engine acceptable providing brake mean effective pressure (BMEP) at rated output does not exceed 1800 kPa.
 - .2 Mechanically driven superchargers not acceptable.
- .2 Engine: minimum of sixteen (16) cylinders.
- .3 Engine with auxiliary starting aids (i.e., glow plug assist start) not acceptable.
- .4 Equip engine air intakes with dry type heavy duty air cleaners located close to inlet manifold.
 - .1 Cleaner element: directly replaceable with elements of Canadian manufacture.

- .5 Provide engine wiring in liquid-tight conduit and fittings with insulated bushings.
 - .1 Use stranded, minimum No. 12 AWG, TEW 105 degree C and coloured coded wires.
 - .2 Terminate wiring with coded, insulated terminals flanged fork type.
 - .1 Terminal blocks heavy duty, screw type.
 - .3 Wire markers of slip on oil proof type.
 - .4 Junction boxes on unit of liquid-tight type.
 - .5 Maximum of two wires per terminal block.
- .6 Provide high quality lubricating oil pressure gauge, lubricating oil temperature gauge, tachometer, cooling air temperature gauge (exit air), thermocouple, exhaust pyrometer and other standard gauges and instruments.
 - .1 Calibrate and scale gauges and instrument in both metric and imperial units and symbols.
 - .2 Mount oil temperature sensors on engine full flow pressure line.
 - .3 Hoses or tubing for gauges: high pressure reinforced type.
- .7 Mount unit accessories, including gauges, instruments, and protective sensors to isolate or dampen vibrations.
- .8 Provide personnel safety guards for exposed moving parts and exhaust manifolds.
 - .1 Provide platform for servicing upper part of engine where applicable.
- .9 Engine control panel complete with:
 - .1 Lubricating oil pressure gauge.
 - .2 Lubricating oil temperature gauge.
 - .3 Cooling air temperature gauge.
 - .4 Low coolant level gauge.
 - .5 Engine switch auto-off-crank-start selector switch and crank pushbutton.
 - .6 D.C. main power supply circuit breaker.
 - .7 Terminal blocks for connection to D.C. power supply, engine monitoring and shutdown device.
 - .8 Provide low pressure, high coolant temperature, and overspeed protection to shut down engine on manual operation.
- .10 Pollutant emissions not to exceed (in g/hp-hour):
 - .1 NO_x + NMHC: 4.59
 - .2 CO: 0.35
 - .3 PM: 0.02

2.06 COOLING SYSTEM

- .1 Provide complete cooling system for unit.
- .2 Cooling system shall be equipped with the following equipment:
 - .1 A built-in radiator (50oC) with forced air fan;
 - .2 A radiator cap with two sealing joints allowing glycol to be transferred (depending on engine pressure) to a separate reserve tank.
 - .3 Thermostatic temperature control;
 - .4 Lifetime lubricated circulating pump;
 - .5 50%-50% water-glycol mixture;

- .6 Air deflector directing air to the radiator with protective grilles on moving parts.
- .7 Metal flange on the front of the radiator to which the section can be connected.

2.07 LUBRICATION SYSTEM

- .1 Provide full pressure lubricating system complete with filters and oil cooler.
- .2 Oil pump: engine driven gear type complete with strainer.
- .3 Equip filters with automatic by-pass valve and full flow filter elements conveniently located for servicing and directly replaceable with elements of Canadian manufacture.
 - .1 Cooler to have sufficient capacity to maintain oil temperature engine manufacturer's tolerances with unit operating at rated load under conditions specified.
- .4 Equip engine oil sump with oil drain pipe, gate valve and pipe cap.
 - .1 Permit complete drainage in convenient manner.
- .5 Metallic oil hoses: steel reinforced rubber type with crimped or swaged end fittings.

2.08 FUEL SYSTEM

- .1 Refer to mechanical drawings for complete description of the system.

2.09 EXHAUST SYSTEM

- .1 Flexible stainless steel tubing, at least 450 mm (18") in length, and appropriate diameter.
- .2 Appropriate grade silencer to maintain the enclosure's required sound level, lateral intake and horizontal outlet type, supplied with connection flanges.
- .3 Lateral intake to be located as close as possible to the centre of the silencer.
- .4 Electric generating unit to withstand back pressure of 34"H₂O.
- .5 Refer to "Soundproofed Enclosure" section.

2.10 SPEED GOVERNOR

- .1 Provide full electronic governor with speed changer and dry type actuator.
 - .1 Governing system: in accordance with ISO 3046-4.
- .2 Governor with following features:
 - .1 Ten turn locking type manual speed adjustment.
 - .2 Speed regulation, steady state, no-load to full load and vice versa: +/-0.25%.
 - .3 Transient peak, no-load to full-load and vice versa: +/-10%.
 - .4 Recovery time to steady state condition on application of 90% from no load not to exceed 4 seconds.
 - .5 Class A accuracy.

2.11 STARTING SYSTEM

- .1 Provide complete starting system including cranking starting motor[s], batteries, battery stand, heavy-duty battery cables and battery charger.
- .2 Provide positive engaging type cranking motor(s).
 - .1 Cranking motor and flywheel ring gear arrangements which may permit tooth to tooth abutment not acceptable.
- .3 Provide lead acid / calcium battery with sufficient capacity in ambient room temperature of 0 degree C to crank unit at engine manufacturer's recommended cranking starting speed for 3 minutes.
 - .1 Voltage measured at starting motor terminals at end of 3 minutes cranking, with cranking current flowing, not less than 1.75 V per cell.
 - .2 Size battery to suit engine and battery manufacturer's published data.
 - .3 Refer to Section 26 33 16 – Batteries Racks.
- .4 Provide battery charger with 120 volt AC input and output equal to 1.20 of ampere-hour capacity of battery based on 8 h rate.
 - .1 Refer to Section 26 33 43 – Battery Chargers.
- .5 Provide necessary heavy duty, maintenance-free battery cables and connectors.
 - .1 Select cable wire size to allow not more than 5% voltage drop at time of peak load.
 - .2 Cable length sufficient to allow battery location on either side of the engine.
- .6 Turbocharged engines shall be fitted with one spring actuated, two stage accumulator per turbocharger to automatically provide pre-start and post run lubrication to the turbochargers.

2.12 OVERSIZED ALTERNATOR

- .1 The alternator shall have the following characteristics:
 - .1 Capacity of 1100 kW, 1375 kVA, in backup use;
 - .2 Capacity of 1080 kW, 1350 kVA in continuous use;
 - .3 347/600 volts, 3-phase, 4 wire, 60Hz rated capacity;
 - .4 Rotating field type;
 - .5 Four (4) terminals;
 - .6 Brushless rotating rotor;
 - .7 Single offset;
 - .8 Anti-drip construction;
 - .9 Class H insulation;
 - .10 Maximum temperature rise in a 40°C climate:
 - .1 150°C in backup use;
 - .2 125°C in continuous use.
 - .11 Startup power of 3200 kVA @ 35% transient voltage drop. (This value does not correspond to the kVA under sustained voltage conditions of 90% of nominal.)
 - .12 13.1% sub-transient reactance;
 - .13 Digital voltage regulator with low frequency compensation, adjustment $\pm 0.25\%$ between 0 and 100% of unit capacity.

- .2 Brushless excitation system.
- .3 Rotating permanent magnets create voltage in a stator that supplies the voltage regulator independently from the alternator outlet. The regulator controls output voltage by producing current that circulates in the excitor stator. All current produced by the excitor is rectified to the main field. The excitation system shall permit:
 - .1 To sustain sufficient current to allow the downstream protections to trip in the event of a short-circuit, regardless of amplitude and duration
 - .2 To isolate voltage regulator supply from the harmonics created by the charge
- .3 The alternator shall have a capacity of 300% of the rated current in "standby" backup use for 10 seconds and 150% for one minute.

2.13 CONTROL PANEL

- .1 Equip the generating unit with a control panel that uses microprocessor technology.
- .2 Control panel shall feature advanced control, system supervision and diagnostic abilities for optimum performance.
- .3 INFORMATION PROVIDED BY THE CONTROL PANEL MUST BE IN FRENCH AND ENGLISH.
- .4 Control panel shall be installed on the wall and not on the generating unit. It shall be supplied in a NEMA1 cabinet made of 12-gauge steel with hinged doors and a handle.
- .5 Control panel shall meet the following standards:
 - .1 NFPA-110;
 - .2 CSA-C282;
 - .3 CSA C22.2;
 - .4 UL-508;
 - .5 CE Directive.
- .6 An alphanumeric display unit, sealed membrane type buttons (stop/restart-auto-on), and arrow switches to access information.
- .7 Display unit characteristics:
 - .1 LCD type;
 - .2 Backlit;
 - .3 64 x 128 pixels;
 - .4 It shall also be equipped with a heating element that will turn on at 0°C and off at 5°C.
- .8 Control panel shall be equipped with:
 - .1 Indicator lights (LEDs):
 - .1 Off (red);
 - .2 Auto (green);
 - .3 On (green);
 - .4 Load supply (green);
 - .5 Not in automatic mode (red);
 - .6 Alarms (flashing red).

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- .2 Audible alarm off button;
 - .3 Indicator test button;
 - .4 Emergency shutdown button;
 - .5 Switch to automatic mode button;
 - .2 Off button;
 - .7 On button;
 - .8 Four (4) menu navigation arrows;
 - .9 Programming button;
 - .10 Reset to zero button;
 - .11 Audible alarm;
 - .12 Dedicated inputs:
 - .1 Remote emergency shutdown;
 - .2 16 programmable inputs.
 - .13 A Modus RTU via onboard RS-485 communication module.
- .9 Range of operation:
- .1 Operating temperature: -40°C to 70°C;
 - .2 Storage temperature: -40°C to 85°C.
 - .3 Voltage: 12 or 24 Vdc, acceptance range 6 to 32 Vdc.
 - .4 Consumption: 5 W in standby mode and 14.2 W in operation with heating element on, and 6 active relays.
- .10 Control functions:
- .1 A clock (lithium battery powered with a typical lifespan of 10 years) and a real-time calendar shall record the time of the events (such as an engine shutdown) and help to determine the commissioning date as well as number of days of operation.
 - .2 An engine cooling function shall allow the user to program a cool-down time before the engine is turned off.
 - .3 To preserve battery power, the display unit shall turn off after a certain period of non-use. The display unit shall turn back on when any key is pressed.
 - .4 A controlled startup function shall permit startup by cycle or continuous (quantity and duration).
 - .5 The number of successful startups shall be recorded and may be displayed.
 - .6 A startup delay function shall delay startup for the period of time set by the user.
- .11 Control panel shall automatically shut the engine off, display a red fault indicator and alphanumeric message for the following conditions:
- .1 Loss of engine probe communication;
 - .2 Engine overrevving;
 - .3 Engine underspeed;
 - .4 High engine temperature;
 - .5 High lubricating oil temperature;
 - .6 Low coolant level;
 - .7 Low oil pressure;
 - .8 Refuse to start;
 - .9 Emergency shutdown;
 - .10 Fuel leak;
 - .11 Critically low fuel level.

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- .12 Control panel shall display an alarm (without engine shutdown) with yellow fault indicator and alphanumeric message for the following conditions:
 - .1 Loss of engine probe communication;
 - .2 Battery charger fault;
 - .3 Low battery voltage;
 - .4 High battery voltage;
 - .5 Low engine temperature;
 - .6 Low ambient temperature;
 - .7 CB circuit closed;
 - .8 Circuit breaker open;
 - .9 Transfer in bypass mode;
 - .10 Reverse power;
 - .11 High engine temperature;
 - .12 High lubricating oil temperature;
 - .13 Low oil pressure;
 - .14 Engine overload kW (3 levels);
 - .15 Timer for interval between maintenance services;
 - .16 Low coolant level;
 - .17 Low fuel level;
 - .10 Fuel leak;
 - .17 High fuel level;
 - .13 All alarms and pre-alarms shall be configurable (enabled/disabled) via programming software. Alarms and pre-alarms may be added upon request.
 - .14 A history of faults (shutdowns and alarms) shall be kept in the system for diagnostic purposes (up to 99 events), and may be reset to zero.
 - .15 A PLC shall be used to program simple combinatorial functions to deal with work site constraints.
 - .16 The display unit shall display the following menus and sub-menus:
 - .1 System overview:
 - .1 Active shutdowns and alarms;
 - .2 Total engine running time;
 - .3 Alternator voltage;
 - .17 Fuel level (%);
 - .5 Length of engine use (hrs.);
 - .9 Maintenance timer.
 - .2 Engine instrumentation:
 - .1 Engine speed;
 - .2 Speed signal source;
 - .3 Current load;
 - .4 Coolant temperature;
 - .5 Oil pressure;
 - .3 Battery voltage(s);
 - .7 Air pressure in the intake manifold;
 - .8 Intake air temperature;

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- .9 Hours of operation;
 - .10 Fuel temperature;
 - .11 ECU power supply voltage;
 - .12 Current torque.
 - .3 Alternator instrumentation:
 - .1 Total power and power per phase in kVA;
 - .2 Total power and power per phase in kW;
 - .3 Total power and power per phase in KVAR;
 - .4 Power factor (PF) and status ("Lead – Lag");
 - .5 % of rated capacity;
 - .6 L-L and L-N voltage on each line;
 - .7 Current on each line;
 - .8 Frequency.
 - .4 Alternator protection:
 - .1 Undervoltage (27);
 - .2 Reverse power (32);
 - .3 Loss of excitation (40Q);
 - .4 Overvoltage (59);
 - .5 Overfrequency (81O);
 - .6 Underfrequency (81U).
 - .5 Cumulative generating unit use:
 - .1 Overall hours and minutes;
 - .2 Hours and minutes under load;
 - .3 Hours and minutes no-load;
 - .6 Last use of generating unit;
 - .1 Total hours and minutes;
 - .2 Hours and minutes under load;
 - .3 Hours and minutes no-load;
 - .17 Equip control with the following inputs and outputs:
 - .1 Inputs:
 - .1 16 programmable digital inputs;
 - .2 1 30-240Ω analog input for fuel level;
 - .3 Each input may be assigned a specific name, not according to a predefined list, but at the operator's discretion.
 - .2 Outputs:
 - .1 30-amp "unit on" contact;
 - .2 2 other programmable 30-amp contacts;
 - .3 12 programmable 2-amp contacts;
 - .4 Reaction time between the time when:
 - .1 A signal is sent to a digital input and when the output relay is closed: 215 ms;
 - .2 A signal is sent to a digital input and when the command to shutdown the engine is issued: 490 ms.
 - .18 Prototype tested for radio interference with a 5 W source emitting random frequencies at 144 and 440 MHz with an antenna located 6" away either horizontally or vertically from the control panel.

- .19 Control panel shall use two sources to read frequency, i.e. a magnetic sensor or the CANbus speed signal and the AC generated by the alternator. In the event magnetic sensor or CANbus signal is lost, control panel shall automatically transfer reading to the alternator's AC.

2.14 POWER CIRCUIT BREAKERS

- .1 An air-circuit breaker will supply the emergency loads and the other charging bench / mobile generator. Circuit breakers shall have the following characteristics:
 - .1 1600 A capacity
 - .2 ILL electronic protection;
 - .3 Position contact.
 - .4 Shunt trip breakers shall be controlled by the unit's control panel;
 - .5 Shunt trip breaker supply shall be from the generating unit's battery(ies);
 - .6 Circuit breaker control wiring shall be done in the factory.
- .2 Electric generating set supplier shall be responsible to demonstrate coordination of the circuit breakers with the alternator's damage curve.
- .3 The purpose of the circuit breaker is to supply the load (either through the stationary generating unit or a mobile generating unit) and allow testing with the test bench. The PLC included controlled by the generator must also safely manage circuit breakers.
- .4 The two "Cam-Lok" cases shall be equipped with a switch that tells the generator control panel when the door is opened, for safe circuit breaker management.
- .5 A reverse power relay shall trip the stationary generator's circuit breaker whenever inverse power is sent to the alternator.

2.15 CSA C282 COMPLIANCE

- .1 The generating unit shall be equipped with a permanent label, as required in article 6.1.1.4 of standard C282-05. The calculated full load value to appear on the label shall be 900 kW.
- .2 A bilingual warning sign shall be affixed on the entry door to the room where the unit is stored, featuring white lettering on a red background, measuring 8" high x 12" wide, that says the following: "Ce groupe électrogène peut démarrer à tout moment. DANGER. This automatic unit may start at any time."
- .3 When the generating unit control receives the startup signal, it shall automatically send a command to trip the charging bench circuit breaker. Command duration shall be 1 second. If the circuit breaker doesn't trip, control shall send a 2nd command after a 1-second delay. If the circuit breaker still doesn't trip after the second command, the control panel shall display the "CB circuit closed" fault. Control must receive confirmation from a position contact that the circuit breaker has tripped. If the circuit breaker was already tripped prior to receipt of the startup signal, control shall not send the "trip" command to the circuit breaker. Power to trip the circuit breaker comes from the generating unit's DC system, and shall be connected in the factory.

- .4 In order to meet the standard, the ambient temperature must be monitored. If the temperature drops below the 10°C threshold for a period of more than 4 hours while the unit is non-operational, a “low ambient temperature” alarm shall be activated. The probe that reads the temperature shall be located about 1 m from the generating unit floor.

2.16 "WALK-IN" TYPE ENCLOSURE

- .1 The generating unit and its accessories shall be installed in a prefabricated enclosure that complies with Quebec’s construction code:
 - .1 The enclosure shall comply with chapter 1;
 - .2 The electricity shall comply with chapter 5;
 - .2 The fuel system shall comply with chapter 8;
- .2 The enclosure shall be constructed with non-flammable materials.
- .3 The enclosure shall be constructed in such a way that it can be handled with a crane, with the generating unit and its accessories already installed inside the enclosure.
- .4 Minimum exterior dimensions of the enclosure:
 - .1 492" long;
 - .2 144" wide;
 - .3 132" high.
 - .4 1 m of clearance must be kept around the unit base (except for the radiator).
 - .5 A “maritime container” type building is too narrow and is unacceptable.
- .5 Sound insulation:
 - .1 The enclosure shall be constructed in such a way as to maintain a noise level at full load of 70 dBA (logarithmic mean) at 8 points around the enclosure, 7 m from the outside of the enclosure.
 - .2 The sound level shall be verified in the factory. The test report shall be signed by a professional acoustician or engineer who is a member of the OIQ.
- .6 Thermal insulation:
 - .1 The enclosure shall be thermally insulated.
 - .2 The insulation shall have an insulation factor of R-17.
 - .3 The floor of the building shall also be insulated.
- .7 Roofing:
 - .1 The roof shall be reinforced so as to sustain the weight of the exhaust system while remaining compliant with requirements of chapter 1 of the Construction Code.
- .8 Accessories:
 - .1 The enclosure shall feature lifting rings that will enable the entire enclosure and equipment installed in it to be handled with a crane.
 - .2 Supply one 32” wide x 84” high doors installed on one side of the enclosure, with a keyed lock, emergency exit panic bar, weatherstripping, stainless steel hinges and a door check chain.

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- .3 Supply a 48" wide x 84" high double door of which one is 32" x 84" and another 16" x 84", installed on the other side of the enclosure, with a keyed lock, emergency exit panic bar, weatherstripping, stainless steel hinges and a door check chain.
 - .4 Create openings in a location to be determined to run electric cables and/or fuel pipes. Install a raised metal rim around the opening.
 - .9 Ventilation:
 - .1 The entire ventilation system shall comply with the generating unit manufacturer's recommendations with regard to the maximum restrictions applied to the ventilation system.
 - .2 The unit shall be removable from the enclosure by removing the air recirculation and outlet system.
 - .3 Damper motors shall:
 - .1 Have sufficient torque for the dampers to operate adequately.
 - .2 Be installed in such a manner as to enable maintenance to be performed inside the enclosure.
 - .3 Be connected for "fail-safe" operation.
 - .4 Air intake:
Shall be through fixed aluminum louvres.
 - .1 Air intake speed shall be such that water penetration into the building is limited to 0.01 oz./ft² per 15 minute period;
 - .2 Aluminum dampers shall be thermally insulated;
 - .3 The acoustic silencer shall be selected according to air supply required for the unit, as well as acoustic performance.
 - .5 Air outlet:
 - .1 Shall be through fixed aluminum louvres;
 - .2 Aluminum dampers shall be thermally insulated;
 - .3 The acoustic silencer shall be selected according to air supply required for the unit, as well as acoustic performance.
 - .4 A diffuser shall be installed at the radiator outlet;
 - .5 Outlet dampers shall be accessible through a removable panel.
 - .6 Recirculation:
 - .1 Recirculation dampers shall be installed between the radiator and the outlet dampers;
 - .2 The surface of the dampers shall be selected to ensure the maximum restriction for the group's fan is not exceeded when the outlet damper is completely closed and recirculation damper is completely open.
 - .3 The dampers shall be made of aluminum;
 - .4 A waterproof seal shall be installed between the radiator flange and recirculation system;
 - .7 A modulating wall-mounted thermostat shall control the entire ventilation system. The thermostat shall be installed in a location that minimizes instability.
 - .8 All accessories necessary for the entire system's proper operation shall be installed (transformer, supports, etc.).
 - .10 Exhaust system:
 - .1 The exhaust system shall be thermally insulated.
 - .2 The silencer selected shall meet the noise level requirements for the enclosure.

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- .3 The exhaust system shall not result in restrictions that exceed the maximum required by the diesel engine manufacturer.
 - .4 A drainage tube and cap shall be installed on the silencer. The tube shall be long enough for the cap to be located outside of the insulation;
 - .5 The silencer shall be located inside the enclosure, without hindering ventilation or movement of personnel;
 - .6 A flexible stainless steel tube, minimum of 18" in length, shall be installed;
 - .7 The exhaust shall be installed to run through the wall and end outside, ensuring that no water can enter the piping;
 - .8 An insulating sleeve shall be used around the piping that runs through the wall;
 - .9 The entire exhaust system shall be supported by the roof in such a way as to allow the unit to be removed from the enclosure without disassembling the exhaust system. All that should be done to remove the unit is disconnect the flexible piping.
- .11 Electricity. Include:
- .1 A 200-amp, 120/208-volt, 3-phase panelboard with 30 circuits, and appropriate circuit breakers;
 - .2 A 45kVA, 600/120/208V, 3ph, 4F transformer shall be installed in the enclosure, in a NEMA1 cabinet;
 - .3 (3) duplex, 15-amp, 120-volt power outlets;
 - .4 (6) fluorescent type light fixtures, with 2 32-watt, 120-volt tubes; protected by wireguard and controlled by a switch installed near both entry doors. Manufacturer: Phillips. Model: V2WAE232UNV;
 - .5 Outdoor 50-watt, 120-volt light fixture – installed near each entry door. Install a control switch inside near one of the doors. Manufacturer: Keene. Model: 313050MALAM1;
 - .6 (2) 24 VDC strobs mounted on each side of the building, activated by the generator's common alarm. Manufacturer: Hubbell. Model: NVSLCFG25RBG;
 - .7 Wall mounted unit heater, with a capacity as shown on the drawings;
 - .8 Self-contained emergency lighting units, 50 lux for 2 hours;
 - .9 An emergency shutdown mushroom button for the generating unit located on the outside of the building next to a door;
 - .10 Wiring shall be type RW90 installed in rigid E.M.T. conduit installed on the surface;
 - .11 All equipment shall be connected, including the battery charger, engine block heater, dampers and other accessories;
 - .12 1600-A power cables shall be installed in the plant;
 - .13 Wiring from the 1600-A circuit breaker box to the C-15 building shall be installed on site by an electrician.
- .12 Fuel Supply System:
- .1 Install fuel supply lines between the diesel engine and daytank;
 - .2 The return line between the diesel engine and main tank shall be installed on site by a plumber.
 - .3 Install piping between the pumps and daytank;
 - .4 Piping shall be black steel and painted with anticorrosive paint. Identify fuel flow direction with painted arrows on the piping.
 - .5 The piping route shall be the shortest possible and protections shall be provided in passageways;
 - .6 Piping between the two tanks shall be installed on site by the plumber.

- .7 Refer to the component description on the mechanical drawings; all of the work on the daytank shall be performed by the contractor who supplies the generator.

2.17 REMOTE ANNUNCIATOR PANEL:

- .1 A remote annunciator panel shall be connected to the generating unit via RS-485 cable, using Modbus protocol. It shall be UL and CSA approved. It shall be surface or mounted.
- .2 The panel shall be equipped with eight red indicator lights for alarms:
 - .1 Low glycol level;
 - .2 High glycol temperature;
 - .3 Low oil pressure;
 - .4 Refuse to start;
 - .5 Overrevving;
 - .6 Emergency shutdown;
 - .7 Fuel leak;
 - .8 Communication status.
- .3 The panel shall be equipped with seven yellow indicator lights for pre-alarms:
 - .1 High glycol temperature;
 - .2 Low glycol temperature;
 - .3 Low oil pressure;
 - .4 Low fuel level;
 - .5 Low battery;
 - .6 DC overvoltage;
 - .7 Battery charger fault;
- .4 The panel shall be equipped with three indicator lights for operating conditions:
 - .1 Not automatic;
 - .2 System ready;
 - .3 Load powered by emergency system.
- .5 Panel connections shall include:
 - .1 One RS-485 port;
 - .2 24 Vcc power supply.
- .6 Piezoelectric type audible alarm when 80 dBa @ 0.6 m.
- .7 NEMA 1 Cabinet.
- .8 Panel communication shall be possible with up to 4000' of wire.
- .9 The panel shall include an audible alarm disabling button and indicator light test switch. The panel shall be powered by the generating unit's battery(ies).

2.18 ENGINE BLOCK HEATER

- .1 Install a 6000W/208V/3ph block heater, with circulation based on the thermosiphon principle, and:

- .1 Aluminum casing;
- .2 Incoloy type heating element;
- .3 Thermostatic control;
- .4 Cut-off valves;
- .5 Grundfos forced circulating pumps.

2.19 OIL MIST RECOVERY UNIT.

- .1 The purpose of the oil mist recovery unit shall be to:
 - .1 Keep the engine compartments and components clean;
 - .2 Prevent oil mist from condensing and accumulating on the ground;
 - .3 Reduce emission of pollutants into the atmosphere;
 - .4 Reduce odours;
 - .5 Prevent the radiator from getting dirty.
- .2 The recovery unit shall be enclosed type; mists shall be burned in the engine combustion chambers.

2.20 QUALITY OF WORK

- .1 Manufacturer and construct equipment free from blemishes, defects, burrs and sharp edges; accuracy of dimensions and marking of parts and assemblies; thoroughness of welding, brazing, painting and wiring, alignment of parts and tightness of assembly screws and bolts.

2.21 QUALITY CONTROL

- .1 General: before acceptance, assemble and set up the unit, complete with specified equipment, for tests at the supplier's plant in accordance of the following:
 - .1 MANUFACTURER'S PRODUCTION TESTS
 - .1 Submit the entire generating unit to rigorous testing. Instruments that take readings shall have accuracy of 1% or better.
 - .2 Each of the tests above shall be performed in compliance with standard MIL-STD-705:
 - .1 Verification of the alternator's maximum capacity;
 - .2 Readings:
 - .1 Current;
 - .2 Voltage;
 - .3 Actual power;
 - .4 Apparent power;
 - .5 Excitor resistance;
 - .6 Stator resistance;
 - .7 Time.
 - .3 Dielectric test of:
 - .1 Main field rotor;
 - .2 Main field stator;
 - .3 Excitor rotor;
 - .4 Excitor stator.
 - .4 Phase sequence for the 3-phase alternators.

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- .3 Other tests. Verify:
 - .1 Maximum load that the generating unit can handle at one time;
 - .2 How the unit reacts when full load at rated power factor is applied;
 - .3 That the engine block heater and oil pan heater operate properly (if applicable);
 - .4 Safe shutdown and automatic controls;
 - .5 Accessories (battery charger, annunciator panel, pumps, etc.)
 - .4 Take the following readings:
 - .1 Oil pressure;
 - .2 Glycol temperature;
 - .3 Battery load rate;
 - .4 Time.
 - .5 Any published defects or variations in performance discovered during one of these tests shall be corrected and tested for again prior to the product being sent to the distributor.
- .2 FACTORY TESTS AT THE DISTRIBUTOR
- .1 Submit the entire generating unit to factory acceptance testing, in the presence of an Departmental Representative.
 - .2 Submit the results form to the engineer for approval at least 10 days before the tests.
 - .3 On the results form, enter the following information:
 - .1 Date;
 - .2 Type of control;
 - .3 Technician's name;
 - .4 Project reference number.
 - .4 Visually inspect:
 - .1 The level of antifreeze;
 - .2 The level of lubricating oil;
 - .3 The electrical and mechanical connections;
 - .4 The condition of the fan grill (in the event it was broken during transportation);
 - .5 Check for leaks:
 - .1 Antifreeze;
 - .2 Fuel;
 - .3 Lube oil.
 - .5 Before starting the engine, take a reading of the engine block heater element resistance.
 - .6 Perform a start-up test, preventing the engine from starting, such that a refuse to start fault is triggered.
 - .7 Start generating unit. Adjust frequency to 60.3 Hz. Once the frequency has been adjusted without the load, apply full load to the generating unit and take a reading of the frequency at full load.
 - .8 The tests shall be performed with a load of 1000 kW for a period of 1 hour, followed by a load of 900 kW for a period of 23 hours.
 - .9 Once the generating unit supplies the load:
 - .1 Adjust voltage to its nominal value;
 - .2 Verify that the rated current is reached;

- .3 Take another engine block heater resistance reading to confirm that the thermostat opened the circuit;
- .4 Calibrate the electrical measuring device readings;
- .5 Verify that the battery's load alternator charges the battery;
- .6 Verify that the engine instrumentation is operating properly.
- .10 Take readings every 30 minutes.
- .11 Perform a transient performance test, recording the voltage drop curves and frequencies as follows:
 - .1 0-100-0%;
 - .2 0-70-0%;
 - .3 40-60-0%;
 - .4 60-80-0%.
- .12 Verify protection operation:
 - .1 Emergency shutdown;
 - .2 Low antifreeze level;
 - .3 High temperature;
 - .4 Low oil pressure;
 - .5 Overvoltage;
 - .6 Anticipated high temperature;
 - .4 Anticipated low oil pressure;
 - .8 Low antifreeze temperature.
- .13 Perform a sound test at 8 points around the generator building and confirm that the unit meets expected performances.
- .14 Verify that the generating unit cools down as expected after the startup contact is returned to the open position.
- .15 Perform the V/Hz adjustment at 58 Hz.
- .16 Clean the machine as needed when the tests have been completed.
- .17 Submit a report to the engineer with the aforementioned information. Indicate any anomalies in the report.
- .18 Verification and on site commissioning: refer to section 26 32 13.03 - Installation of Electric Power Generating Equipment.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions:
 - .1 Verify that substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of liquid cooled diesel electric generating units.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.02 INSTALLATION

- .1 Install air cooled Diesel electric generating units to CAN3-Z299.3 and in accordance with manufacturer's written instructions.
- .2 The division 26 Contractor shall install the weather proof enclosure on the slab built for this purpose, as indicated. The enclosure shall be bolted to the slab.
- .3 Run the emergency power supply to the transformer installed in the enclosure.
- .4 Run the wiring and make the electrical connections, according to the manufacturer's indications and recommendations. Use the manufacturer's shop drawings to complete the following connections:
 - .1 Connections to unit control:
 - .1 Common fault relay on the building's alarm panel;
 - .2 Communication wire (Belden 9463) with the remote annunciator connected to the RS-485 control port;
 - .3 24 Vcc power supply from the generating unit to the remote annunciator.
 - .2 Connections from the main tank to the pump control panel:
 - .1 Fuel level signal;
 - .2 Leak contact;
 - .3 Low level contact.
 - .3 Pump control panel contacts to the generating unit:
 - .1 Common fault;
 - .2 Generating unit shutdown;
 - .3 Low fuel level in the main tank.
 - .4 Connections to the automatic transfert switch:
 - .1 Unit control panel startup contact;
 - .2 Generating unit control "bypass" mode contact;
 - .3 Load management system position contact.

3.03 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.

3.04 CLOSEOUT ACTIVITIES

- .1 Demonstration and Training:
 - .1 As directed by Departmental Representative and in accordance with Section 01 79 00 - Demonstration and Training carry out demonstrations of complete interruptible power unit for Project Acceptance Board.
 - .2 Provide familiarization training of operating and maintenance staff.

- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.
- .4 Provide fuel required for performing site test and top-up after acceptance test completion.

3.05 MAINTENANCE - CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA-B139.

END OF SECTION

1 GENERAL

1.01 SUMMARY

- .1 Materials and installation for storage batteries and racks.
- .2 Related Requirements
 - .1 Section 26 32 13.05 – Diesel Electric Generating Units (Air Cooled).

1.02 REFERENCES

- .1 American National Standards Institute (ANSI)/Underwriters Laboratories (UL).
 - .1 ANSI/UL 94-96, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances (ANSI Approved November 21, 2003).
- .2 Canadian Standards Association (CSA International).
 - .1 CAN3-Z299.3-85(R2002), Quality Assurance Program - Category 3.
 - .2 CAN/CSA-G40.20/G40.21-98(R2003), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 Institute of Electrical and Electronic Engineers (IEEE).
 - .1 IEEE 484-2002, IEEE Recommended Practices for Installation Design and Implementation of Vented Lead-Acid Batteries for Stationary Applications.
 - .2 IEEE 485-1997(R2003), IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications.
 - .3 IEEE 450-2002, Recommended Practice for Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
- .6 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .3 Submit shop drawings and product data to include:

- .1 Dimensioned sketch showing battery rack, individual battery cells, recommended aisle space, headroom, assembly and anchoring of rack.
 - .2 Individual battery cells, type, size, A.h capacity at 8 hours discharge rate, electrolyte, materials for container, cover, separators, retainers, posts and inter-cell connectors.
 - .3 Specific gravity at full charge and 25 degrees C.
 - .4 Cell charge and discharge curves of voltage, current, time and capacity.
 - .5 Derating factor for temperature range (minus 10 degrees C to minus 30 degreesC).
 - .6 Maximum short circuit current.
 - .7 Maximum charging current recommended for fully discharged condition.
 - .8 Full charge voltage per cell.
 - .9 Fully discharged voltage per cell.
 - .10 Hydrogen generation and ventilation requirements.
- .4 Closeout Submittals:
- .1 Provide operation and maintenance data for storage batteries and racks for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operation, maintenance and repair.
 - .3 Installation details of battery rack, individual cells, inter-cell connectors.
 - .4 Replacement instructions for individual cells.
 - .5 Electrolyte handling.
 - .6 Parts lists with catalogue numbers, and names and addresses of suppliers.
 - .7 Factory test records.

1.04 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.05 DELIVERY, STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Place materials defined as hazardous or toxic waste in designated containers.
 - .5 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
 - .6 Ensure emptied containers are sealed and stored safely.
 - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.06 WARRANTY

- .1 Contractor hereby warrants battery against defects in material and workmanship in accordance with General Conditions (GC), but for five years.
 - .1 This warranty is for 100% replacement for first year and prorated replacement value in equal yearly decreasing amounts for remaining 4 years until expiration of warranty at end of 5 years after delivery of battery.
 - .2 Cells to be warranted for 100% replacement for 60 months against electrolyte leakage and corrosion at post seals.

2 PRODUCTS

2.01 MATERIALS

- .1 Steel for battery racks: to CAN/CSA-G40.20.

2.02 BATTERY CHARACTERISTICS

- .1 Nominal battery voltage, full charge, 24 V.
- .2 Designed to supply load current of 1 900 A for @ -18°C.
- .3 Battery to deliver specified output at 25 degrees C, in ambient temperature.

2.03 LEAD ACID BATTERIES/CALCIUM

- .1 Type: Lead-calcium, Sealed, Absorptive glass microfibre (AGM).
- .2 Cell containers: transparent plastic, fire retardant.
- .3 Cover: one piece molded plastic, flame retardant to ANSI/UL 94.
- .4 Plate retainers: fibreglass.
- .5 Plate separators: fibreglass.
- .6 Posts: bolted type with 2 or 4 stainless steel nuts and bolts per cell.
- .7 Inter-cell connectors: lead plated copper, bolted to battery posts.
 - .1 Bolt holes slightly oversized to facilitate cell replacement.
 - .2 Connectors, bolts and nuts: corrosion resistant.
- .8 Cells: of identical construction and from same production run.
- .9 Batteries: in clean state with no evidence of electrolyte on outside of cell containers.

2.04 BATTERY RACK

- .1 Frames: angle iron with welded joints ground smooth.
- .2 Rails: steel channels, bolted to frames.
- .3 Rubber strips to insulate rails from cells.
- .4 Insulated from ground and floor.
- .5 Free standing - not bolted to floor.
- .6 Primed and epoxy painted to prevent corrosion.
- .7 Corrosion resistant bolts and hardware.
- .8 Configuration permitting any one cell to be removed without removing any other cell.
- .9 Dimensions of space available as indicated.

2.05 SOURCE QUALITY CONTROL

- .1 To CAN3-Z299.3.
- .2 Complete battery factory tested in presence of Departmental Representative.
- .3 Install dc indicating voltmeter and ammeter.
- .4 Submit copy of test results to Departmental Representative.

3 EXECUTION

3.01 INSTALLATION

- .1 Locate and erect battery rack.
- .2 Install battery cells on rack.
- .3 Clean posts and connectors and apply no-oxide grease.
- .4 Install inter-cell and inter-tier connectors, and hand tighten nuts in accordance with manufacturer's instructions.
- .5 Using torque wrenches, tighten nuts in accordance with manufacturer's recommended value.
- .6 Connect battery to load circuit.

3.02 FIELD QUALITY CONTROL

- .1 Check battery voltage and voltage of each cell in accordance with manufacturer's instructions.
- .2 Recharge battery to full charge.
- .3 Leave battery in fully charged state.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 26 33 16 – Battery Racks.
- .2 Section 26 32 13.05 – Diesel Electric Generating Units (Air Cooled).

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.107.1-01, General Use Power Supplies.
 - .2 CSA C22.2 No.107.2-01, Battery Chargers.

1.03 PERFORMANCE REQUIREMENTS

- .1 Automatically maintain battery in fully charged state while mains power available. Maintain dc float voltage within plus or minus 1% of setting, no load to full load, during mains voltage variations of plus 10% to minus 15% and frequency variations of plus or minus 5%.
- .2 Equalize charging rate such that after battery has provided full power output for specified duration, charger returns battery to 95% of fully charged state in 8 hours.
- .3 Automatic equalize charging circuit to initiate equalize charging of battery for 24 hours after discharge of 5% of ampere-hour battery rating.

1.04 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Outline sketch with dimensions showing arrangement of cubicle, components, meters and controls.
- .3 Schematic diagram showing components.
- .4 Charger data: type and capacity, battery charging sequence, current-time data for Silicon Controlled Rectifier (SCR) protective devices, estimated noise level, metering, alarms, controls and efficiency.

1.05 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for battery charger for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance instructions covering design elements, construction features, component functions and maintenance requirements to permit effective operation, maintenance and repair.

- .3 Copy of approved shop drawings.
- .4 Technical description of components.
- .5 Parts lists with catalogue numbers and names and addresses of suppliers.

1.06 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

2 PRODUCTS

2.01 CHARGER CHARACTERISTICS

- .1 Battery charger: to CSA C22.2 No. 107.1, CSA C22.2 No. 107.2.
- .2 Input: 120 Vac, 1 phase, 1 wire, grounded neutral, 60Hz.
- .3 Output: 10 Adc at 24 Vdc, ripple voltage less than 2%.

2.02 ACCESSORIES

- .1 dc voltmeter: switchboard type, accuracy plus or minus 2% of full scale, to measure rectifier output voltage.
- .2 dc ammeter: switchboard type, accuracy plus or minus 2% of full scale, to measure rectifier output current.
- .3 Relay and alarm for ac power failure with time delay to prevent alarm during short power outages.
- .4 Low dc voltage alarm to indicate over discharge, hours emergency time available.
- .5 High dc voltage alarm and high dc voltage automatic shutdown.
- .6 No-charge alarm to indicate charger has no dc output.
- .7 Ground detector relay and alarm.

- .8 LEDs mounted on front to indicate: failure ac power, low dc voltage, high dc voltage, no rectifier output.
- .9 Alarms: audible alarm when any LED indicates trouble. Silence pushbutton not to extinguish trouble light.
- .10 Common LED test switch and one common Form C alarm contact.

2.03 ENCLOSURE

- .1 Free standing sheet steel, minimum 2.5mm thick CSA Enclosure 1.
- .2 Access from front.
- .3 Convection ventilated.
- .4 Meters, indicating lamps and controls group mounted on front panel.
- .5 Apply finish in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.04 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 For major components such as input breakers, output breaker: size 5 nameplates.
- .3 For mode lights alarms, meters: size 3 nameplates.

3 EXECUTION

3.01 INSTALLATION

- .1 Locate and install battery charger.
- .2 Connect input terminals to ac mains.
- .3 Connect output terminals to battery.

3.02 TESTS

- .1 Energize battery charger and operate until battery shows full charge.
- .2 Discharge battery to full discharge condition.
- .3 Recharge battery, recording dc voltage and current once per hour for 8 hours. Test battery to ensure it has reached at least 95% full charge.

- .4 Continue charging to ensure charger changes from equalize rate to float charge rate.
- .5 Demonstrate that automatic timer controls charging and correctly transfers from equalize to float charge after selected period.
- .6 Simulate faults to demonstrate that alarm lights and audible alarms are performing as designed.
- .7 At end of tests, with battery in fully charged condition, operate charger on "float" for minimum period of 24 hours to ensure stable condition is reached and held.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1-04, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM F 1137-00(2006), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA)/CSA International.
- .5 ICES-005-07, Radio Frequency Lighting Devices.
- .6 Underwriters Laboratories of Canada (ULC).

1.02 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 45 00 - Quality Control.

1.03 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
- .3 Photometric data to include: VCP Table.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Disposal of fluorescent lamps.

- .5 Disposal of old PCB filled ballasts (if still existing) on renovation jobs.

2 PRODUCTS

2.01 LAMPS

- .1 DE1: 1W, color temperature 2 700K, or as indicated.
- .2 Fluorescent : T8, 28W, medium twin base sockets instant start, color temperature 4 100 K, 2 725 lumens, color index 85, 30 000 hours, or as indicated Philipps Alto II.

2.02 BALLASTS

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.
 - .1 Rating: 120 V, 60 Hz, for use with 2-32W, rapid start lamps.
 - .2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.
 - .3 Totally encased and designed for 40°C ambient temperature.
 - .4 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .5 Crest factor: 1.5 maximum current.
 - .6 Harmonics: 10 % maximum THD.
 - .7 Sound rated: Class A.
 - .8 Mounting: integral with luminaire.

2.03 FINISHES

- .1 Finish and construction of lighting fixtures shall be CSA Certified for usage.

2.04 LIGHT CONTROL DEVICES

- .1 As indicated, see lighting fixture schedule.

2.05 LUMINAIRES

- .1 As indicated, see lighting fixture schedule.

3 EXECUTION

3.01 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Support luminaires adequately with supports and brackets suitable for ceiling system.

3.02 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Install wiring in rigid or flexible conduit, as indicated.

3.03 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.04 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

1 GENERAL

1.01 UNIT EQUIPMENT FOR EMERGENCY LIGHTING

- .1 Materials and installation for emergency lighting systems.

1.02 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 26 05 21 - Wires and Cables (0-1000 V).
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .5 Section 26 53 00 – Exit signs.

1.03 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-M1985(R1999), Unit Equipment fo Emergency Lighting.

1.04 SUBMITTALS

- .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.

1.05 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Dispose of unused batteries at official hazardous material collections site approved by Departmental Representative.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

1.06 WARRANTY

- .1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

2 PRODUCTS

2.01 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V, ac.
- .3 Output voltage: 12 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'.
- .10 Lamp heads: integral on unit, 360 degrees horizontal and 180 degrees vertical adjustment with Lamp.
- .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 Test switch.
 - .2 Time delay relay.
 - .3 Battery disconnect device.
 - .4 AC input and DC output terminal blocks inside cabinet.
 - .5 Shelf.
 - .6 Cord and single twist-lock plug connection for AC.
 - .7 RFI suppressors.

2.02 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized in accordance with manufacturer's recommendations.

3 EXECUTION

3.01 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
 - .2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101-2006, Life Safety Code.

1.02 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.03 WASTE MANAGEMENT AND DISPOSAL

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

2 PRODUCTS

2.01 STANDARD UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.
- .3 Face and back plates: die formed cold rolled steel.
- .4 Lamp : LED , 120VAC and 12VDC, minimum 50 000 hours rating.
- .5 As indicated, see lighting fixture schedule.
- .6 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red on white glass, reading EXIT and SORTIE.

- .7 Downlight: translucent acrylic in bottom of unit.
- .8 Face plate to remain captive for relamping.

2.02 DESIGN [X1]

- .1 Wall mounting, as indicated.
- .2 Single face with die-cast face plate to remain captive for relamping, as indicated.
- .3 As indicated, see lighting fixture schedule.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

3.03 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Underwriters Laboratories of Canada (ULC)
 - .1 ULC-S317-1996, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems.

1.02 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 video surveillance equipment and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit:
 - .1 Functional description of equipment.
 - .2 Technical data sheets of all devices.
 - .3 Device location plans and cable lists.
 - .4 Video camera surveillance chart.
 - .5 Video interconnection detail drawings.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Submit shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labeling scheme.
 - .3 Submit zone layout drawings indicating number and location of zones and areas covered.
- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit 1 sample of each camera selected complete with housing, brackets and mounting hardware.
 - .4 Camera will be returned for incorporation into work as appropriate.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit UL Product safety Certificates.
 - .2 Submit verification Certificate that service company is "UL List alarm service company".
 - .3 Submit verification Certificate that monitoring facility is "UL Listed central station".
 - .4 Submit verification Certificate that video surveillance system is "Certified alarm system".

- .6 Test and Evaluation Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .7 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .8 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.03 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Include following:
 - .1 System configuration and equipment physical layout.
 - .2 Functional description of equipment.
 - .3 Manufacturer's Instructions for operation, adjustment and cleaning.
 - .4 Illustrations and diagrams to supplement procedures.

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect video surveillance materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.05 WARRANTY

- .1 Manufacturer's Warranty 12 month minimum: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

2 PRODUCTS

2.01 DESIGN CRITERIA

- .1 Support: camera functions such as pan/tilt and zoom fully supported by Closed Circuit Television (CCTV) system.
 - .1 Provide operator with ability to control all camera functions.

- .2 Switching:
 - .1 Provision to switch any camera in system to any monitor in system manually or automatically.
- .3 Control: provision for any camera equipped with pan, tilt, and/or motorized zoom lens:
 - .1 Manually control pan, tilt and lens functions.
 - .2 Set pan and tilt home position.
 - .3 Set and clear movement limits of pan and tilt mechanism.
 - .4 Adjust motorized zoom lens.
- .4 Enter and edit CCTV programs and save them for future use.
- .5 Set dwell time for viewing of any camera picture.
- .6 Environment: design video components and systems to operate with specified requirements under following ambient temperatures:
 - .1 Indoor installations:
 - .1 Temperature: 0 degrees C to 60 degrees C.
 - .2 Humidity: 10 to 90%.
 - .2 Outdoor installations:
 - .1 Temperature: -40 degrees C to 60 degrees C.
 - .2 Humidity: 10 to 100%.

2.02 CHARACTERISTICS

- .1 Video Camera:
 - .1 Colour.
 - .2 Sensitivity: lighting requirements for useable video image.
 - .3 Resolution: lines of horizontal resolution:
 - .1 Colour: high resolution 450.
 - .4 Format: 1/2".
 - .5 Environment: indoor.
 - .6 Mounting: visible.
 - .7 Lens functions: motorized electronic iris.
 - .8 Additional features: backlight compensation.
 - .9 Operational voltage: standard 24 AC, 12 DC.
 - .10 Operation temperature: 0-60 degrees C.
- .2 Lenses:
 - .1 Variable Focus Lens: 3.5 mm to 8 mm on same lens.
 - .2 Motorized Zoom Lens.
 - .3 Auto iris lens with video DC.
- .3 Video Handling:
 - .1 Multiplexer: support groups of 4 cameras; Simplex models.
 - .1 Features:

- .1 Permit multi-screen display of live camera images as they are being recorded.
- .2 Video loss detection.
- .3 Video motion detection.
- .4 Security lock.
- .5 Call monitor output.
- .6 Multi display formats i.e.: 4x4, 3x3, 2x2 etc.
- .2 Multi-screen display: permit screen to split to show 1 or 4 images at same time.
- .3 Live-on-playback and play-back-live: permit live camera images while monitoring so that VCR image can be shown on screen at same time.
 - .1 Permit live camera image to be shown during VCR playback.
- .4 Auto sequential switching: permit switching between cameras one field at a time to allow smooth flowing of multi-screen displays.
- .5 Electronic image functions: permit capability to zoom or freeze images from live and recorded sources.
- .6 Camera title indicator: permit 8 character title to be accorded to each channel.
- .7 Alarm function: include 16 alarm inputs and 2 alarm outputs for each camera.
- .8 I.D./time-date generator: include as built-in calendar function with capability to display time and date on monitor or not, and in recording or playback mode.
- .9 On-screen setup menus: include on-screen menus and accessible front panel push buttons permitting quick and easy setup and operation.
- .10 Alarm log function: 100 events.
- .11 Provide S-video input/output terminal.

2.03 CAMERA HOUSINGS

- .1 Indoor: ceiling mount.
- .2 Domes: indoor.
- .3 Transmission Methods: coax.
- .4 Shall be supplied by Axis.

2.04 CAMERA POWER SUPPLY

- .1 Power supply: custom designed for all cameras requiring 24 VAC power, locate inside equipment cabinet; fused (each input and output); capable of providing correct voltage to overcome real and circulated system power loss for 4 cameras and to provide future expansion of 25%. Permanently mount power supply.

2.05 JUNCTION BOX

- .1 Metal, sized to handle all system conduit interconnections with appropriate expansion.

2.06 MONITOR

- .1 Video monitor compatible with type of system.

2.07 Manufacturer/Installer

- .1 In order to be compatible with the existing system, all equipment described herein this section shall be provided by the manufacturer/installer: Marcomm Systems Group inc. Contact: Marc-André Bergeron (phone: 613-8866, extension 226).

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for video surveillance 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.

3.02 INSTALLATION

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheet.
- .2 Install video surveillance equipment and components in accordance with ULC-S317.
- .3 Install cable, boxes, mounting hardware, brackets, video cameras and system components in accordance with manufacturer's written installation instructions.
- .4 Install components secure, properly aligned and in locations shown on reviewed shop drawings.
- .5 Connect cameras to cabling in accordance with installation instructions.
- .6 Install ULC labels where required.
- .7 Besides local monitoring, new cameras shall be also be monitored remotely with the existing central system.

3.03 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.
 - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review Work at stages listed:

- .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
- .2 Twice during progress of Work at 25% and 60% complete.
- .3 Upon completion of Work, after cleaning is carried out.

3.04 SYSTEM STARTUP

- .1 Perform verification inspections and test in the presence of Departmental Representative.
 - .1 Provide all necessary tools, ladders and equipment.
 - .2 Ensure appropriate subcontractors , and manufacturer's representatives are present for verification.
- .2 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
 - .1 Sturdiness of equipment fastening.
 - .2 Non-existence of installation related damages.
 - .3 Compliance of device locations with reviewed shop drawings.
 - .4 Compatibility of equipment installation with physical environment.
 - .5 Inclusion of all accessories.
 - .6 Device and cabling identification.
 - .7 Application and location of ULC approval decals.
- .3 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
 - .1 Measurements of tension and power.
 - .2 Connecting joints and equipment fastening.
 - .3 Measurements of signals (dB, lux, baud rate, etc).
 - .4 Compliance with manufacturer's specification, product literature and installation instructions.
- .4 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
 - .1 Operation of each device individually and within its environment.
 - .2 Operation of each device in relation with programmable schedule and or/specific functions.
 - .3 Operation control of camera lens, pan, tilt and zoom.
 - .4 Switching of camera to any monitor.
 - .5 Switching of system video recorder to selective monitor.
 - .6 Set dwell times.
 - .7 Demonstrate:
 - .1 Sequence viewing of cameras on each monitor.
 - .2 Bypass capability.
 - .3 Display of stored image to cardholder.

3.05 ADJUSTING

- .1 Remove protective coverings from cameras and components.
- .2 Adjust cameras for correct function.

3.06 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.
 - .1 Clean camera housing, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

3.07 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by video surveillance installation.

END OF SECTION

1 GENERAL

1.01 OTHER RELATED REQUIREMENTS

- .1 Not Used.

1.02 REFERENCES

- .1 Treasury Board of Canada Secretariat, Occupational Health and Safety (OHS)
 - .1 Fire protection standard - 10.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-06, Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525-07, Audible Signal Devices for Fire Alarm, Systems, Including Accessories.
 - .3 CAN/ULC-S526-07, Visible Signal Devices for Fire Alarm Systems, including Accessories
 - .4 CAN/ULC-S527-99, Control Units for Fire Alarm Systems.
 - .5 CAN/ULC-S528-05, Manual Stations for Fire Alarm Systems, Including Accessories
 - .6 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems
 - .7 CAN/ULC-S530-91(C1999), Heat Actuated Fire Detectors.
 - .8 CAN/ULC-S531-02, Standard for Smoke Alarms.
 - .9 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems.
 - .10 CAN/ULC-S537-1997-04, Verification of Fire Alarm Systems.

1.03 QUALITY ASSURANCE

- .1 Inspection and testing must comply with the CAN/ULC-S536 and CAN-ULC-537 (2001) standards.
- .2 The inspection report will be submitted to the Departmental Representative.

1.04 TRANSPORTATION, STORAGE AND HANDLING

- .1 The transportation, storage and handling of the materials will comply with Section 01 61 00 – Common Product Requirements and with the manufacturers' written instructions.
- .2 Storage and handling:
 - .1 Materials will be stored so that they will not rest on the ground, and will be stored indoors, in a dry, clean and well-ventilated area, in compliance with the manufacturer's recommendations.
 - .2 Materials will be stored so that they will be protected against scratches, dents and other damage.
 - .3 Faulty or damaged materials will be replaced with new materials.

2 PRODUCTS

2.01 DESCRIPTION

- .1 Existing Edward type EST3 fire alarm and voice communication system for data transmission monitored and controlled by microprocessors, and using digital and multiplexing technology.
- .2 The system is designed to ensure fire alarm and protection, which includes the reception of alarm signals, the triggering of a two-fold alarm, the self-monitoring of circuits and components, annunciation tables, the execution of auxiliary functions, and the triggering of alarms upon faulty signals sent to a monitoring party or agent.
- .3 The materials and devices of the fire alarm system must comply with ULC and be identified as such. They must also come from a single manufacturer.
- .4 Requirements of the regulation organizations.
 - .1 The fire alarm and voice communication system must comply with the following:
 - .1 Fire Protection Standard of the Treasury Board of Canada Secretariat.
 - .2 Submission to the CI for approval.
 - .3 Inspection by the CI for final acceptance.
 - .2 Components of the fire alarm system: ULC approved, compliant with the pertinent provisions of the national building codes (provincial/local) and with the requirements of the competent local organization.

2.02 AUXILIARY CIRCUITS

- .1 Auxiliary contacts for command functions.
- .2 Addressable module, including one NO and one NF auxiliary contacts.

2.03 CABLING

- .1 Copper conductors compliant with the requirements of the manufacturer.

2.04 AUDIBLE WARNING DEVICES

- .1 Bells
 - .1 Wall-mounted vibrating bells (series 439D).
- .2 Strobe lamp
 - .1 Wall-mounted strobe lamp series 403.

2.05 DETECTION DEVICES

- .1 Heat detector
 - .1 Ceiling surface-mounted 280B series thermostatic heat detector.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of conditions: Before installing fire alarms and communication systems, ensure that the surfaces/anchors/mounts previously installed as per the prescriptions of other sections or contracts are acceptable and allow the execution of the work as per the written instruction of the manufacturer.
 - .1 Visually inspect the surfaces and anchors.
 - .2 Immediately inform the Departmental Representative of any unacceptable conditions.
 - .3 Begin the installation only after the unacceptable conditions have been corrected and after reception of a written approval from the Departmental Representative.

3.02 INSTALLATION

- .1 Installation of the fire alarm and voice communication systems in compliance with the CAN/ULC-S524 standard and with the Fire Protection Standard of the Treasury Board of Canada Secretariat.
- .2 Spliced connections are not acceptable.
- .3 Supply the conduits, cables and wires necessary to make interconnections in the connection box, annunciator tables and central unit, in compliance with the manufacturer's requirements.
- .4 Before testing the system and releasing it to the Departmental Representative, make sure the cabling does not include open circuits, short circuits, and ground faults.

- .5 Associated circuits and cabling must be identified at the central unit, at the annunciator tables, and in the connection boxes.
- .6 Installation of the bells and connection to the bell circuits.
- .7 Installation of the heat detectors and connection to the heat detector circuits.

3.03 ON SITE QUALITY CONTROL

- .1 Perform testing in compliance with Section 26 05 00 – Common Work Results for Electrical and with the CAN/ULC-S537 standard.

3.04 CLEANING

- .1 Cleaning during construction: Perform cleaning tasks in compliance with Section 01 74 11 - *Cleaning*.
 - .1 Work areas will be cleaned at the end of every work day.
- .2 Final cleaning: When the work is finished, remove from the site all extra materials, waste, garbage, tools, and equipment, as per Section 01 74 11 - *Cleaning*.
- .3 Waste management: Sort the waste based on re-use and recycling criteria, in compliance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
 - .1 Remove the recycling bins and containers from the site and dispose of the waste in appropriate facilities.

3.05 DEMONSTRATION AND TRAINING

- .1 Make the necessary arrangements so that the manufacturer of the fire alarm system can provide the operating staff with training on site, i.e. training sessions and demonstrations on system operation and maintenance.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 32 12 16.02 – Asphalt Paving for Building Sites.

1.02 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 422-632002, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D 698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D 1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D 4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.04 DEFINITIONS

- .1 Excavation classes: two (2) classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

- .3 Topsoil:
- .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
- .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.1.
 - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
 - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Quality Control:
- .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article.
 - .2 Submit for review by Departmental Representative proposed dewatering methods as described in PART 3 of this Section.
- .2 Preconstruction Submittals:
- .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field clearance record from utility authority location plan of relocated and abandoned services, as required.

- .3 Samples:
 - .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
 - .3 Submit 25 kg samples of type of fill, unshrinkable fill specified.

1.06 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Do not use soil material until written report of soil test results are reviewed and approved by testing laboratory.
- .3 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with CSST.

1.07 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify establish location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to beginning excavation Work, notify applicable Departmental Representative establish location and state of use of buried utilities and structures.
 - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .7 Record location of maintained, re-routed and abandoned underground lines.
 - .8 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
 - .1 Conduct, with the Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by the Departmental Representative.

2 PRODUCTS

2.01 MATERIALS

- .1 Type 1 and Type 2 fill: properties to the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C 117. Sieve sizes to

.3 CAN/CGSB-8.1.
Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by testing laboratory for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

3 EXECUTION

3.01 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.02 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to laboratory representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.03 STRIPPING OF TOPSOIL

- .1 Strip topsoil to depths as indicated.
 - .1 Do not mix topsoil with subsoil.
- .2 Stockpile in locations as directed by Departmental Representative.
 - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .3 Dispose of unused topsoil off site.

3.04 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative.
 - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.05 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.06 EXCAVATION

- .1 Excavation must not interfere with bearing capacity of adjacent foundations.
- .2 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .3 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

- .4 Keep excavated and stockpiled materials safe distance away from edge of trench.
- .5 Restrict vehicle operations directly adjacent to open trenches.
- .6 Dispose of surplus and unsuitable excavated material off site.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify Laboratory Representative when bottom of excavation is reached.
- .10 Obtain Laboratory Representative's approval of completed excavation.
- .11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with fill concrete.
 - .2 Fill under other areas with Type [2] fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .13 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout.

3.07 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698.

3.08 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

- .6 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading.

3.12 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Reinstate lawns to elevation which existed before excavation.
- .3 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .4 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.02 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C 88-99a, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C 117-95, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 123-98, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C 127-01, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - .5 ASTM C 128-01, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C 131-01, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C 136-01, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM D 698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .9 ASTM D 995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D 1557-00, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .11 ASTM D 1559-89, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus, was withdrawn in 1998 with no replacement.
 - .12 ASTM D 2419-02, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .13 ASTM D 3203-94(2000), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .14 ASTM D 4318-00, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .15 ASTM D 4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-1993 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit the required product data.

- .2 Submit asphalt concrete mix design to Laboratory Representative for review.
- .3 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.
- .4 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.

1.05 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Unused protective coating material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

2 PRODUCTS

2.01 MATERIALS

- .1 Granular material: to following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations: within limits specified when tested to ASTM C 136. Sieve sizes to CAN/CGSB-8.1.

<u>Sieve Designation</u>	<u>Granular Base</u>		<u>Granular Sub-Base</u>	
200 mm	-	-	-	-
75 mm	-	-	100	100
50 mm	100	-	-	-
38.1 mm	70-100	-	-	-
25 mm	-	-	55-100	-
19 mm	50-75	100	-	-
12.5 mm	-	70-100	-	-
9.5 mm	40-65	-	-	-
4.75 mm	30-50	40-70	25-100	-
2.00 mm	-	23-50	15-80	-
0.425 mm	10-30	7-25	4-50	0-30
0.180 mm	-	-	-	-
0.075mm	3-8	3-8	8-0	0-8

- .4 Granular base aggregates:
 - .1 Crushed particles: at least 60 % of particles by mass retained on 4.75 mm sieve to have at least 1 freshly fractured face.
- .2 Asphalt concrete aggregates:
 - .1 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C 117.
 - .2 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

- .3 Separate stock piles for coarse and fine aggregate are not required for sheet asphalt.
- .4 Do not use aggregates having known polishing characteristics in mixes for surface courses.
- .5 Aggregate: material to following requirements:
- .1 Crushed stone or gravel.
- .2 Gradations to be within limits specified when tested to ASTM C 136. Sieve sizes to CAN/CGSB-8.1.
- .3 Table

Sieve Designation	% Passing	
	Asphalt Concrete	Sheet Asphalt
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	-	-
19.0 mm	100	-
12.5 mm	-	100
19.0mm	100	100
9.5 mm	60-80	100
4.75	40-65	85-100
2.00	30-50	80-95
0.425	15-30	40-70
0.180	5-20	10-35
0.075	3-8	4-14

- .4 Sand equivalent: to ASTM D 2419.
- .5 Magnesium Sulphate soundness: to ASTM C 88. Max % loss by weight: coarse aggregate 12, fine aggregate 16.
- .6 Los Angeles Degradation: to ASTM C 131. Max % loss by weight: coarse aggregate, 35.
- .7 Absorption: to ASTM C 127. Max % by weight: coarse aggregate, 1.75.
- .8 Lightweight particles: to ASTM C 123. Max % by mass, with less than 1.95. Relative density (formally Specific Gravity): 1.5.
- .9 Flat and elongated particles: to ASTM D 4791, (with length to thickness ratio greater than 5): Max % by weight: coarse aggregate, 15.
- .10 Crushed particles: at least 60 % of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C 136.

.11 Table

Passing		Retained on
19 mm	to	9.5 mm
9.5 mm	to	4.75 mm

- .12 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.
- .3 Mineral filler for asphalt concrete:
 - .1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
- .4 Asphalt cement: to CAN/CGSB-16.3.
- .5 Asphalt prime: to CAN/CGSB-16.1.
- .6 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.
- .7 Asphalt tack coat: to CAN/CGSB-16.2, grade SS-1.

2.02 EQUIPMENT

- .1 Pavers: mechanical self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers for parking lots and driveways:
 - .1 Minimum drum diameter: 750 mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .5 Suitable hand tools.

2.03 MIX DESIGN

- .1 Mix design to AI MS-2.
- .2 Job mix formula to be approved by Laboratory Representative.
- .3 Design of mix: by Marshall method to requirements below:
 - .1 Compaction blows on each face of test specimens: 50.

- .2 Mix physical requirements:
- | <u>Property</u> | <u>Sheet Asphalt</u> | <u>Concrete</u> |
|---|----------------------|-----------------|
| Marshall | 3.0 | 5.5 |
| Stability at 60 degrees C, kN minimum. | | |
| Flow Value, mm. | 2.5 | 2.4 |
| Air Voids in Mixture, % | 3.5 | 3.5 |
| Voids in Mineral Aggregate, % minimum | 16 | 15 |
| Index of Retained Stability, % <u>minimum</u> | 75 | 75 |
- .3 Measure physical requirements as follows:
- .1 Marshall load and flow value: to ASTM D 1559.
 - .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C 127. Make allowance for volume of asphalt absorbed into pores of aggregate.
 - .3 Air voids: to ASTM D 3203.
 - .4 Voids in mineral aggregate: to AI MS-2, chapter 4.
- .4 Do not change job-mix without prior approval of Laboratory Representative. When change in material source proposed, new job-mix formula to be approved by Laboratory Representative.

3 EXECUTION

3.01 GRANULAR BASE

- .1 Place granular base material on clean unfrozen surface, free from snow and ice.
- .2 Place granular base to compacted thicknesses as indicated. Do not place frozen material.
- .3 Place in layers not exceeding 300 mm compacted thickness. Compact to density not less than 95% corrected maximum dry density.
- .4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low.

3.02 ASPHALT PRIME

- .1 Cutback asphalt:
 - .1 Heat asphalt prime for pumping and spraying in accordance with CAN/CGSB-16.1.

- .2 Apply cutback asphalt prime to granular base, at rate directed by Laboratory Representative, but do not exceed 2.2 L/m².
- .3 Apply on dry surface, unless otherwise directed by Laboratory Representative.
- .2 Emulsified asphalt:
 - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Laboratory Representative.
 - .2 Apply diluted asphalt emulsion at rate directed by Laboratory Representative but do not exceed 5 L/m².
 - .3 Apply on damp surface unless otherwise directed Laboratory Representative.
- .3 Do not apply prime when air temperature is less than 5 degrees C or when rain is forecast within 2 hours.
- .4 If asphalt prime fails to set cure within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

3.03 PLANT AND MIXING REQUIREMENTS

- .1 In accordance with ASTM D 995.

3.04 ASPHALT CONCRETE PAVING

- .1 Obtain approval of base from Laboratory Representative before placing asphalt mix.
- .2 Place asphalt mix only when base or previous course is dry and air temperature is above 5 degrees C.
- .3 Place asphalt concrete in compacted layers not exceeding 50 mm.
- .4 Minimum 135 degrees C mix temperature required when spreading.
- .5 Maximum 160 degrees C mix temperature permitted at any time.
- .6 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .7 Compact asphalt concrete to density not less than 95 % of density obtained with Marshall specimens prepared in accordance with ASTM D 1559 from samples of mix being used. Roll until roller marks are eliminated.
- .8 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .9 Moisten roller wheels with water to prevent pick up of material.
- .10 Compact mix with hot tampers or other equipment approved by Laboratory Representative in areas inaccessible to roller.

- .11 Finish surface to be within 10 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.
- .12 Repair areas showing checking, rippling or segregation as directed by Departmental Representative.

3.05 JOINTS

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 50 mm.

3.06 TESTING

- .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory.
- .2 Costs of tests will be paid by Departmental Representative.

3.07 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C. Do not permit stationary loads on pavement until 24 hours after placement.
- .2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal procedures.
- .2 Section 01 35 29.06 – Health and safety requirements.
- .3 Section 01 47 13 – Sustainable requirements – Concept design.
- .4 Section 01 47 15 – Sustainable requirements – Construction.
- .5 Section 01 47 17 – Sustainable requirements – Contractor's verification.
- .6 Section 01 47 19 – Sustainable requirements – Operation.
- .7 Section 01 74 21 – Construction/Demolition waste management and disposal.
- .8 Section 02 81 01 – Hazardous materials.
- .9 Section 03 30 00 – Cast-in-place concrete.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 53/A 53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A 90/A 90M-01, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - .3 ASTM A 121-99, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
 - .4 A653/A653M-03, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM C 618-03, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - .6 ASTM F 1664-01, Standard Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-138.1-96, Fabric for Chain Link Fence.
 - .2 CAN/CGSB-138.2-96, Steel Framework for Chain Link Fence.
 - .3 CAN/CGSB-138.3-96, Installation of Chain Link Fence.
 - .4 CAN/CGSB-138.4-96, Gates for Chain Link Fence.
 - .5 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International).

- .1 CAN/CSA-A23.1/A23.2-00(August 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-A3000-98(R2002), Cementitious Materials Compendium. Includes:
 - .1 CAN/CSA-A23.5-98, Supplementary Cementing Materials
- .4 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .6 The Master Painters Institute (MPI) - Architectural Painting Specification Manual - March 1998.
 - .1 MPI # 18, Organic Zinc Rich Primer.
- .7 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials and Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Coordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
- .4 Shop Drawings to indicate: all dimensions, height of existing, and new fence, barbe wire extension arms, post size, fence grade, plan view and section elevation.

1.4 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers steel, metal and plastic waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .7 Divert unused metal and wiring materials from landfill to metal recycling facility.
- .8 Divert unused concrete materials from landfill to local quarry facility.
- .9 Unused paint or coating material must be disposed of at official hazardous material collections site.
- .10 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .11 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 MATERIALS

- .1 Concrete mixes and materials: in accordance with CAN/CSA-A23.1.
 - .1 Nominal coarse aggregate size: 20-5.
 - .2 Compressive strength: 20 MPa minimum at 28 days.
 - .3 Additives: fly ash to CAN/CSA-A23.5 and ASTM C 618.
- .2 Chain-link fence fabric: to CAN/CGSB-138.1.
 - .1 Heavy style, type, grade, categorie and style as per existing.
 - .2 Height of fabric: as per existing.
- .3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as per existing.
- .4 Top and bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.
 - .1 As per existing.

- .5 Tie wire fasteners: steel wire.
 - .1 As per existing.
- .6 Tension bar: to ASTM A 653/A 653M, 5 x 20 mm minimum galvanized steel, as per existing.
- .7 Gates: to CAN/CGSB-138.4 as per existing.
- .8 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.
 - .1 Tension bar bands: 3 x 20 mm minimum galvanized steel as per existing.
 - .2 Barbed wire extension arms as per existing.
 - .3 Overhang tops to provide waterproof fit, to hold top rails and an outward projection to hold barbed wire overhang.
 - .4 Provide projection with clips or recesses to hold 3 strands of barbed wire spaced 100 mm apart.
 - .5 Projection of approximately 300 mm long to project from fence at 45 degrees above horizontal.
 - .6 Turnbuckles to be drop forged.
- .9 Organic zinc rich coating: to CAN/CGSB-1.181 MPI #18.
- .10 Barbed wire : to ASTM A 121 2 mm diameter galvanized steel wire 4 point barbs 125 mm spacing.
- .11 Barbed wire: to CAN/CGSB-138.2, 2.5 mm diameter.
 - .1 As per existing.
- .12 Grounding rod: 16 mm diameter copperwell rod, 3 m long.

2.3 FINISHES

- .1 Galvanizing:
 - .1 For chain link fabric: to CAN/CGSB-138.1 as per existing.
 - .2 For pipe: 550 g/m² minimum to ASTM A 90.
 - .3 For barbed wire: to ASTM A 121, Class 2 or as per existing.
 - .4 For other fittings: to CAN/CSA-G164.

Part 3 Execution

3.1 GRADING

- .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.
 - .1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 ERECTION OF FENCE

- .1 Erect fence along lines as indicated and to CAN/CGSB-138.3.
- .2 Excavate post holes as per existing.
- .3 Space line posts as per existing, measured parallel to ground surface.
- .4 Space straining posts at equal intervals as per existing if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150 m.
- .5 Install additional straining posts at sharp changes in grade and where directed by Ministerial representative.
- .6 Install corner post where change in alignment exceeds 10 degrees.
- .7 Install end posts at end of fence and at buildings.
 - .1 Install gate posts on both sides of gate openings.
- .8 Place concrete in post holes then embed posts into concrete as per existing.
 - .1 Extend concrete 50 mm above ground level and slope to drain away from posts.
 - .2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .9 Do not install fence fabric until concrete has cured minimum of 5 days.
- .10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface at inclination as indicated.
 - .1 Install braces on both sides of corner and straining posts in similar manner.
- .11 Install overhang tops and caps.
- .12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.
- .13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.
- .14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.
 - .1 Knuckled selvedge at bottom.
 - .2 Twisted selvedge at top.
- .15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals.
 - .1 Give tie wires minimum two twists.

- .16 Install barbed wire strands and clip securely to lugs of each projection.
- .17 Install grounding rods as indicated.

3.3 VERIFICATION

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Wood.
 - .8 Low-emitting materials.

3.4 OPERATIONAL REQUIREMENTS

- .1 Operational requirements in accordance with Section 01 47 19 - Sustainable Requirements: Operation, include:
 - .1 Cleaning materials and schedules.
 - .2 Repair and maintenance materials and instructions.

3.5 TOUCH UP

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas.
 - .1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.6 CLEANING

- .1 Clean and trim areas disturbed by operations.
 - .1 Dispose of surplus material and replace damaged turf with sod as directed by Ministerial representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal procedures.
- .2 Section 01 74 21 – Construction/Demolition waste management and disposal.

1.2 MEASUREMENT PROCEDURES

- .1 Payment for sodding will be made at unit price bid of actual area surface measurements taken and computed by Ministerial representative for:
 - .1 Turf Grass Nursery Sod per square metre.

1.3 SCHEDULING

- .1 Schedule sod laying to coincide with preparation of soil surface.
- .2 Schedule sod installation when frost is not present in ground.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Turf Grass Nursery Sod types:
 - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.
 - .2 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivar.

- .3 Number One Named Cultivars: Nursery Sod grown from certified seed.
- .2 Turf Grass Nursery Sod quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.
- .2 Water:
 - .1 Supplied by Departmental Representative designated source.
- .3 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65 % of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Ministerial representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared surfaces adequately to receive top soil and grass. If discrepancies occur, notify Ministerial representative and do not commence work until instructed by Ministerial representative.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod and plus or minus 15 mm for Commercial Grade Turf Grass Nursery, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.

- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.

3.4 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas as directed by Ministerial representative.
- .4 Maintain sodded areas weed free 95%.
- .5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.5 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by Ministerial representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.6 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Water sodded Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
- .2 Repair and resod dead or bare spots to satisfaction of Ministerial representative.

- .3 Cut grass and remove clippings that will smother grass to height as follows:
 - .1 Turf Grass Nursery Sod:
 - .1 50 mm during normal growing conditions.
 - .2 Cut grass at 2 week intervals, but at intervals so that approximately one third of growth is removed in single cut.

3.7 CLEANING

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

END OF SECTION

1 GENERAL

1.01 ABOVEGROUND FUEL STORAGE

- .1 Material and equipment required for the installation of aboveground petroleum products tanks.

1.02 REFERENCES

- .1 American National Standards Institute (ANSI).
 - .1 ANSI/NFPA-329-99, Handling Underground Releases of Flammable and Combustible Liquids.
 - .2 ANSI/API 650-2000, Welded Steel Tanks for Oil Storage.
- .2 American Petroleum Institute (API).
 - .1 API RP 651-1997, Cathodic Protection of Aboveground Petroleum Storage Tanks.
 - .2 API STD 653R01, Tank Inspection, Repair, Alteration, and Reconstruction.
- .3 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C 618-01, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
- .4 Canadian Council of Ministers of the Environment (CCME).
 - .1 CCME-PN1326-2004, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .5 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .6 Canadian Standards Association (CSA)/CSA International.
 - .1 CAN/CSA-B139-F00, Installation Code for Oil Burning Equipment.
- .7 The Master Painters Institute (MPI).
 - .1 Architectural Painting Specification Manual - September 2002.
- .8 National Research Council/Institute for Research in Construction.
 - .1 NRCC 38727, National Fire Code of Canada (NFC)-1995.
- .9 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .10 Underwriters' Laboratories of Canada (ULC).
 - .1 ULC/ORD-C58.9-97, Secondary Containment Liners for Underground and Aboveground Tanks.
 - .2 ULC/ORD-C58.12-92, Leak Detection Devices (Volumetric Type) for Underground Storage Tanks.

- .3 ULC/ORD-C58.14-92, Leak Detection Devices (Nonvolumetric Type) for Underground Storage Tanks.
- .4 ULC/ORD-C58.15-92, Overfill Protection Devices for Underground Tanks.
- .5 ULC/ORD-C107.4-92, Ducted Flexible Underground Piping Systems for Flammable and Combustible Liquids.
- .6 ULC/ORD-C107.7-93, Glass-Fibre Reinforced Plastic Pipe and Fittings.
- .7 ULC/ORD-C107.19-92, Secondary Containment of Underground Piping.
- .8 ULC/ORD-C142.23-91, Aboveground Waste Oil Tanks.
- .9 ULC-S601-2000, Aboveground Horizontal Shop Fabricated Steel Tanks.
- .10 CAN/ULC-S602-92, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.
- .11 CAN/ULC-S603.1-92, Galvanic Corrosion Protection Systems for Steel Underground Tanks.
- .12 ULC-S630-93, Aboveground Vertical Shop Fabricated Steel Tanks.
- .13 ULC-S652-93, Tank Assemblies for Collection of Used Oil.
- .14 CCME-PN1326-2004, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .15 SOR/2008-197 Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations Canadian Environmental Protection Act.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate details of construction, appurtenances, installation, leakage detection system.
- .3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturers product data to supplement shop drawings.
 - .1 Size, materials and locations of ladders, ladder cages, catwalks and lifting lugs.
 - .2 Tanks capacity.
 - .3 Size and location of fittings.
 - .4 Environmental compliance package accessories.
 - .5 Decals, type size and location.
 - .6 Accessories: provide details and manufacturers product data.
 - .7 Size, material and location of manholes.
 - .8 Size, materials and locations of railings, stairs, ladders and walkways.
 - .9 Finishes.
 - .10 Electronic accessories: provide details and manufacturers product data.
 - .11 Insulation types, locations and RSI values.
 - .12 Identification, name, address and phone numbers of corrosion expert where applicable. Note: Grading drawings to be stamped by licensed corrosion expert.
 - .13 Piping, valves and fittings: type, materials, sizes, piping connection details, valve shut-off type and location, cathodic protection system complete with stamp of corrosion expert indicating that design complies with standards, Federal and Provincial regulations.
 - .14 Spill containment: provide description of methods and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.
 - .15 Tank heaters: provide details and manufacturers product data.

- .16 Thermometers: provide details and manufacturers product data.
 - .17 Anchors: description, material, size and locations.
 - .18 Concrete: type, composition and strength.
 - .19 Footing: Size and location of site pads.
 - .20 Level gauging: type and locations, include:
 - .1 Reporting systems, types of reports and report frequency.
 - .2 Maximum number of tanks to be monitored.
 - .3 Number of probes required and sizes.
 - .4 Provide details and manufacturer's product data.
 - .21 Ancillary devices: provide details and manufacturer's product data.
 - .22 Leak detection system: type and locations, and alarm system.
 - .23 Grounding and bonding: provide details of design, type, materials and locations.
 - .24 Corrosion protection: provide details of design, type, materials and locations.
 - .25 Field-erected AST overfill-protection systems: provide details of design, type, materials and locations.
 - .26 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations.
- .4 Provide maintenance data for tank appurtenances and leakage detection system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 PRODUCTS

2.01 CONVENTIONAL STEEL TANKS

- .1 1 Tank of 15 000 L capacity, dimensions as indicated, 2 single wall.
- .2 Horizontal tanks: ULC-S601, complete with external coat of red oxide primer to MPI #23, with a thickness greater than 5 mil DFT on all surfaces.
- .3 Vertical tanks: ULC-S630, complete with external coat of red oxide primer to MPI #23.
- .4 Manholes: as indicated.
- .5 Railings, stairs, ladders and walkways: as indicated.
- .6 Supports by steel welded saddles factory installed.

2.02 PIPING, VALVES AND FITTINGS

- .1 In accordance with Section 23 11 13 - Facility Fuel Oil Piping.
- .2 Piping located below product level equipped with either manual or automatic shut-off at storage tank.
- .3 Provide means for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.

2.03 LEAKAGE DETECTION SYSTEM

- .1 To ANSI/NFPA-329.
- .2 Leak detector: cable system.
 - .1 Monitoring instrument.
 - .1 Temperature compensated solid state circuitry to continuously monitor leak detection circuits for open circuit or alarm condition. Alarm condition to be indicated by visual indicator light, audible alarm and operation of isolated relay to allow interface with other equipment.
 - .2 Supply voltage: 120 Vac.
 - .3 Module: complete with power-on lamp, alarm lamp, test switch and reset switch.
 - .2 Leak detection cable: twisted pair of 20 AWG woven conductors insulated with hydrocarbon degradable dielectric with loose interlocking aluminum alloy armour.
 - .3 Control cable: twisted pair of 20 AWG woven conductors with 300 V insulation and PVC jacket.

2.04 LINER PENETRATION

- .1 At high point or raised part of dyke floor.
- .2 Sealed.

3 EXECUTION

3.01 INSTALLATION

- .1 Install tanks in accordance with CAN/CSA-B139 and National Fire Code of Canada and manufacturer's recommendations and CCME PN 1326.
- .2 Position tanks using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.
- .3 Install tanks using certified installers.
- .4 Provide certification of installation to Departmental Representative.

3.02 FIELD QUALITY CONTROL

- .1 Test tanks for leaks to requirements of CCME-PN1326 and in presence of authority having jurisdiction.

3.03 TOUCH-UP

- .1 Where coating is damaged, touch-up with original coating material.

3.04 LEVEL GAUGE SYSTEM

- .1 Provide leak and vapour proof caulking at connections.

- .2 Shield capillary and tubing connections in heavy duty 50 mm polyethylene pipe.
- .3 Calibrate system.

3.05 LEAK DETECTION SYSTEM

- .1 Install in accordance with manufacturer's recommendations.

END OF SECTION