KING CITY GENERATOR REPLACEMENT

Project Specifications

Prepared for:
Environment and Climate Change Canada
867 Lakeshore Road
Burlington, ON
L7S 1A1

Prepared by:
Stantec Consulting Ltd.
40-1331 Clyde Ave.
Ottawa, ON
K2C 3G4

0/Ref.: 163302290
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Stantec

DIVISION 01

DIVISION 02

DIVISION 03

DIVISION 07

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 56 00 - Temporary Barriers and Enclosures

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 The Contractor is responsible for completing the following non-comprehensive work covered by the contract documents.

.2 Electrical:

- .1 Replace existing 100kW diesel standby generator at APU building with new 100kW diesel generator complete with new exhaust system, new fuel system and new OEM return fuel cooler (see Fuel Systems).
- .2 Replace existing 400A Automatic Transfer Switch (ATS) in main building electrical room with new 400A ATS.
- .3 Replace two (2) existing conduits from main building to APU Building. New conduits for new generator power wiring and new ATS run signal and damper alarm signals.
- .4 Provide temporary 60kW standby generator and ATS as indicated on drawings to provide temporary standby power for the duration of the construction phase.
- .5 Replace three (3) existing interior light fixtures and one (1) exterior light at APU Building with new LED fixtures.
- .6 Add one (1) new interior LED light fixture at APU Building.
- .7 Provide new Overfill Monitoring Alarm Panel for new fuel tank at APU Building.
- .8 Replace existing combustion air damper actuators with new actuator complete with new Damper Control Panel.
- .9 Provide new recirculating air damper actuator at generator complete with new thermostat.
- .10 Provide a new audio/visual alarm (stack light) in Operations Rooms to indicate generator run status and combustion air damper failure.
- .11 Provide new receptacle as indicated on drawing at APU Building.
- .12 Pay for all necessary permits and fees.
- .13 Provide locate services where trenching for new conduits.

.3 Fuel Systems/Mechanical

- .1 Remove existing fuel storage tank system including all related accessories, tanks, piping and valves.
- .2 Remove existing generator exhaust system and seal wall penetrations to match existing exterior wall on both sides of penetration.
- .3 Remove existing ductwork plenum connecting existing generator radiator cooling exhaust air to building exterior.
- .4 Remove existing window on South wall of APU Building and install new stormproof louver c/w new combustion and ventilation air damper and actuator c/w all required accessories and supports in new opening.
- .5 Provide new 2270L double wall steel vacuum monitored diesel storage tank (CAN/ULC S602) c/w fill, vent, supply and return piping and all required valves, accessories and supports as indicated.

.6 Provide new 100 mm x 150 mm (W x H) cast-in-place concrete curb surrounding diesel storage tank system and generator within APU Building. Seal floor with approved sealant and patch all cracks in floor.

.7 Provide new actuators for existing

.8 Provide new prefabricated ULC-listed exhaust stack for new 100 kW generator c/w supports designed by a seismic engineer and approved by generator silencer and exhaust stack manufacturer. Retain roofing subtrade for all roofing work. Contractor to carry all fees for this Work.

.9 Provide new ductwork plenum, damper, actuator and temperature sensor for generator radiator cooling air recirculation.

.10 Provide new door closer for each side of existing double door.

.4 Structural

.1 Remove existing concrete pad at entrance to APU Building and excavate as indicated.

.2 Provide new reinforced concrete ramp at entrance to APU Building.

1.3 CONTRACT METHOD

.1 Construct Work under stipulated price contract.

1.4 WORK SEQUENCE

.1 Construct Work in stages to accommodate Departmental Representative's continued use of premises during construction.

.2 Maintain fire access/control.

1.5 CONTRACTOR USE OF PREMISES

.1 Limit use of premises to allow:

.1 Departmental Representative occupancy.

.2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.4 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.

.5 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 DEPARTMENTAL REPRESENTATIVE OCCUPANCY

.1 Departmental Representative will occupy premises during entire construction period for execution of normal operations.

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

1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.8 EXISTING 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 with minimum disturbance to tenant operations.

.3 Provide alternative routes for pedestrian 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 tenant systems.

.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.

.11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.9 DOCUMENTS REQUIRED

.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.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 32 16.07- Construction Progress Schedule - Bar (GANTT) Chart.

.2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.2 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.3 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

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

.4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

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

1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.5 EXISTING 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 of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for pedestrian, personnel, and vehicular traffic.

.4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.6 SPECIAL REQUIREMENTS

.1 If directed by Departmental Representative, carry out all noise generating Work Monday to Friday from 18:00 to 07:00 hours only and on statutory holidays, Saturdays, and Sundays.

.2 All shutdowns must be approved by Departmental Representative. Shutdown times are to be coordinated with Departmental Representative after contract award. Departmental Representative will provide 24 hours notice for shutdown availability.

.3 Submit schedule in accordance with Section 01 32 16.07- Construction Progress Schedule - Bar (GANTT) Chart.

.4 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.5 Keep within limits of work and avenues of ingress and egress.

1.7 SECURITY

.1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

.2 Security clearances:

.1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for each individual who will require entering premises.

.2 Obtain requisite clearance, as instructed, for each individual required to enter premises.

1.8 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 52 00 - Construction Facilities.

.4 Section 01 78 00 - Closeout Submittals.

1.2 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work and at the call of Departmental Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.

.4 Make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Produce and distribute minutes within three days after meetings and transmit to meeting participants, Departmental Representative, and affected parties not in attendance.

.8 Representative of Contractor attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Departmental Representative and Contractor will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work: in accordance with Section 01 32 16.07- Construction Progress Schedules - Bar (GANTT) Chart.

.3 Schedule of submission of shop drawings. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.6 Record drawings in accordance with Section 01 78 00 - Closeout Submittals.

.7 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.8 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

.9 Monthly progress claims, administrative procedures, photographs, and hold backs.

.10 Insurances, transcript of policies.

1.4 PROGRESS MEETINGS

.1 During course of Work and monthly.

.2 Contractor and Departmental Representative are to be in attendance.

.3 Notify parties minimum 5 days before meeting

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days of meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

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

.12 Other business.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00- Submittal Procedures.

1.2 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 Milestone: significant event in project, usually completion of major deliverable.

.7 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.

1.3 REQUIREMENTS

.1 Ensure 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 business 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.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit Project Schedule to Departmental Representative within 10 business days of contract award.

.3 Departmental Representative will review and return revised schedules within 5 business days.

.4 Revise impractical schedule and resubmit within 5 business days.

1.5 PROJECT SCHEDULE

.1 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 New slab.
.8 Fuel Systems
.9 Electrical.
.10 Controls.
.11 Heating, Ventilating, and Air Conditioning.
.12 Testing and Commissioning.
.13 Supplied equipment long delivery items.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on biweekly 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.

1.7 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 45 00 - Quality Control

1.2 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, and samples 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.

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Where noted, submit shop drawings stamped and signed by a Professional Engineer licensed in the Province of Ontario, Canada for approval by Departmental Representative.

.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 five (5) business days for review of each submission by Departmental Representative.

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

.10 Submit electronic PDF copies 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.

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

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.12 Submit electronic PDF copies 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.

.13 Submit electronic PDF copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.

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

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

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

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

.17 All PDF submittals shall be unsecured and searchable.

.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, electronic PDF 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 for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

1.4 PHOTOGRAPHIC DOCUMENTATION

.1 Submit original colour digital photographs in .jpg format, highest resolution as directed by Departmental Representative.

.2 Project identification: name and number of project and date stamped.

.3 Photo delivery in file structure organized by date and location/system.

.4 Number of viewpoints: 4 locations.

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

.5 Frequency of photographic documentation: as directed Departmental Representative.

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

1.5 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

.1 For Federal Government projects, Division 2 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 SECTION INCLUDES

.1 Health and safety considerations required to ensure that Contractor shows due diligence towards health and safety on construction sites, and meets the requirements laid out in PWGSC/RPB Departmental Policy DP 073 - Occupational Health and Safety - Construction.

1.3 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 41 00 - Regulatory Requirements.

1.4 REFERENCE STANDARDS

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

.2 National Building Code 2015, Part 8

.3 Province of Ontario

.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended - Updated 2017.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: within five (5) business days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Identify measures necessary to eliminate or mitigate identified risks.

.3 Submit all electronic copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.4 Submit copies of incident and accident reports.

.5 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.

.6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within ten (10) business days. Contractor shall revise plan as appropriate and resubmit plan to Departmental Representative seven (7) days after receipt of comments from the Departmental Representative.

.7 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

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

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

1.6 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

.2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.7 SAFETY ASSESSMENT

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

1.8 MEETINGS

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

1.9 REGULATORY REQUIREMENTS

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

1.10 GENERAL REQUIREMENTS

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

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

1.11 RESPONSIBILITY

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

.2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

.3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.4 Contractor shall clearly identify and secure area of work at all times.

1.12 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.13 UNFORESEEN HAZARDS

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

1.14 POSTING OF DOCUMENTS

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

1.15 CORRECTION OF NON-COMPLIANCE

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

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

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

1.16 DISCIPLINARY ACTION

.1 The Contractor’s disregard and/or lack of compliance to health and safety measures, procedures and policies may lead to disciplinary action by the Departmental Representative.

1.17 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.

1.18 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.19 CONTRACTOR ACCIDENT AND INCIDENT REPORT

.1 The Contractor shall advise the Departmental Representative of any accident, injury, near-miss incident, fire, explosion or chemical spill occurring at the Work site and any visit to the site by a governmental enforcement official.

1.20 WORK STOPPAGE

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

1.21 SITE HEALTH AND SAFETY POLICIES AND DIRECTIVES

.1 Where applicable the Contractor shall comply and follow all prescribed site Health and Safety Policies and Directives including but not limited to the following;

.1 Worker Profile Sheet: The Contractor shall submit to the Departmental Representative a completed Worker Profile Sheet c/w all attachments including

copies of licenses, certificates and permits for supporting qualifications to perform required work for a given project for each individual worker requiring access to the site. The completed Worker Profile Sheets are required for each individual worker prior to working on site. Live work is not permitted.

.2 Emergency and Fire Evacuation Route: The Contractor shall obtain training on procedures of evacuating the site under emergency and/or fire situations. Contractor training and sign-off is required prior to initiating site work.

.3 Ontario Trades Qualifications and Apprenticeship Act: The Contractor shall sign-off confirming that the Trades Qualifications and Apprenticeship Act shall be observed and followed. Contractor sign-off is required prior to initiating site work.

1.22 WORKPLACE SAFETY AND INSURANCE BOARD

.1 Prior to commencing the work, throughout the total performance of the work when requesting payments and prior to receiving final payment, the Contractor shall provide evidence of good standing with Workplace Safety and Insurance Board of Ontario.

1.23 CONSTRUCTION SAFETY MEASURES

.1 Observe and enforce construction safety measures required by Ontario Occupational Health and Safety Acts and Regulations for Construction Projects, Canada Labour Code Part II, Occupational Health and Safety, Workers' Compensation Board and municipal statutes and authorities and site specific Health and Safety Policies and Directives.

.1 In the event of conflict between any provisions of above authorities, the most stringent will apply.

.2 Provide and maintain guardrails, fences, barricades, lights, signs and other devices required for protection of workmen and public in accordance with the requirements of the Canada Labour Code Part II, Occupational Health and Safety, Ontario Occupational Health and Safety Act and Regulations for Construction Projects and Local by-laws. All signs shall be bilingual or CSA universal pictograms.

.3 Ensure the safety of building personnel at all times when performing work.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 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 humans; or degrade environment aesthetically, culturally and/or historically.

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.

.3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.5 Include in Environmental Protection Plan:

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

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

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

.4 Descriptions of environmental protection personnel training program.

.5 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.

.6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.7 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.9 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.10 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.

.11 Waste Water Management Plan identifying methods and procedures for management and 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.

.12 Pesticide treatment plan to be included and updated, as required.

1.3 FIRES

.1 Fires and burning of rubbish on site is not permitted under any circumstances.

.2 Provide supervision, attendance and fire protection measures as directed.

1.4 DRAINAGE

.1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include 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.

.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.

1.5 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2m minimum.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.2 Minimize stripping of topsoil and vegetation.

1.6 POLLUTION CONTROL

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

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

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

1.7 DISCOVERY OF HAZARDOUS MATERIALS OR SITE CONTAMINATION

.1 Should any additional hazardous material be discovered on site, stop work immediately and notify Departmental Representative.

.2 If the Contractor discovers suspected evidence of petroleum impacts to soil and/or groundwater (e.g. discoloration or odours similar to those of petroleum hydrocarbons), the Contractor shall notify the Departmental Representative immediately and proceed as directed by the Departmental Representative.

1.8 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.

.1 Take action only 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.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

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

.2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section references to laws, by laws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction, and other legally enforceable requirements applicable to Work and that are; or become, in force during performance of Work.

1.2 REFERENCES TO REGULATORY REQUIREMENTS

.1 Perform Work in accordance with National Building Code (NBC) 2015 including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Specific design and performance requirements listed in the specifications or indicated on the Drawings may exceed the minimum requirements established by the referenced Building Code; these requirements will govern over the minimum requirements listed in the Building Code

.1 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents including but not limited to:

.1 CSA-B139-15, Installation Code for Oil Burning Equipment.

.2 CSA C22.1-15, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.3 Technical Standards and Safety Act, 2000.

.4 Ontario Electrical Safety Code, 26th Edition, 2015.

.5 SMACNA HVAC Standards.

.6 ULC Standards, as noted.

1.3 HAZARDOUS MATERIAL DISCOVERY

.1 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.4 BUILDING SMOKING ENVIRONMENT

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

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Except as otherwise specified, Constructor shall apply for, obtain, and pay all fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:

.1 Regulatory requirements and fees in force on date of Bid submission,

.2 Any change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission

Part 2 Products

2.1 PERMITS

.1 Building Permit:

.1 Constructor shall apply for, obtain and pay for building permit on behalf of Departmental Representative, and other permits required for Work and its various parts.

.2 Constructor will display building permit and other permits in a conspicuous location at Place of Work.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTION

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

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

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination.

1.2 PROCEDURES

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

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.3 REJECTED WORK

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

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

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

1.4 REPORTS

.1 Submit electronic PDF copies of inspection and test reports to Departmental Representative.

1.5 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.

1.6 EQUIPMENT AND SYSTEMS

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 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.

.2 Indicate use of supplemental or other staging area.

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

.4 Remove from site all such work after use.

1.4 SITE STORAGE/LOADING

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

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

1.5 CONSTRUCTION PARKING

.1 Parking will be permitted on site.

.2 Provide and maintain adequate access to project site.

1.6 SECURITY

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

1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.8 PROTECTION AND MAINTENANCE OF TRAFFIC

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

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

.3 Dust control: adequate to ensure safe operation at all times.

.4 Provide snow removal during period of Work.

1.9 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.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 WEATHER ENCLOSURES

.1 Provide weather tight closures to openings in floors and roofs.

.2 Design enclosures to withstand wind pressure and snow loading.

1.4 FIRE ROUTES

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

1.5 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.6 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

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

1.7 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Conform to reference standards, in whole or in part 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 by Departmental Representative in event of conformance with Contract Documents or by Constructor in event of non-conformance.

1.2 QUALITY

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

.2 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.

1.3 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

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

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

1.4 TRANSPORTATION

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

1.5 MANUFACTURER'S INSTRUCTIONS

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

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative 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.

1.6 QUALITY OF WORK

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

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

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

1.7 CO-ORDINATION

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

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

1.8 CONCEALMENT

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

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

1.9 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.

1.10 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.11 FASTENINGS - EQUIPMENT

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

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.12 PROTECTION OF WORK IN PROGRESS

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

1.13 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 building occupants.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 LOCATION OF EQUIPMENT AND FIXTURES

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

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

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

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

1.3 SUBSURFACE CONDITIONS

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 07 84 00 – Firestopping.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

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

.3 Include in request:

- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Date and time work will be executed.

1.3 MATERIALS

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

1.4 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

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

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.5 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

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

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

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

.8 Contractor shall engage qualified roofing subtrade and carry all costs associated with roofing work to creating new roof opening for exhaust, installation of new exhaust above roof level, installation of supports and all exhaust related work at or above roof level. Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Provide firestopping, sealant and all weatherproofing materials airtight and liquid-tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.

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

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

1.6 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Departmental Representative, Facility Staff, 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 or remove from site as directed by Departmental Representative.

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

.5 Provide on-site all containers necessary for removal of waste.

.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 or as directed by Departmental Representative.

.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.

1.3 FINAL CLEANING

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

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

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

.4 Remove waste products and debris including that caused by Departmental Representative, Facility Staff, or other Contractors.

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

.6 Do not burn waste materials on site.

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

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

.9 Remove stains, spots, marks and dirt from site.

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

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

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

.16 Sweep and wash clean paved areas.

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

.18 Clean roofs, downspouts, and drainage systems.

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

.20 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

1.2 REFERENCE STANDARDS

.1 Ontario Ministry of Environment

.1 Ontario 3 R's Regulations (regulation 102/94) for waste management programs applicable to construction and demolition projects greater than 2,000 m2.

.2 Ontario Environmental Protection Act (EPA)

.1 Regulation 102/94, Waste Audits and Waste Reduction Workplans.

.2 Regulation 103/94, Source Separation Programs.

1.3 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Departmental Representative's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and /or Demolition (CRD) waste to be project generated.

.2 Departmental Representative's waste management goal: to divert a minimum 75 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.

.3 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.

.4 Protect environment and prevent environmental pollution damage.

1.4 DEFINITIONS

.1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.

.2 Class III: non-hazardous waste - construction renovation and demolition waste.

.3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities

.4 Inert Fill: inert waste - exclusively asphalt and concrete.

.5 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.

.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: act of keeping different types of waste materials separate beginning from the point they became waste.

.13 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.

.14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.

.15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities.

1.5 DOCUMENTS

.1 Post and maintain in visible and accessible area at job site, one copy of following documents:

.1 Waste Reduction Workplan (Schedule B).

.2 Waste Source Separation Program.

.3 Schedules completed for project.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:

.1 1 copy and 1 electronic copy of completed Waste Reduction Workplan (WRW): Schedule B.

.2 1 copy and 1 electronic copy of Waste Source Separation Program (WSSP).

.3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by Departmental Representative the following:

.1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.

.2 Updated Waste Materials Tracking form.

.3 Written monthly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.

.4 Submit prior to final payment the following:

.1 Waste Diversion Report, indicating final quantities in tonnes by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials.

.2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of, and destination.

1.7 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.

.2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.

.3 WRW should include but not limited to:

.1 Applicable regulations.

.2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.

.3 Destination of materials identified.

.4 Deconstruction/disassembly techniques and schedules.

.5 Methods to collect, separate, and reduce generated wastes.

.6 Location of waste bins on-site.

.7 Security of on-site stock piles and waste bins.

.8 Protection of personnel, sub-contractors.

.9 Clear labelling of storage areas.

.10 Training plan for contractor and sub-contractors.

.11 Methods to track and report results reliably.

.12 Details on materials handling and removal procedures.

.13 Recycler and reclaimer requirements.

.14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.

.15 Requirements for monitoring on-site wastes management activities.

.4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.5 Post WRW or summary where workers at site are able to review content.

.6 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project.

1.8 WASTE SOURCE SEPARATION PROGRAM (WSSP)

.1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.

.2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.

.3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.5 Locate containers to facilitate deposit of materials without hindering daily operations.

.6 Provide training for all workers in handling and separation of materials for reuse and/or recycling.

.7 Locate separated materials in areas which minimizes material damage.

.8 Clearly and securely label containers to identify types/conditions of materials accepted and assist workers in separating materials accordingly.

.9 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.

.10 On-site sale of salvaged materials is not permitted unless authorized in writing by Departmental Representative and provided that site safety regulations and security requirements are adhered to.

1.9 USE OF SITE AND FACILITIES

.1 Execute Work with minimal interference and disturbance to normal use of premises.

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

1.10 WASTE PROCESSING SITES

.1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.11 QUALITY ASSURANCE

.1 After award of Contract, a mandatory site examination will be held for this Project for Contractor and/or sub-contractors responsible for construction, renovation demolition/deconstruction waste management.

.1 Date, time and location will be arranged by Departmental Representative.

.2 Waste Management Meeting: Waste Management Co-ordinator is to provide an update on status of waste diversion and management activities at each meeting. Written monthly Waste Diversion Report summary to be provided by Waste Management Coordinator.

1.12 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 surface drainage, mechanical and electrical from damage and blockage.

.4 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

.5 Separate and store materials produced during project in designated areas.

.6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.

.1 On-site source separation is recommended.

.2 Remove co-mingled materials to off site processing facility for separation.

.3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

.4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.13 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of oil, mineral spirits, volatile materials, waste, 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 on-site as Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.14 SCHEDULING

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Do Work in compliance with WRW and WSSP.

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

3.2 CLEANING

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

3.3 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 recovered, recyclable, salvaged or reusable material is not permitted.

3.4 WASTE DIVERSION REPORT

.1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:

.1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.

.2 Compare final quantities/percentages diverted with initial projections in Waste Reduction Workplan and explain variances.

.1 Supporting documentation.

.2 Waybills and tracking forms.

.3 Description of issues, resolutions and lessons learned.

3.5 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B

(1) Material Category	(2) Person(s) Respon-sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destina-tion
Wood and Plastics							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Card-board Packaging							
Doors and Windows							
Painted Frames							
Glass							
Wood							
Metal							

Other							

3.6 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule G - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
Ontario	Ministry of Environment and Energy, 135 St. Clair Avenue West Toronto ON M4V 1P5	416-323-4321 800-565-4923	416-323-4682
	Environment Canada Toronto ON	416-734-4494	

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 74 11 - Cleaning.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal

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

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

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

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

.2 Request Departmental Representative inspection.

.2 Departmental Representative Inspection:

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

.2 Contractor to correct Work as directed.

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

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

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, balanced, adjusted, and fully operational.

.4 Certificates required by the Authority having Jurisdiction are submitted.

.5 Operation of systems: demonstrated to Departmental Representative's personnel.

.6 Commissioning/Decommissioning of systems: completed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Departmental Representative requirements.

.7 Work: complete and ready for final inspection.

.4 Final Inspection:

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

.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.3 FINAL CLEANING

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 45 00 - Quality Control

.3 Section 01 71 00 - Examination and Preparation

.4 Section 01 79 00 - Demonstration and Training

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

.6 Section 26 05 00 - Common Work Results - Electrical

1.2 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 warranty requirements and manufacturer's installation instructions.

.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.

.2 Contractor to provide the following documentation:

.1 Letter with Contractor letterhead identifying the storage tanks and associated fuel piping were removed off-site. The letter must include the date of removal, equipment removed, address of the disposal facility, and name of Company who completed the removal (if by others). The letter must be submitted to the Departmental Representative within ten (10) days of the system removal.

.2 Letter with Contractor letterhead identifying that the diesel fuel in the existing storage tanks was removed and disposed off-site in an approved manner. Letter to include the total amount of fuel disposed of from the three storage tanks, the date of disposal, identifying whether any fuel was spilled during the operation (and cleaned up as appropriate) and the disposal location including company name, and the facility name or address.

.3 Letter with Contractor letterhead stating that all new aboveground piping has successfully completed a leak detection test, including the test date, the start and end time, the approximate outside ambient temperature at start and end time, the duration of the test, the test pressure and the testing medium.

.4 Provide the wiring diagrams and conduit layouts to the Departmental Representative prior to final system commissioning for inclusion into as-built drawings.

.5 Red-line mark-up drawings to the Departmental Representative prior to the first product transfer of the new fuel storage tank systems and within two (2) weeks of receiving occupancy. The Contractor must provide the Departmental Representative with mark-up drawings for the production of as-built drawings. As-built drawings must be developed prior to any fuel transfer into the new storage tank (as-built drawings to be completed by others).

.6 Letter with Contractor letterhead stating the systems passed successful commissioning. Letter to be submitted to the Departmental Representative upon successful commissioning of the systems.

.3 Contractor to provide copies of all waste manifests to the Departmental Representative.

.4 Contractor to provide copies of all materials removed from site, including but not limited to: all waste manifests, receipts, and weigh bills.

.5 Pay cost of transportation of submittals.

1.3 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, two final copies of operating and maintenance manuals in English.

.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.

1.4 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, 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 USB key.

1.5 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 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.

.6 Training: refer to Section 01 91 41 – Commissioning: Training.

1.6 SUPPORTING DOCUMENTATION FOR APPENDICES

.1 Include in Project Record Documents supporting documentation relating to installed equipment and system, including:

.1 Mechanical:

.1 Installation permits, inspection certificates.

.2 Piping pressure test certificates.

.3 Ducting leakage test reports.

.4 TAB and PV reports.

.2 Electrical:

.1 Installation permits, inspection certificates.

.2 TAB and PV reports.

.3 Copies of posted instructions.

1.7 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain 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.

1.8 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings and in copy of Project Manual.

.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 Referenced Standards to related shop drawings and modifications.

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

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

.2 Changes made by Addenda and change orders.

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

.7 Provide digital photos, if requested, for site records.

1.9 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 Section 01 91 13 - General Commissioning (Cx) Requirements and Section 26 05 10 - Electrical Testing.

.15 Additional requirements: as specified in individual specification sections.

1.10 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.

1.11 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.

1.12 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.

1.13 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 Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.8 Conduct 9 month warranty inspection, measured from time of acceptance, with 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 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.

.3 Contractor's plans for attendance at 9 month post-construction warranty inspection.

.4 Procedure and status of tagging of equipment covered by extended warranties.

.5 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.

1.14 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.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart

.3 Section 01 91 31 - Commissioning (Cx) Plan.

.4 Section 01 91 33 - Commissioning Forms.

.5 Section 01 91 41 - Commissioning: Training.

1.2 ACRONYMS:

.1 Cx - Commissioning.

.2 EMCS - Energy Monitoring and Control Systems.

.3 O&M - Operation and Maintenance.

.4 PI - Product Information.

.5 PV - Performance Verification.

.6 TAB - Testing, Adjusting and Balancing.

1.3 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 O&M Manual.
- .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 tested 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.

1.4 COMMISSIONING OVERVIEW

.1 For Cx responsibilities refer to Section 01 91 31- Commissioning (Cx) Plan.

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

.3 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.4 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 work 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.

.5 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.

1.5 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.

1.6 PRE-CX REVIEW

.1 Refer to Section 26 32 13.03 - Installation of Electric Power Generating Equipment.

.2 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.

.3 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.4 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.

.5 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.7 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.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than 2 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 2 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 2 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.9 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning (Cx) 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.

1.10 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.

1.11 COMMISSIONING MEETINGS

.1 Convene Cx meetings in accordance with 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 Meeting will be chaired by Contractor, who will record and distribute minutes.

.5 Ensure subcontractors and relevant manufacturer representatives are present at Cx meetings as required.

1.12 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.

1.13 WITNESSING OF STARTING AND TESTING

.1 Provide 7 days notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.14 MANUFACTURER'S INVOLVEMENT

.1 Refer to Section 26 32 13.03 - Installation of Electric Power Generating Equipment.

.2 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.

.3 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.

.4 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.

.5 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.

1.15 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 by Departmental Representative. 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.

.3 Contractor shall be responsible for costs of new equipment and installation of said equipment.

.4 Contractor shall pay for costs of independent testing agency.

1.16 START-UP DOCUMENTATION

.1 Refer to Section 26 32 13.03 - Installation of Electric Power Generating Equipment.

.2 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

.3 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.

1.17 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.

1.18 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.

1.19 START OF COMMISSIONING

.1 Notify Departmental Representative at least 14 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.20 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.

1.21 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under accepted simulated or actual 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.

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 All work must have an OBT1 ten (10) year Comprehensive inspection at end of project. Cost of inspection to be paid by Contractor.

.4 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

.1 It is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems 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 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.

.2 Number and location to be at discretion of Departmental Representative.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT VERIFICATIONS

.1 Pay for 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 Cx 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 Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx, leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx 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 OWNER'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.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 91 33 - Commissioning (Cx) Forms.

.2 Section 01 91 41 - Commissioning (Cx) - Training.

1.2 GENERAL

.1 Provide a fully functional facility:

- .1 Systems, equipment, and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
- .2 Facility users and O & M personnel have been fully trained in aspects of installed systems.
- .3 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx. This document:

- .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
- .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
- .3 Sets out deliverables relating to O&M, process and administration of Cx.
- .4 Describes process of verification of how built works meet design requirements.
- .5 Details steps to produce a complete functional system.
- .6 Acts as a management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
  - .1 Overview of Cx.
  - .2 General description of elements that make up Cx Plan.
  - .3 Process and methodology for successful Cx.

.4 Acronyms:

- .1 Cx - Commissioning.
- .2 EMCS - Energy Monitoring and Control Systems.
- .3 MSDS - Material Safety Data Sheets.
- .4 PI - Product Information.
- .5 PV - Performance Verification.
- .6 TAB - Testing, Adjusting and Balancing.
- .7 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

- .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
- .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.3 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 100% completed within 4 weeks of award of contract to take into account:

- .1 Approved shop drawings and product data.
- .2 Approved changes to contract.
- .3 Contractor's project schedule.
- .4 Cx schedule.
- .5 Contractor's and suppliers' requirements.
- .6 Project construction team's and Cx team's requirements.

.2 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.4 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:

- .1 Changes resulting from Client program modifications.
- .2 Approved design and construction changes.

.2 Revise, refine and update every 3 weeks during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.5 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Contractor’s Commissioning Agent to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.2 Project Manager will select Cx Team consisting of following members:

- .1 Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
  - .1 Review of Cx documentation from operational perspective.
  - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
  - .3 Protection of health, safety and comfort of occupants and O&M personnel.
  - .4 Monitoring of Cx activities, training, development of Cx documentation.
  - .5 Work closely with members of Cx Team.
- .2 Departmental Representative is responsible for:
  - .1 Monitoring operations Cx activities.
  - .2 Certifying accuracy of reported results.
  - .3 Certifying TAB and other tests.
  - .4 Ensuring implementation of final Cx Plan.
- .3 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
  - .1 Organizing Cx.

.2 Testing.
.3 TAB.
.4 Performance of Cx activities.
.5 Performing verification of performance of installed systems and equipment.
.6 Implementation of Training Plan.
.7 Delivery of training and Cx documentation.
.8 Assigning one person as point of contact with Departmental Representative for administrative and coordination purposes.

.4 Contractor's Cx agent implements specified Cx activities including:
.1 Demonstrations.
.2 Training.
.3 Testing.
.4 Preparation, submission of test reports.

.5 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
.1 Receiving facility.
.2 Day-To-Day operation and maintenance of facility.

1.6 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:
.1 Installation contractor/subcontractor:
.1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
.1 To include performance verification.

.3 Client: responsible for intrusion and access security systems.

.4 Ensure that Cx participant:
.1 Could complete work within scheduled time frame.
.2 Is available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
.1 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
.2 Redistribution of electrical services.

.5 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 4 weeks prior to starting date of Cx for review and approval.

1.7 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:
.1 Compile English documentation.
.2 Documentation to be PDF native (not scanned) format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.

.2 Project record documentation.

.3 Inventory of spare parts, special tools and maintenance materials.

.4 Maintenance Management System (CMMS) identification system used.

.5 WHMIS information.

.6 MSDS data sheets.

1.8 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:

.1 Cx as used in this section includes:

.1 Cx of components, equipment, systems, subsystems, and integrated systems.

.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:

.1 Cx Specifications.

.2 Startup, pre-Cx activities and documentation for systems, and equipment.

.3 Completed installation checklists (ICL).

.4 Completed product information (PI) report forms.

.5 Completed performance verification (PV) report forms.

.6 Results of Performance Verification Tests and Inspections.

.7 Description of Cx activities and documentation.

.8 Description of Cx of integrated systems and documentation.

.9 Training Plans.

.10 Cx Reports.

.11 Prescribed activities during warranty period.

.4 Departmental Representative to witness and certify tests and reports of results provided by Contractor.

1.9 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:

.1 Pre-Start-Up inspections: by Contractor to be performed prior to permission for start up. Contractor to rectify deficiencies to Departmental Representative's satisfaction.

.2 Contractor to use approved check lists.

.3 Inform Departmental Representative of these tests and receive approval to proceed prior to commencement of tests. Departmental Representative will monitor some of these pre-start-up inspections.

.4 Include completed documentation with Cx report.

.5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.

.6 Inform DDD of these tests and receive approval to proceed prior to commencement of tests. Departmental Representative will monitor some of these inspections and tests.

.7 Include completed documentation in Cx report.

1.10 START-UP

.1 Start up components, equipment and systems.

.2 Departmental Representative to monitor some of these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of Departmental Representative.

.3 Performance Verification (PV):

.1 Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to Departmental Representative.

.2 Use procedures modified generic procedures to suit project requirements.

.3 Departmental Representative to witness and certify reported results using approved PI and PV forms.

.4 Departmental Representative to approve completed PV reports provided by Contractor.

.5 Departmental Representative reserves right to verify up to 30% of reported results at random.

.6 Failure of randomly selected item shall result in rejection of PV report or report of system start up and testing.

1.11 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx using procedures developed by Contractor and approved by Departmental Representative.

.2 Departmental Representative to monitor Cx activities.

.3 Upon satisfactory completion, Contractor to prepare Cx Report using approved PV forms.

.4 Departmental Representative to witness, certify reported results of all Cx activities completed by Contractor.

.5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.12 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

1.13 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

1.14 PERFORMANCE VERIFICATION (PV) REPORT

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

1.15 CX SCHEDULES

.1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:

.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:

.1 Design criteria, design intents.

.2 Pre-TAB review: 15 days after contract award, and before construction starts.

.3 Cx agents' credentials: 15 days before start of Cx.

.4 Cx procedures: 20 days after award of contract.

.5 Cx Report format: 20 days after contract award.

.6 Discussion of heating/cooling loads for Cx: 15 days before start-up.

.7 Submission of list of instrumentation with relevant certificates: 15 days before start of Cx.

.8 Notification of intention to start TAB: 15 days before start of TAB.

.9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.10 Notification of intention to start Cx: 15 days before start of Cx.

.11 Identification of deferred Cx.

.12 Implementation of training plans.

.13 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Departmental Representative.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

.3 Departmental Representative will monitor progress of Cx against this schedule.

1.16 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Departmental Representative, to Departmental Representative who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.17 TRAINING PLANS

.1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.18 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of Departmental Representative, lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative, supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in O&M Manual at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.2 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the O&M Manual at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative’s approval.

1.3 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms, including those developed by Contractor, are used to record measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative’s approval.

1.4 COMMISSIONING FORMS

.1 Contractor is responsible for creating and completing project-specific Commissioning forms in electronic format complete with specification data. Manufacturer-provided forms can be used, but must be reviewed and approved by Departmental Representative prior to use.

1.5 COMMISSIONING FORM USE

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Contractor develops project-specific Commissioning forms with specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Provide Departmental Representative with originals of completed forms.

.12 Maintain copy on site during start-up, testing and commissioning period.

.13 Forms to be both hard copy and electronic format with typed written results in O&M Manual.

1.6 LANGUAGE

.1 All project documentation shall be provided in English only.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 ADMINISTRATIVE REQUIREMENTS

.1 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.

.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.

1.3 TRAINEES

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

.1 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.

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

1.4 INSTRUCTORS

.1 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.

.2 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.

1.5 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.

1.6 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 TAB and PV Reports.

.3 Departmental Representative will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

1.7 SCHEDULING

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.

.2 Include in Commissioning Schedule time for training.

.3 Deliver training during regular working hours, training sessions to be 3 hours in length.

.4 Training to be completed prior to acceptance of facility.

1.8 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.

1.9 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Functional requirements.

.2 System philosophy, limitations of systems and emergency procedures.

.3 Review of system layout, equipment, components and controls.

.4 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.5 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.

.6 Maintenance and servicing.

.7 Trouble-shooting diagnosis.

.8 Interaction among systems during integrated operation.

.9 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.10 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.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA International

.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015(NBC).

.2 National Fire Code of Canada 2015(NFC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 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.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 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 Perform utility locates in vicinity of work and provide findings to Departmental Representative.

.3 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.4 Notify and obtain approval of utility companies before starting demolition.

.5 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

.1 Protection of In-Place Conditions:

.1 Keep noise, dust, and inconvenience to occupants to minimum.

.2 Protect building systems, services and equipment.

.3 Provide temporary dust screens, covers, railings, supports and other protection as required.

.4 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Demolition/Removal:

.1 Remove items as indicated.

.2 Remove parts of existing building to permit new construction.

.3 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Refer to demolition drawings and specifications for items to be salvaged for reuse.

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Federal Legislation and Guidelines

- .1 Canadian Environmental Protection Act (CEPA), 1999.
- .2 Canadian Environmental Assessment Act (CEAA), 1995.
- .3 Transportation of Dangerous Goods Act (TDGA), 1992.
- .4 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 Government of Ontario Regulations

- .1 Employment Standards Act, 2000, S.O. 2000, c. 41, dated February 20, 2017.
- .2 Environmental Protection Act, R.S.O. 1990, c. E.19, dated March 22, 2017.
- .3 Occupational Health and Safety Act, R.S.O. 1990: O. Reg. 213/91: Construction Projects, dated May 19, 2017.
- .4 Technical Standards and Safety Act, 2000: Ontario Regulation 213/01 – Fuel Oil, dated June 27, 2001.
- .5 Technical Standards and Safety Act, 2000: Ontario Regulation 215/01 – Fuel Industry Certificates, dated May 15, 2015.

.3 CSA International

- .1 CSA-B139-15, Installation Code for Oil Burning Equipment,

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00– Submittal Procedures.

.2 Submit a written report describing in detail the procedures used to remove liquid from the storage tanks, cleaning and removing of the storage tanks, and disposal of liquid residues

- .1 Provide Departmental Representative with copy of vapour removal test results.

.3 Provide verification that materials were disposed of in an environmentally responsible waste disposal facility.

- .1 Provide photographic documentation of the work, including lab and field results, and receipts from the disposal sites for tank and liquid residue.
- .2 Forward affidavit of destruction and proper disposal of aboveground storage tanks to authority having jurisdiction.

.4 Submit a written contingency plan for actions to be taken in the event of a release or emergency including the following:

- .1 Emergency contact numbers;
- .2 Classification of the site land use;
- .3 Plans for covering/containing contaminated soil;
- .4 Plans for site assessment/remediation work; and,
- .5 Reducing the risk to human health.

1.3 QUALITY ASSURANCE

.1 Contractor must be licensed/certified by Provincial authorities having jurisdiction for removal of aboveground storage tanks.

.1 License/certificate, title and number must accompany tender document.

.2 Regulatory Requirements: ensure that all work is performed in compliance with CEPA, CEAA, TDGA and all applicable Provincial regulations to the satisfaction of the Environment and Climate Change Canada and the Technical Standards and Safety Authority (TSSA), including but not limited to Ontario Regulation 213/01, Ontario Regulation 215/01 and Ontario Regulation 216/01.

Part 2 Products

2.1 MATERIALS

.1 Provide all necessary materials, equipment and tarps to prevent contamination of the site, and for safe handling and containment of the fuel and fuel storage tanks.

Part 3 Execution

3.1 PREPARATION, SAFETY AND SECURITY

.1 Provide all necessary personal protective equipment, purging and inert gases, and electrical protection equipment, and verify that equipment is working properly before starting work of this Section.

.2 Conform to or exceed Federal and Provincial codes, local municipal by-laws, by-laws, and codes and regulations of utility authorities having jurisdiction.

.3 Do construction occupational health and safety in accordance with 01 35 29.06 – Health and Safety Requirements.

.4 The storage tank removal must be performed by a person that is approved to do so by TSSA. The Contractor shall provide evidence of the person's valid OBT1 designation prior to any work being performed that involves the removal, altering or installation of fuel storage tanks within this scope of work. Refer to Ontario Regulation 215/01.

.5 Protection:

.1 Meet all safety requirements of Occupational Health and Safety Act, R.S.O. 1990, c. O.1, Employment Standards Act, 2000, S.O. 2000, c. 41 and Regulations for Construction Projects.

.2 De-energize the tank.

.3 Disconnect or remove source of ignition from room.

.4 Open all doors to the room with the tank to allow adequate ventilation. Provide intrinsically safe fans for use in explosive atmospheres to maintain ventilation during procedure.

.5 Provide temporary protection for safe movement of personnel and vehicle traffic.

.6 Cut, braze or weld metal only in monitored areas established to be free of ignitable vapour concentrations.

.7 Ground and bond metal equipment, including tanks and transfer pipes, before operating equipment or transferring flammable materials.

.8 Use non-sparking tools and intrinsically safe electrical equipment.

.6 Smoking is not permitted.

3.2 DRAINING

.1 Keep all doors to the room with the tank open to allow adequate ventilation.

.2 Drain and flush piping into tank.

.3 Pump out liquid from tank

.1 Use explosion proof, air driven or hand pump.

.4 Remove sludge from tank bottom.

.1 Dispose of product and sludge in accordance with local and Provincial regulations using waste disposal carrier licensed by Provincial Environmental Agency having jurisdiction.

3.3 VAPOUR REMOVAL

.1 Purging:

.1 Purge vapours to less than 10% of lower explosive limit (LEL).

.2 Verify with combustible gas metre.

.2 Inverting:

.1 Displace oxygen to levels below necessary to sustain combustion.

.2 Verify with combustible gas metre.

.3 Dry Ice Method:

.1 Add 1.85 g of solid carbon dioxide (dry ice) for each 100 litre capacity.

.2 Crush and distribute ice evenly over greatest area to secure rapid evaporation. Avoid skin contact.

.3 Verify dry ice has vapourized.

.4 Air Method:

.1 Ventilate tank with air using small gas exhauster operated with compressed air or other suitable means.

.2 Air to enter opening at one end and to exit opening at other end to quickly remove vapour.

.3 Test interior of tank to determine when tank is free of vapour.

3.4 TANK AND PIPING REMOVAL

.1 Remove piping and vents.

.2 Verify that the vapour levels in the work area are less than 10% of the LEL. If elevated, use ventilation fan (s) to provide adequate ventilation to the work area.

.3 Following tank clean out and verification that the vapour levels in the tank are acceptable, the tank will have to be cut into manageable pieces to remove from the building, along with all associated tank parts, piping and accessories.

.4 The removed storage tank parts, piping, and accessories shall be digitally photographed with a minimum of 5 photos.

.5 Separate for recycling and place in designated waste containers.

.6 Place materials defined as hazardous or toxic in designated containers.

.7 Handle and dispose of hazardous materials in accordance with the TDGA, Regional and Municipal regulations.

.8 Clearly label location of salvaged material's storage areas and provide barriers and security devices.

3.5 ABOVEGROUND STORAGE TANK REMOVAL

.1 Remove tanks in accordance with applicable Provincial standards and regulations.

.2 Block tanks to prevent movement.

.3 Render tanks unusable for future use.

.4 Dispose of offsite in an environmentally responsible waste disposal facility.

3.6 SITE REMEDIATION

.1 Repair/fill any holes in floor, ceiling, or walls to match surrounding area.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00 - Concrete Reinforcing;

.2 Section 03 30 00 - Cast-in-place Concrete;

.3 Section 03 35 00 - Concrete Finishing.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

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

.2 CAN/CSA O86-14, Engineering design in wood;

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

.4 CSA O153-13, Poplar Plywood.

.5 CSA O437 Series-93 (R2011), Standards for OSB and Waferboard.

.6 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork, National Standard of Canada.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials.

.2 Waste Management and Disposal:

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Divert wood materials from landfill to a recycling facility as approved by Departmental Representative.

.3 Divert plastic materials from landfill to a recycling facility as approved by Departmental Representative.

.4 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

1.4 FORMWORK DESIGN

.1 Every aspect of construction shall at all times comply with various government standards (municipal, provincial and federal standards) that govern the specialized Contractor’s duties regarding worker safety on construction worksites.

1.5 FORMWORK MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series and CSA-O153.

.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 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.

.3 Form release agent: non-toxic, biodegradable and low VOC.

.4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity 24 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.5 Form release oil with chemical properties, containing compounds that react with the free lime in the concrete to form insoluble soaps in the water and prevent the concrete from adhering to the form.

1.6 CONCRETE ACCESSORIES

.1 Auxiliary backer rod for joints: closed cell polyethylene foam, diameters required based on the dimensions shown on the drawings.

.2 Reinforcement steel: according to Section 03 20 00 – Concrete Reinforcing.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 FABRICATION AND ERECTION

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

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

.3 Do not place shores and mud sills on frozen ground.

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

.5 Align form joints and make watertight.

.1 Keep form joints to minimum.

.6 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise.

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

.8 Line forms for following surfaces:

.1 Outer face of outside slabs on grade.
.2 Secure lining taut to formwork to prevent folds.
.3 Pull down lining over edges of formwork panels.
.4 Ensure lining is new and not reused material.
.5 Ensure lining is dry and free of oil when concrete is poured.
.6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
.7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
.8 Cost of textile lining is included in price of concrete for corresponding portion of Work.

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

3.2 REMOVAL OF THE FORMS

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

.1 Seven (7) days for beam soffits, slabs, decks and other structural members.

.2 Remove the formwork when the concrete has reached 70% of its design strength or after the minimum curing period previously specified, whichever of these cases and immediately put back in place the appropriate shoring.

.3 In all cases, the specialized Contractor must take into account the use of special cement types and supplementary cementing materials in concrete for the required length of time prior to removal of the formwork.

.4 Remove the formwork and dismantle the falsework in compliance with Article 6.5.3.5 of the CAN/CSA-A23.1/A23.2 standard, unless otherwise indicated.

.5 Do not disturb or remove the formwork or falsework as long as the concrete has not become strong enough to support its own weight and the load it supports.

.6 Unless otherwise indicated, leave the formwork in place after the concrete has been poured for the following lengths of time:

.1 Slab/Ramp: 7 days (total length of curing time). For exposure class C1 concrete use curing type 2 according to CSA A23.1.

.7 The periods of time specified above represent a cumulative number of hours, days or fractions of days, not necessarily consecutive, during which the ambient temperature is maintained above 10°C.

.8 Depending on weather conditions, the placement of the concrete and curing conditions, the Departmental Representative may specify a minimum period of time that must elapse before the forms are removed from the various pours.

.9 Re-use formwork subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Forming and Accessories;

.2 Section 03 30 00 - Cast-in-place Concrete;

.3 Section 03 35 00 - Concrete Finishing.

1.2 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 CSA International

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

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

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

.3 Reinforcing Steel Institute of Canada (RSIC)

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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 in dry location in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.5 SAMPLING, TRIALS AND INSPECTION

.1 Provide the Departmental Representative with free access to the construction site at all times to enable him to verify, examine and supervise the quality of materials and their manufacture, and if required, take samples for testing, trial and analytical purposes.

.2 Pouring of the concrete is not authorized before the Departmental Representative has inspected and approved the reinforcement in place.

.3 At his request, send the Departmental Representative one (1) copy of the certificates issued by the steel mill attesting to the chemical composition and physical properties of the steel used to manufacture the reinforcement.

.4 Upon request, inform the Departmental Representative regarding the proposed source of supply for the materials to be provided.

Part 2 Products

2.1 MATERIALS

Description	Standards
▪ Weldable high adherence steel reinforcement bars made of low alloy weldable steel, weldable category (W).	CAN/CSA G30.18 Grade 400
▪ Chairs, bar chairs, bar supports, spacers (rustproof)	CSA A23.1/A23.2

2.2 SUBSTITUTES

.1 Obtain the Departmental Representative's written approval to substitute specified bars with bars of different dimensions, and to change spacing, overlapping or bending specified on the drawings.

2.3 FABRICATION

.1 Form the bars at the factory, in compliance with requirements of the CAN/CSA-A23.1/A23.2 standard.

.1 Unless otherwise indicated, forming tolerances are those indicated in Chapter 6 of the Reinforcing Steel Manual of Standard Practice published by the Reinforcing Steel Institute of Canada. Bars that do not comply with these tolerances shall be rejected.

.2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.

2.4 IDENTIFICATION

.1 Clearly identify bar and wire fabric lots to conform to the shop drawings and steel schedules before shipping them to the construction site.

.2 Use factory-labelled reinforcement bars. The label identifies the size, quality and manufacturer of the bar. All unlabelled bars shall be rejected.

Part 3 Execution

3.1 FIELD BENDING

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

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

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

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

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

.4 Ensure cover to reinforcement is maintained during concrete pour.

3.3 MANUFACTURE OF REINFORCEMENT

.1 The manufacture of the reinforcement shall not start until the Departmental Representative has reviewed the drawings of this reinforcement.

.2 Cut and bend the bar in strict compliance with the details shown on the drawings and in accordance with the requirements of the CSA-A23.1/A23.2 standard.

.3 No substitution of the bars shown on the reinforcement drawing shall be allowed without the Departmental Representative’s authorization.

.4 Take every precaution to avoid deforming or dirtying the reinforcement during transportation, handling and storage.

3.4 REINFORCEMENT INSTALLATION

.1 Assemble and install the rebar with care and tie it with black annealed drawn steel wire. Use a pattern and number of supports that comply with Section 6.6.7 of the CAN/CSA-A23.1/A23.2 standard.

.2 Install the rebar and keep it in place during the pouring of the concrete in compliance with the tolerances stipulated in Section 6.6.8 of the CAN/CSA-A23.1/A23.2 standard.

.3 Unless otherwise indicated on the drawings or in Section 3.7 of these specifications, the minimum concrete cover thickness around reinforcement bars is that stipulated for each of the various structural components in Article 6.6.6 of the CAN/CSA A23.1/A23.2 standard.

.4 If required, before placing the rebar in the formwork, remove all excess rust, scale, mud, oil and any other dirt likely to reduce the concrete’s adherence.

.5 Use an adequate number of support bars of the height and rigidity required to ensure all concrete coverage of the rebar complies with the thicknesses stipulated on the drawings and in the standards.

.6 Have the Departmental Representative approve the rebar and its installation, before pouring the concrete. The Departmental Representative shall have 48 hours to approve the steel reinforcement before the concrete is poured.

3.5 OVERLAPS

.1 Overlap the reinforcement as indicated on the drawings and typical details.

.2 Overlap lengths and extension lengths of bars beyond critical points shall comply with the CSA-A23.3 standard. Unless otherwise indicated on the drawings, all overlaps shall be Class B (1.3 Lc), in compliance with Table 17b: overlapping requirements for upper reinforcement in the Reinforcing Steel Institute of Canada's manual of standard practice.

.3 Obtain the Departmental Representative's approval for the locations of reinforcement overlaps other than those shown on the drawings.

3.6 WELDING

.1 Do not weld steel rebar without the Departmental Representative's written authorization.

3.7 REINFORCEMENT COVERAGE

.1 Unless otherwise indicated on the drawings, the reinforcement bars shall be installed at the following specific distances from the surface of the concrete:

Concrete Coverage			
Exposure condition	**Non Exposed**	**Exposed**	**Exposed to chlorine**
Permanent concrete poured directly on ground	-	75 mm	75 mm
1. Slabs, walls and concrete floor joist.	20 mm	40 mm	60 mm
Ratio between the coverage and the nominal diameter of the bars	1	1.5	2
Ratio between the coverage and the maximum measurement of the aggregate.	1	1.5	2

.2 For conditions of the preceding table, the ratio between coverage and the maximum size of the aggregate as well as the ratio between the coverage and the nominal diameter of the bars shall be at least 1.5 for concrete exposed to the ground and weather, and 1.0 for concrete not exposed to the ground and weather.

3.8 STORAGE AND DELIVERY

.1 Deliver the reinforcement and wire fabric to the construction site in clearly identified lots.

.2 Handle the reinforcement and wire fabric with care to avoid deforming them.

.3 As soon as they are delivered on site, properly stack the steel reinforcement and wire fabric on wood skids to protect them against rust and keep them off the ground.

.4 When there is snow; cover all stored steel with a woven tarp to protect it from the weather.

.5 During transportation and handling, use a covering to protect the parts of the bars coated with epoxy and paint.

3.9 CLEANING

.1 In order for the pouring of the concrete to take place, the condition of the reinforcement bars shall comply with Section 6.1.5 of the CAN/CSA A23.1/A23.2 standards.

.2 If required, clean the reinforcement immediately before the concrete is poured.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Forming and Accessories

.2 Section 03 20 00 - Concrete Reinforcing

.3 Section 03 35 00 - Concrete Finishing

1.2 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 C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C494/C494M-10a, Standard Specification for Chemical Admixtures for Concrete.

.3 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.2 CSA International

.1 CSA A23.1-14/A23.2-14, 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).

1.3 ADMINISTRATIVE REQUIREMENTS

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

.1 Ensure site supervisor, Departmental Representative and testing laboratories attend.

.1 Verify project requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

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

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

.4 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 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 Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative.

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

.2 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.

Part 2 Products

2.1 DESIGN CRITERIA

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

2.2 PERFORMANCE CRITERIA

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

.2 The concrete producer assumes responsibility for concrete mix proportioning and performance of the concrete as delivered, and the Contractor assumes responsibility for the concrete in place.

2.3 MATERIALS

.1 Cement: Type MS, MSB or LH (unless otherwise specified) Portland cement that complies with the CSA-A3000 standard. Only use one recognized brand of cement per type of concrete for the entire contract.

.2 Fine aggregate: of normal density, complying with Articles 4.2.3 of the CAN/CSA-A23.1/A23.2 standard. The aggregate may be natural sand or manufactured sand containing at least 20% natural sand.

.3 Coarse aggregate: of normal density, complying with Articles 4.2.3 of the CAN/CSA-A23.1/A23.2 standard. The particles shall be clean, durable and free from dust and harmful material and shall contain less than 20% flat or elongated particles. Loss shall be less than 12% after 5 cycles of the magnesium sulphate soundness test. The Los Angeles abrasion test loss shall be less than 50%. The aggregates shall not contain fine-grained limestone and crystalline limestone. The maximum aggregate size shall be 20 mm, unless otherwise indicated. Subject to the Departmental Representative's approval, a 13 mm maximum aggregate size may be used in certain areas where concrete flow is restricted.

.4 Mixing water: complies with Section 4.2.2 of the CAN/CSA-A23.1/A23.2 standard.

.5 Air-entraining admixture: complies with the ASTM C260 standard.

.6 Chemical and pozzolanic mineral admixtures: comply respectively with the requirements of the ASTM C494/C494M and ASTM C1017/C1017M standards. The use of calcium chloride or admixtures that contain CaCl2 is not allowed. The Departmental Representative must approve accelerators or retarders during hot and cold weather concrete work.

.7 Non-shrink mortar for concrete repairs: pre-mixed Portland cement-based product containing a non-metal aggregate and a plasticizer, capable of achieving at least 35 MPa of compression strength at seven (7) days.

.8 Superplasticizer: complies with requirements of the ASTM C494/C494M standard.

.9 Supplementary Cementing Materials: comply with the CSA-A3000 standard.

.10 Set retarders: comply with the ASTM C494 water-based, low VOC content, solvent-free standard. The set retarder film shall never be exposed to humidity.

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

.1 Compressive strength: 30 MPa at 28 days.

.12 Non-premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 30 MPa at 28 days.

2.4 MIXES

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

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

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

.2 Assume responsibility for the mix of each type of concrete required, while taking into account the requirements described in Section 2.1 of these specifications and the following criteria in compliance with possibility No. 1 presented in Table 5 of the CAN/CSA-A23.1/A23.2 standard.

.1 Types of concrete: normal density concrete

a) Concrete for Slab on grade.

.1 Tested compression strength: 30 MPa at 28 days, unless otherwise indicated on the drawings;

.2 Cement type: GU;

.3 Exposure category (Table No. 1, CSA-A23.1/A23.2): C-1;

.4 Chemical admixtures: that complies with the ASTM C494/C494M standard;

.5 Normal density concrete.

.3 Obtain the Departmental Representative's approval for all admixtures used in concrete mixes (superplasticizers and required air-entrainers or other admixtures needed for any specific purpose, designated by the specialized Contractor). The use of calcium chloride is prohibited.

.4 Provide a sample of the admixture(s) used, at the Departmental Representative's request.

.5 Follow the manufacturer's instructions when using admixtures.

.6 The specialized Contractor is responsible for ensuring the admixtures are compatible with one another and with the materials included in the mix.

.7 Enter the type and quantity of the admixture(s) used on the concrete shipping slip.

.8 The use of an admixture shall never reduce the soundness of the concrete or its ability to withstand freezing and thawing.

2.5 CONCRETE CONTROL

.1 Concrete quality control performed in compliance with the CAN/CSA-A23.1/A23.2 standard by a designated laboratory at the General Contractor's expense.

.2 The concrete's compression strength shall be checked during construction by taking 3 core samples per 75 m^3 poured or at least 3 core samples per pour. The Departmental Representative may ask the laboratory to produce a fourth core sample and let it cure on the construction site as a control sample. A sample shall be crushed on the 7th day; the two other samples shall be crushed on the 28th day.

.3 The cylinders shall be numbered consecutively and the laboratory report shall indicate the exact location of the concrete they represent in the framework, as well as the number of the truck that delivered the concrete.

.4 The laboratory shall measure the concrete slump and air content every time it samples the concrete for strength tests and as often as necessary depending on the type of structure to be built.

.5 Provide a sheltered location on site where the concrete core samples can be stored at an ambient temperature ranging from a minimum of 10°C to a maximum of 25°C before they are shipped to the trial laboratory.

.6 If the core sample test results do not comply with Article 4.4.6.7 of the CAN/CSA A23.1/A23.2 standard, the Departmental Representative may require that Section 4.4.6.8 of the standard be applied.

.7 The specialized Contractor is solely responsible for the all concrete work required to complete the structures as indicated on the drawings or stipulated in the Specifications. All work that

does not meet the requirements of the Specifications, for any reason whatsoever (quality of materials, batching, placement, strength, impermeability, etc.), shall be modified in compliance with the Departmental Representative's requirements, or it shall be completely demolished and rebuilt in compliance with the provisions of the Specifications and drawings, at the specialized Contractor's expense.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Departmental Representative's 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.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

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

.5 Protect previous Work from staining.

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

.7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.

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

3.2 MANUFACTURE AND DELIVERY OF THE CONCRETE

.1 Provide ready-to-use concrete manufactured in a concrete plant, transported and discharged at the site in compliance with Section 5.2 of the CSA-A23.1/A23.2 standard, or provide concrete manufactured on site in compliance with all Section 18 requirements. If the second alternative is chosen, submit the entire procedure to the Departmental Representative for approval.

.2 The manufacturer of the ready-to-use concrete is solely responsible for batching the concrete, and he shall personally, at his expense, take all necessary measures to ensure the quality and uniformity of his product.

.3 Require that the concrete supplier provide a delivery slip for each load of concrete and provide the Departmental Representative with a copy of these slips. The slips shall contain the following information: name and address of the supplier's company, truck number, specialized Contractor's name, project name and location, class of concrete, cumulative

quantity, start of discharge, end of discharge, maximum size of aggregate, slump and air-entrainment required, types of admixtures used, quantity and type of cement and quantity of water.

.4 The addition of water to the mix after the initial batching shall only be carried out in strict adherence with Article 5.2.4.3.2 of the CAN-A23.1/A23.2 standard, but the maximum quantity used shall be 6 l/m3. Submit all anticipated additions to the Departmental Representative for approval and control. Indicate on the delivery slip the quantity of all water added at discharge.

.5 Plan the manufacture of the concrete and schedule the deliveries to the site so that each pour can be performed without any interruptions. Each batch of concrete shall be completely discharged into the forms within two (2) hours of beginning of batching.

.6 Never remix concrete or mortar that has started to set.

.7 The temperature of the concrete at discharge shall be within the range presented in Table 14 of the CSA A23.1/A23.2 standard and shall be controlled according to Article 5.2.4.4 of the same standard. Use all protective measures required for this purpose.

.8 No aluminum component shall be used to batch, transport or place the concrete.

3.3 INSTALLATION / APPLICATION

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

.2 Carry out the consolidation of the concrete using models and sizes of mechanical vibrators approved by the Departmental Representative.

.3 Select an appropriate type and number of vibrators and use them in accordance with Section 7.2.5 of the CSA-A23.1/A23.2 standard.

.4 Lay the concrete without interruption or in layers thick enough that each new layer will bind with the underlying layers before they have hardened enough to form cold joints.

.5 If difficulties arise during pouring, change the concrete formula following the laboratory's directives and use the admixture(s) prescribed by the laboratory, and assume all expenses for this procedure.

3.4 CONCRETE CURING

.1 The concrete shall be cured according to the requirements of Chapter 7.4 of the CSA-A23.1/A23.2 standard.

.2 The concrete shall be cured using two layers of jute kept moist at all times.

.3 Slabs and other unformed surfaces shall be kept moist for a period of at least 7 days.

.4 When the outside temperature exceeds 20°C for mass concrete or otherwise 27°C, keep the forms moist before pouring the concrete and throughout the entire time they remain in place.

.5 In cold weather, water curing ends 12 hours before the end of protection.

.6 Throughout the entire cure, the concrete shall never be under any load and shall be adequately protected against violent shocks, excessive vibration, weather and other disturbances.

3.5 CONCRETE PROTECTION

.1 In hot weather, the concrete shall be protected according to Article 7.4.2.4 of the CAN/CSA-A23.1/A23.2 standard.

.2 Concrete components containing silica fume shall be protected from drying according to Article 7.4.2 of CAN/CSA-A23.1/A23.2 standard.

.3 Other concrete components shall be protected from dry out based on Appendix D – Geotechnical Report of the CAN/CSA A23.1/A23.2 standard.

.4 In cold weather, the concrete shall be protected according to Article 7.4.2.5 of the CAN/CSA-A23.1/A23.2 standard.

3.6 FINISHING OF FORMED SURFACES

.1 Clean and finish the formed surfaces in compliance with Section 7.7.3 of the CAN/CSA-A23.1/A23.2 standard. All surfaces require to be semi-rough formed surfaces in accordance with Article 7.7.3.6 of the CSA-A23.1/A23.2 standard.

.2 Fill the holes left by the form ties in compliance with Section 03 10 00 - Concrete Forming and Accessories of these specifications.

3.7 CONCRETE REPARATION

.1 Remove and replace all damaged or defective concrete with concrete that meets the specifications and requirements of the drawings.

.2 After the forms have been removed, the Departmental Representative shall examine all voids, honeycombs and other defects. If applicable, submit the methods for repairing the voids, honeycombs and other defects to the Departmental Representative for approval. Do not repair any of the surfaces before having received the Departmental Representative's authorization.

.3 Wherever possible, repair formed surfaces as soon as possible after the forms have been removed.

.4 Cover the concrete surfaces with epoxy-based glue before performing concrete or mortar repairs.

.5 The product used shall comply with Paragraph 2.3.7 of this section.

3.8 CUTS, DRILL HOLES AND CUT-OUTS IN HARDENED CONCRETE

.1 Components that have already been poured shall never be cut, drilled or cut-out for any reason whatsoever, unless the Departmental Representative has authorized these procedures.

.2 Any cut, drill hole or cut-out in hardened concrete authorized by the Departmental Representative shall be performed at the specific location, using the exact dimensions he has approved. Use rotary tools that prevent the concrete from shattering.

3.9 TOLERANCES

.1 If the tolerances specified in Article 6.4 of the CSA-A23.1/23.2 standard have not been met during the construction of any component of a structure shown on the drawings, the

Departmental Representative may require that this component be demolished and rebuilt according to the tolerances of said article, at no additional expense to the Departmental Representative.

3.10 ON-SITE QUALITY CONTROL

.1 A testing laboratory designated by the General Contractor shall inspect and test the concrete and its constituents in accordance with the CSA-A23.1/A23.2 and CSA-A283 standards.

.2 The Laboratory shall take additional core samples during cold weather concrete work. These core samples shall be cured on site, under the same conditions as the concrete pours they represent.

.3 Non-destructive concrete trials shall be performed according to the methods described in the CSA-A23.1/A23.2 standard.

.4 The inspection and trials performed by the Laboratory shall not replace or finalize the quality control performed by the Contractor, nor shall they release the Contractor from his contractual obligations in this respect.

3.11 CLEANING

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

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

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

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

.4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

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

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Forming and Accessories;

.2 Section 03 20 00 - Concrete Reinforcing;

.3 Section 03 30 00 - Cast-in-place Concrete.

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA-A23.1-14/A23.2-14 (U2015), Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.

.2 Include application instructions for concrete floor treatment.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Temperature:

.1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.

.2 Moisture:

.1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

.3 Safety:

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.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.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.

.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

2.2 SEALING COMPOUNDS

.1 Surface sealer: to CAN/CGSB-25.20, Type 2 - water based.

.2 Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.3 Surface sealer: acrylic carnauba wax.

.4 Joint sealers two-component, polysulphide-based product with a chemical cure, in compliance with the CAN/CGSB 19.24 Type 2, Class A standard

2.3 MIXES

.1 Mixing ratios in accordance with manufacturer's written instructions.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work and elevations are as recommended by manufacturer's written instructions.

3.2 CONTROL JOINT SAWING

.1 Unless otherwise specified, a maximum of 4 to 12 hours after concreting, use a chain saw suitable for joint control needed on the slab on grade. The maximum distance between control joints in each direction is 4.5 m. Check with the Departmental Representative regarding all joints that are not on the drawings.

.2 Use polysulfide caulking to seal control joints sawn.

.3 Unless otherwise specified, saw control joints as indicated on the plan.

.1 The saw cut should be 6mm wide.

.2 The saw cut must have a 40mm depth where there is no reinforcement. When there are reinforcing bars, the depth of the saw cut must be adjusted to avoid damaging the reinforcing bars.

3.3 CAULKING OF JOINT

.1 Remove dust, loose mortar and other foreign matters and dry the joint surface.

.2 Prepare the surface according to caulking manufacturer's instructions.

.3 Clean the joint to the required depth to install a backer rod. Then apply a coat of sealant as recommended by the manufacturer to the width of the joint.

.4 Apply primer to the mating surfaces and then apply the sealant as recommended by the manufacturer. Clean adjacent surfaces immediately after application.

3.4 FINISHES

.1 Unless otherwise specified, the upper surface of the new ramp shall be broom finished.

3.5 CLEANING

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

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal

3.6 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

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

.1 Material Safety Data Sheets (MSDS).

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S115-11(R2016), Fire Tests of Firestop Systems.

1.2 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1(1) and 9.10.9.6(1)): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 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.

.2 Submit two copies of WHMIS MSDS – Material Safety Data Sheets.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Protection:

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

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating: 3 hour unless otherwise noted.

.2 Service penetration assemblies: systems tested to CAN-ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.

.4 Mechanical pipe insulation: fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 CLEANING

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

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

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.3 Openings and sleeves installed for future use through fire separations.

.4 Around mechanical and electrical assemblies penetrating fire separations.

END OF SECTION

Part 1 General

1.1 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 new work and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 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.

.3 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.

1.2 CLOSEOUT SUBMITTALSS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for new work and equipment.

.1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.2 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.

.3 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.

.4 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.

.5 Approvals:

.1 Submit two (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.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Departmental Representative will provide one (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.

.8 As-built drawings:

.1 Prior to start of final commissioning, 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 final commissioning using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final close-out report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect all equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.1 Develop Waste Reduction Workplan related to Work of this Section.

.2 Packaging Waste Management: remove for reuse by manufacturer and return pallets, crates, padding, and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation of new work.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 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.

3.3 SYSTEM CLEANING

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

3.4 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 - ACTION AND INFORMATIONAL 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.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for recycling and/or reuse 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.

3.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A125-1996(2013)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.

.2 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

.3 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada, 2015 (NPC).

.4 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada for supports serving new generator exhaust.

.3 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.2 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers to withstand seismic events expected within the King City, ON region. Coordinate with Departmental Representative to confirm the type of building/application that shall be adhered to for conformance to applicable seismic requirements.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use hot dipped galvanizing process.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut carbon steel retaining clip.

.1 Rod: 9 mm ULC listed.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, ULC listed, to MSS SP58.

.4 Shop and field-fabricated assemblies:

.1 Steel brackets.

.2 Sway braces for seismic restraint systems.

.5 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.6 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.7 Adjustable clevis: material to MSS SP58, ULC listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP58.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.3 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.5 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.6 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25% of total load.

3.3 HANGER SPACING

.1 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.2 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel
up to 1-1/4	2.4 m
1-1/2	3.0 m
2	3.0 m
2-1/2	3.7 m
3	3.7 m
3-1/2	3.7 m
4	3.7 m
5	4.3 m
6	4.3 m
8	4.3 m
10	4.9 m
12	4.9 m

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

.1 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 - Common Work Results for HVAC.

.2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCE STANDARDS

.1 ASTM International Inc.

.1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C335-10e1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C449/C449M-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.4 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.5 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.6 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-11, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 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" - means "not concealed" as previously defined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

1.5 QUALITY ASSURANCE

.1 Qualifications:

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

1.6 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 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 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, 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 C553 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 C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.3 Aluminum:

.1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Smooth.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

.4 Stainless steel:

.1 Type: 316.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Smooth.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.4 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 C449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.5 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.6 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Canvas adhesive: washable.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on other face both faces of insulation.

.12 Fasteners: 4 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Verification of Conditions: In accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 Pressure test ductwork systems complete, witness and certify.

.3 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and as indicated.

.3 Use two (2) layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum two (2) rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Generator radiator cooling exhaust air duct between generator and louvre	C-1	yes	50

.2 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
Indoor, exposed within mechanical room	CRF/1
Indoor, exposed elsewhere	CRF/2
Outdoor, exposed to precipitation	CRF/3
Outdoor, elsewhere	CRF/4

3.5 CLEANING

.1 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common Work Results for HVAC.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.3 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 THERMOSTATS AND SPACE TEMPERATURE SENSORS (LINE VOLTAGE)

.1 Provide one (1) 120V line voltage, wall-mounted space temperature sensor for controlling generator radiator cooling exhaust air recirculation to recirculate heated air back to room, complete with:

.1 Wall mounting, in slotted type covers having brushed aluminum finish, with guard.

.2 Element 10-50 mm long RTD with ceramic tube or equivalent protection, 0-2k ohm.

.3 Accuracy of plus or minus 0.2 degrees C.

Part 3 Execution

3.1 EXAMINATION

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

3.2 INSTALLATION

.1 Install space temperature sensor as indicated, in accordance with manufacturer's requirements.

.2 Mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

.4 Coordinate installation of line voltage control wiring with Division 26.

.1 Line voltage thermostats and temperature sensors shall be wired by Division 26.

3.3 CLEANING

.1 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common Work Results for HVAC.

.2 Section 33 56 13 - Aboveground Storage Tanks.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME-B16.3-2016, Malleable-Iron Threaded Fittings: Classes 150 and 300.

.2 ASME-B16.9-2012, Factory-Made Wrought Steel Buttwelding Fittings.

.2 ASTM International

.1 ASTM A47/A47M-99(2014), Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 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.

.4 CSA International

.1 CSA B51-14, Boiler, Pressure and Piping Vessel Code.

.2 CSA-B139-15, Installation Code for Oil Burning Equipment.

.5 Government of Ontario Regulations

.1 Technical Standards and Safety Act, 2000: Ontario Regulation 215/01 – Fuel Industry Certificates, dated May 15, 2015.

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

.1 Material Safety Data Sheets (MSDS).

.7 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)

.1 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council Canada (NRC)

.1 National Fire Code of Canada, 2015 (NFC).

.9 Underwriter's Laboratories of Canada (ULC)

.1 ULC S661-10, Standard for Overfill Protection Devices for Flammable and Combustible Liquid Storage Tanks.

.2 ULC S663-11, Standard for Spill Containment Devices for Flammable and Combustible Liquid Aboveground Storage Tanks.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance and operation data for incorporation into manual specified in Section 23 05 00 - Common Work Results for HVAC.

1.5 QUALITY ASSURANCE

.1 Ensure piping is installed by individual certified by TSSA as having a valid OBT1 license as per Ontario Regulation 215/01. The Contractor shall provide evidence of the person's valid OBT1 designation prior to any Work being performed.

1.6 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 - Common Work Results for HVAC.

Part 2 Products

2.1 GENERAL

.1 All components of fuel system shall melt at temperatures greater than 538°C unless:

.1 Device is higher than the bottom of the connected tank and operates under negative pressure or;

.2 The device is directly protected by a fusible link valve rated to less than 177°C with casing rated to greater than 538 °C, and the fusible link valve is located between the tank and the device.

2.2 FILL, VENT AND CARRIER PIPE

.1 Materials as per CSA-B139.

.2 Steel: to ASTM A53/A53M, Schedule 40, continuous weld or electric resistance welded, screwed.

.3 Product-carrying piping: SCH 40 steel, welded or threaded piping.

.4 Fill piping: SCH 40 steel, welded or threaded piping.

.5 Vent pipe: SCH 40 steel, welded piping.

.6 Welding shall be performed by a welder certified through the Technical Standards and Safety Authority (TSSA) using a qualified welding procedure.

.7 All piping exposed to the elements or exterior of building shall be galvanized.

2.3 STEEL PIPE COATING

.1 Apply one coat epoxy primer and two coats epoxy paint.

.2 Primers, Paints, Coating: in accordance with manufacturer's recommendations for surface conditions.

2.4 JOINTING MATERIAL

.1 Screwed fittings: approved petroleum-resistant Teflon tape.

.2 Welded fittings: Socket weld as per Federal and Provincial regulations.

.3 Threaded and welded pipe connections and valves shall have a minimum rating of 1034 kPa and shall meet the applicable approved standard.

.4 Outer casing: shall be exposed wherever possible such that it can be visually inspected regularly for leaks.

2.5 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 A47/A47M.

.4 Nipples: Schedule 40, to ASTM A53/A53M.

2.6 BALL VALVES

.1 ULC listed for petroleum use.

.2 50mm (NPS 2) dia. or less: shall be Class 600, API-607, full or regular port, 3-piece carbon steel body, with 316SS ball and stem, Teflon seats, graphite packing and gaskets, lever handle.

2.7 FUSIBLE LINK SHUTOFF VALVE

.1 Provide one (1) ULC listed for petroleum use fusible link shutoff (fire) valve. Valve to have screwed ends, stainless steel body – S/S Trim, PTFE, fusible link temperature rating 74°C, spring to close. Valve to be sized based on piping size and location. Valve must be acceptable by TSSA and be ULC approved.

2.8 FLEXIBLE FUEL HOSES AT GENERATOR

.1 Shall be ULC listed for petroleum use.

.2 Construction:

.1 Material: stainless steel.

.2 Maximum working pressure: 1 MPa.

.3 Minimum burst pressure: 5.2 MPa.

.4 Service temperature range: -195˚C to 820˚C.

.5 Pressure tested in accordance with CSA B51 and serialized.

.6 Labeled with ULC tag.

.3 Sized to suit new 100 kW standby generator:

.1 Maximum length: 600mm.

.2 Minimum length: twice manufacturer's minimum recommended length for vibration control.

.3 Flexible hose shall have a maximum of 1 bend, and any bends shall be minimum 1.5 times manufacturer's minimum bend radius.

.4 Shall be acceptable by the Technical Standards and Safety Authority for diesel fuel generator application.

2.9 FOOT VALVE

.1 Provide one (1) single poppet foot valve with expansion relief at the bottom of the fuel cooler suction pipe as indicated.

.1 Expansion relief: 172 kPa (25 psi).

.2 Opening pressure: less than 6.9 kPa (1 psi).

.3 Maximum working pressure: 1.38 MPa (200 psi).

.4 Working temperature: -40 °C to 149 °C.

.5 20 mesh inlet screen to mitigate the risk of filter debris from collecting on the seats.

.6 Suitable for petroleum use.

.7 Materials:

.1 Body: 304/316 series stainless steel.

.2 Screen: 304 stainless steel.

.3 Seals: Viton GF.

.8 Size: 12.7mm (1/2”) NPT.

2.10 LABELING

.1 Piping to be labeled with product, flow direction and pipe purpose at intervals not less than 3 m. Lettering to be black, minimum 13 mm in height, on yellow background. Examples of pipe labels include: “DIESEL VENT PIPE”, “DIESEL FILL PIPE”.

.2 Main tank contents and capacity must be labelled on front of outdoor remote spill container and a minimum of 2 sides. Lettering to be black on white background. Lettering size to be a minimum of 25mm on outdoor spill container and a minimum of 75mm on fuel storage tanks.

.1 “DIESEL FUEL”

.2 “2,270 L TOTAL CAPACITY”

.3 All labeling, with the exception of fuel piping labels, shall be black lettering on white background.

2.11 FUEL OIL FILTER

.1 Provide one (1) suitable for petroleum use basket type suction strainer c/w 60 mesh stainless steel screen as indicated.

Part 3 Execution

3.1 APPLICATION

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

3.2 TSSA OBT1 LICENSING

.1 All work involving installing, removing, altering, repairing, testing and servicing the aboveground storage tank system installation including the equipment and accessories essential to its operation must be performed by a person that is approved to do so by TSSA. The Contractor shall provide evidence of the person’s valid OBT1 designation prior to any work being performed that involves the removal, altering or installation of fuel storage tanks within this scope of work.

3.3 FEES, PERMITS AND CERTIFICATES

.1 Pay all fees and obtain all applicable permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

3.4 PIPING

.1 Install fuel oil piping system in accordance with CSA-B139.

.2 Slope piping minimum 1% down in direction of storage tank unless otherwise indicated.

.3 Above ground piping to be protected from physical damage due to impact. Refer to drawings for details.

.4 All threaded piping shall extend a minimum of 50mm beyond floor penetration, 25mm beyond wall penetration before first fitting.

.5 Fill, vent piping:

.1 Main tank vent termination: equipped with ULC-certified weatherproof cap and bird/bug screen.

.6 Piping at tanks:

.1 Suction: terminate 150 mm from bottom of tank with foot valve.

.2 Return: terminate 50 mm from bottom of tank. Drill 6mm hole at top of return line inside tank for anti-syphon protection.

.3 Comply with CSA-B139 requirements for vent piping at tanks.

.4 Fill pipes: install to comply with CSA-B139.

.1 Provide ULC approved spill container with minimum 28 litre capacity in compliance with ULC S663.

.7 Clearly label piping runs in legible form indicating;

.1 Piping product content.

.2 Direction of flow.

.3 Identify transfer points in piping systems to CFA Colour-Symbol System to Mark Equipment and Vehicles for Product Identification

.8 Hangers and Supports

.1 To requirements of CSA-B139 and as below. Adhere to the more stringent requirement.

Pipe size, mm	Maximum Spacing of Supports, m
Horizontal Piping	
≤12.5	1.8
19-25	2.4
32-64	3.0
75-100	4.6
127-203	6.0
>203	7.6
Vertical Piping	
≥32	Every Floor Level

.9 Building Wall Penetrations

.1 To CSA-B139.

.2 All pipe penetrations through building walls must be sleeved with insulation installed in the sleeve-pipe cavity and sealed weather-tight. Refer to drawings for additional requirements.

.3 Sleeves shall protect piping from damage and galvanic action.

3.5 VALVES

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

.2 Install ball valves at branch take-offs, to isolate pieces of equipment and as indicated.

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

.4 No valves are permitted to be installed on any generator return or tank vent pipes.

3.6 OVERFILL AND SPILL PROTECTION

.1 Provide new CAN/ULC-S663 listed, lockable 28 L spill container to be installed on new remote fill pipe in accordance with CSA-B139. Spill container to house the fill pipe connection and come equipped with a weather-tight lockable lid. Spill container shall be equipped with lockable drain valve.

.2 Provide new overfill protection device set to 95% of new tank capacity compatible with intended method of filling. Overfill protection device shall be designed, built and certified to CAN/ULC-S661 with positive shut-off action. Pressure-rated overfill prevention valve to be installed on fill pipe drop tube inside new tank.

.3 Install a ULC approved tamper-proof camlock fitting at the termination of the fill pipe.

3.7 LEAK DETECTION

.1 New tank shall have factory-installed ULC-certified vacuum gauge for leak monitoring.

3.8 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system to CSA-B139 requirements.

.2 Isolate tanks prior to performing piping pressure tests.

.1 Prior to conducting pipe pressure/leak detection test, remove foreign matter and flush piping and equipment using same petroleum product as the one being transported.

.2 Contractor is to provide temporary, flexible fuel-rated hoses to bypass permanent equipment such as pumps, prior to performing flushing.

.3 Following complete installation of piping, hydrostatically test all fuel oil piping at 1-1/2 times the working pressure but at not less than 863 kPa for a period of not less than four (4) hours with a gauge that is capable of measuring up to 1035 kPa using compressed air or nitrogen.

.1 No pressure drop shall be allowed. Test to be witnessed by Departmental Representative using a certified pressure gauge. Caulking of joints shall not be permitted.

.2 Should there be a loss of pressure, soap test all welds and threaded connections, or use a tracer gas with compressed gas as directed by the Departmental Representative.

.4 Pressure test shall be witnessed by Departmental Representative.

.5 Contractor shall provide signed pressure test report to Departmental Representative within three (3) business days of pressure test.

.6 Flush lines with diesel following pressure test.

.7 Dispose of flushing liquids to approval of the Ministry of the Environment and Climate Change and TSSA.

3.9 CLEANING

.1 Clean in accordance with manufacturer's written recommendations, supplemented as follows:

.1 Flush after pressure test with number 2 fuel oil for a minimum of two hours. Clean strainers and filters.

.2 Dispose of fuel oil used for flushing out in accordance with requirements of authority having jurisdiction.

.3 Ensure vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.

.4 Ensure entire installation is approved by authority having jurisdiction.

.2 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 21 05 00 – Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International

.1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 National Fire Protection Association (NFPA)

.1 NFPA 90B-15, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 2007.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure (Pa)	SMACNA Seal Class
500	B
250	B
125	B

.2 Seal classification:

.1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to more stringent of SMACNA and ASHRAE.

.3 Joints: to more stringent of SMACNA and ASHRAE. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to more stringent of SMACNA and ASHRAE.

.3 Hangers: galvanized steel angle with galvanized steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50x50x6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 EXAMINATION

.1 In accordance with Section 21 05 00 – Common Work Results for HVAC.

3.2 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Install breakaway joints in ductwork on sides of fire separation.

.4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA.

3.4 SEALING AND TAPING

.1 Apply sealant in accordance with manufacturer's recommendations and SMACNA.

.2 Bed tape in sealant and recoat with minimum of one (1) coat of sealant to manufacturers recommendations.

3.5 CLEANING

.1 In accordance with Section 21 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.4 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 1.6 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: to match temperature rating. Not less than 90°C.

.4 Hardware:

.1 451 to 1000 mm: piano hinge and minimum two sash locks.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: in accordance with Section 23 05 00 – Common Work Results for HVAC.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Flexible Connections:

- .1 Install in following locations:
  - .1 generator cooling fan exhaust duct connection.
- .2 Length of connection: 100 mm.
- .3 Minimum distance between metal parts when system in operation: 75 mm.
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
  - .1 Ducting on sides of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

3.4 ACCESS DOORS AND VIEWING PANELS

.1 Size:

- .1 450 x 600 mm for servicing entry.

.2 Locations:

- .1 Devices requiring maintenance.
- .2 Required by code.

3.5 CLEANING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common Work Results for HVAC.

.2 Section 23 31 13.01 – Metallic Ductwork – Low Pressure to 500 Pa.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.2 Air Movement and Control Association (ANSI/AMCA) certified ratings program.

.3 AMCA Standard 99-0401-86, Classifications for Spark Resistant Construction

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.4 CLOSEOUT SUBMITTALS

.1 Submit maintenance and operation data for incorporation into manual specified in Section 23 05 00 - Common Work Results for HVAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 ULTRA-LOW LEAKAGE CONTROL DAMPER

.1 Control damper as specified below shall be provided for generator recirculation air damper.

.1 Size: 914 mm (36”) length x 304 mm (12”) width.

.2 Extruded aluminum (6063-T5) damper frame shall not be less than 2.03 mm (0.080”) in thickness. Damper frame shall be 101.6 mm (4”) deep x 25.4 mm (1"), with duct mounting flanges on both sides of frame. Frame to be assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.3 Blades shall be maximum 162.6 mm (6.4") deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 1.52mm (0.06”). Aluminum end caps shall be press fitted to blade ends in order to seal hollow interior and reduce air leakage rates. All blades shall be symmetrically pivoted.

.4 Blade seals shall be extruded silicone, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.

.5 Frame seals shall be extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.6 Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 7/16" (11.11 mm) aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

.7 Hexagonal control shaft shall be 11.11 mm (7/16"). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.

.8 Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage and a Celcon bearing between moving parts to reduce wear and increase longevity. Linkage that consists of metal rubbing metal will not be approved.

.9 Dampers shall be designed for operation in temperatures ranging from -40°C (-40°F) to 100°C (212°F).

.10 Dampers shall be AMCA rated for Leakage Class 1A at 1 in w.g. (0.25 kPa) static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.11 Dampers shall be custom made to required size, with blade stops not exceeding 31.7 mm (1¼") in height. Welded and caulked blade stops shall not be acceptable.

.12 Dampers shall be opposed blade action for generator recirculation air dampers.

.13 Dampers shall be installed in the following manner: Flanged to Duct.

.14 Installation of dampers must be in accordance with manufacturer's current installation guidelines, provided with each damper shipment.

.15 Field supplied intermediate structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. See manufacturer's Aluminum Damper Installation Guidelines.

.16 Provide any fittings, supports and accessories required for a complete installation as recommended by the manufacturer.

2.2 THERMALLY INSULATED DAMPER WITH THERMALLY BROKEN FRAME

.1 Damper as specified below shall be provided for one (1) new generator combustion and ventilation air damper.

.1 Size: 1220 mm (48") height x 914 mm (36") width.

.2 Extruded aluminum (6063-T5) damper frame shall not be less than 2.03 mm (0.080") in thickness. Damper frame shall be 101.6 mm (4") deep x 25.4 mm (1"), with duct mounting flanges on both sides of frame. Frame to be assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.3 Entire frame shall be thermally broken by means of polyurethane resin pockets complete with thermal cuts.

.4 Blades shall be maximum 162.6 mm (6.4") deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 1.52mm (0.06"). Blades shall be internally insulated with expanded polyurethane foam and shall be thermally broken. Complete

blade shall have an insulating factor of R-2.29 and a temperature index of 55 (tested to AAMA 1502.7 Test Method). All blades shall be symmetrically pivoted.

.5 Blade seals shall be extruded silicone, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.

.6 Frame seals shall be extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.7 Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 11.11 mm (7/16") aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

.8 Hexagonal control shaft shall be 11.11 mm (7/16"). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.

.9 Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage and a Celcon bearing between moving parts to reduce wear and increase longevity. Linkage that consists of metal rubbing metal will not be approved.

.10 Dampers shall be designed for operation in temperatures ranging from -40°C (-40°F) to 100°C (212°F).

.11 Dampers shall be AMCA rated for Leakage Class 1A at 0.25 kPa (1 in w.g.) static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.12 Dampers shall be custom made to required size, with blade stops not exceeding 31.7 mm (1¼") in height. The blade stop shall be a continuous and integral part of the head/sill. Welded and caulked blade stops shall not be acceptable.

.13 Dampers shall be parallel blade action.

.14 Dampers shall be Flanged to Duct install type only.

.15 Installation of dampers must be in accordance with manufacturer's current installation guidelines, provided with each damper shipment.

.16 Field supplied intermediate structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width.

.17 Provide blank-off plates to suit new wall opening created by removal of existing window as indicated.

.18 Provide any fittings, supports and accessories required for a complete installation as recommended by the manufacturer.

2.3 10 NM TORQUE DAMPER ACTUATOR, OPEN/CLOSE, 24 VAC/VDC

.1 Damper actuator shall be open/close type, spring return fail-safe open:

.1 Provide three (3) specified damper actuators of this type as indicated: one for each of two (2) existing combustion and ventilation intake air motorized dampers and one for new combustion and ventilation intake air motorized damper inside APU building.

.2 Damper actuator shall be CSA certified and ULC-listed, electric on-off, spring return operation with minimum 10 Nm (90 in-lb) torque rating.

.3 Two (2) SPDT auxiliary switches shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings.

.4 On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter.

.5 Dampers shall have a 95º angle of rotation (adjustable between 35º-95º) and shall be overload protected throughout entire rotation.

.6 Run time:

.1 Motor: <75 seconds.

.2 Spring: <20 seconds between -20°C to 50°C and <60 seconds -30°C.

.7 Housing: NEMA 2, IP54, UL enclosure type 2.

.8 Options: End travel switches must be included.

.9 Power input: 24 VAC/DC.

.10 Provide all mounting accessories as required to adhere to manufacturer's installation instructions.

.11 Electrical connection: two (2) 1m, 18GA appliance cables with ½" conduit connectors.

.12 Rotation direction to suit field installation.

.13 Installation by Division 23. Wiring by Division 26.

.14 Provide any fittings, supports and accessories required for a complete installation as recommended by the manufacturer.

2.4 10NM TORQUE DAMPER ACTUATORS, ON/OFF, 120 VAC

.1 Provide one new damper actuator for generator radiator cooling exhaust air modulating damper. Actuator shall be on/off type and spring return fail-safe close.

.2 Damper actuator shall be CSA certified and ULC-listed, electric on-off, spring return operation with minimum 10 Nm (90 in-lb) torque rating.

.3 Two (2) SPDT auxiliary switches shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings.

.4 Actuators shall be direct coupled to damper frame.

.5 Dampers shall have a 95º angle of rotation (adjustable between 35º-95º) and shall be overload protected throughout entire rotation.

.6 Housing: NEMA 2, IP54, UL enclosure type 2.

.7 Power input: 120 VAC.

.8 Provide all mounting accessories as required to adhere to manufacturer's installation instructions.

.9 Electrical connection: two 1m, 18GA appliance cables with ½" conduit connectors.

.10 Install on horizontal jackshaft in accordance with damper and actuator manufacturer's installation requirement and recommendations. Refer to mechanical drawings and schedules for jackshaft details.

.11 Rotation direction to suit field installation.

.12 Installation by Division 23. Wiring by Division 26.

.13 Provide any fittings, supports and accessories required for a complete installation as recommended by the manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: In accordance with Section 23 05 00 – Common Work Results for HVAC.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's written instructions. Install any fittings, supports and accessories required for a complete installation as recommended by the manufacturer.

.3 Seal multiple damper modules with silicon sealant.

.4 Ensure dampers and actuators are observable and accessible for servicing.

3.3 CLEANING

.1 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 00 – Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.4 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 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.

2.2 STORMPROOF FIXED COMBUSTION AND VENTILATION INTAKE AIR LOUVRE - ALUMINUM

.1 Provide one (1) new 1220 mm (48” H) x 914 mm (36” W) stormproof stationary fixed aluminum louvre for intake air c/w flanged connection as indicated.

.1 Louvre must be licensed to bear the AMCA seal.

.2 Louvre depth shall be 102 mm (4”).

.3 Blades shall be 2.06 mm (0.081”) extruded 6063-T5 aluminum alloy.

.4 Frame shall be 2.06 mm (0.081”) extruded 6063-T5 aluminum alloy.

.5 Blade angle shall be 45°.

.6 Blade centres shall be 124 mm (4.875").

.7 All materials shall be factory finished after assembly with Polyester Power Coat in a colour approved by the Departmental Representative prior to construction.

.2 Frame: flange frame to suit wall opening and the installation of new combustion and ventilation air intake damper.

.3 Construction: all welded construction with exposed joints ground flush and smooth.

.4 Material: extruded aluminum alloy 6063-T5.

.5 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.6 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum with approved caulking slot, integral to unit.

.7 Mullions: continuous line construction with hidden mullions to provide an uninterrupted appearance.

.8 Screen: Louvers shall have removable aluminum wire birdscreen on inside face of louvres in formed U-frame.

.9 Finish: powder coat or baked enamel finish c/w custom colour to match building exterior.

.1 Colour: to Departmental Representative's approval.

.10 Insulated aluminum blank-off panels shall be provided as necessary for the installation of the new louver to suit the new wall opening created by the removal of the existing window.

.1 Insulation thickness: 25.4 mm (1”).

.2 Finish: to match new louvre.

.11 Provide a weather-tight seal between the APU Building exterior wall and the new louvre complete with weatherproof polyurethane foam sealant, or approved equivalent.

.1 Provide caulking, weatherstripping, flashing and any applicable accessories as recommended by the louvre manufacturer for a complete installation.

.12 Ensure that new louvre meets all acoustic requirements as required by applicable codes, regulations and standards set forth by the authority having jurisdiction.

Part 3 Execution

3.1 EXAMINATION

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

3.2 INSTALLATION

.1 Install louvre in accordance with manufacturer's current installation instructions and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

.4 Provide flashing, weatherproofing and caulking as required for a complete installation to suit wall opening as recommended by louvre manufacturer and to the satisfaction of the Departmental Representative.

3.3 CLEANING

.1 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA International

.1 CSA-B139-15, Installation Code for Oil Burning Equipment.

.2 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

.3 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S604-16, Standard for Factory-Built Type A Chimneys.

.4 Government of Ontario Regulations

.1 Technical Standards and Safety Act, 2000: Ontario Regulation 215/01 – Fuel Industry Certificates, dated May 15, 2015.

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

.1 Material Safety Data Sheets (MSDS).

.6 The Ministry of the Environment (Ontario):

.1 Environmental Protection Act, O.Reg. 346/12, Registrations under Part II.2 of the Act – Heating Systems and Standby Power Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Prior to commencing Work related to the new generator exhaust stack under this section, submit Shop Drawings and Product Data for approval clearly indicating the following:

.1 CAD Dimensional Drawing.
.2 Methods of sealing sections.
.3 Methods of expansion.
.4 Details of supports.
.5 Details of thimbles.
.6 Bases/Foundations.
.7 Supports, c/w certification by a seismic Professional Engineer licensed in Ontario in the form of sealed shop drawing(s) approved by manufacturers of generator exhaust silencer and exhaust chimney.
.8 Rain caps.
.9 Drain valves.
.10 Terminations.
.11 Devices and valves.

.2 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CSA B139, CEAA, TDGA, CEPA and applicable Provincial regulations.

.2 All work related to generator exhaust stack shall be completed by a person or persons with valid OBT1 designation through TSSA, with evidence provided to Departmental

Representative prior to proceeding with work. Refer to Ontario Regulation 215/01 – Fuel Industry Certificates.

.3 Certifications:

.1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

1.4 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 PRESSURE CHIMNEY AND BREECHING – GENERATOR EXHAUST

.1 Provide factory assembled, approved generator exhaust as indicated.

.1 The entire chimney exhaust stack shall be pre-fabricated and be ULC-listed to CAN/ULC-S604, rated at a minimum temperature of 540°C for generator exhaust applications and withstand up to 15 kPa positive pressure.

.2 Each prefabricated component shall be supplied with a factory applied ULC label demonstrating a minimum temperature rating of 540°C and a minimum static pressure rating of 15 kPa.

.3 The entire generator exhaust stack system from silencer outlet to termination shall be from the same manufacturer to maintain system ULC rating.

.4 The generator exhaust system provided under this section shall meet or exceed requirements of CSA-B139.

.2 Construction:

.1 Sectional, prefabricated double wall construction with 50 mm fibre insulation with universal flanged inner wall joints and V-bands sealed by manufacturer supplied high temperature sealant. Unidirectional pipe ends and sleeves not acceptable

.2 Inner liner: 20 Ga. type 316 stainless steel.

.3 Outer wall: 24 Ga. Type 316 stainless steel.

.4 The materials and construction of the modular sections and accessories shall be as specified by the terms of the product's ULC listing.

.5 To be designed and installed to be gas tight.

.6 Expansion shall be accommodated through the use of bellows type expansion joints.

.7 Ceramic Fiber insulation between inner and outer pipe shall be 50 mm thick. Clearances to combustible materials shall be as per the more stringent of CSA-B139 and manufacturer's installation instructions and shall have been determined for a continuous operation at temperatures up to 760°C.

.3 Size: as indicated,

.1 Internal diameter: 125 mm.

.2 Chimney flue must terminate at least 1000 mm above where it comes into contact with the roof structure and 600 mm above the highest roof structure within 3000 mm on a horizontal plane perpendicular to the chimney.

.4 Exhaust stack shall be labeled with ULC-listing tag for identification purposes.

.5 An excessive pressure relief valve shall be incorporated as per NFPA 37 and located inside the APU Building as indicated.

.6 This breeching system shall be designed to compensate for all flue gas induced thermal expansions.

.7 The joint assembly shall be a male/female slip-type jointing with flange to flange and V-band assembly. An internal sleeve serves for readily alignment as well as long term joint seal protection from condensate, water and flue gas temperature. Non-slip type joints are not acceptable.

.8 Contractor shall provide all necessary components for a complete exhaust system installation including but not limited to:

- .1 bellows type expansion joints,
- .2 seismic supports certified by a Professional Engineer licensed in Ontario under Contractor's mandate,
- .3 lateral tees,
- .4 base tees,
- .5 vertical and horizontal plate supports,
- .6 guide assemblies, flange adapters,
- .7 cleanout c/w drain,
- .8 roof flashing,
- .9 pitched ventilated roof thimble assembly c/w insulation, weatherproofing and firestopping,
- .10 mitre section termination, and
- .11 pressure relief valve as indicated.
- .12 Venting materials to be located between the appliance outlet and silencer shall be supplied by original generator equipment manufacturer.

.9 Drain connection: at base of stack, draining to a safe location indoors.

.10 Outer seals between sections: to suit application.

.11 Inner seals between sections: to suit application.

.12 The breeching and stack shall be warranted against functional failure due to defects in material and manufacturer's workmanship for a minimum period of 10 years from the date of delivery.

.13 Manufacturer shall provide detailed field assembly drawings showing the actual layout and drawn to scale based on site measurements. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's 15 year warranty and in conjunction with sound engineering practice.

.14 The inner diameter for breeching and stack shall be verified by the manufacturer's computations. The computation shall be technically sound, shall follow ASHRAE calculation methods and incorporate the specific flow characteristics of the inner pipe.

.15 Technical services support: the factory built stack system shall be furnished by a vendor organization which assures design, installation and service coordination and provides in-warranty and post warranty unified responsibility for owner.

.16 Scheduled steel pipe is not acceptable.

2.2 ACCESSORIES AND SUPPORTS

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated.

.2 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA).

.1 The Contractor shall engage a Seismic Engineer licensed in the Province of Ontario to carry out the design of the supports for the proposed generator exhaust including, but not limited to, the new generator exhaust silencer and chimney. The Contractor shall submit sealed shop drawing(s) of the supports for review and approval prior to construction in accordance with the approved schedule of work. The shop drawing(s) for the supports must be approved by the manufacturers of both the approved generator exhaust stack and approved exhaust silencer. The Contractor shall carry all costs associated with designing and providing the generator exhaust chimney supports.

.3 Rain cap (flapper type).

.4 Expansion sleeves with heat resistant caulking, held in place as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 In accordance with Section 23 05 00 – Common Work Results for HVAC.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION - GENERAL

.1 To be installed to serve new 100 kW standby generator and to penetrate existing pitched, combustible roof structure of APU Building in King City, Ontario.

.2 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.3 The stack system shall be installed according to the manufacturer’s installation instructions. The joining of pipe sections must be made using the assembly band, the finishing band and the appropriate sealing material. Wall penetrations shall be suitable for a combustible roof and shall be according to the manufacturer’s detail drawings and installation instructions.

.4 When installed according to the manufacturer’s installation instructions the stack and its supporting system shall resist side loads at least 1.5 times the weight per foot of piping.

.5 Support chimney at bottom, roof and intermediate levels as per manufacturer’s recommendations and as designed by Seismic Engineer licensed in the Province of Ontario.

.6 Install ULC-listed roof thimble at roof penetration. Pack annular space with heat resistant caulking and ensure that roof is made weatherproof.

.7 Suspend breeching at 1.5 m centres and at each joint.

.8 Support new exhaust silencer with hangers so no weight or stress is applied to engine exhaust manifold. Provide engineered seismic supports for entire generator exhaust system, including but not limited the generator exhaust silencer and chimney. Seismic support design drawings shall sealed by a Seismic Engineer licensed in the Province of Ontario. Contractor shall carry all fees associated with this work.

.9 Install flashings on chimneys penetrating roofs, as indicated.

.10 Install rain caps and cleanouts, as indicated.

3.4 CERTIFICATION

.1 The ULC listed generator exhaust stack shall be installed by a certified person only (TSSA-licensed OBT1). Provide OBT1 tag on the installed stacks at the completion of construction.

.2 Stacks installed without a proper installer's tag, signed and dated by a licensed OBT1 will not be accepted. Contractor shall carry all costs associated with providing a complete installation by an OBT1 licensed installer.

3.5 CLEANING

.1 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 11 00 – Summary of Work

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 45 00 – Quality Control

.4 Section 01 74 11 – Cleaning

.5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.6 Section 01 78 00 – Closeout Submittals

.7 Section 26 05 21 – Wires and Cables (0-1000V)

.8 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings

.9 Section 26 05 34 – Conduit, Conduit Fastenings and Conduit Fittings

.10 Section 26 32 13.01 – Power Generation Diesel

.11 Section 26 36 23 – Automatic Transfer Switches

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 0.4-17, Bonding of Electrical Equipment

.3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.4 Ontario Electrical Safety Code, 26th Edition, 2015

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 supplied equipment. Include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide single line electrical diagrams, 600 x 600 mm minimum size, under plexiglass and locate:

.1 Electrical distribution system in main electrical room.

.2 Electrical power generation and distribution systems in power plant rooms.

.4 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.

.2 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 co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 If changes are required, notify Departmental Representative of these changes before they are made.

.5 Certificates:

.1 Provide CSA certified material and equipment.

.2 Where CSA certified equipment is not available, submit such equipment to authority having jurisdiction 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 certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.6 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 5 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

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 new generator and ATS.

.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.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.6 FIREPROOFING

.1 All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

.2 All penetrations made through building structures must be fire stopped with materials and procedures that meet approval of authorities having jurisdiction.

.3 Firestop systems shall be UL Classified to ASTM E814 (UL1479)

1.7 Qualifications

.1 All electrical work shall be carried out by qualified, licensed electricians or by apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentice's program shall be permitted, under the direct supervision of a qualified, licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

1.8 Equipment Substitution

.1 All equipment supplied shall be exactly as specified herein.

1.9 Discrepancies

.1 The drawings and specifications are intended to describe complete working systems including all necessary labour and materials.

Part 2 Products

2.1 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.

2.2 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Factory assemble control panels and component assemblies.

2.3 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 05 21 – Wires and Cables (0 – 1000V) and Section 26 05 34 – Conduit, Conduit Fastenings and Conduit Fittings, respectively.

2.4 WARNING SIGNS

.1 Provide lamicoid Warning Signs to meet requirements of regulation and electrical inspection authority.

.2 Lamicoid Warning Signs: White core with Red face; 3 mm thick plastic engraving sheet.

.3 Lamicoid Warning Signs shall be mechanically fastened by non-corrosive screws or rivets; Tape or adhesive fixings are not acceptable.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

.2 Not more than one conductor shall be terminated at each compression type terminal connection.

.3 Use Copper or Aluminum long barrel compression lug connectors on all #6AWG conductors and larger.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamicoid 3mm thick plastic, black face, white core, mechanically attached with self tapping screws, lettering accurately aligned and engraved into core.

.2 Sizes as follows:

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

.2 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

.3 Allow for minimum of twenty-five (25) letters per nameplate.

.4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.6 Terminal cabinets and pull boxes: indicate system and voltage.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 All grounding conductors shall have a green finish/jacket and shall be used only as a grounding conductor.

.5 Wire Tag:

.1 Wrap around, indelible printed wire markers. Minimum text height: 3 mm.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Provide permanent tags at both ends.

.2 Additional tags shall be required at intermediate locations where conduits & cables pass through concealed section, such as: firestop, conduit, floor.

.3 Cable Tag:

.1 Flexible PVC markers and carrier strip of semi-rigid PVC; K-markers-up to 18 digits.

.4 Cable Designation: The cable shall be labelled at both ends. Additional cable labelling shall be required at intermediate locations where cables pass through concealed sections, such as: firestop, floor, sleeve and conduit.

.1 Power cable: All power cables identifying markers shall indicate the source power and breaker number.

Example 1: 120V Distribution panel DP1102, circuit breaker 7
Cable identification: DP1102.CB7

Example 2: 600V MCC, MCC3, row 5, cell H
Cable identification: MCC3.5H

2.9 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 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.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 and OSEC except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, 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.

3.4 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.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not 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 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power generation 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 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.

.2 Carry out tests in presence of Departmental Representative or Consultant.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL 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.

3.8 SYSTEM STARTUP

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 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 34 –- Conduits, Conduit Fastenings and Conduit Fittings

.5 Section 26 05 43.01 – Installation of Cables in Trenches and Ducts

1.2 REFERENCE STANDARDS

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code, 26th Edition, 2015

1.3 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00 – Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

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

.4 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLP or RWU90 XLPE as indicated.

.3 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon rated at 600 V.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Cross-linked polyethylene XLPE.

.2 Rating: 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride.

.7 Fastenings:

.1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable.

2.3 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket.

.2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: TWH.

.2 Shielding: tape coated with paramagnetic material over each pair.

.3 Overall covering: PVC jackets.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.

.2 Cable Colour Coding: to Section 26 05 00 – Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 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.

.2 In underground ducts in accordance with Section 26 05 43.01 – Installation of Cable in Trenches and Ducts.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by hangers or straps.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 01 78 00 – Closeout Submittals

.5 Section 26 05 00 – Common Work Results Electrical

.6 Section 26 05 21 – Wires and Cables (0-1000V)

1.2 REFERENCE STANDARDS

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International

.1 CSA Z32-15, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

.3 Ontario Electrical Safety Code, 26th Edition, 2015

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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.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 of Ontario, Canada.

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 grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required.

.2 Copper conductor: bare, stranded, soft annealed, size as required.

.3 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.4 Insulated grounding conductors: green, copper conductors, size as required.

.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.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

.13 Ground secondary service pedestals.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 00 – Closeout Submittals

.3 Section 26 05 00 – Common Work Results Electrical

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

.2 Ontario Electrical Safety Code, 26th Edition, 2015

1.3 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 datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.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 of Ontario, Canada.

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 supplied equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat covers.

2.3 CABINETS

.1 Construction: welded sheet steel, hinged door, handle, and catch.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 – Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 00 – Closeout Submittals

.3 Section 26 05 00 – Common Work Results Electrical

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 22nd Edition.

.2 Ontario Electrical Safety Code, 26th Edition, 2015

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 instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.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 of Ontario, Canada.

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 incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.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.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48mm.

.4 102mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 CONDUIT BOXES

.1 Cast aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 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 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 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. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 78 00 – Closeout Submittals

.4 Section 26 05 00 – Common Work Results Electrical

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 18.1-13, Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).

.2 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.

.3 CSA C22.2 No. 211.2-06 (R2016), Rigid PVC (Unplasticized) Conduit.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.2 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 of Ontario, Canada.

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 incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Rigid pvc conduit: to CSA C22.2 No. 211.2.

2.2 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 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18.1, 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.

2.4 FISH CORD

.1 Polypropylene.

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

.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.

.3 Surface mount conduits.

.4 Use electrical metallic tubing (EMT).

.5 Use rigid pvc conduit underground.

.6 Minimum conduit size for lighting and power circuits: 19 mm.

.7 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Mechanically bend steel conduit over 19 mm diameter.

.9 Install fish cord in empty conduits.

.10 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.11 Dry conduits out before installing wire.

3.3 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 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.

3.4 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.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.6 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 26 05 00 – Common Work Results Electrical

1.2 REFERENCE STANDARDS

.1 Insulated Cable Engineers Association, Inc. (ICEA)

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 cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 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 indoors in and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect cables from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MARKERS

.1 Continuous markers: polyethylene underground marker tape with a printed warning.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 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.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Mark cable every 150 m along duct runs and changes in direction.

.2 Mark underground splices.

.3 Continuous cable identification is to be placed halfway between the cable and the finished grade.

.4 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform tests using qualified personnel.

.1 Include 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.

.1 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 1000V 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 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.3 Waste Management: separate waste materials for recycling]in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 01 78 00 – Closeout Submittals

.5 Section 26 05 00 – Common Work Results Electrical

1.2 REFERENCE STANDARDS

.1 CSA International

.1 CSA C22.2 No.42-10 (R2015), General Use Receptacles, Attachment Plugs and Similar Wiring Devices.

.2 CSA C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.111-10 (R2015), General-Use Snap Switches (Bi-national standard, with UL 20).

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 wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

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 wiring devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect grounding equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 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 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Ivory urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.2 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

2.3 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 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 for Electrical.

.2 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.3 Waste Management: separate waste materials for 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 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 01 78 00 – Closeout Submittals

.5 Section 23 11 13 – Facility Fuel-Oil Piping

.6 Section 23 33 15 – Dampers - Operating

.7 Section 23 51 00 – Breeching, Chimneys and Stacks

.8 Section 26 05 00 – Common Work Results Electrical

.9 Section 26 32 13.03 – Installation of Electric Power Generating Equipment

.10 Section 26 36 23 – Automatic Transfer Switches

.11 Section 33 56 13 – Above Ground Fuel Storage Tanks

1.2 REFERENCE STANDARDS

.1 Canadian Environmental Protection Act (CEPA)

.1 CCME PN 1326-2013, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.

.2 CSA International

.1 CSA-B139-15, Installation Code for Oil Burning Equipment.

.3 International Organization for Standardization (ISO)

.1 ISO 3046-1:2002, Reciprocating Internal Combustion Engines - Performance - Part 1: Declarations of Power, Fuel and Lubricating Oil Consumptions, and Test Methods - Additional requirements for engines for general use.

.4 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1-2016, Motors and Generators.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S602-14, Standard for Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.

.6 Technical Standards and Safety Authority (TSSA)

.1 TSSA Act 2000.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit 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 power generators and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada and include:

.1 Engine: make and model, with performance curves.

.2 Alternator: make and model.

.3 Voltage regulator: make, model and type.

.4 Automatic transfer switch: make, model and type.

.5 Manual bypass switch: make and model.

.6 Battery: make, type and capacity.

.7 Battery charger: make, type and model.

.8 Alternator control panel: make and type of meters and controls.

.9 Governor type and model.

.10 Automatic engine room ventilation system.

.11 Cooling air requirements in m3/s.

.12 British standard or DIN rating of engine.

.13 Flow diagrams for:

.1 Diesel fuel.

.2 Cooling air.

.14 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, and total weight.

.15 Continuous full load output of set at 0.8 PF lagging.

.16 Description of set operation including:

.1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.

.2 Manual starting.

.3 Automatic shut down and alarm on:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.6 Alternator over voltage.

.7 Lube oil high temperature.

.8 Over temperature on alternator.

.4 Manual remote emergency stop.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.5 WARRANTY

.1 The complete system including all controls and auxiliaries shall be guaranteed for a period of 60 months or 1500 operating hours, whichever occurs first, from the date of final on-site testing and acceptance, to be free of all defects in workmanship and material.

.2 During the final month prior to expiry of the warranty period, the diesel generator supplier shall provide technical staff on a weekend to conduct an in-depth check out of the system. Carry out full maintenance procedures and replace any components which have failed or have become degraded. Submit a detailed itemized report covering all maintenance carried out.

.3 All repairs made under this warranty including final month maintenance check shall be included in the Tender cost.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance 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.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Include:

.1 2 fuel filter replacement elements.

.2 2 lube oil filter replacement elements.

.3 2 air cleaner filter elements.

.4 2 sets of fuses for control panel.

.5 Special tools for unit servicing.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Generating system consists of:

- .1 Diesel engine.
- .2 Alternator.
- .3 Alternator control panel.
- .4 Automatic transfer equipment.
- .5 Battery charger and battery.
- .6 Automatic engine room ventilation system.
- .7 Fuel supply system.
- .8 Integral return fuel cooler.
- .9 Exhaust system.
- .10 Steel mounting base.

.2 System designed to operate as emergency standby power source.

2.2 DIESEL ENGINE

.1 Diesel engine: to ISO 3046-1.

.2 Turbo charged and after cooled, synchronous speed 1800 rpm.

.3 Capacity:

- .1 Rated continuous power in kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.
  - .1 Under following site conditions:
    - .1 Altitude: 300 m
    - .2 Ambient temperature: +10° to + 40°C
    - .3 Relative humidity: 20 to 60%
- .2 Engine overload capability 110% of continuous output for 1 hour within 12 hours period of continuous operation.

.4 Cooling System:

- .1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side, with ethylene glycol anti-freeze non-sludging above -46 degrees C.
- .2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 degrees C.
- .3 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to Panel F to allow engine to start in room ambient 0 degrees C.
  - .1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from Panel F.

.5 Fuel: Diesel Fuel.

.6 Fuel system: solid injection, mechanical fuel transfer pump, fuel filters and air cleaner, fuel rack solenoid energized when engine running.

.7 Fuel pump: the integral fuel pump shall be self-priming and capable of overcoming the static pressure losses of the proposed fuel oil piping system indicated on the drawings.

.1 The generator's factory-installed, tested and warrantied integral fuel pump shall be capable of delivering a minimum diesel fuel flow rate of 1.84 L/min (0.49 gpm) with a suction pressure of 13.5 kPa (2 psi) and a discharge pressure of 27.5 kPa (4 psi).

.8 Governor: mechanical hydraulic with:

.1 Steady state speed band of plus or minus 0.5%.

.2 Speed regulation no load to full load 5% maximum.

.3 Electronic load sharing type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of plus or minus 0.25%.

.9 Lubrication system:

.1 Pressure lubricated by engine driven pump.

.2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.

.3 Lube oil cooler.

.4 Engine sump drain valve.

.5 Oil level dip-stick.

.10 Starting system:

.1 Positive shift, gear engaging starter 12 or 24V dc.

.2 Cranking limiter to provide three (3) cranking periods of 10s duration, each separated by 5s rest.

.3 Lead acid, 12 or 24V storage battery with sufficient capacity to crank engine for 1 min at 0 degrees C without using more than 25% of ampere hour capacity.

.4 Battery box enclosure coated with acid resistant paint and fabricated from 16 gauge steel with additional 20mm plywood bottom.

.5 Battery charger: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use.

.1 Regulation: plus or minus 1% output for plus or minus 10% input variation.

.2 Equipped with dc voltmeter, dc ammeter and on-off switch.

.3 Minimum charger capacity: 7A.

.11 Vibration isolated engine instrument panel with:

.1 Lube oil pressure gauge.

.2 Lube oil temperature gauge.

.3 Lube oil level gauge.

.4 Coolant temperature gauge.

.5 Coolant level gauge.

.6 Running time meter: non-tamper type.

.12 Guards to protect personnel from hot and moving parts.

.1 Provide a factory mounted metal guard suitably sized to shield operator from direct contact with engine exhaust outlet and turbocharger.

.2 Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

.13 Drip trays:

.1 Drip trays shall be located under all filters, pump glands, and any other location which may be subject to unavoidable dripping.

.2 Provide engine oil drip trays as required, 16 AWG minimum, galvanized steel with a 50mm lip suitable for location on the floor between the vibration isolators. Extend the tray 25mm past the outer perimeter of the engine to protect the floor and be readily movable without disturbing any components.

2.3 ALTERNATOR

.1 Alternator: to NEMA MG1.

.2 Rating: 3 phase, 600/347 V, 3 wire, 100 kW, 60Hz, at 0.8PF, 1800rpm

.3 Output at 40 degrees C ambient:

.1 100% full load continuously.

.4 Construction:

.1 Revolving field, brushless, single bearing.

.2 Drip proof.

.3 Amortisseur windings.

.4 Synchronous type.

.5 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.6 Exciter: synchronous brushless

.7 EEMAC class H insulation on windings.

.5 Platinum resistance temperature transducers embedded in stator winding and connected to alternator control circuitry.

.6 Voltage regulator: thyristor controlled rectifiers with phase controlled sensing circuit:

.1 Unit must be capable of starting, attaining settled voltage and frequency limits (±2%) within 15 seconds.

.2 Stability: 2% maximum voltage variation at any constant load from no load to full load.

.3 Transient: 2 s maximum voltage recovery time with application or removal of 0.8PF full load.

.7 Alternator Output Breaker:

.1 3-pole moulded case circuit breaker with solid neutral to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 Magnetic instantaneous trip elements in circuit breaker to be interchangeable and operate only when value of current reaches setting.

.3 Minimum of 50,000 A symmetrical rms interrupting capacity rating.

.4 One 120VAC/DC, 10A rated customer available form C contact indicating the circuit breaker position.

2.4 CONTROL PANEL

.1 Totally enclosed, mounted on generator.

.2 Instruments:

.1 100% solid state circuitry indicating type 2% accuracy, rectangular face, flush panel mounting:

.1 Voltmeter: ac

.2 Ammeter: ac

.3 Wattmeter: kW

.4 Frequency meter: Hz

.5 kVAR meter

2.5 CONTROLS

.1 Engine start button.

.2 Selector switch: Off-Auto-Manual

.3 Engine emergency stop button

.4 Operator Control Panel and Display:

.1 Dual 4x20 LCD display.

.2 Programmable crank limiter

.3 7-day programmable exerciser

.4 Full system status

.5 Utility monitoring

.6 Low fuel pressure indication

.7 Power Output (kW)

.8 Power factor

.9 kW Hours, total, and last run

.10 Real/Reactive/Apparent power

.11 All phase AC voltage

.12 All phase currents

.13 Oil pressure

.14 Coolant temperature

.15 Coolant level

.16 Engine speed

.17 Battery voltage

.18 Frequency

.19 Date/time fault history (Event Log)

.20 Waterproof/sealed connectors

.21 Audible alarms and shutdowns

.22 Not in Auto (flashing light)

.23 Password parameter adjustment protection

.24 15 channel data logging

.25 Alarms:

.1 Oil Pressure

.2 Coolant temperature
.3 Coolant level
.4 Low fuel pressure
.5 Engine speed (overspeed)
.6 Battery voltage
.7 Alarms and warnings time and date stamped
.8 Alarms and warnings spelled out (no alarm codes)

2.6 AUTOMATIC TRANSFER SWITCH

.1 See section 26 36 23 – Automatic Transfer Switches.

2.7 STEEL MOUNTING BASE

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.

.1 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.3 Sound insulation pads for installation between isolators and concrete base.

2.8 EXHAUST SYSTEM

.1 Refer to Section 23 51 00 - Breeching, Chimneys and Stacks.

.2 Provide ULC-listed heavy duty residential-type horizontally mounted exhaust silencer in accordance with manufacturer's written instructions.

.1 Provide written confirmation from generator manufacturer to Departmental Representative of silencer compliance with generator exhaust requirements and applicable Codes and Regulations regarding noise pollution. Do not proceed with generator exhaust-related work until confirmation from generator manufacturer has been approved by Departmental Representative.

.3 Provide all fittings and accessories as per manufacturer's written installation instructions.

.4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.

2.9 FUEL SYSTEM

.1 In accordance with Section 23 11 13 – Facility Fuel-Oil Piping and Section 33 56 13 – Above Ground Storage Tanks.

.2 The original equipment manufacturer shall provide an integral return fuel cooler that is factory installed, tested & warrantied with the generator prior to delivery to site.

.3 The factory testing of the OEM return fuel cooler must explicitly demonstrate that the temperature of the fuel returning from the generator is < 38°C and a copy of the factory testing shall be provided to the Departmental Representative prior to approval.

2.10 COOLING AIR SYSTEM

.1 Engine ventilating system:

.1 Recirculating damper assembly with modulating damper actuator, as indicated. Refer to Section 23 33 15 – Dampers - Operating.

.2 Cold air inlet damper assembly with modulating motor, as indicated and as per manufacturer's installation instructions.

.3 Modulating thermostat.

.4 Replaceable air intake filters.

2.11 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Control panel:

.1 Size 5 nameplates for controls including alternator breakers and program selector switch.

.2 Size nameplates for meters, alarms, indicating lights and minor controls.

2.12 FABRICATION

.1 Shop assemble generating unit including:

.1 Base.

.2 Engine and radiator.

.3 Alternator.

.4 Control panel.

.5 Battery and charger.

2.13 FINISHES

.1 Engine and alternator: manufacturer's standard colour

.2 Exhaust and inlet air hoods: international orange.

.3 Other ducts and racks grey.

.4 Supply 0.25 L of grey touch-up enamel and touch-up enamel to match engine color.

2.14 SOURCE QUALITY CONTROL

.1 Factory test generator set including engine, alternator, control panels, transfer switch and accessories in presence of Departmental Representative.

.2 Notify Departmental Representative 10 days in advance of date of factory test.

.3 Test procedure:

.1 Prepare FAT blank forms and check sheet with spaces to record data and at top of first sheet record:

.1 Date.

.2 Generator set serial no.

.3 Engine, make, model, serial no.

.4 Alternator, make, model, serial no.

.5 Voltage regulator, make and model.

.6 Rating of generator set, kW, kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.3 Departmental Representative's signature on completed forms to indicate concurrence in results of test.

.4 Provide completed FAT form for review by Departmental Representative prior to Site Acceptance Testing of unit.

.4 Factory Acceptance Tests (FATs):

.1 With 100% rated load, operate set for 24 hours, taking readings at 30 minute intervals, and record following:

.1 Time of reading.
.2 Running time.
.3 Ambient temp in degrees C.
.4 Lube oil pressure in kPa.
.5 Lube oil temp in degrees C.
.6 Engine coolant temp in degrees C.
.7 Exhaust stack temp in degrees C.
.8 Alternator voltage: phase 1, 2, 3.
.9 Alternator current: phase 1, 2, 3.
.10 Power in kW.
.11 Frequency in Hz.
.12 Power Factor.
.13 Battery charger current in A.
.14 Battery voltage.
.15 Alternator cooling air outlet temp.

.2 After completion of 24 hours run, demonstrate following shut down devices and alarms:

.1 Overcranking.
.2 Overspeed.
.3 High engine temp.
.4 Low lube oil pressure.
.5 Short circuit.
.6 Alternator over voltage.
.7 Low battery voltage, or no battery charge.
.8 Manual remote emergency stop.
.9 High alternator temperature.

.3 Next install a digital chart recorder to record frequency and voltage variations during load switching procedures. Each load change delayed until steady state conditions exist. Switching increments to include:

.1 No load to full load to no load.
.2 No load to 70% load to no load.
.3 No load to 20% load to no load.
.4 20% load to 40% load to no load.
.5 40% load to 60% load to no load.
.6 60% load to 80% load to no load.

.5 Demonstrate:

.1 Automatic starting of set and automatic transfer of load on failure of normal power.

.2 Automatic shut down of engine on resumption of normal power.

.3 That battery charger reverts to high rate charge after cranking.

.6 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

.7 Provide and pay for all necessary fuel to perform FAT test, as described above.

Part 3 Execution

3.1 INSTALLATION

.1 Locate generating unit and install per section 26 32 13.03 – Installation of Electric Power Generating Equipment.

.2 Install fuel supply system as indicated in CSA-B139.

.3 Install ventilating air duct system as indicated.

.4 Pipe muffler drains to safe location indoors, as approved by Departmental Representative.

.5 Complete wiring and interconnections as indicated.

.6 Start generating set and test to ensure correct performance of components.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform tests in accordance with Section 26 32 13.03 – Installation of Electric Power Generating Equipment.

.3 Notify Departmental Representative 10 working days in advance of test date.

.4 Provide fuel for testing and leave full tanks on acceptance.

.5 Demonstrate:

.1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.

.2 Unit start and shut down on "Manual" control

.3 Unit start and transfer on "Test" control.

.4 Unit start on "Engine start" control.

.5 Operation of automatic alarms and shut down devices.

.6 Run unit on station load for minimum period of 4 hours.

.7 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Divert unused batteries from landfill to battery recycling facility.

.3 Divert unused lubricating oil materials from landfill to oil recycling facility.

.4 Divert unused antifreeze from landfill to antifreeze recycling facility.

.5 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

3.4 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

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 01 91 13 – General Commissioning (Cx) Requirements

.5 Section 23 11 13 – Facility Fuel-Oil Piping

.6 Section 23 51 00 – Breeching, Chimneys and Stacks

.7 Section 26 05 00 – Common Work Results Electrical

.8 Section 26 32 13.01 – Power Generating Diesel

.9 Section 33 56 13 – Above Ground Fuel Storage Tanks

1.2 PAYMENT

.1 Submit payment for services of qualified diesel electric technician.

1.3 REFERENCE STANDARDS

.1 CSA International

.1 CSA B139-15, Installation Code for Oil-Burning Equipment.

.2 CSA C282-15, Emergency Electrical Power Supply for Buildings.

.2 Underwriter’s Laboratories of Canada (ULC)

1.4 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 generating equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit verification of diesel electric technician qualification.

.4 Submit commissioning report.

1.5 QUALIFICATIONS

.1 Use qualified diesel electric technician.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Arrange and pay for a certified rigging company to store the equipment, transport the equipment to site, and set the equipment into final location.

Part 2 Products

2.1 MATERIALS

.1 Include materials as follows:

- .1 Conduits and boxes as required.
- .2 Fuel lines and fittings as required.
- .3 ULC automatic fire shut-off valve.
- .4 Primary fuel filter/water separator.
- .5 Insulation for exhaust system.
- .6 Electrical components as indicated.
- .7 Wiring material.
- .8 Antifreeze, ethylene glycol.
- .9 Diesel fuel; storage tank initial fill, plus top-up after testing.
- .10 Manual IPU bypass switch.
- .11 Wiring and materials, including necessary conduits and fittings for making connections.
- .12 The power circuit cables shall be as indicated on contract drawings.
- .13 The control circuit cables shall be as indicated on contract drawings.
- .14 Electronic governor control cable shall be minimum size No. 18 stranded copper conductor, shielded complete with drain wire and overall PVC jacket.
- .15 Battery cable shall be welding cable type, extra flexible, rope stranded copper conductor with neoprene oil-resistant insulation, sized to limit voltage drop to 5% at time of peak load.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for generating equipment installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 LOCATING AND MOUNTING

.1 Locate unit as indicated.

.2 Fit and adjust isolators in accordance with manufacturer's installation and adjustment instruction bulletin contained in unit manual.

.3 Do not bolt housings to foundation if isolator housing feet are equipped with 6 mm rubber sound pads.

3.3 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.

3.4 FUEL SUPPLY SYSTEM

.1 Refer to Section 23 11 13 – Facility Fuel-Oil Piping.

3.5 BATTERIES AND CHARGER

.1 For dry charged batteries, activate in accordance with manufacturer's instructions manual prior to installation.

.2 For wet batteries, inspect individually each battery cell and check electrolyte level.

.1 Check charge condition by measuring temperature and specific gravity of electrolyte.

.2 Consult manufacturer's instructions for recommended readings.

.3 If readings are lower, give batteries freshening charge until readings are reached.

.3 Locate batteries as indicated and ensure batteries are accessible for service.

.1 Run and protect cables to starting motor using cables supplied with unit.

.4 Install battery charger on wall, adjacent to batteries and make connection to batteries.

.5 Clean connections and tighten securely.

.6 Install removable plexiglass cover on batteries.

3.6 EXHAUST SYSTEM

.1 In accordance with Section 23 51 00 - Breeching, Chimneys and Stacks.

.2 Support silencer with hangers so no weight or stress is applied to engine exhaust manifold or turbocharger.

.3 Provide ULC-approved OEM flexible exhaust connectors between silencer and manifold.

3.7 COOLING AND VENTILATION

.1 Install air outlet and inlet louvres and hoods in their respective openings.

.2 Install louvre motors and linkages, adjust to ensure louvres are tight in closed position and give free damper movements from fully closed to fully open.

.3 Where canvas boot is not provided, maintain 13 mm clearance between radiator and air outlet duct.

.4 Mount thermostat as indicated.

.5 Install conduits and junction boxes and make connections from louvre motors to thermostat and to 120/24 V AC transformer in panel.

.6 Fill engine radiator with water/ethylene glycol antifreeze mix good for -40 degrees C.

3.8 CONTROL AND TRANSFER PANEL

.1 Make control and power circuit connections as indicated.

.2 Identify cables at both ends.

.3 Tag with slip-on wire maker, each wire end with number corresponding to number in panel.

.4 Make terminations with self-insulated terminals of flanged fork or ring type.

3.9 ADDITIONAL WORKS

.1 Complete any additional work as instructed by Departmental Representative to:

.1 Ensure equipment is safe to operate.

.2 Provide complete and operating system.

3.10 FIELD QUALITY CONTROL

.1 Qualified diesel electric technician to: inspect and verify that installation of interruptible power unit is acceptable and complete. Provide inspection report to the Departmental Representative.

.2 Commissioning: site commissioning of diesel electric generator unit by qualified diesel electric technician in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Develop and submit commissioning report including time delay settings, operational set points and adjustment ranges.

3.11 SYSTEM STARTUP

.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.

.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 Confirm 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 points.

.8 Check and tighten properly nuts, bolts.

.9 Confirm 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 confirm 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 "test control".

.3 Unit cranking, start, and shutdown by means of engine-mounted key switch.

.4 Run unit on full load for minimum period of 4 hours to show load-carrying capability, stability of voltage and frequency, and satisfactory performance of engine ventilating system to provide adequate cooling, exhaust system.

.5 Every 1/2 hour carry out and record readings on Test Chart.

.17 Perform additional tests as required by Departmental Representative to confirm unit is operating satisfactorily.

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 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 DEMONSTRATION AND TRAINING

.1 As directed by Departmental Representative carry out demonstrations of a complete interruptible power unit.

.2 Deliver familiarization training of operating and maintenance staff.

.1 Include instruction to site operation and maintenance staff for proper care, operation, and maintenance of equipment.

.2 Maintain services for such period, and for as many visits as necessary to put equipment in operation, and confirm that operating personnel are conversant with aspects of its care and operation.

.3 Include fuel required for performing diesel-generator site test and top-up after acceptance test completion.

3.14 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect fuel lines from mechanical damage.

.3 Repair damage to adjacent materials caused by electric power generating equipment installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 74 11 – Cleaning

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.4 Section 01 78 00 – Closeout Submittals

.5 Section 26 05 00 – Common Work Results Electrical

.6 Section 26 05 13.01 – Power Generation Diesel

.7 Section 26 32 13.03 – Installation of Electric Power Generating Equipment

1.2 REFERENCE STANDARDS

.1 CSA International

.1 CSA C22.2 No.5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, NMX-J-266-ANCE-2016).

.2 CSA C22.2 No.178.1-14, Transfer switch equipment (Tri-national standard, with NMX-J-672 ANCE and UL 1008).

.3 CAN/CSA C60044-8-07 (R2016), Instrument Transformers - Part 8: Electronic Current Transformers (Adopted IEC 60044-8:2002, first edition, 2002-07, with Canadian deviations).

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

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 transfer switches and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.1 Indicate on drawings:

.1 Make, model and type.

.2 Load classification:

.1 Tungsten lamp load: kW

.2 Ballast lamp load: kW

.3 Motor load: kW

.4 Restricted use: resistance and general loads, 0.8 pf or higher: kW

.3 Single line diagram showing controls and relays.

.4 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.

.2 Test control.

.3 Manual control.

.4 Automatic shutdown.

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 transfer switches for incorporation into manual.

.3 Detailed instructions to permit effective operation, maintenance and repair.

.4 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 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 indoors in dry location]and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect transfer switches from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay.

2.2 MATERIALS

.1 Instrument transformers: to CAN/CSA C60044-8.

.2 Contactors: to NEMA ICS2.

2.3 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

.1 Circuit Breaker Type Transfer Equipment: to CSA C22.2 No.5.

.2 Rated: 600V, 60Hz, 400A, 3wire.

.1 Fault withstand rating: 10,000 kA symmetrical for 3 cycles.

.2 One normal 3 pole moulded-case circuit breaker with thermal trip, mounted on common base, designed for double throw action, motor operated, mechanically held and interlocked, CSA enclosure floor mounted.

.3 One emergency 3 pole moulded-case circuit breaker with thermal trip, motor operated, and interlocked.

.4 Circuit breakers:

.1 Trip free in closed position.

.2 Interrupting rating: 10,000 kA

.5 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.

.6 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.

.7 Solid neutral bar.

2.4 CONTROLS

.1 Solid state, multi-function, microprocessor-based automatic transfer switch controller:

.1 Minimum 2-line, 16-character LCD display

.2 NEMA 12, door mounted

.3 Programmable setpoints

.4 LED mimic screen

.5 Passcode protection

.6 Integral engine test and programmable engine exerciser

.7 Manual retransfer from emergency to normal source

.8 Generator start, pre-transfer and alarm relay outputs

.9 Lockout and monitor modes

.10 Open, delayed and in-phase transition

.11 Event log

.12 Voltage and frequency metering

.13 Phase reversal sensing

.14 Voltage imbalance sensing

.15 UL 1008 / CSA 22.2-178

.2 Control transformers: dry type with 120 V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Control panel:

.1 Enclosure: size 5 nameplate.

.2 Nameplates to include: voltage, amperes, and interrupting ratings.

2.6 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested Departmental Representative.

.2 Notify Departmental Representative 10 days minimum in advance of date of factory test.

.3 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for transfer switches installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate, install and connect transfer equipment as indicated.

.2 Check solid state monitors and adjust as required to ensure correct operation.

.3 Install and connect battery.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Energize transfer equipment from normal power supply.

.3 Set mode to "Test" position to ensure proper standby start, running, transfer, retransfer. Return mode to "Auto" position to ensure standby shuts down.

.4 Set mode in "Manual" position and check to ensure proper performance.

.5 Set mode to "Engine start" position and check to ensure proper performance. Return mode to "Auto" to stop engine.

.6 Set mode to "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 30 minutes, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.7 Repeat, at 1 hour intervals, 2 times.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 01 61 00 – Common Product Requirements

.4 Section 01 74 11 – Cleaning

.5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

.6 Section 26 05 00 – Common Work Results Electrical

.7 Section 26 05 21 – Wires and Cables (0-1000V)

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 CAN/CSA C22.2 No. 250.13-14, Light Emitting Diode (LED) Equipment for Lighting Applications.

.2 Canadian Standards Association (CSA International)

.3 Underwriters' Laboratories of Canada (ULC)

1.3 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 datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.

.3 Photometric data to include: spacing criterion.

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00 – Quality Control.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Divert unused metal materials from landfill to metal recycling facility.

.4 Disposal and recycling of fluorescent lamps as per local regulations.

.5 Disposal of old PCB filled ballasts.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 LED Fixture – Type A

- .1 General: 4’ Industrial LED Lamp and Fixture
- .2 Construction:
  - .1 Full body die-formed cold rolled steel housing
  - .2 Low profile
  - .3 Suspended mount
  - .4 cULus, ROHS compliant
- .3 Electrical
  - .1 Power: 120VAC
  - .2 Long life LED system, minimum 50,000 hours at 70% lumen output
  - .3 LED:
    - .1 CCT: 4,000K
    - .2 CRI > 80
    - .3 5,000 lumen output
- .4 Lens
  - .1 Frosted lens
- .5 Additional Items:
  - .1 Necessary mounting brackets

.2 Outdoor Flood – Type B

- .1 General: Outdoor wall pack LED fixture.
- .2 Construction:
  - .1 One-piece die-cast aluminium housing
  - .2 Hinged, removable die-cast aluminium door
  - .3 One-piece silicone gasket to seal optical chamber
  - .4 IP68 ingress protection
  - .5 Suitable for outdoor use.
- .3 Electrical
  - .1 Power: 120VAC
  - .2 ½” threaded conduit entry
  - .3 Long life LED system
  - .4 LED:
    - .1 4,000K
    - .2 CRI > 70
    - .3 2,000 lumen output minimum
- .4 Lens
  - .1 Clear lens
- .5 Additional Items:
  - .1 Necessary mounting brackets

2.2 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 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.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.

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

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 20 00 - Concrete Reinforcing.

.3 Section 03 30 00 - Cast-in-place Concrete.

.4 Section 03 35 00 - Concrete Finishing.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM D422-63(2002), Standard Test Method for Particle-Size Analysis of Soils.

.3 ASTM D1557-09, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ;) (2,700 kN-m/m ;).

.2 Canadian General Standards Board (CGSB)

.3 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 1010-April 2004, Material Specification for Aggregates.

1.3 DEFINITIONS

.1 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.

Frost susceptible materials

.8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 SUBMITTALS

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

.2 Quality Control:

.1 Submit to Departmental Representative written notice when bottom of excavation is reached.

.2 Submit to Departmental Representative testing results and report as described in PART 3 of this Section.

1.5 QUALITY ASSURANCE

.1 Qualification Statement: submit proof of insurance coverage for professional liability.

.2 Keep design and supporting data on site.

.3 Health and Safety Requirements:

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

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Divert excess aggregate materials from landfill to local facility for reuse as directed by Departmental Representative.

1.7 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work verify 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 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.

.5 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing.

.6 Record location of maintained, re-routed and abandoned underground lines.

.7 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, lawns, fencing, and pavement which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

.3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

1.8 CHOICE OF EXCAVATION METHODS

.1 The Contractor is solely responsible for choosing the excavation methods to be applied.

1.9 PROTECTION OF EXISTING STRUCTURES

.1 Protect the excavation bottoms against any softening. If softening occurs, remove the softened soil and replace it with type 2 compacted fill.

.2 Protect excavation bottoms against frost.

.3 Take the necessary measures to eliminate the dust generated.

.4 Adequately protect existing facilities, buildings and services, and existing equipment located on site to ensure they are not damaged during the work.

.5 Never stack waste material in an area where it could hinder the work or property drainage.

.6 Underground structures and utility systems

.1 Before starting to dig trenches, notify the Departmental Representative and/or the authorities of the public utility companies involved and determine the location and condition of the underground structures and systems. Clearly identify the locations to prevent any service interruptions while the work is being performed.

.2 Confirm the location of the underground systems by carefully performing trial excavations.

.3 Maintain in operation and protect against any damage all water, sewage, gas, electricity and telephone lines as well as other systems or structures that might be in the areas to be excavated. Before moving or disturbing a structure or a public utility system in any way, obtain appropriate directives from the Departmental Representative.

.4 If required, provide the Departmental Representative and the public company with recommendations regarding the removal or detour of existing systems at the excavation site. Assume the costs for this work.

.5 Take note of the location of the underground lines that have been retained, diverted or abandoned.

.6 Confirm the location of excavations recently performed near the work area.

.7 Existing buildings and structures on the property

.1 In the presence of the Departmental Representative, check the condition of the buildings, lawns, fences, survey markers and elevation indicators that need to stay in place and which may be damaged during the work.

.2 Protect existing buildings and structures on the property likely to sustain damage, against all such damage while the work is being performed. In the event of damage, immediately restore the affected components to their original state, to the Departmental Representative's satisfaction.

.3 If roots or branches need to be cut to complete the excavation work, only perform this work after obtaining the Departmental Representative's approval.

.8 Adequately protect elevation indicators, alignment markers, survey markers and survey monuments located on the construction site.

.9 Take all necessary measures to prevent any property damage and bodily injury.

Part 2 Products

2.1 MATERIALS

.1 Type 1 fill: OPSS Granular A

.1 Clean, hard, durable crushed stone or gravel free of shale, clay and friable, organic or deleterious material; the sizing of the material shall remain within the range indicated below, in accordance with the OPSS 1010 Standard, and the sizing curve plotted on a semi-logarithmic graph shall be continuous and progressive. The fill shall not contain pyrite.

.2 Before using, have the Departmental Representative approve all fill materials. After receiving approval, always purchase the same materials from the same sources.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 PREPARATION/PROTECTION

.1 Keep excavations clean, free of standing water, and loose soil.

.2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.

.3 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.

.4 Protect buried services that are required to remain undisturbed.

3.3 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.

.2 Strip topsoil to depths as directed by Departmental Representative.

.1 Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed by Departmental Representative.

.1 Stockpile height not to exceed 2 m and should be protected from erosion.

.4 Dispose of unused topsoil as directed by Departmental Representative off site.

3.4 STOCKPILING

.1 Stockpiles 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.

.4 Separate suspected contaminated materials from clean materials. Stockpile suspected contaminated materials excavated on-site on 6 mm poly liner base to prevent mixing or leeching into ground on-site and cover with 6 mm poly liner to protect from precipitation.

3.5 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.3 Protect open excavations against flooding and damage due to surface run-off.

.4 If water is encountered, do not pump wastewater effluent, or water ponding on or adjacent to the construction site, into any waterway catch basin, or ditch. Remove any wastewater effluent that may be contaminated with hazardous product including hydrocarbons from the site and dispose of in an appropriate manner, which includes testing and treatment of the suspected contaminant.

3.6 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as directed by Departmental Representative.

.2 Excavation must not interfere with bearing capacity of adjacent foundations.

.3 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.

.4 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.5 Dispose of surplus and unsuitable excavated material off site.

.6 Do not obstruct flow of surface drainage or natural watercourses.

.7 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.8 Obtain Departmental Representative approval of completed excavation.

.9 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.10 Correct unauthorized over-excavation as follows:

.1 Fill with Type 1 fill compacted to not less than 95% of corrected Standard Proctor maximum dry density.

.11 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

.12 Do not dispose of liquid and solid waste on site. Haul to the nearest existing licensed facility. Treat any waste that may contain contaminants and has not been shown to be

within guidelines for disposal at a non-hazardous waste facility as a hazardous waste and dispose of at a permitted facility

3.7 FILL TYPES AND COMPACTION

.1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D1557.

.1 Under concrete slabs and around concrete foundation walls: provide layers of 300 mm compacted 100% standard proctor modified dry density test (SPMDD)

3.8 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.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill/compact around or over cast-in-place concrete within 48 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading.

3.9 INSPECTION AND LABORATORY TRIALS

.1 The materials and compacting analyses shall be performed by a testing laboratory designated and paid by the Contractor.

3.10 FROST PROTECTION

.1 When backfilling is performing under freezing conditions, defrost and heat the material before placing and compacting it. Protect the ground against frost until the backfilling operation is completed.

3.11 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.2 Replace topsoil as directed by Departmental Representative.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.5 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 65 00 - Storage Tank Removal.

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

.3 Section 23 05 00 – Common Work Results for HVAC.

.4 Section 23 11 13 - Facility Fuel Oil Piping.

1.2 REFERENCE STANDARDS

.1 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.2 Canadian Standards Association (CSA)/CSA International.

.1 CAN/CSA-B139-15, Installation Code for Oil Burning Equipment.

.3 Government of Ontario Regulations

.1 Environmental Protection Act, R.S.O. 1990, c. E.19, dated March 22, 2017.

.2 Technical Standards and Safety Act, 2000: Ontario Regulation 215/01 – Fuel Industry Certificates, dated May 15, 2015.

.4 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S602-14, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.

.2 CAN/ULC S661-10, Standard for Overfill Protection Devices for Flammable and Combustible Liquid Storage Tanks.

.3 CAN/ULC S663-11, Standard for Spill Containment Devices for Flammable and Combustible Liquid Aboveground Storage Tanks.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.

.2 Indicate details of construction, appurtenances, installation, and 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 Finishes.

.8 Electronic accessories: provide details and manufacturers product data.

.9 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.

.10 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.

.11 Anchors: description, material, size and locations.

.12 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.

.13 Ancillary devices: provide details and manufacturer's product data.

.14 Leak detection system, type and locations, and alarm system.

.15 Grounding and bonding: provide details of design, type, materials and locations.

.16 Corrosion protection: provide details of design, type, materials and locations.

.17 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.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling 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 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 Clearly label location of salvaged material's storage areas and provide barriers and security devices.

.6 Ensure emptied containers are sealed and stored safely.

.7 Do not dispose unused paint material must into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

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

Part 2 Products

2.1 TANKS: CONVENTIONAL STEEL

.1 Provide one (1) new double wall steel vacuum-monitored aboveground diesel storage tank in APU Building as indicated and as specified below:

.1 Nominal capacity: 2270 Litres.

.2 Tank to be constructed in accordance with ULC-S602 with label bearing conformance to ULC-S602 clearly affixed to tank.

.3 Tank to be factory pressure tested to 35 kPa with documentation provided to Departmental Representative.

.4 The outer dimensions of the tank shall not exceed the following under any circumstances in order to fit through the existing doorway to the APU Building:

.1 Width: 1296 mm.

.2 Length: 1982 mm.

.3 Height: 1350 mm.

.5 Tank to come with grounding lugs.

.2 Corrosion protection: external coat of epoxy primer and top coat white paint as per manufacturer's instructions.

.1 Tanks to arrive on-site primed and painted white by the tank manufacturer. Contractor responsible for repainting damaged/scratched areas as a result of the tank installation. Contractor to use touch up paint provided by the tank manufacturer only.

.3 Double-wall steel vacuum monitored storage tank shall be placed entirely within 150 mm high concrete-dyked area as indicated, complete with impermeable barrier in floor of containment around storage tank and in dyke walls.

.1 Concrete curb shall be provided as indicated, in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Concrete-dyked area shall:

.1 Be sufficiently sized to contain 10% of volume of new diesel storage tank, as indicated.

.2 Have a sustained permeability to water less than 1×10^{-6} cm/s under hydraulic head of 3 m.

.3 Expansion joints as indicated.

.1 Expansion joints and entire floor within dyked area sealed with approved sealant that is compatible with #2 fuel oil.

.4 All unused tank openings shall be sealed liquid- and vapour-tight.

.5 Connections for new double-wall steel vacuum monitored storage tank:

.1 Eight (8) top connections, minimum.

.2 Sizes: 50 mm diameter, minimum.

.3 Normal vent size: 75 mm.

.4 The normal vent for this tank shall be sized in accordance with CSA-B139 and ULC S602.

2.2 ANCHORAGE AND STEEL PIPE SUPPORTS

.1 Each of four (4) support legs of new double-wall steel vacuum monitored storage tank shall be anchored to new 100mm diameter, 100mm high Schedule 80 steel pipe as per manufacturer's written installation instructions. Rigidly anchor each steel pipe to existing floor with expansion-type bolts approved by fuel storage tank manufacturer.

.2 Prime and paint new 100mm diameter, 100mm high Schedule 80 steel pipe legs to match tank. Contractor shall procure paint from original tank manufacturer.

2.3 INSTRUMENTATION AND CONTROL WIRING/CABLING

.1 Provide all control wiring, cabling and accessories for the instrumentation required under the Work which includes but may not be limited to: remote electronic overfill alarm and related design equipment. Install instrumentation and control wiring as per the manufacturer's instructions.

2.4 PIPING, VALVES AND FITTINGS

.1 In accordance with Section 23 11 13 - Facility Fuel Oil Piping.

2.5 GROUNDING AND BONDING

.1 Aboveground fuel storage tanks to be grounded in accordance with Section 26 05 28 – Grounding – Secondary.

2.6 LEVEL GAUGING

.1 New double-wall steel vacuum monitored storage tank shall be equipped with a new ULC-approved visual level gauge.

.2 No dipstick gauging is permitted indoors.

2.7 LEAKAGE DETECTION SYSTEM

.1 Interstice of new tank shall be equipped each with a new ULC-approved visual vacuum gauge.

2.8 OVERFILL AND SPILL CONTAINMENT

.1 Install ULC-S661 listed weatherproof audible and visual overfill alarm panel (120V AC).

.1 Install 1-position stainless steel float switch inside new tank. The float switch shall trigger an audible and visual alarm at 90% of the tank capacity.

.2 Pilot lights:

.1 "Power" (white in colour).

.2 "Diesel Tank High Level" (red in colour). Red light to remain illuminated until alarm condition is corrected.

.3 Push buttons:

.1 "Mute" or "Acknowledgement". Mute button shall be momentary switch to mute the audible alarm.

.2 "Test". Test button shall trigger the audible alarm.

.4 Horn: 95 dB at 3 m distance.

.5 Be mounted to the exterior building wall at the location indicated in the drawings.

.6 Refer to the drawings and electrical specifications for further details.

2.9 SPILLS

.1 Contained, treated and disposed of in accordance with applicable Federal and Provincial regulations, guidelines and policies.

.2 Contractor shall provide a new spill kit in the APU Building for petroleum product-type spills up to 500 L that includes, but is not limited to, the following materials:

.1 Absorbent pads.

.2 Absorbent booms.

.3 Absorbent socks.

.4 Rubber drain covers (two minimum).

.5 Waste disposable bags.

.6 Safety goggles.

.7 Nitrile gloves.

Part 3 Execution

3.1 INSTALLATION

.1 Install tanks in accordance with CAN/CSA-B139, CCME PN 1326, National Fire Code of Canada and manufacturer's recommendations.

.2 Install new tank in existing APU Building. Provide minimum 460 mm clearance on one side and end of each tank and 50 mm clearance on opposite side and back of tank. Provide adequate service clearances for new 100 kW generator as per manufacturer's written recommendations.

.3 Install tanks such that certification labels are visible.

.4 Install all equipment in accordance with the manufacturer's written instructions.

.5 Install and provide final hook-up of all control wiring as required for the complete installation of the instrumentation, including remote overfill alarm and associated probe/level transmitter in accordance with the manufacturer's written instructions. Installation of conduit and line voltage is the responsibility of the electrical (Division 26). Contractor to coordinate rough-in requirements with Division 26.

.6 Position tanks using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.

.7 Contractor to provide ten (10) working days' notice to Departmental Representative for tank removal and tank installation activities.

.8 Provide redline drawings of installation during construction to the Departmental Representative for the production of as-built drawings by others.

.9 Tanks shall only be installed by persons certified by TSSA as having a valid OBT1 license as per Ontario Regulation 215/01. The Contractor shall provide evidence of the person's valid OBT1 designation prior to any work being performed that involves the removal, altering or installation of fuel storage tanks and associated components within this scope of work.

.10 Provide certification of installation to Departmental Representative.

.11 No fuel shall be added to the storage tank system until the Departmental Representative and authority having jurisdiction has provided approval for the first product transfer.

.12 The storage tank system shall not put into operation until:

.1 The Contractor has received approval from the Departmental Representative and the authority having jurisdiction.

.2 The Contractor has applied and paid for all applications and licensing fees for the project, if applicable.

3.2 FIELD QUALITY CONTROL

.1 Test tanks for leaks to requirements of CSA B139 and in presence of Departmental Representative and authority having jurisdiction.

.2 During testing, do not exceed recommended operating pressure as directed by manufacturer.

.3 Confirm storage tank is not leaking prior to entering the tank into service.

.1 If the tank interstice is under a vacuum, the vacuum gauge reading on the new storage tank interstice to be a maximum of -20” Hg, otherwise Contractor is required to pull new vacuum at own expense.

.4 Contractor is responsible for repairing and/or replacing faulty tanks and components at their own expense.

3.3 TOUCH-UP

.1 Where coating is damaged, touch-up with original coating material in accordance with manufacturer’s guidelines.

3.4 STORAGE TANK REFUELING

.1 Contractor is responsible for procuring #2 diesel fuel oil and filling the new diesel fuel storage tank to 90% of its maximum storage capacity. Coordinate scheduling of first fill with Departmental Representative and authority having jurisdiction.

3.5 LEVEL GAUGE SYSTEM

.1 Provide leak and vapour proof caulking at connections.

3.6 FUEL STORAGE TANK SYSTEM COMMISSIONING

.1 Remote overfill alarm panel:

.1 Test and confirm that alarm conditions and components are functional.

.2 A person certified by TSSA as having a valid OBT1 license as per Ontario Regulation 215/01 shall provide a certified commissioning test report to stipulate that the overfill alarm was tested, verified and fully functional.

.2 Test and confirm the mechanical overfill protection devices by verifying the device engages during the first transfer of product into new storage tank.

END OF SECTION