

Municipal Service Centre Fuel Tanks Replacement City of Niagara Falls

Specifications **Project No. 190812**

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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 It is the intention of the City of Niagara Falls (otherwise referred to as the Client or Owner) to replace previously removed fuel tanks with new above grade fuel tanks and add additional provisions for fueling as outlined in the contract documents.

1.2 SCOPE OF WORK

- .1 This work is turn-key. Contractor shall hire sub-trades including, electrical contractor, concrete cutting etc. to complete the work as specified.
- .2 Schedule is critical for this project. Contractor is required to purchase the proposed tanks upon notification of award of the contract.
- .3 The specification and drawings specify complete systems. Include all labour and material required to make them so.
- .4 The intent is to provide the Owner complete systems and while no attempt has been made to detail or list each individual part required, include all parts and furnish all labour reasonably implied by these documents in order to deliver to the Owner the complete systems ready for operation.
- .5 Provide components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.
- .6 Plans and specifications augment each other, and any item reasonably implied in one but omitted in the other is interpreted as sufficiently covered, and must be provided.
- .7 Furnish all required labour and materials, machinery, scaffolding, tools, implements, or other appliances together with all proper and required facilities for moving and transporting same, so that the contract and all work to be done under it, can and will be carried on in a workmanlike manner, properly, satisfactorily, continuously, and expeditiously, to completion, in all respects, to the satisfaction of the Owner.
- .8 The general scope of work includes, but is not limited to, the following:
- Obtain all necessary ESA and TSSA inspections, permits and approvals where required.
 - Temporary hoarding of building openings during construction.
 - Civil/Structural work as identified on Civil/structural drawings
 - Provide concrete pads to facilitate the above ground storage tanks, dispensers, control panels.
 - Supply and installation of new tanks, dispenser's c/w piping, suction pumps pedestal base platform c/w sump including all appurtenances.
 - Supply and install all connections to new tanks including cranes/rigging, piping, electrical connections and venting, normal vents, emergency vents.

- All necessary fittings and hardware to be supplied by Contractor
- Supply and installation of all required pipe supports, tank anchorage to concrete pads.
- Supply and installation of all sump leak detectors, tank leak detectors, tank fuel level indicators including mechanical indicators, overflow protection system.
- Supply and installation of all valves and fittings.
- Supply and installation of new panels, conduit, wiring, disconnects and starters. All necessary fittings and hardware to be supplied by Contractor
- Supply and install the new fuel management system (Winfuel) including all control wires, control panels, sensors.
- Supply and install the new complete set of leak detection, fuel level status c/w sensors, explosion proof control panel, overflow protection system from Incon system.
- Paint the tank as per owner required color finishes.
- Cleaning, flushing and refilling of fuel systems.
- Proving of Winfuel and Incon controls/instrumentation with technical representative and Owner's representative.
- Equipment start-up and commissioning.
- All installation works shall be done in accordance with TSSA Liquid Fuels Handling Code, latest edition.

- .9 The contractor shall comply with the requirements of City of Niagara Falls Contractor Safety Package and Niagara Falls City supplier's Code of conduct.

1.3 ALLOWANCES

- .1 Cash allowances as called for in this specification shall represent the full amount of monies (including HST) included in the contract for the item which they are earmarked. The Contractor shall add to this amount his mark-up for overhead and profit and carry that amount in his tender price.
- .2 Expenditures from the allowances will be deducted using supplier invoices including HST but not including Contractor mark-ups. (Mark-ups being deemed to be included in the tender price.)
- .3 At the completion of the project the balance remaining in the allowance(s) will be deducted from the contract price.
- .4 This contractor shall carry the following allowances in his tender price;
- a) One set of Master attendances control box, four Attendant HPP™ System for three tanks with each pumps set at Main Island and Mechanic Garage building, c/w hardware and software upgrade, low voltage connections, testing and commissioning from Winfuel (ASI Fluid Management) cost \$62,000.00
 - b) One complete sets of sump leak detection, tanks leak detection, tank fuel level status c/w required sensors, control panels (explosion proof), overflow protection system, testing and commissioning from Incon System through Ethernet network cost \$46,000.00.
 - c) General contingency allowance: \$40,000.00
 - d) Inspection and testing: \$5,000.00

1.4 WORK BY OTHERS

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Consultant.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Consultant, in writing, any defects which may interfere with proper execution of Work.

1.5 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Owner's intermittent use of premises during construction. Sectioning of the Specifications is for convenience and to facilitate reference by the Contractor's forces. Each section may contain more or less than the complete work of any trade. The Specifications shall be read as a whole by all parties concerned and it is solely the responsibility of the Contractor to make clear to the subcontractors precisely what is required of them and what is to be included in their price.
- .2 Co-ordinate Progress Schedule during construction.
- .3 Required Stages:
 - .1 Preparation of area to receive new equipment
 - .2 Receive and install new equipment.
 - .3 Craning of equipment
 - .4 Installation of new equipment and appurtenances.
 - .5 Commissioning and turnover.

1.6 CONTRACTOR USE OF PREMISES

- .1 Restricted use of site.
- .2 Limited use of premises for Work, for storage, and for access, to allow:
 - .1 Owner usage
 - .2 Work by other contractors.
 - .3 Public usage.
- .3 Co-ordinate use of premises under direction of Owner and Project Manager.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this contract.
- .5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work.

- .7 At completion of operations condition of existing work; equal to or better than that which existed before new work started.

1.7 OWNER USE OF PREMISES

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

1.8 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.9 EXISTING SERVICES

- .1 Notify, Owner and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Owner at least 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 pedestrians, vehicular traffic and tenant operations.
- .3 Provide alternative routes for personnel, pedestrians and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Consultant of findings.
- .5 Submit schedule to and obtain approval from Owner 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 Owner to maintain critical building and tenant systems.
- .7 Where unknown services are encountered, immediately advise Owner and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed and abandoned service lines.
- .10 Construct barriers in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.

1.10 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 Report.
 - .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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .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 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Owner Representative and Consultant to enable monitoring of project work in relation to established milestones.

1.3 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately [5] working days, to allow for progress contract.

- .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 SUBMITTALS

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

1.5 MASTER PLAN & MILESTONES

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

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award
 - .2 Shop Drawings, Samples
 - .3 Permits
 - .4 Mobilization
 - .5 Civil work
 - .6 Receipt of equipment
 - .7 Electrical Installation
 - .8 Structural Installation
 - .8 Mechanical installation
 - .9 De-mobilization
 - .10 Testing and Commissioning
 - .11 Final Review/Acceptance
 - .12 Close-out documents

1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly 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.

1.8 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 Record minutes of meeting and circulate to attendees within 2 business of meeting. Responsibility of the general contractor
- .3 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 45 00 – Quality Control

1.2 REFERENCES

- .1 CCDC 2 GC 3.11.

1.3 ADMINISTRATIVE

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

1.4 SHOP DRAWING AND PRODUCT DATA

- .1 Refer to CCDC 2 GC 3.10.
- .2 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.
- .3 Submit shop drawings bearing stamp and signature of qualified Professional Engineer registered or licensed in the Province of Ontario, Canada
- .4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for

completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .5 Allow 2 days for Consultant review of each submission.
- .6 Adjustments made on shop drawings by Consultants are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .7 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.
- .8 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.
- .9 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
- .10 After Consultants' review, distribute copies.
- .11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

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- .12 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.
 - .13 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Consultant.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .14 Submit 6 electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
 - .15 Submit 6 electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .16 Submit 6 electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.
 - .17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .18 Submit 6 electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.
 - .19 Delete information not applicable to project
 - .20 Supplement standard information to provide details applicable to project.
 - .21 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
 - .1 This review shall not mean that approve detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relive Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that

pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.5 SAMPLES

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

1.6 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour, digital photography in standard resolution weekly with progress statement as directed by Consultant.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of view points: 4 locations.
 - .1 Viewpoints and their locations as determined by Consultant.
- .4 Frequency of photographic documentation: weekly as directed by Consultant.
 - .1 Upon completion of work as directed by Consultant.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 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 Departmental Policy and Occupational Health and Safety Construction.
- .2 Successful contractor shall comply with the requirements of City of Niagara Falls Contractor Safety Package and Niagara Falls City supplier's Code of conduct.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 Submittal Procedures

1.3 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Ontario
 - .1 Occupational Health and Safety Act, R.S.O. 1990 Updated 2005,

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and Prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Result of safety and health risk or hazard analysis for site tasks and Operation
- .3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Consultant and authority having jurisdiction weekly.
- .4 Submit copies of report or directions issued by Provincial and Safety Inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS.
- .7 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within [3] days after receipt of plan. Revise plan as appropriate and resubmit plan to Consultant within [3] days after receipt of comments from Owner.

HEALTH AND SAFETY REQUIREMENTS

- .8 Consultants' review of Contactor'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.
- .9 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 Consultant.
- .10 On-Site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.5 FILING OF NOTICE

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

1.6 SAFETY ASSESSMENT

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

1.7 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Consultant prior to commencement of Work.

1.8 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Consultant
 - .2 Owner representatives

1.9 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and Continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.10 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety or property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations and ordinances, and with site-specific Health and Safety Plan.

1.11 COMPLIANCE REQUIREMENTS

HEALTH AND SAFETY REQUIREMENTS

- .1 Comply with Ontario Health and Safety Act. R.S.O.
- .2 Comply with Occupational Health and Safety Act, Industrial and Commercial Establishments Regulation, R.R.Q.
- .3 Comply with Occupational Health and Safety Regulations, 1996.
- .4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .5 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.12 UNFORSEEN HAZARDS

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

1.13 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with Petroleum Works.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible to implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.14 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 Province having jurisdiction and in consultation with Consultant.

1.15 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.
- .2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 WORK STOPPAGE

HEALTH AND SAFETY REQUIREMENTS

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

EXISTING PREMISES PROCEDURES

1. General

- 1.1. Perform work in or on existing building in accordance with each applicable Section of the Specification, together with structural, mechanical, and electrical drawings in their entirety as they apply.
- 1.2. Execute each part of the work in existing building by workers specializing in such work, in accordance with these Specifications for similar work where applicable.
- 1.3. Schedule demolition to avoid interference with progress of new construction work, and the operation of the existing building.
- 1.4. Patching or replacement of damaged work shall be done by workers experienced in the type of work to be patched. Make patches indistinguishable in final assembly. Paint surfaces out, wall-to-wall in accordance with requirements of architectural specification, where areas are patched.

2. Deficiency List

- 2.1 Before beginning Work and admittance of any workers on the site, the Contractor shall furnish the Consultant with a report in the form of a deficiency list, covering all fittings, fitments, fixtures, surfaces, and any other building component in the existing building and exterior building surfaces or site work where work is being done, whose proximity to alternation work renders it vulnerable to damage.
- 2.2 Any deficiency not recorded in the report will result in the Contractor being required to make good such deficiency without an increase to the Contract Price.

3. Owner's Use of Existing Building

- 3.1 The existing buildings will remain in full use and occupancy throughout the duration of construction of the Work.
- 3.2 Provide and maintain continuation of fire protection, fire walls and fire rated assemblies in buildings.
- 3.3 Maintain existing exits and provide proper and safe means of egress from all parts of existing buildings to open spaces at all times to the approval of jurisdictional authorities. Identify, provide exit lights, and illuminate temporary means of egress.
- 3.4 Maintain access to service and delivery entrances, and for maintenance and inspection services.
- 3.5 Maintain security of existing building during the Work.
- 3.6 Execute work in existing building at times approved by Consultant and as mutually agreeable to Owner, so not to inconvenience his occupation or in any manner hinder his use of building.
- 3.7 Give Owner 72 hours notice of intention to commence work in a room or area of existing building. No work is to be performed in any area without approval from the Consultant and Owner.

EXISTING PREMISES PROCEDURES

- 3.8 Execute work as quietly as possible in and around existing buildings at all times. Schedule noisy operations with Consultant to achieve least disturbance to Owner. This will generally need to be performed after hours.

4. Protection

- 4.1 Work shall include temporary, watertight, dust tight screens or partitions between work area and existing building and as required to localize dust generating activities, and for the protection of workers, finished area of work and public. Maintain and relocate protection until such Work is complete.
- 4.2 Provide weatherproof coverings over openings made in walls and roofs of existing building, immediately after they are opened.
- 4.3 Protection of existing buildings, including roofs, shall be substantial enough to prevent damage to them by falling objects, demolition, and mandatory construction traffic during new work.
- 4.4 Protection of property in, or on existing buildings shall include equipment, furniture, and other similar furnishings, hardware, trim, and supplies, whether fixed to buildings or not.
- 4.5 Take all precautions to ensure that no structural damage is caused to existing building by demolition and alteration work, or by new construction.
- 4.6 Ensure during demolition work that materials, components, and similar items to be reused are protected from damage, and that measures are taken to keep down dust.

5. Removal of Existing Work and Salvage

- 5.1 Remove building elements, components, materials, and equipment as required to expedite installation of structural, mechanical and electrical services. Store and protect re-used materials from damage for re-installation when above work is complete.
- 5.2 All materials not relocated and recovered from the existing building, shall become the property of the Contractor and shall be disposed of away from site unless otherwise noted.
- 5.3 Limit removal of items to smallest areas possible, and make good disturbed existing work.

6 New and Replacement Work

- 6.1 Make good material, and prepare surfaces and refinish all finished surfaces damaged, marred, replace, or otherwise remedied in the existing building.

7 Contractor's Use of Existing Buildings

- 7.1 Limit access of construction personnel to existing buildings only at locations approved by Consultant for work being performed at a specific time.
- 7.2 Ensure that construction personnel perform work in existing buildings only as required under the Contract; and that they do not use it as access to work areas, except for work in existing building for other purposes.
- 7.3 Assume total responsibility for security of existing buildings upon commencement of Work except for those areas specifically retained by the Owner for his exclusive use during Construction.
- 7.4 Secure existing building except for those parts retained by the Owner for his use, by

methods compatible with the total security established for buildings.

8 Existing Services

- 8.1 Ensure that existing services are not damaged during demolition and construction. Immediately cut off and cap concealed services uncovered during work by qualified workers.
- 8.2 Relocate exposed existing mechanical and electrical services where alteration work occurs.
- 8.3 Do not interrupt mechanical or electrical services of the existing buildings except for temporary close-downs and as approved by the project schedule or by prior arrangements with Consultant and Owner. Give both Consultant and Owner 3 working days notice of intention to interrupt mechanical or electrical services in existing buildings and obtain written permission from the Owner.
- 8.4 Should existing services be accidentally uncovered and disrupted, make complete restoration immediately, and provide adequate protection to avoid further disruption until alternative means of providing permanent continuation of the services are made.
 - .1 Payment for work specified in the foregoing shall be made by the Contractor at no additional cost to the Owner, if in the opinion of the Consultant, such work could have been foreseen and which has been caused by lack of proper care and protection.
 - .2 If accidental disruption is made and could not have been foreseen, in the opinion of the Consultant, the Contractor shall advise Consultant and the Owner of the commencement, duration and termination dates of this work; keep a record of work hours, number of workers, tools, equipment rentals, quantities of materials used, mileage, etc. to present with his claim.
- 8.5 Unless otherwise specified, restore services on which work is performed to original condition.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2- 2008, Stipulated Price

1.2 INSPECTION

- .1 Refer to CCDC 2, GC 2.3
- .2 Allow Owner Representative and Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Owner's Representative and Consultant instructions, or law of Place of Work.
- .4 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.
- .5 Owner's Representative and Consultant will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.3 INDEPENDENT INSPECTION AGENCIES

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

1.4 ACCESS TO WORK

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

1.5 PROCEDURES

- .1 Notify appropriate agency and Owner Representative and Consultant in advance of requirement for test in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing as specifically requested in specification. 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.

1.6 REJECTED WORK

- .1 Refer to CCDC, GC 2.4.
- .2 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 Owner and Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .3 Make good other Contractor's work damaged by such removals or replacements promptly.
- .4 If in opinion of Owner Representative and Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Owner Representative and Consultant.

1.7 REPORTS

- .1 Submit [2] copies of inspection and test reports to Owner Representative and Consultant.
- .2 Provide copies to subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.8 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 Owner Representative and Consultant and may be authorized as recoverable.

1.9 MILL TESTS

- .1 Submit mill test certificates as requested.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

TEMPORARY BARRIERS AND ENCLOSURES

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-1971, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-OI2I-[M1978(R2003)] ,Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May t4, 2004.

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 HOARDING

- .1 Erect temporary site enclosures using fencing.
- .2 Apply plywood panels vertically as indicated flush and butt jointed.
- .3 Provide lockable entrance gate and at least one pedestrian door as directed. Equip gates with locks and keys.
- .4 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around water meter room, open shafts, open edges of floors and roofs as required.
- .2 Provide as required by governing authorities.

1.5 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

1.6 ACCESS TO SITE

- .1 Provide and maintain access to underground parking, vehicles. ramps and construction runways as may be required for access to Work.

TEMPORARY BARRIERS AND ENCLOSURES

1.7 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators. traffic signals, barricades and flares, lights. or lanterns as required to perform Work and protect public.

1.8 FIRE ROUTES

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

1.9 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.

1.10 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 Owner locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

COMMON PRODUCT REQUIREMENTS

Part 1 General

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-[2008], Stipulated Price Contract.
- .2 Within text of each specifications section, reference may be made to reference standards. List of standards reference writing organizations is contained in Section.
- .3 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .4 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.
- .5 Cost for such testing will be borne by Consultant in event of conformance with Contract Documents or by the Contractor in event of non-conformance.

1.2 QUALITY

- .1 Refer to CCDC 2.
- .2 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.
- .3 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .4 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.
- .5 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.
- .6 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .7 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.

COMMON PRODUCT REQUIREMENTS

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

1.6 MANUFACTURER'S INSTRUCTIONS

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

1.7 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties the Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

COMMON PRODUCT REQUIREMENTS

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

1.8 COORDINATION

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

1.9 CONCEALMENT

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

1.10 LOCATION OF FIXTURES

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

1.12 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 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.

COMMON PRODUCT REQUIREMENTS

- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 PROTECTION OF WORK IN PROGRESS

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

1.15 EXISTING UTILITIES

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-[2008], Stipulated Price Contract.
- .2 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D. Title: General Conditions "C", In Effect as Of: May 14, 2004.

1.2 PROJECT CLEANLINESS

- .1 Maintain work in tidy condition, free from accumulation of waste products and debris including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Owner Representative. Do not burn waste materials on site unless approved by Owner Representative.
- .3 Clear snow and ice from access to building outside of work area as required.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Dispose of waste materials and debris at registered dumping areas off site.
- .7 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.

1.2 FINAL CLEANING

- .1 Refer to CCDC 2, GC 3.13.
- .2 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

- .3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .4 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .5 Remove waste products and debris including that caused by Owner or other Contractors.
- .6 Remove waste materials from site at regularly scheduled times or dispose of as directed by Owner Representative. Do not burn waste materials on site unless approved by Owner Representative.
- .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 decorative work, electrical and mechanical fixtures, furniture fittings, walls, floors and ceiling.
- .10 Clean lighting reflectors, lenses, and other lighting surfaces as required.
- .11 Vacuum, clean and dust building interiors, behind grilles, louvres and screens.
- .12 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .13 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.
- .14 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .15 Remove dirt and other disfiguration from exterior surfaces.
- .16 Clean and sweep roofs, gutters, areaways, and sunken wells as required.
- .17 Sweep and wash clean paved areas as required.
- .18 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .20 Remove snow and ice from access to constructional working areas as required.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

- Part 2** **Products**
- 2.1** **NOT USED**

- Part 3** **Execution**
- 3.1** **NOT USED**

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 45 00 Quality Control.

1.2 REFERENCES

- .1 n/a

1.3 ADMINISTRATIVE REQUIREMENTS

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedure.
- .2 Two weeks after to Substantial Performance of the Work, submit to the Consultant, four 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.

1.5 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x279 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 process flow under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacture'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.
 - .2 Provide scaled CAD files in drawing format on CD.

1.6 CONTENTS - PROJECT RECORD DOCUMENTS

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

1.7 AS-BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Consultant one record copy of:
 - .1 Contract Drawings
 - .2 Specifications
 - .3 Addenda
 - .4 Change Orders and other modifications to Contract
 - .5 Reviewed shop drawings, product data, and samples

- .6 Field text 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 OWNER 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, provided by Consultant.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and Appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacture, 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 manufacture's certifications, inspection certifications, field test records, required by individual specifications sections.

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

1.10 MATERIALS AND FINISHES

- .1 Building products applied materials, and finishes include product data, with catalogue number, size, composition, and color 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 site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Owner Representative.
 - .2 Include approved listings in Maintenance Manual
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specifications section.
 - .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items.
 - .1 Submit inventory listing to OWNER Representative.
 - .2 Include approved listings in Maintenance Manual.

1.12 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, 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 products at own expense and for review by Owner Representative.

1.13 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan. 5 days before planned pre-warranty conference, to Owner.
- .3 Warranty management plan to include required actions and documents to assure that Owner's 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 Owner 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 joint 11 months warranty inspection, measured from time of acceptance, with Owner 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 organization of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificate of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors and commissioned system such a leak monitoring alarm systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.

- .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
-
- .4 Contractor's plans for attendance at 11 months post-construction warranty inspections.
 - .5 Procedures and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operations is critical for warranty and/or safety reasons.
 - .7 Comprehensive checklists for each tank and appliance.
 - .8 TSSA Site Inspection Report.
 - .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
 - .10 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Owner Representative to proceed with action against Contractor.

1.14 WARRANTY TAGS

- .1 Tag at time installation, each warranted item. Provide durable, oil and water resistant tag approved by Owner 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

Part 3 Execution

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 General Requirements

- (a) Instructions to Bidders, Form of Tender, Form of Contract and Division 1 form part of this Section.
- (b) The Contractor shall visit the site and become thoroughly familiar with all conditions to be met in carrying out the work covered by these specifications, prior to submitting bid. No extras will be allowed for failure to properly evaluate conditions which affect the scope of work included in this Division.
- (c) Where a contradiction or discrepancy is found in the specifications or drawings, the Engineer shall be notified prior to tender closing. An addendum may be issued to clarify the intent of the drawings or specification. If the contractor fails to notify the Engineer prior to tender closing, the Engineer reserves the right to interpret the intent of the tender documents at any time.
- (d) Where conflict does occur between codes, Specifications and Drawings, the most stringent stipulation shall govern, and the Tender shall be based on whichever indicates the greater cost.
- (e) All equipment and materials shall be new, undamaged and free from defects.
- (f) This is a Base Bid specification, see section 2.1.

.2 Definitions

- (a) Wherever the words *indicated, designated, shown, noted, listed* or similar words or phrases are used in the Specifications, they shall be understood, unless the context otherwise provides, to mean that material(s) or item(s) referred to shall be read as *indicated on, designated on, shown on, noted on or listed on* the Drawings.
- (b) Wherever the words *approved, satisfactory, as directed, submit, permitted, inspected* or similar words or phrases are used in the Specifications they shall be understood, unless the context otherwise provides, to mean that material(s) or item(s) referred to shall be *approved by, satisfactory to, as directed by, submitted to, permitted by or inspected by* the Consultant.
- (c) The term *provide* where used shall be understood to include labour, materials and services necessary to supply the Work and/or and install the item(s) referred to.

1.4 Requirements of Regulatory Agencies and Codes

.1 Permits, Tests, Regulations, Etc.:

- (a) Before tendering, become fully acquainted with by-laws of any local or other authority having jurisdiction.

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- (b) Carry out all applications, submissions, changes and alterations required by the authority inspector of any authority having jurisdiction without delay to the progress of the work and without extra cost.
- (c) Upon completion of the contract, issue to the Owner a formal certification of completion of work before final payment for work may be considered due.
- (d) Pay for all permits required for completion of this work.

.2 Quality Assurance:

- (a) All equipment supplied by this Contractor shall only be by manufacturer's having a current ISO 9001, Quality Management System certification.
- (b) Material and workmanship of the highest quality, conforming to the rules and regulations of the latest revisions of the following regulatory agencies and codes:
 - .1 Ontario Regulation 350/06 (Ontario Building Code)
 - .2 Natural Gas Installation Code CAN/CGA B149.1
 - .3 ASHRAE 90.1-2010 Energy Standard
 - .4 Canadian Standards Association
 - .5 Technical Standards and Safety Authority (TSSA)
 - .6 TSSA Liquid Fuels Handling Code, latest edition.
 - .7 Ontario Regulation 220/01, Boilers & pressure Vessels
 - .8 Boiler, Pressure Vessel and Pressure Piping Code CSA B51
 - .9 Local Fire Codes
 - .10 The Construction Lien Act, R.S.O. 1990, c. C.30, as amended.
 - .11 The Occupational Health and Safety Act, R.S.O. 1990, c. 0.1, as amended.
 - .12 Workplace Safety and Insurance Act, S.O. 1997 C16, as amended.
- (c) The Code, Regulation, Statute, By-Law, or this specification having the most stringent requirement applies. Before tendering, the Contractor shall make himself fully acquainted with by-laws of any local or other Authority Having Jurisdiction and all changes and alterations required by the authorized inspector of any Authority Having Jurisdiction shall be carried out without charge or expense to the Owner.
- (d) All changes and alterations required by the Authorities Having Jurisdiction shall be carried out without delay to the progress of the work.

1.5 Minor Field Variations

The location, arrangement and connection of equipment and material as shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Engineer to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes shall be done at no extra cost to the Owner unless the location, arrangement or connection is more than 5'-0" from that shown.

1.9 Intent

- .1 Mention in the Specifications or indication on the Drawings of equipment, materials, operation and methods, requires provision of the quality noted, the quantity required, and the systems complete in every respect.

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- .2 The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.
- .3 The contractor shall be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. The Contractor shall promptly replace defective material, equipment and part of equipment and repair related damages.

1.10 Examination of Site

Before submitting Bids, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfill this condition.

1.11 Contemplated Changes

When a change to the work is contemplated, the Engineer will issue a "Supplemental Instruction" outlining the proposed variation in the works. The Contractor shall, as promptly as possible, estimate the cost implications of the proposed change (extra or credit) for materials, labour and incidentals, HST Tax, overhead and profit and return a detailed breakdown for each item to the Engineer for review. Upon approval by the Engineer a "Change Order" will be issued and the change in price will be added to or deducted from the contract price.

1.13 Job Conditions

- .1 Site Visit
Visit the site and become thoroughly familiarly with existing site conditions so as not to overlook any condition which may affect the scope of the work. For any such item which could be foreseen, no extra will be allowed.
- .2 Services
Refer to Division 1 concerning the provision of temporary water, light, power and heat. Supply all extensions cords, lamps, hose, etc.
- .3 Shops
Provide own office, workshops, tools and materials storage if necessary, and be responsible for any loss or damage thereto.
- .4 Storage and Site Operating Facilities
 - (a) Provide own office, workshops, tools and materials storage if necessary, and be responsible for any loss or damage thereto.
 - (b) At all times keep the Owner's property in clean and tidy condition and properly store and stack all materials neatly upon the site so as not to litter the premises.
 - (c) Store packaged materials and equipment in original undamaged condition with manufacturer's labels and seals intact or properly crated where such applies. Prevent damage to materials during handling and storage. Keep storage area dry and secure from pilfering. Protect pipe ends, valves and other parts of the system from damage and from intrusion of foreign matter by means of caps, plugs, blind flanges etc.

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- (d) The Mechanical Contractor shall be responsible for the security of all his materials, tools and equipment stored on the site.
- (e) Upon completion of the contract the Mechanical Contractor shall remove from the site all waste materials, clean all equipment, and leave all items in perfect operating condition.

.5 Health & Safety

It is the responsibility of the Mechanical Contractor to understand and to meet or exceed the Ontario Health & Safety Act and Regulations as well as the Health & Safety Policies at the location of the project.

1.14 Submittals

.1 Manufacturer's Shop Drawings

- (a) Comply with the provisions listed herein.
- (b) Before fabrication of any materials or equipment, submit six (6) copies of detailed drawings of equipment and apparatus to the Engineer for review. Do not order materials until review has been given. Check the drawings and note comments, date and signature before submitting.
- (c) Shop drawings must apply to the equipment under consideration. Advertising literature and comprehensive data sheets are not acceptable. The drawings must contain the actual dimensions of unit and dimensioned location and size of all outlets and connections, model range, capacity, hp, voltage, etc., of all accessories listed in the specifications, and/or being provided, and the operating points of the proposed equipment.
- (d) Do not consider review rendered on shop drawings as a guarantee of measurements for building conditions. Where drawings are reviewed, said review does not mean that drawings have been checked in detail. The review does not in any way relieve this contractor from his responsibility or necessity of furnishing material to meet the performance of equipment specified and/or as shown on the contract drawings.
- (e) Mechanical items for which shop drawings are specifically requested are listed in each section of the Specification.

.2 Record Drawings

- (a) On two (2) sets of prints of this project, mark all changes and deviations from the original plans. Correctly mark all changes in red ink.
- (b) On completion of the project, turn these plans over to the Owner for the Owner's record of the exact location of all piping and equipment.
- (c) Certify these plans, "as-built". Plans are not considered certified unless they are signed and sealed by an officer of this contractor's company.
- (d) Where piping is buried, dimension locations with respect to building walls and mark levels with respect to the elevation of finished floor below which piping is buried.

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.3 Maintenance Data and Operating Instructions

- (a) Collect and assemble manufacturer's data and operating and maintenance instructions.
- (b) Print name of project and Owner's, Architect's and Engineer's names on the title sheet and cover, and return over two (2) sets of manuals to the Architect for approval before completion of the work.
- (c) Assemble all data in logical order and insert in as suitable hard cover, black, three-ring loose leaf binder. Mark each Section with a labeled tab protected with a celluloid cover.
- (d) Protect schedules, lists and directories with plastic covers.
- (e) Type all notes. Printed literature may be used.
- (f) Neatly assemble data complete with a list of contents.
- (g) Include a complete list of mechanical equipment supplied and installed under this contract.
- (h) Instructions shall include specific warning of maintenance and operation practices or materials which may damage or disfigure the particular material or equipment.

1.15 Final Documents

.1 Issue to the Owner, through the Engineer

- (a) Two (2) copies "As-built" drawings.
- (b) Two (2) copies "Operation and Maintenance Brochures".
- (c) Final completion and guarantee certificates.
- (d) The Engineer's final acceptance of the work is contingent upon these being received.
- (e) The above submissions are subject to final Engineer approval.

1.16 Warranty

- .1 Guarantee in writing that all materials and workmanship used on the project are in strict accordance with the specifications and will give proper and efficient operation and are free from mechanical or electrical defects. Repair and/or replace any defects which may appear in any of the work within one year after written acceptance by the Owner (except due to ordinary wear and tear) without additional expense to the Owner. Note that the one year period referred to above may exceed the equipment guarantee appreciably, and allowance must be made for this fact.

1.17 System Turnover

- .1 Upon completion of the installation, the Contractor shall start up the system, perform all necessary tests, and run diagnostics to ensure proper operation. A full operational test of the fueling and control systems shall be performed in the presence of the Owner's representative and the Engineer. They shall be required to be in attendance as long as necessary and shall be prepared to make any necessary adjustments and corrections at their own expense to make the system operational in the manner designated by the Engineer. When the system performance is deemed satisfactory by these observers, the system parts will be accepted for beneficial use, and placed under warranty.

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- .2 Provide training for maintenance staff on the operation of the installed systems.
- .3 Contractor shall provide a Declaration of Completion signed by a responsible officer of the Company indicating that the following procedures and tests have been performed in accordance with the drawings and specifications:
 - (a) All approvals and permits obtained.
 - (b) All debris and construction materials removed from mechanical system.
 - (c) Major equipment identified and installed.
 - (d) Fueling system installed, tested and approved.
 - (e) Final documents approved and submitted.
 - (f) Operating and maintenance on site instructions provided.
 - (g) Guarantee submitted and accepted by Owner

PART 2 - PRODUCTS

2.1 Base Bid and Alternative Equipment

- .1 This is a base bid specification. Items on the Drawings and subsequent divisions of these specifications are listed with the names of specific manufacturers, the first of which is a base bid and has been used in the design and is the equipment shown on the Drawings. Where additional manufacturer names have been listed, these are deemed equal to the equipment or material specified as base bid, provided the equipment or material will have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material. The price submitted for this contract shall be based on the use of materials and equipment specified or approved as equal. Where no choice is indicated, the base bid supplier or equipment shall be used. No additional alternatives shall be accepted in the base bid unless written approval has been obtained from the Engineer.
- .2 Contractor may offer alternative equipment where, based on the Contractor's experience and knowledge, the alternative equipment provides equal performance and is built to the same quality standards as the base bid equipment. The Contractor shall supply a break out price adjustment for the use of the alternate equipment. The Contractor shall state in his tender:
 - (a) the name of the manufacturer
 - (b) adjustment in price
 - (c) equipment model number and capacity
 - (d) Provide verification that the manufacturer of the alternative equipment has been regularly engaged in the production of such equipment and with a minimum of fifteen continuous years of proven production experience.
- .3 The final price selected, base bid or equal with alternatives (if any), will dictate the scope of equipment supply from the Contractor.
- .4 Any additional work associated with the installation of equal or alternate equipment (including back charges from other Contractors) shall be the responsibility of the Contractor.
- .5 Any equal or alternative equipment submitted must not exceed space requirements

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allocated on the Drawing, and must have capacity, performance, rating, construction, physical dimensions, accessories and features which, in the opinion of the Consultant, are equal to those of the specified equipment or material.

- .6 All of the materials required for the performance of the work shall be new and the best of their respective kind and be of uniform pattern throughout the work.

PART 3 - EXECUTION

.1 Coordination

- (a) Start work and proceed as soon as possible after the contract has been let and in accordance with the construction of the building.
- (b) Confer and cooperate with other trades in order to eliminate any unnecessary delays to the construction schedule. Where doubt exists regarding other trades, confer with the Project Manager without delay for detailed instructions concerning how to proceed with the work. Expedite delivery of all equipment and materials to meet the construction schedule.

.2 Layout and Planning

- (a) The Mechanical Contractor shall be responsible for laying out, planning, and locating all systems, equipment, ductwork and piping based on accurate field measurements and shop drawings or certified prints as required to properly install, maintain, repair and operate all systems and equipment. Drawings shall not be scaled to locate equipment, ductwork or piping. The drawings are diagrammatic, and indicate the general arrangement and routing only. The Contractor shall plan the work to avoid interferences, minimize offsets, and to provide for a neat and proper installation.
- (b) The runs of piping, position of apparatus, etc., specified or shown on the drawings, indicate general arrangements of the equipment. This Contractor shall be required to make without charge, any necessary changes or additions to the runs to accommodate structural or other conditions.
- (c) All exposed piping shall be installed neatly and closely to the structure. Pipes which are not installed as they should be, in the opinion of the Engineer, shall be corrected without cost to owner.
- (d) All exposed piping shall be stainless steel unless noted otherwise on drawings.
- (e) Pipes and duct runs shall be installed in such a way as to interfere as little as possible with the free use of the space through which they pass.
- (f) The Mechanical Contractor shall test, adjust, startup, and place into proper operational equipment and systems installed under this contract. Prior to the startup of any equipment or system, the Contractor shall make certain that all equipment is clean, free of foreign matter, all bearings are lubricated and all precautions have been followed in accordance with the equipment manufacturer's instructions.
- (g) Contractor shall take due care during the installation and ensure no damage shall result to any of the building due to the installation work. Contractor shall only use specified access paths.

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.3 Scaling Drawings

- (a) All drawings are in general made to scale and where figured dimensions are not given, obtain approximate distance by scaling plans. It is however, distinctly understood that the Contractor does so entirely on his own responsibility as the accuracy of the drawings is not guaranteed.
- (b) The drawings upon which this contract is based show the arrangements, general design and extend of the duct and piping and other systems. These systems are suitably outlined on the drawings with regard to sizes, locations, general arrangements
- (c) The mains and connections thereto are shown more or less in diagram, except where in certain cases the drawings may include details giving the exact locations and arrangements required. Any necessary change or additions to the runs to accommodate structural conditions are done without additional charge or expense to the Owner. Conceal all ductwork and piping unless shown otherwise. Notify the Engineer immediately and secure his authority in writing for such revisions before proceeding with the work.

3.2 Installation

.1 Excavating and Backfilling

- (a) Excavating and backfilling for mechanical work: bases, curbs, pads, trenches, thrust blocks, etc., inside and outside the building where required for mechanical installations, provided by this Contractor.

- (b) Trench Excavation

Excavate to alignment and grade required for placing of underground services. Brace and dewater trench so that workmen can work safely and efficiently.

- (c) Pipe Bedding

Prepare bottom of trench by removing unsuitable material, debris and other irregularities which may interfere with a proper installation. Compact loose or disturbed areas to ensure continuous support for pipe.

Cover bottom of trench with granular bedding material (Class B) to a depth of 5' -0" (1.52m), compacted to 95% of max. density at optimum moisture content as determined by Modified Proctor Test to provide even bearing under pipe. Leave recesses at joints.

All piping must be inspected and approved by the Plumbing Inspector and Engineer prior to covering or piping.

- (d) Backfilling

Do not commence backfilling until work to be covered has been inspected by the Plumbing Inspector and Engineer.

.2 Cutting and Patching

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Cutting of holes and related patching, in floors, roof or walls where required for mechanical installations, shall be provided by this Contractor. Coordinate with General Contractor for openings to be left for mechanical equipment or air circulation. Hire the services of the necessary trade to perform any cutting, core drilling, patching and making good to all materials and surfaces affected by the work disturbed or tampered with, in order that his portion of the contract can be completed satisfactory

.3 Access Doors in Building Construction

- (a) Provide access doors in floors, wall, ceilings, etc. to give access to mechanical lubrication points, controls, duct hardware, cleanouts, fire dampers, isolating and balancing valves, air vents, etc.
- (b) Appropriate size and type to suit the individual application, and similar to adjoining construction.
- (c) 12 gauge prime coated steel access door with heavy duty fully concealed hinges and positive locking and master keyed cylinder lock. Size: 18" x 18" (450mm x 450mm) as manufactured by Mifab.
- (d) Fire rated access door has 16 gauge steel frame, 20 gauge insulated steel door attached to frame with continuous hinge with stainless steel in. Self-latching key operated cylinder lock. Size 16" x 167" (400mm x 400mm) as manufactured by Mifab.
- (e) Access doors are not necessary where inverted "T" lay-on ceiling tile construction is used.
- (f) Supply access doors to the appropriate sub-trade for installation.
- (g) Individually specified access doors occurring directly on exposed mechanical items need not be coordinated in the above manner.

.4 Sleeves and Escutcheons

- (a) Provide sleeves for piping and ducts, and provide lintels for openings for grilles, fans and similar equipment. Installation by General Contractor.
- (b) Do not set pipes in contact with concrete, masonry, wood, steel or similar materials. Pipes must be free to expand, contract or otherwise move without wear or noise.
- (c) Pipe insulation shall be carried uninterrupted through pipe sleeves except where otherwise noted or required by Ontario building code or local authority. Where space will not permit application of sectional insulation on pipes in sleeves, pack sleeves with insulation.
- (d) Pipe sleeves shall be of the same material and wall thickness series as the pipe. For piping passing through partition walls #22 gauge galvanized steel sleeves are acceptable. Insulation on pipes passing through fire walls to be fit tight to the fire stop material and shall not pass through.
- (e) Where exposed pipes pass through floors, walls, etc., finish with solid type escutcheon plates held in place with set screws where necessary. Paint escutcheons to match the walls except when used with chrome piping, when they are chrome plated to match. When pipes are insulated, escutcheons may be omitted, provided the insulation is butted neatly to the wall and completely

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covered by its finish jacket in a manner acceptable to the Engineer.

.5 Supports

- (a) This Contractor shall supply and erect all special structural or concrete work required for the installation of the mechanical equipment. He shall supply and install all anchor bolts and other fastenings. Where apparatus is required to be mounted on concrete pads, this Contractor shall locate the pads accurately and with neatly chamfered edges and corners.
- (b) This Contractor shall supply and install all necessary steel beams, channels, angle iron for supporting the equipment, pipes, apparatus, etc.
- (c) Welding to, cutting or burning of structural members by Contractor will not be permitted, except where approved. No holes will be punched or drilled in structural members without the prior consent of the Engineer. Where such permission is not given, all attachments to steel members shall be done with suitable clamps or clips.

.6 Fire Stopping and Smoke Seals

- (a) Provide fire stopping and smoke seals where ducts, pipes or conduits penetrate rated fire separations to maintain integrity of fire separations. Fire stopping materials to meet ULC CAN S115 and be ULC listed.
- (b) Firestopping to be manufactured by 3M.
- (c) Installations to conform to approved ULC details and standards. Seal space between penetrating service and sleeve or opening in slab with firestop and smoke sealing system in accordance with terms and conditions of original ULC approval and manufacturers recommended procedures. Contractor to submit firestopping system details to Engineer for approval prior to installation.
- (d) Select firestopping system to allow insulation and vapour barrier to pass unbroken through assembly, as required.
- (e) Follow Manufacturer's published installation instructions precisely including field quality control after installation. Surfaces to be clean, dry and free from dust, oil, grease, loose or flaking paint and foreign materials at time of application of materials.
- (f) Submit to Consultant, suitable document signed by Manufacturer's local representative, stating:
 - .1 Div. 230000 sub-contractor received sufficient installation instruction from Manufacturer's representative.
 - .2 Manufacturer's representative witnessed installation procedures on site.
- (g) Remove firestopping assembly for random inspection by Consultant and replace at no extra cost to Owner.

.7 Painting

- (a) Carefully brush and clean all iron work after installation in order that it may be in proper condition for paint. Paint all metal, unless galvanized or shop primed, with one coat of metal priming paint.

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- (b) Clean any equipment defaced during construction to restore original finish. All mechanical equipment which comes on the site painted, rusty or otherwise defaced due to construction and installation is to be painted with one coat of paint, oil base type, of the original colour.
- (c) Unless otherwise noted, finish painting will be performed by General Contractor. Provide assistance in the form of supervision to General Contractor to ensure that painting and colour coding of the work of this Division is done correctly.

.8 Electrical Wiring and Starters of Mechanical Devices

- (a) All electrical power wiring and non-integral motor starters shall be provided and installed by Division 16.
- (b) Advise Division 16 Contractor of the appropriate designations of all starters to enable the Division 16 contractor to label same.
- (c) Install motorized equipment. Some of the said equipment contains packaged wiring, etc. such that Division 16 Sub-Contractor will only have to bring power to an electrical connection point.
- (d) All devices must bear CSA approval stamp. Verify that the power characteristics specified herein agree with the requirements of the installation before any equipment is ordered.
- (e) All low voltage control wiring and connections to sensors, control panels shall be installed by Division 16.

3.3 Field Quality Control

.1 Hydrostatic Test (Piping)

- (a) All piping to be tested in accordance with the Building Services Piping Code ANSI/ASME B 31.9 (latest edition) and in accordance with TSSA Liquid Fuels Handling Code, latest edition.
- (b) Meet testing requirements of all authorities having jurisdiction. Obtain certification and certify tests not required by authorities. Perform not less than the following tests.
- (c) Prove hydronic piping tight under a hydrostatic test of 150% of design working pressure but not less than {700 kPa} [100 psi]. Test without pressure drop for a period of not less than 4 hours.
- (d) Perform tests before piping is covered or concealed.
- (e) Remove all components which will not withstand test pressure and replace after tests.
- (f) Eliminate leaks or remove and refit defective parts. Do not caulk threaded or welded joints.
- (g) After work is completed, adjust and put all parts of the system into proper working order. Leave the complete job ready for regular operation, all to the satisfaction of the Consultant.
- (h) Provide lubricating oils, packing, and other accessories, for proper operation of the system.

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- (i) The final test and acceptance shall not be made until the work is finally completed.

END OF SECTION

PART 1 - GENERAL

1.1. Work Included

- .1 Provide all labour, materials, products, equipment and services to supply and install the basic mechanical materials indicated on the Drawings and specified in Division 23 of these Specifications.

PART 2 - PRODUCTS

2.1. Inserts

- .1 Submit proposed materials and methods for cast-in-place inserts.
- .2 Where inserts must be placed after concrete is poured, use Phillips Red Head Multiset II Anchor system or equivalent Hilti System.

2.2. Pipe Hangers

- .1 Provide pipe hangers and supports for all piping. Provide hangers in accordance with the following requirements. Provide steel supports in accordance with the subsequent article in this specification section. Provide galvanized steel hangers and supports with galvanized fittings and accessories where exposed to direct contact with water or to possible high humidity conditions where condensation can occur.
- .2 Provide manufactured hangers, accessories and supports in accordance with ANSI B31.1 and MSS SP58, SP69, SP89 and SP90 similar to the Grinnell or Myatt figures numbers below.
- .3 Select products to ensure adequate safety factors under anticipated loads.
- .4 Provide upper attachments as follows:
 - .1 Standard beam clamp for normal service - Grinnell Fig 133 with Fig 290 or Fig 278 or Myatt Fig 500 with Fig 480 or Fig 440.
 - .2 Standard side beam clamp for normal service - Grinnell Fig 225 or Myatt Fig 505.
 - .3 Top beam clamp - Grinnell Fig 92 or Myatt Fig 406.
 - .4 C clamp - Grinnell Fig 86 or Myatt Fig 586.
 - .5 Angle clip for light duty side mounting - Grinnell Fig 202 or Myatt Fig 542.
- .5 For vertical adjustment of hanger rods, provide forged steel turnbuckle - Grinnell Fig 230 or Myatt Fig 475.
- .6 Provide pipe attachments as follows:
 - .1 Adjustable swivel rings for insinuated fire service piping - ULC approved - Grinnell Fig 69 or Myatt Fig 41.
 - .2 Clevis hanger for copper piping up to and including {100 mm} [4"] diameter - Grinnell Fig CT-65 plastic coated or Myatt Fig 56 epoxy coated.
 - .3 Swivel ring hanger for copper tubing up to and including {25 mm} [1"] diameter - Myatt Fig 43 epoxy coated.
 - .4 Standard duty clevis hanger for steel piping - Grinnell Fig 260 or Myatt Fig 124.

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- .5 Standard duty long clevis hanger for steel piping - Grinnell Fig 300 or Myatt Fig 124L.
 - .7 Provide vertical pipe supports as follows:
 - .1 Riser clamp for copper pipe - Grinnell Fig CT121C plastic coated or Myatt Fig 186 epoxy coated.
 - .2 Riser clamp for steel or cast iron pipe - Grinnell Fig 261 or Myatt Fig 182 or Fig 183.
 - .8 Provide supports for other piping types such as plastic, mechanically fused or packed joint pipe according to the pipe manufacturer's published recommendations. Support piping continuously where required to prevent sagging.
 - .9 Provide protection saddles where insulated piping is supported from below.
 - .10 For high temperature insulated pipe - Grinnell Fig 160 or Fig 165 or Myatt Fig 210 or Fig 240.
 - .11 For insulated pipe with vapour barrier for low temperature service, insulate pipe with calcium silicate at hangers and provide Grinnell Fig 167 or Myatt Fig 251.
 - .12 Where pipe hangers or supports are used with chilled water insulated pipes, they shall be placed outside the insulation to prevent conductivity and the insulation shall be suitable to prevent crushing under the weight of the pipe.
 - .13 Provide roll type supports where shown on the drawings and where longitudinal movement may occur. Provide single pipe rolls - Grinnell Fig 177 or Myatt Fig 262 where supported from below and Grinnell Fig 171 or Myatt Fig 261 where suspended. Provide spring cushions where slight vertical movement is likely and cushioning required - Grinnell Fig 178 or Myatt Fig 880.
 - .14 Provide Grinnell or Myatt engineered constant support hangers on piping subject to vertical movement exceeding {40 mm} [1 1/2"] due to vertical pipe expansion.

2.3. Equipment Rigging Supports

- .1 Provide eyebolts suitable for block and tackle connection, adequately supported by the structure above for:
 - .1 sewage and bilge pumps
 - .2 pumps in Mechanical Equipment Rooms
 - .3 motors
 - .4 other equipment which will require block and tackle handling

2.4. Sleeves, Wall And Floor Plates

- .1 For pipe sleeves, use machine cut and reamed standard weight steel piping.
- .2 Concealed perimeter risers and runouts may have sleeves of {1.31 mm} [18 gauges] galvanized steel set around section of insulation to provide freedom of movement of piping. Extend {50 mm} [2"] above finished floor level.
- .3 For piping through exterior walls, cooperate with the waterproofing trade at all times, and do not break any waterproofing seal without consent of the waterproofing trade. Provide waterproof link seals as detailed on Drawings.

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- .4 Provide leak plates where pipe sleeves pass through exterior building walls. Each leak plate shall be a {3.42 mm} [10 gauge] steel plate, welded to the sleeve, {100 mm} [4"] diameter greater than sleeve outside diameter.
 - .5 Provide {1.31 mm} [18 gauges] galvanized steel duct sleeves. Provide adequate bracing for support of sleeves during concrete and masonry work. For fire rated floors and walls, build fire damper assemblies into structure to attain fire rated construction, in a manner acceptable to the governing authorities.
 - .6 Cover pipe sleeves in walls and ceilings of finished areas, other than Equipment Rooms, with satin finish stainless steel, or satin finish chrome or nickel plated brass escutcheons, with non-ferrous set screws. Do not use stamped steel split plates. Split cast plates with screw locks, however, may be used.
 - .7 Cover exposed duct sleeves in finished areas with {1.31 mm} [18 gauge] galvanized steel plates in the form of duct collars. Fix in position with non-ferrous metal screws.

2.5. Provision For Pipe Expansion, Contraction And Building Shrinkage

- .1 Where space limitations do not permit the use of expansion loops or offsets, provide Flexonics Expansion Joints properly selected for system operating pressures according to the following:
 - .1 For piping up to and including {65 mm} [2-1/2"], select ends to suit specified pipe fittings. Pressure shall be external to the bellows. Pressure ratings for Model H and HB expansion compensated as {1400 kPa} [200 psi] and {1050 kPa} [150 psi].
 - .2 Steel Piping - Flexonics Model H expansion compensator with two ply stainless steel bellows.
 - .3 Copper Piping - Flexonics Model HB expansion compensator with two ply bellow, all bronze construction.
 - .4 For piping {75 mm} [3"] and above, use flanged ends.
 - .5 Steel Piping - Flexonics controlled, flexing expansion joint with stainless steel pressure carrier, flanged ends.
 - .6 Copper Piping - Flexonics controlled, flexing expansion joint with monel pressure carrier, and brass flanged ends.
 - .7 Provide Victaulic 150/155 expansion joints for Victaulic piping systems.
- .2 Submit for Consultant review prior to installation, drawings showing the location of expansion joints, anchors and guides. Show details of proposed connection to structure and loads to be imposed. All Drawings must be signed by a Professional Engineer registered in the Province of Ontario.

2.6. Motors and Motor Starters

- .1 Motors:
 - .1 Supply and install all motors for Mechanical equipment.
 - .2 All motors 1 HP and greater shall be T-Frame AC, three phase and equal to or exceeding the Ontario Hydro EnerMark Efficiency Level as tested to either CSA 390 M1985, or IEEE 112B, and approved under the Canadian Electrical Safety Code.

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- .3 All single phase motors shall be capacitor type, capable of a minimum 10 starts per hour.
 - .4 Select motors for quiet, continuous operation to suit the loads which may be imposed by the equipment. Motor horsepowers specified and scheduled are minimum sizes. If larger motors are supplied, ensure that all extra costs for larger motor, starters, power wiring and additional control wiring is included in the Tender.
 - .5 Motor enclosures shall be selected to suit service conditions as follows:
 - (a) Protected from the weather, entrained moisture or process related liquids: open drip proof motors with service factor 1.15
 - (b) Located in air stream: suitable for operation at maximum air temperature and moisture levels, with drip proof enclosure, encapsulated windings and weatherproof terminal box
 - (c) Where scheduled or otherwise specified: explosion-proof motors
 - (d) Remainder: totally enclosed fan-cooled motors with service factor of 1.00
 - .6 Submit an accurate schedule of all motors. Show for each motor; horsepower, speed (RPM), nameplate current, equipment served, location, electrical characteristics and identification number.
- .2 Contactors and Control Devices:
- .1 Supply and install all automatic devices such as aquastats, pneumatic/electric switches, thermostats controlling electrically powered equipment specified in Division 15 of the Specification.
 - .2 Magnetic starters, disconnect switches, fuses, etc. for all mechanical equipment shall be supplied and installed by the Electrical contractor, unless otherwise specified

2.7. Access Doors And Panels

- .1 Provide access to concealed mechanical equipment and components which require inspection, adjustment, repair and preventive maintenance. Install systems and components to result in a minimum number of access doors and panels. Install equipment and components in locations readily accessible through doors and panels.
- .2 Supply for installation by Other Contractors, doors, panels and frames. Ensure that access doors and panels are properly located.
- .3 Select access doors and panels to suit Architectural finishes and large enough to provide adequate access to equipment and components. Where personnel must pass through, provide {600 mm x 450 mm} [24" x 18"] minimum size doors and panels. Otherwise, provide {300 mm x 300 mm} [12" x 12"] minimum size doors and panels.
- .4 Provide access doors and panels with a fire rating required by the code governing the fire rating of the structure.
- .5 In tile walls, and washroom walls, supply minimum {2.78 mm} [12 gauge] Type 304 stainless steel with #4 finish, with recessed frame secured with stainless steel countersunk flush head screws.
- .6 For all other surfaces, supply minimum {2.66 mm} [12 gauge] welded steel, flush type with concealed hinges, lock and anchor strap, and factory prime coat finish.

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2.8. Concrete

- .1 Provide {150 mm} [6"] concrete housekeeping pads under all floor mounted mechanical equipment and supports. Extend pads over the full equipment base and isolator area.
- .2 Provide floating reinforced concrete bases, and floating floors which are specified under Sound and Vibration Control.
- .3 Concrete work, including housekeeping pads, required for Division 20 work and shown on the Structural or Architectural Drawings will be provided by others.
- .4 Provide other concrete work required for Division 15 work, including reinforcing steel.

2.9. Steel

- .1 Provide steel required for Division 15 work including supports, framing of openings and lintels over openings that are not shown on Structural or Architectural Drawings.
- .2 Provide steel of adequate strength to support equipment and materials during all operating and test conditions.
- .3 Support suspended equipment from the bottom or from manufacturer's designated suspension points. Support tanks and similar equipment with adequate beam strength by saddles with curvature to match the equipment. Continuously support other equipment.
- .4 Provide base supports for all pipe risers. Design to distribute operating and static loads.
- .5 Fabricate steel supports in contact with water or humidity conditions from materials having approved corrosion resistance or galvanize after fabrication or brush welds clean and apply a prime coat of rust inhibiting paint.

2.10. Firestopping

- .1 Provide ULC classified fire stopping products by 3M or Hilti which have been tested in accordance with CAN4-S115.

2.11. Welding And Brazing

- .1 All welding and brazing shall conform to all rules and regulations which apply in the latest issues of the following codes and standards:
 - .1 Building Services Piping Code ANSI/ASME B 31.9 (latest edition)
 - .2 CSA B51 (latest edition), Boiler, Pressure Vessel and Pressure Piping Code
 - .3 ASME Boiler Code - Section IX
 - .4 All requirements of the Technical Standards and Safety Authority (TSSA)
- .2 Welding shall conform to a welding procedure which must be in accordance with TSSA requirements and include materials, weld preparation, heat treatment and welding equipment to be used.
- .3 Qualify all welders for the project work according to ASME equivalent testing procedures. The contractor shall not use welders, under any circumstances, for on-site or off site work that are not qualified for the work performed. Maintain records for all qualification testing, by welder and provide copies to the Consultant on request. Qualification will include welding and examination of test pieces.

BASIC MECHANICAL MATERIALS AND METHODS

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- .4 Qualified welders shall be issued with an identification number and a stamp for use in identifying welds performed by an individual welder. Welding work shall be identified using the identification number and the contractor shall maintain identification records.
 - .5 Welds shall be full penetration, continuous and without defects.
 - .6 Welding shall be made by machine or manual shielded metallic arc process.
 - .7 Provide a copy of TSSA registration and include with Maintenance Manuals.

PART 3 - EXECUTION

3.1. Pipe, Duct And Equipment Installation

- .1 Locate distribution systems, equipment and materials for maximum usable space, optimum service clearances and to accommodate current requirements and identified future expansion.
- .2 Include all pipe and duct offsets required to eliminate interference with the work of other Divisions.
- .3 Install equipment and materials to present a neat appearance. Run piping, ducts and conduit parallel to or perpendicular to building planes. Conceal piping, ducts and conduit in finished areas. Install so as to require a minimum amount of furring.
- .4 Install pipe, duct and conduit straight, parallel and close to walls and slab or deck underside, with specified pitch.
- .5 Use standard fittings for all direction changes. Do not use drilled tees and other field fabricated fittings.
- .6 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
- .7 Where pipe sizes differ from connection sizes of equipment, provide reducing fittings between inline components such as valves, strainers and fittings, and equipment. Reducing bushings are not permitted.
- .8 Cap open ends of piping during installation.
- .9 Lay copper tubing so that it is not in contact with dissimilar metal and will not kink or collapse.
- .10 Use non-corrosive lubricant or Teflon tape equal to Dow Corning and apply on male thread.
- .11 Provide brass adaptors or dielectric couplings wherever dissimilar metals are joined.
- .12 No pipe to be laid in water or when, in opinion of Consultant conditions are unsuitable.
- .13 Protect buried copper and steel piping with Tapecoat materials using procedures recommended by Tapecoat Company of Canada Limited, or other approved manufacturer.
- .14 Ensure that pipe installation does not transmit vibration to the walls and floors through which they pass.
- .15 Make provisions for neat insulation finish around equipment and materials. Do not mount equipment within insulation depth.

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- .16 In electrical rooms and elevator machine rooms, provide drip trays under the entire length of all pipes within the confines of the room. Pipe drip tray to nearest floor drain.
- .17 Perform pipe welding to meet ANSI B31.9.

3.2. Connections To Equipment

- .1 Provide unions or flanges at all connections to equipment. Ensure that piping adjacent to equipment is readily removable for servicing and/or removal of equipment without shutting down entire system.
- .2 Install unions in piping up to and including {50 mm} [2"] pipe size. Install flanges in piping {65 mm} [2-1/2"] pipe size and larger.
- .3 Prevent galvanic corrosion by isolating copper and steel. Use red brass adapters, or completely isolate flanges using full face gaskets with bolts installed through phenolic sleeves with insulating fibre washers. Where the Plumbing Code prohibits the use of red brass adapters, use insulating couplings. Where system valves are required, solid brass isolating valves may be used in lieu of adapters or couplings.

3.3. Inserts

- .1 Size and space for the loads to be supported.
- .2 Properly locate and firmly secure inserts to forms before concrete is poured.
- .3 Place inserts only within main structure and not in any finishing materials.
- .4 When inserts are required in precast concrete, supply inserts and location drawings to the precast concrete supplier for casting into material. Otherwise, include the cost of having the precast concrete supplier install inserts at the site.
- .5 Do not use powder actuated tools.

3.4. Sleeves, Wall Plates, Floor Plates

- .1 Set sleeves for piping and ductwork in conjunction with erection of floors and walls. Locate sleeves accurately in accordance with submittal drawings, and as follows:
- .2 Through interior walls, set sleeves flush with finished surfaces on both sides.
- .3 Through exterior walls above grade, set sleeves flush with finished surfaces on inside and to suit flashing on outside.
- .4 For floors in Mechanical Equipment Rooms, Janitors Closets, Kitchens and similar areas where a water dam is required, set sleeves flush to underside of structure and extending {50 mm} [2"] above finished floor.
- .5 For other floors, set sleeves flush to both finished surfaces. Refer to Room Finish Schedule.
- .6 Size sleeves to provide {25 mm} [1"] clearance around insulated piping and ductwork.
- .7 Provide continuous insulation runs through fire separations. Ensure that piping and ductwork do not touch sleeves or for warm and hot water piping and ductwork terminate insulation cover on each side of sleeve. For chilled water and domestic cold water piping, provide same thickness Manville Thermo-12 pipe insulation with all-purpose vapour barrier jacket through fire separation to a point {100 mm} [4"] on each side of fire separation.

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- .8 Install leak tight seals to meet the manufacturer's requirements. Select the inside diameter of each wall sleeve opening to fit the pipe and leak tight seal, all to ensure watertight joint.
 - .9 Additional sleeving requirements:
 - .1 Provide sleeves for systems not part of Contract, but identified to be required on Drawings.
 - .2 Provide sleeves to accommodate compressed air piping and wiring conduits required for Division 15 work.
 - .3 Provide additional sleeves as required by Drawings to accommodate service requirements. Include for the cost of drilling and setting sleeves.
 - .4 Fill unused sleeves through fire separations with firestop material (see Firestopping article). Fill other unused sleeves with suitable noncombustible materials.

3.5. Firestopping

- .1 Ensure that fire ratings of floors and walls are maintained.
- .2 Pack clearance spaces; fill all spaces between openings, pipes and ducts passing through fire separations and install fire stopping systems in accordance with the appropriate ULC system number for the products and type of penetration.
- .3 Install firestopping systems using personnel trained or instructed by the product manufacturer.

3.6. Pipe Guides And Anchors

- .1 Install pipe guides for expansion joints according to expansion joint manufacturer's published recommendations. Use at least two guides on each side of expansion joint.
- .2 Install manufactured or field fabricated alignment guides to allow movement in axial direction only.
- .3 Install vertical risers properly anchored and guided to maintain accurate vertical position of piping. At time of startup, clean and lubricate guides, and adjust to allow free sliding at operating conditions.
- .4 For piping up to and including {75 mm} [3"], guide pipes at every floor or every {3900 mm} [13 ft]. Guide larger pipes at every second floor or every {7500 mm} [25 ft].
- .5 Fabricate anchors from structural steel channels, plates or angles.
- .6 Secure anchors to the structure. Avoid introduction of excessive reactive forces and operating weights into the structure and onto equipment and piping.
- .7 Where guides are provided on cold piping, provide thermal break to prevent sweating.

3.7. Painting

- .1 Supply ferrous metal work except piping and galvanized and stainless steel ductwork, with at least one factory prime coat, or paint one prime coat on job.
- .2 Clean and steel brush surfaces with welds. Then prime coat all steel supports and brackets.

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- .3 On uninsulated piping, steel brush and prime coat welds.
- .4 Touchup or repaint all surfaces damaged during shipment or installation and leave ready for finish painting.
- .5 Prime coat material shall conform to Canadian General Standards Board Standard No. 1-GP-48.
- .6 Finish painting will be provided by Division 9.

3.8. Welding And Brazing Inspection

- .1 Failure of any retests by one welder shall result in examination of that welder's qualifications and test work. Further testing will be required in that welder's work without additional cost to the Contract.
- .2 Any and all welds found to be of poor or doubtful quality shall be cut out and replaced with satisfactory welds at Contractor's expense.
- .3 One or more of the following defects shall be cause for rejection of a weld:
 - .1 failure to meet radiographic requirements or other code tests
 - .2 welding performed by unqualified personnel
 - .3 welds not reasonably uniform in appearance
 - .4 evidence of peeling
 - .5 cracks
 - .6 oxidation around welds
 - .7 lack of fusion
 - .8 the presence of porosity, slag inclusion or overlaps
 - .9 undercutting adjacent to completed welds or evidence of undercutting by grinding
- .4 Include all costs associated with the specified inspection of welding and brazing.

3.9. Identification Of Mechanical Services

- .1 Identify all mechanical services after finish painting is complete.
- .2 Use terminology consistent:
 - .1 with the Drawings and Specifications
 - .2 with the Owner's requirements and standards
- .3 Identify lay-in type acoustic ceilings used for access to equipment and components by a method acceptable to Consultant.
- .4 Mark valve and equipment identification on Record Drawings.
- .5 Provide typewritten master lists for each Equipment Room. Frame under glass. Insert copies in Operating and Maintenance Instruction Manuals.
- .6 Pipe Identification
 - .1 Provide SMS Wrap-Mark on all pipe coverings, using Wrap-Mark pipe markers with flow arrow and alternating wording. For outside diameters up to {150 mm} [6"], allow marker to completely wrap pipe. For larger outside diameters, secure markers with stainless steel springs. Secure markers on vertical piping and elsewhere where markers could be inadvertently moved.
 - .2 Where outside diameter of pipe (or insulation) exceeds 3" provide labels with a minimum width of 2.5" and 2" high letters. Where outside diameter of pipe (or

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- insulation) is 3" or less, provide labels of 1" minimum width and 1" high lettering.
- .3 Locate identification and flow arrows so they can be seen clearly from floor and service platforms
 - (a) at each piece of equipment
 - (b) at each branch close to connection point to main piping.
 - (c) at not greater than intervals of {15 metres} [50 ft] on straight runs of exposed piping
 - (d) at entry and leaving point to pipe and duct chases, or other concealed spaces
 - (e) on vertical pipes and ducts approximately {1800 mm} [6 ft] above floor
 - (f) behind each access door and panel
 - (g) at valves, identify piping upstream of valves and identify branch, equipment.
 - .4 Colour code pipes to meet code and Owner's requirements. At minimum, colour code pipes with {50 mm} [2"] wide bands in accordance with the detail shown on the drawings.
 - .5 Conform to ASHRAE and ANSI/ASME Standards for primary label colour and with legend and direction arrows in black. Print legend in full wherever feasible, or a recognized abbreviation of the service involved.
 - .6 Identify electrical tracing of pipes on pipe insulation.
- .7 Valve Tags
- .1 Provide {40 mm} [1-1/2"] dia., {1 mm} [0.040"] thick brass tags with {10mm} [3/8"] high die-stamped black letters.
 - .2 Attach to valves with {100 mm} [4"] long brass chains.
 - .3 Tag all valves except for small valves isolating a single piece of equipment such as a unit heater, fan coil unit, terminal reheat coil and radiation section.
- .8 Equipment Nameplates
- .1 Identify equipment, starters, and, remote control devices in a manner consistent with the Drawings.
 - .2 Use solid black capitalized lettering {100 mm} [4"] high.
 - .3 Where equipment size does not permit stencil identification, use lamacoid labels, engraved white on black, mechanically fastened to the equipment. Minimum lettering size {10 mm} [3/8"].
 - .4 Do not insulate or paint over Manufacturer's Nameplates.

END OF SECTION

CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

PART 1 - GENERAL

1.1. Work Included

- .1 Comply with General Requirements and all documents referred to therein.
- .2 This specification describes the minimum performance and basic requirements.

1.2. Design Requirements

- .1 Cleaning and Flushing of Piping Installations:
 - .1 Clean and flush all piping installed in the fueling systems. The limit of responsibility shall be designated by the contract drawings. Where separate service and building contracts are involved, the systems shall be flushed out independently of each other or as a combined operation if mutually agreed between the contractors concerned.
 - .2 The contractor shall clean and flush all piping installed in the distribution system.
 - .3 On completion of the piping installation covered by this contract, all piping shall be thoroughly blown out with compressed air at no less than 100 p.s.i.g. until all lines are clear. Upon completion of the blowing out of all lines, final connections shall be made. The following procedures for the flushing and cleaning of all piping installed in the distribution system piping shall be carried out.
 - .4 Fuel supply Piping:
 - (a) All valves shall be removed from the line and replaced with temporary spool pieces of full bore pipe diameter.
 - (b) A temporary fine mesh strainer shall be installed in place of the strainers located immediately upstream of the temporary pump.
 - (c) A temporary pump shall be installed in the system and shall be capable of pumping adequate discharge at adequate head.
 - (d) At the end of the chemical cleaning period, the lines shall be completely drained and refilled with respective fuel. Circulation will take place for a minimum of 2 hours and the system will then be completely drained and disposed as per ministry of environment guidelines.
 - (e) All temporary strainers, spool pieces and piping connections are then to be removed and all control valves and permanent strainers replaced in the lines and all scale debris collected shall be removed from the job site.
 - .5 Connections of Systems:

CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

- (a) After the flushing and cleaning of all piping systems has been completed, the contractor shall remove all temporary piping, strainers, pumps and other associated equipment from the tanks.
- (b) All procedures for temporary piping and valve arrangements shall be flushed and cleaned. Flushing plan shall be approved by the engineer before cleaning is carried out by the contractor.
- (c) Should any piping or other parts of the systems be obstructed, restricted or stopped by any foreign matter after the above program has been completed, the piping shall be disconnected, obstructions removed and piping re-connected.
- (d) All costs associated with this work or resulting from damage to the work of others shall be borne by the contractor.

PART 2 - MATERIALS

2.1. Materials and Equipment

- .1 Supply all test equipment required to perform the work of this section.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section includes:
 - .1 Materials and installation for light fuel oil piping from oil tanks to boilers or engines.

1.2 **RELATED SECTIONS**

- .1 Section 15000 – Mechanical General Requirements
- .2 Section 15410 – Cleaning and Start-Up of Mechanical Piping Systems.
- .3 Section 15550 – Aboveground Fuel Storage Tanks
- .4 Section 15999 - Commissioning

1.3 **REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-B16.3, Malleable-Iron Threaded Fittings.
 - .2 ASME-B16.9, Factory-Made Wrought Steel Buttwelding Fittings.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
 - .4 ASTM B75M, Standard Specification for Seamless Copper Tube.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-B139, Installation Code for Oil Burning Equipment.
 - .2 CAN/CSA-B140.0, General Requirements for Oil Burning Equipment.
- .4 Health Canada/Workplace Hazardous Materials Information Systems
 - .1 Material Safety Data Sheets (MSDS)
- .5 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
 - .1 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .6 Technical Standards & Safety Authority (TSSA)
 - .1 2017 Liquid Fuels Handling Code from TSSA.

1.4 **SUBMITTALS**

- .1 Submittals in accordance with Submittal Procedures
- .2 Product Data

- .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
 - .1 Indicate on manufacturer's catalogue literature the following: valves
- .3 Submit WHMIS MSDS in accordance with Section. Indicate VOC's for adhesive and solvents during application and curing Hazardous Materials.
- .4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Instructions: submit manufacturer's installation instructions.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Closeout Submittals

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers, steel, metal, plastic waste in accordance WMP.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with Canadian Environmental Protection Act (CEPA), Transportation of Dangerous Goods Act (TDGA), Regional and Municipal regulations.

- .7 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.
- .8 Unused paint, coating materials must be disposed of at official hazardous material collection site as approved by Owner's Representative.
- .9 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

PART 2 **PRODUCTS**

2.1 **FILL, VENT AND CARRIER PIPE (ABOVE GROUND)**

- .1 Stainless Steel 316L seamless: to ASTM A269/A213 tubing, Schedule 40, continuous weld or electric resistance welded, screwed.

2.2 **STEEL PIPE COATING**

- .1 Bituminous paint: in accordance with manufacturer's recommendations for exterior above ground or galvanized.

2.3 **JOINTING MATERIAL**

- .1 Screwed fittings: Teflon or pulverized lead paste. In accordance with manufacturers recommendations.
- .2 Soldered fittings: 95/5.

2.4 **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 Copper:
 - .1 Piping: soldered type.
 - .2 Connections to equipment: flared.

2.5 **GATE VALVES**

- .1 NPS 2 and under, screwed bonnet:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, solid wedge disc as specified under Section 23 05 23.01 – Valves - Bronze.

2.6 **GLOBE VALVES**

- .1 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, screwed over bonnet, renewable bronze disc as specified under Section 23 05 23.01 – Valves – Bronze.

2.7 BALL VALVES

- .1 NPS 2 and under:
 - .1 Bronze body, screwed ends, TFE seal, hard chrome ball, 4 MPa, WOG as specified under Section 23 05 23.01 – Valves - Bronze.

2.8 SWING CHECK VALVES

- .1 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc suitable for oil service, screw in cap, regrindable seat as specified under Section 23 05 23.01 – Valves - Bronze

2.9 FUEL OIL TRANSFER PUMPS

- .1 Two positive displacement self-priming, rotary gear or screw type, direct driven from TEFC motor, mounted on common base. Complete with mechanical seal, permanently sealed ball bearings, relief valve, compound gauge on inlet, pressure gauge on discharge
- .2 Capacity:
 - .1 Pumped fluid: as indicated.
 - .2 Flow rate: as indicated.
 - .3 Motor: as indicated.

2.10 OIL FILTER

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

2.11 OIL METERS

- .1 Accuracy: tested and certified by manufacturer for accuracy within plus or minus 0.2% between 20% and 100% rated capacity.
- .2 Capacity: as indicated.

2.12 ANTI-SIPHON VALVE

- .1 Each tank: Automatic shut-off to prevent spillage in the event of line rupture, cast or ductile iron body, adjustable hydrostatic pressure, brass trim, corrosion-resistant steel spring, fluorocarbon seal, sized for application, built-in thermal expansion pressure relief valve.

2.13 FUSIBLE VALVE

- .1 Gate or globe type, gate type preferred, with spring and replaceable fusible element at 74°C, also manually operable.

2.14 FOOT VALVES

- .1 Provide and install on the tank suction stub a double poppet foot valve of bronze construction, with lapped-in seats, stem guided poppets and 20 mesh monel screen. At the tank suction stub exit install a foot valve extractor.

PART 3 **EXECUTION**

3.1 **PIPING**

- .1 Install oil piping system in accordance with CAN/CSA-B139 and CAN/CSA-B140.0.
- .2 Slope piping down in direction of storage tank unless otherwise indicated.
- .3 Suction and return piping inside building (above ground):
 - .1 Steel, with screwed fittings in trench below floor or run on floor protected by 6 mm checkered aluminum plate cover in traffic areas.
 - .2 Install filter and gate valve at burners.
 - .3 Where suction line enters building, install union, gate valve, anti-syphon device and cap (for priming purposes).
- .4 Fill, vent, suction and return outside building: (above ground).
 - .1 Steel piping welded throughout except at tanks where use electrically isolating fittings.
 - .2 Grading: slope piping at 1% minimum back to tanks.
- .5 Install suction and return buried piping in outer casings in accordance with provincial regulations and Section 33 56 13 – Aboveground Fuel Storage Tanks.
- .6 Piping at tanks:
 - .1 Suction: terminate 150 mm from bottom of tank with foot valve.
 - .2 Return: terminate 100 mm from bottom of tank with return bend.
 - .3 Vent: vent whistle. Terminate open end 3600 mm above grade with return bend, vent alarm and removable 10 mesh copper screen.
 - .4 Fill: terminate as indicated with liquid-tight and vapourproof cover and locking cap, chain and padlock.
 - .5 Dipstick: extend tube to within 150 mm from bottom of tank. Terminate at grade with cap and chain and watertight cover.
- .7 Interconnections between tanks:
 - .1 Interconnect fill, vent, suction, and tank bottoms.
 - .2 Valve to permit isolation of tanks without interfering with use of other tanks.

3.2 **VALVES**

- .1 Install valves with stems upright or horizontal unless approved otherwise by Owner's Representative.
- .2 Install ball valves at branch take-offs, to isolate pieces of equipment and as indicated.
- .3 Install globe valves for balancing and in by-pass around control valves.
- .4 Install swing check valves on discharge of pumps and as indicated.

3.3 **OIL TRANSFER PUMPS**

- .1 Install as indicated.
- .2 Install gate valves on inlet and discharge connections.
- .3 Install pressure gauge at pump discharge, compound gauge on pump inlet connection.

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

3.4 OIL FILTERS

- .1 Install as indicated
- .2 At time of Substantial Completion, replace filter cartridge with new.

3.5 OVERFILL AND SPILL PROTECTION

- .1 See Section 15550 – Aboveground Fuel Storage Tanks.

3.6 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CSA-B139 and CSA-B140.0 and authorities having jurisdiction.
 - .2 Isolate tanks from piping pressure tests.
 - .3 Maintain test pressure during backfilling.
- .2 Manufacturer's Field Services:
 - .1 Have manufacturer of products, supplied under this Section, review work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of work with contract.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of work at 25% and 60% complete.
 - .3 Upon completion of the work, after cleaning is carried out.
 - .4 Obtain reports, within three (3) working days of review, and submit, immediately, to Owner's Representative.
- .3 Refer to Section 23 08 01 – Performance Verification Mechanical Piping System

3.7 CLEANING AND START-UP

- .1 In accordance with Section 15410 - Cleaning and Start-Up of Mechanical and Piping Systems, supplemented as specified herein.
- .2 Flush after pressure test with respective fuel for a minimum of two hours. Clean strainers and filters.
- .3 Dispose of fuel used for flushing out in accordance with requirements of authority having jurisdiction.
- .4 Check vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.

- .5 Check entire installation is approved by authority having jurisdiction.
- .6 Perform cleaning operations as specified in Section 15410 – Cleaning and in accordance with manufacturer’s recommendations.
- .7 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.8 PERFORMANCE VERIFICATION/COMMISSIONING

- .1 Refer to Section 15999 – General Commissioning (Cx) Requirements.

END OF SECTION

Fuel Dispenser Specification for one nozzle, One-Product, Remote Dispenser, Island-Oriented Fuel dispenser specification for enhanced capacity one-product, remote dispenser with island-oriented nozzle boots, which is rated up to 22 GPM/83 LPM at the discharge (one hose operating) for petrol and remote dispenser with island oriented nozzle boots, which is rated up to 44 GPM/ 166 LPM at the discharge for Diesel. Designed for dispensing gasoline, including standard oxygenated blends; diesel, including biodiesel blends up to 20%; and kerosene.

FEATURES:

- Electronic displays. Mechanical registers are not acceptable.
- For each hose, matching backlit 6-digit 1" liquid crystal (LCD) litres display on each side of dispenser.
- Display backup for a minimum of 15 minutes in the event of power loss.
- Thermostatically controlled heater fan for cold temperatures.
- Four-character 1/2" LCD operator message display for each hose to denote authorization status, cut-off limit, etc.
- All displays covered with tempered or double-strength glass (plastic not acceptable).
- Electronic register and lights - 115VAC, 60 hz.
- Electromechanical totalizer, 7-digit non-resettable, for each hose located on dispenser sides for inventory control.
- Electronic 6-digit non-resettable and resettable totalizers per hose.
- Diagnostics including log of last 50 errors/events. Dispenser software configurable and downloadable from PC.
- Hand held remote control for accessing totals, diagnostics, & configuring dispenser via LCD w/o opening cabinet.
- Dual pulse output interface for each hose for connection to fuel control and tank monitoring systems.
- Cabinet: All exterior panels made from galvanized steel for corrosion-resistance. Side panels 14-gauge minimum.
- Finish: Powder-coated metallic silver sides, top, and base with blue lower doors. (Color to be approved by owner)
- Hinged lower doors for easy service access without having to remove panels.
- Lighted brand panels
- Island-oriented nozzle boots located on sides of cabinet with lift-to-start nozzle hooks to turn on/off dispenser.
- Nozzle boots shall accommodate OPW 11VF long spout vapor recovery nozzles.
- Hose hanger for each hose outlet to keep hoses off the island when not in use.
- One (1) positive displacement, one-piston meters with integral hall effect pulsers with no moving parts to wear out.
- Electronic calibration without the need to set mechanical adjusters.
- One (1) proportional solenoid valve for each hose, programmable through electronic register to set maximum flow rate.
- One (1) internal filter with 30-micron element for each hose to help ensure product purity.
- One (1) 1" discharge outlets with 3/4" reducing bushings so that either a 3/4" or 1" hoses may be used.
- One (1) 1.5" NPT inlet for one product.
- Explosion-proof junction box in hydraulic cabinet to make all dispenser power and control wiring terminations.
- Warranty: One year parts and labor.

Standards/Approvals: ADA compliant user controls per ANSI A117.1; UL listed; CSA, FCC, W&M approvals.

Manufacturer: Wayne, Austin, TX.

Note: Specifications do not include hanging hardware that is typically required for operation of a fuel dispenser.

This includes fuel hoses, automatic nozzles, breakaways, and swivels.

SUBMERSIBLE TURBINE PUMP SPECIFICATIONS

*(Fixed speed models: 1/3, 3/4, 1-1/2, and 2 horsepower)**

GENERAL

- The entire pumping assembly shall have UL listing and shall meet all requirements of UL Standard UL 79.
- The pump discharge head and manifold assembly shall be manufactured from ASTM A48 Class 25 gray iron.
- The pump shall be available in 1/3, 3/4, 1 1/2, and 2 horsepower sizes and shall be manufactured to the proper length as determined by the tank diameter, type of tank, and the depth.
- An optional variable length telescopic feature shall be provided such that the length of the pump is field adjusted at the job site to fit the specific pump length required. This variable length option shall be available in three variable length ranges, referred to as VL1, VL2 & VL3, where the VL2 model will fit 94% of all known installations.
- The pump motor shall have a thermal over-current overload protector with automatic reset.
- The pump motor assembly shall be clearly marked with pertinent information including Model, Horsepower, Voltage, Phase, and Manufacturer.
- Fixed speed Single-phase pump motors shall be a permanent split phase capacitor, and shall incorporate a 15 μ F capacitor for 1/3, 3/4, and 1 1/2 horsepower motors and a 40 μ F capacitor for 2 horsepower motors.
- The pump shall be UL listed for blend concentrations of:
 - Standard models:**

0% - 15% ethanol or methanol and gasoline	20% MTBE with 80% gasoline
20% ETBE with 80% gasoline	17% TAME with 83% gasoline
 - AG (alcohol/gasoline) models:**

0% - 100% ethanol or methanol and gasoline	20% MTBE with 80% gasoline
20% ETBE with 80% gasoline	17% TAME with 83% gasoline
- The pumping unit shall not incorporate any flexible diaphragms and all sealing shall be accomplished with O-rings or UL recognized gaskets.
- The pump shall be rated to operate between -40°F (-40°C) and 104°F (40°C) with non-gelled product.
- FE Petro Inc. shall manufacture the pump.

INSTALLATION AND MAINTENANCE

- The pump shall have a two or three wire field connection depending on single or three phase models and an easy access ground wire terminal, and shall incorporate a wire retainer which will accommodate these wires.
- The pump shall incorporate a port for line pressure testing that shall be sealed with a 1/4" NPT pipe plug.
- The pump head shall be equipped with a manual pressure relief screw to manually drop line pressure to zero by venting line pressure into storage tank. Purpose of this function is to avoid fuel spraying into dispenser and pump containment sumps during any routine service requiring piping to be opened to atmosphere such as filter replacement or leak detector maintenance.
- The pump unit shall have a fully extractable head in order to permit removal of the pump motor assembly without disturbing the discharge piping, product in the pipelines downstream of the check valve, syphoning system with syphon check valve installed, or the electrical wiring.
- During the removal of the extractable portion of the pump, product contained in the discharge manifold of the pump shall drain automatically into the storage tank.
- The pump will be equipped as standard with a 2 3/4" line check valve.
- The line check valve shall be independent of the removable head and shall be easily accessible.
- The pump motor shall be interchangeable by horsepower with different manufacturers' products.

OPERATION

- The pump shall have an air/vapor elimination system that returns air or vapors to the above ground storage tank through a tube.
- The pump unit shall contain a built-in expansion relief valve that relieves pressure at or above pumping pressure but below 50 psi as standard. Other pressure relief settings required by electronic line leak detection shall be available.
- The pump motor shall utilize the product being pumped for lubrication of the motor bearings and for cooling the stator, and this fluid shall discharge into the above ground storage tank at the top of the motor.
- The pump shall have syphon capability built into the pump as standard.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section includes:
 - .1 Materials and installation for aboveground oil storage tanks.

1.2 **RELATED SECTIONS**

- .1 Section 15000 – Mechanical General Requirements.
- .2 Section 15410 –Cleaning and Start-up of Mechanical Piping systems.
- .3 Section 15999 - Commissioning.
- .4 Section 15415 - Facility Fuel-Oil Piping.

1.3 **REFERENCES**

- .1 American National Standards Institute (ANSI).
 - .1 ANSI/NFPA-329, Handling Underground Releases of Flammable and Combustible Liquids.
 - .2 ANSI/API 650, Welded Steel Tanks for Oil Storage.
- .2 American Petroleum Institute (API).
 - .1 API STD 653, Tank Inspection, Repair, Alteration, and Reconstruction.
- .3 Canadian Council of Ministers of the Environment (CCME).
 - .1 CCME-PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .4 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, (CEPA).
- .5 Canadian Standards Association (CSA)/CSA International.
 - .1 CAN/CSA-B139, Installation Code for Oil Burning Equipment.
- .6 National Research Council/Institute for Research in Construction.
 - .1 NRCC 38727, National Fire Code of Canada (NFC).
- .7 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, (TDGA).
- .8 Underwriters' Laboratories of Canada (ULC).
 - .1 ULC/ORD-C142.23, Aboveground Waste Oil Tanks.
 - .2 ULC-S601, Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids.
 - .3 ULC-S602, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.
 - .4 ULC-S652, Tank Assemblies for Collection of Used Oil.

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- .9 Province of Ontario:
 - .1 Storage and Handling of Gasoline and Associated Products Regulations.
 - .2 2017 Liquid Fuels Handling Code from TSSA.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Submittal Procedures.
- .2 Indicate details of construction, appurtenances, installation, leakage detection system.
- .3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturer's product data to supplement shop drawings.
 - .1 Size, materials and locations of ladders, ladder cages, catwalks and lifting lugs.
 - .2 Tanks capacity.
 - .3 Size and location of fittings.
 - .4 Environmental compliance package accessories.
 - .5 Decals, type, size and location.
 - .6 Accessories: provide details and manufacturers product data.
 - .7 Size, material and location of manholes.
 - .8 Size, materials and locations of railings, stairs, ladders and walkways.
 - .9 Finishes.
 - .10 Electronic accessories: provide details and manufacturers product data.
 - .11 Insulation types, locations and RSI values.
 - .12 Identification, name, address and phone numbers of corrosion expert where applicable. Note: Grading drawings to be stamped by licenced corrosion expert.
 - .13 Piping, valves and fittings: type, materials, sizes, piping connection details, valve shut-off type and location.
 - .14 Spill containment: provide description of methods and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck, or vessel.
 - .15 Anchors: description, material, size and locations.
 - .16 Concrete: type, composition and strength.
 - .17 Size and location of site pads.
 - .18 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.
 - .19 Ancillary devices: provide details and manufacturer's product data.
 - .20 Grounding and bonding: provide details of design, type, materials and locations.
 - .21 Corrosion protection: provide details of design, type, materials and locations.
 - .22 Field-erected overfill-protection systems: provide details of design, type, materials and locations.
 - .23 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations.

ABOVE-GROUND FUEL STORAGE TANKS

- .4 Provide maintenance data for tank appurtenances and leakage detection system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials and appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan.
- .5 Place Materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the Regional and Municipal regulations.
- .7 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
- .8 Ensure emptied containers are sealed and stored safely.
- .9 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.
- .10 Divert unused concrete materials from landfill to local quarry facility as approved by Owner's Representative.
- .11 Dispose of unused paint or coating materials at an official hazardous material collections site as approved by Owner's Representative.
- .12 Do not dispose of unused paint, thinners, solvents, etc. into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .13 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 ABOVE GROUND FUEL OIL STORAGE TANK (DOUBLE WALL)

- .1 Provide packaged, factory fabricated and tested fuel oil storage tank, as specified, including double walled steel tank welded to steel support legs.
- .2 Tank Construction:
 - .1 Horizontal cylindrical double walled (300°-360° secondary containment) fabricated and certified to ULC S 601.
 - .2 Material: low carbon steel.
 - .3 Exterior coating: factory-applied, primer coat to CAN/CGSB-1.181 Ready Mix Organic Zinc-Rich Coating, two (2) coats of suitable corrosion resistant epoxy paint, and one (1) top coat of suitable polyurethane paint. Color finishes shall be approved by City of Niagara Falls.

ABOVE-GROUND FUEL STORAGE TANKS

- .4 Fittings: vent opening c/w vent pipe (size and length as required) with 180° close bend, fill opening c/w fill tube, locking cap, and spill containment device, 50 mm diameter tapping for each suction, 50 mm for return, one 100 mm tapping for level gauge, one 100 mm diameter spare tapping (threaded and plugged), vacuum gauge tapping.
- .5 Vacuum applied to interstitial space. With vacuum gauge and pressure switch for connection to monitoring system.
- .3 Tank Support:
 - .1 Four steel support saddles welded to tank drilled for holddown anchor bolts.
- .4 Accessories:
 - .1 Access stairs/platform c/w handrail for filling and inspection of tanks.
 - .2 Spill containment device on fill pipe c/w locking 50 mm tight fill cap, collar and drain valve.
 - .3 Level gauge: Type as indicated on the drawings.
 - .4 Emergency vent device.
 - .5 Vacuum gauge (tank mounted) c/w switch.
 - .6 Dipstick and gauge chart. Dipstick to be tank mounted in lockable enclosure.
 - .7 Lifting lugs.
 - .8 Grounding lug.
 - .9 Pipe support bracket on end of tank.
 - .10 Overfill protection and alarm panel.
- .5 Size: as indicated.
- .6 Anchored to concrete base with four anchor bolts.
- 2.2 CONCRETE WORK**
 - .1 In accordance with Civil/structural drawing.
- 2.3 GROUNDING AND BONDING**
 - .1 Provide grounding for tank.
 - .2 To coordinate with Electrical contractor for powering of dispenser, pumps, control panels.
- 2.4 ANTI-SIPHON VALVE**
 - .1 Automatic shut-off to prevent spillage in the event of line rupture, cast or ductile iron body, adjustable hydrostatic pressure, brass trim, corrosion-resistant steel spring, fluorocarbon seal, sized for application, built-in thermal expansion pressure relief valve.
- 2.5 FILL SIGNAL DEVICE**
 - .1 Vent whistle, whistles, when tank is being filled and stops whistling when tank is full, install on vent pipe at tank.
- 2.6 LEVEL GAUGING**
 - .1 Tank gauging stick to manufacturer's standard.
 - .2 Local manual type: level gauge mechanical display mounted on tank or immediately adjacent to tank, accuracy 2%, dial selected to suit tank.

ABOVE-GROUND FUEL STORAGE TANKS

- .3 Electronic solid-state type: combination tank level sensor and leak detector. Single or multiple tanks installation, and containment sump (s) monitoring where sumps are indicated on drawings.
 - .1 Monitor console containing visual LED display and printer and algorithms to automatically compute required operation, battery backup. Capable of handling up to 4 tanks, up to 8 sensors, complete with minimum of 2 output relays. Probe diagnostics. Fuel delivery reports. System to be programmable for:
 - .1 Inventory reporting with following features:
 - .1 Litres of fuel remaining.
 - .2 Amount of water in bottom of tank.
 - .2 Level probe: factory calibrated and pre-set, corrosion resistant and fuel oil compatible materials, two (2) 75 mm polyurethane floats to monitor water and fuel oil, top mounted on tank, sized to suit tank.
 - .3 Alarm annunciator: visual and audible alarm, non-hazardous location. Alarm silence/reset. Output to building EMCS via modem complete with software. Computer software to be installed on EMCS computer and operation verified.
 - .4 System shall provide visual and audible alarm for:
 - .1 Low product
 - .2 High water
 - .3 Leaks
 - .5 Additional Leak detection sensors for underground containment sump(s) and tank(s): if required refer to subsection

2.7 LEAKAGE DETECTION SYSTEM

- .1 To ANSI/NFPA 329.
- .2 Leak detector system: Cable system.
- .3 Monitoring instrument:
 - .1 Temperature compensated solid state circuitry to continuously monitor leak detection circuits for open circuit or alarm condition. Minimum 2 output relays. Alarm condition to be indicated by visual indicator light and audible alarm and operation of isolated relay to allow interface with other equipment.
 - .2 Supply voltage: 120 VAC.
 - .3 Module: complete with power-on lamp, alarm lamp, test switch and reset switch.
- .4 Leak detection cable: twisted pair of 18 AWG woven conductors insulated with hydrocarbon degradable dielectric with loose interlocking aluminum alloy armour.(Gas and oil resistance)
- .5 Control cable: twisted pair of 18 AWG woven conductors with 300 V insulation and PVC jacket.
- .6 Leak detection sensors:
 - .1 Sump sensor: for continuous monitoring and detection of liquid (fuel and/or water) in piping system sump. Communicates presence of liquid in the sump as an alarm condition to the monitoring instrument.
 - .2 Tank sensor: pressure sensor/switch for continuous monitoring of fuel tank interstitial space. Communicates loss of interstitial vacuum as an alarm condition to the monitoring instrument.

ABOVE-GROUND FUEL STORAGE TANKS

- .3 Alarm annunciator: visual and audible alarm, alarm silence/reset function. Output to building EMCS via modem complete with software where building EMCS is available. Refer to drawings to the availability of the same. Software to be installed on EMCS computer and operation verified.
- .4 Leak detection system supplied and installed as a complete, functional system including all wiring, controls, options and accessories as required.

2.8 METALLIC PIPING, VALVES, AND FITTINGS

- .1 In accordance with Section 15415 – Facility Fuel-Oil Piping.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install tank(s) and all piping, fittings, accessories and associated systems in accordance with National Fire code of Canada, CCME – “Code of Practice”, CSA B139 (as applicable), provincial regulations and manufacturer’s recommendations.
- .2 Position tank(s) using lifting lugs and hooks, and where necessary use spreader bars. Do not use chain in contact with tank walls.
- .3 Provide all registrations and permits as required by Provincial regulations.

3.2 FIELD QUALITY CONTROL

- .1 Test tank(s) for leaks to requirements of authority having jurisdiction and in presence of authority having jurisdiction.
- .2 Commission in accordance with Section 15999-General Commissioning(Cx) Requirements.

3.3 TOUCH-UP

- .1 Where coating is damaged touch-up original coating material.
- .2 Shield capillary and tubing connections in heavy-duty 50 mm stainless steel pipe.

3.4 LEVEL GAUGE SYSTEM

- .1 Provide leak and vapour proof caulking at connections.
- .2 Shield capillary and tubing connections in heavy-duty 50 mm stainless steel pipe.
- .3 Calibrate system.

3.5 LEAK DETECTION SYSTEM

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

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The purpose of this section is to specify the Division 15 responsibilities and participation in the commissioning process.
- B. Division 15 contractors shall engage Testing and balancing firm for all testing and balancing jobs. Division 15 shall engage (Commissioning Authority (Cx A)). Cx A will provide support for start-up, testing, and commissioning procedures. The commissioning process does not relieve Division 15 from participation in the process or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner.
- C. The Commissioning Authority (Cx A) will verify and document the following field tests and observations:
 - 1. Field Installation Verification (FIV). Verification of all installed systems for compliance to plans and specification. These inspections are to be described in detail in the commissioning plan.
 - 2. Operation Performance Tests (OPT). Operational tests which verify proper start-up of all equipment and systems. These tests are to be described in detail in the commissioning plan.
 - 3. Functional Performance Tests (FPT). Functional system tests that verify all systems are functioning and interacting with other systems correctly. These tests are to be described in detail in the commissioning plan.
- D. The Commissioning Authority (Cx A) will provide all Testing, Adjusting and Balance work with test and Balancing Firm.
- E. Work of Division 15 includes:
 - 1. Testing and start-up of the equipment.
 - 2. Assistance in testing and balancing.
 - 3. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial commissioning.
 - 4. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements.
 - 5. Providing operation and maintenance information and as-built drawings to the NEBB Systems Commissioning Firm for verification, organization, and distribution.
 - 6. Providing assistance to the CxA to develop and edit system operation descriptions.
 - 7. Providing training for the systems specified in this Division with coordination by the CxA.

1.2 COOPERATION

- A. Cooperate with the Test and Balance Firm and the Commissioning Authority (Cx A) in the following manner:
1. Allow sufficient time before final completion dates so that testing and balancing can be accomplished.
 2. Provide labor and material to make corrections when required without undue delay. Install balancing dampers/balancing cocks/ P&T taps as required by Test and balance firm.
 3. Put all heating, ventilating, and air conditioning systems and equipment into full operation and continue the operation of the same during each working day of testing and balancing.
 4. Include the costs of dampers, sheaves, and belts, including the cost of exchange sheaves and belts as required by the Testing and balancing.
 5. Provide test holes in ducts and plenums where directed or necessary for pitot tubes for taking air measurements and to balance the air systems. Test holes shall be provided with an approved removable plug or seal. At each location where ducts or plenums are insulated, test holes shall be provided with an approved extension with plug fitting.
 6. Provide P&T (pressure and temperature) taps as noted on construction documents and as required by the CxA to adequately test and/or balance the hydronic systems.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

The test equipment will be provided by the NEBB Test and Balance Firm as part of their contract. Provide test equipment as necessary for start-up of the mechanical equipment.

2.2 TEST EQUIPMENT - PROPRIETARY

Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Cx A in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

- A. Complete all phases of work so the system can be started, tested, balanced, and otherwise commissioned. Division 15 has primary startup responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc. per

the contract documents and related directives, clarifications, change orders, etc.

- B. A commissioning plan will be developed by the Cx A. Upon request of the Cx A, Division 15 shall provide assistance and consultation. Division 15 is obligated to assist the Cx A in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation.

If system modifications/clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner. If Contractor initiated system changes have been made that alter the commissioning process, the Cx A will notify the City Project Manager.

- C. Specific pre-commissioning responsibilities of Division 15 are as follows:
 - 1. Factory start-up or Contractor start-up of all equipment and systems installed under division 15000.
 - 2. Normal start-up services required bringing each system into a fully operational state. This includes motor rotational check, cleaning, filling, purging, control sequences of operation, leak testing, full load, and part load performance, etc. The NEBB Systems Commissioning Firm will not begin the functional commissioning process until each system is complete, including normal contractor start-up.

3.2 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start-up and debug all systems within Division 15. These same technicians shall be made available to assist the Cx A in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc. will be requested by the CxA and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustment, and/or problem resolutions.
- B. System problems and discrepancies may require additional technician time, Cx A, redesign and/or reconstruction of systems, and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.
- C. The Cx A reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or subsystem. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Cx A to get the job done. A liaison or intermediary between the Cx A and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

3.3 WORK TO RESOLVE DEFICIENCIES

- A. In some systems, mis-adjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the City Project Manager, with input from

the Contractor, equipment supplier, and Cx A. Whereas all members will have input and the opportunity to discuss, debate and work out problems, the City Project Manager will have final jurisdiction on the necessary work to be done to achieve performance.

- B. Corrective work is to be completed in a timely fashion to permit the timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Cx A deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Cx A will notify the City Project Manager indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.

3.5 TRAINING

- A. In addition to the requirements of City Project Manager arrange for and participate in the training of Owner's engineering and maintenance staff on each system and related components. Training will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.
- B. Training will be conducted jointly by the Cx A the design engineers, the equipment vendors, and the Contractor. The Contractor will be responsible for highlighting system peculiarities specific to this project.

3.6 SYSTEMS DOCUMENTATION

- A. In addition to the requirements of City Project Manager, update contract documents to incorporate field changes and revisions to system designs to account for actual constructed configurations. All drawings shall be redlined on one set of transparencies provided by the contractor. Division 15 as-built drawings shall include architectural floor plans, elevations and details, and the individual mechanical or electrical systems in relation to actual building layout.
- B. Maintain as built redlines as required in City Project Manager. Given the size and complexity of this project, redline drawings at completion of construction, based on memory of key personnel, is not satisfactory. Continuous and regular redlining of drawings is considered essential and mandatory.

- C. In addition to the requirements of City Project Manager for operation and maintenance data, provide five (5) copies of equipment technical literature, operation and maintenance literature, and shop drawings to the Cx A as soon as they are available. This requirement does not relieve the Contractor of submitting the final operating and maintenance data at project closeout.

END OF SECTION

ELECTRICAL GENERAL PROVISIONS

Part 1 General Provisions

1.1 GENERAL

- .1 This section of the Specifications is an integral part of the Contract Documents and shall be read accordingly.
- .2 Comply with Division 1 - General Requirements - and all documents referred to therein.
- .3 The General Conditions of the Contract, the Supplementary General Conditions, and General Requirements shall form part of this Specification as though written out in full herein.
- .4 Failure to execute the contract and to file satisfactory documentation, as required herein within the specified time period shall be just cause for the cancellation of the contract award.
- .5 Coordinate the electrical work with other trades. Provide an adequate work force and supervision to meet the construction schedule.

1.2 DEFINITIONS

- .1 Wherever the words indicated, designated, shown, noted, listed or similar words or phrases are used in the Specifications, they shall be understood, unless the context otherwise provides, to mean that material(s) or item(s) referred to shall be read as indicated on, designated on, shown on, noted on or listed on the Drawings.
- .2 Wherever the words *approved, satisfactory, as directed, submit, permitted, inspected* or similar words or phrases are used in the Specifications they shall be understood, unless the context otherwise provides, to mean that material(s) or item(s) referred to shall be *approved by, satisfactory to, as directed by, submitted to, permitted by or inspected by* the Consultant.
- .3 The term *provide* where used shall be understood to include labour, materials and services necessary to supply the Work and/or and install the item(s) referred to.

1.3 SPECIFIED, EQUIVALENT AND ALTERNATIVE APPARATUS AND MATERIALS

- .1 Tenders shall be prepared and submitted only on the basis of specified material and equipment. Supply all items, articles, materials using methods, operations or techniques mentioned, shown, scheduled or reasonably implied by the drawings and specifications. This shall include all labour, equipment, tools, apparatus and incidentals required to provide a complete and operable electrical system or electrical systems. The plans and specifications are intended to complement one another. Materials and operations shown or implied on one and not the other shall be deemed to be required and must be included in the contract.
- .2 If materials or apparatus manufactured and/or specified by a manufacturer named as equivalent are used in lieu of the manufacturer specified, this Contractor shall be responsible for ensuring that the substituted material or apparatus is equivalent in performance and operating characteristics to the specified materials or apparatus, and it shall be further understood that all costs for larger starters, additional space, larger power feeders and any other changes to associated or adjacent work will be borne by the

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Contractor offering the substitution. In addition, in Equipment Rooms where apparatus named as equivalent is used in lieu of specified apparatus and the dimensions of such apparatus differs from the specified apparatus, prepare and submit for approval before purchase, accurately dimensioned layouts of rooms affected.

- .3 In addition to the manufacturers specified or named as equivalent, this Contractor may propose alternative manufacturers of equipment and/or apparatus to the Client for acceptance, listing in each case a corresponding credit for each alternative proposed. The tender price must be based on apparatus or materials specified or named as equivalent. Certify in writing to the Consultant that the alternative meets space, power, design and all other requirements of the specified or equivalent material or apparatus. In addition, it shall be understood that costs for larger starters, space, power feeders, and any other changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives, will be borne by the party making the proposal.
- .4 Unless otherwise noted, all materials and apparatus shall be new.

1.4 DOCUMENTS

- .1 All work shall be in accordance with the Ontario Electrical Safety Code (Latest Edition), the Ontario Building Code, Canadian Standards Association (CSA), CAN/ULC standards, Ontario Fire Code, NFPA, TSSA Liquid Fuels Handling Code 2017, ASHRAE 90.1 Energy Standard, any other Authorities having jurisdiction and to the Owner's requirements.
- .2 The sentence in the General Conditions: "Specifications shall govern over Drawings" shall not apply to this Division. Where conflict does occur between codes, Specifications and Drawings, the most stringent stipulation shall govern, and the Tender shall be based on whichever indicates the greater cost.

1.5 INSPECTIONS AND CERTIFICATIONS AND PAYMENTS

- .1 This Contractor shall apply for all required Electrical Inspections and submit a final inspection certificate on completion of the work.
- .2 Arrange and pay for permits, tests, certificates of inspection and utility charges required for the Work. Submit applications requiring Owner's signature before commencing Work.
- .3 Do Work in compliance with laws, rules, ordinances and regulations of authorities having jurisdiction

1.6 INSTALLATION DRAWINGS AND INSTRUCTIONS

- .1 Provide sleeving drawings showing all openings in the structure and between fire separations with all required dimensions. Provide all changes necessitated by the submission of incorrect or late information.
- .2 Provide installation drawings of all Work with dimensions, drawn to scale, and coordinate with all Trades and Divisions. These drawings shall show the actual equipment installed including all switches, outlets and conduit runs. Completely dimension all devices, openings, recesses and sleeves where practical.
- .3 Submit all drawings prior to commencement of the Work. Submit copies of drawings to all

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Divisions for co-ordination.

- .4 Submit notification of locations where installation of fixtures, fittings, and equipment would interfere with interior treatment and use of building.
- .5 Submit drawings as part of as-built documentation at completion of project.

1.7 SHOP DRAWINGS

- .1 Submit shop drawings, unless otherwise specified, electronically or in the form of hard, original copies for each major item of equipment such as panels, light fixtures and special systems.
- .2 Manufacturer's printed data sheets for standard items are acceptable providing pertinent characteristics and specific model numbers are clearly identified and related to specified items. Submit three (3) copies of data sheets except where specified otherwise.
- .3 Shop drawings shall be clearly marked with project name, identification, materials and/or equipment actually to be supplied, dimensions, weights, capacities, electrical performance characteristics.
- .4 Each shop drawing shall be checked and stamped as being correct by the Contractor submitting the drawing before it is submitted. If the above requirements are not complied with, shop drawings will be rejected and returned forthwith.
- .5 Where applicable, provide wiring details, schematics, single line drawings, and wiring diagrams showing interconnection with work of other Trades.
- .6 Shop drawings for non-catalogue items shall be specifically prepared for this project.
- .7 Verify and check dimensions to ensure proper installation of equipment in available space and without interference to work of other Trades. Ensure that electrical and all other coordination is complete prior to submission of shop drawings.
- .8 Provide data sheets and samples for all wiring devices and wall plates prior to installation. Device and plate colors/finishes are to be confirmed prior to ordering.
- .9 Do not have equipment delivered to site until a shop drawing for the item has been reviewed, approved, stamped and returned.
- .10 For lighting fixtures, submit for approval the fixture cuts and catalogue numbers of the fixtures being supplied in the same sequence as the specified fixture list with clear indication of the item designation on the fixture list.

1.8 PROTECTION OF WORK AND PROPERTY

- .1 Each trade shall protect its own and other trade's finished and unfinished work from damage, due to the carrying out of its work.

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- .2 Cover floors and other work with tarpaulins, if required, for this purpose. Each trade shall assume responsibility for repairing damage to floor and wall surfaces resulting from its failure to provide such protection. Carry out such repairs in a satisfactory manner without expense to Owner.

1.9 CLEANING UP

- .1 Assume responsibility for removing tools and waste materials during the Work and maintain in clean and perfect condition.

1.10 EXAMINATION

- .1 Carefully examine the local conditions affecting the Work and building site, together with the Structural and Mechanical Drawings to make sure that Work under Specification and as shown on Drawings can be satisfactorily carried out without changes. Work for all trade Divisions shall be examined, before commencing Work, and any defect or interference affecting Work shall be reported at once.
- .2 No allowances will be made for any expense incurred through failure to make these examinations or on account of any condition of site or any growth or item existing thereon which was visible or known to exist at time Tender for Work was submitted.

1.11 OFFICE AND STORAGE

- .1 Provide temporary office, workshop and tools and material storage space for the Work and assume responsibility for any loss or damage thereto. Buildings erected for this purpose shall conform in appearance to those erected for similar purposes under other Divisions of Specification. Provide heat, light and telephone for the buildings.

1.12 CO-ORDINATION WITH CEILING AND WALL PATTERNS

- .1 Locate wall and ceiling components in exact accordance with dimensions furnished by the ceiling installer, wall finish installer and masonry installer. Make any necessary adjustments in same to allow switches, receptacles, detectors and other devices to coincide with ceiling and wall patterns.

1.13 SCAFFOLDING, SHORING, RIGGING & HOISTING

- .1 Provide scaffolding and shoring necessary for work of this Division. Scaffolding and shoring shall be adequate to protect the workmen according to Provincial and Local Regulations.
- .2 Provide labour and equipment necessary for the Work of this Division. Employ only workmen well experienced and skilled in such Trades for this portion of the Work.
- .3 Provide hoisting machinery, operators, labour and materials necessary to lift and place equipment supplied under this Division.

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1.14 DRAWINGS

- .1 Drawings showing the Work do not show every detail and are diagrammatic only. Record on the As-Built drawings any obtained information involving accurate measurements of building from physical conditions.
- .2 Locate devices, fixtures, equipment, exactly as detailed on the Drawings.
- .3 Provide intermediate supports in walls, ceilings etc as necessary to locate items exactly as directed.
- .4 Coordinate locations with other Trades prior to installation.

1.15 CONTRADICTIONS AND DISCREPANCIES

- .1 Prior to the questions deadline as identified in the Instructions to Bidders, report any contradiction or discrepancies found in the drawings to Procurement for clarification.
- .2 The Engineer will interpret the intent of the article in question and may issue an addendum to clarify the intent.
- .3 Failure by the Contractor to report contradictions or discrepancies until after the tenders close will give the Engineer the right to interpret the intent of the article in question and render a binding decision without having it affect the tendered bids. Ie. The Contractor shall assume high cost option.

1.16 MINOR FIELD CHANGES

- .1 The location, arrangement and connection of equipment and material as shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Owner to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes shall be done at no extra cost to the Owner, unless the location, arrangement or connection is more than ten feet from that shown.

1.17 EXECUTION

- .1 Start work and proceed as soon as possible after the contract has been let and in accordance with the construction of the building.
- .2 Confer and cooperate with other trades in order to eliminate any unnecessary delays to the construction schedule. Where doubt exists regarding other trades, confer with the Owner without delay for detailed instructions concerning how to proceed with the work. Expedite delivery of all equipment and materials to meet the construction schedule.
- .3 All drawings are in general made to scale and where figured dimensions are not given, obtain approximate distance by scaling plans. It is however, distinctly understood that the Contractor does so entirely on his own responsibility as the accuracy of the drawings is not guaranteed.

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- .4 The drawings upon which this contract is based show the arrangements, general design and extent of the conduit, wiring and other systems. These systems are suitably outlined on the drawings with regard to sizes, locations and general arrangements.
- .5 The mains and connections thereto are shown more or less in diagram, except where in certain cases the drawings may include details giving the exact locations and arrangements required. Any necessary change or additions to the runs to accommodate structural conditions are done without additional charge or expense to the Owner. Notify the Engineer immediately and secure his authority in writing for such revisions before proceeding with the work.

1.18 RECORD DRAWINGS

- .1 An extra set of white prints of Drawings for Work must be supplied by this Contractor. Mark on these Drawings in red ink, every change and deviation from runs of cable tray, conduit, junction boxes and any other services as originally shown so that, on completion of the job, they will constitute a record of exact locations of those services as installed. Keep these Drawings in the site office and keep them up-to-date. Final certificate of job acceptance will not be issued until these Drawings are completed and submitted.
- .2 Dimension locations of junction boxes, pull-boxes, conduits, cable tray and any other items, with respect to building column centers. Mark levels with respect to elevation which will be provided.

1.19 DATA BOOK

- .1 Submit three complete sets of manufacturer's operating and maintenance instructions, bound in vinyl covered hard backed, 8½ x 11 size, three-ring binders at completion, and before final acceptance of Work. Contents of books shall not include handwritten data.
- .2 Title sheet, in each book, shall be labeled "**Manufacturers' Data Book**" and shall bear the following:
 - .1 Project Name
 - .2 Date
 - .3 List of Contents
- .3 Each book shall contain the following:
 - .1 Manufacturer's literature, parts list, approved shop drawing, and name and address of closest service organization and spare parts source, for each item of equipment.
 - .2 Voltage and ampere rating for each item of electrical equipment.
 - .3 Suitably fold shop drawings larger than 8½ x 11 and place in a manila envelope, 3-hole punched, for inclusion in book.
 - .4 Copy of all panel schedules / directories as build with actual Room numbers.

1.20 COMMISSIONING

- .1 Commissioning is the activation of the completed installation to complete working order at the specified requirements as certified by the Consultant.
- .2 Be responsible for the installation and performance of all Work provided under this

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Division.

- .3 This Division shall cooperate and provide assistance to the Consultant & Owner as required to perform commissioning. Make labour available for the duration of the commissioning work.
- .4 The Contractors shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.

END OF SECTION

BASIC ELECTRICAL MATERIALS AND METHODS

Part 1 Basic Materials and Methods

1.1 GENERAL

- .1 This section of the Specifications is an integral part of the Contract Documents and shall be read accordingly.
- .2 Comply with Division 1 - General Requirements - and all documents referred to therein.
- .3 Conform to the requirements of Section 16010 ELECTRICAL GENERAL PROVISIONS.

1.2 WORK INCLUDED

- .1 Work to be done under this Section shall include furnishings of labour, materials, and equipment required for installation, testing and putting into proper operation complete Electrical systems as shown, as specified and as otherwise required. Complete systems shall be left ready for continuous and efficient satisfactory operation.

1.3 STANDARD OF MATERIALS

- .1 Where materials and equipment are specifically described and named in either the Drawings or these Specifications, it is done so in order to establish a standard of material and workmanship.
- .2 Materials required for performance of work shall be new and the best of their respective kinds and of uniform pattern throughout the Work.
- .3 Materials shall be of Canadian manufacture where obtainable. Materials of foreign manufacture, unless specified, shall require approval before being used.
- .4 Equipment items shall be standard products of approved manufacture. Identical units of equipment shall be of same manufacture. In any unit of equipment, identical component parts shall be of same manufacture, but the various component parts comprising the unit need not be of one manufacture.
- .5 Chemical and physical properties of materials and design performance characteristics and methods of construction and installation of items of equipment, specified herein, shall be in accordance with latest issue of applicable Standards or Authorities when such are either mentioned herein, or have jurisdiction over such materials or items of equipment.
- .6 Materials shall bear approval labels as required by Code and/or Inspection Authorities.
- .7 Equipment shall be rated for hazardous locations (Class I, Division 1, Group D gas) in areas noted on plans or as otherwise required by materials specified.
- .8 Install materials in strict accordance with manufacturer's recommendations.
- .9 Include items of material and equipment not specifically noted on Drawings or mentioned in Specification but which are necessary to make a complete and operating installation.
- .10 Remove materials, condemned as not approved for use, from job site and deliver and install suitable approved materials in their place.

BASIC ELECTRICAL MATERIALS AND METHODS

- .11 Unless otherwise noted, all materials and apparatus shall be new.

1.4 CUTTING AND PATCHING

- .1 All cutting and patching performed by Division 16 shall be in accordance with Division 2, Cutting and Patching. Layout such work for approval before undertaking same.
- .2 Cutting shall be kept to an absolute minimum and performed in a neat and workmanlike manner using the proper tools and equipment. Caution shall be exercised in all cutting and procedures to ensure that concealed services are not affected. **Do not cut if in doubt.** Request Consultant's presence to determine if concealed services exist.
- .3 Assume responsibility for prompt installation of Work in advance of concrete pouring or similar Work. Should any cutting or repairing of finished/unfinished Work be required because such installation was not done, employ the particular trade whose Work is involved to do such cutting and patching. Pay for any resulting costs. Layout such Work for approval before undertaking same.

1.5 PAINTING

- .1 Primary and final painting for Work, other than items specified as factory primed or finished, will be done under Finish Division 9.
- .2 Repair and finish factory finished equipment, damaged or scratched during installation, in an approved manner.
- .3 All structural steel including hangers, brackets, supports and other ferrous metals shall be shop or factory prime painted wherever practicable. Wherever structural steel including hangers, brackets, supports, and other ferrous metals cannot be shop or factory prime painted, wire brush to remove all traces of rust, clean off all traces of dirt, oil, and grease, and apply one coat of an approved rust inhibiting primer in accordance with CGSB-GB-40d and leave ready to receive finish paint.

1.6 EXCAVATING AND BACKFILLING

- .1 Excavate and backfill as required for the work, both inside and outside the building in accordance with applicable Section in General Division.
- .2 Existing underground services existing throughout the area of excavation. Arrange for locates on private property for all main and branch services in entire work area, prior to start of work. Carefully check such locations and report any serious discrepancy before proceeding with any Work. The services of local Public Utilities Commission, Hydro, Telephone and Gas Authorities shall be engaged to accurately determine location of any underground piping.
- .3 Prepare excavation for underground services of required depth and dimension as required so that no portion of any conduit or duct bank bears directly against any rock or other hard surface.
- .4 Form bottoms of trenches in earth inside building so that conduits or ducts are supported on a solid bed of undisturbed earth. Care shall be taken to relieve conduits of undue strain.

BASIC ELECTRICAL MATERIALS AND METHODS

- .5 Support conduits and duct banks passing through building foundation walls.
- .6 Thoroughly tamp sand around ducts and over conduits in 150 mm layers to a height of at least 600 mm above top of pipes, conduits and banks and water as necessary (unless otherwise indicated on the Plans). Fill remainder of trench and consolidate in 300 mm layers with approved excavated material, free from stone and water, as required.
- .7 Backfill trenches under building floors, roads and paved areas with coarse sand placed in layers in an approved manner. Use clean earth fill for other backfilling.

1.7 EQUIPMENT IDENTIFICATION

- .1 Labels for feeder conduits and cables to indicate their content shall comprise pressure sensitive tape. Labels shall be printed on plastic coated tape, 2" x 6" size with black printing on yellow background indicating applicable voltage, i.e. "208Vac".
- .2 Labels shall be manufactured by:
 - .1 W.M. Brady Co. of Canada Limited
 - .2 Ideal Electric Canada Ltd.
- .3 Provide nameplates on each piece of electrical equipment, namely power panels, distribution panels, lighting panels, disconnect switches, contactors and miscellaneous systems panels.
- .4 Nameplates for Disconnect Switches and Contactors shall indicate equipment being controlled and voltage.
- .5 Nameplates shall be white lamacoid with beveled edges and black engraved letters. Fasten nameplates to equipment in a conspicuous location. Locate nameplate on flush mounted panels on front of panel behind hinged door.
- .6 Modify panel schedules for all lighting and power panels to suit revised layout.
- .7 Identify control conductors for motors and equipment by pressure sensitive tape markers at each main terminal point and wherever they are introduced into ducts or equipment.
- .8 Maintain a schedule of numbers with corresponding machine numbers and locations and include with Record Drawings.
- .9 Label feeder conduits and cables.
- .10 Locate labels as follows:
 - .1 At every end of every conduit, duct or cable run, adjacent to item of equipment serviced.
 - .2 On each exposed conduit, duct or cable passing through a wall, partition or floor (one on each side of such wall partition or floor).
 - .3 At intervals of 50'-0" along every exposed conduit, duct or cable run exceeding 50'-0" in length.
 - .4 At every access point on concealed conduit duct or cable
- .11 Labels shall be visible from 5'-0" above adjacent floor platform.

BASIC ELECTRICAL MATERIALS AND METHODS

1.8 TESTING

- .1 Perform tests of equipment and wiring at times requested.
- .2 Tests shall include meggered insulation values, voltage and current readings to determine balance of panels and feeders under full load, and operation of each piece of equipment for correct operation.
- .3 Supply meters, materials and personnel as required to carry out these tests.
- .4 Test electrical work to standards and function of Specification and applicable codes in an approved manner. Replace defective equipment and wiring with new material and leave entire system in complete, first-class operating condition.
- .5 Connect single phase loads so that there is the least possible unbalance of the supply phases.
- .6 Submit all test results in report format.

1.9 CONDUIT SLEEVES AND CURBS

- .1 Provide DB/2 PVC sleeves at points where Teck cables are passing through concrete walls, beams, slabs and floors.
- .2 Extend conduit sleeves for conduit rising through slabs 4" minimum above finished floors. Provide sleeves, passing through floors having a waterproof membrane, with an integral flashing clamp.

1.10 SUPPORTS AND BASES

- .1 Submit proposed method of attachment of hangers and beam clamps, to cellular steel deck for approval before proceeding with Work
- .2 Supply and erect special structural Work required for the installation of electrical equipment.
- .3 Provide anchor bolts and other fastenings unless noted otherwise. Mount equipment required to be suspended above floor level, where details are not shown, on a frame or platform bracketed from the wall or suspended from the ceiling. Carry supports to either the ceiling or the floor, or both as required, at locations where, because wall thickness is inadequate, it is not permitted to use such brackets.
- .4 Electrical panels, switches or other electrical equipment shall be complete with suitable bases or mounting brackets.
- .5 Provide channel or other metal supports where necessary, to adequately support lighting fixtures. Do not use wood unless wood forms part of the building structure. All light fixtures shall be adequately supported from the roof structure.
- .6 Support hangers, in general, from inserts in concrete construction or from building structural steel beams, using beam clamps. Provide additional angle or channel steel members, required between beams for supporting conduits and cables.

BASIC ELECTRICAL MATERIALS AND METHODS

- .7 Provide any additional supports required from concrete construction for any piping or equipment, by drilling same and installing expansion bolt cinch anchors.
- .8 Do not use explosive drive pins in any section of Work without obtaining prior approval.

1.11 HANGERS

- .1 Hangers for electrical conduit shall be galvanized after fabrication.
- .2 Conduit hangers shall be as manufactured by:
 - .1 Burndy Canada Ltd.
 - .2 Canadian Strut Products Ltd.
 - .3 E. Myatt & Co. Ltd.
 - .4 Steel City Electric Co.
 - .5 Pilgrim
 - .6 Thomas & Betts
 - .7 B-line
- .3 Do not use perforated strapping (grappler bars).

1.12 GROUNDING AND BONDING

- .1 Ground electrical equipment and wiring in accordance with these Specifications, the Drawings, the Ontario Electrical Safety Code and Local Inspection Authority's Rules and Regulations.
- .2 Install grounding conductors, outside Electric Rooms in conduit and conceal where possible. Make connections to water mains, all metallic piping systems, neutral and equipment with brass, copper or bronze bolts and connectors or weld using Cadweld or Thermoweld processes.
- .3 Provide grounding conductors, sized as per Code, and connect to grounding bus or water main wherever non-raceways are installed.
- .4 All non-current-carrying metal parts of dispensing pumps, metal raceways, and other electrical equipment shall be bonded to ground in accordance with OESC section 10.
- .5 Tanks are to be bonded to ground in locations at grounding lugs via #6 AWG bare copper.

1.13 WIRING OF MECHANICAL TRADES' MOTORS

- .1 To limit responsibility and to specifically define the Work under this Division, use the following procedure with regard to motors provided under Mechanical Division 15.
- .2 The Contractor under Mechanical Division 15 will be responsible for the supply of motors and starters, specific to equipment supplied by their Division.
- .3 In every instance whether pertaining to Plumbing, Air Conditioning, Refrigeration, Heating or Ventilating equipment, install starter and wire to line side of the starter or motor. Extend wiring from starter to motor as indicated.

BASIC ELECTRICAL MATERIALS AND METHODS

- .4 Where individual starters and controls are grouped together, provide a panel for mounting this equipment. Provide a feeder, main fused disconnect and a splitter of adequate size and capacity and wire to line side of the starters on this panel and from starters to motors.
- .5 Provide branch circuit wiring and an outlet for each motorized damper, variable air volume box (VAV Box), infrared plumbing fixture control or heating control valve. Control wiring below 120Vac shall be performed under Division 15.
- .6 In the case of exhaust fans, unit heaters, gas furnace, energy recovery ventilator, air conditioning and condensing units, terminate wiring on terminals provided. Control wiring, thermostats or other control device operating at voltages below 120Vac will be done under Mechanical Division 15.
- .7 Ascertain exact locations of starters, motors, motorized dampers, VAV boxes, infra-red plumbing fixture controls and heating control valves from Mechanical Drawings and coordinate exact locations with Division 15.
- .8 Unless specifically determined in Drawings or Specifications, motors up to and including 1/3 H.P., shall be 1 phase, 60 Hz, 120 volts.
- .9 Unless specifically determined in Drawings or Specifications, motors 1/2 H.P. and above shall be 3 phase, 60 Hz, 208 volts.

1.14 WIRING METHODS

- .1 Install wiring in conduit unless otherwise specified.
- .2 Use thin wall conduit, for branch circuit and feeder wiring in ceilings, furred spaces, and in hollow walls and partitions. Use rigid PVC conduit for wiring in poured concrete, or where exposed. Use rigid PVC conduit for wiring in slabs on grade and wiring below grade.
- .3 Aluminum conduit may be used, in lieu of rigid steel conduit, in clean and dry locations, but shall not be used in poured concrete, or for signal and intercommunication systems wiring.
- .4 Conduit manufacturer's touch-up enamel shall be used to repair all scratches and gouges on epoxy-coated conduit.
- .5 Teck cable shall be used in hazardous locations, as indicated by the Plans, with intrinsically-safe threaded connectors and seals.

1.15 OUTLET BOXES

- .1 Boxes shall conform to C.S.A. Standard C22.2 No. 18-1972.
- .2 Where 103 mm square outlet boxes are installed in exposed concrete or cinder block finished areas, blocks will be cut under Masonry Division as instructed under this Section. Opening shall be cut to provide a close fit to boxes and covers so that edges of openings are not visible after installation of plates. Mortar shall not be used to patch up openings that are cut too large or to patch ragged edges.

BASIC ELECTRICAL MATERIALS AND METHODS

- .3 Ceiling boxes shall be 103 mm octagon or square, complete with fittings, where required to support fixtures.
- .4 Switch and receptacle boxes shall be:
 - .1 103 mm square with plaster ring, where flush mounted in plaster walls.
 - .2 No. 1104, where flush mounted in wood or drywall, with stud fasteners as required.
 - .3 Masonry boxes in masonry walls.
- .5 Where boxes are surface mounted in unfinished areas they shall be FS conduits.
- .6 Standard outlet boxes shall be manufactured from code gauge galvanized steel.
- .7 Provide a suitable outlet box for each card-reader, security camera, powered-door operator, light, switch, receptacle or other outlet, approved for the particular area it is to be installed.
- .8 Support outlet boxes independently of conduit and cable.
- .9 Locate outlet boxes, mounted in hung ceiling space, so they do not obstruct or interfere with the removal of lay-in ceiling tiles.
- .10 Offset outlet boxes, shown back to back in partitions, horizontally a min. of 150mm to minimize noise transmission between adjacent rooms.
- .11 Use gang boxes at locations where more than one device, of the same system only, is to be mounted. Each system shall utilize separate boxes.
- .12 Use tile wall covers where 103 mm square outlet boxes are installed in exposed concrete or cinder block in finished areas.
- .13 Flush mount boxes, panels, cabinets and electrical devices, which are installed in finished areas, shall be provided with suitable flush trims and doors or covers, unless specifically noted otherwise.
- .14 Provide pre-formed polyethylene vapor barriers for all boxes located in walls with internal vapor barriers.

1.16 CONDUIT ACCESSORIES, CONDULETS AND FITTINGS

- .1 Conduit accessories, conduits and fittings shall conform to C.S.A. Standard C22.2 No. 18-1972.
- .2 Rigid conduit bushings shall be as manufactured by:
 - .1 Thomas & Betts Ltd - Series 5031
 - .2 Efcor of Canada Ltd - Series 720B
 - .3 Commander/Iberville.
- .3 EMT Connectors shall be as manufactured by:

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- .1 Thomas & Betts Ltd - Steel City TC 121E Series
 - .2 Efcor of Canada Ltd - Series 720B
 - .3 Commander/Iberville

 - .4 Ground bushing shall be as manufactured by:
 - .1 Thomas & Betts – Blackjack or 1220 Series
 - .2 Efcor of Canada Ltd.
 - .3 Commander / Iberville

 - .5 Flexible conduit connectors shall be as manufactured by:
 - .1 Thomas & Betts Ltd - Series 3110
 - .2 Efcor of Canada Ltd - Series 1001B
 - .3 Commander/Iberville
 - .4 EMT couplings shall be steel concrete tight to match connectors.

 - .6 Conduit fittings shall be as manufactured by:
 - .1 Crouse-Hinds of Canada Ltd.
 - .2 Kondu Mfg. Co. Limited
 - .3 Thomas & Betts Ltd.
 - .4 Killark of Canada
 - .5 Efcor of Canada Ltd.
 - .6 Commander/Iberville

 - .7 Steel conduit shall be as manufactured by:
 - .1 Conduits National Co. Ltd.
 - .2 MBF Industries

 - .8 Aluminum conduits shall be as manufactured by Alcan Canada Products Ltd.

 - .9 Terminate rigid conduit entering boxes or enclosures with nylon insulated steel threaded bushings such as Thomas & Betts – 8125 Series

 - .10 Terminate flexible conduit entering boxes or enclosures with nylon insulated steel connectors such as Thomas & Betts 5332 Series or equivalent.

 - .11 Install wall entrance seals where conduits pass through exterior walls below grade.

 - .12 Provide expansion coupling in conduit runs at building expansion joints and in long runs subject to thermal expansion, all in accordance with manufacturer recommendations.

 - .13 Junction boxes in hazardous areas shall be intrinsically safe, Condulet EAB series by Eaton/Crouse-Hinds.
- 1.17 CONDUCTORS, WIRES AND CABLES (EXCLUDING TECK CABLES)**
- .1 Wiring installed in conduit, unless otherwise noted, shall be 600volt "RW 90 X-Link".
 - .2 Feeder conductors shall be copper or aluminum and sized as indicated on the Drawings. Feeder conductors shall be sized for no more than 2% maximum voltage drop.

BASIC ELECTRICAL MATERIALS AND METHODS

- .3 Lighting and power branch circuit conductors shall be copper, minimum No. 12 gauge. Branch circuit conductors shall be sized for no more than 3% maximum voltage drop to farthest device on a maximum 80% loaded circuit.
- .4 Home runs to lighting and receptacle panels which exceed 75 feet (22.6 m) in length shall be minimum No. 10 gauge.
- .5 Conductors shall be color coded. Conductors #10 gauge and smaller shall have color impregnated into insulation at time of manufacture. Conductors size #8 gauge and larger may be color coded with adhesive color coding tape but only black insulated conductors shall be employed in this case, except for neutrals, which shall be white wherever possible.
- .6 Color Coding shall be as follows:
 - .1 Phase "A" – Red
 - .2 Phase "B" – Black
 - .3 Phase "C" – Blue
 - .4 Control - Orange
 - .5 Ground - Green
 - .6 Neutral - White
- .7 Wire shall be as manufactured by:
 - .1 Canada Wire and Cable Co. Ltd.
 - .2 Industrial Wire and Cable (1970) Ltd.
 - .3 Phillips Cables Ltd.
 - .4 Pirelli Cables Ltd.
- .8 Neatly arrange circuit wiring in cabinets, panels, pull boxes and junction boxes and hold with nylon cable ties.
- .9 Splice wire, up to and including No. 6 gauge, with nylon insulated expandable spring type connectors such as Thomas & Betts – Marr Max Series.
- .10 Splice large conductors using compression type connections insulated with heat shrink sleeves.
- .11 Where color coding tape is utilized, it shall be applied for a minimum of 2" at terminations, junction and pull boxes and conduit fittings. Do not paint conductors under any condition.
- .12 Color coding shall also apply to bussing in panels and switchgear, disconnects, and metering cabinets.

1.18 TECK CABLES

- .1 For power (multi-conductor): CSA Teck 90 – 1000V Power Cable, to CSA C22.2 No. 131 – Type Teck 90 Cable, CSA C22.2 No. 174 – Cables in Hazardous Locations (CSA HL rating). Acceptable product/manufacturer: Southwire Canada, Texcan.
- .2 For control (multi-conductor): CSA Teck 90 – 600V Control Cable, to CSA C22.2 No. 131 – Type Teck 90 Cable, CSA C22.2 No. 174 – Cables in Hazardous Locations (CSA HL rating). Acceptable product/manufacturer: Southwire Canada, Texcan.

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- .3 For 18AWG Instrument Teck Cable: XLPE Insulated, to CSA C22.2 No. 239 – Control and Instrumentation Cable, CSA C22.2 No. 174 – Cables in Hazardous Locations (CSA HL rating). Acceptable product/manufacturer: Armcon by Shawflex.
- .4 For Ethernet Teck Cable: Category 5e Multi-conductor, 4-24 AWG bonded-pairs solid bare copper conductors, direct burial, industrial ethernet for harsh environments. Acceptable product/manufacturer: 7934A Multi-Conductor - DataTuff Waterblocked Enhanced Category 5e by Belden.

1.19 RECEPTACLES

- .1 Receptacles shall be as shown and as specified.
- .2 Equal receptacles are acceptable as manufactured by:
 - .1 Hubbell of Canada Ltd.
 - .2 Pass & Seymour
 - .3 Leviton
 - .4 Cooper Wiring Industries
- .3 Receptacles shall be ivory colored, specification grade.
- .4 Receptacles shall be as listed below:
 - .1 15 ampere, 120 volt, single phase grounded duplex receptacle shall be NEMA-U-ground type CSA Configuration 5-15R.
 - .2 ampere, 120 volt, single phase grounded duplex receptacle shall be NEMA-U-ground type CSA Configuration 5-20RA
 - .3 15 ampere, 120 volt, weatherproof receptacles shall be equal to those above but complete with gasketed cast plate and hinged covers.
- .5 Other types of receptacles shall be provided as shown on Drawings
- .6 Exact position of service fittings shall be verified to suit furniture or equipment layout.
- .7 Connect receptacle's grounding terminal to the outlet box with an insulated green ground strap.
- .8 Verify color with Owner prior to ordering.

1.20 SAFETY SWITCHES

- .1 Fused or un-fused disconnect or safety switches shall be Type "A", quick-make, quick-break construction with provision for padlocking switches in either "ON" or "OFF" position.
- .2 Switches throughout job shall be of same manufacture.
- .3 Fused switches shall have fuse clips designed for Class "J" fuses and designed to reject standard N.E.C. fuses.
- .4 Switches shall be as manufactured by:

- .1 Cutler Hammer
- .2 Group Schneider
- .3 Siemens

- .5 Provide fused or un-fused safety or disconnect switches as shown and as required by Code.

1.21 FUSES

- .1 Fuses shall be sized as shown, time delay type, and of the same type throughout.
- .2 Fuses shall be CSA certified Class-J for 1-600 Amps or Class-L for 650 Amps and above.
- .3 Provide a complete set of fuses in each fusible device supplied under this Division and provide 3 spare fuses for each size used, and mount in a 3' x 3' x 1' cabinet in Electrical Room.

1.22 LIGHTING AND RECEPTACLE PANELS

- .1 See Section 16471 PANELBOARDS.

1.23 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centre-line 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: 1150 mm.
 - .2 Wall receptacles – General: 350 mm.
 - .3 Wall receptacles – Above top of counters or counter splash backs: 175 mm.
 - .4 Wall receptacles – In electrical/mechanical service rooms: 700 mm.
 - .5 Telephone and data outlets: 350 mm
 - .6 Power door operator controls: 1050 mm.
 - .7 Thermostats, barrier-free path of travel: 1200 mm.
 - .8 Other devices, switches, etc., in barrier-free path of travel: 1000 mm.
 - .9 Panelboards: as required by Code or as indicated.

END OF SECTION

Part 1 Panel Boards

1.1 GENERAL

- .1 This section of the Specifications is an integral part of the Contract Documents and shall be read accordingly.
- .2 Comply with Division 1 - General Requirements - and all documents referred to therein.
- .3 Comply with the requirements of Sections 16010 and 16050.

1.2 WORK INCLUDED

- .1 The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.3 REFERENCES

- .1 The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of EEMAC and CSA.

1.4 SUBMITTALS FOR REVIEW AND APPROVAL

- .1 The following information shall be submitted to the Engineer:
 - .1 Breaker layout drawing with dimensions indicated and nameplate designation.
 - .2 Component list.
 - .3 Conduit entry/exit locations.
 - .4 Assembly ratings including:
 - a) Short circuit rating
 - b) Voltage class
 - c) Continuous current rating
 - .5 Cable terminal sizes
- .2 Where applicable, the following information shall be submitted to the Engineer:
 - .1 Busway connections
 - .2 Key interlock scheme drawing and sequence of operations

1.5 SUBMITTALS FOR INFORMATION

- .1 When requested by the Engineer the following product information shall be submitted:
 - .1 Descriptive bulletins
 - .2 Product sheets

1.6 SUBMITTALS FOR CLOSEOUT

- .1 The following information shall be submitted for record purposes prior to final payment:

- .1 Final as-built drawings for items listed in this section
- .2 Installation information
- .3 Seismic certification and equipment anchorage details (where required).

1.7 QUALIFICATIONS

- .1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly including circuit breakers and fusible switches.
- .2 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this request.

1.8 REGULATORY REQUIREMENTS

- .1 All panelboards shall comply with the latest standard CSA C22.2 #31.

1.9 OPERATION AND MAINTENANCE

- .1 Five (5) copies of the equipment operation and maintenance manuals shall be provided prior to final payment:
- .2 Operation and maintenance manuals shall include the following information:
 - .1 Instruction books and /or leaflets
 - .2 Recommended renewal parts list
 - .3 Drawings and information

1.10 RATINGS

- .1 Panelboards rated 240 Vac or less shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
- .2 Panelboards rated 600 Vac: N/A
- .3 Panelboards shall be labeled with a CSA short circuit rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings of installed frames. It shall state the conditions of the CSA series ratings including:
 - .1 Size and type of upstream device
 - .2 Branch devices that can be used
 - .3 CSA series short circuit rating

1.11 CONSTRUCTION

- .1 Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

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- .2 Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Furnish semi flush cylinder lock and catch assembly to secure hinged door over circuit breaker handles. Provide door-in-door type construction so that the trim may be opened to access wire-ways without removing the trim from the panel. All trims shall have concealed mounting hardware when the door is closed.
 - .3 Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
 - .4 Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides and shall be constructed to allow trim contact on all sides with box when mounted in flush wall.
 - .5 A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
 - .6 All locks shall be keyed alike.
 - .7 Supply and install internal contactor on mains as required, normally-open, to be closed (energized) on 120V circuit coil.

1.12 BUS

- .1 Main bus bars shall be plated aluminum or copper sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
- .2 A bolted ground bus shall be included in all panels.
- .3 Full-size insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
- .4 Where panels exceed 42 circuits, use multi-section panel with main crossover solid bus bars. Main bus capacity of each section shall be full size to match crossover bus.

1.13 BRANCH CIRCUIT PANELBOARDS

- .1 The Minimum Integrated Short Circuit Rating for branch circuit panelboards shall be indicated on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical. Panelboards shall be manufactured by Square D. Panelboards shall have circuit breakers as indicated below.
- .2 Bolt-in type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
- .3 Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers.

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- .4 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management and control system (EMCS) panels and fire alarm panels.
 - .5 Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts. All breakers shall be approved for switching duty.
 - .6 Where shown on Drawings or required by Code, certain breakers shall include ground fault interrupter.
 - .7 Panels shall have mains of voltage and capacity, and main and branch breakers, as shown on the drawings. Spaces shall include necessary bus work such that Owners, at a later date, need buy only the breakers.
 - .8 Panels shall be surface or flush-mounting type, as shown.
 - .9 Panels shall be dead front type in code gauge steel enclosures.
 - .10 Panels for non-linear loads shall be complete with lugs for double neutrals.
 - .11 Panels shall be constructed and finished in accordance with details specified in Article "Panel Trim".
 - .12 Supply typed circuit index card with protective plastic cover.

1.14 PANEL TRIM

- .1 Panels shall be given a rust-resistant treatment to both tub and trim.
- .2 Flush panels shall have concealed hinges and flush type combination lock latch. Locks shall be chrome plated. Doors shall open minimum 135 degrees. Trims shall have fasteners concealed and shall be prime coated to receive room finish paint.
- .3 Surface mounted panels shall have manufacturer's standard surface door trim complete with lock and latch.
- .4 Recessed panels shall have standard flush trims.
- .5 Deliver five (5) duplicate keys for each panel lock to Owner.
- .6 Mount electrical panels, where possible, with top of trim at uniform height of 2000 mm.

1.15 ENCLOSURE

- .1 Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the Ontario Electrical Safety Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
- .2 Enclosures shall be provided with one (1) blank end and one (1) end with knockouts.

1.16 NAMEPLATES

- .1 Provide an engraved nameplate for each panel section.

1.17 FINISH

- .1 Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.

1.18 INSTALLATION

- .1 The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

END OF SECTION

Part 1 Lighting Equipment

1.1 GENERAL

- .1 This section of the Specifications is an integral part of the Contract Documents and shall be read accordingly.
- .2 Comply with Division 1 - General Requirements - and all documents referred to therein.
- .3 Comply with the requirements of Sections 16010 and 16050.

1.2 WORK INCLUDED

- .1 The Contractor shall furnish and install the light fixtures having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

1.3 REFERENCES

- .1 N/A

1.4 SUBMITTALS FOR REVIEW AND APPROVAL

- .1 Submit an electronic copy of shop drawings for the product specified.
- .2 Shop drawings shall be clearly marked as to fixture type, operating voltage, ballast or transformer information, number, type and wattage of lamps required, special information regarding housings and ratings for insulated ceilings or any special mounting instructions.
- .3 Luminaire shop drawings shall bear the electrical contractor's stamp indicating that the Contractor has reviewed the shop drawings and is satisfied that the product represented meets all the criteria of the specification and is of the type, size and fit that is suited for the system in which it is to be installed. Any discrepancies shall be noted on the shop drawings.

1.5 SUBMITTALS FOR INFORMATION

- .1 Lighting shall be as suitable for installation in Class I, Division 1, Group D location, including pole-based fixtures.

1.6 SUBMITTALS FOR CLOSEOUT

- .1 Provide drawings produced by the Contractor recording as-built circuiting and any layout changes with red ink. These drawings shall consist of four (4) sets of clean drawings marked up as required. The as-built drawings shall be turned over to the Engineer at the completion of the project. The contract shall not be deemed complete until this requirement is fulfilled.
- .2 Include a copy of all luminaire shop drawings, manufacturer's special installation instructions, lamp data and maintenance instructions in the maintenance manuals.
- .3 Turn over to the Owner a minimum a spare quantity equal to 10% of the total of each lamp type supplied by this Contractor under this contract.

1.7 LAMPS

- .1 All fixtures shall be supplied complete by this Contractor with the proper number, size and wattage of lamps installed unless noted otherwise.

1.8 LIGHTING CONTROLS

- .1 Exterior lighting fixtures shall be controlled as shown on the drawings or as specified elsewhere in this document using switches, dimmers, contactors, photo cell controls and occupancy sensors. Tie into existing control system, providing new components as required (eg. additional circuit breakers).

1.9 COORDINATION

- .1 Check the area where fixtures are to be installed for any interference with piping duct work equipment or building structure. Coordinate and adjust layout with other trades to avoid conflicts. No additional costs due to the failure of the Contractor to coordinate his work will be allowed.
- .2 Verify that the specified fixture is compatible with the ceiling type and insulation in the area where the fixture is to be installed. Report any discrepancies to the Engineer.

1.10 FIXTURE SCHEDULE

- .1 The fixture schedule is shown on the drawings.

1.11 ALTERNATE FIXTURES

- .1 Other acceptable fixture manufacturers include Cooper, Thomas and Lithonia.

1.12 INSTALLATION

- .1 All lighting fixtures shall be supplied complete with the proper lamp(s) and all required accessory items such as IC housings, yokes, plaster rings, bar hangers, chains and other mounting materials.
- .2 Methods of mounting which differ from the manufacturer's standard mounting arrangement shall be submitted to the Engineer for review.
- .3 Install fixtures inline and level and avoid light leaks. Remove and reinstall luminaires which are not installed to the satisfaction of the Owner, Architect or Engineer.

1.13 COMMISSIONING

- .1 Confirm new fixtures are fully operational with controls as indicated, eg. switches, contactors, photocontrols, timers, etc.

END OF SECTION