GENERATOR SUB-TANKS REPLACEMENT
3900 VICTORIA PARK AVE., TORONTO, ON

PROJECT SPECIFICATIONS

ISSUED FOR TENDER
MARCH 2023

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SEALS PAGE

DISCIPLINE	SEAL & SIGNATURE
MECHANICAL This seal governs all Documents and Sections of these Specification	

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1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Title and description of Work.

1.1.2 Contractor uses of premises.

1.1.3 Owner occupancy.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

1.2.1 The Work of this Contract comprises general construction renovation of emergency generator fuel system located at 3900 VICTORIA PARK AVE., Toronto.

1.2.2 The Work of this Contract includes furnishing all labour, materials, equipment, services, and other related expenses to execute the construction of the Work.

1.2.3 This shall be a single phase project.

1.2.4 The Contractor shall be responsible for, and coordinate the work of, all sub-trades.

1.2.5 The Work shall include all information provided via drawings, specifications, and supplementary documents.

1.2.6 The following is a General Description of the Work to be performed:

.1 Provide all work as indicated in contract documents.

.2 Include all mechanical, electrical and control work required to complete the project.

.3 Contractor shall retain TSSA for all required certifications, variance approvals and inspections.

.4 Decommission two sub-tanks and disconnect from service. Disconnect two sub-tanks from generator c/w all accessories and as shown on the drawings.

.1 Remove all fuel and fuel vapours and confirm that fuel vapour concentration is less than 10% of the lower explosive limit for type-2 diesel fuel using a calibrated gas vapour meter.

.2 Demolish and remove connected fuel oil supply piping as shown, applicable piping supports, valves, fittings, control devices, and tank fuel polisher.

.3 Power and control conduit, conduit supports, and wiring related to sub-tanks items to be demolished entire length.

.4 All demolished equipment shall be removed from site and disposed in accordance with all applicable regulations.

.5 Contractor to provide a tank decommissioning report for review and submission to TSSA. Complete TSSA variance application for tanks to be abandoned in place.

.5 Abandoned sub-tank in the same location. Cap the supply and return fuel piping. Fill the sub-tanks with concrete after completing the installation of the new tanks. Sub-tank vent to remain.

.6 Contractor is responsible to review project specific dss report included in specifications package. Coordinate with facility for all operations.

.7 Provide new ULC listed fire safety fusible link valves connected to rigid supply piping for each existing generator as shown.

.8 Provide and install fuel tank as per equipment schedule. Complete with sensors, vent and related accessories as per drawings.

.9 Provide and install fill station and all piping as per drawings.

.10 Coordinate with all trades prior to construction.

.11 Contractor shall prepare shop drawings for all work. Contractor shall forward all shop drawings to the engineer and owner for approvals prior to starting any work.

.12 Contractor to ensure new fuel tank full at completion of project.

.13 Test and commission all affected equipment and systems.

.14 Along with testing and commissioning reports, provide fuel oil system comprehensive inspection form completed by a licensed oil burner technician.

.15 Contractor to provide as-built drawings for the project in cad format to infrastructure Ontario standards. Consultant to provide cad drawings to contractor.

1.2.7 The contractor shall obtain and pay for all required regulatory approvals, permits and fees.

1.3 CONTRACTOR USE OF PREMISES

1.3.1 Contractor has restricted use of site limited to the work area. Work exterior to the generator room will need to be coordinated with BDA Inc who is currently occupying construction areas around the exterior of the building.

1.3.2 Coordinate use of premises under direction of Owner's Representative.

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

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

1.3.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Owner's Representative.

1.4 OWNER OCCUPANCY

1.4.1 Owner will occupy premises during entire construction period for execution of normal operations.

1.4.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.5 RELATED WORK

1.5.1 .1The following specification sections are referenced to indicate work responsibilities as specified and carried in other versions.

.1 Section 21 05 01 – Common Work Results for Mechanical.

.2 Section 26 05 00 – Common Work Results – Electrical.

1.6 ON-SITE DOCUMENTS

1.6.1 Maintain at job site documents as indicated in Section 01 32 00 – Project Management and Coordination.

1.7 CONTRACT DOCUMENTS

1.7.1 Legends and schedules in the Issued for Tender Drawings take precedence over the Technical Specifications with respect to products and materials identified.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Coordination work with other contractors and subcontractors under administration of Owner's Representative.

1.1.2 Scheduled project meetings.

1.2 RELATED SECTIONS

1.2.1 Section 01 11 00 - Summary of Work.

1.3 DESCRIPTION

1.3.1 Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other contractors and subcontractors under instructions of Owner's Representative.

1.4 PROJECT MEETINGS

1.4.1 Project meetings to be held at times and locations as determined by Owner's Representative.

1.4.2 Owner's Representative will arrange project meetings and record and distribute minutes.

1.5 CONSTRUCTION ORGANIZATION AND START-UP

1.5.1 Within ten (10) working days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

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

1.5.3 Agenda to include following:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling in accordance with Section 01 32 00 - Construction Progress Documentation.

.3 Schedule of submission of shop drawings, samples, colour chips in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00 - Temporary Utilities.

.5 Work restrictions and potential service interruptions in accordance with Section 01 14 00 – Work Restrictions.

.6 Delivery schedule of specified equipment in accordance with Section 01 32 00 - Construction Progress Documentation.

.7 Site security in accordance with Section 01 52 00 - Construction Facilities.

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

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

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

.11 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 - Closeout Procedures and 01 78 00 - Closeout Submittals.

.12 Monthly progress claims, administrative procedures, photographs, and holdbacks.

.13 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 - Quality Control.

.14 Insurances and transcript of policies.

1.5.4 Comply with Owner’s Representative's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.

1.5.5 During construction coordinate use of site and facilities through Owner’s Representative's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.

1.5.6 Comply with instructions of Owner’s Representative for use of temporary utilities and construction facilities.

1.6 ON-SITE DOCUMENTS

1.6.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 List of outstanding shop drawings.

.6 Change orders.

.7 Other modifications to Contract.

.8 Field test reports.

.9 Copy of approved Work schedule.

.10 Health and Safety Plan and other Safety related documents.

.11 Manufacturers' installation and application instructions.

.12 Labour conditions and wage schedules.

.13 Other documents as specified.

1.7 SCHEDULES

1.7.1 Submit preliminary construction progress schedule in accordance with Section 01 32 00 - Construction Progress Documents to Owner's Representative coordinated with Owner's Representative's project schedule. Schedule to show anticipated progress stages and final completion of work within time period required by contract documents.

1.7.2 Clearly identify all potential service interruptions on the Project Schedule in accordance with Section 01 14 00 – Work Restrictions.

1.7.3 After review, revise and resubmit schedule to comply with project schedule requirements.

1.7.4 During progress of Work revise and resubmit at project progress meetings or as directed by Owner's Representative.

1.8 SUBMITTALS

1.8.1 Make submittal to Owner's Representative for review.

1.8.2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 – Submittal Procedures for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Owner's Representative.

1.8.3 Submit requests for payment for review to Owner's Representative.

1.8.4 Submit requests for interpretation of Contract Documents and obtain instructions through Owner's Representative.

1.8.5 Process change orders through Owner's Representative.

1.8.6 Deliver closeout submittals for review by Owner's Representative.

1.9 COORDINATION

1.9.1 Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.

1.9.2 Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection and operation.

1.9.3 Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

1.9.4 Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair of all components, mechanical, electrical, and otherwise,

.1 Provide adequate clearances for installation and maintenance of equipment.

.2 Install work to permit removal of parts requiring periodic replacement or maintenance.

.3 Arrange pipes, ducts, raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, and control components.

.4 Doors and access panels shall be kept clear.

.5 Utilize space efficiently so that adequate accessibility is retained for future maintenance, repairs, modifications and additions.

.6 Check the locations selected for all sprinkler heads and check the Architectural reflected ceiling plans to prevent conflicts between the trades.

.7 Contractor is cautioned that, where specific dimensions are not indicated or where Drawings are schematic in nature, as with most Electrical and Mechanical Drawings, Contractor shall have sole responsibility to coordinate the work to meet this requirement.

1.9.5 Make adequate provisions to accommodate items scheduled for later installation.

1.9.6 Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work and completion within the specified Contract duration. Such administrative activities include, but are not limited to, the following:

.1 Preparation of Contractor's Construction Schedule.

.2 Installation and removal of temporary facilities and controls.

.3 Delivery and processing of submittals.

.4 Progress meetings.

.5 Start-up, check-out, and final acceptance of systems.

.6 Project closeout activities.

.7 Protection of existing and new work.

1.9.7 Changes required in the Work of the Contract, caused by the Contractor’s neglect to coordinate the work with others shall be made at the Contractor’s own expense.

1.10 COORDINATION DRAWINGS

1.10.1 Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1.10.2 Contractor to submit to the Owner’s Representative, in AutoCAD format, coordination drawings, drawn accurately to a scale large enough to indicate and resolve conflicts.

1.10.3 Indicating the functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

1.10.4 Do not base coordination drawings on standard printed data.

1.10.5 Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

1.10.6 Show location and size of access doors required for access to concealed dampers, valves, and other controls.

1.10.7 Indicate required installation sequences.

1.10.8 Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.

1.10.9 Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.10.10 Owner's Representative will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination. If Owner's Representative determines that coordination drawings are not being prepared in enough scope or detail, or are otherwise deficient, Owner's Representative will so inform Contractor, who shall make changes as directed and resubmit.

1.11 CLOSEOUT PROCEDURES

1.11.1 Notify Owner's Representative when Work is considered ready for Substantial Performance.

1.11.2 Accompany Owner's Representative on preliminary inspection to determine items listed for completion or correction.

1.11.3 Comply with Owner's Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Owner-occupied areas.

1.11.4 Notify Owner's Representative of instructions of items of Work determined in Owner's Representative's final inspection.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

1.1.1 Section 01 77 00 - Closeout Procedures.

1.2 SCHEDULES REQUIRED

1.2.1 Submit schedules as follows:

.1 Construction Progress Schedule.

.2 Submittal Schedule for Shop Drawings and Product Data.

.3 Submittal Schedule for Samples.

.4 Product Delivery Schedule.

.5 Cash Allowance Schedule for purchasing Products.

.6 Shutdown or closure activity.

1.3 FORMAT

1.3.1 Prepare schedule in form of a horizontal bar chart.

1.3.2 Provide a separate bar for each major item of work, trade or operation.

1.3.3 Split horizontally for projected and actual performance.

1.3.4 Provide horizontal time scale identifying first work day of each week.

1.3.5 Format for listings: chronological order of start of each item of work.

1.3.6 Identification of listings: By Systems description.

1.4 SUBMISSION

1.4.1 Submit initial format of schedules within 15 working days after award of Contract.

1.4.2 Submit schedules in electronic format as PDF files.

1.4.3 Owner's Representative will review schedule and return review copy within ten (10) working days after receipt.

1.4.4 Resubmit finalized schedule within seven (7) working days after return of review copy.

1.4.5 Submit revised progress schedule with each application for payment.

1.4.6 Distribute copies of revised schedule to:

.1 Job site office.

.2 Subcontractors.

.3 Other concerned parties.

1.4.7 Instruct recipients to report to Contractor within ten (10) working days, any problems anticipated by timetable shown in schedule.

1.5 CRITICAL PATH SCHEDULING

1.5.1 Include complete sequence of construction activities.

1.5.2 Include dates for commencement and completion of each major element of construction as follows.

.1 Site clearing/Demolition.

.2 Service Interruptions

.3 Subcontractor Work.

.4 Temporary Work.

.5 Equipment Installations.

.6 Finishes.

.7 Testing, Adjusting, Balancing & Start-Up

.8 Commissioning

1.5.3 Show projected percentage of completion of each item as of first day of month.

1.5.4 Indicate progress of each activity to date of submission schedule.

1.5.5 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

1.5.6 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

1.6 SUBMITTALS SCHEDULE

1.6.1 Include schedule for submitting shop drawings, product data, and samples.

1.6.2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 SECTIONS INCLUDE

1.1.1 Shop drawings and product data.

1.1.2 Samples.

1.2 RELATED SECTIONS

1.2.1 Section 01 32 00 – Construction Progress Documentation.

1.2.2 Section 01 45 00 – Quality Control

1.2.3 Section 01 78 00 – Closeout Submittals

1.3 ADMINISTRATIVE

1.3.1 This section specifies general requirements and procedures for contractor's submissions of shop drawings, product data, samples and mock-ups to Owner's Representative 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 an extension of Contract Time and no claim for extension by reason of such default will be allowed.

1.3.2 Do not proceed with work until relevant submissions are reviewed by Owner's Representative.

1.3.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

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

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

1.3.6 Notify Owner's Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

1.3.7 Verify field measurements and affected adjacent Work are coordinated.

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

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

1.3.10 Make any changes in submissions which Owner's Representative may require consistent with Contract Documents and resubmit as directed by Owner's Representative. When resubmitting, notify Owner's Representative in writing of revisions other than those requested.

1.3.11 Notify Owner's Representative, in writing, when resubmitting, of any revisions other than those requested by Owner's Representative.

1.3.12 Keep one reviewed copy of each submission on site.

1.4 SUBMITTALS

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

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

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

1.4.4 Allow ten (10) working days for Owner's Representative review of each submission.

1.4.5 Adjustments made on shop drawings by Owner's Representative are not intended to change contract price. If adjustments affect value of Work, state such in writing to Owner's Representative immediately after receipt of approval of shop drawings. If value of work is to change a change order must be issued prior to proceeding with work.

1.4.6 Structural Attachments:

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

1.4.7 Accompany submissions with transmittal letter, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

1.4.8 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

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

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

1.4.9 After Owner’s Representative review, distribute copies.

1.4.10 Submit one electronic copy in PDF format of shop drawings for each requirement requested in specification Sections and as Owner’s Representative may reasonably request.

1.4.11 Delete information not applicable to project.

1.4.12 Supplement standard information to provide details applicable to project.

1.4.13 Cross-reference product data information to applicable portions of Contract Documents.

1.4.14 If upon review by Owner’s Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of work may proceed.

1.4.15 Samples: examples of materials, equipment, quality, finishes, workmanship. Label samples with origin and intended use.

1.4.16 Notify Owner's Representative in writing, at time of submission of deviations in samples from requirements of contract documents.

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

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

1.4.19 Make changes in samples, which Owner's Representative may require, consistent with Contract Documents.

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

1.4.21 Where shop drawings are requested to be stamped and signed by a Professional Engineer, they shall be registered or licensed within the Applicable Jurisdiction of the subject Project.

1.5 MOCK-UPS

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

1.6 PROGRESS PHOTOGRAPHS

1.6.1 Progress photograph to be electronically formatted and labelled as to location and view.

1.7 SHOP DRAWINGS REVIEW

1.7.1 The review of shop drawings by Owner's Representative is for the sole purpose of ascertaining conformance with the general concept. This review shall not mean that Owner's Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all sub-trades.

1.8 STRUCTURAL ATTACHMENTS

1.8.1 Contractor to engage a third party Professional Structural Engineer, licensed to practice within the Applicable Jurisdiction of the subject Project, for submission of stamped and signed shop drawings indicating acceptable mounting procedures for all equipment which is suspended, mounted or otherwise attached. The Structural Engineer to also verify correct installation of the equipment.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

1.1.1 Section 02 82 00.02 – Asbestos Abatement

1.2 REFERENCES AND CODES

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

1.2.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.3 HAZARDOUS MATERIAL DISCOVERY

1.3.1 Asbestos: stop work immediately should materials believed to contain asbestos be encountered in during the execution of the work and notify Owner's Representative. Do not proceed until written instructions have been received from Owner's Representative.

1.3.2 Mould: stop work immediately should material resembling mould be encountered during the execution of work and notify Owner's Representative. Do not proceed until written instructions have been received from Owner's Representative.

1.4 BUILDING SMOKING ENVIRONMENT

1.4.1 Comply with smoking restrictions.

1.5 RELICS AND ANTIQUITIES

1.5.1 Protect relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during course of work.

1.5.2 Give immediate notice to Owner's Representative and await Owner's Representative's written instructions before proceeding with work in this area.

1.5.3 Relics, antiquities and items of historical or scientific interest remain Her Majesty's property.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION

3.1 PERMITS, APPROVALS & FEES

3.1.1 Obtain and pay for all required permits, approvals and fees from all authorities having jurisdiction. These shall include, but will not be limited to:

.1 Safety Inspections and Approvals:

.1 TSSA

.2 ESA

.2 Waste disposal, recycling & management

END OF SECTION

1 GENERAL

1.1 RELATED DOCUMENTS

1.1.1 Drawings and general provisions of this contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.2 INDUSTRY STANDARDS

1.2.1 Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made part of the Contract Documents by reference.

1.2.2 All construction industry standards referenced in this specification to meet the edition of the standard referenced by the National Building Code of Canada (NBC) or Local Provincial Code (whichever Code is Applicable based on jurisdiction). If the construction industry standard in not referenced in the Applicable Code, the latest edition of the standard shall apply.

1.2.3 Each entity engaged in construction on this Project must be familiar with construction industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Construction Documents.

.1 Where copies of construction industry standards are needed to perform a required construction activity, obtain copies directly from publication source and make them availably upon request.

1.3 ABBREVIATIONS AND ACRONYMS FOR INDUSTRY ORGANIZATIONS

1.3.1 Where abbreviations and acronyms are used, they shall mean the recognized name of the entities in the following list. Names are believed to be accurate and up-to-date as of the date of the Contract Documents.

1.3.2 Industry Organizations:

.1 Air Conditioning and Mechanical Contractors Association (AMCA).

.2 Air Conditioning and Refrigeration Institute (ARI).

.3 Americans with Disability Act (ADA).

.4 Air Movement and Control Association (AMCA).

.5 American Association of State Highway and Transportation Officials (AASHTO).

.6 American Association of Textile Chemists and Colourists (AATCC).

.7 American Bearing Manufacturers Association (ABMA).

.8 American Boiler Manufacturer's Association (ABMA).

.9 American Concrete Institute (ACI).

.10 American Industrial Hygiene Association (AIHA).

.11 American Institute of Steel Construction (AISC).

.12 American Iron & Steel Institute (AISI).

.13 American National Standards Institute (ANSI).

.14 American Petroleum Institute (API).

.15 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

.16 American Society of Mechanical Engineers (ASME).

.17 American Society of Sanitary Engineer's (ASSE).

.18 American Society for Testing and Materials (ASTM).

.19 American Water Works Association (AWWA).

.20 American Welding Society (AWS).

.21 Associated Air Balance Council (AABC).

.22 Association of the Wall and Ceilings Industries International (AWEI).

.23 Building Industry Consulting Services International (BICSI).

.24 Canada Green Building Council (CaGCB).

.25 Canadian Council of Ministers of the Environment (CCME).

.26 Canadian Construction Materials Centre (CCMC).

.27 Canadian Environmental Protection Act (CEPA).

.28 Canadian Gas Association (CGA).

.29 Canadian General Standards Board (CGSB).

.30 Canadian Institute of Steel Construction (CISC).

.31 Canadian Paint Manufacturer's Association (CPMA).

.32 Canadian Roofing Contractors' Association (CRCA).

.33 Canadian Sheet Steel Building Institute (CSSBI).

.34 Canadian Standards Association (CSA).

.35 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).

.36 Canadian Urethane Foam Contractors' Association Inc. (CUFCA).

.37 Consumer Electronics Association (CEA).

.38 Cooling Technology Institute (CTI).

.39 Electrical and Electronic Manufacturers' Association of Canada (EEMAC).

.40 Electronic Industries Alliance (EIA).

.41 Environment Canada (EC).

.42 Environmental Protection Agency (EPA).

.43 Environmental Protection Services (EPS).

.44 ETL Listing Laboratories (ETL).

.45 Factory Mutual (FM).

.46 Federal Communications Commission (FCC).

.47 Health Canada - Workplace Hazardous Materials Information System (WHMIS).

.48 Hydraulics Institute (HI).

.49 Hydronic Institute of Boiler and Radiator Manufacturers (IBR).

.50 Industry Canada - Terminal Attachment Program.

.51 Institute of Electrical and Electronics Engineers (IEEE).

.52 Institute for Research in Construction (IRC).

.53 Insulated Cable Engineers Association (ICEA).

.54 International ElectroTechnical Commission (IEC).

.55 International Standards Organization (ISO).

.56 Laminators Safety Glass Association (LSGA).

.57 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.58 National Energy Code of Canada for Buildings (NECB).

.59 National Association of Corrosion Engineers (NACE).

.60 National Building Code of Canada (NBC).

.61 National Bureau of Standards/Products Standard (NBS/PS).

.62 National Electrical Manufacturers Association (NEMA).

.63 National Environmental Balancing Bureau (NEBB).

.64 National Fire Code of Canada (NFC).

.65 National Fire Protection Association (NFPA).

.66 National Fireproofing Contractors Association (NFCA).

.67 National Plumbing Code of Canada (NPC).

.68 National Research Council Canada (NRC).

.69 National Roofing Contractors Association (NRCA).

.70 National Sanitation Foundation (NSF).

.71 Plumbing and Drainage Institute (PDI).

.72 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

.73 Sealant and Waterproofer’s Institute.

.74 Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA).

.75 Society of Automotive Engineers (SAE).

.76 The Society for Protective Coatings (SSPC).

.77 Telecommunications Distribution Methods Manual (TDMM).

.78 Telecommunications Industries Association (TIA).

.79 Thermal Insulation Association of Canada (TIAC).

.80 Transport Canada (TC).

.81 Treasury Board of Canada (TB).

.82 Treasury Board Information Technology Standard (TBITS).

.83 Underwriters' Laboratories Inc. (UL).

.84 Underwriter's Laboratories of Canada (ULC).

.85 United States Federal Trade Commission (US Federal Trade Commission).

.86 U.S. Department of Transportation (DOT).

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 SECTIONS INCLUDE

1.1.1 Inspection and testing, administrative and enforcement requirements.

1.1.2 Tests and mix designs.

1.1.3 Mock-ups.

1.1.4 Mill tests.

1.1.5 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

1.2.1 Section 01 33 00 – Submittal Procedures

1.2.2 Section 01 78 00 – Closeout Submittals

1.3 INSPECTION

1.3.1 Allow Owner's Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

1.3.2 Give 48 hours notice requesting inspection if Work is designated for special tests, inspections or approvals by Owner's Representative instructions.

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

1.3.4 Owner's Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Owner's Representative shall pay cost of examination and replacement.

1.3.5

1.4 ACCESS TO WORK

1.4.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

1.4.2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES

1.5.1 Notify appropriate agency and Owner's Representative in advance of requirement for tests, in order that attendance arrangements can be made.

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

1.5.3 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

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

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

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

1.7 REPORTS

1.7.1 Submit 3 copies of inspection and test reports to Owner's Representative, plus electronic copies in PDF format.

1.7.2 Provide copy to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.7.3 Include copy of all inspection and test reports in Commissioning Manuals.

1.8 MOCK-UPS

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

1.8.2 Construct in all locations acceptable to Owner's Representative as specified in specific Section.

1.8.3 Prepare mock-ups for Owner's Representative review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

1.8.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

1.8.5 Remove mock-up at conclusion of Work or when acceptable to Owner's Representative

1.8.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.8.7 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.

1.8.8 Mock-ups may remain as part of Work.

1.9 EQUIPMENT AND SYSTEMS

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

1.9.2 Mechanical – coordinate with mechanical division.

1.9.3 Electrical – Coordinate with electrical division.

1.10 FIRE SEPARATIONS

1.10.1 Provide fire separation labelling/stenciling to match base building standards.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Construction aids.

1.1.2 Office and sheds.

1.1.3 Parking.

1.1.4 Project identification.

1.2 INSTALLATION AND REMOVAL

1.2.1 Provide construction facilities in order to execute work expeditiously.

1.2.2 Remove from site all such work after use.

1.3 SCAFFOLDING

1.3.1 Provide and maintain scaffolding in rigid, secure and safe manner.

1.3.2 Erect scaffolding independent of walls. Remove promptly when no longer required.

1.4 HOISTING

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

1.4.2 Hoists cranes shall be operated by certified operator.

1.5 SITE STORAGE/LOADING

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

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

1.6 CONSTRUCTION PARKING

1.6.1 Parking will be permitted on site provided it does not disrupt performance of work or building operations.

1.6.2 Provide and maintain adequate access to project site.

1.6.3 Build and maintain temporary roads where indicated or directed by Owner's Representative and provide snow removal during period of Work.

1.6.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.8 SANITARY FACILITIES

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

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

1.9 CLEAN-UP

1.9.1 Remove construction debris, waste materials, packaging material from work site daily.

1.9.2 Clean dirt or mud tracked onto paved or surfaced roadways.

1.9.3 Store materials resulting from demolition activities that are salvageable.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Product quality, availability, storage, handling, protection, and transportation.

1.1.2 Manufacturer's instructions.

1.1.3 Quality of Work, coordination and fastenings.

1.2 RELATED SECTIONS

1.2.1 Section 01 45 00 – Quality Control.

1.2.2 Section 01 73 00 – Execution.

1.3 REFERENCES

1.3.1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.

1.3.2 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.4 QUALITY

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

1.4.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

1.4.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Owner’s Representative based upon requirements of Contract Documents.

1.4.4 Within seven (7) working days of written request by Owner’s Representative, submit following information for material and equipment proposed for supply:

.1 Name and address of manufacturer.

.2 trade name, model and catalogue number,

.3 performance, descriptive and test data,

.4 manufacturer's installation or application instructions,

.5 evidence of arrangements to procure.

1.4.5 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.

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

1.5 AVAILABILITY

1.5.1 During the tender process, confirm that the anticipated delivery times of the proposed equipment will meet the project's intended schedule. Notify the Owner during the tender process should any issues arise.

1.5.2 Immediately upon signing Contract, reconfirm product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Owner's Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of work.

1.5.3 If the award of the contract is within 30 days of the tender closing, and there are changes to the delivery times of the proposed equipment, the Owner's Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time. The Contactor shall be responsible to absorb the cost of any additional material and labour that may be required to accommodate the installation of the alternative available product.

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

1.6 STORAGE, HANDLING AND PROTECTION

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

1.6.2 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.

1.6.3 Store products subject to damage from weather in weatherproof enclosures.

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

1.6.5 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.

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

1.6.7 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.

1.6.8 Remove and replace damaged products at own expense and to satisfaction of Owner’s Representative.

1.6.9 Touch-up damaged factory finished surfaces to Owner’s Representative satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

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

1.8 MANUFACTURER'S INSTRUCTIONS

1.8.1 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.

1.8.2 Notify Owner’s Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Owner’s Representative may establish course of action.

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

1.9 QUALITY OF WORK

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

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

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

1.10 CO-ORDINATION

1.10.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.10.3 Provide co-coordination drawings that encompass the work of all sub-trades to ensure that the work can be carried out as intended and without conflict. Notify the Engineer of any potential conflict and do not proceed with the installation of the work that may have such conflict.

1.11 CONCEALMENT

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

1.11.2 Before installation, inform Owner's Representative if there is interference. Install as directed by Owner's Representative.

1.12 REMEDIAL WORK

1.12.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

1.12.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 LOCATION OF FIXTURES

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

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

1.13.3 Inform Owner's Representative of conflicting installation. Install as directed.

1.13.4 Submit field drawings to indicate relative position of various services and equipment when required by Owner's Representative.

1.14 FASTENINGS GENERAL

1.14.1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior work, unless stainless steel or other material is specifically requested in affected specification section.

1.14.2 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood plugs are not acceptable.

1.14.3 Conceal fasteners where indicated. Space evenly and lay out neatly.

1.14.4 Fastenings which cause Spalding or cracking are not acceptable.

1.14.5 Obtain Owner's Representative's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166.

1.15 FASTENINGS - EQUIPMENT

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

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

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

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

1.16 PROTECTION OF WORK IN PROGRESS

1.16.1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Owner's Representative.

1.17 EXISTING UTILITIES

1.17.1 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.

1.17.2 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.

1.17.3 Submit schedule to and obtain approval from Owner's Representative for any shut-down or closure of active services or facility. Adhere to approved schedule and provide notice to affected parties.

1.17.4 Where unknown services are encountered, immediately advise Owner's Representative and confirm findings in writing.

1.17.5 Remove abandoned services lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Owner's Representative.

1.18 SELECTION OF MATERIAL AND EQUIPMENT

1.18.1 The specification package is governed by the individual sections that specify the exact requirements of the materials and systems required for this project. Listed below is the manner in which these sections allow for how the materials and equipment may be selected. The requirements of the individual specification section will take priority over these general requirements. It is the Contractor's responsibility to review and understand the requirements of all individual sections.

1.18.2 Material and equipment will be specified in the tender documents, and selected by the Contractor, by one or more of the following methods:

.1 Specification by reference to a relevant Standard, such as CSA, ASTM, ULC, etc., select any material or equipment that meets or exceeds the specified.

.2 Specification by Prescriptive or Performance specification – select the material or equipment meeting or exceeding specification as may be allowed by the relevant specification sections.

.3 Specification by identification of one or more Manufacturer's specific product(s) as an "Acceptable Product", along with a listing of other manufacturers who may offer equivalent products – select any product so named or select from equivalent product(s) of other listed manufacturers.

1.18.3 "Acceptable Product" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name, or any combination thereof, and will constitute the minimum standard of acceptance.

1.18.4 Owner's Representative will determine acceptability of Contractor's selection of material and equipment at time of Shop Drawing review.

1.18.5 When material or equipment is specified by a Standard, Prescriptive or Performance specification, upon request of the Owner's Representative, obtain from manufacturer an independent laboratory reporting, showing that material or equipment meets or exceeds the specified requirements.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

1.2.1 Section 01 11 00 - Summary of Work.

1.2.2 Section 01 33 00 - Submittal Procedures.

1.3 SUBMITTALS

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

.1 Structural integrity of any element of Project.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

.5 Work of Owner or separate contractor.

1.3.2 Include in request:

.1 Identification of Project.

.2 Location and description of affected Work.

.3 Statement on necessity for cutting or alteration.

.4 Description of proposed Work, and products to be used.

.5 Alternatives to cutting and patching.

.6 Effect on Work of Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

1.4 PREPARATION

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

1.4.2 After uncovering, inspect conditions affecting performance of Work.

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

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

1.4.5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.4.6 Obtain Owner’s Representative’s approval before cutting, boring or sleeving load-bearing members.

1.5 EXECUTION

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

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

1.5.3 Uncover Work to install ill-timed Work.

1.5.4 Remove and replace defective and non-conforming Work.

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

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

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

1.5.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

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

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

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

1.5.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

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

1.5.14 Make cuts with clean, true, smooth edges.

1.5.15 Where new work connects with existing, and where existing work is altered, cut, patch and make good to match existing work.

1.6 WASTE MANAGEMENT AND DISPOSAL

1.6.1 Separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 GENERAL

1.1.1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

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

1.1.3 Provide adequate ventilation during use of volatile or noxious substances. Use for building ventilation systems is not permitted for this purpose.

1.2 RELATED SECTION

1.2.1 Section 01 77 00 - Closeout Procedures.

1.3 PROJECT CLEANLINESS

1.3.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

1.3.2 Remove waste materials and debris from site at the end of each working day. Do not burn waste materials on site.

1.3.3 Clear snow and ice directly from the work area and the access to the work area. Coordinate the snow removal requirements of the facility with the Owner. The intent of this contract is not to replace the efforts or scope of the Owner's existing snow removal contract.

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

1.3.5 Provide on-site containers for collection of waste materials and debris.

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

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

1.3.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

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

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

1.3.11 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.

1.4 FINAL CLEANING

1.4.1 Refer to General Conditions.

1.4.2 The list below covers many potential eventualities that may occur in the final cleaning process of a project. All requirement listed below that are directly impacted by the scope of work of this project shall be fulfilled.

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

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

1.4.5 When the Work is Totally Performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.

1.4.6 Remove waste materials from the site at regularly scheduled times or dispose of as directed by the Owner's Representative. Do not burn waste materials on site.

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

1.4.8 Leave the work broom clean before the inspection process commences.

1.4.9 Clean and polish mechanical and electrical fixtures. Replace broken, scratched or disfigured items.

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

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

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

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

1.4.14 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

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

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

1.4.17 Remove dirt and other disfiguration from exterior surfaces.

1.4.18 Clean roofs, gutters, downspouts and drainage systems. Clean areaways and sunken wells.

1.4.19 Sweep and wash clean paved areas.

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

1.4.21 Remove snow and ice from access to building.

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

1.5 WASTE MANAGEMENT AND DISPOSAL

1.5.1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

1.1.1 Section 01 74 00 - Cleaning.

1.1.2 Section 01 78 00 - Closeout Submittals.

1.2 FINAL INSPECTION AND DECLARATION PROCEDURES

1.2.1 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects; repair as required. Notify the Owner's Representative in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made. Request an Owner's Representative's Consultant's Inspection.

1.2.2 Owner's Representative's Inspection: Owner's Representative and the Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly.

1.2.3 Completion: submit written certificate that the following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Fire Commissioner, Utility companies have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Work is complete and ready for Final Inspection.

1.2.4 Final Inspection: When items noted above are completed, request final inspection of Work by the Owner's Representative and the Contractor. If Work is deemed incomplete by the Owner's Representative, complete outstanding items and request a reinspection.

1.2.5 Declaration of Substantial Performance: When the Owner's Representative considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Certificate of Substantial Performance. Refer to General Conditions for specifics to application.

1.2.6 Commencement of Lien and Warranty Periods: The date of acceptance of the submitted declaration of Substantial Performance shall be the date for commencement for the warranty period and commencement of the lien period.

1.2.7 Declaration of Total Performance: When the Owner's Representative considers final deficiencies and defects have been corrected and it appears requirements of the Contract have been totally performed, make application for certificate of Total Performance. Refer to General Conditions for specifics to application. If Work is deemed incomplete by the Consultant, complete the outstanding items and request a reinspection.

1.3 REINSPECTION

1.3.1 Should status of work require reinspection by Owner's Representative due to failure of work to comply with Contractor's claims for inspection, Owner will deduct amount of compensation for reinspection services from payment to Contractor.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 As-built, samples, and specifications.

1.1.2 Equipment and systems.

1.1.3 Product data, materials and finishes, and related information.

1.1.4 Operation and maintenance data.

1.1.5 Spare parts, special tools and maintenance materials.

1.1.6 Warranties and bonds.

1.1.7 Final site survey.

1.2 RELATED SECTIONS

1.2.1 Section 01 33 00 – Submittal Procedures.

1.2.2 Section 01 45 00 – Quality Control.

1.2.3 Section 01 77 00 - Closeout Procedures.

1.3 SUBMISSION

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

1.3.2 Submit one PDF copy of the completed volumes in final form 15 days following Substantial Performance of the Work. The PDF file shall be fully indexed.

1.3.3 The Copy will be returned with the Owner's Representative's comments prior to Total Completion of the Work.

1.3.4 Revise content of documents per the Owner's Representative's comments within 15 Days of receiving the comments to create the Final Submittal.

1.3.5 Submit the Final Submittal, in PDF format, to the Owner's Representative for final review by the Owner's Representative. Once the Final Submittal approved, submit the Final Submittal in PDF format along with six (6) final hard copies of the operating and maintenance manuals.

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

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

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

1.3.9 Pay costs of transportation.

1.4 FORMAT

1.4.1 Organize data in the form of an instructional manual.

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

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

1.4.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

1.4.5 Arrange content under Section numbers and sequence of Table of Contents.

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

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

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

1.4.9 Provide CAD files in DWG format on a USB. Also provide electronic files in PDF format.

1.5 CONTENTS - EACH VOLUME

1.5.1 Table of Contents: provide title of project; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.

1.5.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

1.5.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

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

1.5.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.6 AS-BUILTS AND SAMPLES

1.6.1 In addition to requirements in General Conditions, maintain at the site for Owner’s Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

1.6.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

1.6.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

1.6.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

1.6.5 Keep record documents and samples available for inspection by Owner's Representative.

1.7 RECORDING ACTUAL SITE CONDITIONS

1.7.1 Record information on set of blue line opaque drawings, provided by Owner's Representative.

1.7.2 Provide felt tip marking pens, maintaining red color pens for recording information.

1.7.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

1.7.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

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

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

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

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

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

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

.2 Changes made by Addenda and change orders.

1.7.6 Other Documents: submit manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7.7 At completion of project, provide all recorded information on print drawings. Transfer recorded information to AutoCAD files in DWG format. Submit DWG files, also with electronic files in PDF format as part of the Closeout Submittals.

1.8 EQUIPMENT AND SYSTEMS

1.8.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

1.8.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

1.8.3 Include installed colour coded wiring diagrams.

1.8.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

1.8.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

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

1.8.7 Include manufacturer's printed operation and maintenance instructions.

1.8.8 Include sequence of operation by controls manufacturer.

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

1.8.10 Provide installed control diagrams by controls manufacturer.

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

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

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

1.8.14 Include test and balancing reports

1.8.15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

1.9.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

1.9.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

1.9.3 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.

1.9.4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

1.10.1 Provide spare parts, in quantities specified in individual specification sections.

1.10.2 Provide items of same manufacture and quality as items in Work.

1.10.3 Deliver to site location as directed; place and store.

1.10.4 Receive and catalogue all items. Submit inventory listing to Owner’s Representative. Include approved listings in Maintenance Manual.

1.10.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 MAINTENANCE MATERIALS

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

1.11.2 Provide items of same manufacture and quality as items in Work.

1.11.3 Deliver to site location as directed; place and store.

1.11.4 Receive and catalogue all items. Submit inventory listing to Owner’s Representative. Include approved listings in Maintenance Manual.

1.11.5 Obtain receipt for delivered products and submit prior to final payment.

1.12 SPECIAL TOOLS

1.12.1 Provide special tools, in quantities specified in individual specification section.

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

1.12.3 Deliver to project site place and store.

1.12.4 Receive and catalogue all items. Submit inventory listing to Owner's Representative. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

1.13.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

1.13.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

1.13.3 Store components subject to damage from weather in weatherproof enclosures.

1.13.4 Store paints and freezable materials in a heated and ventilated room.

1.13.5 Remove and replace damaged products at own expense and to satisfaction of Owner's Representative.

1.14 WARRANTIES AND BONDS

1.14.1 Develop warranty management plan to contain information relevant to Warranties.

1.14.2 Submit warranty management plan to Owner's Representative's approval.

1.14.3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.

1.14.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

1.14.5 Assemble approved information in binder and submit upon acceptance of work. 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 the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

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

.6 Co-execute submittals when required.

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

1.14.6 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection 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 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.14.7 Respond in a timely manner to oral or written notification of required construction warranty repair work.

1.14.8 Written verification will follow oral instructions. Failure to respond will be cause for the Owner's Representative to proceed with action against Contractor.

1.15 PRE-WARRANTY CONFERENCE

1.15.1 Meet with Owner's Representative to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Owner's Representative.

1.15.2 Owner's Representative will establish communication procedures for:

.1 Notification of construction warranty defects.

.2 Determine priorities for type of defect.

.3 Determine reasonable time for response.

1.16 WARRANTY TAGS

1.16.1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Owner's Representative.

1.16.2 Leave date of acceptance until project is accepted for occupancy.

1.16.3 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

2 PRODUCTS (NOT APPLICABLE)

3 EXECUTION (NOT APPLICABLE)

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

1.1.1 Division 1

1.1.2 'Mechanical Divisions'

.1 Division 21

.2 Division 22

.3 Division 23

1.2 GENERAL

1.2.1 This section of the specification is an integral part of the Contract Documents and shall be read accordingly.

1.2.2 The General Conditions of the Contract, the Supplementary Conditions and all Sections of Division 1 - General Requirements shall be deemed to apply and be a part of this section of the specification as fully as if recited in full herein.

1.2.3 Definition

.1 Mechanical Contractor: The term "Mechanical Contractor" is used within this specification when referring to the Division 21, 22 and 23 Contractor.

1.2.4 This Section is specific to the aforementioned Mechanical Divisions and is relevant and applicable in all cases.

1.2.5 All bidders with relevant work under these Mechanical Divisions shall include for all labour, material, equipment and any other related costs to provide a complete and fully operational mechanical system as described and visually represented in the mechanical drawings and Mechanical Division Specifications.

1.2.6 In the event of any doubt from the Mechanical Contractor or their sub-contractors, the consultant must be contacted via written documentation for clarification of doubt. Misinterpretation of Mechanical Division drawings or specifications does not relieve the Mechanical Contractor or their sub-contractors from the responsibility of providing a complete and fully operational mechanical system.

1.2.7 The Mechanical Contractor must examine the site and the local conditions that may affect the work prior to the start of work. All other Division drawings and specifications must be reviewed and understood prior to the commencement of work. If any discrepancies are noted, the Mechanical Contractor must promptly notify the Consultant. No allowance will be made later for any expenses incurred through the failure to make examinations or to report any such discrepancies in writing to the Consultant.

1.2.8 Mechanical Contractor shall provide all tools, scaffolding, materials and storage, site office, etc. as required to complete the work.

1.3 CODES, PERMITS AND FEES

1.3.1 All work shall conform with Federal, Provincial and Local Regulations.

1.3.2 Any ESA, TSSA and/or other Authorities having jurisdiction's permit fees associated with the Mechanical Divisional work shall be paid for by the Mechanical Contractor.

1.3.3 Any equipment that does not bear the required UL/ULC, CSA and/or CETL label will be required to be certified on site by an appropriate 3rd party certification agency. The Mechanical Contractor shall pay for all associated costs of certification.

1.3.4 Provide all inspection and certificates at the completion of work to signify that all work is compliant with the laws and regulations of Authorities having jurisdiction.

1.4 CONTRACT AGREEMENT AND UNDERSTANDING

1.4.1 The mechanical drawings and specifications are specific to the aforementioned Mechanical Divisions. Drawings do not show or explain any architectural or structural details, and any specifications involving installation, measurement, material or equipment. Architectural and structural information shall be extracted from their respective Divisional drawings and specifications. Any necessary changes to physical runs of piping, ductwork, tubing, etc. shall be completed to adhere to the aforementioned drawings and specifications.

1.4.2 Structural, Architectural and Electrical drawings and specifications may provide information relevant to the Mechanical Divisions and should be used in conjunction with the mechanical drawings and specifications.

1.4.3 The relocation of any equipment may be done so at no additional charge pending the relocation is altered prior to installation and does not necessitate major additional material and/or labour.

1.4.4 In some cases, there may be differences that occur between floor plans and riser diagrams or schematics and drawings. The Mechanical Contractor shall base their bids on whichever indicates the greater cost.

1.4.5 The Mechanical Contractor must provide field verification and measurements with respect to drawings. Prior to the commencement of any work, the contractor must verify all grade and invert elevations, levels, and dimensions to ensure proper and precise installation. Work completed without field verification is subject to alleviation under the direction of the Consultant at no cost to the Owner.

1.4.6 Any discrepancies found on drawings and/or specifications that differ between drawings or actual field conditions must be brought to the attention of the Consultant immediately for instruction.

1.4.7 All equipment, piping, ductwork, etc. shall be installed in a manner that provide ample service clearances and access. Any interferences with other equipment or material is not acceptable. Access doors shall be provided for all concealed operable mechanical equipment. In the case where the Mechanical Contractor does not abide to these statements, they shall alleviate the issues under the direction of the Consultant at no cost to the Owner.

1.4.8 Further to the work specifically mentioned in the Mechanical Division drawings and specifications, the Mechanical Contractor shall provide all other items, components, service space, etc. that are obviously necessary to complete the installation of work.

1.4.9 If Mechanical Division drawings and/specifications do not provide mounting heights and exact locations of wall mounted equipment, the Mechanical Contractor must obtain approval from the Consultant prior to installation.

1.4.10 The approximate location of terminal devices such as thermostats, humidistats, plumbing fixtures, sprinkler heads, grilles and diffusers etc. located within the finished space are shown on the mechanical drawings. The dimensioned location for these devices is to be obtained from the Architectural drawings. Where these devices are not dimensioned on the Architectural drawings, request the final elevation and location from the Consultants prior to installation. Locate the devices within 1.5 metres of the position shown on the Mechanical Drawings at no cost to the Owner.

1.5 PROGRESS PAYMENTS

1.5.1 The Mechanical Contractor shall submit requests for payment in accordance with Table 1.6.1.

1.5.2 The Mechanical Contractor shall breakdown payment progress draws into identifiable line items as requested by the Mechanical Consultant or Owner. If the Owner does not provide a detailed breakdown list of line items, the contractor can assume the following categories as a rubric:

Line Item	Itemized Description	Sub-Section Breakdowns
Mobilization		
Project Management		
Shop Drawings		
As Built Documentation and Manuals		
Commissioning		
HVAC	Each System (i.e. HVAC Piping, Sheet Metal, etc.)	- Material - Labour
	Equipment (i.e. Pumps, dampers etc.)	- Material - Labour - Start-Up
Controls	Building Automation System Wiring and Conduit	- Material - Labour
	Equipment (Control Panels, Sensors, Integrators, Etc.)	- Material - Labour
	Programming	- Labour
Commissioning		

1.5.3 The Consultant shall review the monthly progress draw requests in accordance with the procedures identified in the contract documents.

1.6 FINAL PAYMENT

1.6.1 Final payment to the mechanical contractor will not be released until following test and certificates are submitted to the consultant:

1.6.2 Release of HVAC and P&D permit from the City where the building is being erected.

1.6.3 TSSA certificate/letter of final review and approval for high pressure steam., fuel oil installation, refrigeration piping etc.,

1.6.4 Video scope result of below grade piping,

1.6.5 Final as-built drawings (soft copy).

1.6.6 Confirmation by the client or minutes of meeting stating training /demonstration sessions have all been completed.

1.7 SUBMITTALS

1.7.1 Submittals: in accordance with Table 1.6.1.

1.7.2 Shop drawings; submit drawings stamped and signed for approval by Owner's Representative.

1.7.3 Shop drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

1.7.4 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

1.7.5 In addition to transmittal letter referred to in Table 1.6.1.: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.7.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Table 1.6.1.

.2 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Engineer / Architect.

.2 Make changes as required and re-submit as directed by Owner's Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Owner's Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right-hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Owner's Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.8 QUALITY ASSURANCE

1.8.1 Quality Assurance: in accordance with Table 1.6.1.

1.8.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Table 1.6.1.

1.9 MAINTENANCE

1.9.1 Furnish spare parts in accordance with Table 1.6.1. as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

1.9.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Table 1.6.1.

1.9.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.9.4 Provide any and all additional equipment or components as identified in their respective Divisional specifications.

1.10 INSTALLATION OF WORK

1.10.1 It is the responsibility of the Mechanical Contractor to ensure that all Installation of Work is completed in a respectable and professional manner. The Mechanical Contractor shall be responsible for the following:

.1 The protection and maintenance of all work completed.

.2 The condition of all material and equipment.

.3 Workmanship.

.4 The protection of finished and unfinished work and equipment from other Divisions work. No damage due to other Divisions shall be acceptable.

.5 Coordinate all work with other Divisions.

.6 Prompt installation of work prior to concrete pouring or similar work (i.e. unground services and piping, etc.).

.7 Provide necessary temporary and/or future connections and rough-ins as required to allow for a streamlined work approach. Proceed with work as quickly as practical so that construction may be completed as swiftly as possible in accordance to the construction schedule (refer to table 1.6.1.).

.8 Ensure that all equipment and materials is delivered to site to accommodate the construction schedule (refer to Table 1.6.1.). If deliveries are on site prior to the possibility of installation or placement, all equipment and material must be securely and safely stored as to not be susceptible to exterior environmental extremities.

.9 All equipment shall be installed strictly as per manufacturer's instructions and recommendations unless otherwise noted by the Consultant.

1.11 INTERFERENCE DRAWINGS

1.11.1 The Mechanical Contractor shall provide information and locations for the preparation of interference drawings.

1.11.2 Interference drawings shall be prepared in ACAD 2018. If drawings are prepared in Revit, they must be regularly updated and provided to the Consultant for review.

1.11.3 Interference drawings shall be submitted to the Consultant for review in both hard copy (size to match indicated drawing size and scale) and electronic copy (i.e. PDF).

1.11.4 If specific congested areas require interference drawings, the Mechanical Contractor shall inquire with the Consultant on an appropriate drawing viewing scale (specifically for ACAD).

1.11.5 Interference drawings should always be provided in areas where there may be potential conflict of mechanical and electrical installation (i.e. piping, ductwork, cable trays, etc.).

1.11.6 All interference drawings must be coordinated with all other Divisions to ensure accuracy and acknowledgement. Any installation that must be modified to suit interference drawings shall be done so at no cost to the Owner.

1.11.7 Any installation that is completed without the use or submission of interreference drawings will be subjected to revision to adhere to interference requirements at no cost to the Owner.

1.11.8 The Mechanical Contactor must provide interference drawings for any alternative equipment that is approved by the Consultant and does not adhere to the original specified equipment dimensions.

1.11.9 Installation of work shall not commence until approval of interference drawings is completed by the Consultant.

1.11.10 In the event that there is interferences between multiple Divisions, an on site work meeting shall be organized by the Mechanical Contractor for prompt remedial action to take place.

1.12 MATERIALS

1.12.1 All materials shall be in accordance with the Mechanical Division drawings and specifications. In the event that the Mechanical Contractor wishes to provide an alternative, equivalent and/or substitute, the following criteria must be followed:

.1 The Mechanical Contractor shall provide itemized cost savings.

.2 The Consultant has the ability to reject submissions and request samples from the Mechanical Contractor.

.3 The Mechanical Contractor must bear any and all additional costs associated with requirement of 3rd party certified testing agencies to evaluate the quality of materials and equipment to be installed.

1.12.2 The basis of bid is based on manufacturer, brand name, performance, type and/or serial number provided in the Mechanical Division drawings and specifications. Materials and equipment specified shall be used as part of this work, unless mutual acceptance is provided in writing between the Mechanical Contractor and the Consultant.

1.13 SHOP DRAWINGS

1.13.1 The Mechanical Contractor must submit detailed performance, dimensional and installation piping and wiring diagrams for the mechanical equipment part of this work.

1.13.2 All shop drawing documentation shall be sent in electronic format (i.e. PDF). Each submission shall include a front-page transmittal indicating date of submission, Mechanical Contractor information, project title and address, Owner and Consultants project number, project managers names and titles (both Owner and Consultant) and review stamp by Mechanical Contractor.

1.13.3 The Consultant shall provide a stamped electronic copy of the shop drawing documents. It is the Mechanical Contractors responsibility to review comments and resubmit shop drawings as required.

1.13.4 The Mechanical Contractor shall ensure that a minimum of one (1) hard copy of each reviewed shop drawing is provided on site for reference.

1.14 CONSULTANT'S INSTRUCTIONS

1.14.1 At any given time during the course of construction, the Consultant may provide instructions as deemed necessary for verification and/or correction to the work. All instruction shall be provided in written documentation and shall effectively become a binding agreement as part of the drawings and/or specifications.

1.15 WARRANTY

1.15.1 All work and installed equipment shall be provided with a warranty against all defects of workmanship and material for a period of one (1) year after the substantial completion date of the work. The substantial completion date must be documented in written format.

1.15.2 Equipment warranties are indicated in their respective Divisional specification sections.

1.16 EQUIPMENT

1.16.1 All equipment shall be installed in such a way to permit accessibility for maintenance.

1.16.2 All equipment shall be installed with unions, flanges or other means to allow for ease of replacement and to minimize disturbance to mechanical systems.

1.16.3 All equipment shall be installed as to not interfere with building structure or other mechanical equipment.

1.16.4 All equipment drain ports must be piped to nearest floor drain. For glycol systems, pipe to nearest glycol feeder tank. In no case will drain ports not piped to a drain be accepted.

1.16.5 All equipment must be installed with the proper support (i.e. saddles, platforms, hangers, etc.) as deemed necessary by Structural, Mechanical Division specifications and manufacturer's requirements.

1.17 REVIEW OF INSTALLATIONS

1.17.1 No workmanship and equipment that is to be concealed shall be insulated or finished without Consultant review and approval prior to completion. The Mechanical Contractor shall arrange for Consultant site visits based on the construction schedule and inform the Mechanical Consultant when tests are deemed to take place.

1.17.2 The Mechanical Contractor shall bear all costs associated with retesting and making good as deemed necessary by the Consultant due to failure of adhering to statement 1.19.1.

1.17.3 Prior to any testing of hydronic or air systems, the Mechanical Contractor shall isolate all equipment and any other systems that are not designed to withstand test pressures. The Mechanical Contractor must also ensure any capped ductwork or valves are rated at a 'dead end' operational pressure rating larger than test pressure.

1.18 PAINTING FOR MECHANICAL

1.18.1 During construction, the Mechanical Contractor must identify any and all scuffs and damages that must be repainted and touched up to match the original finish in quality and appearance. The Consultant may request the Mechanical Contractor "make-good" any areas which they deem unfit.

1.18.2 Apply a minimum of one (1) coat of corrosion resistant paint to supports, hangers and equipment fabricated of ferrous materials and subjected to oxidation.

1.19 FLASHING

1.19.1 The Mechanical Contractor shall coordinate all requirements for roofing, water-proofing and flashing with other Divisions.

1.19.2 All mechanical equipment and supports passing through or built into a roof shall be provided with flashing as directed by the roofing trade. All flashing must be installed to ensure a watertight seal.

1.19.3 Fit counter flashing over flashing or equipment curb. All counter flashing must be installed to ensure a watertight seal.

1.20 CUTTING AND PATCHING

1.20.1 Any cutting and patching work required for Mechanical Division equipment and material installation shall be done so after approval from the Architect. The Mechanical Contractor shall provide detailed location and dimensional drawings for approval prior to the commencement of any work.

1.20.2 All cutting and patching shall be governed by Division 1 and Architectural drawings and specification. In the case that there are no Architectural drawings and/or specifications provided, the Mechanical Contractor shall adhere to the following requirements:

.1 All cutting and patching work shall be completed by a specialized trade in the materials to be cut. Cutting and patching drawings or details shall be created by the Mechanical Contractor and submitted to the Consultant for review and approval prior to the commencement of work.

.2 In no case shall any load bearing or structural walls and supports be cut unless written acceptance is provided by a certified Structural Engineer.

.3 Any supporting membranes, walls or structure that is required to be cut must by approved by the Consultant prior to the commencement of work. The Mechanical Contractor shall provide detailed location and dimensional drawings to indicated cuts.

1.21 MECHANICAL AND ELECTRICAL COORDINATION

1.21.1 The following is a table of mechanical and electrical responsibilities for the work to be completed.

Item	Provided By	
	Mechanical (Divisions 21, 22, 23 and 25)	**Division 26**
Motor Control Centres, Switchboards, etc.		X
Remote Disconnect Switches complete with fuses when required		X
Motors	X	
Fire Alarm Work		X
Life Safety Control Wiring and Relays		X
Stand-By Generators (Including Equipment Specification and Accessories)		X
Ventilation and Fuels Systems for Generators	X	
Power Wiring to Heat Tracing		X
Electrical Connections for Trap Seal Primer Manifolds, Softeners, Faucets	X	
Wiring of Level Switches for Sump Pumps	X	
Wiring and conduit for Voltages below 120 V	X	
Wiring and conduit for Voltages 120 V and above		X

1.21.3 All motor control centres, switchboards, motors at 120 V and above, etc., along with input and output power wiring will be by Division 26 unless Mechanical equipment is shipped to site as a packaged solution with a single power feed and includes internal transformers and starters. Refer to individual specification sections to identify equipment that is to be provided with single power feeds.

1.21.4 All starters shall be supplied by Mechanical Divisions. Installation and wiring of starters by Division 26 for any line and load side voltages of 120 V and above. Otherwise, by Mechanical Divisions.

1.21.5 Packaged equipment will have integral starters and only power feeders need be provided by Division 26.

1.21.6 Provide fire rated plywood backboards whenever communication equipment is to be wall mounted. Plywood is to be 21mm thick. Plywood to be either fire rated or with the appropriate label or coated with fire retardant paint.

1.21.7 If no wall location is suitable for mounting motor starters or VFD's, then mount the equipment on plywood backboard on Unistrut supports to meet the applicable code requirements for motor isolation switches.

2 PRODUCTS

2.1 SLEEVES

2.1.1 Shall be a minimum 22-gauge (0.8 mm) thick galvanized steel with lock seam joints at partition walls.

2.1.2 Use cast iron sleeve or steel pipe sleeves with annular fin continuously welded at midpoint. PVC sleeves with annular fin are also acceptable as follows:

.1 Through foundation walls.

.2 Where sleeves are specified to extends above finished floor.

2.1.3 Sizes

.1 1/4" (6 mm) clearance all around, between sleeve and pipes or between sleeve and insulation.

2.1.4 Where piping passes below footings, provide minimum clearance of 2" (50 mm) between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing.

2.1.5 Terminate sleeves flush with surface of concrete and masonry and 4" (100 mm) above floors. Not applicable to concrete floors on grade.

2.1.6 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water tight durable joint.

2.1.7 Fill voids around pipes.

2.1.8 For sleeves and pipe in foundation walls and below grade floors, provide "link seal” clamp.

2.1.9 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe (duct) and sleeve with waterproof fire retardant non hardening mastic. Seal space at each end of sleeve with waterproof, fire retardant, non hardening mastic.

2.1.10 Ensure no contact between copper tube or pipe and ferrous sleeve.

2.1.11 Fill future use sleeves with easily removable fire stop filler.

2.1.12 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

2.1.13 Where pipes and ducts pass through fire rated walls, floors and partitions, pack space with fire stopping materials as specified in Section 07 84 00 "Fire Stopping"

2.1.14 Install sleeves following approval of interference drawings.

2.1.15 On typical floors, provide one diameter between adjacent sleeves.

2.1.16 Extend sleeves 6" (150 mm) above floors in mechanical rooms and all areas where waterproofing is required.

2.1.17 All sleeves shall be as detailed on drawings.

2.1.18 All sleeve locations including dimensions shall be submitted to the Structural Engineer for review.

2.1.19 All sleeved or formed openings through the structure must be shown on sleeving drawings which are submitted to all Consultants for review prior to Construction. No holes through the structure will be permitted without written approval of the Architect.

2.1.20 The Mechanical Contractor shall be responsible for showing all sleeve locations required by the Mechanical Sub Contractors on the interference drawings.

2.1.21 The Mechanical Contractor shall be responsible for installing all of the sleeves required for the Mechanical contract and the Mechanical Sub Contractors.

2.1.22 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water tight durable joint.

2.1.23 For sleeves and pipe in foundation walls and below grade floors, provide link seal clamp.

2.1.24 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

2.2 ESCUTCHEONS AND PLATES

2.2.1 Use chrome or nickel-plated brass, solid type with set screws for ceiling or wall mounting. All escutcheons and plates in exhibition spaces shall be flat black.

3 EXECUTION

3.1 CLEANING

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

3.2 FIELD QUALITY CONTROL

3.2.1 Site Tests: conduct following tests in accordance with Table 1.6.1. and submit report as described in SUBMITTALS.

.1 Submit tests as specified in other sections of this specification.

3.2.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in QUALITY ASSURANCE.

3.3 DEMONSTRATION

3.3.1 Owner’s Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.

3.3.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

3.3.3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

3.3.4 Instruction duration time requirements as specified in appropriate sections.

3.3.5 Owner’s Representative may record these demonstrations on video tape for future reference.

3.4 PROTECTION

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

3.5 SLEEVES

3.5.1 Where piping passes below footings, provide minimum clearance of 2" (50 mm) between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing.

3.5.2 Terminate sleeves flush with surface of concrete and masonry and 4" (100 mm) above floors. Not applicable to concrete floors on grade.

3.5.3 Fill voids around pipes.

3.5.4 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe (duct) and sleeve with waterproof fire retardant non hardening mastic. Seal space at each end of sleeve with waterproof, fire retardant, non hardening mastic.

3.5.5 Ensure no contact between copper tube or pipe and ferrous sleeve.

3.5.6 Fill future use sleeves with easily removable fire stop filler.

3.5.7 Where pipes and ducts pass through fire rated walls, floors and partitions, pack space with fire stopping materials as specified in Section 07 84 00 "Fire Stopping"

3.5.8 Install sleeves following approval of interference drawings.

3.5.9 On typical floors, provide one diameter between adjacent sleeves.

3.5.10 Extend sleeves 6" (150 mm) above floors in mechanical rooms and all areas where waterproofing is required.

3.5.11 All sleeves shall be as detailed on drawings.

3.5.12 All sleeve locations including dimensions shall be submitted to the Structural Engineer for review.

3.5.13 All sleeved or formed openings through the structure must be shown on sleeving drawings which are submitted to all Consultants for review prior to Construction. No holes through the structure will be permitted without written approval of the Architect.

3.5.14 The Mechanical Contractor shall be responsible for showing all sleeve locations on the interference drawings.

3.5.15 The Mechanical Contractor shall be responsible for installing all of the sleeves.

3.6 ESCUTCHEONS AND PLATES

3.6.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

3.6.2 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.

3.6.3 Where sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

3.6.4 Secure to pipe or finished surface but not to insulation.

3.7 DIELECTRIC COUPLINGS

3.7.1 Provide wherever pipes of dissimilar metals are joined complete with rubber gaskets to prevent contact.

3.7.2 Cast brass adapters may be used on domestic water systems where approved by the Consultant.

3.7.3 Insulating unions to be provided for all pipes NPS 2" and below. Pipes larger to be provided with flanges.

3.8 CONNECTIONS TO EQUIPMENT

3.8.1 In accordance with manufacturer's instructions unless otherwise indicated.

3.8.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.1 Unions are not required in installations using grooved mechanical couplings (The couplings shall serve as unions).

3.8.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.8.4 The flexible type grooved joint couplings may be used only when approved by the consultant in lieu of a flexible connector at equipment connections for vibration attenuation and stress relief. Couplings shall be placed in close proximity to the source of the vibration, as per manufacturer's recommendations.

3.9 CLEARANCES

3.9.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

3.9.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.10 PREPARATION FOR FIRESTOPPING

3.10.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

3.10.2 Uninsulated unheated pipes not subject to movement: No special preparation.

3.10.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation or install per manufacturer's recommendation as specified within the associated approval.

3.10.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

3.11.1 In accordance with Section 23 08 16 - Cleaning and Start-up of Mechanical Piping Systems.

3.11.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning supplemented as specified in relevant sections of other Divisions.

3.11.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

3.12.1 Advise Owner's Representative, 48 hours minimum prior to performance of pressure tests.

3.12.2 Pipework: Test as specified in relevant sections of other sections or Divisions.

3.12.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of other Divisions.

3.12.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

3.12.5 Conduct tests in presence of Owner's Representative. Work to be carried out in off hours after 5 p.m., weekends or holidays.

3.12.6 Pay costs for repairs or replacement, retesting, and making good. Owner's Representative to determine whether repair or replacement is appropriate.

3.12.7 Insulate or conceal work only after approval and certification of tests by Owner's Representative.

3.13 EXISTING SYSTEMS

3.13.1 Connect into existing piping systems at times approved by Owner's Representative. Work to be carried out off hours after 5 p.m., weekends or holidays.

3.13.2 Request written approval ten (10) working days minimum, prior to commencement of work.

3.13.3 Be responsible for damage to existing plant by this work.

3.13.4 Ensure daily clean-up of existing areas.

END OF SECTION

1 GENERAL

1.1 SUMMARY

1.1.1

1.2 RELATED SECTIONS

1.2.1 Section 21 05 00 – Common Work Results for Mechanical

1.3 NUMBER OF COPIES

1.3.1 Provide minimum of six (6) copies of Mechanical Maintenance Manuals.

1.3.2 Provide soft copy in PDF format of the Mechanical Maintenance Manuals.

1.4 SCHEDULE

1.4.1 Mechanical Maintenance Manuals shall be delivered to the Consultant 30-days prior to the start of the Operator Training.

1.5 DELIVERY

1.5.1 Manuals to be bound in a hard cover neatly labeled: "OPERATING AND MAINTENANCE INSTRUCTIONS".

1.6 SPARE PARTS

1.6.1 Manuals shall include recommended spare parts and consumables for start up, commissioning, first six months of operation and yearly maintenance requirements.

1.7 FORMAT

1.7.1 Manuals shall be provided to identify the overall system requirements as well as identifying individual components.

1.7.2 The information included within the manuals shall be for the equipment that was supplied to the project site. Where the shop drawings indicate multiple features that can be provided with the equipment they shall be marked up to show exactly what was provided.

1.7.3 Provide the Operating and Maintenance manuals that are supplied with the Equipment.

1.7.4 Any deviations that were made to the equipment that is not consistent with what is shown on the shop drawings shall be clearly identified in the Maintenance Manuals. The item that has not been installed shall be crossed out and the item that has been installed shall be inserted into the drawings.

1.7.5 Where equipment is wired together as a system a control schematic drawing shall be provided showing how all of the devices are interconnected including terminals and labeling.

1.7.6 Where equipment is piped together as a system a schematic drawing shall be provided showing how all of the devices are piped together.

1.8 MANUFACTURER'S START UP REPORTS

1.8.1 The manufacturer's start up reports shall be included in the maintenance manuals with each system.

1.8.2 Include manufacturers follow up reports for all issues identified in the start up reports.

1.9 FLUSHING AND CLEANING

1.9.1 Include a copy of the flushing and cleaning water quality reports for each system.

1.10 FACTORY TESTING

1.10.1 Reports generated by factory testing of the equipment prior to shipment to site shall be included with the applicable piece of equipment shop drawing.

1.11 SERVICE AGREEMENTS

1.11.1 Include any service agreements and their length that are part of the contract.

1.12 WELDING

1.12.1 Refer to Section 23 05 17.

1.12.2 The Contractor shall include in the Operating and Maintenance manuals the following information:

1.12.3 Material Certifications

1.12.4 Weld Procedures/Logs

1.12.5 Weld Maps

1.12.6 Weld Inspection Reports

1.12.7 Welder/Inspector Certifications.

1.12.8 Electropolishing, passivation and cleaning procedures/logs/certificates.

1.12.9 Test Reports

1.13 VALVE DIRECTORIES

1.13.1 Valve shall be numbered by system.

.1 HVAC

.2 Plumbing and Drainage

.3 Process Systems

1.13.2 Valve directories shall be provided in both hard copy and electronic files.

1.13.3 Install one copy of the valve directory in the Operations and Maintenance Manual.

1.13.4 Install one framed copy with clear face glass of the valve directory to be hung in the mechanical room.

1.13.5 Include an electronic version of the valve directory in the maintenance manual.

1.14 SPARE PARTS

1.14.1 Provide a list of spare parts provided for the building. List shall be organized by category.

1.14.2 From the Manufacturer's Maintenance Manuals identify recommended spare parts for each piece of equipment/system.

1.14.3 Identify any spare parts that were turned over to the Owner as part of the Contract.

1.15 WARRANTIES

1.15.1 Provide a warranty letter from the Contractor within the Maintenance Manuals.

1.15.2 For any equipment that has an extended warranty include the Manufacturer's warranty with the equipment shop drawing and identify the date of the extended warranties expiration.

1.16 MAINTENANCE

1.16.1 The maintenance requirements for each piece of equipment shall be taken from the Manufacturer's Operation and Maintenance Information.

1.16.2 Provide a summary page for each piece of equipment which identifies the following:

.1 Daily Maintenance

.2 Weekly Maintenance

.3 Monthly Maintenance

.4 Semi Annual Maintenance

.5 Annual Maintenance

.6 As Required Maintenance.

2 EXECUTION

2.1 FORMAT

2.1.1 Maintenance manuals shall be divided into sections with neatly labeled and tabbed dividers between each section.

2.1.2 Each binder shall include a table of contents.

2.2 SECTION 1 – GENERAL

2.2.1 Section 1 shall include the following:

2.2.2 A list giving name, address and telephone number of the following:

.1 Consultant

.2 Engineers

.3 Construction Manager

.4 Mechanical Trade

.5 Mechanical Sub Trades

.6 Controls Trade

2.2.3 Provide documentation indicating when Operator Training took place and who was present at the Training.

2.3 SECTION 2 – WARRANTIES AND SHOP DRAWINGS.

2.3.1 Include a list giving the name, address and telephone number of all suppliers.

2.3.2 A copy of the Contractor's Warranty letter.

2.3.3 A copy of all approved shop drawings for all equipment. Provide a tab with each shop drawing to identify the relevant section of the specification that the equipment is associated with.

2.3.4 The Contractor shall include a report which identifies any deviations from the approved shop drawings that occurred on site. The report shall also identify any field installed components (transformers, relays, switches) that do not appear on the shop drawings.

2.4 SECTION 3 – CONTROLS

2.4.1 Section 8 shall be organized by system.

.1 General

.2 The version of software that has been installed.

.3 Shop Drawings

.4 Complete Record drawings.

.5 Complete Control Diagrams for each system.

.6 Wiring Diagrams and description of Control system and the functioning of the system.

.7 A copy of all calibration certificates.

.8 Ladder logic diagrams.

.9 Sequence of operation

.10 Final Setpoints and delays for all systems

2.4.2 Functional Testing

.1 Point to point check sheets for each system.

.2 Components Lists

.3 Detailed component lists including part numbers shall be provided.

2.4.3 Passwords

.1 Provide a summary sheet identifying how the Operator can add additional people to the system, set their password and set their password level so that they are limited with regard to what they can change based on their operator level.

2.4.4 Disaster Recovery

.1 Identify disaster recovery procedures

.2 Provide a description of actions that must be taken in the event of system failure.

2.4.5 Back Up

.1 Back up copies of all software on USB thumb drive.

2.4.6 As-built plan drawings

.1 A Drawing indicating where all of the control devices and control panels have been installed and their associated point number.

2.4.7 Panels

.1 Provide a table which indicates the control panel names, their locations, the type of power (normal or emergency) and which electrical panel they have been connected to.

2.4.8 Alarms

.1 A complete list of Alarms and their priority.

.2 Trouble Shooting Guide

.3 Provide a trouble shooting guide for typical problems with the system.

2.5 SECTION 4 – PROCESS SYSTEMS

2.5.1 The section shall be organized by system.

2.5.2 Systems shall include the following:

.1 Fuel Oil Systems

2.5.3 A system description shall be provided for each system. The description shall include the following:

.1 System Type

.2 Areas Served

.3 Function of Major Components

.4 Location in Building

.5 The following design criteria shall be provided:

.6 Operating Pressures

.7 Any Future Load Allowances

.8 Standby Capabilities.

2.5.4 A system schematic shall be provided for each system.

2.5.5 Operating Instructions shall be included. They shall include:

.1 Type and specific location of each device used in the system operation.

.2 Identify safety devices and interlocks that must be satisfied in order for the system to start.

.3 Operation of Equipment when building is operating on emergency power.

.4 Include Manufacturer's Equipment Start Up Sheets for Each System.

.5 Include Warranty information for each piece of equipment.

.6 Include maintenance tasks and schedules for the system.

.7 Identify all pressure relief devices installed in each system. Record the setpoint that the pressure relief has been set to.

.8 Include all TSSA pressure vessel and piping inspection reports.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

1.1.1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.1.2 Section 23 05 05 - Installation of Pipework.

1.2 REFERENCES

1.2.1 American National Standards Institute/American Society of Mechanical Engineers. (ANSI/ASME)

- .1 ANSI/ASME B31.1, Power Piping.
- .2 ANSI/ASME B31.3, Process Piping.
- .3 ANSI/ASME B31.5 – Refrigeration Piping and Heat Transfer Components.
- .4 ANSI/ASME B31.9 Building Services.
- .5 ANSI/ASME Boiler and Pressure Vessel Code
  - .1 Section I: Power Boilers.
  - .2 Section V: Non-destructive Examination.
  - .3 Section IX: Welding and Brazing Qualifications.

1.2.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

- .1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.

1.2.3 American Welding Society (AWS)

- .1 AWS C1.1, Recommended Practices for Resistance Welding.
- .2 AWS Z49.1, Safety Welding, Cutting and Allied Process.
- .3 AWS W1, Welding Inspection Handbook.

1.2.4 Canadian General Standards Board

- .1 CAN/CGSB-48.2, Spot Radiography of Welded Butt Joints in Ferrous Materials.

1.2.5 Canadian Standards Association (CSA International)

- .1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
- .2 CSA W48 series-, Filler Metals and Allied Materials for Metal Arc Welding.
- .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
- .4 CSA B52 Mechanical Refrigeration Code.
- .5 CSA W117.2, Safety in Welding, Cutting and Allied Processes.
- .6 CSA W178.1, Certification of Welding Inspection Organizations.

.7 CSA W178.2, Certification of Welding Inspectors.

1.2.6 Provincial regulations: Boiler, Pressure Vessel and Compressed Gas Regulations.

1.3 QUALIFICATIONS

1.3.1 Welders

.1 Welding qualifications in accordance with CSA B51

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Furnish welder's qualifications to Owner's Representative.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.6 Al pipes shall be Electric resistance welded grade A and B.

1.3.2 Inspectors

.1 Inspectors qualified to CSA W178.2.

1.4 QUALITY ASSURANCE

1.4.1 Registration of welding procedures in accordance with CSA B51, CSA B52 and provincial regulations.

1.4.2 Copy of welding procedures available for inspection.

1.4.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.5 WASTE MANAGEMENT AND DISPOSAL

1.5.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction / Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.

1.5.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

1.5.3 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.

1.5.4 Divert unused metal materials from landfill to metal recycling facility as approved by Owner's Representative.

2 PRODUCTS

2.1 ELECTRODES

2.1.1 Electrodes: in accordance with CSA W48 Series.

3 EXECUTION

3.1 WORKMANSHIP

3.1.1 Welding: in accordance with ANSI/ASME B31.1 B31.3, B 31.5, B31.9, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS C1.1, and special procedures specified elsewhere in Mechanical Division and applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

3.2.1 Identify each weld with welder's identification symbol.

3.2.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

3.2.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

3.3.1 Review weld quality requirements and defect limits of applicable codes and standards with Owner’s Representative before work is started.

3.3.2 Formulate "Inspection and Test Plan" in co-operation with Owner’s Representative.

3.3.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

3.3.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

3.4.1 General

.1 Perform examinations and tests by specialist engaged by contractor, qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Owner’s Representative.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 In accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and/or spot or full gamma ray radiographic (hereinafter referred to as "radiography") tests. As per applicable reference standard or as specified.

.4 All steam piping shall be mag particle tested and radiographically tested based on the following sequence:

.1 20% shall be tested utilizing magnetic particle test, anything that fails the magnetic particle test shall be followed up with a radiographic testing. The Contractor may test more than 20% based on the testing conducted up to that point, this is at the contractor's discretion.

.2 An additional 10% of randomly selected welds or areas that may be difficult to repair shall be tested by radiographic testing.

.3 At a minimum 20% mag particle and visual inspection plus 10% radiographic testing shall be completed. The testing procedure could accumulate to 30% testing if 20% of the mag particle testing fails.

.5 Testing of Chilled Water systems as required per item 3.6.2.6.

3.4.2 Hydrostatically test welds to requirements of ANSI/ASME B31.1.

3.4.3 Visual and Magnetic Particle examinations: include entire circumference of weld externally and wherever possible internally.

3.4.4 Radiography testing to CAN/CGSB-48.2.

.1 Radiographic film:

.1 Identify each radiographic film with date, location, name of welder, and submit to Owner's Representative. Replace film if rejected because of poor quality.

.2 Interpretation of radiographic films:

.1 By qualified radiographer.

.3 Failure of radiographic tests:

.1 Extend tests to welds by welder responsible when those welds fail tests.

3.4.5 Magnetic particle tests for piping systems as indicated.

3.5 WELDING FUMES

3.5.1 Contractor shall use welding fume extraction and filtration systems to minimize smoke propagation thru building areas.

3.5.2 For all welding in tunnel spaces provide air moving fans at all times during construction to facilitate air transfer tunnel to outside.

3.5.3 Provide three HEPA air scrubbers (rated at 2,000CFM) complete with all accessories in immediate area of welding work to provide local air filtration.

3.5.4 Contractor shall be responsible for all costs associated with setup of fume extraction equipment, air circulation fans, HEPA air scrubbers, etc. including location nearest power supply/receptacle and providing all required extension cords, plug adapters, etc. for complete operational system.

3.5.5 Proposed location of air circulation fans are indicated on drawings for reference only. Contractor shall complete final adjustments in field to ensure effective transfer of fumes.

3.5.6 Provide all necessary accessories including extension cords, plugs, etc. to ensure fully operating system.

3.5.7 Welding in areas utilized as a plenum for air handling systems (eg. penthouse room used as a return air plenum) shall be completed afterhours once air handling systems are scheduled off. Coordinate with the facility management.

3.6 DEFECTS CAUSING REJECTION

3.6.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.6.2 In addition, chilled water systems below 1000 kPa:

.1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.

.2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.

.3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.

.4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.

.5 Repair cracks and defects in excess of 0.8 mm in depth.

.6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic particle tests.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

3.7.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

1 GENERAL

1.1 SUMMARY

1.1.1 Section includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

1.2.1 Section 01 33 00 - Submittal Procedures.

1.2.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.2.3 Section 21 04 99 - Common Work Results for Mechanical

1.2.4 Section 23 05 05 - Installation of Pipework

1.3 REFERENCES

1.3.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

1.3.2 American Society for Testing and Materials (ASTM)

.1 ASTM A125, Specification for Steel Springs, Helical, Heat Treated.

.2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.

.4 ASTM A653 G90 SS Gr. 33 - Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dipped Process

.5 ASTM B633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel

.6 ASTM A 123/A 123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.7 ASTM A 153/A 153M, Standard Specification for Zinc Coating (Hot-Dip Galvanized) on Iron and Steel Hardware

.8 ASTM D 1929, Standard Test Method for Determining Ignition Temperature of Plastics

1.3.3 Factory Mutual (FM)

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

.1 Materials Safety Data Sheets (MSDS).

1.3.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3.6 Underwriter's Laboratories of Canada (ULC)

1.3.7 NFPA

.1 NFPA-13, Standard for Installation of Sprinkler Systems

1.4 SYSTEM DESCRIPTION

1.4.1 Design Requirements

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

1.4.2 Performance Requirements

.1 Design supports, platforms, catwalks, hangers, to withstand seismic events for location as per the Ontario Building Code

1.5 SUBMITTALS

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

1.5.2 Shop drawings: submit drawings stamped and signed for approval by Owner’s Representative.

1.5.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

1.5.4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Owner's Representative will make available 1 copy of systems supplier's installation instructions.

1.5.5 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.6 QUALITY ASSURANCE

1.6.1 Health and Safety:

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

1.7 DELIVERY, STORAGE, AND HANDLING

1.7.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.7.2 Waste Management and Disposal:

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

2 PRODUCTS

2.1 GENERAL

2.1.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58 and SP-89.

2.1.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

2.2.1 General

.1 Provide spring hangers where specified

.2 Provide saddles for all insulated pipes and prefabricated insulation shields with high density insulation with vapour barriers for domestic cold water and chilled water piping.

.3 For all domestic cold water, chilled water and steam and condensate piping the hangers shall be oversized to fit over the outside of the insulation.

.4 Supports, guides and anchors shall be designed so that excessive heat will not be transmitted to the structure.

.5 Where piping is subjected to shock loads, such as thrust imposed by the activation of safety valves or the starting and stopping of condenser water systems hanger design shall include the provision of rigid restraints or shock absorbing devices of approved design.

.6 The pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping and prevent excessive stress resulting from transferred weight being introduced into the connected equipment.

.7 Hangers shall adequately support the piping system. They shall be located near or at changes in piping direction and as close as possible to concentrated loads. They shall provide a means for vertical adjustment after erection to maintain pitch required for proper drainage.

.8 All steam and condensate piping shall be hung in accordance with the requirements outlined in ANSI B31.1. Refer to Specification Sections for Steam and Condensate piping for requirements for stress analysis calculations.

2.2.2 Finishes:

.1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

2.2.3 Upper attachment structural: Suspension from lower flange of I-Beam.

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed, 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.

2.2.4 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.

.2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.

2.2.5 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.

2.2.6 Shop and field-fabricated assemblies.

.1 Trapeze hangar assembly: MSS SP-89.

.2 Steel brackets: MSS SP-89.

.3 Sway braces for seismic restraint systems: to MSS SP-89.

2.2.7 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

2.2.8 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation saddles for hot pipework.

.4 Oversize pipe hangers and supports for insulated pipes.

2.2.9 Adjustable Swivel Ring Hangers

.1 Utilize adjustable swivel ring hangers for:

.1 Pipe Sizes 2-1/2” (65mm) and smaller

.2 Pipe Sizes 2-1/2” (65mm) and larger

.2 Hanger shall constructed of carbon steel.

.3 Hanger to be UL, ULc and FM approved.

.4 For sprinkler piping applications the swivel hanger shall meet the requirements of the NFPA.

.5 Swivel nut shall provide vertical adjustment once the pipe is in place.

.6 For non insulated copper pipe utilize either copper plated or epoxy coated hangers.

.7 Standard of Acceptance uninsulated steel pipe: Hunt Fig. #20, Myatt, Anvil Fig.69.

.8 Standard of Acceptance uninsulated copper pipe: Hunt Fig #20C or Hunt Fig # 20E, Myatt, Anvil Fig. CT-69.

.9 Standard of Acceptance insulated copper or steel pipe: Hunt Fig # 25H, Myatt, Anvil, Cooper B-Line

2.2.10 Adjustable clevis Hangers

.1 Utilize adjustable clevis hangers for:

.1 Pipe Sizes 2-1/2" (65mm) and larger

.2 Material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.3 Ensure "U" has hole in bottom for riveting to insulation shields.

.4 Hanger shall be constructed of carbon steel.

.5 Hanger to be UL, ULc and FM approved.

.6 Hanger shall provide vertical adjustment once the pipe is in place. For sizes 5" (125 mm) and larger utilize rod with two nuts. For sizes less than 5" (125 mm) utilize bolt and nut.

.7 For non insulated copper pipe utilize either copper plated or epoxy coated hangers.

.8 For roller hangers provide cast iron roller.

.9 Standard of Acceptance uninsulated steel pipe: Hunt Fig #32, Myatt, Anvil, Cooper B-Line.

.10 Standard of Acceptance uninsulated copper pipe: Hunt Fig 30C or 30E, Myatt, Anvil Fig 65 epoxy coated, Cooper B-Line.

.11 Standard of Acceptance steam piping requiring roller hangers: Hunt Fig #3436, Myatt, Anvil Fig 181, Cooper B-Line.

.12 Standard of Acceptance insulated copper or steel pipe: Hunt Fig 32U, Myatt, Anvil Fig 260, Cooper B-Line.

2.2.11 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

2.2.12 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.

2.2.13 Pipe rollers:

.1 cast iron roll and roll stand with carbon steel rod to MSS SP-69.

.2 Utilize roller type hangers on steam and condensate services

2.2.1 Trapeze Hangers

.1 Hanger shall be tube construction constructed of 12 gauge rolled form ASTM 1011 structural steel Gr. 33 structural steel channel with galvanized finish.

.2 Hanger shall be sized for the total weight of the pipes, concentrated loads, water and insulation supported on the trapeze.

.3 Trapeze assembly shall be supported by a minimum of two rods with washer plates sized for the total weight of the pipes, concentrated loads and fluids within the pipes.

.4 All insulated pipe shall be provided with insulation shields and high-density insulation so that the insulation can be supported above the trapeze.

.5 Pipes mounted on trapeze hangers shall be guided by a U bolt every second hanger.

.6 Trapeze hangers shall be sized as follows:

Trapeze Hangers												
Tubing Size	**Maximum Load (lbs) based on the following distance between supports (inches) at a maximum temperature of 250 F.**											
	18″	**20″**	**22″**	**24″**	**26″**	**28″**	**30″**	**36″**	**42″**	**48″**	**54″**	**60″**
3/16″ x 4″ x 3″	5800	5200	4800	4400	3900	3600	3500	2900	2500	2200	1900	1700
¼″ x 4″ x 4″	10200	9100	8300	7500	7000	6500	6100	5100	4300	3800	5300	4800
¼″ x 6″ x 4″				12000	11100	10300	9600	8000	6800	6000	5300	4800
¼ ″ x 8″ x 4″				20000	18400	17100	16000	13300	11400	10000	8800	8000

2.3 RISER CLAMPS

2.3.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.

2.3.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.

2.3.3 Bolts: to ASTM A307.

2.3.4 Nuts: to ASTM A563.

2.3.5 For uninsulated copper pipe utilize copper plated riser clamp.

2.3.6 Standard of Acceptance: Hunt Fig #40, 41, 42C, Myatt, Anvil Fig 261, Cooper B-Line.

2.4 INSULATION PROTECTION SHIELDS

2.4.1 Insulation shields shall be constructed of carbon steel and shall be galvanized.

2.4.2 Insulation shields shall be utilized in conjunction with high compressive strength inserts.

2.4.3 For pipes sizes NPS 5 and smaller the minimum metal thickness shall be 0.12″ (3.2 mm).

2.4.4 For pipes sizes NPS 6 and larger the minimum metal thickness shall be 0.19″, (4.8 mm).

2.4.5 Shields shall 12″ (300 mm) in axial length and shall span an arc of approximately 180 degrees.

2.4.6 Shields for pipe sizes NPS 12 and larger shall have a centre rib.

2.4.7 Insulated cold piping:

.1 64 kg/m3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

2.4.8 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.4.9 Standard of Acceptance: Hunt, Myatt, Anvil Fig 167, Cooper B- Line or approved alternate.

2.5 CONSTANT SUPPORT SPRING HANGERS

2.5.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report(CMTR).

2.5.2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

2.5.3 Provide upper and lower factory set travel stops.

2.5.4 Provide load adjustment scale for field adjustments.

2.5.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

2.5.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

2.6.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

2.6.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

2.6.3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

2.6.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.1 ROOF MOUNTED PIPE SUPPORT AND PIPE CROSSOVER SYSTEMS

2.1.1 General

.1 Provide rooftop support system for all roof mounted piping, size to suit pipe size, weight and quantity. Refer to drawing M-3.4 for piping layouts.

2.1.2 Materials

.1 Bases are high density polypropylene with UV inhibitors and anti-oxidants conforming to following:

.1 Color: Black color as molded

.2 Moisture Content: negligible

.3 Shrinking/Swelling due to moisture: Negligible

.4 Resistant to oil, gasoline, antifreeze, battery acid and sulfuric acid

.5 Do not use bases that are made of pressed rubber, steel, stainless steel, recycled tires or carbonated plastics

2.1.3 Base Dimensions:

.1 18-inches wide by 18-inches long by 3-inches tall (18x18)

.2 Base Size: 18" x 18" x 3", or 18" round

.3 Base Weight: 7 lbs and 10-1/2 lbs

.4 Base Material: Injection molded high density/high impact polypropylene with UV-inhibitors and Antioxidants

.5 Base Color: Black

.6 Base Density: 55.8 lb/cu ft (894 kg/cu m)

.7 Steel frame: Steel, 12ga 1-5/8” or 1-7/8” strut galvanized per ASTM A123 or 14ga 13/16” strut galvanized per ASTM A653 for PP10 and SS8.

2.1.4 Hanger Type:

.1 Conforms to MSS SP-58 and MSS SP-69

.2 Material: Carbon steel(Standard); 304 SS available

.3 Clevis Hanger: Used for all insulated and uninsulated lines

.4 Roller Hanger: Used for uninsulated lines

.5 Finish: Hot Dipped Galvanized (HDG)

2.1.5 Walkway Surface

.1 Interlocking Planking:

.1 Thickness: 18 gauge

.2 Section width: 12 inches(305 mm) standard, or 6 inches(152 mm)

.3 Planking height: 2.5 inches

.4 Flange options: MM/MF

.5 Surface: Slip resistant

.6 Finish: HDG

.2 Bar Grating: Type WB-4

.1 1" x 3/16" Bearing Bars, 1-3/16" on Center, Regular Cross Bars 4"

.2 Width: 24 inches(standard), or 36 inches – as required

.3 Surface: Serrated

.4 Finish: HDG

.3 Handrail

.1 12 gauge, 1-5/8" strut, Galvanized

.4 Attaching hardware

.1 HDG threaded rod, nuts and attaching hardware per ASTM A153.

2.1.6 Fuel piping (up to 3 ½"OD, not exceeding 16" in height)

.1 The support shall be designed for installation without roof penetrations, flashings, or damage to the roofing material. Refer to the contract drawing for the support detail.

.2 The support can be used on virtually any roofing system from flat roofs to roofs sloped up to 2 in 12.

.3 The supports should be spaced according to the specifications.

.4 Seismic and High-Wind applications are available for the system.

.5 Systems shall be designed for seismic and high wind application.

.6 Product: PHP Systems PP10 with channel, Miro Industries

2.1.7 Crossover and Equipment Access Platform

.1 All walkway systems shall be installed directly on the roof without penetrating the roof surface.

.2 Systems allow technicians and service professionals to gain safe and convenient access to varying roof levels and equipment otherwise encumbered by rooftop pipes, ducts, and other types of rooftop components.

.3 Install above condenser water piping on E and C-wing roof and above glycol piping on E-wing.

.4 Height of cross over to suit pipe height.

.5 Height of cooling tower access platform to suit access door and fil media, coordinate final height with structural drawigns.

.6 Product: PHP Systems Crossover, Miro Industries

2.2 EQUIPMENT SUPPORTS

2.2.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.3 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

2.3.1 Provide templates to ensure accurate location of anchor bolts.

2.4 PLATFORMS AND CATWALKS

2.4.1 To Section 05 50 00 - Metal Fabrication.

2.5 HOUSE-KEEPING PADS

2.5.1 For all boilers, pumps, air compressors, fans and other rotating equipment installed on the floor or specified in individual sections, provide chamfered edge housekeeping pads a minimum of 4" (100 mm) high and 4" (100 mm) larger than equipment dimensions all around.

2.5.2 For all air handling units provide housekeeping pads so that units are mounted on chamfered edge housekeeping pads a minimum of 4" (100 mm) larger than the equipment dimensions all around as follows:

2.5.3 Total Static Pressure Less than or equal to 5” WC – 150mm (6”) housekeeping pad

2.5.4 Total Static Pressure Greater than 5” WC – 200mm (8”) housekeeping pad

2.5.5 Work shall be performed by the trades specializing in this work.

2.5.6 Concrete: to Section 03 30 00 - Cast-in-place Concrete by Division 3.

2.6 OTHER EQUIPMENT SUPPORTS

2.6.1 From structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

2.6.2 Submit structural calculations with shop drawings.

3 EXECUTION

3.1 MANUFACTURE’S INSTRUCTIONS

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

3.2 INSTALLATION

3.2.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

3.2.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

3.2.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

3.2.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

3.2.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2.6 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm or more,

.2 transfer of load to adjacent hangers or connected equipment is not permitted.

3.2.7 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.

.2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

3.3.1 Plumbing piping: to Ontario Plumbing Code.

3.3.2 Fire protection: to applicable fire code.

3.3.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

3.3.4 Copper piping: up to NPS 1/2: every 1.5 m.

3.3.5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

3.3.6 Govern spacing between pipe rack supports using smallest pipe size.

3.3.7 All hanger rods shall be galvanized or painted with red chromate primer.

3.3.8 Rods shall be threaded at both ends or be provided with a continuous thread. Use adjusting locknuts at upper attachments and hangers. No wire, chain or perforated straps shall be allowed.

3.3.9 Use rod diameters and spacing for pipe supports as shown in table with following exceptions:

.1 Support plumbing piping in accordance with more stringent requirements of authorities having jurisdiction or as specified.

.2 Support NPS 1/2 gas pipe every 6 ft (1.8 m).

.3 Support NPS 1/2 copper pipe every 5 ft (1.5 m).

3.3.10 Hanger Support

.1 Support fire protection piping in accordance with NFPA codes.

.2 Support plumbing piping in accordance with the Ontario Building Code, and the following:

.1 Support all vertical soil pipe, vents, waste stacks and rain water leaders at every floor with steel pipe clamps.

Pipe Size NPS	Rod Diameter	Maximum Spacing:	
		Steel	Copper
up to, 3/4	3/8" (10 mm)	7 ft (2.1 m)	6 ft (1.8 m)
1	3/8" (10 mm)	7 ft (2.1 m)	6 ft (1.8 m)
1-1/4	3/8" (10 mm)	7 ft (2.1 m)	6 ft (1.8 m)
1-1/2	3/8" (10 mm)	9 ft (2.7 m)	8 ft (2.4 m)
2	3/8" (10 mm)	10 ft (3 m)	9 ft (2.7 m)
2-1/2	½" (12 mm)	12 ft (3.6 m)	10 ft (3 m)
3	½" (12 mm)	12 ft (3.6 m)	10 ft (3 m)
3-1/2	½" (12 mm)	13 ft (3.9 m)	11 ft (3.3 m)
4	5/8" (16 mm)	14 ft (4.2 m)	12 ft (3.6 m)
5	5/8" (16 mm)	16 ft (4.8 m)	
6	7/8" (22 mm)	17 ft (5.1 m)	
8	7/8" (22 mm)	19 ft (5.7 m)	
10	7/8" (22 mm)	22 ft (6.6 m)	

3.3.11 Within 300 mm of each elbow.

3.3.12 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

3.4.1 Install hanger so that rod is vertical under operating conditions.

3.4.2 Adjust hangers to equalize load.

3.4.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members, comprised of angel iron or c-channel.

3.4.4 All hangers shall be directly hung from the structure. No hangers shall be installed or supported off other pipes, ducts, equipment, or steel decks.

3.4.5 Where necessary to support piping from floor, use concrete pier base with cast iron pipe rest with floor flange and pipe roll stands.

3.4.6 Where multiple pipes run parallel at the same elevation trapeze hangers may be utilized. Trapeze hangers shall be spaced according to the smallest pipe size.

3.4.7 All hangers and connections to open web steel joists, must be made at the panel joints. It is not structurally acceptable to impose any loads on either the top or bottom chord of the joist, between panel points. The maximum working load that can be suspended from a joist panel point is not to exceed 1.0 kN. Loads must be applied so that they do not cause twisting of the joists.

3.4.8 All vertical piping shall be supported by the horizontal pipe, or a pedestal support or the foundation at the base of the riser and riser clamps at each floor level for cast iron or PVC pipe and every other floor for steel and copper pipe. For floors greater than 12 feet (3650 mm) provide riser clamps at every floor. Wherever possible locate riser clamps directly below the pipe couplings or shear lugs.

3.4.9 Provide roller hangers for steam and condensate systems as required for expansion and contraction.

3.4.10 All hangers exposed to the Outdoors shall be hot dipped galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor use.

3.4.11 All hangers exposed in Corrosive Areas shall be type 304 stainless steel with stainless steel hardware.

3.4.12

3.5 HORIZONTAL MOVEMENT

3.5.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical. If they do roller hangers shall be utilized.

3.5.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5.3

3.6 FINAL ADJUSTMENT

3.6.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

3.6.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

3.6.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

3.6.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

1 GENERAL

1.1 SUMMARY

1.1.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

.2 Sustainable requirements for construction and verification.

1.2 RELATED SECTIONS

1.2.1 Section 01 33 00 - Submittal Procedures.

1.2.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.2.3

1.3 REFERENCES

1.3.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.

.2 CSAZ7396.1 Medical Gas pipeline Systems – Part 1: Pipelines for medical gases and vacuum.

1.3.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-24.3, Identification of Piping Systems.

1.3.3 National Fire Protection Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14, Standard for the Standpipe and Hose Systems.

1.4 SUBMITTALS

1.4.1 Product Data:

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

.2 Product data to include paint colour chips, other products specified in this section.

.3 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

1.5.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

1.5.2 Health and Safety:

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

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Packing, shipping, handling and unloading:

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

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.6.2 Waste Management and Disposal:

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

.2 Dispose of unused paint coating material at official hazardous material collections site approved by Owner's Representative.

.3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

2.1.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

2.1.2 Lettering and numbers to be raised or recessed.

2.1.3 Information to include, as appropriate:

.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.1.4 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

2.2 SYSTEM NAMEPLATES

2.2.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

2.2.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

2.2.3 Sizes:

.1 Conform to following table:

Size # (mm)	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

2.2.4 Locations:

.1 Terminal cabinets, control panels: Use size # 5.

.2 Equipment in Mechanical Rooms: Use size # 9.

2.2.5 Identify equipment type and number (e.g. Hot Water Pump 1) and service or areas or zone of building served e.g. " Kettle Room 1 AHU-1".

2.2.6 All plates shall be pop riveted in place.

2.2.7 Fasten nameplates securely in conspicuous place.

2.2.8 Submit list of nameplates for review prior to engraving.

2.3 EXISTING IDENTIFICATION SYSTEMS

2.3.1 Apply existing identification system to new work.

2.3.2 Where existing identification system does not cover for new work, use identification system specified this section.

2.3.3 Before starting work, obtain written approval of identification system from Owner's Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

2.4.1 Identification:

.1 Natural gas: to CSA/CGA B149.1, authority having jurisdiction.

.2 Propane gas: to CSA/CGA B149.1 authority having jurisdiction.

.3 Medical Gas: to CAN/CSA Z7396.1.

2.5 IDENTIFICATION OF PIPING SYSTEMS

2.5.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

2.5.2 Pictograms:

.1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

2.5.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

2.5.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

2.5.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

2.5.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.3 For outside diameters up to 6" the markers shall be coiled and wrap completely around the pipe with six rows of wording in alternate directions.

.4 For outside diameters greater than 6" the markers shall be saddle style with two (2) rows of wording and shall be installed utilizing nylon cable ties provided with the marker.

2.5.7 Colours and Legends:

.1 Where not listed, obtain direction from Owner's Representative.

.2 Colours for legends, arrows, to following table:

Background colour	**Legend, arrows**
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	**Background colour marking**	**Legend**
No. 2 fuel oil supply	Yellow	# _2__ FUEL OIL
No. 2 fuel oil return	Yellow	# _2__ FUEL OIL
Engine exhaust	Yellow	ENGINE EXHAUST

2.6 IDENTIFICATION DUCTWORK SYSTEMS

2.6.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

2.6.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.6.3 Identify system: e.g. Supply AHU-1, Exhaust F-7.

2.6.4 Maintain maximum 15m (50 ft) distance between markings.

2.6.5 Identify ducts each side of dividing walls or partitions and beside each access door.

2.6.6 Stencil over final finish only.

2.7 VALVES, CONTROLLERS

2.7.1 Provide two-ply engraved laminated plastic tags.

2.7.2 Provide Consultant with six (6) identification flow diagrams of approved size for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.

2.7.3 Install where directed one (1) copy of flow diagram and valve schedule mounted in glazed frame. Provide one (1) copy in each operating and maintenance instruction manual.

2.7.4 Consecutively number valves in systems.

2.7.5 Mechanical Contractor shall coordinate the valve numbering system utilized for the new building with the Owner's current valve numbering system.

2.8 CONTROLS COMPONENTS IDENTIFICATION

2.8.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in section 25 05 54 – EMCS: Identification. If no EMCS included in project, identification as per this section.

2.8.2 Inscriptions to include function and (where appropriate) fail-safe position, component ID name.

2.9 LANGUAGE

2.9.1 Identification to be in English.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

3.2.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

3.2.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

3.3.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

3.3.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

3.3.3 Protection

.1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

3.4.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

3.4.2 Adjacent to each change in direction.

3.4.3 At least once in each small room through which piping or ductwork passes.

3.4.4 On both sides of visual obstruction or where run is difficult to follow.

3.4.5 On both sides of separations such as walls, floors, partitions.

3.4.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

3.4.7 At beginning and end points of each run and at each piece of equipment in run.

3.4.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

3.4.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

3.5.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

3.5.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Owner's Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

3.5.3 Number valves in each system consecutively.

3.6 CLEANING

3.6.1 Proceed in accordance with Section 01 74 00 – Cleaning.

3.6.2 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

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.

.2 Related Sections:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 45 00 - Quality Control

.3 Section 01 74 19 - Construction/Demolition Waste Management and Disposal

.4 Section 01 78 00 - Closeout Submittals.

1.2 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 International (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 International)

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

.2 CSA-B140.0, Oil Burning Equipment: General Requirements.

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

.1 Material Safety Data Sheets (MSDS).

.5 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)

.1 MSS-SP-80-, Bronze Gate, Globe, Angle and Check Valves.

1.3 SUBMITTALS

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

.2 Co-ordinate submittal requirements and provide submittals required by drawings

.3 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

.4 Submit WHMIS MSDS in accordance with Section . Indicate VOC's for adhesive and solvents during application and curing requirements

.5 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.7 Instructions: submit manufacturer's installation instructions.

.8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with all applicable regulations and Division 1

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

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

.3 Handle and dispose of hazardous materials in accordance provincial regulations.

.4 Unused materials must be disposed of at official hazardous material collections site as approved by provincial standards.

.5 Unused 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 MATERIALS

.1 Materials and resources in accordance with this section

2.2 FILL VENT AND CARRIER PIPE

.1 Steel: to ASTM A53/A53M, Schedule 40, continuous weld or electric resistance welded, screwed.

.2 Copper: type L, soft copper tubing, to ASTM B75M, in lengths.

2.3 STEEL PIPE COATING

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

2.4 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

2.5 FITTINGS

.1 Steel:

.1 Malleable iron: socket welded, 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: compression.

2.6 BALL VALVES

.1 NPS 2 and under:

.1 Bronze body, screwed ends, TFE seal, hard chrome ball, 4 MPa, WOG and ULC certified for use with fuel oil.

2.7 SWING CHECK VALVES

.1 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PIPING

.1 Install oil piping system in accordance with CSA-B139 and CSA-B140.0.

.2 Slope piping down in direction of the storage tank unless otherwise indicated.

.3 Apply two (2) coats of bituminous paint to buried steel outer casing, fill and vent piping.

.4 Fill, vent, suction outside building:

.1 Steel piping welded throughout except at tanks where use electrically isolating fittings.

.2 Grading: slope piping at 2% minimum back to tanks.

.5 Install suction piping in outer casings in accordance with provincial regulations.

.6 Piping at tanks:

.1 Vent: extend into tank and terminate less than 25mm from top. Terminate open end 450 mm above high point of fill piping with ULC certified vent cap.

.2 Fill: terminate as indicated and per all applicable requirements for pressurized fill. Use check valve for means of anti-syphon protection and fill station with locking cap, chain and padlock.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless approved otherwise by Consultant.

.2 Install ball valves at branch take-offs, to isolate pieces of equipment and as indicated.

.3 Install swing check valves and as indicated.

3.4 OVERFILL AND SPILL PROTECTION

.1 Provide ULC certified overfill protection by means of positive pressure displacement overfill protection valve. Include tight fill

3.5 CATHODIC PROTECTION SYSTEM

.1 Install in accordance with CSA-B139-19.

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 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to Engineer.

3.7 CLEANING

.1 In accordance with Division 1, supplemented as specified herein.

.2 Flush after piping pressure test with number 2 fuel oil for a minimum of two (2) hours. Clean strainers and filters.

.3 Dispose of fuel oil used for flushing out in accordance with requirements of authority having jurisdiction.

.4 Check vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.

.5 Check entire installation is approved by authority having jurisdiction.

.6 Perform cleaning operations as specified in Division 1 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.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for aboveground oil storage tanks.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 78 00 - Closeout Submittals

.3 Section 23 11 13- Fuel Oil Piping, Fittings, and Accessories

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 RP 651, Cathodic Protection of Aboveground Petroleum Storage Tanks.

.2 API STD 653, Tank Inspection, Repair, Alteration, and Reconstruction.

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.4 Canadian Council of Ministers of the Environment (CCME).

.1 CCME-PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.

.5 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.6 Canadian Standards Association (CSA)/CSA International.

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

.7 The Master Painters Institute (MPI).

.1 Architectural Painting Specification Manual.

.8 National Research Council/Institute for Research in Construction.

.1 NRCC 38727, National Fire Code of Canada (NFC).

.9 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.10 Underwriters' Laboratories of Canada (ULC).

.1 ULC-S601-2014, Aboveground Horizontal Shop Fabricated Steel Tanks.

1.4 SUBMITTALS

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

.2 Indicate details of construction and leakage detection system.

.3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturers product data to supplement shop drawings.

.1 Size, materials and locations of ladders, ladder cages, catwalks and lifting lugs.

.2 Tanks capacity.

.3 Size and location of fittings.

.4 Environmental compliance package accessories.

.5 Decals, type size and location.

.6 Accessories: provide details and manufacturers product data.

.7 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, values and fittings: type, materials, sizes, piping connection details, valve shut-off type and location, cathodic protection system complete with stamp of corrosion expert indicating that design complies with standards, Federal and Provincial regulations.

.14 Spill containment: provide description of method[s] and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.

.15 Tank heaters: provide details and manufacturers product data.

.16 Thermometers: provide details and manufacturers product data.

.17 Anchors: description, material, size and locations.

.18 Concrete: type, composition and strength.

.19 Size and location of site pads.

.20 Level gauging: type and locations, include:

.1 Reporting systems, types of reports and report frequency.

.2 Maximum number of tanks to be monitored.

.3 Number of probes required and sizes.

.4 Provide details and manufacturer's product data.

.21 Ancillary devices: provide details and manufacturer's product data.

.22 Leak detection system, type and locations, and alarm system.

.23 Grounding and bonding: provide details of design, type, materials and locations.

.24 Corrosion protection: provide details of design, type, materials and locations.

.25 Field-erected AST overfill-protection systems: provide details of design, type, materials and locations.

.26 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations.

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

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

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

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

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

.5 Ensure emptied containers are sealed and stored safely.

.6 Divert unused materials from landfill to metal recycling facility as approved by applicable regulations.

.7 Dispose of unused paint or coating material at an official hazardous material collections site as approved by applicable regulations.

.8 Do not dispose unused material must into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 MAIN TANK

.1 One (1) tank of 6,000 L capacity, double wall.

.2 Horizontal tanks: ULC-S601-14, complete with two (2) external coats of white oxide primer.

.3 Connections: as indicated. Sizes: as indicated.

.4 Railings, stairs, ladders and walkways: as indicated.

.5 Tank to be provided complete with:

.1 Certification for Tank manufactured to Underwriters` Laboratories of Canada Standard CAN/ULC-S601 latest edition.

.2 Tank is to be designed and constructed without bottom openings.

.3 Material – Carbon Steel ASTM A36 or equal.

.4 Primary tank must have a normal and Emergency vent to atmosphere. The ULC listing shall be for a tank containing Diesel fuel. Numbered brass plaque issued by ULC S601 shall be installed on the tank and be clearly visible to inspectors.

.5 Minimum Primary head thickness: 4mm

.6 Secondary head thickness: 4mm

.7 Primary shell thickness: 4mm

.8 Secondary shell thickness: 3mm

.9 The external surface of the tank shall be protected from corrosion. Coated with one coat of Zinc Chromate primer and finish with white polyurethane enamel.

.10 Tank to be provided with:

.1 ULC listed positive pressure overfill prevention valve

.2 2” NPT stainless steel overfill prevention float switch

.3 ULC listed weatherproof overfill alarm panel

.4 ULC listed normal and emergency vent caps

.5 Filling station spill containment box complete with spring loaded check valve with tight fill connection

.11 Acceptable Manufacturers: Waleco, Westeel, Hassco, or equivalent

2.2 ANCHORAGE

.1 Anchor tank to existing concrete pad

2.3 PIPING, VALVES AND FITTINGS

.1 In accordance with Section 23 11 13 - Facility Fuel Oil Piping and CSA-B139-15 complete with TSSA amendments

.2 Piping located below product level equipped with either manual or automatic shut-off at storage tank

.3 Provide means for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.

2.4 LEVEL GAUGING

.1 Tank gauging stick: to manufacturer's standard.

.2 Tank level gauging and indicator.

.1 Magnetic probe, wired to remote reading device (Incon panel in steam plant).

.2 Gauge and gauge openings: protected against liquid overflow and possible liquid and vapour release.

.3 ULC certified inventory level gauge

.3 Electronic solid state combination tank level sensor and leak detector: console containing visual LED display and printer, algorithms to automatically compute required operations. System to be programmable for:

- .1 Inventoring reporting with following features.
  - .1 Litres of fuel remaining.
  - .2 Temperature of fuel.
  - .3 Millimeters of water in bottom of tank.
  - .4 Millimeters of fuel in tank.
- .2 Fuel delivery report.
- .3 Multiple tank installation, interstitial space leak detection.
- .4 Visual and audible alarm for:
  - .1 Overfill.
  - .2 Low product.
  - .3 High water.
  - .4 Theft.
  - .5 Leaks.
- .5 Probe diagnostics.
- .6 Leak tests.
- .7 Probe and sensor: factory calibrated and pre-set, length to suit diameter of tank.
- .8 Ancillary devices:
  - .1 Interface capability with remote facility for monitoring and inventory reconciliation.

2.5 LEAKAGE DETECTION SYSTEM

.1 Provide interstitial leak detection switch wired to leak detection panel.

2.6 GROUNDING AND BONDING

.1 As per electrical specifications

2.7 OVERFILL AND SPILL CONTAINMENT

.1 Shop-fabricated AST overfill protection.

- .1 Automatic valve closure on product supply line to terminate petroleum product flow upon detection of high levels in the storage tank.
- .2 Overfill protection device compatible with intended method of filling designed, built and certified to ULC/ORD-C58.15 with positive shut-off action.
- .3 Audible and visual alarm located where personnel care constantly on duty during transfer operation and can promptly stop or divert flow when detected levels are too high.
- .4 Storage tanks with capacity of 50,000 L or less.
  - .1 Level gauge located on storage tank for frequent monitoring throughout transfer operation permitting personnel to promptly

shut down flow, or communicate immediately with person controlling delivery for shut down.

2.8 PRODUCT TRANSFER

.1 ASTs with normal vent and separate emergency vent.

.1 Liquid- and vapour-tight connection on fill pipes for flammable products.

2.9 LINER PENETRATION

.1 At high point or raised part of dyke floor.

.2 Sealed.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install tank in accordance with CSA-B139 (complete with TSSA amendments) and National Fire Code of Canada and manufacturer's recommendations.

.2 Position tank using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.

.3 Install tanks using licensed installers (OBT-1 or PM-3).

.4 Provide certification of installation to Consultant.

3.2 FIELD QUALITY CONTROL

.1 Test tank for leaks to requirements of CSA-B139 and in presence of authority having jurisdiction (TSSA).

3.3 TOUCH-UP

.1 Where coating is damaged, touch-up with original coating material.

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 polyethylene pipe.

.3 Calibrate system.

3.5 LEAK DETECTION SYSTEM

.1 Install in accordance with manufacturer's recommendations.

END OF SECTION