

**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
  - .2 Indicate on drawings:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .3 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.
  - .4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

**1.2 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for all new equipment for incorporation into manual.
  - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
    - .7 Colour coding chart.

- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 11 23 – Facility Fuel-Oil Piping.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

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

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

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

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

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

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

### **1.4 DELIVERY, STORAGE AND HANDLING**

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect louvres from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.1 Develop Construction Waste Management Plan related to Work of this Section.

.2 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 NOT USED**

.1 Not Used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 PAINTING REPAIRS AND RESTORATION**

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

**3.3 SYSTEM CLEANING**

- .1 Clean interior and exterior of all systems including strainers.

**3.4 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .1 Fuel-oil system test
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

**3.5 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 Fuel-oil system.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting

and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

### **3.6 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.7 PROTECTION**

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

**END OF SECTION**

**Part 1        General**

**1.1        USE OF SYSTEMS**

- .1    Use of existing permanent heating systems for supplying temporary heat is permitted only under following conditions:
  - .1    Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
  - .2    There is no possibility of damage.
  - .3    Systems will be:
    - .1    Operated as per manufacturer's recommendations and instructions.
    - .2    Operated by Contractor.
    - .3    Monitored continuously by Contractor.
  - .4    Warranties and guarantees are not relaxed.
  - .5    Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of Departmental Representative.
  - .6    Refurbish entire system before static completion; clean internally and externally, restore to "as-new" condition.

**Part 2        Products**

**2.1        NOT USED**

- .1    Not Used.

**Part 3        Execution**

**3.1        NOT USED**

- .1    Not Used.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 07 84 00 - Fire Stopping
- .2    Section 23 11 13 – Facility Fuel-Oil Piping

**1.2            REFERENCES**

- .1    Canadian Standards Association (CSA International)
  - .1    CSA B139-09, Installation Code for Oil Burning Equipment.
- .2    National Fire Code of Canada (NFCC 2010)
- .3    Canadian Council of Ministers of the Environment (CCME).
  - .1    CCME-PN1326-2004, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .4    Canadian Environmental Protection Act (CEPA)
  - .1    SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4            DELIVERY, STORAGE AND HANDLING**

- .1    Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2    Delivery and Acceptance Requirements:
  - .1    Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3    Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

---

**Part 2            Products**

**2.1            MATERIAL**

- .1    Paint: zinc-rich.
  - .1       Primers, Paints, Coating: In accordance with manufacturer's recommendations for surface conditions.
- .2    Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

**Part 3            Execution**

**3.1            APPLICATION**

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

**3.2            CONNECTIONS TO EQUIPMENT**

- .1    In accordance with manufacturer's instructions unless otherwise indicated.
- .2    Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3    Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

**3.3            CLEARANCES**

- .1    Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer, National Fire Code of Canada, and CSA B139.
- .2    Provide space for disassembly, removal of equipment and components as recommended by manufacturer, CSA B139, and National Fire Code of Canada without interrupting operation of other system, equipment, components.

**3.4            DIELECTRIC COUPLINGS**

- .1    General: compatible with system, to suit pressure rating of system.
- .2    Locations: where dissimilar metals are joined.
- .3    NPS 2 and under: isolating unions or bronze valves.
- .4    Over NPS 2: isolating flanges.

**3.5            PIPEWORK INSTALLATION**

- .1    Install pipework to CSA B139.
- .2    Screwed fittings jointed with Teflon tape.
- .3    Protect openings against entry of foreign material.



- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
  - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Group piping wherever possible.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Valves:
  - .1 Install in accessible locations.
  - .2 Remove interior parts before soldering.
  - .3 Install with stems above horizontal position unless indicated.
  - .4 Valves accessible for maintenance without removing adjacent piping.
  - .5 Use gate valves at branch take-offs for isolating purposes except where specified.
- .14 Check Valves:
  - .1 Install silent check valves on discharge of pumps and as indicated.

### **3.6 SLEEVES**

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
  - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
  - .2 Other floors: terminate 25 mm above finished floor.

- .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint.
- .6 Sealing:
  - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
  - .2 Elsewhere:
    - .1 Provide space for firestopping.
    - .2 Maintain fire rating integrity.
  - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
  - .4 Ensure no contact between copper pipe or tube and sleeve.

### **3.7 PREPARATION FOR FIRE STOPPING**

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.

### **3.8 FLUSHING OUT OF PIPING SYSTEMS**

- .1 Flush system in accordance with Section 23 11 13 – Facility Fuel-Oil Piping.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 – Cleaning, supplemented as specified in Section 23 11 13 – Facility Fuel-Oil Piping.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

### **3.9 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK**

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

**3.10 EXISTING SYSTEMS**

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

**3.11 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1-2014, Power Piping.
  - .2 ANSI/ASME B31.3-2014, Process Piping.
  - .3 ANSI/ASME Boiler and Pressure Vessel Code :
    - .1 BPVC-I-2013, Section I: Rules for Construction of Power Boilers.
    - .2 BPVC-V-2013, Section V: Non-destructive Examination.
    - .3 BPVC-IX-2013, Section IX: Welding, Brazing and Fusing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C206-11, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
  - .1 AWS C1.1M/C1.1-2000(R2012), Recommended Practices for Resistance Welding.
  - .2 AWS Z49.1-2012, Safety in Welding, Cutting and Allied Process.
  - .3 AWS W1-2000, Welding Inspection Handbook..
- .4 Canadian Standards Association (CSA International)
  - .1 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
  - .2 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
  - .3 CSA B51-14, Boiler, Pressure Vessel and Pressure Piping Code.
  - .4 CSA-W117.2-12, Safety in Welding, Cutting and Allied Processes.
  - .5 CSA W178.1-14, Certification of Welding Inspection Organizations.
  - .6 CSA W178.2-14, Certification of Welding Inspectors.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

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

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 ELECTRODES**

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

### **Part 3 Execution**

#### **3.1 APPLICATION**

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

#### **3.2 QUALITY OF WORK**

- .1 Welding: in accordance with ANSI/ASME B31.1 and B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

#### **3.3 INSTALLATION REQUIREMENTS**

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

#### **3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS**

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.

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

### **3.5 SPECIALIST EXAMINATIONS AND TESTS**

- .1 General:
  - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
  - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
  - .3 Inspect and test 5% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
  - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental.

### **3.6 DEFECTS CAUSING REJECTION**

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

### **3.7 REPAIR OF WELDS WHICH FAILED TESTS**

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

### **3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).
  - .2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
  - .1 ASTM A276-13a, Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B283/B283M-14, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  - .4 ASTM B505/B505M-14, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
  - .1 MSS-SP-25-2013, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS-SP-80-2013, Bronze Gate Globe, Angle and Check Valves.
  - .3 MSS-SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
  - .2 Submit data for valves specified in this Section.

**1.3 CLOSEOUT SUBMITTALS**

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

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
  - .1 Furnish following spare parts:
    - .1 Valve seats: one for each size valve.
    - .2 Discs: one for each size valve.
    - .3 Stem packing: one for each size valve.
    - .4 Valve handles: 2 of each size.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Valves:
  - .1 Except for specialty valves, to be single manufacturer.
  - .2 Products to have CRN registration numbers.
- .2 End Connections:
  - .1 Connection into adjacent piping/tubing:
    - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
    - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
- .3 Gate Valves:
  - .1 Requirements common to gate valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
    - .5 Packing: non-asbestos.
    - .6 Handwheel: non-ferrous.
    - .7 Handwheel Nut: bronze to ASTM B62.



- .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
  - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  - .2 Operator: Handwheel.
- .4 Check Valves:
  - .1 Requirements common to check valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Connections: screwed with hexagonal shoulders.
  - .2 NPS 2 and under, swing type, bronze disc, Class 125:
    - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
    - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
- .5 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: 4140-kPa.
    - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders.
    - .4 Stem: tamperproof ball drive.
    - .5 Stem packing nut: external to body.
    - .6 Ball and seat: replaceable hard chrome solid ball and Teflon seats.
    - .7 Stem seal: TFE with external packing nut.
    - .8 Operator: removable lever handle.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

### **3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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

**END OF SECTION**

**Part 1        General**

**1.1        REFERENCES**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1 ASME B16, Fittings and Valves Package.
  - .2 ASME B16.5-2013, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
  - .3 ANSI/ASME B16.10-2009, Face-to-Face and End-to-End Dimensions Valves.
  - .4 ANSI/ASME B16.25-2012, Buttwelding Ends.
  - .5 ANSI/ASME B16.34-2013, Valves Flanged, Threaded and Welding End. Includes Supplement (2010).
- .2 American Petroleum Institute (API)
  - .1 API STD 598-2009, Valve Inspection and Testing.
- .3 ASTM International
  - .1 ASTM A49-12, Standard Specification for Heat-Treated Carbon Steel Joint Bars, Micro Alloyed Joint Bars, and Forged Carbon Steel Comprise Joint Bars.
  - .2 ASTM A182/A182M-14a, Standard Specification for Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valve Parts for High Temperature Service.
  - .3 ASTM A193/A193M-14, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
  - .4 ASTM A194/A194M-14, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both.
  - .5 ASTM A216/A216M-14, Standard Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
  - .6 ASTM B85/B85M-13, Standard Specification for Aluminum-Alloy Die Castings.
- .4 Efficiency Valuation Organization (EVO)
  - .1 International Performance Measurement and Verification Protocol (IPMVP)
    - .1 IPMVP 2007 Version.
- .5 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
  - .1 MSS SP-25-2013, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS SP-61-2013, Pressure Testing of Valves.

## **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for each valve and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

## **1.3 CLOSEOUT SUBMITTALS**

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

## **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect valves from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Extra Stock Materials:
- .3 Furnish following spare parts:
  - .1 Valve seats: one for each size valve.
  - .2 Discs: one for each size valve.
  - .3 Stem packing: one for each size valve.

- .4 Valve handles: 2 of each size.

## **Part 2 Products**

### **2.1 MATERIAL**

- .1 Valves:
  - .1 To be of single manufacturer.
  - .2 Test valves individually.
- .2 Requirements common to valves, unless specified otherwise:
  - .1 Pressure-temperature ratings: to ANSI B16.34.
  - .2 Inspections and tests: to API 598.
  - .3 Pressure testing: to MSS SP-61.
  - .4 Flanged valves:
    - .1 Face-to-face dimensions: to ANSI B16.10.
    - .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
  - .5 Butt-weld valves:
    - .1 End-to-end dimensions: to ANSI B16.10.
    - .2 End dimensions: to ANSI B16.25 bored for standard pipe schedule.
  - .6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
  - .7 Markings: to MSS SP-25.
  - .8 Identification:
    - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
    - .2 Body markings: manufacturer, size, primary service rating, material symbol.
  - .9 CRN registration number required for all products.

### **2.2 GATE VALVES**

- .1 NPS 2 1/2 - 12, rising stem, OS Y, solid wedge disc, flanged ends, Class 150:
  - .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB, with full length disc guides designed to ensure correct re-assembly.
  - .2 Body/bonnet joint: flat face with corrugated metallic gasket.
  - .3 Bonnet studs: to ASTM A193/A193M Type B7.
  - .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
  - .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
  - .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.

- .7 Yoke sleeve: Ni-Resist, minimum melting point above 954 degrees C.
- .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
- .9 Disc: with disc stem ring to connect to stem, guided throughout its travel.
  - .1 NPS 2 1/2 - 6: solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.
- .10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.
- .11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut, T-head disc-stem connection.
- .12 Operator: see elsewhere in this Section.

## **2.3 VALVE OPERATORS**

- .1 Handwheel: on all valves.
- .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in mechanical equipment rooms.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

### **3.3 COMMISSIONING**

- .1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by cast steel valve installation.

**END OF SECTION**

**Part 1        General**

**1.1        REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1-2014, Power Piping.
- .2 ASTM International
  - .1 ASTM A125-96(2013)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563-07a(2014), Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 MSS SP69-2009, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP89-2009, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 Underwriter's Laboratories of Canada (ULC)

**1.2        ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta Canada.
  - .2 Submit shop drawings for:
    - .1 Bases, hangers and supports.
    - .2 Connections to equipment and structure.
    - .3 Structural assemblies.



- .4 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.

### **1.3 CLOSEOUT SUBMITTALS**

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

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
  - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

### **2.2 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58.

## **2.3 PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized and painted with zinc-rich paint after manufacture.
  - .2 Use hot dipped galvanizing process.
  - .3 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut carbon steel retaining clip.
    - .1 Rod: 9 mm UL listed.
  - .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 and to MSS-SP58 and MSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 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 to MSS SP69.
- .5 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 22 mm or 28 mm rod.
- .6 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel black.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .9 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: black.
  - .2 Finishes for copper, glass, brass or aluminum pipework: black.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

## **2.4 RISER CLAMPS**

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

## **2.5 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

## **2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

# **Part 3 Execution**

## **3.1 MANUFACTURER'S INSTRUCTIONS**

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

## **3.2 INSTALLATION**

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps.
- .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 industry standards.
  - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: install below joint.

- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .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.
- .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**

- .1 Fuel oil piping: every 1.8 m.

### **3.4 HANGER INSTALLATION**

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### **3.5 HORIZONTAL MOVEMENT**

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

### **3.6 FINAL ADJUSTMENT**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

### **3.7 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### **3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1        General**

**1.1        REFERENCES**

- .1 Canadian Gas Association (CGA)
  - .1 CSA/CGA B149.1-10, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 14-2013, Standard for the Installation of Standpipe and Hose Systems.

**1.2        ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

**1.3        QUALITY ASSURANCE**

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

**1.4        DELIVERY, STORAGE, AND HANDLING**

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

- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Dispose of unused paint and coating material at official hazardous material collections site approved by Departmental Representative.
  - .3 Do not dispose of unused paint and coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

## **Part 2 Products**

### **2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .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.

### **2.2 SYSTEM NAMEPLATES**

- .1 Colours:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
  - .1 3 mm thick white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .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.
- .4 Locations:
  - .1 Terminal cabinets, control panels: use size # 5.
  - .2 Equipment in Mechanical Rooms: use size # 9.
- .5 Identification for PWGSC Preventive Maintenance Support System (PMSS):
  - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
  - .2 Equipment in Mechanical Room:
    - .1 Main identifier: size #9.
    - .2 Source and Destination identifiers: size #6.
    - .3 Terminal cabinets, control panels: size #5.
  - .3 Equipment elsewhere: sizes as appropriate.

## **2.3 EXISTING IDENTIFICATION SYSTEMS**

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

## **2.4 PIPING SYSTEMS GOVERNED BY CODES**

- .1 Identification:
  - .1 Fuel oil: to authority having jurisdiction.

## **2.5 IDENTIFICATION OF PIPING SYSTEMS**

- .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 Pictograms:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .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.



- .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.
- .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 Other pipes: pressure sensitive plastic-coated cloth with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Departmental Representative.
  - .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
No. 2 fuel oil suction	Yellow	# 2 FUEL OIL
No. 2 fuel oil return	Yellow	# 2 FUEL OIL

## **2.6 VALVES, CONTROLLERS**

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

## **2.7 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

## **2.8 LANGUAGE**

- .1 Identification in English.

## **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 TIMING**

- .1 Provide identification only after painting has been completed.

### **3.3 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

### **3.4 NAMEPLATES**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
  - .1 Do not paint, insulate or cover.

### **3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .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.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification 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.

**3.6 VALVES, CONTROLLERS**

- .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.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

**3.7 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 23 11 13 – Facility Fuel-Oil Systems.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

**1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS**

- .1 In accordance with Section 23 11 13 – Facility Fuel-Oil Systems.

**1.4 FUEL OIL SYSTEMS**

- .1 Environmental protection systems:
  - .1 Test oil storage tank leakage detection system using manufacturer's recommended procedures.
  - .2 Test spill protection and over-fill protection systems using manufacturer's recommended procedures.
- .2 Fuel oil pumps:
  - .1 Check strainers on pump inlet, relief valve on pump outlet with discharge to oil return piping, pressure gauge on strainer inlet, pump inlet and pump discharge.
  - .2 Verify pump performance.
  - .3 Pump performance within plus 20% and minus 0% of design.
- .3 Operational Tests:
  - .1 Charge system and verify operation.
  - .2 Verify adequacy of flow rates and pressure from storage facilities to burners.
  - .3 Verify accurate metering of fuel to burners.
- .4 Notify authorities having jurisdiction to enable witnessing of tests as required.

**1.5 REPORTS**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx)  
Requirements: Reports.

**1.6 TRAINING**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx)  
Requirements: Training of O M Personnel.

**Part 2            Products**

**2.1            NOT USED**

          .1        Not Used.

**Part 3            Execution**

**3.1            NOT USED**

          .1        Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 23.01 - Valves - Bronze.
- .2 Section 23 05 05 - Installation of Pipework.

**1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME-B16.3-2011, Malleable-Iron Threaded Fittings: Classes 150 and 300.
  - .2 ASME-B16.9-2012, Factory-Made Wrought Steel Buttwelding Fittings.
- .2 ASTM International
  - .1 ASTM A47/A47M-99(2014), Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  - .3 ASTM B61-08(2013), Standard Specification for Steam or Valve Bronze Castings.
  - .4 ASTM B75M-11, Standard Specification for Seamless Copper Tube (Metric).
- .3 Canadian Environmental Protection Act (CEPA)
  - .1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .4 CSA International
  - .1 CSA-B139-09, Installation Code for Oil Burning Equipment.
  - .2 CSA-B140.0-03(R2013), Oil Burning Equipment: General Requirements.
  - .3 CSA-C282-09, Emergency Electrical Power Supply for Buildings.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
  - .1 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.
- .7 National Association of Corrosion Engineers (NACE)
  - .1 NACE SP0169-2007, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
- .8 National Fire Code of Canada (NFCC 2010)
- .9 Underwriter's Laboratories of Canada (ULC)

- .1 CAN/ULC S603.1-11, External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.
- .2 ULC ORD-C107.12-1992, Line Leak Detection Devices for Flammable Liquid Piping.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meeting:
  - .1 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Charts.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building subtrades.
    - .4 Review manufacturer's installation instructions and warranty requirements.

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.
- .3 Test Reports:
  - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions: provide manufacturer's installation instructions.

### **1.5 CLOSEOUT SUBMITTALS**

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

### **1.6 QUALITY ASSURANCE**

- .1 Ensure piping is installed by company authorized by authority having jurisdiction.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 DIESEL SUPPLY TANK ST-1**

- .1 Volume: 17,700 L
- .2 Dimensions: maximum internal diameter of 2082 mm. Maximum assembly height of 2768 mm. Maximum assembly length of 6400 mm.
- .3 ULC Labelled.
- .4 Material: Steel
- .5 Type: Double wall, with 100% secondary containment
- .6 Max Operating pressure: 7 kPa
- .7 Internal finish: As welded
- .8 External finish: Blast cleaned to SSPC-SP6, finished with white polyurethane.
- .9 Supports: Saddle base supports welded to tank. Tank assembly mounted on 200mm high skid.
- .10 Connections:
  - .1 100ø mm NPT connection for fill line, complete with overfill protection valve installed in tank
  - .2 75ø mm NPT connection for vent line
  - .3 150ø mm NPT emergency vent on tank, with provisions for connection to vent piping.
  - .4 50ø mm NPT connection complete with lockable gauge hatch – primary tank dip port, complete with dip stick and dip chart.
  - .5 50ø mm NPT connection complete with 50ø mm x 25ø mm reducer bushing with 25ø mm drop tube – water draw connection
  - .6 50ø mm NPT connection complete with 50ø mm x 25ø mm reducer bushing with 25ø mm drop tube & 25ø foot valve – supply line
  - .7 50ø mm NPT connection complete with 50ø mm x 25ø mm reducer bushing with 25ø mm drop tube & 25ø foot valve – return line



- .8 100ø mm NPT connection complete with 100ø mm x 50ø mm reducer bushing with drop tube – draw/discharge line
- .9 Two 100ø mm NPT connection with MI plug – spare
- .10 One 50ø mm NPT connection with MI plug – spare
- .11 All connections are to be liquid- and vapour-tight.
- .11 Accessories:
  - .1 Side-mounted ladder complete with access platform to all connections.
  - .2 Annular space leak detector
- .12 Level controls
  - .1 The supply tank shall be equipped with a fuel level sensor as per the specifications provided in this section. The fuel level sensor shall provide continuous tank level readings to the fuel management system.
  - .2 The supply tank shall be equipped with a fuel level switch as per the specifications provided in this section. The fuel level switch shall have 2 independent liquid level switches that activate at the following fuel levels in ST-1:
    - .1 93%: ST-1 high level
    - .2 50%: ST-1 low level

## **2.2 TEMPORARY DIESEL SUPPLY TANK ST-T**

- .1 Volume: 17,700 L
- .2 Dimensions: maximum internal diameter of 2082 mm. Maximum assembly height of 2768 mm. Maximum assembly length of 6400 mm.
- .3 Material: Steel
- .4 ULC Labelled.
- .5 Type: Double wall, with 100% secondary containment
- .6 Max Operating pressure: 7 kPa
- .7 Internal finish: As welded
- .8 External finish: Blast cleaned to SSPC-SP6, finished with white polyurethane.
- .9 Supports: Saddle base supports welded to tank. Tank assembly mounted on 200mm high skid.
- .10 Connections:
  - .1 100ø mm NPT connection for fill line, complete with overfill protection valve installed in tank
  - .2 75ø mm NPT connection for vent line
  - .3 150ø mm NPT emergency vent on tank, with provisions for connection to vent piping.
  - .4 50ø mm NPT connection complete with lockable gauge hatch – primary tank dip port, complete with dip stick and dip chart.

- .5 50ø mm NPT connection complete with 50ø mm x 25ø mm reducer bushing with 25ø mm drop tube – water draw connection
- .6 50ø mm NPT connection complete with 50ø mm x 25ø mm reducer bushing with 25ø mm drop tube & 25ø foot valve – supply line
- .7 50ø mm NPT connection complete with 50ø mm x 25ø mm reducer bushing with 25ø mm drop tube & 25ø foot valve – return line
- .8 100ø mm NPT connection complete with 100ø mm x 50ø mm reducer bushing with drop tube – draw/discharge line
- .9 Two 100ø mm NPT connection with MI plug – spare
- .10 One 50ø mm NPT connection with MI plug – spare
- .11 All connections are to be liquid- and vapour-tight.
- .11 Accessories:
  - .1 Side-mounted ladder complete with access platform to all connections.
  - .2 Annular space leak detector

## **2.3 FUEL MANAGEMENT SYSTEM FMS-1**

- .1 Operator Interface
  - .1 The fuel management system shall consist of a Microprocessor-based Programmable Logic Control Strategy, Nema 1 Enclosure, UL/CSA Listed. Components include:
    - .1 Main disconnect
    - .2 Magnetic motor starters for duplex pump set P-1 and P-2
    - .3 Hand-off-Auto selector switches for pumps P-1 and P-2
    - .4 Pilot lights for 'Power on', Motor 'Run', Motor 'Trip'
    - .5 Terminal strip
    - .6 Pump failure pilot light and manual reset
    - .7 High and low pressure cut outs with red pilot light and manual reset
    - .8 Status lights for ST-1: high level, low level, and leak detection
    - .9 Status lights for DT-1: very high level, critical high level, very low level, and leak detection
    - .10 Status light for general alarm.
    - .11 Dry alarm contacts for each status light.
      - .1 Dry alarm contact for general alarm to be rated for 120V/240V.
    - .12 Digital display oil level indicator for each of ST-1 and DT-1
    - .13 Emergency stop mushroom head style pushbutton with red pilot light.
    - .14 Push-to-test pushbutton for alarm beacon with lamacoid label indicating purpose.
    - .15 Provision for all alarms to signal at BAS.

- .16 Lamacoid labels for each pilot light indicating purpose of light
- .2 Refer to drawing E1 for controller design requirements.
- .3 Pressure sensor, supplied with pumpset, shall be wired to the fuel management system to signal a pressure variation from the normal system pressure causing a system fault which will shut down the pumps and alert the operator. Control system must override low pressure sensor during pump starting (time delay).
- .4 Fuel management system to adhere to the requirements of CSA B139-09.
- .2 Sequence of Operations
  - .1 As the fuel in DT-1 is consumed by the generators and the fuel level drops, the lead pump shall engage when the 'DT-1 low level' float makes on drop. The lead pump shall remain engaged until the 'DT-1 high level' float makes on rise. The system will automatically alternate the Lead Pumps upon each successive demand call of DT-1.
  - .2 Low Level alarm: If the fuel level continues to drop in DT-1 while the lead supply pump is engaged and the 'DT-1 very low level' float makes on drop, the system will engage the lag supply pump. The alarm will sound and the system will display a low level alarm condition.
  - .3 High Level alarm: If the fuel level continues to rise in DT-1 after the 'DT-1 high level' float makes on rise, the 'DT-1 very high level' float will make on rise. The system will sound the alarm and display a high level alarm condition. The supply pumps will be locked out until the alarm condition is cleared and the system is reset.
  - .4 Critical High Level alarm: If the fuel level continues to rise in DT-1, the 'DT-1 critical high level' float will make on rise. The system will sound the alarm and display a critical high level condition.
  - .5 Leak detection: If a leak detector detects a leak in the annular space of ST-1 or the rupture basin of DT-1, the system will sound the alarm and display the appropriate leak detected condition.
  - .6 Pump Pressure: If the pressure sensor detects a variation in the normal operating pressure at the pumpset, the system will sound the alarm and display the appropriate pressure anomaly condition. The supply pumps will be locked out until the alarm condition is cleared and the system is reset.
  - .7 Pump Overload: If the system detects a pump overload in the pumpset, the system will sound the alarm and display the appropriate pump overload condition. The supply pumps will be locked out until the alarm condition is cleared and the system is reset.
- .3 Connections
  - .1 The fuel management system is to allow provisions for connections for various alarms and readouts to the following equipment.
    - .1 Fire Alarm Panel: DT-1 very low level alarm
    - .2 Exterior alarm light: DT-1 very low level alarm, DT-1 very high level alarm, DT-1 critical high level alarm, DT-1 leak detected, ST-

- 1 leak detected, pumpset high pressure alarm, pumpset low pressure alarm, pumpset overload
- .3 Fill Box: ST-1 high level alarm
- .4 BAS: all alarms and readouts are to be provided to the BAS panel. The contractor is to connect these alarms and readouts, and produce a graphic at the operator workstation that displays a facsimile of the fuel management system control panel, complete with all alarm statuses, and the fuel level readouts for ST-1 and DT-1.

## **2.4 TEMPORARY FUEL MANAGEMENT SYSTEM FMS-T**

- .1 Operator Interface
  - .1 The fuel management system shall consist of a Microprocessor-based Programmable Logic Control Strategy, Nema 1 Enclosure, UL/CSA Listed. Components include:
    - .1 Main disconnect
    - .2 Magnetic motor starters for temporary pump P-T
    - .3 Hand-off-Auto selector switch for pump P-T
    - .4 Pilot lights for 'Power on', Motor 'Run', Motor 'Trip'
    - .5 Terminal strip
    - .6 Pump failure pilot light and manual reset
    - .7 High and low pressure cut outs with red pilot light and manual reset
    - .8 Status lights for ST-T: leak detection
    - .9 Status lights for DT-1: very high level, very low level, and leak detection
    - .10 Emergency stop mushroom head style pushbutton with red pilot light.
    - .11 Dry alarm contacts for each status light for ST-1 and DT-1
    - .12 Lamacoid labels for each pilot light indicating purpose of light
  - .2 Refer to drawing E1 for controller design requirements.
  - .3 Pressure sensor, supplied with pumpset, shall be wired to the fuel management system to signal a pressure variation from the normal system pressure causing a system fault which will shut down the pumps and alert the operator. Control system must override low pressure sensor during pump starting (time delay).
  - .4 Fuel management system to adhere to the requirements of CSA B139-09.
- .2 Sequence of Operations
  - .1 As the fuel in DT-1 is consumed by the generators and the fuel level drops, the pump shall engage when the 'DT-1 low level' float makes on drop. The pump shall remain engaged until the 'DT-1 high level' float makes on rise.

- .2 Low Level alarm: If the fuel level continues to drop in DT-1 while the lead supply pump is engaged and the 'DT-1 very low level' float makes on drop, the system will engage the lag supply pump. The alarm will sound and the system will display a low level alarm condition.
- .3 High Level alarm: If the fuel level continues to rise in DT-1 after the 'DT-1 high level' float makes on rise, the 'DT-1 very high level' float will make on rise. The system will sound the alarm and display a high level alarm condition. The supply pump will be locked out until the alarm condition is cleared and the system is reset.
- .4 Leak detection: If a leak detector detects a leak in the annular space of ST-T or the rupture basin of DT-1, the system will sound the alarm and display the appropriate leak detected condition.
- .5 Pump Pressure: If the pressure sensor detects a variation in the normal operating pressure at the pumpset, the system will sound the alarm and display the pressure anomaly condition. The supply pump will be locked out until the alarm condition is cleared and the system is reset.
- .6 Pump Overload: If the system detects a pump overload in the pump, the system will sound the alarm and display the pump overload condition. The supply pump will be locked out until the alarm condition is cleared and the system is reset.
- .3 Connections
  - .1 The fuel management system is to allow provisions for connections for various alarms and readouts to the following equipment.
    - .1 Fire Alarm Panel: DT-1 very low level alarm

## **2.5 DAY TANK DT-1**

- .1 Provide and install one (1) 225 litre, ULC labelled Day Tank constructed of reinforced 10 gauge steel with channel side supports, NPS 1 drain, removable gasketed 150mm square inspection plate, fuel level gauge, and level control probe. Exterior shall be finished in an oil resistant, textured grey enamel.
- .2 Tank Connections
  - .1 Tank connections shall include fuel inlet, required vent openings, and fuel outlet. All connections shall be piped with reinforced, welded pipe adapters. Fuel inlet and outlet must be supplied with factory installed drop tubes to prevent surging and foaming in the day tank.
- .3 Rupture Basin
  - .1 The rupture basin shall consist of an open-top, welded heavy gauge steel structure sized to a minimum 160% capacity of the tank capacity. Exterior shall be finished in an oil resistant, textured grey enamel. Provide and factory install a rupture basin leak detector to the specifications of this section for alarming and fuel supply pump shutdown.
- .4 Level controls

- .1 The day tank shall be equipped with a fuel level sensor as per the specifications provided in this section. The fuel level sensor shall provide continuous tank level readings to the fuel management system.
- .2 The day tank shall be equipped with a fuel level switch as per the specifications provided in this section. The fuel level switch shall have 5 independent liquid level switches that activate at the following fuel levels in DT-1
  - .1 98%: DT-1 critical high level
  - .2 95%: DT-1 very high level
  - .3 90%: DT-1 high level
  - .4 50%: DT-1 low level
  - .5 30%: DT-1 very low level

## **2.6 FUEL PUMPS P-1, P-2**

- .1 Type
  - .1 Provide and mount two (2) positive displacement rotary type pumps, with cast iron housing and self-adjusting mechanical, Carbon ring seals. Pumps that have aluminum, brass, or bronze housings or rotors are not acceptable. Packing gland equipped pumps, close-coupled pumps, Carbonator shaft mounted pumps, or centrifugal pumps are not acceptable.
- .2 Motors
  - .1 Provide and mount two (2) TEFC, rigid base, standard NEMA frame motors. Pump and motor assemblies shall be factory assembled on a structural steel channel. Rotating parts shall have a steel OSHA guard.
- .3 Pump Isolation and Check Valves
  - .1 Provide and mount four (4) pump isolation valves. Locate one (1) valve on the suction and discharge side of each pump. Isolation valves will allow off-line pump maintenance without system loss of availability. Isolation valves shall be ball type valves to provide full flow while open and positive shutoff when closed. Additionally, two (2) check valves shall be provided and mounted, one (1) located on the discharge of each pump.
- .4 Controls
  - .1 The pumps shall be controlled through the fuel management system. If either pumps fails, a signal shall be sent to the fuel management system indicating failure.
- .5 Fuel Oil Strainer
  - .1 Provide and mount one (1) duplex fuel oil strainer with 40 mesh basket on the suction side of the pump set.
- .6 Relief Valves

- .1 Provide and mount two (2) relief valves sized to relieve the full outlet flow of the pump without causing the pump motor to overload or any component's pressure rating to be exceeded if the discharge is inadvertently valved off. Relief valves must be externally mounted from the pumps and piped to the return line in the field according to NFPA 30. Pump internal relief valves shall not be accepted.
- .7 Compound and Pressure Gauges
  - .1 Provide and mount a compound gauge on the suction side of the strainer. The gauge shall read 7.5 kPa vacuum to 105 kPa. Provide and mount a pressure gauge on the discharge side of the pump set. Each gauge shall be equipped with an isolation ball valve.
- .8 Capacity:
  - .1 Pumped fluid: number 2 fuel oil.
  - .2 Flow rate: 350 L/h; 30 kPa discharge pressure.
  - .3 Motor: 1/2 hp, 120 V, 1 ph., 60 Hz, 1800 r/min.

## **2.7 TEMPORARY FUEL PUMP P-T**

- .1 Type
  - .1 Provide and mount one (1) positive displacement rotary type pumps, with cast iron housing and self-adjusting mechanical, Carbon ring seals. Pumps that have aluminum, brass, or bronze housings or rotors are not acceptable. Packing gland equipped pumps, close-coupled pumps, Carbonator shaft mounted pumps, or centrifugal pumps are not acceptable.
- .2 Motors
  - .1 Provide and mount one (1) TEFC, rigid base, standard NEMA frame motors. Pump and motor assemblies shall be factory assembled on a structural steel channel. Rotating parts shall have a steel OSHA guard.
- .3 Pump Isolation and Check Valves
  - .1 Provide and mount two (2) pump isolation valves. Locate one (1) valve each on suction and discharge side of the pump. Isolation valves will allow off-line pump maintenance without system loss of availability. Isolation valves shall be ball type valves to provide full flow while open and positive shutoff when closed. Additionally, one (1) check valve shall be provided and mounted, located on the discharge of each pump.
- .4 Controls
  - .1 The pumps shall be controlled through the temporary fuel management system. If the pump fails, a signal shall be sent to the fuel management system indicating failure.
- .5 Fuel Oil Strainer

- .1 Provide and mount one (1) duplex fuel oil strainer with 40 mesh basket on the suction side of the pump.
- .6 Relief Valves
  - .1 Provide and mount one (1) relief valves sized to relieve the full outlet flow of the pump without causing the pump motor to overload or any component's pressure rating to be exceeded if the discharge is inadvertently valved off. Relief valves must be externally mounted from the pumps and piped to the return line in the field according to NFPA 30. Pump internal relief valves shall not be accepted.
- .7 Compound and Pressure Gauges
  - .1 Provide and mount a compound gauge on the suction side of the strainer. The gauge shall read 7.5 kPa vacuum to 105 kPa. Provide and mount a pressure gauge on the discharge side of the pump. Each gauge shall be equipped with an isolation ball valve.
- .8 Capacity:
  - .1 Pumped fluid: number 2 fuel oil.
  - .2 Flow rate: 350 L/h; 30 kPa discharge pressure.
  - .3 Motor: 1/2 hp, 120 V, 1 ph., 60 Hz, 1800 r/min.

## **2.8 LEAK DETECTOR**

- .1 Provide and install three (3) leak detectors, one each for ST-T, ST-1, and DT-1. The leak detector shall be solid state and discriminate between oil and water, display the leak with two (2) LEDs on its indicating transmitter, and send an appropriate alarm signal to the fuel management system. All leak detectors shall be intrinsically safe, have continuous electronic checking, fail safe to an alarm condition, and have indicating transmitters with a magnetic test mechanism to exercise the sensors and check the fuel management system response. Test systems that bypass the sensors or rely only on electronic simulation are unacceptable.

## **2.9 FUEL LEVEL SENSOR**

- .1 Type: Wire float level sensor
- .2 Provide a float type level sensor to provide accurate level monitoring that is unaffected by changes in the specific gravity of the tank liquid, and is suitable for use with non-corrosive fluids and fuels up to and including No. 6 fuel oil. The level sensor shall consist of a NEMA 6P rated, 6mm cast aluminum head, connected to a float assembly by a flexible stainless steel cable. The sensor head assembly shall mount to the tank through a standard NPS 4 125/150 lb flat face flange opening, with standard bolt pattern. The sensor shall provide fuel level information to the fuel management system. The sensor shall include an external test mechanism to allow overfill alarm and full tank calibration checks without removal of the sensor from the tank. Tests that electronically simulate a high tank level, instead of physically moving the float, are not acceptable.
- .3 Enclosure: NEMA 7 for ST-1, NEMA 2 for DT-1



**2.10 LIQUID LEVEL SWITCH**

- .1 Provide and install two (2) liquid level switches, one each for ST-1, ST-T, and DT-1. The liquid level switches shall have up to five independent float switches on one sealed probe. Magnetic reed switches are encapsulated in the sealed brass probe where they are protected from liquid and vapours. Buna-N floats, containing magnets, slide on the outside of the brass probe. A rising liquid level causes each float to rise to its upper travel stop position where it actuates a switch. Any switch may be specified "open" or "closed" with the float at its lower stop position.

**2.11 OVERFILL PREVENTION VALVE**

- .1 Provide and install an overfill prevention valve for aboveground pumped-in storage tanks. The unit shall have a float-operated, two stage valve system. The main valve shall shut-off at approximately 95% of the tank capacity as required by NFPA 30, leaving a small bypass valve to open to permit hose drain down. At maximum tank fill as permitted by NFPA 30, the bypass valve will close completely to shut off all flow. The valve shall be the same size as the fill piping.
- .2 Flow rate: 2080 L/min at 70 kPa pressure drop

**2.12 DOUBLE POPPET FOOT VALVE**

- .1 Provide and install at the bottom of the tank suction a double poppet foot valve of bronze construction, with lapped-in seats, flat poppets, and 20 mesh monel screen. The valve shall be the same size as the suction piping.

**2.13 FOOT VALVE EXTRACTOR FITTING**

- .1 Furnish and install at the tank suction stub exit a foot valve extractor fitting. The fitting shall be of sufficient size to allow for the easy removal and reinstallation of the tank double poppet foot valve. The removable access cap shall be gasket sealed to prevent loss of prime due to air leakage.

**2.14 ANTI-SIPHON VALVE**

- .1 Furnish and install at the high point of the oil suction line, a ULC listed and labelled anti-siphon valve per NFPA 30. The installing contractor shall assume all liability for the installation of this valve and shall certify to the Departmental Representative that a ULC tested and labelled anti-siphon valve has been supplied and installed as per manufacturer's instructions. The valve shall be sized to meet the flow requirements of the system and piping and shall be equipped with a spring to match the vertical distance between the highest oil storage level of the main tank and the inlet to the fuel oil pumps.

**2.15 FILL BOX**

- .1 Storage tank fill lines shall terminate at the building wall in a fill box per NFPA 31. The fill box shall have a total of 20 litres holding capacity, NEMA 4 rated construction with a neoprene gasket door seal, three point latch locking handle, oil fill connection dry disconnect and dust cover. The cabinet shall be 304 stainless steel, 12 gauge construction, and be equipped with a NPS ½ drain

connection. The enclosure shall be equipped with "stitch" weld 50 x 50 x 6 mm angle steel flanges for flush mounting, with 2 pre-drilled holes per side. The entire interior shall be prime coated and painted with white enamel. Cap shall provide a liquid- and vapour-tight connection to fill pipe when filling is not occurring.

- .2 Provide an overfill alarm station integral to the fill box. The station shall consist of an explosion proof "Overfill Alarm" light, alarm horn, and "Alarm Silence" pushbutton. Provide a separate explosion proof digital tank content display. The light and bell shall be automatically silenced in 90 seconds or instantly silenced when the operator selects the "Alarm Silence" button. Explosion proof components are required to prevent the ignition of the fuel oil vapors generated from the sun heating the fill box.

## **2.16 FUSOMATIC GATE VALVE**

- .1 Provide and install, where shown on plans, a quick-closing, spring-loaded and thermally-actuated fusible element that melts at 165 °F causing the valve to close tightly.

## **2.17 FILL VENT AND CARRIER PIPE**

- .1 Materials as per NFCC.
- .2 Steel: to ASTM A53/A53M, Schedule 40, continuous weld or electric resistance welded, screwed.

## **2.18 STEEL PIPE COATING**

- .1 Bituminous paint: in accordance with manufacturer's recommendations.
- .2 Primers, paints, and coating: in accordance with manufacturer's recommendations for surface conditions.

## **2.19 JOINTING MATERIAL**

- .1 Screwed fittings: Teflon tape.
- .2 Brazed fittings: 85/15.

## **2.20 FITTINGS**

- .1 Steel:
  - .1 Malleable iron: screwed, banded, Class 150 to ASME-B16.3.
  - .2 Welding: butt-welding to ASME-B16.9.
  - .3 Unions: malleable iron, brass to iron, ground seat, screwed, to ASTM A47/A47M.
  - .4 Nipples: Schedule 40, to ASTM A53/A53M.

**2.21 GATE VALVES**

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

**2.22 BALL VALVES**

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

**2.23 SWING CHECK VALVES**

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

**2.24 PRESSURE GAUGES**

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.
- .2 Provide:
  - .1 Diaphragm assembly for corrosive service.
  - .2 Gasketed pressure relief back with solid front.
  - .3 Bronze stop cock.

**2.25 STRAINER**

- .1 Type: Duplex
- .2 Size: as required.
- .3 Internal channels to have 100% cross-sectional area of equivalent pipe size.
- .4 Strainer to be equipped with built-in, tapered plug valve that directs flow through either side without shutting off the flow.
- .5 Basket type: 40 mesh

**2.26 RELIEF VALVE**

- .1 Body material: Bronze
- .2 Seat material: Bronze
- .3 Valve material: Stainless steel
- .4 Size: to suit application
- .5 Application: on discharge of pumps. Pipe back to return line to ST-1.

## **Part 3          Execution**

### **3.1          APPLICATION**

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

### **3.2          PIPING**

- .1      Install piping in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified.
- .2      Install oil piping system in accordance with NFCC and CSA-B139.
- .3      Slope piping down in direction of storage tank unless otherwise indicated.
- .4      Above ground piping to be protected from physical impact due to impact.
- .5      Piping inside building:
  - .1          Use approved fitting to CSA-B139 for steel, copper, and brass piping.
- .6      Fill, vent, suction and return piping outside building:
  - .1          Steel piping welded throughout except at tanks where electrically isolating fittings are used.
  - .2          Grading: slope piping at 1% minimum back to tanks.
- .7      Piping at tanks:
  - .1          Suction: terminate 150 mm from bottom of tank with foot valve and strainer.
  - .2          Return: terminate 150 mm from bottom of tank with return bend.
  - .3          Comply with CSA-B139 and authority having jurisdiction for piping for venting at tanks.
  - .4          Fill pipes: install to comply with CSA-B139.
    - .1              Include vapour and liquid tight tamperproof cover.
    - .2              Equip fill pipes on tanks with capacity greater than 5000 L with liquid and vapour tight connections.
  - .5          Dipstick: extend tube to within 150 mm from bottom of tank. Terminate at grade with lockable cap and chain, and watertight cover.
- .8      Clearly label piping runs in legible form indicating;
  - .1          Piping product content.
  - .2          Direction of flow.
  - .3          Identify transfer points in piping systems to CPPI Colour-Symbol System to Mark Equipment and Vehicles for Product Identification

### **3.3          VALVES**

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

- .2 Install gate valves at branch take-offs, to isolate pieces of equipment and as indicated.
- .3 Install swing check valves on discharge of pumps and as indicated.

### **3.4 OIL TRANSFER PUMPS**

- .1 Equip pumps with check valve installed below suction pump to permit contents of pipe to drain back to storage tank if suction is broken.
- .2 Install as indicated.
- .3 Install ball valves on inlet and discharge connections.
- .4 Install pressure gauge at pump discharge and on pump inlet connection.
- .5 Install relief valve in pump discharge piping with relief valve discharge pipe to return line to tank.

### **3.5 OVERFILL AND SPILL PROTECTION**

- .1 To CSA-B139.

### **3.6 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Test system to CSA-B139 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, supplying materials for Work of this Section, review Work involved in handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, at stages listed:
    - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
    - .2 Twice during progress of Work at 25% and 60% complete.
    - .3 Upon completion of the Work, after cleaning is carried out.
  - .4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.
- .3 Performance Verification:
  - .1 Refer to Section 23 08 01 - Performance Verification Mechanical Piping System.

### **3.7 CLEANING**

- .1 Clean in accordance with Section manufacturer's written recommendations, supplemented as follows:
  - .1 Flush after pressure test with number 2 fuel oil for a minimum of two hours. Clean strainers and filters.
  - .2 Dispose of fuel oil used for flushing out in accordance with requirements of authority having jurisdiction.
  - .3 Ensure vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.
  - .4 Ensure entire installation is approved by authority having jurisdiction.
  - .5 Clean in accordance with Section 01 74 11 - Cleaning.
    - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**Part 1        General**

**1.1        REFERENCES**

- .1    ASTM2042ernational
  - .1    ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2    Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .3    Society of Automotive Engineers (SAE)

**1.2        ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for louvres and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2    Indicate following:
    - .1    Pressure drop.
    - .2    Face area.
    - .3    Free area.
- .3    Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4    Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

**1.3        DELIVERY, STORAGE AND HANDLING**

- .1    Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2    Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3    Storage and Handling Requirements:
  - .1    Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2    Store and protect louvres from nicks, scratches, and blemishes.
  - .3    Replace defective or damaged materials with new.
- .4    Develop Construction Waste Management Plan related to Work of this Section.
- .5    Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

### **2.2 FIXED LOUVRES - ALUMINUM**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, and reinforcing bosses.
- .4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .6 Screen: 12 mm mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .7 Finish: factory applied enamel. Colour: to Departmental Representative's approval.
- .8 Minimum free area: 50%

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION**

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



**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**