

PART 1. GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete
- .2 Section 31 14 11 - Earthwork and Related Work
- .3 Section 33 40 00 - Storm Sewers and Culverts
- .4 Section 01 33 00 - Submittal procedures

1.2 STANDARDS

- .1 ASTM A48/A48M-03(R2008), Gray Iron Castings.
- .2 ASTM C478M-08, Precast Reinforced Concrete Manhole Sections (Metric)
- .3 CAN/CSA A257 Series-03, Standards for Concrete Pipe and Manhole Sections.
- .4 CAN/ULC S701-05, Thermal Insulation, Polystyrene Boards and Pipe Covering

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings to the Departmental Representative for review prior to construction as per Section 01 33 00.

1.4 HANDLING AND STORAGE

- .1 Prevent damage to materials during storage and handling.
- .2 Store gaskets in cool location out of direct sunlight, and away from petroleum products.

PART 2. PRODUCTS

2.1 MATERIALS

- .1 Precast Bases and Sections:
 - .1 Precast Concrete Bases and Sections: to ASTM and Sections C478M or CSA A257.

- .2 Gaskets:
 - .1 O-Rings: to manufacturer's standard.
 - .2 Bituminous Compound: precast manufacturer's recommended compound.
- .3 Frames, covers and gratings:
 - .1 to ASTM A48, gray cast iron, factory coated.

PART 3. EXECUTION

3.1 PREPARATION

- .1 Carefully inspect products for defects and remove defective products from site.

3.2 EXCAVATION AND BACKFILLING

- .1 Do excavating and backfilling to Section 31 14 11 earthwork and Related Work.

3.3 INSTALLATION

- .1 Construct units as indicated.
- .2 Complete units as pipe laying progresses.
- .3 Cast or set base on 150 mm thick pipe bedding or material as indicated in the Project Documents compacted to 95% Standard Proctor Density or as indicated. Top of base to be level.
- .4 Place stubs at elevations and in positions indicated. Provide flexible pipe joints within 1m of outside face of poured-in-place and precast structure where there is no in-wall gasket for pipe sizes up to and including 750mm diameter.
- .5 Form manhole bases to provide smooth U-shaped channels with depth equal to diameter of pipes or as indicated. Curve channels smoothly and slope uniformly from inlet to outlet. Benching to drain towards channel, 4% maximum slope.

- .6 Install base section of precast shafting on cast-in-place base as indicated and assure watertight joint.
- .7 Install gaskets in accordance with manufacturer's published instructions.
- .8 Install precast sections plumb and true with opening centered over upstream pipe.
- .9 Make all joints watertight in sanitary sewer manholes and valve chambers.
- .10 Install ladder if required by Project Documents.
- .11 Set frame and cover or grating to elevation and slope indicated. Use cast-in-place concrete for adjustment and secure frame in place with cement grout or use manufactured type.
- .12 Clean debris and foreign material from unit. Remove fins and sharp projections. Prevent debris from entering system.

3.3 INSTALLATION IN EXISTING SYSTEM

- .1 Installing units in existing systems:
 - .1 Where new unit is to be installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
 - .2 Make joints watertight between new unit and existing pipe.
 - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

3.4 TESTING

- .1 Test manholes and catch basins.
- .2 Provide labour, equipment and materials required to perform testing.
- .3 Backfill prior to testing.

- .4 Notify the Departmental Representative 24 hours in advance of proposed test. Do test in presence of the Departmental Representative.
- .5 Test method:
 - .1 Water testing: perform test as follows:
 - .1 If water used for flushing or testing is obtained from a potable water supply, the potable water supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow prevention device.
 - .2 Plug all inlet and outlet pipes with watertight plugs.
 - .3 Fill with water to top of precast sections.
 - .4 Allow time for initial absorption.
 - .5 Measure and record volume of water required to maintain level for one hour.
 - .6 Leakage not to exceed 5.0 litres per hour per 1000 mm diameter per 1000 mm of height above groundwater.
 - .7 Locate and repair defects if test fails. Retest using same methodology.
 - .8 Repair leaks regardless of test results.
- .6 Vacuum Testing:
 - .1 Plug all inlet and outlet pipes. Restrain pipes.
 - .2 Place and seal vacuum tester head on manhole frame.
 - .3 Draw vacuum of 250mm Hg on the manhole and measure the time for the vacuum to drop to 225mm Hg.
 - .4 Time to be not less than 45, 50, 65, and 80 seconds for manhole diameters of 1050mm, 1200mm, 1500mm, and 1800mm respectively.
 - .5 For manholes deeper than 6m, increase test times by 2 seconds per 300mm of additional manhole depth.
 - .6 Locate and repair defects if test fails. Retest using same methodology.
 - .7 Repair leaks regardless of test results.

END OF SECTION

PART 1. GENERAL

1.1 DESCRIPTION

- .1 The system shall continuously monitor new transition sump sensors for the presence of hydrocarbons and water, as well as, alarms from existing basement leak sensors. Detected leaks shall be indicated at the system console and communicated to the boiler plant OWS and main site monitoring station via the existing DDC system.
- .2 System as described shall be supplied and installed by Division 33. Connection of system to the BMS as indicated shall be by the Controls Contractor.

1.2 RELATED SECTIONS

- .1 Section 25 05 01 - Common Work Results - Controls.
- .2 Section 33 56 13 - Aboveground Fuel Tanks.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-E60079-11-02(R2006) - Electrical Apparatus for Explosive Gas Atmospheres.
 - .2 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Complete descriptive system diagram of console showing interconnection of sensors, input modules, output modules, relays, communication ports and modules, and electrical connections.
 - .2 Enclosure dimensions and mounting details.
 - .3 Operating specifications.
 - .4 Sensor technical data, wiring diagrams, and installation instructions.
 - .5 Sensor leader cable technical data and instructions.
 - .6 Manufacturer's installation instructions for specified equipment and devices.

- .3 Provide operations and maintenance data for complete system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 22 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility.

PART 2. PRODUCTS

2.1 STANDARDS COMPLIANCE

- .1 All equipment and materials shall conform to the standards or certifications of the Canadian Standards Association (CSA) or Canadian Underwriters Laboratory (cUL).

2.2 GENERAL

- .1 The complete system including, but not limited to, console, I/O modules, sensors and sensor cables, and connectors shall be of a single manufacturer.
- .2 Accepted manufacturers are as follows:
 - .1 OPW Fuel Management Systems
 - .2 Veeder-Root
 - .3 Franklin Fueling Systems

2.3 SYSTEM CONSOLE

- .1 Surface mounted, microprocessor based leak detection controller, with multiline LCD display. Visible alarm, warning, and power indicators. Nonvolatile memory for event history.
- .2 Integrated keypad for programming, setup, and configuration.

- .3 Continuous leak monitoring capabilities.
- .4 Sufficient input modules for quantity of sensors as indicated in the Contact Documents. Provide one spare input module.
- .5 Sufficient relay output modules for functionality as indicated in the Contact Documents. Provide one spare relay module.
- .6 Alarm output provisions for connection to existing DDC system.
- .7 Minimum operating temperature range: 0 to 40 degrees Celsius.
- .8 Programmable water and oil alarm level set points.
- .9 This Contractor shall be responsible for providing console that is fully compatible with new and existing sensors as indicated and is fully functional as indicated.
- .10 Acceptable product:
 - .1 OPW Fuel Management Systems - SiteSentinel Series
 - .2 Veeder-Root - TLS-350 Series
 - .3 Franklin Fueling Systems - TS-5 Series

2.4 MAGNETORESTRICTIVE SENSORS

- .1 Discriminating, fast acting, containment sump sensors.
- .2 Capable of detecting and differentiating the presence of both hydrocarbons and water.
- .3 Compatible with No. 2 fuel oil.
- .4 Minimum operating temperature range: -40 to 60 degrees Celsius.
- .5 Sensor alarm and warning conditions:
 - .1 Fuel high level alarm.
 - .2 Water high level alarm.
 - .3 Sensor malfunction alarm.
- .6 Sensors shall be intrinsically safe and approved for Class 1 - Zone 1 hazardous rated locations.
- .7 Acceptable product:
 - .1 OPW Fuel Management Systems - 30-0232-DH-20 Series
 - .2 Veeder-Root - 857080 Series
 - .3 Franklin Fueling Systems - TMS-DMS Series

PART 3. EXECUTION

3.1 INSTALLATION

- .1 Perform complete installation as to provide a complete, operational system as described in the Contract Drawings and Specifications.
- .2 Coordinate installation with all other trades. Reference Mechanical and Electrical Contract Documents for transfer sump and conduit routing details.
- .3 Install alarm console as indicated in the Contract Documents and in accordance with the manufacturer's requirements.
- .4 Connect existing sensor and equipment wiring to new console.
- .5 Install new sensors as indicated in the Contract Documents and in accordance with the manufacturer's requirements. Install all required sensor cables and wiring and connect to new console as per manufacturer's instructions.
- .6 Connect communications ports to existing DDC system as indicated.

3.2 FIELD QUALITY CONTROL

- .1 Program console and alarm settings for complete functionality as indicated.
- .2 All new and existing sensors are to be properly set up and calibrated.
- .3 Test all sensors under listed alarm conditions and verify operation of console display, indicators, and console outputs to existing DDC system. Make adjustments as required for proper operating condition.

3.3 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 01 91 13 - Commissioning (Cx) Plan.

END OF SECTION

PART 1. GENERAL

1.1 DESCRIPTION

- .1 The system shall continuously monitor the interstitial space of new aboveground double wall piping for the presence of hydrocarbons. Detected leaks shall be indicated at the main system console and communicated to the boiler plant OWS and main monitoring station via the existing DDC system.
- .2 System as described shall be supplied and installed by Division 33. Connection of system to the BMS as indicated shall be by the Controls Contractor.

1.2 RELATED SECTIONS

- .1 Section 25 05 01 - Common Work Results - Controls.
- .2 Section 33 56 13 - Aboveground Fuel Tanks.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-E60079-11-02(R2006) - Electrical Apparatus for Explosive Gas Atmospheres.
 - .2 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Overall system architecture indicating console, modules, and sensing cable layouts and lengths.
 - .2 Complete console layout showing interconnection of input modules, output modules, communication ports and modules, and electrical connections.
 - .3 Enclosure dimensions and mounting details.
 - .4 Operating specifications.
 - .5 Sensing cable technical data, wiring diagrams, and installation instructions.
 - .6 Manufacturer's installation instructions for specified equipment and devices.

- .3 Provide operations and maintenance data for complete system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 22 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility.

PART 2. PRODUCTS

2.1 STANDARDS COMPLIANCE

- .1 All equipment and materials shall conform to the standards or certifications of the Canadian Standards Association (CSA) or Canadian Underwriters Laboratory (cUL).

2.2 GENERAL

- .1 The complete system including, but not limited to, monitoring and alarm console, modules, sensing cable, leader cable, connectors, splices, and sensing cable terminations shall be of a single manufacturer.
- .2 Accepted manufacturers are as follows:
 - .1 PermAlert Environmental Specialty Products
 - .2 Tyco Thermal Controls
 - .3 Approved alternate manufacturer

2.3 SYSTEM CONSOLE

- .1 Surface mounted, microprocessor leak detection controller, with LCD display. Visible alarm, warning, and power indicators. Nonvolatile memory for event history.
- .2 Integrated keypad for programming, setup, and configuration.
- .3 Multiple leak detection capabilities.

- .4 Sufficient interface modules to monitor 110% of the total overall sensing cable length as required in the Contact Documents.
- .5 4-20mA communication port for connection to existing DDC system.
- .6 Minimum operating temperature range: 0 to 40 degrees Celsius.
- .7 Precision: +/- 0.1% of total circuit length.
- .8 Metric units.
- .9 Minimum alarm outputs:
 - .1 Leak detection alarm.
 - .2 Leak location.
 - .3 Sensing cable fault alarm.
- .10 This Contractor shall be responsible for providing console that is fully compatible with sensing cables as indicated and is fully functional as indicated.
- .11 Acceptable product:
 - .1 Tyco Thermal Controls - TraceTek TTDM Series.
 - .2 PermAlert Environmental Specialty Products - PAL-AT Series.
 - .3 Approved alternate.

2.4 FUEL SENSING CABLE

- .1 Non-resettable, liquid hydrocarbon sensing cable.
- .2 Capable of detecting hydrocarbon fuels at any point along its length within 1 meter, without reacting to water.
- .3 Core consisting of:
 - .1 Two sensing wires.
 - .2 Alarm signal wire.
 - .3 Continuity wire.
 - .4 Conductive polymer jacket.
- .4 Outer fluoropolymer braid.
- .5 Typical response time for #2 diesel fuel - 120 minutes at 20 degrees Celsius.
- .6 Operating temperature range: -20 to 60 degrees Celsius.
- .7 Sensing cable shall be intrinsically safe and approved for Class 1 - Zone 1 hazardous rated locations.
- .8 Acceptable product:

- .1 PermAlert Environmental Specialty Products - PAL-AT TFH Series
- .2 Tyco Thermal Controls - TraceTek TT5000 Series
- .3 Approved alternate.

PART 3. EXECUTION

3.1 INSTALLATION

- .1 Perform complete installation as to provide a complete, operational system as described in the Contract Drawings and Specifications.
- .2 Coordinate installation with all other trades. Reference Mechanical and Electrical Contract Documents for aboveground double wall pipe and conduit routing details.
- .3 Install monitoring console in boiler plant office as indicated in the Contract Documents and in accordance with the manufacturer's requirements.
- .4 Install new sensing cable as indicated in the Contract Documents and in accordance with the cable manufacturer's instructions and the pipe installer's requirements.
- .5 Install all required sensing cable, leader cables, splices, connectors, terminations, and interface equipment and connect to new console as per manufacturer's requirements.
- .6 Install zener safety barrier and other safety equipment in accordance with local authority having jurisdiction and manufacturer's requirements.
- .7 Connect communications ports to existing DDC system as indicated.

3.2 FIELD QUALITY CONTROL

- .1 Program console for complete functionality as indicated.
- .2 Properly setup and calibrate console for complete functionality as indicated.
- .3 Test continuity of sensing cable as per manufacturer's instructions. Verify operation of console display, alarm indicators, and console output to existing DDC system. Make adjustments as required for proper operating condition.

3.3 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 01 91 13 - Commissioning (Cx) Plan.

END OF SECTION

PART 1. GENERAL

1.1 DESCRIPTION

- .1 The system shall continuously monitor the oil/water separator for the presence of hydrocarbons. Detected oil shall be indicated at the main control unit and communicated to the boiler plant OWS and main monitoring station via the existing DDC system.
- .2 System as described shall be supplied and installed by Division 33. Connection of system to the BMS as indicated shall be by the Controls Contractor.

1.2 RELATED SECTIONS

- .1 Section 25 05 01 - Common Work Results - Controls.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-E60079-11-02(R2006) - Electrical Apparatus for Explosive Gas Atmospheres.
 - .2 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Overall system architecture indicating console, modules, and sensor.
 - .2 Complete console layout showing interconnection of input modules, output modules, communication ports and modules, and electrical connections.
 - .3 Enclosure dimensions and mounting details.
 - .4 Operating specifications.
 - .5 Sensor technical data, wiring diagrams, and installation instructions.
 - .6 Manufacturer's installation instructions for specified equipment and devices.
- .3 Provide operations and maintenance data for complete system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 22 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility.

PART 2. PRODUCTS

2.1 STANDARDS COMPLIANCE

- .1 All equipment and materials shall conform to the standards or certifications of the Canadian Standards Association (CSA) or Canadian Underwriters Laboratory (cUL).
- .2 Accepted manufacturers are as follows:
 - .1 Arjay Engineering Ltd
 - .2 Approved alternate manufacturer

2.2 GENERAL

- .1 The complete system including, but not limited to, control unit and sensor shall be of a single approved manufacturer.

2.3 CONTROL UNIT

- .1 Intelligent alarm controller, with backlit LCD display and keypad in surface mounted NEMA 4X polycarbonate enclosure.
- .2 Visible alarm (red) and power (green) indicator lights.
- .3 Alarm buzzer mounted on enclosure.
- .4 Display shall indicate oil level in metric units.
- .5 Integrated keypad for programming, setup, and configuration.
- .6 120 VAC power input.
- .7 Two 10 amp @240 VAC SPDT alarm relays.

- .8 4-20mA analog output for connection to existing DDC system.
- .9 Minimum operating temperature range: -20 to 55 degrees Celsius.
- .10 This Contractor shall be responsible for providing control unit that is fully compatible with sensor as indicated and is fully functional as indicated.
- .11 Acceptable product:
 - .1 Arjay Engineering Ltd - 2852-OWS Series.
 - .2 Approved alternate.

2.4 SENSOR

- .1 High frequency capacitive level probe to monitor dielectric change between the water and surface oil.
- .2 PTFE active probe with 316 stainless steel probe shield.
- .3 Cast aluminum, epoxy coated explosion proof junction head.
- .4 Length of probe as required for installation in oil water man hole as per manufacturer's instructions.
- .5 Operating temperature range: -60 to 55 degrees Celsius.
- .6 Sensor shall be approved for Class 1 - Zone 1 hazardous rated locations.
- .7 Acceptable product:
 - .1 Arjay Engineering Ltd - PAA Series.
 - .2 Approved alternate.

PART 3. EXECUTION

3.1 INSTALLATION

- .1 Perform complete installation as to provide a complete, operational system as described in the Contract Drawings and Specifications.
- .2 Coordinate installation with all other trades. Reference Electrical Contract Documents for conduit routing details.
- .3 Install control unit in boiler plant office as indicated in the Contract Documents and in accordance with the manufacturer's requirements.

- .4 Install new sensor as indicated in the Contract Documents and in accordance with the manufacturer's requirements. Install all required wiring and connect to new control unit as per manufacturer's instructions.
- .5 Install zener safety barrier and other safety equipment in accordance with local authority having jurisdiction and manufacturer's requirements.
- .6 Connect alarm outputs to existing DDC system as indicated.

3.2 FIELD QUALITY CONTROL

- .1 Program control unit and alarm settings for complete functionality as indicated.
- .2 Properly install, set up, and calibrate sensor.
- .3 Test sensor under listed alarm conditions and verify operation of console display, indicators, and console outputs to existing DDC system. Make adjustments as required for proper operating condition.

3.3 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 01 91 13 - Commissioning (Cx) Plan.

END OF SECTION

PART 1. GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete
- .2 Section 31 14 11 - Earthwork and Related Work
- .3 Section 33 30 00 - Precast Manholes, Catch Basins and Structures
- .4 Section 01 33 00 - Submittal Procedures

1.2 STANDARDS

- .1 ASTM C14M-07, Concrete Sewer, Storm Drain, and Standards Culvert Pipe (Metric).
- .2 ASTM C76M-08a, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).
- .3 ASTM D1056-07, Flexible Cellular Materials - Sponge or Expanded Rubber.
- .4 CSA-G401-M-07, Corrugated Steel Pipe Products.
- .5 CAN/CSA A257 Series-03, Standards for Concrete Pipe and Manhole Sections.
- .6 CAN/CSA B1800 Series-06, Thermoplastic Non- Pressure Piping Compendium.

1.3 SHOP DRAWINGS

- .1 Submit Shop Drawings to the Departmental Representative for review prior to construction as per Section 01 33 00.

1.4 HANDLING AND STORAGE

- .1 Prevent damage to materials during storage and handling.
- .2 Store gaskets in cool location out of direct sunlight, and away from petroleum products.

PART 2. PRODUCTS

2.1 MATERIALS

- .1 Plastic Pipe and Fittings:
 - .1 Pipe:
 - .1 PVC DR35
 - .2 Fittings:
 - .1 Approved petroleum-resistant gaskets.
 - .3 Joints: bell and spigot with locked-in petroleum-resistant gasket.

PART 3. EXECUTION

3.1 PREPARATION

- .1 Carefully inspect products for defects and remove defective products from site.
- .2 Ensure that pipe and fittings are clean before installation.

3.2 EXCAVATION AND BACKFILLING

- .1 Do excavating and backfilling to Section 31 14 11 Earthwork And Related Work.

3.3 PIPE INSTALLATION

- .1 Lay and joint pipe and fittings as specified herein and according to manufacturer's published instructions.
- .2 Lay pipe and fittings on prepared bed, true to line and grade indicated within following tolerances:
 - .1 Horizontal Alignment: 50mm.
 - .2 Vertical Alignment: the lesser of 13mm or one half the rise per pipe length.
- .3 Commence laying at outlet and proceed in upstream direction with bell ends facing upgrade.
- .4 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipelaying is not in progress.

- .5 Install gaskets in accordance with manufacturer's published instructions. During cold weather, store gaskets in heated area to assure flexibility.
- .6 Align pipe carefully before joining. Do not use excessive force to join pipe sections.
- .7 Support pipes as required to assure concentricity until joint is properly completed.
- .8 Keep pipe joints free from mud, silt, gravel or other foreign material.
- .9 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.
- .10 Complete each joint before laying next length of pipe.
- .11 Where deflection at joints is permitted, deflect only after the joint is completed. Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .12 Where a flexible joint is not integral to the structure, provide flexible joint not more than 1m from outside face of structure.
- .13 Install plastic pipe in accordance with CAN/CSA B1800.
- .14 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer.
- .16 Make watertight connections to manholes and catch basins. Use non shrink grout when suitable gaskets are not available.

3.3 UNDERCROSSING

- .1 Provide shop drawings showing proposed method of installation for pipe in undercrossing.
- .2 Excavate working pit according to reviewed shop drawings.
- .3 Dewater area of excavation and undercrossing.
- .4 Place jacking, boring or tunnelling equipment in working pit to approved line and grade of the proposed pipe.

- .5 Install encasing pipe to proposed line and grade as indicated.
- .6 Use mechanical or welded type joints for encasing pipe.
- .7 After encasing pipe has been installed, check line and grade for approval.
- .8 Remove any soil that remains in the casing pipe.
- .9 Insert pipe into encasement pipe, starting from the working pit.
- .10 Place pipe one length at time outside encasement pipe. Maneuver pipe into position.
- .11 Use approved blocking method to guide pipe in true alignment.

3.4 INSPECTION

- .1 The Departmental Representative may require inspection of installed sewers by television camera, photographic camera or by other visual method.
- .2 Provide television camera inspection.

3.5 DEFLECTION TESTING

- .1 Measure deflection by pulling deflection gauge Testing - Plastic through each pipe from manhole to manhole after Pipe backfilling.
- .2 Provide deflection gauges to measure a 5% and 7- 1/2% deflection. Gauges to be a "Go-No-Go" device.
- .3 Within 30 days after installation, pull a deflection gauge measuring 5% deflection through the installed section of pipeline. If this test fails proceed with 7-1/2% deflection test. If 7-1/2% deflection test fails, locate defect and repair. Retest using same methodology.
- .4 30 days prior to completion of warranty period, pull a deflection gauge measuring 7-1/2% deflection through the installed section of pipeline. If 7 1/2% deflection test fails, locate defect and repair. Retest using same methodology.

3.6 CLOSED CIRCUIT TELEVISION INSPECTION

- .1 Conduct closed circuit television inspection Television procedures to meet North American Association Inspection of Pipeline Inspectors (NAAPI) WRc Standard.
- .2 Equipment:
 - .1 Provide equipment meeting following requirements:
 - .1 Self-contained, self-leveling monitoring unit and pan-tilt camera with remotely controlled lighting system capable of varying the illumination.
 - .2 Picture quality shall produce continuous 600-line resolution picture, showing entire periphery of pipe.
 - .3 A meter device with readings above ground or marking on cable to clearly identify exact location of camera.
- .3 Inspection:
 - .1 Perform inspection of pipe from manhole to catch basin by passing TV camera through sewer in direction of flow.
 - .2 Classify results in accordance with North American Pipeline Inspectors (NAAPI) WRc Standard.
- .4 Records:
 - .1 Maintain inspection record in log form, during television inspection.
 - .2 Log to include location of each fault and service lateral distance measured from centreline of reference manhole and position referenced to axis of pipe.
 - .3 Photograph fault from the television screen. All photographs to be clear and precise with distinct definition of fault.
 - .4 Include detailed technical description with photographs as supporting data for each fault.
 - .5 Provide minimum of two photographs for each sewer main section televised, detailing typical joint, and typical building service lateral.
 - .6 All photos and videos to be in colour.
- .5 Reports:
 - .1 Provide a composite report of TV inspection. Enclose report in binder on letter size paper. Include following pages and information:
 - .1 Title page identifying project, camera operator and dates of inspection.

- .2 Index page identifying street name, section from manhole to manhole, page number or numbers where information for section is contained.
- .2 Organize inspection records in sequence from upstream manhole to downstream manhole.
- .3 Report on each pipe section to contain:
 - .1 Heading:
 - .1 Manhole numbers applicable to section.
 - .2 Reference drawing number, if applicable.
 - .3 Weather on the day of inspection.
 - .4 Statement of soil condition in area of inspection, i.e., dry, damp, wet, frozen.
 - .5 Date of inspection.
 - .2 Key Plan, showing corresponding manhole numbers, magnetic north, horizontal distance, pipe and material between manholes, and direction of flow.
 - .3 Inspection findings for each sewer main section to include:
 - .1 Location of all faults.
 - .2 Photographs of all faults.
 - .3 One photograph each of typical joint.
 - .4 Mount photographs on left-hand page and place corresponding description on right-hand page. Number all photographs in order. Number beside photograph to correspond with description number.
 - .5 Enclose all pages of report in transparent sheet protector.
- .6 Accuracy:
 - .1 Maximum permissible error in accuracy to be within following limits of fault location:
 - .1 Up to 375 mm pipe: ± 75 mm per 100 m of length.
 - .2 450 mm - 600 mm pipe: ± 150 mm per 100 m of length.
 - .3 750 mm - 900 mm pipe: ± 225 mm per 100 m of length.
- .7 Video Record:
 - .1 Supply a complete record of all inspections in digital format.
 - .2 Index all files, listing sections of inspections.
 - .3 Submit video or CD's with written reports to the Departmental Representative.
- .8 Repeat Inspection:
 - .1 Repair faults detected during television inspection. Repeat television inspection at no cost to Owner.

.9 Testing:

.1 Low Pressure Air Testing

CAUTION:

FOR SAFETY OF PERSONNEL AND PUBLIC, OBSERVE PROPER PRECAUTIONS DURING AIR TESTING. USE TEST EQUIPMENT DESIGNED TO OPERATE ABOVE GROUND. DO NOT PERMIT PERSONNEL IN TRENCH DURING TESTING. DO NOT AIR TEST PIPE WITH DIAMETER GREATER THAN 600 MM.

.1 Provide air testing equipment meeting the following requirements:

- .1 Air Blower: 14 litres/sec, maximum pressure 70 kPa continuous.
- .2 Pressure Relief Valve: Sized to relieve full blower capacity at maximum blower pressure. Range 20 - 70 kPa, adjustable.
- .3 Pressure Gauges: Range 0 to 70 kPa with accuracy +/- 0.25 kPa.

.2 Provide plugs at each end of section, with one plug equipped for air inlet connection.

.3 Fill test section slowly until a constant pressure of 28 kPa is reached. If ground water is above section being tested, the Departmental Representative may recommend increase in air pressure.

.4 Allow minimum 2 minutes for air temperature to stabilize, adding only amount of air required to maintain pressure.

.5 After 2 minute period, shut off air supply.

.6 Decrease pressure to 24 kPa. Measure time required for pressure to reach 17kPa. Minimum time allowed for pressure drop is as follows:

Pipe Diameter (mm)	Minimum Time (Min:Sec)
100	1:53
150	2:50
200	3:47
250	4:43
300	5:40
375	7:05
450	8:30
525	9:55
600	11:20

.7 Locate and repair defects if test fails. Retest.

.8 Repair visible leaks regardless of test results.

END OF SECTION

PART 1. GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for aboveground oil storage tanks.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 03 30 00 - Cast-in-Place Concrete.
- .5 Section 26 05 00 - Common Work Results - Electrical.
- .6 Section 33 30 04 - Transition Sump Leak Detection Systems.
- .7 Section 33 30 05 - Aboveground Double Wall Pipe Leak Detection Systems.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI).
 - .1 ANSI/NFPA-329, Handling Underground Releases of Flammable and Combustible Liquids.
 - .2 ANSI/API 650, Welded Steel Tanks for Oil Storage.
- .2 American Petroleum Institute (API).
 - .3 API RP 651, Cathodic Protection of Aboveground Petroleum Storage Tanks.
 - .4 API STD 653, Tank Inspection, Repair, Alteration, and Reconstruction.
- .3 American Society for Testing and Materials International, (ASTM).
 - .5 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
- .4 Canadian Council of Ministers of the Environment (CCME).

- .6 CCME-PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .5 Department of Justice Canada (Jus).
 - .7 Canadian Environmental Protection Act, 1999 (CEPA).
- .6 Canadian Standards Association (CSA)/CSA International.
 - .8 CAN/CSA-B139, Installation Code for Oil Burning Equipment.
- .7 The Master Painters Institute (MPI).
 - .9 Architectural Painting Specification Manual.
- .8 National Research Council/Institute for Research in Construction.
 - .10 NRCC 38727, National Fire Code of Canada (NFC).
- .9 Transport Canada (TC).
 - .11 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .10 Underwriters' Laboratories of Canada (ULC).
 - .12 ULC/ORD-C58.9, Secondary Containment Liners for Underground and Aboveground Tanks.
 - .13 ULC/ORD-C58.12, Leak Detection Devices (Volumetric Type) for Underground Storage Tanks.
 - .14 ULC/ORD-C58.14, Leak Detection Devices (Nonvolumetric Type) for Underground Storage Tanks.
 - .15 ULC/ORD-C58.15, Overfill Protection Devices for Underground Tanks.
 - .16 ULC/ORD-C971, Nonmetallic Underground Piping for Flammable and Combustible Liquids.
 - .17 ULC/ORD-C142.23, Aboveground Waste Oil Tanks.
 - .18 ULC-S601, Aboveground Horizontal Shop Fabricated Steel Tanks.
 - .19 CAN/ULC-S602, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.
 - .20 CAN/ULC-S603.1, Galvanic Corrosion Protection Systems for Steel Underground Tanks.
 - .21 ULC-S630, Aboveground Vertical Shop Fabricated Steel Tanks.
 - .22 ULC-S652, Tank Assemblies for Collection of Used Oil.
- .11 National Research Council Canada (NRC)
 - .23 National Fire Code of Canada 2010.

1.4 SUBMITTALS

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

- .2 Indicate details of construction.
- .3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturer's product data to supplement shop drawings.
 - .1 Aboveground Storage Tanks shall include:
 - .1 Size, materials and locations lifting lugs.
 - .2 Tanks capacity.
 - .3 Size and location of fittings.
 - .4 Environmental compliance package accessories.
 - .5 Decals, type size and location.
 - .6 High level and vacuum sensor types.
 - .7 Accessories: provide details and manufacturers product data.
 - .8 Size, materials and locations of railings, stairs, ladders and walkways.
 - .9 Finishes.
 - .10 Field-erected AST overfill-protection systems: provide details of design, type, materials and locations.
 - .2 Anti-siphon/Solenoid valves: type, materials, sizes and hydrostatic head pressure setting.
 - .3. Piping, valves and fittings: type, materials, sizes, piping connection details, valve shut-off type and location, cathodic protection system complete with stamp of corrosion expert indicating that design complies with standards, Federal and Provincial regulations.
 - .4 Fill Stations: provide details of design, type materials, locations fitting sizes, fitting types.
 - .5 Spill containment: provide description of method[s] and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck.
 - .6 Size, material and location of manholes.
 - .7 Electronic accessories: provide details and manufacturers product data.
 - .8 Identification, name, address and phone numbers of corrosion expert where applicable. Note: Grading drawings to be stamped by licensed corrosion expert.
 - .9 Anchors: description, material, size and locations.
 - .10 Level gauging: type and locations, include:
 - .1 Reporting systems, types of reports and report frequency.
 - .2 Maximum number of tanks to be monitored.
 - .3 Number of probes required and sizes.
 - .4 Provide details and manufacturer's product data.
 - .11 Ancillary devices: provide details and manufacturer's product data.

- .12 Leak detection system, type and locations, and alarm system.
 - .13 Emergency Shut-off valve: Materials, End Connection types, pressure rating, seal, actuator type, valve box material and assembly. For valve adapters to PVC piping, provide materials and proposed assembly.
 - .14 Grounding and bonding: provide details of design, type, materials and locations.
 - .15 Corrosion protection: provide details of design, type, materials and locations.
 - .16 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations.
- .4 Provide maintenance data for tank appurtenances and leakage detection system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers Metal Plastic waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
- .8 Ensure emptied containers are sealed and stored safely.

- .9 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .10 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.
- .11 Dispose of unused paint or coating material at an official hazardous material collections site as approved by Departmental Representative.
- .12 Do not dispose unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .13 Fold up metal banding, flatten and place in designated area for recycling.

PART 2. PRODUCTS

2.1 ABOVE GROUND HORIZONTAL STEEL TANKS

- .1 Clemmer LS Vac-U-Test 60,000 L (22,000 Imp .Gal.) shop fabricated, above ground horizontal, double walled steel (360°), vacuum monitored storage tank. 3,000 dia x 8,510mm (118 ¾" dia x 335"L). Manufactured in accordance with ULC S601 Code.
 - .1 Exterior finish: Blast cleaned to SSPC-SP6 with one coat of grey primer and one finish coat of white epoxy enamel.
 - .2 Tanks to be complete with:
 - .1 End supports fabricated from wide flange steel designed to support tank.
 - .2 Lifting lugs.
 - .3 Emergency vent.
 - .4 Dipstick and gauge chart.
 - .5 Normal vent c/w galvanized riser pipe.
 - .6 Elevated walkway complete with handrails supported on the tank and stairway, fabricated with stainless steel grade 304. Position as indicated.
 - .7 Secondary containment (interstitial vacuum space and tank capacity) shall be equal or greater than 100% of total tank capacity.
 - .8 Clemmer RVLM-1 Level and Vacuum Monitor.

- .2 Clemmer LS Vac-U-Test 10,000 L (2,200 Imp .Gal.) shop fabricated, above ground horizontal, double walled steel (360°), vacuum monitored storage tank. 2,000mm dia x 3,200mm (79" dia x 126"L). Manufactured in accordance with ULC S601 Code.
 - .1 Exterior finish: Blast cleaned to SSPC-SP6 with one coat of grey primer and one finish coat of white epoxy enamel.
 - .2 Tank to be complete with:
 - .1 End supports fabricated from wide flange steel designed to support tank.
 - .2 Lifting lugs.
 - .3 Emergency vents.
 - .4 Dipstick and gauge chart.
 - .5 Normal vent c/w riser pipe.
 - .6 Elevated walkway complete with handrails supported on the tank and stairway, fabricated with stainless steel grade 304. Position as indicated.
 - .7 Secondary containment (interstitial vacuum space and tank capacity) shall be equal or greater than 100% of total tank capacity.
 - .8 Clemmer RVLM-1 Level and Vacuum Monitor.

2.2 TANK ACCESSORIES

- .1 Anti-Siphon/Solenoid Valves
 - .1 Two-way, one directional flow, hung piston valve, normally closed when unpowered. Installed on pipeline leading from an aboveground tank and used to help prevent accidental siphoning of product.
 - .1 Bronze body.
 - .2 120 Volts operation.
 - .3 Normally closed.
 - .4 Class H standard coil.
 - .5 No differential pressure required to open the valve.
 - .6 Watertight and rated for hazardous locations - NEMA 4X, Group D
 - .7 Viton seal.
 - .8 Built-in expansion relief.
 - .9 CSA Certified.
 - .10 Standard of Acceptance: Morrison Bros. Fig 710
 - .2 In-line strainers shall be installed on inlet of solenoid valves.
 - .1 Bottom clean-out.
 - .2 Stainless steel construction.
 - .3 100 mesh screen.

- .4 Size to match associated fuel line. Tanks 1 and 2 size shall be 38mm strainer. Tank 3 size shall be 25mm.
 - .5 Standard of Acceptance: Morrison Bros. Fig 284S
- .2 Overfill Prevention Valves
 - .1 ULC listed.
 - .2 Materials:
 - .1 Valve body, adaptor and collar: cast aluminum
 - .2 Poppet: cast aluminum, hard-coated.
 - .3 Cam: stainless steel.
 - .4 Follower: brass.
 - .5 Shaft: zinc-plated.
 - .6 Float: closed-cell nitrile.
 - .3 Fully adjustable.
 - .4 690 kPa (100 PSI) pressure rated with low pressure drop
 - .5 Provide the following spare parts:
 - .1 Retaining Collar. Minimum one, each size.
 - .2 350mm nipple. Minimum one, each size.
 - .3 Float. Minimum one, each size.
 - .4 Body, adaptor and collar: cast aluminum
 - .6 Standard of acceptance: OPW 61fSTOP
 - .3 Open Atmospheric Vents (aboveground tanks)
 - .1 Materials: Aluminum body with 40-mesh brass screen.
 - .2 Attach to top of vent line with set screws.
 - .3 Provide the following spare parts:
 - .1 Screw, nut and screen. Minimum one, each size.
 - .4 Standard of acceptance: Morrison Bros Fig. 354
 - .4 Utility Tank Vent
 - .1 For use on containment boxes
 - .2 Aluminum body
 - .3 40-mesh brass screen
 - .4 Brass set screws
 - .5 Standard of Acceptance: OPW fig. 23 (38mm)

2.3 CONCRETE

- .1 In accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.4 PIPING, VALVES AND FITTINGS

- .1 Single wall Schedule 40 steel piping:
 - .1 For use indoor, in transition sumps, containment boxes and for tank fill pipes.

- .2 To ASTM A53/A53M, continuous weld or electric resistance welded, screwed.
 - .3 Steel pipe coating: Bituminous paint in accordance with manufacturer's recommendation. Color to match existing.
 - .2 Double-wall Underground piping:
 - .1 Flexible pipe used in underground service designed, constructed and certified to ULC/ORD-C971.
 - .2 Primary pipe and secondary outer pipe to be PVDF construction
 - .3 690 kPa (100 PSI) rated working pressure
 - .4 Temperature rating of -29 to +49 degrees Celsius.
 - .5 Installation: Follow manufacturer's instructions.
 - .6 Standard of acceptance: Franklin Fueling Systems XP Pressure/Suction series, OPW Flexworks Double Wall Supply Piping.
 - .3 Underground corrugated flexible conduit
 - .1 Ducted pipe for providing access to underground piping. Not to be used as secondary containment piping.
 - .2 Installation: Follow manufacturer's instructions unless indicated otherwise.
 - .3 Standard of acceptance: Franklin Fueling Systems DCT-400 series, OPW AXP40
 - .4 Aboveground Double Wall Piping
 - .1 Carrier Pipe: Extra heavy weight carbon steel, ASTM A-53 Grade B ERW or seamless. Joints for piping 50mm and below to be socket or butt welded. Sections to be provided with 6 inches of piping exposed at each end for field joint fabrication.
 - .2 Secondary Containment: Carbon steel in accordance with ASTM A-135 Grade B, or ASTM A-53 Grade B with a minimum thickness of 10 Gauge for secondary piping 150mm to 650mm. Piping shall be spiral wound, welded joint and pressure tested to 70kPa. Secondary containment piping shall be protected by 2.54mm (100 mil) thick filament wound fibreglass reinforced plastic. Secondary Containment shall be fabricated to maintain 64mm clearance around Carrier Pipe.
 - .3 Carrier Pipe Supports: Supports shall be carbon steel 6.35mm thick plate type designed and factory installed by the secondary containment manufacturer. Support spacing shall be determined by the manufacturer based on pipe diameter, pipe material and operating temperature of the product pipes, and at not more than 3,000 mm intervals. Supports to be designed to allow continuous airflow and drainage of the secondary

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- containment in place. Supports shall have 19mm ID type 304 stainless steel guide tubes at every support to facilitate pulling of a leak detection/location cable and to prevent damage during pulling operations. Plastic type supports shall not be allowed.
- .4 Sub-assemblies: End seals and other sub-assemblies shall be designed and factory prefabricated to prevent ingress of moisture into the system. All sub-assemblies shall be designed to allow for complete draining of the secondary containment. Containment pull ports shall be located at a maximum of 150m apart for straight runs and reduced by 46m for every 90 degree change in direction.
 - .5 Standard of Acceptance: Permalert Ultra FS.
- .5 Ball Valves NPS 7mm - 100mm
- .1 Materials: Brass body.
 - .2 Working pressure up to 4,100 kPa (600 psig).
 - .3 Complete with lockable handle with PVC grip.
 - .4 Provide the following spare parts:
 - .1 Valve seats: one for every ten valves, each size. Minimum one.
 - .2 Discs: one for every ten valves, each size. Minimum one.
 - .3 Stem packing: one for every ten valves, each size. Minimum one.
 - .4 Gaskets for flanges: one for every ten flanges.
 - .5 Standard of acceptance: Morrison Bros. Co. (Fig.691B),
- .6 Remote Fill Stations
- .1 ULC listed.
 - .2 Lid and container constructed of 12 Ga. Steel
 - .3 56 litre capacity.
 - .4 Powder coated white, weather-tight enclosure and continuously vented to prevent build-up of vapours.
 - .5 25mm NPT drain with locking ball valve.
 - .6 Single column base with adjustable height from 790mm to 1195mm. Base plate with four 13mm mounting holes.
 - .7 Lockable lid, held open by gas spring cylinders during use.
 - .8 One fill port per remote fill station only
 - .9 Standard of Acceptance: Morrison Bros. Co Fig. 515 - AST Remote Spill Container
- .7 Check Valves (50mm and 75mm)
- .1 Bronze body, brass seat ring, viton disc, bronze cap.
 - .2 Full bore inside diameter.
 - .3 Rated normal pressure limit: 860kPa (125 psi).
 - .4 Provide the following spare parts

- .1 Pin (50mm only): one for every ten valves, each size. Minimum one.
- .2 Stem (75mm only): one for every ten valves, each size. Minimum one.
- .3 Plug: one for every ten valves, each size. Minimum one.
- .4 Cap: one for every ten valves, each size. Minimum one.
- .5 Disc (50mm only): one for every ten valves, each size. Minimum one.
- .6 Disc Sub-Assembly (75mm only): one for every ten valves, each size. Minimum one.
- .7 Disc Nut (50mm only): one for every ten valves, each size. Minimum one.
- .8 Disc Holder (50mm only): one for every ten valves, each size. Minimum one.
- .9 Carrier: one for every ten valves, each size. Minimum one.
- .10 Retaining Ring (50mm only): one for every ten valves, each size. Minimum one.
- .11 Washer (50mm only): one for every ten valves, each size. Minimum one.
- .12 Lock Nut (75mm only): one for every ten valves, each size. Minimum one.
- .5 Standard of Acceptance: OPW 175 Swing Check Valve.
- .8 Flexible Entry Boot NPS 13mm - 100mm ($\frac{1}{2}$ " - 4")
 - .1 Install air testable version for testing of the 100mm (4") corrugated ducting.
 - .2 Includes stainless steel studs and corrosion resistant nuts and washer plates.
 - .1 Standard of acceptance: Franklin Fueling Systems APT (DEB Series), OPW Flexworks DEB
- .9 Transition Sumps
 - .1 Materials: Non corroding polyethylene container with fibreglass top.
 - .2 Weatherproof lockable cover.
 - .3 Standard of acceptance: OPW Flexworks (PST-4630)

2.5 LEVEL GAUGING

- .1 Tank gauging stick: to manufacturer's standard.
- .2 Mechanical Level Gauges
 - .1 Mechanical clock gauge with metric face for measuring liquid level in aboveground storage tanks.
 - .2 Vapor tight construction.
 - .3 Stainless steel float and cable, aluminum body.

- .4 360degree swivel for adjustable orientation.
 - .5 Maximum measurement shall be at least 3,600 mm.
 - .6 Gauge suitable for reading level within 3mm accuracy at a distance of 6 meters away
 - .7 Standard of acceptance: Morrison Bros Fig818MET with drop tube float.
 - .8 Provide gauge chart for horizontal tank. Volume shall be in litres and depth will be in 1 cm increments. Provide protection from weather and UV from sunlight.
- .3 Electronic Level Transmitter:
- .1 2-wire pulse radar level transmitter for continuous monitoring of liquids in storage tanks.
 - .2 Working range of 20m.
 - .3 Working pressure of 40 bar (580 psig).
 - .4 Designed to withstand a range of temperatures from -40 to 200 degrees Celsius (-40F to 392F).
 - .5 Tank connection: 100mm flat faced flanged ASME Class 150.
 - .6 Output signal 4 to 20mA.
 - .7 Power: 24V DC, max 30V DC.
 - .8 Approvals: CSA
 - .9 Standard of acceptance: Siemens Sitrans LR250

2.6 FLOW MEASUREMENT

- .1 Oil Flowmeter:
- .1 Coriolis mass flowmeter used to measure liquids or gases.
 - .2 Flowmeter Measured values: Volume flow, mass flow, density fraction, temperature and totalizer.
 - .3 Accuracy: 0.10%
 - .4 Measuring range: 0 -192,000kg/h
 - .5 Temperature range: -50 to 180 degrees Celsius (-58F to 356F)
 - .6 Single tube bended, full bore design.
 - .7 NEMA 4 Enclosure
 - .8 Standard of Acceptance: Siemens MASS2100 DI25 sensor with MASS 6000 transmitter.

2.7 OVERFILL AND SPILL CONTAINMENT

- .1 Shop-fabricated AST overfill protection.
- .1 Audible and visual alarm located where personnel are constantly on duty during transfer operation and can promptly stop or divert flow when detected levels are too high.

2.8 PRODUCT TRANSFER

- .1 Aboveground Storage tanks shall be provided with emergency vents in addition to normal vents.
 - .1 Liquid and vapour-tight connection on fill pipes.

2.9 SPILLS, OVERFILLS AND STORM RUNOFF WATER

- .1 Contained, treated and disposed of in accordance with applicable provincial or territorial regulations, guidelines and policies.
- .2 Oil/water separator (for storm water runoff from product transfer area).
 - .1 Designed to produce discharge water with 10 mg/L, or less, of oil and grease.
 - .2 Sized for hydraulic flow rate of 440 L/min for oil with specific gravity of .85.
 - .3 Designed to capture spill of petroleum product of volume equal to amount of petroleum product transferred in 2 minutes at highest pumping rate normally used within area that drains to oil/water separator.
 - .4 Product holding capacity of 6,445L.
 - .5 Designed with hydraulic retention time required to separate oil particles from storm water based on Stokes' law.
 - .6 Designed in accordance with the API manual on disposal of refinery wastes, API Bulletin No 1630 First Edition, API Bulletin No 421 and ULC S615.
 - .7 Standard of Acceptance: ZCL Composites Inc. model COWS-620.
- .3 Open Atmospheric Vents (oil/water separator)
 - .1 Materials: Aluminum body with 40-mesh brass screen.
 - .2 Attach to top of vent line with set screws.
 - .3 Standard of acceptance: Morrison Bros Fig. 354.
- .4 Emergency shut-off valve for isolating drainage of the tank area from site drainage system.
 - .1 Gate valve for use with PVC drainage pipe.
 - .2 Meets or exceeds applicable requirements of ANSI/AWWA C515 Standard.
 - .3 UL Listed, FM Approved and certified to ANSI/NSF 61.
 - .4 Ductile Iron body and bonnet with nominal 10 mil fusion epoxy coated interior and exterior surfaces.
 - .5 Ductile Iron wedge, symmetrical and fully encapsulated with molded rubber; no exposed iron.

- .6 Non-rising stem.
- .7 Triple O-ring seal stuffing box.
- .8 50mm square wrench nut.
- .9 Suitable for pressures up to 1,723 kPa.
- .10 Ends: Mechanical Joint (MJ).
- .11 Standard of Acceptance: Mueller Co. A-2361 D.I.
Resilient Wedge Gate Valve M.J. x M.J.
- .5 Valve box for access at ground level
 - .1 Valve box complete with cast iron lid and 300mm ductile iron adjustable top.
 - .2 Standard of Acceptance: Mueller Co. MVB series.

2.10 FROST BARRIERS

- .1 Waterproofing protection board: Extruded polystyrene board to rigid closed cell type, with integral high density skins.
 - .1 Board size: 1220mm wide, 15.24 metres long, 6mm thick.
 - .2 Compressive strength: minimum 55 kPa.
 - .3 Edges: Square, fan folded panels at 610mm o.c.
 - .4 Water Vapour Permeance: to ASTM E96, 5lmg/Pa per 25.4mm thickness.
 - .5 Standard of Acceptance: Dow Protection Board III Extruded Polystyrene Insulation.
- .2 Adhesive: To CGSB 71-GP-24M, Type 1.

2.11 PUMP P-14

- .1 Helical gear pump for use in an oil transfer system from oil storage tanks to oil-fired burners.
 - .1 Bearings: Full face thrust bearings, bronze.
 - .2 Direct Drive with safety guard.
 - .3 Self Priming
 - .4 Pedestal type pump, mounted to manufacturer supplied base.
 - .5 Pump Characteristics: 37.8L/min (10 GPM), 1,300kPa (188 PSI) at 1,750 RPM, 2.2kW (3 hp) motor.
 - .6 Standard of Acceptance: Albany Pump Model 018H

2.12 STRAINERS

- .1 Duplex Strainer to provide protection to pumps, nozzles, valves and other sensitive pipeline equipment from foreign contaminants such as dirt and debris.
 - .1 Duplex valve for screen maintenance without interruption of flow.

- .2 Cast iron body, cover and valve caps
- .3 Stainless steel basket screen.
- .4 ANSI B16.1 flanged port connections
- .5 Manufacturer supplied steel mounting foot.
- .6 Working Pressure: 1,378 kPa at 65°C(200PSI at 150°F)
- .7 UL Listed, bodies individually tested to UL specifications.
- .8 Standard of Acceptance: Kraissl 72F series

2.13 HYDRAULIC PRESSURE RELIEF VALVES

- .1 Relief valve for protecting oil transfer system from over-pressure.
 - .1 Cast iron body with screw connections
 - .2 Buna O-ring cap seal
 - .3 Piston material: Hardened steel
 - .4 Standard of Acceptance: Fulflo V-Series
- .2 For every Hydraulic Pressure Relief Valve, provide the following spare parts:
 - .1 O-Ring
 - .2 Spring
 - .3 Piston
 - .4 Gasket

2.14 NON-SHRINK GROUT

- .1 To Section 03 30 00 - Cast-In-Place-Concrete.

2.15 EPOXY COATINGS

- .1 Epoxy coatings shall be applied to protect surfaces from UV and weather conditions in outdoor environments.
- .2 Apply coatings where indicated on drawings.
- .3 Surface Preparation: Sa2 1/2 or NACE 2, suitable for hand tool or power tool preparation.
- .4 Base coat: Solvent free, direct to steel.
 - .1 Standard of acceptance: 2 layers 3M Scotchkote Epoxy Coating 152LV @ 20 mils total.
- .5 Top coat: High gloss polyurethane cosmetic coating.
 - .1 Scotchkote Uni-tech XF 129. 1 coat @ 2 mils.

2.16 DIESEL FUEL FILTRATION SYSTEM

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- .1 Enclosure:
 - .1 Filtration system must be protected in a lockable, weatherproof, rust-proof NEMA rated enclosure complete with lifting points.
 - .2 Enclosure to be insulated and equipped with CSA approved internal cabinet heater for freeze protection.
 - .3 Enclosure to be ventilated with manually operated venting.
 - .4 Enclosure footprint is not to exceed 600mm x 600mm. Coatings shall be applied to protect surfaces from UV and weather conditions in outdoor environments.
 - .2 Pump and Motor Assembly
 - .1 Base mounted, TEFC motor and positive displacement rotary gear pump with cast iron or bronze housing.
 - .2 Pump shall be industrial type intended for continuous heavy duty service.
 - .3 Motor to be protected with splash guard.
 - .4 Capacities
 - .1 Pump fluid: #2 fuel oil and fatty acid methyl esters (biodiesel) blends.
 - .2 Flow rate: Per manufacturer's recommendations for systems up to 10,000L.
 - .3 Combined motor and cabinet heater electrical requirements not to exceed 120V, single phase, 60Hz, 20A dedicated circuit.
 - .3 Filtration System
 - .1 Stainless steel or schedule 10 powder coated mild steel filter canister with replaceable filter element which shall:
 - .1 Extract free standing and emulsified water to 0.009% volume/volume.
 - .2 Remove particles down to 0.5 microns.
 - .3 Use covalent bonding technology to remove emulsified water and collect free water.
 - .2 The filtration system must work with low sulphur diesel (LSD), ultra-low sulphur diesel (ULSD) and fatty acid methyl ester (biodiesel) blends.
 - .3 Filter replacement is to be simple, convenient and easily accessible, requiring no disassembly of the system or enclosure.
 - .4 Internal Piping
 - .1 All internal piping to consist of CSA approved copper and stainless steel piping and meet ASME B31.3
 - .2 Stainless steel flex lines to be used to reduce pump vibration and noise.

- .3 Internal piping to include a visual flow indicator (sight glass).
- .5 Controller
 - .1 Programmable logic controller to ensure automatic fuel maintenance. Start and run time to be pre-programmed as per manufacturer recommendations for this system size (10,000L). The controller shall have the capability to be programmed on-site by qualified/trained personnel. The controller shall have the capability to detect the following faults:
 - .1 Spill inside of cabinet.
 - .2 High water level in filter canister.
 - .3 Differential pressure across the filter canister, requiring filter change.
 - .4 Low temperature detected inside of cabinet.
 - .5 High temperature detected at motor.
 - .6 High temperature detected at pump.
 - .2 All faults to input a fault warning to existing building management system (BMS) via single dry contact.
 - .3 All faults to shut down filtration system until fault is resolved, except low temperature.
 - .4 Controller to open/close supply piping solenoid valve at tank as required for system operation.
- .6 Auxiliaries
 - .1 Systems shall include drip tray at bottom of cabinet, pressure transmitters, switch over valves, oil filter pressure/vacuum gauges, temperature sensors, internal cabinet heater, visual flow indicator, 100-200 micron basket strainer on inlet side of pump.
- .7 Standard of Acceptance:
 - .1 Refuel Systems Incorporated RSI-5 Series

PART 3. EXECUTION

3.1 ABOVEGROUND FUEL TANKS

- .1 Install tanks and accessories in accordance with CAN/CSA-B139, National Fire Code of Canada, CCME PN 1326 and manufacturer's recommendations.
- .2 Position tanks using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.

- .3 Install tanks using installers certified by Nova Scotia Department of Environment.
- .4 Provide certification of installation to Departmental Representative.
- .5 Test tanks for leaks to requirements of authority having jurisdiction.
- .6 Where coating is damaged, touch-up with original coating material.
- .7 Install drop down piping in oil tanks for supply pipes. Size to match associated fuel pipe. Fill pipes and return pipes shall not have drop down piping installed.

3.2 LEVEL GAUGE SYSTEM

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

3.3 LEAK DETECTION SYSTEM

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

3.4 DOUBLE WALL ABOVEGROUND PIPING

- .1 Final installation shall be done in the presence of manufacturer's trained field representative.
- .2 The piping installation contractor shall be responsible for running a pull cable throughout the length of the secondary containment pipe using the built-in steel guide tubes. The pull cable shall be used to pull leak detection cable (by controls contractor).
- .3 Install piping in accordance with the directions furnished by the manufacturer. Test the secondary containment at 10 psig and product piping hydrostatically tested to 50 psig. Maintain test pressures for not less than 1 hour.
- .4 Keep the secondary piping clean and dry during the installation process.

- .5 Keep isolation valves and anti-siphon valves in enclosures. Enclosures shall drain to tank.
- .6 Aboveground piping shall be supported as indicated on drawings and such that they are not in direct contact with the ground.

3.5 UNDERGROUND DOUBLE WALL PIPING

- .1 Flexible double wall pipe shall be installed underground only and shall terminate in sumps.
- .2 Flexible piping shall be installed with bend radius not less than the radius prescribed by manufacturer.
- .3 Kinked sections of pipe shall be cut-off, discarded and never used.
- .4 Keep all piping, fittings and other components in original packaging until ready for use. Piping to be protected from impacts, vehicles and shall be stored such that they will not be subject to direct sunlight or other harmful environmental conditions.
- .5 Install piping using manufacturer supplied tools and fittings.
- .6 Continuous pipe lengths shall be used between sumps. All fittings shall be located inside sumps.
- .7 Ducted access piping shall be used for all underground piping to provide easy access to double wall pipe.
- .8 Flexible pipe shall enter transition sumps through sides, not less than 50mm from the bottom of the sump. Penetration into sump shall be sealed using manufacturer supplied boots. Seal shall be such that a leak in the primary piping will drain product into the transition sump.
- .9 Piping entry angle shall not be more than 15°.
- .10 Flexible piping shall be installed with a slope to drain into transition sumps in the event of a leak.
- .11 Ducted access piping shall be installed in pipe sleeves encased in concrete (by div. 03). Piping shall be sloped at a minimum rate of 2% to drain to nearest sump.

3.6 REMOTE FILL STATIONS

- .1 New tanks will be provided with a separate Remote Fill Station, as indicated on drawings, with single fill port connection.
- .2 Remote fill stations shall be anchored with four 13 mm anchors on the base plate. Drilling for anchors by the mechanical contractor.
- .3 Obtain and follow manufacturer's instructions.

3.7 SOLENOID VALVES

- .1 Install on highest point of supply line, orientation as shown on drawing. Solenoid valves shall be installed with strainers on inlet side, with a 100 mesh screen.

3.8 OIL-WATER SEPARATOR

- .1 Install in accordance with the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .2 Emergency shut off valve shall be located on the outlet side of the oil water separator
- .3 Maintain a slope of 2% towards the inlet of the Oil-Water Separator and a slope of 2% from the outlet of the Oil-Water Separator towards the catch basin.
- .4 Provide pump-outs on inlet and discharge side for drainage of Oil-Water Separator. Connect pump-out fittings with a riser pipe vertically to grade (no elbows). Install a spill box at grade. Construct riser such that any surface load cannot be transferred to the tank connection.
- .5 Provide vent for Oil-Water Separator. Vent pipe shall be 100mm sch.40 galvanized steel terminated 3,500 mm above grade with 100mm vent cap.
- .6 Install manway riser, riser street box and cover as per manufacturer's instructions.
- .7 Follow manufacturer's written instructions for installation of Oil Water Separator.

3.9 FROST BARRIERS

- .1 Follow manufacturer's installation instructions.
- .2 Verify that the insulation boards and adjacent materials are compatible.
- .3 Unfold bundles prior to application.
- .4 Apply continuous 6 mm beads of adhesive in a grid pattern. Apply adhesive fully around protrusions.
- .5 Place boards in a method to maximize contact with bedding. Stagger side and end joints. Butt edges and ends tight to adjacent boards.
- .6 Place folds at corners or transition points to provide continuous board installation and protection.

3.10 ELECTRONIC LEVEL TRANSMITTER

- .1 Radar Transmitter shall be mounted on a 100 mm ASME Class 150 flat faced flange with a 100 mm horn antenna.
- .2 Radar Transmitter shall be installed such that the end of the horn protrudes a minimum of 10mm below the inner tank wall. Use horn extension supplied by same manufacturer as Radar Transmitter as required.
- .3 Keep Emission Cone beam free from interference from pipes, I-beams or filling streams
- .4 Follow manufacturer's written instructions for installation of Radar Transmitter.
- .5 Wiring and integration of the Level Transmitter into the existing EMCS shall be the responsibility of the Controls Contractor.

3.11 OIL FLOWMETER

- .1 Oil Flowmeters shall not be installed in the vicinity of strong electromagnetic fields such as motors, pumps and transformers.
- .2 Avoid long drop lines downstream from the Flowmeter.

- .3 Flowmeters shall not be installed near the highest point of the system, where air/gas bubbles will be trapped. Install flow meter in low pipeline sections, at the bottom of a U-section in the pipeline.
- .4 Flowmeters shall be anchored to a steel frame using manufacturer supplied mounting brackets. Separate steel frames shall be used for multiple Flowmeter applications.
- .5 Wiring and integration of the Flowmeter into the existing EMCS shall be the responsibility of the Controls Contractor.

3.12 CONTAINMENT BOXES

- .1 Containment boxes shall be used to contain single wall above ground piping and accessories on fuel supply and return lines.
- .2 Transitions from schedule 40 piping to double wall above ground piping shall be inside containment boxes.
- .3 Containment boxes shall be bolted to fuel storage tank flanges and connection shall be epoxy coated.
- .4 Provide weather tight access door for access to isolation valves and anti-siphon valves.
- .5 Fillet weld aboveground double wall piping to inside and outside of containment box. Apply epoxy coating on welded surface.
- .6 Provide utility tank vent for pressure and vacuum relief as indicated on drawings.

3.13 STRAINERS

- .1 Strainers shall be installed in accordance with Manufacturers' instructions.

3.14 FUEL POLISHING SYSTEM

- .1 Onsite installations and commissioning shall be performed by manufacturer's authorized service representative. System is to be installed by approved installer in the Province of Nova Scotia.

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- .2 Manufacturer shall provide training and a customized operations and maintenance manual for the filtration system including the following:
 - .1 Inspection and testing of equipment.
 - .2 Filter element replacement.
 - .3 Preventative maintenance.
 - .4 Controller programming.
 - .3 The equipment being maintained is to be covered under the parts and labour warranty for a duration of 1 year. Manufacturer to guarantee that the equipment specified is capable of maintain the low sulphur, ultra-low sulphur and biodiesel blend.
 - .4 Any and all revisions or alterations to the fuel polishing system, piping and storage facility must follow manufacturer's recommendation or risk having warranty and guarantees voided.
 - .5 Manufacturer will make detailed inspection including photographs of completed installation prior to commissioning and store such documentation in a central database for reference. A copy shall be provided to the owner upon completion of installation and commissioning.
 - .6 Cost of 1 year's worth of filter cartridges will be included as part of this project.
 - .7 Manufacturer is responsible to obtain a fuel sample prior to start-up of the fuel filtration system and again six months after the system has been started. The sample is to be taken either from the bottom of the storage tank or the inlet of the fuel filtration system. Both the start-up sample and the six month sample must be taken from the same location using the same methodology. Results will be presented to the departmental representative.
 - .8 The fuel samples are to be analyzed for:
 - .1 Free standing water, saturated water and emulsified water using the Karl Fischer titration methodology.
 - .2 Particulate size analysis using the SEM methodology with results indicating particulates 0.25 micron and larger.
 - .9 Manufacturer is to provide an example of the particulate size analysis report as part of the tender package for evaluation. Cost of all sampling will be included as part of this project.

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