

1 GENERAL

1.01 WORK INCLUDED

- .1 This Section specifies requirements for construction of domestic water mains and services. Work includes supply, installation and testing of pipe, fittings and service connections, and disinfection.

1.02 RELATED SECTIONS

- .1 Excavating, Trenching and Backfilling: Section 31 23 10
- .2 Granular Base: Section 32 11 23

1.03 REFERENCES

- .1 ANSI/AWWA C900-2016, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. (100mm) Through 12 in. (300mm), for water distribution.
- .2 ASME B18.2.1-2012, Square, Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Heavy Flange, Lobed Head and Lag Screws.
- .3 ANSI/AWWA C515-2009, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
- .4 ANSI/AWWA C651-2014, Disinfecting Water Mains.
- .5 ASTM B418-16A, Standard Specification for Cast and Wrought Galvanic Zinc Anodes.
- .6 AWWA C110/A21.10-12, Ductile Iron and Gray Iron Fittings.
- .7 AWWA C111/A21.11-17, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- .8 AWWA C104/A21.4-16, Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water.
- .9 AWWA C153/A21.53-19, Ductile Iron Compact Fittings.
- .10 AWWA C905-16, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 100mm through 1500mm.
- .11 CSA B137-Series 17, Thermoplastic Pressure Piping Compendium.

- .12 Health Canada:
 - .1 Guidelines for Canadian Drinking Water Quality.
- .13 CAN/ULC S701-2011, Thermal Insulation, Polystyrene, Board and Pipe Coverings.
- .14 NFPA 13-2019, Standard for The Installation of Sprinkler Systems.
- .15 NFPA 14-2019, Standard for the Installation of Standpipe and Hose System.
- .16 NFPA 24-2019, Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- .17 NSF 61-2019, Drinking Water System Components.

1.04 SHOP DRAWINGS

- .1 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures for all pipe, fittings, valves, thrust restraint and all other items necessary for a complete installation. Include details showing dimensions and tolerances of pipe and joint proposed.

1.05 CERTIFICATES

- .1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section and the latest Guidelines for Canadian Drinking Water Quality as published by Health Canada.

1.06 HANDLING AND STORAGE

- .1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore. Do not damage coatings or linings.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.
- .3 Store valves to prevent retention of water and damage by freezing.

1.07 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

1.08 SCHEDULING OF WORK

- .1 Coordinate and organize work to minimize interruptions to existing services.

2 PRODUCTS

2.01 GENERAL

- .1 Diameter, material and strength class of pipe and fittings: as indicated.
- .2 Any material that comes in contact with drinking water must comply with NSF 61.
- .3 All fire service piping to be installed by licensed plumber or a sprinkler installer with a bronze certificate.

2.02 SERVICE PIPE AND FITTINGS

- .1 Pipe and Joints: as indicated to CAN/CSA B137.3, AWWA C900 or AWWA C905, cast-iron outside diameter, gasketed bell-end joint.
- .2 Fittings:
 - .1 PVC: to CAN/CSA B137.
 - .2 Gray or ductile-iron: to AWWA C110 and C153 cement mortar lined to AWWA C104, minimum pressure rating 1035 kPa for cast, 1720 kPa for ductile iron.
- .3 Trace Wire:
 - .1 RWU90, number 10 gauge (AWG), single stranded, insulated copper wire with 60mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial application or approved equivalent.
 - .2 Make all spliced or repaired wire connections in the tracer wire system or approved equivalent and waterproof using an approved buried service wire closure.
 - .3 Accessible by a tracer wire test location.
- .4 Gate Valve:
 - .1 Buried: to AWWA C515 up to 300mm, minimum working pressure rating 1380kPa and as follows:
 - .1 Body: cast-iron with mechanical joint ends.

- .2 Mechanism (AWWA C515): wedge disc with resilient rubber seat ring and machined seating surface, non-rising spindle, and O-ring seals.
- .3 Direction of opening: counter-clockwise.
- .4 Operating nut: 50mm square
- .5 Provide centering disc
- .2 Epoxy coat all gate valves with minimum 150 micron coating.
- .5 Valve Boxes:
 - .1 Cast-iron, slide type, adjustable for depth of pipe below finished grade or composite valve box.
 - .2 Covers marked "Water".
 - .3 Lugged to prevent turning and rolling of cover, and cover notched to suit.
- .6 Gaskets and Bolts for Flanges:
 - .1 Gaskets: unless otherwise specified, supply full face one piece red virgin rubber gaskets of 3mm thickness for all flange joints.
 - .2 Bolts: unless otherwise specified, all steel bolts and nuts to be American Standard threads of the coarse thread series, conforming to ANSI B18.2.1. Bolts, heads and nuts to be hexagonal. Length of any bolts to be such that it will not project beyond nut more than 10mm or less than 5mm and no bolt to be less than diameter of the hole in which it fits by more than 3mm. Bolts to be utilized for all flanged joints unless otherwise indicated. Studs or stub bolts may be used for certain connections only when approved by the Engineer.
- .7 Couplings: For joining pipes of dissimilar outside diameter.
 - .1 Casing: 304L Stainless Steel,
 - .2 Bars: 304L Stainless Steel,
 - .3 Bolts: 304 Stainless Steel, Metric socket head cap screw, Stainless Steel bolts coated to prevent galling.
 - .4 Inner steel plate: 304L Stainless Steel
 - .5 Rubber gasket: EPDM for water and sewer service, Temperature rating -4°F to 212°F
 - .6 Welds: GTAW welds. All welds fully passivated for enhanced corrosion resistance
 - .7 Product: Arpol REP by Robar Industries or equal.
- .8 Thrust Restraint:
 - .1 Mechanical Joint restraint device: (100mm to 600mm) ductile iron follower gland to AWWA C153 and C111 with multiple wedge restraining mechanism, minimum pressure working rating 2410 kPa and minimum safety factor of 2:1. Lugs to have twist-off torque nuts.

- .9 Insulation: to ULC S701, Type 4, extruded polystyrene.
- .10 Anode Packs: zinc anodes, to ASTM B418 as directed.

3 EXECUTION

3.01 PREPARATION

- .1 Clean pipes, fittings, valves and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.
- .2 Provide proper implements, tools and facilities approved by the Departmental Representative for the safe and convenient execution of the work. Take every precaution to prevent foreign material from entering the pipe.

3.02 TRENCHING, BEDDING AND BACKFILLING

- .1 Do trenching, bedding and backfilling to Section 31 23 10 and as specified on the drawings.

3.03 BURIED PIPE INSTALLATION

- .1 Lay and join pipe fittings, and valves 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: 150mm
 - .2 Vertical Alignment: 75mm
- .3 Face bell ends in direction of laying. On grades of 5% or greater lay pipe up grade.
- .4 Do not exceed maximum joint deflection recommended by manufacturer.
- .5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .6 Do not lay pipe and fitting when trench bottom is frozen, underwater or when trench conditions or weather are unsuitable.

- .7 Install gaskets in accordance with manufacturers published instructions. Use only lubricant supplied by manufacturer. During cold weather store gaskets in heated area to promote flexibility.
- .8 Align pipe before joining.
- .9 Support pipes as required to promote concentricity until joint is properly completed.
- .10 Keep pipe joints free from mud, soil, gravel or other foreign materials.
- .11 Avoid displacing gasket or contaminating with soil, petroleum products or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.
- .12 Completed each joint before laying next length of pipe.
- .13 Where deflection at joints is permitted, deflect only after spigot is fully inserted in bell.
- .14 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating and leave smooth beveled edge.
- .15 Provide concrete thrust blocks to undisturbed ground on all tees, bends, plugs, and caps or as indicated on Project Documents. Construct as indicated and keep joints and couplings free of concrete.
- .16 Install mechanical joint restraint to AWWA C111 and tighten lug nuts until all wedges are in firm contact with pipe surface. Continue to tighten alternating between bolts until lug nuts twists off.

3.04 VALVES AND VALVE BOXES

- .1 Install valves to manufacturer's recommendation at locations indicated. Joints and bedding as specified for pipe and fittings.
- .2 On direct buried valves, install valve boxes centered over operating nut, using centering disc, and true to line and grade.
- .3 Use thrust anchors for valves greater than 150mm on PVC and polyethylene pipe.

3.05 HYDROSTATIC AND LEAKAGE TESTING

- .1 Test all pipework for water tightness. All tests to be made in the presence of the Departmental Representative. Notify Departmental Representative twenty-four (24) hours in advance of testing.
- .2 Test pipework using potable water. Provide potable water as required.
- .3 The allowable leakage shall not be exceeded between adjacent valves.
- .4 Conduct tests on sections of pipeline as directed by the Departmental Representative.
- .5 Provide all labour, equipment and materials required to perform hydrostatic and leakage tests. All equipment used to be approved by the Departmental Representative before use.
- .6 Before testing confirm all relevant open ends are blanked off with watertight plugs or caps and all bends are adequately restrained.
- .7 Discharge test water through newly laid pipeline if a suitable outfall exists, or otherwise in accordance with the directions of the Departmental Representative.

3.06 TESTING PIPEWORK

- .1 Test pipework after backfilling.
- .2 Fill watermain, for testing. Pipeline to remain filled for not less than 24 hours prior to pressure test. Confirm all air is purged before starting pressure and leakage tests.
- .3 Gradually increase water pressure inside pipe until it reaches 1379 kPa at the lowest location under test. Maintain pressure test for two hours.
- .4 When testing is done during freezing weather, protect hydrants, valves, joint and fittings from freezing.
- .5 Measure leakage of water as measured by a water meter approved by the Departmental Representative.

$$Q = \frac{LD \sqrt{P}}{795,000}$$

Where Q = allowable leakage, in
Litres/hour.

L = length of pipe, m.
D = diameter of pipe, in millimetres.
P = average test pressure, in kilopascals.

- .6 Testing and submittals to meet requirements of NFPA 13 and NFPA 14.
- .7 The allowable leakage must not be exceeded between adjacent valves.
- .8 Replace, at no cost to Contract, all pipes, valves, fittings and couplings which are defective. Perform test at no cost to Contract until pipeline is approved by the Departmental Representative.
- .9 Underground fire water line shall be flushed, and shall be hydrostatically tested as specified herein and at 200 psi for 2 hours as required by NFPA 13 and NFPA 24.
- .10 As per NFPA 13, have all fire service piping installed by licensed plumber or a sprinkler installer with a bronze certificate.
- .11 As per NFPA 13 and NFPA 14 requirements, have test certificates for underground piping signed by the trades person responsible for the installation, and identify their trade and role adjacent to their signature.

3.07 FLUSHING

- .1 Flush and disinfect all water mains and services to ANSI/AWWA C651 and as specified. Notify the Departmental Representative four (4) days in advance of flushing and disinfection.
- .2 Flush water service laterals with potable water through available outlets with sufficient flow to produce minimum velocity of 1.5m/sec for a minimum 10 minutes. Flush until foreign materials have been removed and water is clear.
- .3 Slowly open and close valves and hydrants to ensure thorough flushing.
- .4 If satisfactory results cannot be achieved by flushing, swab pipes by approved methods and re-flush.

END OF SECTION

1 GENERAL**1.01 RELATED WORK**

- .1 Excavating, Trenching and Backfilling: Section 31 23 10

1.02 REFERENCES

- .1 ASTM A48/A48M-03(R2016), Standard Specification for Gray Iron Castings.
- .2 ASTM C478M-19, Specification for Precast Reinforced Concrete Manhole Sections.
- .3 ASTM C858-2019, Standard Specification for Underground Precast Concrete Utility Structures.
- .4 ASTM D3350-14, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .5 CSA A23.1/A23.2-2019, Concrete Materials and Methods for Concrete Construction.
- .6 CSA A3000-2018, Cementitious Materials Compendium.

1.03 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's test data and certification that materials meet requirements of this section. Include manufacturer's drawings, information, size of components, dimensions and details where pertinent.

2 PRODUCTS**2.01 MATERIALS**

- .1 Manholes and Catch Basins:
 - .1 Precast manhole and catch basin sections: to ASTM C478M, circular. Manhole top sections to be eccentric cone type where identified on Drawings. Precast concrete bases to be approved by Engineer.

- .2 Joints: to be made watertight using rubber O-rings.
- .3 Mortar:
 - .1 Cement: to CSA A3000.
- .4 Adjusting rings: precast concrete, to ASTM C478.
- .5 Frames and grates: to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
 - .2 Gray iron castings: to ASTM A48/A48M.
 - .3 Bearing surfaces to be ground to eliminate surface imperfections.
 - .4 Catch basin frames and grates: heavy duty municipal type for road service and as indicated on the drawings.
- .6 Bedding material: Class A as specified in Section 32 11 23.

3 EXECUTION

3.01 EXCAVATION AND BACKFILLING

- .1 Provide excavating and backfilling in accordance with Section 31 23 10.
- .2 Obtain approval of the Departmental Representative before installing, manholes or catch basins.
- .3 Inform the Departmental Representative at least 24 hours prior to beginning excavation and installation. Departmental Representative must be on site during these operations.

3.02 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete manholes as pipe laying progresses.
- .3 Dewater excavation as directed by the Departmental Representative and remove soft and foreign material before placing concrete base.
- .4 Set precast concrete base on 150 mm minimum of granular bedding compacted in accordance with Section 31 23 10.

- .5 Set riser sections on precast base and make joint watertight with O-ring gaskets. Grout joints inside and out with non-shrink grout.
- .6 Plug lifting holes with non-shrink grout.
- .7 Place stub outlets at elevations and in position indicated. Provide type of gasket connection as indicated.
- .8 Install frames and grates on applicable top sections to elevation shown on Drawings or as directed.
- .9 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

3.03 SYSTEM CLEANLINESS

- .1 Upon manhole adjustment, removal of catchment device and all works associated with restoration around the manhole, provide all testing equipment, labour, incidentals, traffic control, etc., required to undertake an inspection of the system to verify its cleanliness. Conduct inspection in the presence of the Departmental Representative.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 Facility Fuel Oil Piping: Section 23 11 13

1.02 REFERENCES

- .1 American National Standards Institute (ANSI).
 - .1 ANSI/NFPA-329-2020, Handling Underground Releases of Flammable and Combustible Liquids.
 - .2 ANSI/API 650-2013, Welded Steel Tanks for Oil Storage.
- .2 American Petroleum Institute (API).
 - .1 API RP 651-2014, Cathodic Protection of Aboveground Petroleum Storage Tanks.
 - .2 API STD 653-2014, Tank Inspection, Repair, Alteration, and Reconstruction.
- .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 Standards Association (CSA).
 - .1 B139.1-2019, Installation Code for Oil Burning Equipment.
- .5 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .6 The Master Painters Institute (MPI).
 - .1 Architectural Painting Specification Manual - 2015.
- .7 National Research Council/Institute for Research in Construction.
 - .1 NRCC 38727, National Fire Code of Canada (NFC)-2015.
- .8 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .9 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN/ULC-S663-11(R2016), Standard for Spill Containment Devices for Flammable and Combustible Liquid Aboveground Storage Tanks.
 - .2 CAN/ULC-S601-14, Aboveground Horizontal Shop Fabricated Steel Tanks.
 - .3 CAN/ULC-S602-14, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.

- .4 CAN/ULC-S661-10(R2016), Standard for Overfill Protection Devices for Flammable and Combustible Liquid Storage Tanks.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate details of construction, appurtenances, installation and leakage detection system.
- .3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturer's product data to supplement shop drawings.
 - .1 Size, materials and locations of ladders, ladder cages, catwalks and lifting lugs.
 - .2 Tanks capacity.
 - .3 Size and location of fittings.
 - .4 Environmental compliance package accessories.
 - .5 Decals, type size and location.
 - .6 Accessories: provide details and manufacturers product data.
 - .7 Size, materials and locations of railings, stairs, ladders and walkways.
 - .8 Finishes.
 - .9 Piping, valves and fittings: type, materials, sizes, piping connection details, valve shut-off type and location.
 - .10 Spill containment: provide description of methods and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck.
 - .11 Anchors: description, material, size and locations.
 - .12 Level gauging: type and locations.
 - .13 Ancillary devices: provide details and manufacturer's product data.
 - .14 Leak detection system, type and locations.
 - .15 Grounding and bonding: provide details of design, type, materials and locations.
 - .16 Corrosion protection: provide details of design, type, materials and locations.
 - .17 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations.
- .4 Provide maintenance data for tank appurtenances and leakage detection system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction 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 Steel 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 the Departmental Representative.
- .10 Dispose of unused paint or coating material at an official hazardous material collections site as approved by the Departmental Representative.
- .11 Do not dispose unused paint material must into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .12 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 TANKS: CONVENTIONAL STEEL

- .1 One tank of 3,800 L capacity, double wall (300° secondary containment) for diesel fuel storage.

- .2 Horizontal tanks: Diesel Tank to ULC-S601.
- .3 Connections: Sizes and quantities as indicated.
- .4 Railings, stairs, ladders and walkways: as indicated.
- .5 Finishes:
 - .1 Exterior of tank: Exterior coating: factory-applied, primer coat to CAN/CGSB-1.181 Ready Mix Organic Zinc-Rich Coating, two (2) coats of suitable corrosion resistant epoxy paint, and one (1) top coat of suitable polyurethane paint.
 - .2 Interior of tank: Protective coating in accordance with API RP 1631 from the tank bottom up to 1 m off the bottom.
- .6 Markings:
 - .1 The following information shall be incorporated on a corrosion resistant label permanently attached to the tank and located so as to be readily visible when installed.
 - .1 "DIESEL".
 - .2 "DO NOT LIFT OR TRANSPORT TANK CONTAINING PRODUCTS" (located at each lift lug or fork lift channel.)
 - .3 "CONSULT THE INSTALLATION INSTRUCTIONS OF THE MANUFACTURER AND AUTHORITY HAVING JURISDICTION".
 - .2 Tank shall be marked at the receptacle with the following international symbols at least 100 mm high in a contrasting color:
 - .1 No smoking.
 - .2 Combustible liquid.
 - .3 In addition to the markings identified in ULC-S601/652, attach the following labels to tank. NOTE: Clearly mark tank with the following information in letters at least 12 mm in height located as indicated:
 - .1 Located adjacent to all emergency interstice vents: "INTERSTICE EMERGENCY VENTING - DO NOT REMOVE".
 - .2 Located adjacent to the vacuum monitor device: "SECONDARY CONTAINMENT VACUUM MONITOR - DO NOT OPEN VALVE OR REMOVE VACUUM GAUGE. READING BELOW 42 KPA INDICATES A PROBLEM. CONTACT THE ORIGINAL TANK MANUFACTURER."
 - .3 Located adjacent to each lifting lug: "DOUBLE WALL TANK EMPTY -- KG (--TONS)."
 - .4 Located adjacent to each normal vent: "NORMAL VENT(S) SHALL BE INSTALLED PRIOR TO USE."
 - .5 Located adjacent to each emergency vent: "EMERGENCY VENT(S) SHALL BE INSTALLED PRIOR TO USE."
 - .6 Located adjacent to manufacturer's name plate, the tank identification number as obtained from storage tank registry.

2.02 ANCHORAGE

- .1 Two steel support saddles welded to tank drilled for hold down anchor bolts.

2.03 PIPING, VALVES AND FITTINGS

- .1 In accordance with Section 23 11 13 - Facility Fuel Oil Piping.
- .2 Vent opening c/w vent pipe (size and length as required).
- .3 Fill opening c/w fill tube, locking cap and spill containment device. Provide liquid and vapour-tight connection fittings.
- .4 Vacuum applied to interstitial space with vacuum gauge and pressure switch for connection to monitoring system. Switch to have both NC and NO contacts. Provide enclosure for protection of gauge and switch on tank.
- .5 Emergency vent.
- .6 Fill signal device. Provide a vent whistle on diesel tank that whistles when tank is being filled and stops when tank is full. Whistle to be installed on tank vent pipe.
- .7 Piping located below product level equipped with an automatic shut-off at storage tank.
- .8 Provide means for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.

2.04 LEVEL GAUGING

- .1 Tank gauging stick: to manufacturer's standard with gauge chart and tank mounted tube to store gauging stick.
 - .1 Mechanical direct reading device with protection guard.
 - .2 Gauge and gauge openings: protected against liquid overflow and possible liquid and vapour release.
- .2 Electronic solid-state type: combination tank level sensor and leak detector. Single or multiple tanks installation, and containment sump(s) monitoring where sumps are indicated on drawings.
 - .1 Monitor console containing visual LED display and algorithms to automatically compute required operation, battery backup. Capable of handling up to four (4) tanks, up to eight (8) sensors, complete with minimum of four (4) output relays and two (2) inputs. Probe diagnostics. Fuel delivery reports capable of Statistical Inventory

Reconciliation (SLR) capable of detecting a leak of 0.38 L/h with a probability of detection of 0.95 or greater and a probability of false alarm of 0.05 or less considered to be an annual test, and 0.76 L/h considered to be a monthly test. TCP/IP Communications module, level sensor module, and liquid sensor module. System to be programmable for:

- .1 Inventory reporting with following features:
 - .1 Litres of fuel remaining.
 - .2 Amount of water in bottom of tank.
- .2 Level probe: Factory calibrated and pre-set, corrosion resistant and fuel oil compatible materials, two (2) 75 mm polyurethane floats to monitor water and fuel oil, top mounted on tank, sized to suit tank.
- .3 Room leak detection: Non-discriminating two wire sensor for sensing presence of liquid on floor in area of fuel tank.
- .4 Alarm annunciator: Visual and audible alarm, non-hazardous location. Alarm silence/reset.
- .5 System shall provide visual and audible alarm for:
 - .1 Overfill.
 - .2 Low product.
 - .3 High water.
 - .4 Leaks.
- .6 Supply voltage: 120 VAC.

2.05 GROUNDING AND BONDING

- .1 To Section 26 05 00 - Common Work Results - Electrical.

2.06 SPILL CONTAINMENT

- .1 Spill Containment to ULC-S663.

2.07 PRODUCT TRANSFER

- .1 ASTs with normal vent and separate emergency vent.
 - .1 Liquid- and vapour-tight connection on fill pipes for flammable products.

3 EXECUTION

3.01 INSTALLATION

- .1 Install tanks in accordance with CEPA, CSA B139.1, National Fire Code of Canada, manufacturer's recommendations and CCME PN 1326.
- .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 licensed installers.
- .4 Provide certification of installation to Departmental Representative.

3.02 FIELD QUALITY CONTROL

- .1 Test tanks for leaks to requirements of authority having jurisdiction.

3.03 TOUCH-UP

- .1 Where coating is damaged, touch-up with original coating material.

3.04 LEVEL GAUGE SYSTEM

- .1 Provide leak and vapour proof caulking at connections.
- .2 Install in accordance with manufacturer's recommendations.
- .3 Install room leak detector in area below tank and test for operation.
- .4 Connect to fuel storage tank vacuum switch.
- .5 Calibrate system.
- .6 Program auxiliary inputs and output relays as indicated.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Electrical General Requirements: Section 26 05 00
- .2 Excavating, Trenching and Backfilling: Section 31 23 10

1.02 REFERENCES

- .1 Canadian Standards Association (CSA):
 - .1 CSA C22.2 No. 211.1-06(R2016), Rigid PVC (Unplasticized) Conduit.

2 PRODUCTS

2.01 PVC DUCTS AND FITTINGS

- .1 Rigid PVC ducts: to CSA C22.2 No. 211.2, with moulded fittings for direct burial.
- .2 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors of same product material as duct, to make complete installation.
- .3 Rigid PVC 90° and 45° bends.
- .4 Rigid PVC 5° angle couplings.
- .5 Expansion joints where conduits exit ground.

2.02 BEDDING

- .1 Bedding: sand as specified in Section 31 23 10 - Excavation, Trenching and Backfilling.

2.03 SOLVENT WELD COMPOUND

- .1 Solvent cement for PVC conduit joints.

2.04 CABLE PULLING EQUIPMENT

- .1 6 mm stranded polypropylene pull rope, tensile strength 5 kN, continuous throughout each conduit run with 3 m spare rope at each end.

2.05 MARKER TAPE

- .1 Plastic flagging tape, 50mm wide, clearly marked as follows:

- .1 "CAUTION - BURIED ELECTRICAL LINE", coloured red.

3 EXECUTION

3.01 INSTALLATION

- .1 Install direct buried underground cable ducts in accordance with the requirements of the authorities having jurisdiction.
- .2 Install duct in accordance with manufacturer's instructions.
- .3 Clean inside of ducts before laying.
- .4 Open trench before conduits are laid and confirm no obstructions will necessitate change in grade of conduit.
- .5 Confirm full, even support every 1.5m throughout duct length.
- .6 Install conduits at elevations and slope ducts with 1:400 minimum slope.
- .7 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .8 Pull through each duct mandrel not less than 300mm long and of diameter 6mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling in cables.
- .9 In each duct, install pull rope continuous throughout each duct run with 3m spare rope at each end.

3.02 MARKERS

- .1 Mark duct bank every 100m along the run and at any change in direction.
- .2 Where markers are removed to permit installation of additional duct banks or conduit, reinstall existing markers.
- .3 Connect concrete markers flat and centered over the duct bank run with the top flush with finished grade.

END OF SECTION