

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 20 00 – Concrete Reinforcement.
- .3 Section 03 30 00 - Cast-in-Place Concrete.
- .4 Section 31 05 16 – Aggregates for Earthwork.
- .5 Section 31 23 33.01 - Excavation, Trenching and Backfilling.
- .6 Section 33 56 13 – Aboveground Fuel – Storage Tanks

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International).
 - .1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.
 - .2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM C139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .4 ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D2240, Standard Test Method for Rubber Property-Durometer Hardness.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International).
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .3 CAN/CSA-A165 Series, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

- .4 CSA A3000 “Cementitious Materials Compendium”.

1.3 SUBMITTALS

- .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.4 SCHEDULING OF WORK

- .1 Submit schedule of expected interruptions for approval and adhere to approved schedule.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Cast-in-place concrete: to Section 03 30 00 - Cast-in-Place Concrete.
- .2 Concrete reinforcement: to Section 03 30 00 - Concrete Reinforcement.
- .3 Joints: to be made watertight using rubber rings.
- .4 Mortar:
 - .1 Aggregate: to CSA A82.56.
 - .2 Cement: to CAN/CSA-A8.
- .5 Adjusting rings: to ASTM C478M.
- .6 Concrete Brick: to CAN/CSA-A165 Series.
- .7 Steel gratings, I-beams and fasteners: as indicated.
- .8 Frames, gratings, covers to dimensions as indicated.
- .9 Granular bedding and backfill: in accordance with Section 31 05 16 –
Aggregates for Earthwork and following requirements:
- .10 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing, manholes or catch basins.

3.2 CONCRETE WORK

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

3.3 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .3 Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
- .4 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

3.4 LEAKAGE TEST

- .1 Install watertight plugs or seals on inlets and outlets of new tank and fill tank with water. Leakage not to exceed 0.3% per hour of volume of manhole.
- .2 If permissible leakage is exceeded, correct defects. Repeat until approved by Departmental Representative.
- .3 Departmental Representative will issue Test Certificate for passing test.
- .4 Provide copy certification of leakage test acceptance to Departmental Representative. Include certification in Commissioning Manual.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for water mains, valves, valve boxes, and valve chambers, including service connections.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 03 20 00 – Concrete Reinforcing.
- .4 Section 03 30 00 – Cast-in-Place Concrete.
- .5 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.3 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B301, Liquid Chlorine.
 - .2 ANSI/AWWA C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - .3 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75 mm through 1200 mm), for Water.
 - .4 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.
 - .5 ANSI/AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - .6 ANSI/AWWA C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
 - .7 ANSI/AWWA C500, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
 - .8 ANSI/AWWA C600, Installation of Ductile-Iron Water Mains, and Their Appurtenances.
 - .9 ANSI/AWWA C651, Disinfecting Water Mains.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .2 ASTM C117, Standard Test Method for Material Finer Than 75 [MU] m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C478M, Standard Specification for Precast Reinforced Concrete Manhole Sections, Metric.

- .5 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m³)).
- .3 American Water Works Association (AWWA)/Manual of Practice
 - .1 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
- .5 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A257 Series, Standards for Concrete Pipe.
 - .2 CSA A3000, Cementitious Materials Compendium
 - .3 CSA B137 Series, Thermoplastic Pressure Piping Compendium
 - .4 CAN/CSA-G30.18, Billet Steel Bars for Concrete Reinforcement.
 - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.4 SUBMITTALS

- .1 Inform Departmental Representative (DR) of proposed source of bedding materials and provide access for sampling at least four (4) weeks prior to commencing work.
- .2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least four (4) weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .3 Pipe certification to be on pipe.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.6 DELIVERY, STORAGE AND HANDLING

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

1.7 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to Departmental Representative (DR) for approval and adhere to interruption schedule as approved by Departmental Representative (DR).
- .3 Notify Departmental Representative (DR), building occupants, superintendent minimum of two (2) working days in advance of interruption in service.
- .4 Notify fire department of any planned or accidental interruption of water supply to hydrants.

- .5 Advise local police department of anticipated interference with movement of traffic.
- .6 Provide "Out of Service" sign on hydrant not in use.

Part 2 PRODUCTS

2.1 PIPE, JOINTS AND FITTINGS

- .1 Ductile iron pipe: to ANSI/AWWA C151/A21.51, pressure class 350, cement mortar lined to ANSI/AWWA C104/A21.4,
- .2 Joints and fittings for ductile iron pipe.
 - .1 Joints:
 - .1 Rubber gasket for mechanical pipe joints: to ANSI/AWWA C111/A21.11,
 - .2 Bolts, nuts, hex head with washers: to ASTM A307, heavy series.
 - .3 Ensure electrical conductivity across joints.
 - .2 Fittings:
 - .1 Mechanical joint cast iron and ductile iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10,
 - .2 Compact Fittings to ANSI/AWWA C153/A21.53,

2.2 VALVES AND VALVE BOXES

- .1 Gate valves: to AWWA C500, Latest Edition, standard iron body, bronze mounted double disc valves with non-rising stems. Suitable for 1 Pa with mechanical joints.
- .2 Valves to open counter clockwise and to be supplied with a square-sided operating nut, 51 mm to the side unless otherwise specified.
- .3 Cast iron valve boxes: bituminous coated screw type adjustable over minimum of 450 mm complete with valve operating extension rod, 30 mm minimum diameter, 25 x 25 mm cross section, of such length that when set on valve operating nut, top of rod will not be more than 150 mm below cover. Top of box to be marked "WATER".

2.3 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material to: Section 31 05 16 – Aggregates for Earthwork

2.4 BACKFILL MATERIAL

- .1 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.5 PIPE DISINFECTION

- .1 Liquid chlorine to ANSI/AWWA B301, to disinfect water mains.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651,

2.6 TOOLS AND EQUIPMENT

- .1 Provide Departmental Representative (DR) with following tools:

- .1 One tee-handle operating keys for valves.

Part 3 EXECUTION

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects to approval of Departmental Representative (DR). Remove defective materials from site as directed by Departmental Representative (DR).

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

3.3 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% of corrected maximum density to ASTM D698.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling with (*compacted bedding material, compacted Type 3, fill lean mix concrete*).

3.4 PIPE INSTALLATION

- .1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as permitted in 3.3.2.
- .2 Join pipes in accordance with manufacturer's recommendations.
- .3 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3.0 m.
- .5 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .6 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .7 Position and join pipes with equipment and methods approved by Departmental Representative (DR).

- .8 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .9 Align pipes before jointing.
- .10 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .11 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.
- .12 Complete each joint before laying next length of pipe.
- .13 Minimize deflection after joint has been made.
- .14 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .15 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative (DR).
- .16 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .17 Do not lay pipe on frozen bedding.
- .18 Do hydrostatic and leakage test and have results approved by Departmental Representative (DR) before surrounding and covering joints and fittings with granular material.
- .19 Backfill remainder of trench.

3.5 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of concrete blocks, located between valve and solid ground. Valves not to be supported by pipe.

3.6 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Departmental Representative (DR).
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints approved by Departmental Representative (DR).

3.7 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.

- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Departmental Representative (DR) at least two (2) working days in advance of proposed tests. Perform tests in presence of Departmental Representative (DR).
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or two (2) days if high early strength concrete is used.
- .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Departmental Representative (DR).
- .6 Upon completion of pipe laying and after Departmental Representative (DR) has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
- .7 Leave valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply hydrostatic test pressure of 1000 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.
- .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .16 Repeat hydrostatic test until defects have been corrected.
- .17 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 h.
- .18 Do not exceed allowable leakage of 0.03 L/mm diameter per 300 m of pipe, including lateral connections, per hour.
- .19 Locate and repair defects if leakage is greater than amount specified.
- .20 Repeat test until leakage is within specified allowance for full length of watermain.
- .21 Co-ordinate test procedure with Departmental Representative (DR) and provide certification of test acceptance.

3.8 PIPE SURROUND

- .1 Upon completion of pipe laying and after Departmental Representative (DR) has inspected work in place, surround and cover pipes as indicated.

- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 1.00 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % of corrected maximum density to ASTM D698.

3.9 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under footings, parking area and walks, compact backfill to at least 95% maximum density to ASTM D698.

3.10 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations shall be carried out by specialist contractor and witnessed by Departmental Representative (DR). Notify Departmental Representative (DR) at least four (4) days in advance of proposed date when disinfecting operations will commence.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed and water is clear.
- .3 Flushing flows as follows: 38 L/s minimum.
- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to satisfaction of Departmental Representative (DR) introduce a strong solution of chlorine as approved by Departmental Representative (DR) into watermain and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains.
- .8 Rate of chlorine application to be proportional to rate of water entering pipe.
- .9 Chlorine application to be close to point of filling water main and to occur at same time.
- .10 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.
- .12 Measure chlorine residuals at extreme end of pipe-line being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or recur during this period, repeat disinfecting procedure. Specialist contractor to submit certified copy of test results.

- .14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .15 Co-ordinate flushing disinfection with Departmental Representative (DR).
- .16 Provide certification of test acceptance.

3.11 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative (DR).

3.12 QUALITY ASSURANCE

- .1 Provide copies of all inspections and test results for Commissioning Manuals.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI).
 - .1 ANSI/NFPA-329, Handling Underground Releases of Flammable and Combustible Liquids.
 - .2 ANSI/API 650, Welded Steel Tanks for Oil Storage.
- .2 American Petroleum Institute (API).
 - .1 API RP 651, Cathodic Protection of Aboveground Petroleum Storage Tanks.
 - .2 API STD 653, Tank Inspection, Repair, Alteration, and Reconstruction.
- .3 ASTM International (ASTM).
 - .1 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
- .4 Canadian Council of Ministers of the Environment (CCME).
 - .1 CCME-PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- .5 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .6 CSA Group (CSA)
 - .1 CAN/CSA-B139, Installation Code for Oil Burning Equipment.
- .7 The Master Painters Institute (MPI).
 - .1 Architectural Painting Specification Manual.
- .8 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2015 (NFC).
- .9 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .10 Underwriters' Laboratories of Canada (ULC).
 - .1 ULC/ORD-C58.9, Secondary Containment Liners for Underground and Aboveground Tanks.
 - .2 ULC/ORD-C58.12, Leak Detection Devices (Volumetric Type) for Underground Storage Tanks.
 - .3 ULC/ORD-C58.14, Leak Detection Devices (Nonvolumetric Type) for Underground Storage Tanks.
 - .4 ULC/ORD-C58.15, Overfill Protection Devices for Underground Tanks.
 - .5 ULC/ORD-C107.4, Ducted Flexible Underground Piping Systems for Flammable and Combustible Liquids.

- .6 ULC/ORD-C107.7, Glass-Fibre Reinforced Plastic Pipe and Fittings.
- .7 ULC/ORD-C107.19, Secondary Containment of Underground Piping.
- .8 ULC/ORD-C142.23, Aboveground Waste Oil Tanks.
- .9 ULC-S601, Aboveground Horizontal Shop Fabricated Steel Tanks.
- .10 CAN/ULC-S602, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.
- .11 CAN/ULC-S603.1, Galvanic Corrosion Protection Systems for Steel Underground Tanks.
- .12 ULC-S630, Aboveground Vertical Shop Fabricated Steel Tanks.
- .13 ULC-S652, Tank Assemblies for Collection of Used Oil.
- .11 NACE International
 - .1 NACE International
 - .1 ANSI/NACE No. 13/SSPC-ACS-1-SG, Industrial Coating and Lining Application Specialist Qualification and Certification.

1.2 DEFINITIONS

- .1 An individual who performs surface preparation and application of protective coatings and linings to steel and concrete surfaces of complex industrial structures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate details of leakage detection system, appurtenances, construction, and installation.
- .3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturers product data to supplement shop drawings.
 - .1 Size, materials and locations of ladders, ladder cages, catwalks and lifting lugs.
 - .2 Tanks capacity.
 - .3 Size and location of fittings.
 - .4 Environmental compliance package accessories.
 - .5 Decals, type size and location.
 - .6 Accessories: provide details and manufacturers product data.
 - .7 Size, material and location of manholes.
 - .8 Size, materials and locations of railings, stairs, ladders and walkways.
 - .9 Finishes.
 - .10 Electronic accessories: provide details and manufacturers product data.
 - .11 Insulation types, locations and RSI values.
 - .12 Identification, name, address and phone numbers of corrosion expert where applicable. Note: Grading drawings to be stamped by licenced corrosion expert.
 - .13 Piping, 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.

- .14 Spill containment: provide description of method[s] and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.
- .15 Tank heaters: provide details and manufacturers product data.
- .16 Thermometers: provide details and manufacturers product data.
- .17 Anchors: description, material, size and locations.
- .18 Concrete: type, composition and strength.
- .19 Size and location of site pads.
- .20 Level gauging: type and locations, include:
 - .1 Reporting systems, types of reports and report frequency.
 - .2 Maximum number of tanks to be monitored.
 - .3 Number of probes required and sizes.
 - .4 Provide details and manufacturer's product data.
- .21 Ancillary devices: provide details and manufacturer's product data.
- .22 Leak detection system, type and locations, and alarm system.
- .23 Grounding and bonding: provide details of design, type, materials and locations.
- .24 Corrosion protection: provide details of design, type, materials and locations.
- .25 Field-erected AST overfill-protection systems: provide details of design, type, materials and locations.
- .26 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations.
- .4 Provide maintenance data for tank appurtenances [and leakage detection system] for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .5 Certificates:
 - .1 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

1.4 QUALIFICATIONS

- .1 Ensure that 50% of industrial coating, lining applications specialists, who perform concrete and steel surfaces preparation and coating applications, are certified by a recognized Applicator Certification Agency, in accordance with NACE 13/SSPC ACS-I, Applicator Certification Standard (ACS).
- .2 Maintain a current and valid ACS certification during project period.
 - .1 Application specialists who perform surface preparation and coating application work on this project must have a current ACS.
- .3 Notify Departmental Representative of any change in application specialist certification status.
 - .1 Any delays to the completion of the Project due to invalid certifications will not be considered, and liquidated damages shall not be waived for any non-performance by Contractor.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling, and reuse in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 TANKS: CONVENTIONAL STEEL

- .1 Tanks double wall, double bottom, self containing, dimensions as indicated.
- .2 Horizontal tanks: ULC-S601, complete with one Vacuum in interstitial space with vacuum gauge and vacuum switch. MPI #23
- .3 Tanks inside buildings: CAN/ULC-S602.
- .4 Large field erected tanks: ANSI/API 650.
- .5 Connections: 5 minimum. Sizes: as indicated.
- .6 Manholes: as indicated.
- .7 Railings, stairs, ladders and walkways: as indicated.

2.2 CONCRETE

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

2.3 PIPING, VALVES AND FITTINGS

- .1 In accordance with Section 23 11 13 - Facility Fuel Oil Piping.
- .2 Fibreglass-reinforced plastic pipe and fittings used for primary pipe in underground service designed, constructed and certified to ULC/ORD-C107.7.
- .3 Flexible pipe and fittings used for primary pipe in underground service designed, constructed and certified to ULC/ORD-C107.4.
- .4 Mechanical joints on buried primary piping is not permitted.
- .5 Piping located below product level equipped with either manual or automatic shut-off at storage tank.
- .6 Provide means for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.
- .7 Underground piping larger than 75 mm nominal diameter.
 - .1 Secondary containment with interstitial space leak detection.
 - .2 Precision leak tested in conformance with National Fire Code of Canada every two years beginning in fifth year of operation.

2.4 LEVEL GAUGING

- .1 Tank gauging stick: to manufacturer's standard.

- .2 Tank level gauging and indicator.
 - .1 Hydrostatic or Mechanical, remote reading device with 100 mm size dial.
 - .2 Gauge and gauge openings: protected against liquid overflow and possible liquid and vapour release.
- .3 Electronic solid state combination tank level sensor and leak detector: console containing visual LED display and printer algorithms to automatically compute required operations. System to be programmable for:
 - .1 Inventoring reporting with following features.
 - .1 Litres of fuel remaining.
 - .2 Temperature of fuel.
 - .3 Millimeters of water in bottom of tank.
 - .4 Millimeters of fuel in tank.
 - .2 Fuel delivery report.
 - .3 Single tank installation, interstitial space leak detection.
 - .4 Visual and audible alarm for:
 - .1 Overfill.
 - .2 Low product.
 - .3 High water.
 - .4 Theft.
 - .5 Leaks.
 - .5 Probe diagnostics.
 - .6 Leak tests.
 - .7 Probes and sensors: factory calibrated and pre-set to suit diameter of tank.
 - .8 Ancillary devices:
 - .1 Interface capability for monitoring and inventory reconciliation.
 - .2 Security key lock system to select normal operation, setup to enter or change system and tank parameters or operation, or diagnostics to check systems hardware and software.

2.5 LEAKAGE DETECTION SYSTEM

- .1 To ANSI/NFPA-329.
- .2 Leak detector: interstitial space gauge.

2.6 GROUNDING AND BONDING

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

2.7 CORROSION PROTECTION

- .1 Underground Piping.
 - .1 In accordance with Section CAN/ULC-S603.1 26 42 00.01 - Telethermics - Cathodic Protection.
- .2 Steel storage tank systems.

- .1 Cathodic protection installed to API RP 651, designed by corrosion expert.

2.8 TANK INSULATION

- .1 In accordance with Section 23 07 16 - HVAC Equipment Insulation.

2.9 OVERFILL AND SPILL CONTAINMENT

- .1 Shop-fabricated AST overfill protection.
 - .1 Automatic valve closure on product supply line, or automatic pump shut-off to terminate petroleum product flow upon detection of high levels in the storage tank.
 - .2 Overfill protection device compatible with intended method of filling designed, built and certified to with positive shut-off action ULC/ORD-C58.15.
 - .3 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.
 - .4 Storage tanks with capacity of 4,000 L or less.
 - .1 Visual monitoring and gauging for frequent monitoring throughout transfer operation permitting personnel to promptly shut down flow, or communicate immediately with person controlling delivery for shut down.

Part 3 Execution

3.1 INSTALLATION

- .1 Install tanks in accordance with [CAN/CSA-B139] and National Fire Code of Canada and 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 trained, licensed installers.
- .4 Provide certification of installation to Departmental Representative.

3.2 FIELD QUALITY CONTROL

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

3.3 TOUCH-UP

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

3.4 LEVEL GAUGE SYSTEM

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

3.5 LEAK DETECTION SYSTEM

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

END OF SECTION