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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 31 23 33.01 – Excavating, Trenching and Backfilling.

**1.2            REFERENCES**

- .1        ASTM International
  - .1        ASTM B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
- .2        American Water Works Association (AWWA)
  - .1        AWWA B301, Standard for Liquid Chlorine.
  - .2        AWWA C651, Standard for Disinfecting Water Mains.
  - .3        AWWA C500, Metal Seated Gate Valves for Water Supply Service.
  - .4        AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings.
  - .5        AWWA C153, Ductile Iron Compact Fittings.
  - .6        AWWA C515, Reduced Wall Resilient Seated Gate Valves for Water Supply Service.
  - .7        AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
  - .8        AWWA C800, Underground Services Line Valves and Fittings.
  - .9        AWWA C502, Dry Barrel Fire Hydrants.
- .3        Underwriters' Laboratories of Canada (ULC)
  - .1        CAN/ULC-S520, Standard for Fire Hydrants.
  - .2        CAN/ULC-S543, Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.
- .4        Newfoundland and Labrador Occupational Health and Safety Act.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.
- .2        Certification: to be marked on pipe.

**1.4            SCHEDULING OF WORK**

- .1        Schedule Work to minimize interruptions to existing services.
- .2        Submit schedule of expected interruptions for approval to Departmental Representative and authorities having jurisdiction.
- .3        Notify Departmental Representative and authorities having jurisdiction a minimum of 48 hours in advance of interruption in service.

- .4 Do not interrupt water service for more than 3 hours at a time.
- .5 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .6 Provide and post "Out of Service" sign on hydrant not in use.

## **Part 2 Products**

### **2.1 PIPE, JOINTS AND FITTINGS**

- .1 Water pipe: to AWWA C900, DR18 polyvinyl chloride (PVC) pipe.
- .2 All fittings to be ductile iron to AWWA C153.

### **2.2 VALVES**

- .1 Valves to open as per local standard.
- .2 Gate valves: to AWWA C515.
- .3 Valve boxes: to AWWA C500, cast-iron slide type. Covers marked "water" or "hydrant" as applicable.

### **2.3 TRACE WIRE**

- .1 RWU90, number 10 gauge (AWG), single stranded, insulated copper wire with 60 mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial application.
- .2 Make all spliced or repaired wire connections in the tracer wire system waterproof using approved buried service wire closure as per manufacture instructions.

### **2.4 THRUST RESTRAINTS**

- .1 Thrust blocks and anchors: 20 MPa concrete and 15M, Grade 400 reinforcing steel.
- .2 Mechanical joint restraint: ductile iron follower gland to AWWA C153 and C11 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.

### **2.5 ANODE PACKS**

- .1 Zinc anodes, to ASTM B418.

### **2.6 GRANULAR BEDDING AND BACKFILL**

- .1 As indicated on drawings and to Section 31 23 33.01 – Excavating, Trenching and Backfilling.

## **2.7 HYDRANTS**

- .1 Dry barrel type: to AWWA C502, NSF 61 and as follows:
  - .1 Depth of bury: as per pipe specification.
  - .2 Barrel: two-piece with safety break-away flange and break-away stem rod coupling.
  - .3 Main valve: compression type, minimum 134 mm (5.28") diameter.
  - .4 Inlet connection: mechanical joint, 150 mm (6") diameter.
  - .5 Nozzles: two hose and one pumper.
  - .6 Direction of opening: as per Town requirements.
  - .7 Operating nut: 32 mm (1-1/4") square.
  - .8 Colour: painted safety red.

## **2.8 PIPE DISINFECTION**

- .1 Liquid chlorine to ANSI/AWWA B301 to disinfect water mains.
- .2 Disinfect water mains in accordance with ANSI/AWWA C651.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
  - .1 Inspect materials for defects.
  - .2 Remove defective materials from site.

### **3.2 TRENCHING**

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Ensure trench depth allows coverage over pipe of 2.4 m minimum from finished grade. Where cover cannot be achieved, water line shall be insulated as indicated on drawings.

### **3.3 GRANULAR BEDDING**

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
- .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 98 % SPMDD to ASTM D698.

### 3.4 PIPE INSTALLATION

- .1 Lay pipes to manufacturer's standard instructions and specifications.
  - .1 Do not use blocks except as specified.
- .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.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - .2 Take up and replace defective pipe.
  - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .5 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
- .6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
  - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes with equipment and methods approved by Departmental Representative.
- .9 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.
- .10 Align pipes before jointing.
- .11 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.
- .12 Avoid displacing gasket or contaminating with dirt or other foreign material.
  - .1 Remove disturbed or contaminated gaskets.
  - .2 Clean, lubricate and replace before jointing is attempted again.
- .13 Complete each joint before laying next length of pipe.
- .14 Minimize deflection after joint has been made.
- .15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes.

- .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .19 Do not lay pipe on frozen bedding.
- .20 Do hydrostatic and leakage test and have results approved by Departmental Representative before fully surrounding and covering joints and fittings with granular material.
- .21 Backfill remainder of trench.

### **3.5 HYDRANTS**

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA M17.
- .3 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.
- .4 Place concrete thrust blocks ensuring that drain holes are unobstructed.
- .5 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.
- .6 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

### **3.6 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.

### **3.7 THRUST BLOCKS AND RESTRAINED JOINTS**

- .1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, and fittings and undisturbed.
- .2 Keep joints and couplings free of concrete.
- .3 Do not backfill over concrete within 24 hours after placing.
- .4 All valves, tees, plugs, caps, bends, reducers, and fittings to be installed with thrust blocks and mechanical restraints.

### **3.8 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 at least 48 hours in advance of proposed tests.
  - .1 Perform tests in presence of Departmental Representative.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
- .5 Test pipeline in sections not exceeding 365 m (1200') in length.
- .6 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
- .7 Leave hydrants, 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.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 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 leakage test pressure of 1035 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .14 No leakage is permitted by the test.
- .15 Locate and repair defects if leakage is observed.
- .16 Repeat test until defects have been corrected.

### **3.9 PIPE SURROUND**

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated on drawings.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .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 98 % SPMDD to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 98 % SPMDD to ASTM D698.

### 3.10 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated on drawings.
- .2 Do not place backfill in frozen condition.
- .3 Under roadways and walkways, compact backfill to at least 98 % SPMDD.
- .4 Place unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling in areas where bedding or backfill cannot be properly compacted.

### 3.11 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: witnessed by Departmental Representative.
  - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .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 water is clear.

- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

- .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, introduce strong solution of chlorine into water main 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 pipeline being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
  - .1 Take samples daily for minimum of 2 days.
  - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .15 After adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 hours.
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

### **3.12 GRANULAR TESTING**

- .1 Quality control testing of bedding, surround and backfill shall be carried out and paid for by the Contractor. Submit satisfactory compaction testing results to Departmental Representative for review and approval as results become available.
- .2 Testing shall be completed by an approved third-party materials testing agency. The testing agency shall determine the frequency of testing.

### **3.13 SURFACE RESTORATION**

- .1 After installing and backfilling over water mains, restore surface to match existing.

**END OF SECTION**



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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .3      Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2            REFERENCE STANDARDS**

- .1      CSA International
  - .1      CAN/CSA G401, Corrugated Steel Pipe Products.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product Data:
  - .1      Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.
- .3      Certification: to be marked on pipe.
- .4      Test and Evaluation Reports:
  - .1      Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.

**1.4            DELIVERY, STORAGE AND HANDLING**

- .1      Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2      Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3      Storage and Handling Requirements:
  - .1      Store materials in accordance with manufacturer's recommendations.
  - .2      Store and protect pipes from damage.
  - .3      Replace defective or damaged materials with new.
- .4      Packaging Waste Management: remove for reuse or return packaging materials accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

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**Part 2            Products**

**2.1                CORRUGATED STEEL PIPE**

- .1      Corrugated steel pipe: to CAN/CSA-G401.
- .2      Water-tight cut-off collars: as indicated.

**2.2                GRANULAR BEDDING AND BACKFILL**

- .1      Class A gravel in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                PREPARATION**

- .1      Temporary Erosion and Sedimentation Control:
  - .1      Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust off-site according to sediment and erosion control plan.
  - .2      Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3      Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.3                TRENCHING**

- .1      Do trenching Work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.
- .2      Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

**3.4                BEDDING**

- .1      Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

- .2 Place 150 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of SMPDD to ASTM D698.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated, free from sags or high points.
- .4 Place bedding in unfrozen condition.

### **3.5 LAYING CORRUGATED STEEL PIPE CULVERTS**

- .1 Begin pipe placing at downstream end.
- .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.
- .5 Do not allow water to flow through pipes during construction.

### **3.6 JOINTS: CORRUGATED STEEL CULVERTS**

- .1 Corrugated steel pipe:
  - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
  - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
  - .3 Insert and tighten bolts.
  - .4 Repair spots where damage has occurred to spelter coating by applying two coats of zinc rich epoxy paint.

### **3.7 BACKFILLING**

- .1 Backfill around and over culverts as indicated.
- .2 Place backfill material in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .3 Compact each layer to 95% SPMDD to ASTM D698 taking special care to obtain required density under haunches.
- .4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.
  - .1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
- .5 Place backfill in unfrozen condition.

**3.8 CLEANING**

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

**END OF SECTION**