

## **GENERAL**

### **1.1 RELATED REQUIREMENTS**

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

### **1.2 REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA B300-10, Standard for Hypochlorites.
  - .2 ANSI/AWWA B301-01, Standard for Liquid Chlorine.
  - .3 ANSI/AWWA B303-10, Standard for Sodium Chlorite.
  - .4 ANSI/AWWA C104/A21.4-08, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - .5 ANSI/AWWA C105/A21.5-10, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - .6 ANSI/AWWA C110/A21.10-08, American National Standard for Ductile-Iron and Gray Iron Fittings for Water.
  - .7 ANSI/AWWA C111/A21.11-07, American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.
  - .8 ANSI/AWWA C150/A21.50-08, Standard for Thickness Design of Ductile-Iron Pipe.
  - .9 ANSI/AWWA C151/A21.51-09, Standard for Ductile-Iron Pipe, Centrifugally Cast.
  - .10 ANSI/AWWA C153/A21.53-11, Standard for Ductile-Iron Compact Fittings.
  - .11 ANSI/AWWA C200-05, Standard for Steel Water Pipe – 6 Inch (150 mm) and Larger.
  - .12 ANSI/AWWA C203-08, Standard for Coal, Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied.
  - .13 ANSI/AWWA C205-07, Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 Ince (100 mm) and Large – Shop Applied.
  - .14 ANSI/AWWA C206-11, Standard for Field Welding of Steel Water Pipe.
  - .15 ANSI/AWWA C207-07, Standard for Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
  - .16 ANSI/AWWAC208-07, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
  - .17 ANSI/AWWA C600-10, Standard for Installation od Ductile-Iron Water Mains, and Their Appurtenances.
  - .18 ANSI/AWWA C602-11, Standard for Cement-Mortar Lining of Water Pipelines – 4 Inch (100 mm) and Larger.

- .19 ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.
- .20 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.
- .21 ANSI/AWWA C900-07, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch though 12 Inch (100 mm through 300 mm), for Water Transmission and Distribution.
- .2 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM A 53/A 53M-10, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
  - .2 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A 307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
  - .4 ASTM B 88M-05(2011), Standard Specification for Seamless Copper Water Tube Metric.
  - .5 ASTM C 117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .6 ASTM C 136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .7 ASTM D 698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .8 ASTM D 2310-06, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
  - .9 ASTM D 2657-07, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
  - .10 ASTM D 2992-06, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
  - .11 ASTM D 2996-01(2007)e1, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
  - .12 ASTM F 714-10, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
  - .13 ASTM C 618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- .3 American Water Works Association (AWWA)/Manual of Practice
  - .1 AWWA M11-2004, Steel Pipe - A Guide for Design and Installation.
  - .2 AWWA M17-2006, Installation, Field Testing, and Maintenance of Fire Hydrants.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

- .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquid.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA A3000, Cementitious Materials Compendium.
  - .2 CSA B137 Series, Thermoplastic Pressure Piping Compendium.
    - .1 CAN/CSA-B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
    - .2 CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .6 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - [current edition].
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S520-07, Standard for Fire Hydrants.
  - .2 CAN/ULC-S543-09, Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.

### **1.3 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Pipe certification to be on pipe
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Newfoundland and Labrador, Canada.
  - .2 Submit complete drawings and construction schedule for water mains 600 mm diameter and larger. Include method for installation of water main.
- .4 Samples:
  - .1 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
  - .2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 4 weeks minimum prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .5 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit 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.
  - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.
- .3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, valve boxes, valve chambers and hydrants for incorporation into manual.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: 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 in clean, dry, well-ventilated area.
  - .2 Store and protect water distribution piping from nicks, scratches, and blemishes.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse or disposal at an approved facility as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.6 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of 24 hours in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized.
- .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.

- .7 Advise local police department of anticipated interference with movement of traffic.

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

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

## **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 pipe.
  - .1 Joints:
    - .1 Push-on joints: to ANSI/AWWA C111/A 21.11.
    - .2 Rubber gasket for mechanical pipe joints: to ANSI/AWWA C111/A21.11.
    - .3 Rubber gasket for flange pipe joints to ANSI/AWWA C111/A21.11.
    - .4 Bolts, nuts, hex head with washers: to ASTM A 307, heavy series.
    - .5 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 Flanged cast iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10.
    - .3 Compact Fittings to ANSI/AWWA C153/A21.53.
  - .3 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 235 Psi, DR 18, 1 MPa gasket bell end, cast iron outside diameter
    - .1 CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket.
    - .2 Composite epoxy impregnated fibreglass PVC pipe to ASTM D 2996, class H. Unplasticized PVC core over wrapped with bonded fibreglass reinforced epoxy resin. Pressure class 300, 2.4 MPa with cast iron outside diameter and integral bell gasketed joints to ANSI/ASTM D2992. Material to ASTM D 2310, classification RTRP-11HZ-5001-PVC-13223.
    - .3 Cast iron fittings: to ANSI/AWWA C110/A21.10, and for pipe diameters larger than NPS 4

### **2.2 PIPE PROTECTION**

- .1 Provide means of protection for iron pipe in corrosive soils in accordance with ANSI/AWWA C105/A21.5.

## 2.3 VALVES AND VALVE BOXES

- .1 Valves to open counter-clockwise.
- .2 Gate valves: to ANSI/AWWA C500, standard iron body, resilient valves with non-rising stems, suitable for 1 Pa with mechanical joints.
- .3 Cast iron valve boxes: bituminous coated three piece, 125 mm diameter sliding type, adjustable over a minimum of 450 mm. Valve to have circular guide plate which fits over operating nut and prevents lateral movement of a valve box. Guide plate not to interfere with operation of valve or key. Base to be large round type with minimum inside diameter of 234 mm. Top of box to be marked "WATER".

## 2.4 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136, and ASTM C117, Sieve sizes to CAN/CGSB-8.1,
  - .3 Table:

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10
- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete. Minimum 28 day strength 25 Mpa.

## 2.5 PIPE DISINFECTION

- .1 Sodium hypochlorite, Calcium hypochlorite or Liquid Chlorine in accordance with AWWA B300-10 and AWWA B301-01 to disinfect water mains.
- .2 Swab all lines before disinfecting

- .3 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

## 2.6 HYDRANTS

- .1 Hydrants shall conform to the requirements of AWWA C502-14 and shall be ULC and Provincial Fire Marshall approved.
- .2 Post type hydrants in accordance with ULC CAN-S520-14; designed for maximum working pressure of system with two (2) 65 mm threaded hose outlets, one (1) 100 mm steamer port, 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main. Hydrants to open counter-clockwise, threads, outlets and operating nut to St. John's standard unless otherwise specified in the Unit Price Table.
- .1 Provide key operated gate valve located 1 m from hydrant unless otherwise specified in the Schedule of Quantities and Prices.
- .2 Paint hydrants in accordance with the following colour code:

<u>CHART</u>	<u>FLOW RATE</u>	<u>REFLECTIVE COLOUR</u>	<u>CGSB 1-GP-12C COLOUR</u>
	Under 38 l/s	RED	509-102
	38 to 75 l/s	ORANGE	208-103
	Over 75 l/s	GREEN	503-107

## 2.7 PIPE BEDDING MATERIALS

- .1 Granular material in accordance with Section 02223, for granular bedding.
- .2 Concrete required for cradles, encasement, supports, thrust blocks and cut-off walls all in accordance with Section 033300, strength 25 MPa.

## 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. Remove defective materials from site as directed by Departmental Representative.

### 3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 2.0 m from finished grade or as indicated.

- .3 Trench alignment and depth require Departmental Representative approval prior to placing bedding material and pipe.

### 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 Terminate building water service 1.5 m outside building wall opposite point of connection to main. Install flange adapter and or coupling necessary for connection to building plumbing. If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Lay pipes to manufacturer's standard instructions and specifications. Do not use Blocks.
- .3 Join pipes in accordance with manufacturer's recommendations.
- .4 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.
- .5 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 m.
- .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. 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. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced 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 or as otherwise approved by Departmental Representative.
- .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .18 Do not lay pipe on frozen bedding.
- .19 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
- .20 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 HYDRANTS**

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA M17.
- .3 Install 150 mm gate valve and cast iron valve box on hydrant services leads as indicated.

- .4 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 50mm above final grade.
- .5 Place concrete thrust blocks as indicated and specified, ensuring that drain holes are unobstructed.
- .6 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.
- .7 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.

### 3.7

#### **PRESSURE TEST**

- .1 After the pipe has been laid and backfilled and following the installation of service pipes and fittings, all newly laid pipe, or valve section thereof, shall be subjected to a hydrostatic pressure of 150% of normal operating pressure based on the elevation at the test gauge location or a minimum of 1000 kPa, whichever is greater, for a period of one (1) hour.
- .2 Each valved section of pipe shall be slowly filled with water and the test pressure shall be applied by means of pump connected to the pipe in a manner satisfactory to the Departmental Representative. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor.
- .3 Before applying the test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points the Contractor shall install corporation cocks at such points so the air can be expelled, the corporation cocks shall be closed, and the test pressure applied.
- .4 The pressure test shall be of a duration of at least two (2) hours and the pressure shall not vary by more than +/- 35 kPa.
- .5 Pressure testing of PE pipe to be carried out as per Manufacturer's recommendations.
- .6 Pressure testing of HDPE pipe
  - .1 Water is to be used as the pressure medium. Testing can be done before or after the pipe is placed in the trench. If the pipe must be backfilled before it is tested, the mechanical joints may be exposed for visual inspection during testing.
  - .2 Pipe should be tested at a pressure of 1.5 times the rated pressure of the pipe (1.5 times series number) at the lowest point in the system. To compensate for initial pipe stretch, a period of three (3) hours is required to pressurize the pipe plus one (1) hour during which time the required pressure is maintained before the test period is started. Unless a high-volume high pressure pump is used, it is sometimes difficult to raise the pressure within the allowable time.

- .3 After the completion of the initial expansion stage, i.e.: a total of four (4) hours, the pressure should be at the required level and the test period should commence. This period should not exceed three (3) hours. After the test period, a measured amount of make-up water should be added to return the pipe to the test pressure. The amount of make-up water should not exceed the allowance given in the following table:

Allowance for Expansion (Litres/100 metres of pipe)				
Nominal Pipe Size		1-hr Test	2-hr Test	3-hr Test
mm	(in.)			
75	(3)	1	2	4
100	(4)	2	4	5
150	(6)	4	7	11
200	(8)	6	12	19
250	(10)	10	16	26
275	(11)	12	25	37
300	(12)	14	29	42
350	(14)	17	35	52
400	(16)	21	41	62
450	(18)	27	53	81
500	(20)	35	68	99
550	(22)	43	87	130
600	(24)	56	111	168
700	(28)	68	138	209
800	(32)	87	178	267
900	(36)	112	224	335
1000	(40)	137	273	410
1100	(48)	186	335	534

- .4 Under no circumstances should the total time under test exceed eight (8) hours at 2 times the pressure rating. If the test is not completed because of leakage or equipment failure, the test section should be permitted to “relax” for eight (8) hours prior to the next testing sequence.
- .5 Testing for leakage can be done by developing the test pressure (described above) for a period of four (4) hours and then dropping the pressure by 69 kPa (10 psi). if the pressure remains steady for one (1) hour, this indicates that there is no leakage in the system.
- .7 All faulty or leaking connections shall be corrected at the Contractor’s expense.

### 3.8 LEAKAGE TEST

- .1 A leakage test shall be conducted concurrently with the pressure test. The Contractor shall supply all equipment necessary for the conducting of this test.
- .2 "Leakage" shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof, to maintain pressure within +/- 35 kPa of the test pressure after the air in the pipelines has been expelled.
- .3 No pipe installation will be accepted if the leakage is greater than the allowable leakage for joints plus the allowable leakage for closed metal seated valves.
- .4 Allowable leakage for joints is calculated as follows:

$$L = \frac{N D (P)^{0.5}}{128}$$

where:

L = the allowable leakage in l/h

N = the number of joints in the length of the pipeline tested

D = the nominal diameter of the pipe in metres

P = the average test pressure during the leakage test in kilopascals

- .5 Allowable leakage for closed metal seated valves shall be 0.00121 l/h/mm of nominal valve size.
- .6 If any test of pipe discloses leakage greater than the allowable, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance. All joints until leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

### 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.
- .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.

### **3.10 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.

### **3.11 HYDRANT FLOW TESTS**

- .1 Conduct flow tests on every hydrant to determine fire flows prior to painting hydrant caps and ports.

### **3.12 PAINTING OF HYDRANTS**

- .1 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

### **3.13 FLUSHING AND DISINFECTING**

- .1 Flushing and disinfecting operations shall be carried out by specialist contractor and witnessed by Departmental Representative. Notify Departmental Representative at least 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 introduce a strong solution of chlorine as approved by Departmental Representative 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.
- .16 Provide certification of test acceptance.

**3.14 SURFACE RESTORATION**

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

**3.15 QUALITY ASSURANCE**

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

**END OF SECTION**