

**Part 1 General**

**1.1 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submit to Departmental Representative at least 2 weeks prior to beginning work, samples of granular bedding and pipe surround materials proposed for use.
- .4 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 2 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .5 Pipe certification to be on pipe.
- .6 Submit current and complete documentation of the welder's qualifications prior to the commencement of welding.

**1.2 CLOSEOUT SUBMITTALS**

- .1 Provide in Operation and Maintenance Manuals data 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 in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide record drawings in accordance with Section 01 78 00 - Closeout Submittals. Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material for recycling in accordance with Waste Management Plan.
- .3 Separate for recycling and place in designated containers Steel, Metal and Plastic in accordance with Waste Management Plan
- .4 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA and Regional and Municipal regulations.
- .6 Transfer unused metal and wiring materials from site to a metal recycling facility as approved by Departmental Representative.

- .7 Transfer unused concrete materials from site to a local facility as approved by Departmental Representative.
- .8 Transfer unused asbestos cement pipe in accordance with regulations governing disposal of hazardous materials.
- .9 Transfer unused aggregate materials from site to a facility for reuse as approved by Departmental Representative.
- .10 Dispose of unused disinfection material at official hazardous material collections site approved by Departmental Representative.
- .11 Do not dispose of unused disinfection material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.
- .12 Fold up metal banding, flatten and place in designated area for recycling.

#### **1.4 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of 7 days in advance of interruption in service.
- .4 Where work involves breaking into or connecting to existing services, give RCMP/PWGSC 7 days of notice for necessary interruption of water service throughout course of work. Keep duration of interruptions to a minimum. Carry out interruptions after normal working hours of occupants (16:30 hours) and preferably on weekends. If interruption of the water service is planned for longer than 4 hours, provide temporary service to the facility via an alternate source.
- .5 Interruption of water service for any period of time will require the provision of temporary washroom facilities. The requirement for temporary washroom facilities varies per building. The contractor is responsible for coordination with RCMP representatives, scheduling and administering supply and maintenance of the temporary washroom facilities.
- .6 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .7 Provide "Out of Service" sign on hydrant not in use.
- .8 Advise RCMP of anticipated interference with movement of traffic.

#### **Part 2 Products**

##### **2.1 PIPE**

- .1 High-density Polyethylene (HDPE)

- .1 The pipe shall be made from polyethylene resin compound with a minimum cell classification of PE 345464C for PE 3408 materials in accordance with ASTM D 3350. This material shall have a Long Term Hydrostatic Strength of 1600 psi when tested and analyzed by ASTM D2837, and shall be a Plastic Pipe Institute (PPI) listed compound.
  - .2 The raw material shall contain a 2% - 3% well dispersed, carbon black. Additives that can be conclusively proven not to be detrimental to the pipe may also be used, provided the pipe produced meets the requirements of this standard.
  - .3 The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification and from the same raw material supplier.
  - .4 Compliance with the requirements shall be certified in writing by the pipe supplier, upon request.
  - .5 Dimension ratio (DR) of all HDPE water mains shall be DR17.
- .2 Polyvinyl Chloride (PVC)
- .1 Sizes 300 mm and smaller – pipe certified to CSA B137.3 and NSF 61 and conforming in all respects to ANSI/AWWA C900 latest edition Class 150 pipe.
  - .2 For PVC pipe to be installed by open excavation methods, use IPEX Blue Brute or approved equal. For PVC pipe to be installed by horizontal directional drilling (HDD) methods, use IPEX Terra Brute or approved equal.
  - .3 Gaskets shall be standard gaskets recommended for typical water main applications where cast iron sized pipe is being used. Nitrile gaskets shall be used for water mains buried in soil with hydrocarbon contamination.
  - .4 Push-On joint gasket lubricant acceptable to the pipe manufacturer shall be non-toxic, water soluble and approved for use in contact with potable water by the National Sanitation Foundation (NSF).
  - .5 Approved pipe manufacturers are:
    - .1 IPEX
    - .2 Royal Pipe Systems
    - .3 Rehau
  - .6 PVC double bell end pipe certified to CSA B137.3 and conforming in all respects to ANSI/AWWA C900 latest edition for Class 150 pipe. Manufacture pipe with integral wall thickened bell ends complete with factory installed gaskets in one continuous process. Modification of normal bell and spigot pipe to double bell pipe is not allowed.
    - .1 Pipe laying lengths of 3.05 or 6.1 metres.
    - .2 Bell ends machined to ensure right angles with the inside and outside walls of the pipe and uniform contact between adjoining double bell end pipes.
    - .3 Short lengths of PVC pipe to act as connection spools for joining double bell end pipe sections. Length of connection spools to be twice the normal insertion length for spigot end of standard bell and spigot pipe. Bevel on both ends of spools to be standard 15 degree chamfer angle. Insertion stop mark on the end of each connection spool.
    - .4 Do not use PVC pipe that is more than 24 months old.

- .3 Stainless Steel (SS)
  - .1 All pipe sizes to be Austenitic stainless steel to ASTM A312 Grade TP316, Sch. 10S.
  - .2 Fittings:
    - .1 50 mm & less: Forged stainless steel to ASTM A182, F316, ANSI B16.11, Class 3000, socket weld.
    - .2 65 mm and up: Austenitic stainless steel to ASTM A403, CR316, MSS-SP-43, Sch. 10S, Butt-weld.
  - .3 Flanges:
    - .1 15 mm to 50 mm: Forged stainless steel to ASTM A182 F316, ANSI B16.5
    - .2 65 mm and up: Austenitic stainless steel stub ends, Type A MSS length with galvanized carbon steel back-up flange ASTM A403 CR316, MSS-SP-43, Sch. 10S, Butt weld.
  - .4 For schedule rated stainless steel pipe smaller than 75 mm in diameter, socket-weld pipe. Where disassembly is required, use threaded unions.
  - .5 For thin wall or schedule rated stainless steel pipe equal to or greater than 75 mm in diameter, butt-weld pipe unless otherwise shown or specified.
- .4 Copper
  - .1 Tubing to be to ASTM B88M Type K, annealed.
  - .2 For copper or brass piping, use soldered couplings. Where disassembly is required, use compression unions.
    - .1 Soldered couplings for copper pipe conform to ANSI B16.26. Solder to be lead free conforming to ASTM B32 and the Plumbing Code.

## 2.2 FITTINGS

- .1 HDPE
  - .1 Polyethylene fittings for use with the pipe shall be heat fusion fittings made of the same material of the pipe and be completely fibreglass reinforced as required to achieve at least the same pressure rating as the pipe to which it is to be joined.
  - .2 Flanged fittings shall comprise of a flange adapter, butt fused to the pipe end, together with a slip on flange which shall comply with ANSI B16.5 bolt circles for the highest rating for the pipe size and shall be manufactured from ductile iron and epoxy coated.
- .2 Cast Iron
  - .1 To be used only for 250 mm diameter and larger.
  - .2 Cast conforming to the latest edition of AWWA/ANSI C110.
  - .3 Push-on joint with a working pressure rating of 1.74 MPa (250 psi).
  - .4 Gasket material suitable for potable water.
  - .5 Exterior asphaltic coated per AWWA/ANSI C110, Latest Edition.
  - .6 Interior epoxy lined to a minimum thickness of 300 microns (12 mils) with a non-coal tar based epoxy certified for use in potable water, and recommended by the coating manufacturer for the service. Prepare surfaces and apply lining in strict accordance with the manufacturer's instructions.
- .3 PVC

- .1 200 mm and smaller – injection-molded PVC tees, crosses, wyes and bends certified to CSA B137.2 latest revision and in full compliance with ANSI/AWWA C907 latest revision for a working pressure of 1500 kPa (220 psi).
- .2 Fittings shall be manufactured by:
  - .1 IPEX Inc.
  - .2 Harrington Corporation (HARCO).
- .4 Joint Restraints
  - .1 Restraint devices shall incorporate a series of machined serrations on the inside diameter to provide proper restraint and contact with the pipe.
  - .2 Restraint bodies shall be manufactured of high strength Ductile Iron, ASTM A536, Grade 64-45-2.
  - .3 Bolts shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11.
  - .4 Restraint systems shall meet or exceed the requirements of UNI-B-13-92.
  - .5 Models 1300, 1350, 1360 and 1390 as manufactured by:
    - .1 Uni-Flange
- .5 Thread Compound
  - .1 Teflon tape or a Teflon based liquid approved for use in contact with potable water by the National Sanitation Foundation (NSF).
- .6 Nuts and Bolts
  - .1 Provide hex head bolts and nuts. Threads to be ANSI B1.1, standard coarse thread series.
  - .2 Stainless steel bolts and nuts on direct buried or submerged applications conforming to ASTM A193 Grade B8 or B8M.
  - .3 Exposed services – carbon steel bolts conforming to ASTM A307 Grade B7. Carbon steel nuts conforming to ASTM A307 Grade 2H, semi-finished hex head. Bolts and nuts to be electroplated with zinc per ASTM B633-latest edition, Type I coating. Hot dip galvanizing is not acceptable.
  - .4 Provide hex nuts equal to or less than 25 mm. Greater than 25 mm, provide heavy hex.

## **2.3 TAPPING SLEEVES**

- .1 Tapping Sleeves
  - .1 Tapping sleeves shall be split body, full circle type with body, stub pipe and flange constructed of fully passivated T304 stainless steel with BUNA-N ringseal and BUNA-S liner. Inside diameter of outlet connection to be at least equivalent to that of standard weight steel pipe of the same nominal size. Sleeve bolts and nuts to be stainless steel to ASTM A193/A194-B8 or B8M. Threads to be teflon coated. Outlet flange 150 lb ANSI, flat faced. ROBAR Series 6606 or ROMAC SST or as approved.

## **2.4 COUPLINGS AND ADAPTORS**

- .1 For coupling HDPE to HDPE, use flanged connections or electrofusion type couplings in accordance with ASTM F1055. Electrofusion couplings shall be made of the same material of the pipe and be completely fibreglass reinforced as required to achieve at least the same pressure rating as the pipe to which it is to be joined.

- .2 For coupling HDPE to PVC, use restrained compression sleeve type couplings with epoxy lined and coated ductile iron body and built-in wedge-action restraining glands. Provide internal wall stiffeners for restraining HDPE pipe. Approved products:

- .1 EBAA Series 3800

## 2.5 VALVES

- .1 Gate Valves – 75 to 600 mm inclusive to be iron body, resilient seated with materials, manufacturing and performance in full compliance with the latest edition of ANSI/AWWA C509.

- .1 End connections and operators to be fully compatible with the service, location of installation and pipe to which the valve is being attached.
  - .2 Direct buried valves to have a non-rising stem with a 50 mm square AWWA standard wrench nut and open with a counter clockwise rotation.
  - .3 Direct buried valves to have stainless steel bolting and exterior asphaltic or fusion bonded epoxy coating suitable for direct bury service.
  - .4 All bronze or brass components to conform to Section 2, Table 1, Grade A, D or E with stem material of Grade E as published within ANSI/AWWA C509 latest edition.
  - .5 Approved Products:
    - .1 Mueller
    - .2 Clow

## 2.6 WATER SERVICE CONNECTIONS

- .1 Water Service Pipe

- .1 Piping for building water services shall be in accordance with the following table and be CSA certified:

Service Size (mm)	Material	Standard	Minimum Rating
All Sizes 50 mm and smaller	Copper-Type K Soft Drawn	CSA HC66 AWWA C800	1100 kPa (160 psi)
All sizes 65 mm and smaller	HDPE	AWWA C901 PE4710	1100 kPa (160 psi)

- .2 Service Saddles

- .1 Full circle type, constructed of fully passivated T304 stainless steel with BUNA-N or EPDM gaskets and T304 stainless bolts with rolled threads and nuts. ROBAR Series 2600 or as approved

- .3 Repair Clamps

- .1 Constructed of fully passivated T304 stainless steel with BUNA-A or EPDM gaskets and 304 stainless steel bolts with rolled threads and nuts. ROBAR Series 5600, ROMAC Style SS2 or as approved.

- .4 Unions
  - .1 Standard brass compression type, adaptable to the size and type of pipe used. Ford, Mueller, Cambridge Brass or as approved.
- .5 Curb Stops and Boxes
  - .1 50 mm and smaller
    - .1 Bronze or brass body, stop and waste design, globe or ball style, with compression type end connections designed for the specific pipe types being joined. Mueller Type H 15219, Mueller Type H15182, Ford Model B44, Cambridge Brass model 203 or as approved.
    - .2 Curb boxes and top extensions – Sch. 40 Type 304 stainless steel pipe complete with polymer boot.
    - .3 Curb box covers – Mueller Type A808 ribbed cover complete with standard pentagon plug No. 143469 or as approved
    - .4 Curb box rods – Type 304 L stainless steel, 13 mm diameter with standard pigtail to fit standard 25 mm I.D. curb box.
    - .5 Cold forge u-shape complete with hole for brass cotter pin to fit 20 mm to 50 mm curb stop
- .6 Corporation Stops
  - .1 Corporation stops shall be: Mueller Type H 115008, for sizes 25 mm and smaller and 25008 for sizes 40 mm to 50 mm; Ford Model F1000 or FB1000; Cambridge Brass Model 301; or as approved. Standard brass or bronze construction with Mueller tapping thread and compression type joint compatible with type of pipe used.
  - .2 Corporation stops on service sizes 75 mm and larger shall be resilient seated gate valves and shall be the same size as the service lines.
- .7 Tapping Machine
  - .1 Tap water mains using a Mueller Model B-100, Model B-101, Model A3, Ford Model 77 or as approved.

## **2.7 FLANGE GASKETS**

- .1 Flange gaskets to be cloth inserted red rubber or other material conforming to the latest edition of ANSI/AWWA C207, Non-metallic, non-asbestos and approved for use with potable water.
- .2 Ring type gaskets for raised face flanges.
- .3 Full face gaskets for flat faced surfaces.
- .4 Gasket thickness as follows:
  - .1 100 mm to 600 mm – 1.6 mm thick
  - .2 750 mm to 1800 mm – 3.2 mm thick
- .5 Where petrolatum primer may be in contact with gasketed fittings, gaskets shall be BUNA-N, NEOPRENE or as recommended by the pipe manufacturer.

## **2.8 VALVE BOXES AND COVERS**

- .1 127 I.D. x 6 W.T. Schedule 40 PVC lower section as manufactured by IPEX Inc. or approved equal.
- .2 1200 or 760 long x 150 I.D. x 11 W.T. "Type A" cast iron upper valve box section and appurtenances as detailed.
- .3 Cast iron upper valve box, covers, extensions and lifter rings as manufactured by:
  - .1 Titan Foundries
  - .2 Norwood Foundries
  - .3 WD Valve Boxes Ltd.
  - .4 Sigma Corporation
  - .5 Approved equal
- .4 Top of box to be marked "WATER"/"EAU"

## **2.9 CONCRETE FOR THRUST BLOCKS**

- .1 Concrete mix in accordance with Section 03 30 00.01 Cast-In-Place Concrete.

## **2.10 PIPE LOCATING**

- .1 Tracer Wire:
  - .1 Type: 12 Gauge Copper Wire with 30 mil polyethylene jacket design specifically for buried use.
  - .2 Tracer wire shall be installed for all pipe, including those sections installed by open trench and directional drilling.
  - .3 Direct buried connector splices: 3M DBY/DBR wire
  - .4 Bring to surface at surface splice boxes as indicated.
  - .5 Surface splice box: Carson Industries #910 Junction

## **2.11 METERING VAULT**

- .1 Precast concrete sections to ASTM C478M. Ladder rungs to be cast integral with unit; field installation not permitted.
- .2 Access Hatch
  - .1 Installation: cast-in-place
  - .2 Materials:
    - .1 Members: aluminum
    - .2 Plate: aluminum checker plate
  - .3 Options: hold-open-arms, flush sealed lift handle and lockable
  - .4 Size: 750 mm x 750 mm (30"x30")
  - .5 Approved Manufacturer:
    - .1 MSU
    - .2 East Jordon
- .3 Jointing materials:
  - .1 Manufacturer's rubber ring gaskets.
  - .2 Mastic joint filler.



- .3 Cement mortar.
- .4 Combination of above types.
- .4 Mortar: aggregate to CSA A82.56, masonry cement to CAN/CSA-A8.
- .5 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CAN/CSA-G30.18, hot-dipped galvanized after fabrication to CAN/CSA-G164. Rungs to be safety pattern.
- .6 Sump Pump:
  - .1 Approved products:
    - .1 Flygt Ready 8

## **2.12 CORROSION PROTECTION**

- .1 Provide means of protection for all cast iron appurtenances in corrosive soils to ANSI/AWWA C105/A21.5
- .2 Sacrificial Anode Materials
  - .1 Anode(s) to be 5.4 kg (12 lb.) packaged zinc anodes complete with #6 three metre lead.
  - .2 Cadweld to be 25 gram "Erico" specification CA25XF-19 (there exists CA25XF-19 but not CS25XF-19) or as approved. A #6 copper sleeve crimped to anode lead is required prior to cadwelding. Cadweld mould "Erico" specification CAHBA-1H or as approved.
  - .3 Eyelets to be 16 mm (5/8") or 20 mm (3/4") copper stud #6 cable eyelet.
- .3 Protective Tape Coating
  - .1 Petrolatum primer and cold applied petrolatum tape conforming to AWWA C217 latest edition – (Cold –Applied Petrolatum Tap and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections and Fittings for Steel Water Pipeline). Approved product, Denso Paste and Denso tape.
  - .2 Store, handle and apply coating materials according to the manufacturer instructions.

## **2.13 PIPE BEDDING, SURROUND AND BACKFILL MATERIAL**

- .1 In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## **2.14 PIPE DISINFECTION**

- .1 Sodium hypochlorite, Calcium hypochlorite or Liquid chlorine to ANSI/AWWA B300, ANSI/AWWA B301 or ANSI/AWWA B303 to disinfect water mains.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

## **2.15 MODULAR SEAL**

- .1 Seal Element: EPDM (Black)
- .2 Pressure Plates: Reinforced Nylon Polymer
- .3 Bolts & Nuts: 316 Stainless Steel (Metric)

- .4 Temp. Range: -40 to +250°F (-40 to +121°C)\*
- .5 Approved Product:
  - .1 Link-Seal, Pipeline Seal and Insulator, Inc. Supplied by Wolseley Engineering Sales Phone 1-888-931-9901.

## **2.16 STRUCTURAL ATTACHMENTS - PIPE HANGERS AND SUPPORTS**

- .1 Concrete anchors to be suitable for intended use and designed for all loading conditions. Approved manufacturers are Hilti Canada Ltd., Ramset Fastening Systems, Superior Concrete Accessories, Ucan Fastening Products, USE Diamond, Concrete Chemicals Keystone and Williams Canada Ltd.
- .2 Where piping, fittings, supports and hangers are galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m<sup>2</sup>.

## **Part 3 Execution**

### **3.1 PREPARATION**

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

### **3.2 EXCAVATION AND 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 2.74 m (9') from finished grade or as indicated.
- .3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

### **3.3 HORIZONTAL DIRECTIONAL DRILLING**

- .1 Do work in accordance with Section 31 23 33.02 - Horizontal Directional Drilling.
- .2 Ensure cover pipe of not less than 2.74 m (9') from finished grade or as indicated.
- .3 Proposed alignment and depth require Departmental Representative's approval prior to drilling.

### **3.4 CONCRETE BEDDING AND ENCASEMENT**

- .1 Do concrete work in accordance with Section 03 30 00.01 - Cast-in-Place Concrete.
  - .1 Place concrete to details as indicated or as directed by Departmental Representative.

- .2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placing.

### 3.5 UNDERGROUND PIPE INSTALLATION

- .1 General
  - .1 Handle pipe by methods approved by Departmental Representative recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
  - .2 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.  
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.
  - .3 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .4 Position and join pipes in accordance with pipe manufacturer's recommendations and methods approved by Departmental Representative.
  - .5 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.
  - .6 Align pipes before jointing.
  - .7 Do not lay pipe on frozen bedding.
- .2 PVC Pipe
  - .1 Lay and join pipes to ANSI/AWWA C605, ANSI/AWWA C900, ANSI/AWWA C906, and AWWA M-23 and pipe manufacturer's standard instructions and specifications. Do not use blocks except as specified.
  - .2 Join fittings in accordance with ANSI/AWWA C605, ANSI/AWWA C900, ANSI/AWWA C906, and pipe manufacturer's recommendations.
  - .3 Bevel or taper ends of PVC pipe to match fittings.
  - .4 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
  - .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.
  - .7 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.
  - .8 Avoid displacing gasket or contaminating with dirt or other foreign material.
  - .9 Remove disturbed or contaminated gaskets. Clean, lubricate and replace before jointing is attempted again.
  - .10 Complete each joint before laying next length of pipe.
  - .11 Minimize deflection after joint has been made.

- .12 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .13 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
- .14 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .15 Recheck pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .3 HDPE Pipe
  - .1 Install HDPE pipe in accordance with AWWA M55 PE Pipe Design and installation
  - .2 Joining methods:
    - .1 Whenever possible, the HDPE pipe should be joined by the method of thermal butt-fusion, as outlined in ASTM-D2657, Heat Joining Polyethylene Pipe and Fittings. Butt-fusion joining of pipe and fittings shall be performed in accordance with the procedures recommended by the manufacturer. The temperature of the heater plate should not exceed  $210^{\circ}\text{C} \pm 5^{\circ}\text{C}$  ( $410^{\circ}\text{F} \pm 10^{\circ}\text{F}$ ) and the joining pressure should not exceed 25 pounds per square inch of projected end area, excluding an allowance for friction.
    - .2 The polyethylene pipe may be adapted to fittings or other systems by means of an assembly consisting of a polyethylene stub-end, butt-fused to the pipe, a backup flange of ductile iron, made to Class 150, ANSI B16.5 dimensional standards with exceptions, bolts of compatible material and a gasket of suitable red rubber or asbestos-rubber compound cut to fit the joint. In all cases, the bolts shall be drawn up evenly and in line.
    - .3 Polyethylene pipes of the same outside diameter but different wall thicknesses shall be joined by means of a flange assembly as designated above.
    - .4 The pipe supplier shall be consulted to obtain machinery and expertise for the joining by butt-fusion of polyethylene pipe and fittings. No pipe or fittings shall be joined by fusion by any Contractor unless he is adequately trained and qualified in the techniques involved.
    - .5 Pipe manufacturer's representative must provide on-site training and certification for each fusing technician completing pipe joints on the fusing machine used for the work including butt-fusion and electrofusion. Engineer to be present for all certifications.

### 3.6 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated according to AWWA M44.
- .2 Support valves located in valve boxes or valve chambers by means of concrete located between valve and solid ground. Bedding same as adjacent pipe. Valves not to be supported by pipe. Install restraints on valves when required or as directed by Departmental Representative.
- .3 Install underground post-type indicator valves as indicated, valve boxes to be PVC (lower) and Cast Iron (upper section), depth of bury 2.74 m (9'). Minimum overlap of between lower and upper sections of valve boxes to be 300 mm (minimum).

### **3.7 HYDRANT INSTALLATION**

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA M17.
- .3 Install 150 mm gate valve and valve box a minimum of 2 m in front of hydrants on hydrant service leads or 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 50 mm above final grade.
- .5 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
- .6 To provide proper draining for each hydrant, excavate pit measuring not less than 1 m x 1 m x 0.5 m deep and backfill with coarse gravel or crushed stone to level 300 mm above drain holes.
- .7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

### **3.8 THRUST BLOCKS AND RESTRAINED JOINTS**

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00.01 - 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.
- .3 Place 8 mil polyethylene sheet between the full contact face of the fitting and the thrust block.
- .4 Keep joints and couplings free of concrete.
- .5 Remove all wooden formwork prior to backfilling.
- .6 Do not backfill over concrete within 24 hours after placing.
- .7 For restrained joints: only use restrained joints approved by Departmental Representative.

### **3.9 WATER SERVICE CONNECTIONS**

- .1 Water service piping up to and including 50 mm may be installed in a common trench with the sanitary sewer service as long as a clear separation of 300 mm is maintained between the lines. Water service pipeline greater than 50 mm must be installed in a separate trench from the sewer service pipe, with a clear separation of 1.0 meters of undisturbed soil between these lines.
- .2 Whenever common trenched services must be installed at different elevations, install the higher service on a shelf of undisturbed ground. If shelving the higher service line is not possible, re-establish the foundation of the high utility with compacted backfill

- .3 Ensure corporation stops are in the open position before backfilling.
- .4 Provide a goose neck with a minimum radius of 600 mm immediately adjacent to the corporation stop on all service connections 40 mm and smaller.
- .5 Tap corporation stops into the watermain using an approved tapping machine while the main is under normal operating pressure. After completion of each tapping connection, backfill to 75 mm above the top of the gooseneck with material as specified in Section 31 23 33.01 Excavation, Trenching and Backfill.
- .6 For valves 75 mm and larger installed as corporations stops, provide and install a lower section of PVC valve box on the valve and cut it off at 600 mm below finished surface. Suitably cap the PVC section. Thoroughly encapsulate the valve except the operating nut.
- .7 Provide a minimum depth of 2.7 m along entire water service.
- .8 Conditions for tapping PVC Pipe:
  - .1 Use an approved tapping sleeve.
  - .2 Tapping size used on PVC pipe shall be at least one (1) nominal pipe size smaller than the watermain being connected to.

<b>PVC Pipe (mm)</b>	<b>150</b>	<b>200</b>	<b>250</b>
<b>Tap Size (mm)</b>	<b>Tapping Method</b>		
20	1	1	1
25	1	1	1
40	2	2	2
50	2	2	2
75	2	2	2

Where: 1 = Direct Tap  
2 = Tap through an approved service saddle

- .9 Direct tapping of water main with corporation stops 25 mm and smaller.
  - .1 Install the corporation stop in the top quadrant of the water main at an angle of between 30 to 60 degrees above the horizontal unless noted otherwise.
  - .2 Do not tap corporation stops into water mains within 600 mm of the pipe joint, fitting or valve. Space multiple taps a minimum of 450 mm on centre.
  - .3 Tighten corporation stops into PVC water mains (cast iron O.D. only with 35 to 40 Newton-Meters of torque).
  - .4 Wrap the thread of the corporation stops used on PVC with three to four wrappings of teflon pipe thread tape before installation of the corporation stop.

.10 Curb Stops

- .1 Install service to existing buildings along a line that will best suit the interior plumbing.
- .2 Support each curb stop on a 75 mm x 200 mm x 250 mm concrete block.
- .3 In fine-grained or clay soils construct a 0.2 m<sup>3</sup> volume drainage sump below and around each curb stop.
- .4 Adequately secure the curb extension rod to each curb stop. Set the service box plumb with the upper sections of the service box adjusted to grade elevation. Install the lower section of the service box and the extension rod a minimum 300 mm below ground elevation to prevent heavy loads being transmitted to the curb stop.

**3.10 TEMPORARY WATER SUPPLY**

- .1 For shut down of water services longer than a period of 3 hours, provide and maintain pressurized, temporary potable water supply to all facilities affected.

**3.11 HYDROSTATIC AND LEAKAGE TESTING**

.1 General

- .1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .2 Notify Departmental Representative at least 24 hours in advance of proposed tests.
- .3 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 in length, unless otherwise authorized by Departmental Representative.
- .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 or as directed by Departmental Representative.
- .7 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .8 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .9 The initial fill of water for pressure testing will be supplied by the Owner at no cost to the Contractor. However, any subsequent refills of the line required by failure to meet the requirements of the tests will be charged to the Contractor at standard water rates.
- .10 Expel air from main by slowly filling main with potable water (0.45 m/s maximum).
  - .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.
- .11 For pipe materials other than PVC or HDPE calculate leakage from formulas in the appropriate AWWA Standard for that type of pipe being tested.

.2 Leakage Test - PVC Pipe

- .1 Do tests in accordance with ANSI/AWWA C905.
- .2 After backfilling is completed, carry out leakage test on all water mains at an initial test pressure of 692 kPa.
- .3 Maintain test pressure for at least one hour. At the end of one hour, repressurize the main to 692 kPa with water pumped from a tank. Measure the amount of water used to repressurize the main to the initial test pressure to determine the leakage in the test section. The test will not be accepted if the leakage exceeds the quantity determined by the following formula from the latest edition of ANSI/AWWA C605.

$$L = \frac{ND\sqrt{P}}{130,400}$$

for PVC Pipe

L = the allowable leakage (litres per hour)

N = the number of joints in the pipeline tested

D = nominal diameter of the pipe (mm)

P = The average test pressure during leakage tests in kilopascals (kPa)

- .4 If leakage exceeds the allowable, locate and repair.
- .5 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .6 Repeat hydrostatic test until leakage is within allowable limits.

.3 Hydrostatic Test - PVC Pipe

- .1 Pressure test all pipes, couplings, joints and other appurtenances under a hydrostatic pressure in compliance with AWWA M55 and ASTM F2164 latest edition. Testing procedure shall consist of an initial expansion phase and test period.
- .2 Initial expansion phase:
  - .1 Maintain initial expansion pressure of 758 kPa (110 psi) for approximately 3-4 hours during initial expansion phase of pipe by adding make up water.
- .3 Test period:
  - .1 Commence testing after initial expansion phase.
  - .2 At beginning of test period, reduce test pressure to 690 kPa (100 psi). This will be the target pressure during the test period.
  - .3 Allow the pressurized test section to sit for 1 hour. Do not add makeup water at this time.
  - .4 Test is successful if pressure remains within 34 kPa (5 psi) of the target pressure after 1 hour.
  - .5 If test is not successful, relieve pressure and repair any leakage. Allow test section to relax for at least 24 hours before re-testing.

**3.12 FLUSHING AND DISINFECTION**

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



- .2 Disinfect new watermains and any new branch connections to the requirements of ANSI/AWWA C651. Become familiar with and strictly adhere to all safety requirements relating to the handling of concentrated chlorine chemicals and solutions.
- .3 Caution - do not use calcium hypochlorite in powder form in PVC piping as an explosive reaction may result. Use of this chemical in tablet or solution form is safe in PVC piping.
- .4 Attach calcium hypochlorite tablets to the inside top surface of the pipe or fitting, using a waterproof, food grade type adhesive. The number of 5 gram tablets required per 6.0 m length of pipe for each size of pipe is shown on the following list:
  - 150 mm diameter pipe - 2 tablets
  - 200 mm diameter pipe - 2 tablets
  - 250 mm diameter pipe - 3 tablets
- .5 Protect installed tablets from moisture
- .6 Alternatively liquid sodium hypochlorite may be injected into the pipe as it is being filled. Subject to all provisions within ANSI/AWWA C651 for use of sodium hypochlorite a written description of proposed procedure and equipment used for injection must be submitted to the Departmental Representative for approval at least 4 days in advance.
- .7 Inject the sodium hypochlorite solution near the tie-in(s) to the existing system as the pipe is being filled.
- .8 Obtain a chlorine concentration of at least 25 mg/L throughout the system being disinfected and maintain for at least 24 hours. If the water temperature is less than 5°C, the chlorine solution shall remain in the pipe for a minimum of 48 hours.
- .9 Following this contact period, operate all valves and hydrants on the main to ensure that all parts have been in contact with the chlorine solution.
- .10 Disinfection
  - .1 The initial fill of water for watermain disinfection will be supplied by the Departmental Representative at no cost to the Contractor. However, any subsequent refills of the line required by failure to meet the requirements of the disinfection or hydrostatic tests will be the responsibility of the Contractor.
  - .2 Perform high-level total residual chlorine tests at a minimum of two locations or as directed by the Departmental Representative.
- .11 Flushing
  - .1 Upon completion of the 24 hour disinfection period, thoroughly flush the main until the Total Residual Chlorine concentration in the water being discharged is less than 1.0 mg/L.
  - .2 The initial volume of water required to flush the line of the highly chlorinated water will be made available by the Departmental Representative at no charge.
- .12 Coliform Bacteria Test
  - .1 After the main has been thoroughly flushed, obtain water samples and submit to the Province of Saskatchewan, Department of Health Laboratory

- for a coliform bacteria test. The results must conform to the Saskatchewan Provincial Water Quality Standards before the new watermain can be put into service. Forward all test results to the Departmental Representative.
- .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .13 Disposal of Water
- .1 Dispose of highly chlorinated water to the existing sanitary sewer system or, where it is not possible, to other receiving facilities, approved by the Departmental Representative at rates that do not exceed the available capacity of the system at the time of disposal.
- .2 Provide and apply the chemicals necessary to de-chlorinate this water to a level below 5.0 mg/L as the water enters a drainage channel.
- .3 Provide additional chemical or temporary diking works as found to be necessary to ensure that the free residual chlorine content of this water is less than 1.5 mg/L before it reaches the drainage channel.
- .4 Chemicals that may be employed to lower chlorine residuals are listed in ANSI/AWWA C651.
- .14 Provide all planning, coordination, supervision, labour equipment and materials for all aspects of the disinfection, testing, de-chlorination, monitoring and disposal operations.
- .15 Provide a minimum of forty-eight (48) hours advance notice of requirement for water to the Departmental Representative.
- .16 Water Main Swabbing
- .1 In all locations where it is not possible to disinfect new waterlines, as described previously in this section, use the following method:
- .1 Disinfect each length of pipe by pulling a chlorine-soaked swab through the inside of the pipe after it has been placed in its final position.
- .2 The configuration of the swab must be of the proper dimensions to ensure firm contact with all portions of the interior of the pipe.
- .3 Place water main(s) in service upon completion of flushing and obtainment of satisfactory results from the coliform bacteria test(s).
- .17 Chlorine Concentrations in Disinfected Sections
- .1 Prior to returning the water main to potable service the concentrations of total and residual chlorine shall conform to the Saskatchewan Water Regulations.
- .2 Minimum residual chlorine concentration shall be 0.1 mg/L.
- .3 Maximum total chlorine concentration shall be 1.0 mg/L.

**END OF SECTION**