

## Chapter 6 – Material Specification

Materials incorporated in the finished work and used during construction shall be according to the standards and specifications specified in this chapter. Alternate materials will not be permitted without written consent of the General Manager, Toronto Water.

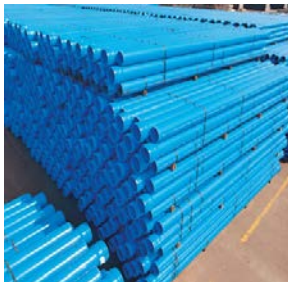
### Watermain Pipe

#### ***Ductile Iron***



Ductile iron (DI) pipe shall be manufactured according to AWWA/ANSI standard C151/A21.51, Pressure Class 350 in sizes 150 mm up to and including 600 mm diameter, with standard cement lining thickness according to AWWA/ANSI C104/A21.4. Ductile iron pipe shall be installed with polyethylene encasement according to AWWA/ANSI C105/A21.5.

#### ***Polyvinyl Chloride***



All polyvinyl chloride (PVC) pipes ranging in size from 100 mm through 600 mm in diameter, will be Pressure Class 235, DR 18 and manufactured according to AWWA C900, certified to CSA B137.3 and have the same outside diameter dimensions as cast iron.

#### ***Molecularly Oriented Polyvinyl Chloride***

Molecularly oriented polyvinyl chloride (PVCO) pipes, ranging in size from 100 mm through 450 mm in diameter and manufactured according to AWWA C909, certified to CSA B137.3.1 and certified as compliant with NSF/ANSI standard 61. Piping shall be pressure class 235, have cast iron outside dimensions, colour coded blue and be biaxially oriented, that is to say molecular orientation in two directions.

### **High Density Polyethylene**

Where high density polyethylene (HDPE) pressure pipe is specified and approved by the engineer for situations of specialized installations, it will have ductile iron or gray pipe outside diameter, co-extruded blue or blue stripe in colour and meet the requirements of OPSS.MUNI 1842.

### **Concrete Pressure Pipe**

Prestressed concrete pressure pipe, steel cylinder type shall be manufactured according to AWWA C301 for pipe diameters 600 mm and larger. Concrete pressure pipe, bar-wrapped, steel cylinder type shall be manufactured according to AWWA C303 for pipe diameters 400 and 500 mm.

Fittings shall be manufactured according to AWWA C301 and AWWA C303. Concrete pressure pipe and fittings will be joined using rubber gaskets and approved joints as outlined in the manufacturer's installation guide and AWWA C301 and AWWA C303. All joints shall be protected on the exterior using diapers and grout.

Thrust restraint will be provided through the use of restraining joints approved and supplied by the manufacturer.

Reinforced concrete bedding may be required for large diameter pipes which have welded joints.

### **Horizontal Directional Drilling**

TerraBrute and Cobra Lock for PVC pipes and HDPE are approved for use on horizontal directional drilling.

## **Appurtenances**

### **Special Fittings**

#### *Metallic*

Ductile iron compact fittings shall be according to AWWA/ANSI C153/A21.53. Rubber gasket joints, fittings will be supplied with mechanical joint or push-on joint type ends according to

AWWA/ANSI C111/A21.11. All special fittings will be cement lined according to AWWA/ANSI C104/A21.4.

### *Non-Metallic*

PVC fittings shall be according to AWWA C907. PVC fittings shall be used with PVC pipe only, having cast iron outside diameter dimensions, DR 18, Pressure Class 235, certified to CSA B137.2. PVC fittings will be supplied with push-on rubber gasketed joints in nominal sizes 100 mm through 300 mm.

### **Transition Couplings**

Transition couplings—100 mm and over—shall be according to AWWA C219.

All couplings must be coated with fusion bonded epoxy according to AWWA C213 and supplied with stainless steel nuts, bolts, and non-corrosive washers. Transition couplings will be supplied with rubber gaskets shall be according to AWWA/ANSI C111/A21.11.



### **Flanged Transition Coupling Adapters**

Flanged transition—100 mm and over—coupling adapters shall be according to AWWA C219.

All flanged coupling adapters must be coated with fusion bonded epoxy in accordance with AWWA C213 and supplied with stainless steel nuts, bolts, and non-corrosive washers. Flanged coupling adapters will be supplied with rubber gaskets manufactured according to AWWA/ANSI C111/A21.11.



### **Joint Restraint Devices**

Joint restraints used on PVC pressure pipe, shall be according to AWWA C900 and must adhere to ASTM F1674 and ULC standard testing procedures. Approved manufacturers are:

- Uni-Flange            Series 1300–C, 1350–C, 1390–C
- Ebba Iron            Series 1600, 2000PV, 2500
- Romac                Grip Ring
- Clow Tyler Union PVC TUFgrip

- Star PVC StarGrip 4000P, 4100P, Series 1000CP, 1100C, 1200C
- Sigma One-LOK Series SLCEP, PV-LOK Series PWP, PVPF, PWPF
- SIP Industries EZGrip Series Models EZPVC and EZPVCU

Joint restraints used on ductile iron Class 52 pressure pipe, shall be according to AWWA/ANSI C151/A21.51 and must adhere to ULC standard testing procedures. Approved manufacturers are:

- Uni-Flange Series 1300, 1390, 1400
- Ebba Iron MegaLug Series 1100, 1700
- Romac Grip Ring
- Clow Tyler Union Ductile TUFGRIP
- Star StarGrip Series 3000P, 3100P, 3100S
- Sigma One-LOK Series SLDEH, SSLDP
- SIP Industries EZGrip Series Model EZD

Joint restraints used on PVC pressure pipe, shall be compatible with both C900 and Bionax. Recommended products are:

*PVCO Pipe to PVC Fitting 100 mm to 300 mm*

- Clow 360c
- Ebba Iron Series 2600
- Sigma PV-Lok PWPF
- Star PVC 3500PF with 1200 Series
- Uni-Flange Series UFR 1369
- SIP Industries EZGrip Series Model PTPFC

*PVCO Pipe Standard Bell and Spigot Push-On Joints 100 mm to 300 mm*

- Clow 390c
- Ebba Iron Series 1900
- Sigma PV-Lok PWP
- Star PVC 3500C Series
- Uni-Flange Series UFR 1399
- SIP Industries EZGrip Series Model PTPPVC

*PVCO Pipe to Mechanical Joint Fitting 100 mm to 300 mm*

- Clow 300c
- Clow TUFGRIP
- Ebba Iron 19MJ00
- Sigma PWM
- Sigma One-Lok SLC
- Star PVC 3500 Series
- Star PVC 4000 Series
- Uni-Flange 1500
- SIP Industries EZGrip Series Models PTPDF, EZPVC and EZPVCU

Adapter flanges used on PVC pressure pipe, shall be according to AWWA C900 and must adhere to ASTM F1674 and ULC standard testing procedures. Approved manufacturers are:

- Uni-flange Series 900–C
- Ebba Iron Series 2100
- SIP Industries EZGrip Series Model FAPVC

Adapter flanges used on ductile iron Class 52 pressure pipe, shall be according to AWWA/ANSI C151/A21.51 and must adhere to ULC standard testing procedures. Approved manufacturers are:

- Uni-Flange Series 800, 1400
- Ebba Iron Series 1000, 2100
- Robar 7404/7506
- Romac FCA 501
- Smith Blair 912
- SIP Industries EZGrip Series Model FADP

**Gate Valves – 100 mm to 400 mm**



All valves shall be according to AWWA C509 or C515. Approved manufacturers for valves in sizes 100 mm to 400 mm inclusive, shall be:

- Mueller resilient seat gate valve A2361
- Clow resilient seat gate valve F-6100
- AVK resilient seat gate valve Series 65 – upto 300 mm
- AVK resilient seat gate valve Series 45 – upto 400 mm

- Clow McAvity II–figure 20075

All valves will have inside screw non-rising spindle, complete with mechanical joint ends. Valves specified to open right must be supplied with 'Toronto Operating Nut' and valves specified to open left must be supplied with 50 mm square operating nut. To determine the direction to open the valve in your district, see Appendix C, Maps.

All valves must be coated with fusion bonded epoxy in according to AWWA C550. All unprotected nuts and bolts used in the bonnet and valve stem assembly will be made of stainless steel. All 100 mm diameter valves must be supplied with a stainless steel stem.

Valve tie downs to be pre-fabricated as manufactured to City specifications, as approved by the engineer.

Valve tie downs to be galvanized and supplied with stainless steel nuts and bolts.

### ***Tapping Sleeves and Valves***



All valves will be manufactured according to AWWA C509 or C515. All valves are to have inside screw non-rising spindle, 50 mm square operating nut, complete with a flanged end with a male spigot and a mechanical joint at the other end. Direction to open valve clockwise or counter clockwise is district specific. To determine your requirements, see Appendix C, Maps. All valves must be interior coated with fusion bonded epoxy according to AWWA C550. All unprotected nuts and bolts, used in the bonnet and valve stem assembly will be made of stainless steel. All 100 mm diameter valves must be supplied with stainless steel stem.

Approved manufacturers for tapping valves will be:

- Mueller resilient seat gate valve T-2360
- Clow resilient seat gate valve F-6114
- AVK resilient seat gate valve Series 45
- Clow McAvity II–20695

Tapping sleeves for ductile iron, cast iron, polyvinyl chloride, and asbestos cement pipe will be:

- Robar 6606
- Ford all stainless steel (FAST)
- Romac SST 304
- Mueller H615 s/b H-304

All tapping sleeves will be stainless steel and supplied with stainless steel nuts and bolts and non corrosive washers. Size of tapping sleeves must provide a full seal around the outside circumference of the pipe. Size of tapping sleeves must have a longer body as specified by the engineer.

### **Air Valves**

Air valves are to be 25 mm, 50 mm, and 100 mm and shall be:  
Valmatic 15 A.3  
Golden Anderson  
Empire

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**Note:** Mueller A206 main stop must be used

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All air valves must be coated with fusion bonded epoxy according to AWWA C550 on both interior and exterior surfaces and supplied with a ring check valve T480Y–13 mm pressure tested to 1725 kilopascals.

### **Valve Boxes**

Valve box on watermains less than 400 mm in diameter will be 130 mm, regular style, slide type with guide plate and with 184 mm diameter cover. Approved manufacturers are:

- Bibby-Ste-Croix VB2200
- Mueller Canada MVB—bottom section only

Valve box for service valves on watermains smaller or equal to 300 mm diameter shall be 105 mm, regular style, and slide type with guide plate and with 149 mm diameter cover. Approved manufacturers are:

- Bibby-Ste-Croix VB1200
- Mueller Canada MVB—bottom section only

### **Repair Clamps**

Repair clamps will be:

- Cambridge Brass           Series 425
- Clow Concord             D-76R all stainless
- Mueller                    full seal series 520
- Smith Blair               261/256 full circle
- Robar                     style 5636–style 1
- Romac                     SS1
- Ford                       FS1 style
- EZ–Max                    4000

All repair clamps to be all stainless steel and be supplied with stainless steel nuts with passivated bolts. Body length to suit repair as per manufacturer's installation instructions.

All repair clamps will provide a full rubber seal around entire outside diameter of the pipe to be repaired.

### **Service Saddles**



All service saddles shall be made of a stainless steel band fastened with a minimum double bolt mechanism, tapered rubber gaskets and supplied with stainless steel nuts, bolts, and non-corrosive washers.

For existing cast iron, ductile iron, and asbestos cement pipe, service saddles are required for 19 mm, 25 mm, 32 mm, 38 mm, and 50 mm diameter main stops—all AWWA tapered threads.

On PVC pipe, service saddles must be used for 19 mm, 25 mm, 32 mm, 38 mm, and 50 mm diameter main stops—all AWWA tapered threads.

For new ductile iron only, small water services greater than 25 mm in diameter require saddles.

Approved manufacturers are:

- Romac                     306
- Smith Blair             372
- Mueller                 Servi–Seal 521 to 529 series
- Ford                     FS 303
- Cambridge Brass       Teck series 403



- Robar 2616DB
- Robar 2706

### **Water Services**

The standard water service diameters are 19 mm, 25 mm, 32 mm, 38 mm, and 50 mm. Copper pipe will be ASTM B88-03 (ASTM B88M-05 for metric sizes) type 'K' soft copper.

All main stops will have a compression joint and approved manufacturers are:

- Cambridge Brass Series 301NL
- A.Y. McDonald 4701T
- Ford F-1000
- Mueller H15008N

All curb stop will have a compression joint. Approved manufacturers are:

- Cambridge Brass century ball valve
- Ford ball valve B-44 series
- Mueller H15209N
- A. Y. McDonald 6100 T ball valve

All couplings shall have a compression joint. Approved manufacturers are:

- Cambridge Brass Series 118
- Ford C-44
- Mueller H15403
- A.Y. McDonald 4758T

Service boxes will be made of cast iron and will suit the respective curb stop. The boxes will be adjustable from 1800 mm to 2100 mm bury.

The rods will be 1125 mm long, made of passivated #304 stainless steel with M5 x 70 mm brass cotter pins.

The plug must be brass and screw type.

Where further extension is required for the box because of extra depth, the extension and the coupling must be of threaded type.

If the final grade is more than 1000 mm above the top of the rod, then the rod must be replaced with one which is made of continuous passivated #304 stainless steel.

Box top to be stamped "water".

Self-draining stop and drain. Approved manufacturers are:

- Emco Series-15790
- Mueller H15219



### **Hydrants**

Hydrants shall be:

- AVK Model 2780
- Canada Valve Century
- Clow-McAvity Brigadier M67
- Mueller Modern Centurion

All hydrants shall be according to AWWA C502 and NSF/ANSI 61 for dry barrel hydrants and open counter clockwise. Hydrants will have tapped drain ports, 150 mm mechanical joint inlet with brass to brass fittings on the main valve seat, two 63.5 mm hose nozzles spread 180 degrees apart and a 114.3 mm pumper nozzle with a 100 mm ULC S543 approved Storz connection. Hydrants will be connected to the watermain using a 150 mm lead, 150 mm gate valve and anchor tee. Hydrants will be supplied for a minimum bury depth of 1.8 metres.

Hydrant extensions required to adjust the length of the hydrant barrel are to be obtained from the hydrant manufacturer or approved supplier.

Hydrant anti-tamper devices shall be manufactured according to City specifications, as approved by the engineer.

Hydrant paint will be high gloss exterior chrome yellow and shall be applied over a quality dry red oxide primer. Storz nozzles shall be painted black.

## Petrolatum Tape Systems



Anti-corrosion wrap shall be as supplied by Denso North America Inc. or Trenton Tape. Only material from one supplier exclusively shall be used on an installation. At no time will materials from either system be utilized with the other.

Microcrystalline wax and petrolatum tape coating system components shall meet the material and testing requirements of AWWA C217.

Denso coatings material will consist of Denso paste or Denso priming solution for cold temperature application, Denso profiling mastic or Denso Mastic Blanket and Denso LT Tape.

Trenton Tape coating material will consist of TecTape Primer, Fill Putty, and TecTape petrolatum tape.

## Insulation Type



Any non-buried watermain will be insulated with polyisocyanurate foam or polyurethane foam and wrapped in an aluminium jacket. The thickness of the insulation will be determined by the engineer. In most cases the thickness will be 50 mm.

## Sewer Pipe

Both rigid and flexible pipe are permitted in the construction of sanitary and storm sewer systems including service connections. These materials include concrete and polyvinyl chloride. However, the bedding design must be compatible with the type of pipe material used. To determine the preferred pipe material based on the diameter of the pipe, go to Chapter 2, *Sanitary Sewer*, Table: *Sanitary sewer preferred materials* or Chapter 3, *Storm Sewers*, Table: *Storm sewer preferred material*.

Pipe materials for storm and sanitary sewer mainline, fittings, and service laterals will be CSA certified and according to the following:



### ***Concrete Sewer Pipe and Fittings***

Circular concrete pipe and fittings will conform to OPSS.MUNI 1820 and will be manufactured at a plant certified under the Ontario concrete plant prequalification program. Non reinforced concrete pipe will be according to CSA A257.1. Reinforced concrete pipe will be according to CSA A257.2. Joints and gaskets will be according to CSA A257.3.

### ***PVC Sewer Pipe and Fittings***

Circular PVC pipe and fittings complete with bell and spigot joints, rubber gasket, lubricant and all other necessary appurtenances will be manufactured according to OPSS.MUNI 1841 and certified to CSA B182.2 for PVC sewer pipe and fittings. PVC pipe will have a minimum pipe stiffness of 320 kilopascals.



### ***HDPE Sewer Pipe and Fittings***

Circular PE pipe and fittings complete with bell and spigot joints, rubber gasket, lubricant and all other necessary appurtenances will be manufactured according to OPSS.MUNI 1840 using virgin resin and will be certified to CSA B182.6 for polyethylene sewer pipe and fittings for non-pressure applications. Circular PE pipe and fittings will have a minimum pipe stiffness of 320 kilopascals and 100 kilopascals gasketed joints.

### ***Hybrid Pipe Systems***

The City will review and consider the use of specialized pipe designed to minimize inflow and infiltration in areas of high groundwater. These pipe products combined both concrete and plastic materials into one pipe system. The acceptance of these pipe systems for use will be considered on a case-by-case basis.

**Table 40: Sanitary sewer pipe materials**

<b>Type of pipe</b>	<b>Specification</b>	<b>Diameter</b>	<b>Approved use</b>
non-reinforced concrete	CSA A257.1 extra strength	200 mm to 250 mm	service laterals
reinforced concrete	CSA A257.2	300 mm and larger	mainline
DR 35 PVC	CSA B182.2 320 kPa stiffness	200 mm and larger	mainline
DR 28 PVC	CSA B182.2 625 kPa stiffness	100 mm and 150 mm	service laterals
vitriified clay	CSA A60.1 and CSA A60.3	200 mm and larger	mainline and laterals

Sanitary public and private side laterals sewers will be SDR28 and green in color.



### ***Sanitary Forcemain Material***

Sanitary forcemain material will be selected to suit the installation and system requirements and be pre-approved by the City. Under no circumstances will the material selected for the forcemain be colour coded blue.

**Table 41: Storm sewer pipe materials**

<b>Type of pipe</b>	<b>Specification</b>	<b>Diameter</b>	<b>Approved use</b>
non-reinforced concrete	CSA A257.1 extra strength	200 mm to 250 mm	service laterals
reinforced concrete	CSA A257.2	300 mm and larger	mainline
DR 35 PVC	CSA B182.2 320kPa stiffness	200 mm and larger	mainline
DR 28 PVC	CSA B182.2 625kPa stiffness	150 mm	service laterals

Storm public and private side laterals sewers will be SDR28 and white in color.

## Sewer Related Appurtenances

### ***Maintenance Hole and Catchbasin Adjustment Units***

Concrete adjustment units shall be manufactured according to material specification OPSS.MUNI 1351. Precast adjustment units will be laid in a full bed of mortar with successive units being joined using sealant as recommended by the manufacturer. A minimum of one adjustment unit will be installed with a minimum height of 75 mm. A maximum of four adjustment units be installed to a height not in excess of 0.3 metre.

Rubber adjustment units shall be manufactured according to material specification OPSS.MUNI 1853 and installed according to City standard T-704.010-1.

### ***Integrated Frame and Cover (IFC-25) Maintenance Hole System***



A single precast adjustment unit sizes vary from 100mm-550mm eliminating the use of multiple precast adjustment units and mortared joints. Reduces inflow and infiltration and frequency of sunken maintenance holes and surrounding road deterioration. Applications include new infrastructure as well as rehabilitation of existing precast maintenance holes such as tapered tops, chambers and flat caps.

### ***Precast Maintenance Holes and Catchbasins***

Precast maintenance holes and catchbasin shall be as manufactured in according to material specification OPSS.MUNI 1351.

### ***Maintenance Holes, Catchbasins Frame and Covers***



Maintenance holes and catchbasin frame and covers will be manufactured in accordance with material specification OPSS.MUNI 1850.

### **Optimized Maintenance Hole Assembly**

Optimized castings provide superior performance with reduced weight, saving energy and raw materials. These castings exceed the current OPSS 1850 load requirement and adhere to AASHTO M306 specifications that improve material quality and loading requirements.

Optimized maintenance frame and cover assembly

- East Jordan MC401010406

Optimized frame for catchbasin

- East Jordan MC401040105

Standard OPSD 400.070 Herring Bone catchbasin grate

- East Jordan MC400070302

### **Flexible Rubber Connectors**

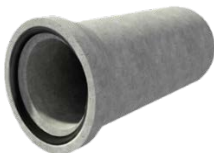


Flexible rubber connectors for connecting pipe to maintenance holes can be either cast-in during the manufacture of the precast product, or installed into a cored or preformed hole in the finished maintenance hole. Both types shall be according to CSA A.257.3 and ASTM C923M.

EZ-TEE is manufactured by Galaxy Plastics Ltd and Inserta Tee manufactured by Advanced Drainage System Inc. (ADS) can be used to connect laterals to both existing and new pipes.

Flexible rubber connectors for connecting pipe of dissimilar material or pipe sizes on mainline sewers will not be approved.

### **Concrete Pipe Gaskets**



The standard gaskets supplied with any concrete product are generally formulated for maximum sealing performance in a standard sewer installation carrying storm water or sanitary sewage. Other types of gaskets would be required where resistance against hydrocarbons, acids, ultraviolet rays, ozone, and extreme heat is needed. Nitrile gaskets should be specified where hydrocarbon oil and petroleum resistance is required.

## **Approved Manufacturers' Product List**

If the City receives product approval requests from suppliers interested in having the products evaluated for purchase by the City, the supplier should contact The Road Authority.

The City supports the efforts of the Ontario Good Roads Association (OGRA) and the Ontario Provincial Standards (OPS) organization. As part of these relationships, the City is considering to use The Road Authority (TRA) to post its approved manufacturer's product list for watermain and sewer related products on the Internet. The Road Authority is a service provided by the OGRA and is "an Internet-based information resource that provides a mechanism for infrastructure owners, consultants, contractors and product suppliers to collaborate and share information. TRA provides users with information on products, services and technical solutions available for use in the public works sector."

If a product is listed on the TRA approved supplier list, it means the product is approved for its intended use, however, it is at the City's discretion whether to use the product.

For more information on The Road Authority, go to web site: [www.roadauthority.com](http://www.roadauthority.com) .