

Chapter 6 – Material Specifications

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/A21.51–09. Special thickness class 'Class 52' in sizes 150 mm up to and including 300 mm diameter, with standard cement lining thickness according to AWWA/ANSI C104/A21.4–08. Ductile iron pipe will be supplied with push-on joints complete with copper bonding cables from pipe to pipe for maintaining electrical continuity. Ductile iron in sizes of 400 mm and 600 mm diameter will use special thickness class 'Class 53' pipe.

Polyvinyl Chloride

All polyvinyl chloride (PVC) pipes ranging in size from 100 mm through 300 mm in diameter, will be Pressure Class 235, DR 18 and manufactured according to AWWA C900-07, certified to CSA B137.3-05 and have the same outside diameter dimensions as cast iron. All PVC pipe ranging in size from 350 mm through 600 mm in diameter, will have a minimum pressure rating 235, DR 18, manufactured according to AWWA C905–10, certified to CSA B137.3-05 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 300 mm in diameter and manufactured according to AWWA C909-09, 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 pipe outside diameter, co-extruded blue or blue stripe in colour and meet the requirements of OPSS 441.

The HDPE pipe fittings will meet the requirements of OPSS 441. Joints will be restrained in accordance with OPSS 441.

Concrete Pressure Pipe

Concrete pressure pipe shall be manufactured according to AWWA C301-07 for pipe diameters up to 500 mm. Use AWWA C303-09 for pipe diameters 600 mm and larger.

Fittings shall be manufactured according to AWWA C301-07 and AWWA C303-08. Concrete pressure pipe and fittings will be joined using rubber gaskets and approved joints as outlined in the manufacturer's installation guide and AWWA C301-07 and AWWA C303-08. 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.

Appurtenances

Special Fittings

Metallic

Ductile iron compact fittings shall be according to AWWA/ANSI C153/A21.53-11. Rubber gasket joints, fittings will be supplied with mechanical joint or push-on joint type ends according to AWWA/ANSI C111/A21.11-07. All special fittings will be cement lined according to AWWA/ANSI C104/A21.4-08.

Non-Metallic

PVC fittings shall be according to AWWA C907-12. PVC fittings shall be used with PVC pipe only, having cast iron outside diameter dimensions, DR 18, Pressure Class 235, certified to CSA B137.2-05. 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 C219–11.

All couplings must be coated with fusion bonded epoxy according to AWWA C213–07 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/A21.11–07.

Flanged Transition Coupling Adapters

Flanged transition—100 mm and over—coupling adapters shall be according to AWWA C219–11.

All flanged coupling adapters must be coated with fusion bonded epoxy in accordance with AWWA C213–07 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/A21.11–07.

Joint Restraint Devices

Joint restraints used on PVC pressure pipe, shall be according to AWWA C900–07 or C905–10 and must adhere to ASTM F1674-05 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, PVPF

Joint restraints used on ductile iron Class 52 pressure pipe, shall be according to AWWA/ANSI C151/A21.51–09 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

Joint restraints used on PVC pressure pipe, shall be compatible with both C900–07 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

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

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

Adapter flanges used on PVC pressure pipe, shall be according to AWWA C900–07 or C905–10 and must adhere to ASTM F1674-05 and ULC standard testing procedures. Approved manufacturers are:

- Uni-flange series 900–C
- Ebba Iron series 2100

Adapter flanges used on ductile iron Class 52 pressure pipe, shall be according to AWWA/ANSI C151/A21.51-09 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

Gate Valves – 100 mm to 400 mm

All valves shall be according to AWWA C509-09 or C515-09. Approved manufacturers for valves in sizes 100 mm to 400 mm inclusive, shall be:

- Mueller resilient seat gate valve A2360
- Clow resilient seat gate valve F-6100
- AVK resilient seat gate valve Series 65
- 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 C550-13. 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 C509-09 or C515-09. 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 C550-13. 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 65
- 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

Note: Mueller A206 main stop must be used

All air valves must be coated with fusion bonded epoxy according to AWWA C550-05 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, 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:

- 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 passified bolts. Body length to suit repair as per manufacturers 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.

[Plastic water services] is planned to be approved in the future.

[Plastic water services—reserved for future]

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

- Cambridge Brass series 102
- A.Y. McDonald 4701T
- Ford F-1000 and F-600
- Mueller H15008

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

- Cambridge Brass century ball valve
- Ford ball valve B-44 series
- Mueller H15209
- 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 C502-05 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.

Metal Items

Bolts, Nuts, and Washers

Zinc Coated

Zinc coated bolts, nuts, and washers will conform to the latest issue of ASTM. Use Grade 2, designated A 305 bolts for flanges up to and including 300 mm diameter, and Grade 5, designated A 307 for flanges larger than 300 mm diameter.

Cadmium Coated

Cadmium coated bolts, nuts, and washers will conform to the latest issue of ASTM. Use Grade 2, designated A 305 bolts for flanges up to and including 300 mm diameter, and Grade 5, designated A 307 for flanges larger than 300 mm diameter.

Stainless Steel

Stainless steel bolts, nuts, and washers will be stainless steel type 304 manufactured according to ASTM F593-02e2 and ASTM F594-02.

Cast Iron

Cast iron will conform to ASTM A48, Class 30B, standard specification for gray iron castings. Cast iron products will be asphalt coated.

Galvanizing

Galvanizing will conform to ASTM A123—zinc coatings on iron and steel products. Metal products specified as galvanized will be galvanized after fabrication.

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.

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.

Anodes

Packaged anodes will be zinc Z-24-48 manufactured using a high purity zinc—99.99 percent pure zinc—conforming to ASTM B-418-06 Type II. The anode shall have an average current efficiency of 90 percent and provide an open circuit potential with a minimum 1.10 volt direct current (DC) as measured with respect to the copper or copper sulphate reference electrode. The zinc casting shall have a 6 mm diameter electro-galvanized steel core wire extending 100 percent of the length of the casting and shall be packaged in a cardboard container approximately 100 mm in diameter. The depolarizing material surrounding the zinc casting shall be composed of a gypsum or bentonite base material having an electrical resistivity less than 45 ohm-cm when saturated with distilled water. An insulated copper wire—AWG #10/7 strand, 3 metres in length will be brazed to the end of the core wire. For details and additional design information, see TS 7.22

Tracer Wire

Tracer wire will be #10 gauge AWG single or seven strand, insulated copper wire. For details and additional design information, see TS 7.40.

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.

Gasket Type

Standard gasket meeting ASTM D3139 requirements for plastic pressure pipe using flexible elastomeric seals will be used for typical watermain applications where PVC pipe is being used. Nitrile gaskets will be used for watermain applications when the pipe must be buried in soil with hydrocarbons.

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 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 A257.1-03. Reinforced concrete pipe will be according to CSA A257.2-03. Joints and gaskets will be according to CSA A257.3-03.

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 1841 and certified to CSA B182.2-06 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 1840 using virgin resin and will be certified to CSA B182.6-06 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.

Table: Sanitary sewer pipe materials

Type of pipe	Specification	Diameter	Approved use
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
vitrified clay	CSA A60.1 and CSA A60.3	200 mm and larger	mainline and laterals

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: Storm sewer pipe materials

Type of pipe	Specification	Diameter	Approved use
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

Sewer Related Appurtenances

Maintenance Hole and Catchbasin Adjustment Units

Concrete adjustment units shall be manufactured according to material specification OPSS 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 1853 and installed according to City standard T-704.01.

Precast Maintenance Holes and Catchbasins

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

Maintenance Holes and Catchbasins Frame and Covers

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

Flexible Rubber Connectors

Flexible rubber connectors for connecting pipe to maintenance holes can be either cast-in-place 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-07.

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 use but 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 .