

1.0 GENERAL

1.1 Work Included

1.1.1 This section refers to the supply and installation of watermain piping, fittings and appurtenances.

1.2 Related Sections

1.2.1 Section 02315 – Trench Excavation and Backfill

1.2.2 Section 02500 – Supply of Portland Cement Concrete

1.2.3 Section 02516 - Water and Sewer Service Connections

1.2.4 Section 0217 – Watermain Hydrostatic Tests

1.2.5 Section 02519 – Disinfection and Flushing

1.3 Submittals

1.3.1 Submit shop drawings in accordance with the Section 01300 - Submittals.

1.3.2 Provide marked up field record drawings and sketches as necessary for the Engineer to produce accurate, complete office record drawings.

1.3.3 Provide detailed operating and maintenance instructions for all equipment installed.

1.3.4 For watermain valves, fittings, couplings, adaptors provide complete descriptions including specific model numbers, materials, end connection types and adaptive outside diameters. For pipes include specific material, class or dimension ratio, manufacturer identification code as it appears stamped on the pipe or supplier's invoice.

1.3.5 Provide detailed lists of any special or proprietary tools or equipment which are required to assemble, disassemble, operate or maintain any device installed on this project.

1.4 Scheduling of Work

1.4.1 Schedule and co-ordinate all work to minimize disruption to existing services.

1.4.2 Submit a proposed work schedule as may be stipulated within the Special Provisions.

1.4.3 Comply with any special service interruption or other scheduling requirements stipulated within the Special Provisions.

1.5 Testing of Materials

1.5.1 Provide necessary samples and bear all costs for testing of materials or provide certified test results for materials to be employed.

1.6 Handling and Storage of Materials

1.6.1 Provide all handling and storage facilities for materials as recommended by the manufacturer.

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- 1.6.2 Seal both ends of each pipe length to prevent contamination during pipe transportation and storage. Use an ultra violet stable material having a minimum thickness of 0.15 mm (6 mils). Install covers immediately following the pressure testing of the pipe at the manufacturing plant
 - 1.6.3 Do not use PVC pipe that is more than 24 months old.
 - 1.7 Applicable Standards (use latest version)
 - 1.7.1 ANSI/AWWA C110/A21.10 - Ductile Iron and Gray Iron Fittings, 3 in through 48 in (75mm through 1200 mm), for Water and Other Liquids
 - 1.7.2 ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
 - 1.7.3 ANSI/AWWA C200 - Steel Water Pipe 6 Inch (150 mm) and Larger
 - 1.7.4 ANSI/AWWA C206 - Field Welding of Steel Water Pipe
 - 1.7.5 ANSI/AWWA C207 -Steel Pipe Flanges for Waterworks Service - Sizes 4 in through 144 in (100 mm through 3600 mm)
 - 1.7.6 ANSI/AWWA C208 - Dimensions for Fabricated Steel Water Pipe fittings
 - 1.7.7 ANSI/AWWA C210 - Liquid-Epoxy Coatings and Linings for the Interior and Exterior of Steel Water Pipelines
 - 1.7.8 ANSI/AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
 - 1.7.9 ANSI/AWWA C214 - Tape Coatings for Steel Water Pipelines
 - 1.7.10 ANSI/AWWA C217 - Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
 - 1.7.11 ANSI/AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe
 - 1.7.12 ANSI/AWWA C500 - Metal-Seated Gate Valves for Water Supply Service
 - 1.7.13 ANSI/AWWA C502 - Dry-Barrel Fire Hydrants
 - 1.7.14 ANSI/AWWA C504 - Rubber Seated Butterfly Valves
 - 1.7.15 ANSI/AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
 - 1.7.16 ANSI/AWWA C800 - Underground Service Line Valves and Fittings
 - 1.7.17 ANSI/AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)
 - 1.7.18 ANSI/AWWA M11 - Steel Pipe - A Guide for Design and Installation
 - 1.7.19 ANSI/AWWA M17 – Installation, Field testing and Maintenance of Fire Hydrants
 - 1.7.20 ANSI/AWWA M23 - PVC Pipe - Design and Installation
 - 1.7.21 ANSI/AWWA M44 – Distribution valves: Selection, Installation, Field Testing and Maintenance
 - 1.7.22 ANSI/AWWA M55 – PE Pipe – Design and Installation
 - 1.7.23 ANSI/NSF 61 - NSF/ANSI 61: Drinking Water System Components _ Health
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Effects

1.7.24 CSA B137 Series 13 – Thermoplastic Pressure Piping

2.0 PRODUCTS

- Use only those products in the Approved Products List, product ID:
 - WP – 02: PVC Pipes
 - WP – 03: PVC Fittings
 - WP – 04: Joint Restraint: Bolts
 - WP – 05: Couplings and Adaptors
 - WP – 06: Couplers
 - WP – 07: Valves: Gate Valves
 - WP – 08: Valves: Butterfly Valves
 - WP – 09: Valves: Air Release
 - WP – 10: Valve Boxes
 - WP – 11: Hydrants
 - WP – 26: Interior Pipe Lining
 - WP – 27: Exterior Pipe Coating
 - WP – 28: Cadweld
 - WP – 29 Pumper Connection

2.1 Pipe

2.1.1 Polyvinyl Chloride (PVC)

- .1 Sizes 300 mm and smaller: pipe certified to CSA B137 SERIES-13 and ANSI/NSF 61 and conforming in all respects to ANSI/AWWA C900 latest edition, Class 235.
- .2 Sizes larger than 300: pipe certified to CSA B137 SERIES-13 and ANSI/NSF 61 and conforming to AWWA C900 latest edition, Class 165, or an approved alternate specified or approved by the Engineer.
- .3 Gaskets shall be standard gaskets recommended for typical watermain applications where cast iron sized pipe is being used. Nitrile gaskets shall be used for watermains 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 to ANSI/NSF 61.
- .5 PVC double bell end pipe certified to CSA B137.3 and conforming in all respects to AWWA C900. 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.

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- .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° chamfer angle. Insertion stop mark on the end of each connection spool.

2.1.2 High Density Polyethylene (HDPE)

- .1 ***Use of HDPE pipe will only be approved by the City on a location by location basis and will not be approved in locations where service connections are or may be required.***
- .2 Pipe certified by the manufacturer as having been produced from raw resin which meets or exceeds the requirements of ASTM D1248 for Type III, Class C, Category 5, Grade P34 Polyethylene Material and which qualifies as a PE3408 material by the method of determining and validating the Long Term Hydrostatic Stress (LTHS) of the Plastic Pipe Institute. Without compromising the foregoing, provide pipe of iron pipe sizing configuration (IPS) in conformance with ASTM F714 and to AWWA C906 latest edition.
- .3 50 to 75 mm- Dimension Ratio (DR) 11.
- .4 Greater than 75 mm - as specified or directed by the Engineer.

2.1.3 Steel Pipe

- .1 Steel pipe shall be designed and installed to AWWA M11 – A Guide for Design and Installation of Steel Pipe. Steel pipe shall be design for a minimum pressure of 690 kPa plus an allowance for surge pressure.
- .2 Sizes smaller than 150 mm - pipe which conforms to ASTM A53B, seamless or welded, Schedule 80.
- .3 Sizes 150 mm and larger shall conform to AWWA C200 – Steel Water Pipe, 6 in (150 mm) and Larger. Steel plate used in the manufacture and fabrication of steel pipe shall meet the minimum requirements of ASTM A53 (Grade B, Type E or Type S) or API 5L (Grade B), or CSA Z245.1 (Grade 241), and have minimum yield strength 241 MPa (35,000 psi). All seams and joints shall be butt welded.
- .4 Steel pipe is to be furnished principally in 15 metre net laying lengths with shorter lengths, field trim pieces and closure pieces as required by plan and profile for location of elbows, tees, reducers and other in-line fittings or as required for construction. The Contractor shall prepare a pipe laying schedule showing the location of each piece by mark number with station and invert elevation.

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- 2.1.4 Concrete Cylinder Pressure Pipe
- .1 Where this pipe is required it will be definitively specified in the Special Provisions.
- 2.2 Fittings
- 2.2.1 Cast Iron
- .1 Cast or ductile iron conforming to the latest edition of AWWA/ANSI C110 and complete with integral tie rod lugs. Where fittings are used with mechanical joint restraints, ensure that the lug pattern on the fittings is compatible with the lug pattern of the restraint manufacturer being used.
- .2 Push-on joint fully compatible with the pipe being joined and having a working pressure rating of 1.74 MPa (250 psi).
- .3 Gasket material suitable for potable water in accordance with AWWA C111-latest edition.
- .4 Exterior asphaltic coated per AWWA/ANSI C110.
- .5 Interior lined to a minimum thickness of 16 mils (406 µm) liquid epoxy coating to AWWA/ANSI C210 or fusion bonded epoxy coating to AWWA/ANSI C213.
- 2.2.2 PVC
- .1 PVC fittings up to 300mm - injection-moulded PVC tees, crosses, wyes and bends certified to CSA B137.2 latest revision and in full compliance with AWWA C907 latest revision for a working pressure of 1500 kPa (220 psi).
- 2.2.3 HDPE Pipe Fittings
- .1 Moulded HDPE, sizes as available, manufactured in accordance with ASTM D2683 for socket type or ASTM D3261 for butt fusion type and all in accordance with AWWA C906 Latest Edition. Fitting pressure rating must be at least equivalent to the pipe to which it is being attached. Electrofused fittings may be used, if approved by the Engineer. Flanged fittings shall be used at connections to mains of differing materials.
- .2 Backing flanges to be ductile iron epoxy coated or minimum grade 304 passivated stainless steel.
- .3 ***Fabricated HDPE fittings are not acceptable.***
- 2.2.4 Steel Pipe Fittings
- .1 Fittings: Sizes 50 mm and smaller – threaded Class 300 lb. banded malleable iron conforming to latest revision of the following: ANSI B16.3, AWWA C200, and AWWA C208.
- .2 Fittings: Sizes 65 mm through 750 mm - standard weight, butt welding type conforming to ANSI B16.9, material to ASTM A234, Gr. WPB. Grooved or fabricated fittings only where called for on the

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- drawing(s).
- .3 Flanges: Sizes 100 mm and larger – minimum Class 250 lb. forged steel, standard bore, weld neck type conforming to ANSI B16.5, material to ASTM A105 or A181. Flat-Faced when mating to cast iron fittings/valves or wafer bodied valves.
 - .4 Anvilet: Sizes 305 mm through 610 mm - forged steel, butt weld type conforming to ANSI B16.25, material to ASTM A105. Reinforcing pads for hot taps to be CSA G40.21M Grade 350W.
- 2.2.5 Joint Restraints
- .1 Restraint devices shall incorporate a series of machined serrations on the inside diameter to provide proper restraint and 360° contact with the pipe. All Restraint Devices for PVC Pipe shall have a water working pressure rating equivalent to the full rated pressure of the PVC. Pipe on which they are installed, with a minimum 2:1 safety factor in any nominal pipe size.
 - .2 Restraint bodies shall be manufactured of high strength Ductile Iron, ASTM A356, 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.
- 2.3 Thread Compound
- 2.3.1 Teflon tape or a Teflon based liquid approved for use in contact with potable water by the ANSI/NSF 61.
- 2.4 Nuts and Bolts
- 2.4.1 Stainless steel bolts and nuts on direct buried or submerged applications conforming to ASTM A193 Grade B8 or B8M.
 - 2.4.2 Exposed service - carbon steel bolts conforming to ASTM A193 Grade B7. Carbon steel nuts conforming to ASTM A194 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.
- 2.5 Steel Pipe and Fittings Coating/Lining
- 2.5.1 Interior Lining
 - .1 Standard
 - .1 All materials to be approved for direct contact with potable water by the National Sanitation Foundation - Standard NSF 61
 - .2 Exposed pipe 300 mm and smaller - none required.
 - .3 Exposed pipe 350 mm and larger and buried pipe 100 mm and larger:

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- .1 Liquid or fusion bonded epoxy materials and procedures to meet or exceed the requirements of AWWA C210 or AWWA C213 (latest edition).
 - .4 Shop apply lining in strict accordance with the manufacturer's recommendations for: surface cleaning and preparation; atmospheric conditions, product preparation, application equipment requirements and curing times and conditions. Without limiting the foregoing, re-blast surfaces which exhibit unsatisfactory finish or flaws such as burrs or slivers after initial blast cleaning. Remove flaws by grinding or filing prior to re-blasting.
 - .5 Provide a finished lining system having a minimum finished dry film thickness of at least 16 mils (406 μm) or as recommended by the manufacturer. Apply multiple coats of products having a solids content of 75% or less unless a single coat, pinhole-free finish is guaranteed by the manufacturer or applicator for the product being used. Finished lining color to be white or near white.

2.5.2 Exterior Coating

- .1 Exposed Pipe - finish exterior in accordance with relevant section(s) for painting or as specified in the Special Provisions.
- .2 Buried Pipe 600 mm and smaller:
 - .1 External continuous sheath of extruded high density polyethylene covering. Grind smooth welded joints and cover with heat shrink sleeves or tape. Cutback of covering on pipe ends to be 75 mm.
 - .3 Buried Pipe: optional for pipe 600 mm and smaller and for all pipe diameters greater than 600 mm.
 - .1 Fusion Bonded Epoxy Coatings to AWWA C213 minimum 16 mil (406 μm) dry film thickness or as recommended by the manufacturer; prepare surface and apply coating in accordance with AWWA C213. If pipe is to be installed using trenchless methods, provide an additional sacrificial layer to increase coating thickness to a minimum of 25 mils (634 μm).
 - .3 Polyolefin Tape Coating system conforming to or exceeding the requirements of AWWA C214 (latest edition); minimum three layers and having a minimum finished thickness of 50 mils (1268 μm) for a machine applied system or 70 mils (1775 μm) for a hand applied system.
 - .1 First layer – liquid adhesive primer.
 - .2 Second layer-tape layer for corrosion protection
 - .3 Outer layer-tape for mechanical protection.
 - .4 Pipe surface preparation and coating application to meet or exceed the coating manufacturer's recommendations. Apply tape systems with a

minimum spiral overlap of 12.5 mm (0.5”).

- .5 Inner layer tape backing material to be polyolefin only containing greater than 1% but less than 3.5% by weight of non-polyolefinic material consisting of carbon black and antioxidants.
- .6 Outer tape backing material to be polyolefin only containing greater than 3% but less than 7% by weight of non-polyolefinic material consisting of pigments, antioxidants and stabilizers.
- .4 Liquid Epoxy Coating systems conforming to or exceeding the requirements of AWWA C210 (latest edition) may be used for field spot repairs only; minimum 20 mil (508 µm) dry film thickness or as recommended by the manufacturer.

2.5.3 Quality Assurance

- .1 For all linings and coatings applied to steel pipe, the Contractor shall submit a report from an independent, third party inspection firm or consultant confirming preparation and application procedures have been followed and providing measurements confirming DFT.

2.6 Couplings and Adaptors

2.6.1 For coupling 300 mm diameter or less,

- .1 PVC to PVC use moulded PVC couplings produced under the certification of CSA B137.2, AWWA C900, ANSI/NSF 61.
- .2 PVC to PVC, or to asbestos cement or to cast iron mains, may use two bolt, sleeve type couplings for plain end pipe to AWWA C219. Center sleeves shall be Type 304 stainless steel to ASTM A666, or ductile iron to ASTM A536. Ductile iron shall be liquid epoxy coated to AWWA C210 or fusion bonded epoxy coated to AWWA C213, minimum 16 mils (406 µm), ANSI/NSF 61.

2.6.2 For pipe sizes larger than 300 mm, use a compression sleeve coupling to join asbestos cement pipe to steel pipe, PVC pipe to steel pipe, steel pipe to steel pipe or PVC to PVC. Couplings to have Type 304 stainless steel or ductile iron center sleeve sized to suit the pipe types and to provide a water tight compressive gasket seal on each pipe. Coupling design and construction methods and materials must or exceed all requirements of the latest edition of AWWA C219 and all additional requirements specified in these documents. Unless otherwise specified, coupling design working pressure to be at least 1050 kPa (150 psi) with a minimum safety factor of 2.0 using the minimum yield stress of the material used.

- .1 For exposed locations:
 - .1 Interior lining - minimum 16 mils (406 µm) fusion bonded epoxy coating to AWWA C213. and ANSI/NSF 16. Preferred colour, white or off white.
 - .2 Exterior coating - minimum 16 mils (406 µm) liquid epoxy

coating to AWWA C210 or fusion bonded epoxy coating to AWWA C213.

- .3 Nuts and bolts - stainless steel or alloy steel, zinc plated to ASTM B633, Type I (not galvanized), material per AWWA C219.
- .2 For direct buried submerged locations:
 - .1 Interior lining - as above
 - .2 Exterior Coating - minimum 16 mils (406 µm) epoxy as recommended by the coating manufacturer for the service. Coating must be ANSI/NSF 61 potable approved if submerged in potable water.
 - .3 Nuts and bolts - stainless steel material either per AWWA C219 or as specified elsewhere in this section.

2.7 Valves

2.7.1 Gate Valves - 75 to 300 mm inclusive to be iron body, resilient seated with materials, manufacturing and performance in full compliance with the latest edition of AWWA C509. Gate valves 350 mm and greater to be iron body, resilient seated with materials, manufacturing and performance in full compliance with the latest edition of AWWA C515 with 250 psi working pressure.

- .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 50mm sq. 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 AWWA C509 latest edition.
- .5 Valves used on HDPE mains shall be flanged.

2.7.2 Butterfly Valves

- .1 For sizes 75 mm to 500 mm - resilient seated wafer body constructed as follows and must comply with latest edition of AWWA C504:
 - .1 Body - cast or ductile iron
 - .2 Disc - 304 SS 18-8 grade or 316 stainless steel edged cast iron
 - .3 Stem - Grade 304 SS 18-8 grade Stainless Steel
 - .4 Stem Fasteners - 316 or 304SS 18-8 grade stainless steel

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- .5 Shaft seal – Chevron V packing or 'O' ring seals to AWWA C504 latest edition.
 - .6 Hydrostatic test capability which meets or exceeds ANSI 150 and a certified bubble tight differential working pressure rating of at least 1050 kPa (150 psi). Minimum flow of 4.9 m/sec is standard unless specified otherwise by the Engineer.
 - .2 For sizes 600 mm and larger - same as valves sizes 75mm to 500 mm with the following revisions:
 - .1 Body - ductile iron through tapped flange wafer body.
 - .2 Meet or exceed the performance requirements of ANSI/AWWA C504 and CSA B16.1.
 - .3 Operators - Buried or Vault installation
 - .1 All buried valves and all valves 150 mm and larger installed in valve vaults to be equipped with an enclosed, sealed and grease packed gear operator with stainless steel bolting and epoxy coating. Operators sized for a maximum 27.5 kg rim pull assuming a 600 mm diameter hand wheel. Valve vaults smaller than 150 mm to be equipped with notch plate type lever operator.
 - .4 Operators - Exposed Service
 - .1 All valves 150 mm and larger standard enclosed type gear actuator with a hand wheel operator. Actuators sized per 2.7.2.3.1. Valves smaller than 150 mm to be equipped with notch plate type lever operator.
- 2.7.3 Air Release Valves (13mm to 500mm)
- .1 Bodies and covers made from either of: grey cast-iron, ductile-iron, or stainless steel.
 - .2 Maximum working pressure of the water systems – 2,070 kPa (300 psi).
 - .3 Temperature ranges above freezing to maximum of 52°C (125°F).
 - .4 Shall conform to ANSI/AWWA C512 and NSF 61, latest revisions.
- 2.8 Flange Gaskets
- 2.8.1 Flange gaskets to be cloth inserted red rubber or other material conforming to the latest edition of AWWA C207 and approved for use with potable water.
 - 2.8.2 Ring type gaskets for raised face flanges
 - 2.8.3 Full face gaskets for flat-faced surfaces

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- 2.8.4 Gasket thicknesses as follow:
- .1 100 mm to 600 mm - 1.6 mm thick.
 - .2 750 mm to 1800 mm - 3.2 mm thick
- 2.8.5 Where petrolatum primer may be in contact with gasket fitting, gaskets shall be BUNA-N, NEOPRENE or as recommended by the manufacturer.
- 2.9 Valve Boxes and Covers
- 2.9.1 127 I.D. x 6 W.T. Schedule 40 PVC lower section as manufactured by approved manufacturer in the product list.
- 2.9.2 1200 or 760 long x 150 I.D. x 11 W.T. "Type A" cast iron upper valve box section and appurtenances.
- 2.10 Hydrants
- 2.10.1 Dry-barrel, compression type hydrants which are designed, manufactured and tested in full compliance with the latest edition of AWWA C502.
- 2.10.2 Pentagonal operating nut and nozzle cap nuts which open counter clockwise. Cap chains are not required.
- 2.10.3 Hydrants to have the following:
- .1 Minimum 114 mm diameter opening lower valve.
 - .2 Two (2) – 65 mm x 6 threads per 25 mm hose nozzle.
 - .3 Pumper Hose Connection
 - .1 One (1) – 5" Storz pumper connection. Cap complies with ASTM B108, body complies with ASTM B763, and type 304 stainless steel hex socket set screw. Storz Outlet connection shall meet or exceed all testing requirements set forth by NFPA 1963, UL 246, and FM 1510,
 - .2 One (1) 5" Storz pumper connection shall have a mechanical latching mechanism. Cap to have integrated operating nut, pentagonal in shape and measuring 7/8" point-to-flat. Cap to have independent, swiveling gasket seal. All aluminium used in the cap and outlet shall be hard coat anodized; all copper alloy used shall be C99500. Outlet connection shall meet or exceed all testing requirements set forth by NFPA 1963, UL 246, and FM 1511.
 - .4 150 mm Tyton inlet compatible with C900 Class 165 PVC pipes.
 - .5 Drain outlet – 6 mm NPT to be on the hydrant. Plugging to be done internally.
 - .6 Barrel length as required but to provide a minimum of 2.7 m bury to top of inlet.

- .7 Breakaway style flange and main stem.
- .8 A permanently lubricated housing region with a non-toxic potable grease or oil is required. External means of self-lubrication is necessary without dismantling the hydrant.

2.10.4 Hydrant Finishes

- .1 Finish on all exterior surfaces below the hydrant flange to be asphaltic coated as recommended by the coating manufacturer.
- .2 Exterior finish colour - yellow to match City of Regina requirements.

2.11 Concrete for Thrust Blocks

- 2.11.1 Provide a Concrete Mix Design prior to the placement of any concrete.
- 2.11.2 Cement to conform to CAN/CSA A3000, Type HS.
- 2.11.3 Air entraining admixtures to conform to CSA A266.1 and ASTM C494.
- 2.11.4 Water reducing admixtures to conform to ASTM C494.
- 2.11.5 Retarding admixtures, which require approval for use, to conform to ASTM C494.
- 2.11.6 Minimum concrete design strength to be 20 MPa at 28 days. Higher design strength concrete may be substituted to obtain shorter curing time.

2.12 Puddle Flanges

- 2.12.1 Use minimum 6.35 mm thick steel plate as puddle flange material with diameters as follows:

PIPE DIAMETER	PUDDLE FLANGE DIAMETER
75 mm to 300 mm	Pipe diameter plus 50 mm
350 mm to 550 mm	Pipe diameter plus 100 mm
600 mm and larger	Pipe diameter plus 150 mm

2.13 Sacrificial Anode Materials

- 2.13.1 Anode(s) to be 5.4 kg (12 lb.) packaged zinc anodes complete with #6 three metre lead.
- 2.13.2 Cadweld to be 25 gram. A #6 copper sleeve crimped to anode lead is required prior to cadwelding.
- 2.13.3 Eyelets to be 16 mm (5/8") or 20 mm (3/4") copper stud #6 cable eyelet.
- 2.13.4 Refer to Standard Drawings W-25 to W-29 for construction details.

2.14 Tapping Sleeve and Valves

- 2.14.1 Refer to Section 2516 Water and Sewer Service Connections

3.0 EXECUTION

3.1 Trench Excavation and Backfill

- 3.1.1 Refer to Section 02315-Trench Excavation and Backfill. Carry out trench excavation and backfill in full compliance with that section.
- 3.1.2 Comply with all safety requirements of:
 - .1 *Local codes and bylaws*
 - .2 *Occupational Health and Safety Act & Regulations, Latest Edition*
 - .3 *National Building Code of Canada, 2010 or the latest revision*
- 3.1.3 Maintain trench excavation and bedding preparation a sufficient distance in front of the pipe installation operation to avoid interference with the pipe installation.

3.2 Pipe Installation

- 3.2.1 Obtain Engineer's approval of backfill and bedding materials and installation procedures prior to pipe installations.
- 3.2.2 Prevent dirt or other foreign material from entering installed pipe with temporary blocking.
- 3.2.3 Install pipe true to line and grade as staked by the Engineer to within 100 mm horizontally and 50 mm vertically.
- 3.2.4 Keep contamination protection cover on pipe ends until just prior to jointing to the previously installed pipe.
- 3.2.5 Handle, install and joint pipe in accordance with the manufacturer's instructions.
- 3.2.6 Install push-on joint pipe such that the spigot ends are inserted into bell ends.
- 3.2.7 Modify pipe ends to be installed into push-on fittings as recommended by the pipe manufacturer.
- 3.2.8 Clean pipe ends of all foreign materials and substances prior to joint makeup.
- 3.2.9 Remove any pipe, which has floated due to trench flooding and reinstall only after acceptable trench and bedding conditions have been re-established.
- 3.2.10 Provide any pipe or joint deflections required in a manner recommended by the pipe manufacturer and/or as approved by the Engineer.
- 3.2.11 Install all special structures such as air release valves, drains, blowoffs, hydrants, swabbing facilities and valve chambers at the locations indicated and in accordance with the contract documents.
- 3.2.12 Install, bed and backfill pipe such that deflection of pipe is within the manufacturers' tolerances for long term service.
- 3.2.13 Protect pipe and fittings from excessive exposure to direct sunlight or other damage. Replace any pipe or fittings which have become discoloured,

cracked or otherwise marred or damaged.

- 3.2.14 Ensure proper operation of all fittings and appurtenances having moving parts both prior to and after installation.
- 3.2.15 Steel pipe shall be installed as per AWWA M11 and as follows:
- .1 All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of AWWA C200 and AWWA coating and lining standard as supplemented by the requirements herein.
 - .2 Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of AWWA C200 and AWWA coating and lining standards.
 - .3 The Contractor shall perform required tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor; provided, that the Contractor's schedule is not delayed for the convenience of the Engineer.
 - .4 All welding procedures used to fabricate pipe shall be qualified under the provision of AWS B2.1 or ASME Section IX.
 - .5 Skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used shall do all welding. Welders shall maintain current qualifications under the provisions of AWS B2.1 or ASME Section IX. Machines and electrodes similar to those in the work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders.

3.3 Thrust Blocks

- 3.3.1 Provide only cast-in-place concrete thrust blocks that are sized and located as shown on Standard Drawing W-13 on all push-on and mechanical joint fittings.
- 3.3.2 Cut bearing soil wall to the proper angle for the fitting and ensure an undisturbed soil bearing face.
- 3.3.3 Obtain approval of the Engineer for all thrust block formwork prior to concrete placement.
- 3.3.4 Place a minimum 8 mil (200 μ m) polyethylene sheet between the full contact face of the fitting and the thrust block.
- 3.3.5 Remove wooden formwork prior to backfilling. Wooden formwork used for the sides may remain in the ground at the Engineer's discretion.
- 3.3.6 Use mechanical thrust restraint devices only with the approval of the Engineer.
- 3.3.7 Use mechanical thrust restraints or poured in place concrete thrust blocks with cast iron fittings. Use poured in place concrete thrust blocks only with PVC plugs and ends caps.
- .1 Restrain all joints that fall within the lengths of horizontal pipes as shown on Standard Drawing W-14

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- .2 Restrain all joints that fall within the lengths of vertical of pipes as shown on Standard Drawing W-14.
 - .3 Restraints for appurtenances 400 mm and larger as recommended by the manufacturer.
- 3.4 Connection to Existing Watermains
- 3.4.1 Adhere to the scheduling stipulations for service interruptions contained in these specifications.
 - 3.4.2 Provide notice in accordance with the general requirements to all customers whose water service will be interrupted by the connection. Standard notices may be obtained from the City of Regina, Public Works Division.
 - 3.4.3 Adhere to standard or special tie-in details contained in the contract documents and confirm acceptability with the Engineer prior to proceeding.
 - 3.4.4 Carefully inspect exterior surface of asbestos cement pipe where couplers will contact the pipe. Ensure that the surface is free of pitting, cracks or other imperfections that could compromise proper sealing of the coupler gasket to the pipe surface.
 - 3.4.5 In the event that the surface of asbestos cement pipe is judged to be questionable to provide proper sealing, replace the entire section of asbestos cement pipe with PVC pipe back to the first available joint at the direction of the Engineer.
 - 3.4.6 Make good at no expense to the Owner all damages resulting from an unsuccessful tie-in or failure of materials installed to complete tie-in or damage to existing structures or works caused during performance of the tie-in.
- 3.5 Hot Tap Connection to Steel Watermain
- 3.5.1 Generally design in accordance with AWWA M11 and construct in accordance with AWWA C208, C209, and C213.
 - 3.5.2 Anvilet and weldneck flange may be shop welded prior to connection to the watermain. Bolts holes to straddle centre line of flange.
 - 3.5.3 Remove all exterior coatings from the watermain prior to fitting flange. Flange shall be mounted perpendicular to the horizontal centerline of the pipe.
 - 3.5.4 All welding to be performed by certified welders. Weld material shall be manual arc welding electrodes suitable for welding carbon steel to carbon steel in all positions.
 - 3.5.5 Following hot tapping and installation of pipe connections, replace coating on main and connection with a similar coating, thoroughly encapsulate anvilet, flange and valve with a petrolatum primer and tape conforming to AWWA C217.
 - 3.5.6 Adhere to standard drawing W-36 for hot taps on 610 mm, 914 mm and 1042 mm mains, or special tie-in details if provided.

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- 3.5.7 For mains other than specified in 3.5.6 design according to AWWA M11 and confirm acceptability to The Engineer prior to proceeding.
 - 3.6 Hydrant Installation
 - 3.6.1 Install hydrants in accordance with Standard Drawing W-02.
 - 3.6.2 Install hydrants and leads straight and plumb.
 - 3.6.3 Install pumper nozzle facing the street.
 - 3.6.4 Install hydrants such that the hydrant flange is 50 mm above top of curb, walk or finished grade of lot as directed by the Engineer.
 - 3.6.5 Install gate valve on all hydrant leads as shown on Drawing W-02
 - 3.7 Valve Installation
 - 3.6.1 Install valves in accordance with Standard Drawing W-01. Use slings manufactured of nylon or other suitable material for hoisting valves in and out of trench excavations.
 - 3.6.2 Provide a valve box on each valve that is direct buried. Valve box to be installed straight and plumb.
 - 3.6.3 Install PVC bottom section to within a maximum of 150 mm of finished grade.
 - 3.6.4 Minimum overlap between the top and bottom sections of the valve boxes shall be 150 mm.
 - 3.6.5 Install thrust blocks or mechanical thrust restraints at all valves.
 - 3.8 Valve Box Adjustment
 - 3.8.1 Where valve boxes are being rebuilt, constructed, raised or lowered and/or adjusted in conjunction with surface re-construction or renewal, adjust valve boxes in accordance with Section 2350.
 - 3.8.2 Adjust top section of valve box by excavating to below collar on bottom section of valve box and raising top section to finished grade. Minimum overlap between top and bottom sections shall be 150 mm. If adjustment required is less than 75 mm then “lifter rings” may be used (maximum of 1). Valve box risers or “lifter rings” will not be permitted on new construction.
 - 3.8.3 Place and compact granular material under collar of valve box to grade required.
 - 3.8.4 Where top section of valve box cannot be raised use top extension piece.
 - 3.9 Puddle Flanges
 - 3.9.1 Provide a puddle flange at each point where a pipe passes through a buried concrete wall.
 - 3.9.2 For pipes 65mm and smaller, use a full coupling as a puddle flange.
 - 3.9.3 Provide continuously welded annular plates as puddle flanges on all pipes 75mm and larger.
 - 3.9.4 Centre puddle flanges in walls unless directed otherwise.
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- 3.9.5 Repair damage done to internal linings caused by welding of puddle flange. Remove any exterior pipe coatings, except galvanizing, from surface area which will be embedded in concrete or grout.
 - 3.9.6 Fill new penetrations through existing walls or slabs with a non-shrink, non-metallic grout to within 25 mm of the face of the surface. Fill the remaining depression with Portland Cement grout and finish neatly.
 - 3.9.7 Provide proper atmospheric conditions for curing of grout as recommended by the grout manufacturer. Do not backfill or load grouted penetrations until curing is complete.
- 3.10 Corrosion Protection
- 3.10.1 Provide corrosion protection on all buried metallic objects. Sacrificial anodes are to be provided on all hydrants. All buried valves and metal fittings shall be wrapped with a physical encapsulation system as specified in Section 02516. Anodes are not required on buried metal objects (except for hydrants) unless the air temperature at the time of installation is less than 5 °C or, in the opinion of the Engineer, other conditions make its use impractical. In those instances **only**, use a sacrificial anode system to provide corrosion protection.
 - .1 Anode Installation
 - .1 Install anode(s) as shown on the applicable Standard Drawings W-25 to W-29.
 - .2 Securely crimp anode lead(s) to eyelet connectors when used.
 - .3 Re-torque hydrant bolts after eyelet connection is made.
 - .4 Prior to cadwelding, clean the metal surface to bare shiny metal by filing or grinding, Remove any dust and dry thoroughly.
 - .5 Cadwelding to be performed only by personnel who have been formally trained to carry out the procedure. Provide all required safety apparel and strictly adhere to all applicable safety procedures when carrying out this procedure.
 - .6 Remove slag from cadweld by tapping with a chipping hammer.
 - .7 After the weld has completely cooled apply a mastic protection system to the cadweld and adjacent areas affected by the procedure.
 - .8 Remove any plastic bags from zinc anodes. Cut slits in cardboard tubes.
 - .9 Install anodes as shown on Standard Drawings and pour water over anodes prior to backfilling.
 - .10 Ensure slack is left in anode leads so that they are not pulled out or damaged during backfilling.