



PROVIDING MORE

Design and Construction Standards

Volume 4 Water

January 2013



WATER INDEX

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1. DEFINITIONS

- 1.1 **EPCOR, EPCOR Water Services:** the water utility company that services the City of Edmonton.
- 1.2 **Engineer:** the person for the time being designated by the Senior Vice President, EPCOR Water Services, to represent EPCOR during the course of the work.
- 1.3 **Inspector:** the person for the time being designated by the Senior Vice President EPCOR Water Services, to inspect the works on behalf of EPCOR.

2. ACTS, BYLAWS AND STANDARDS

- 2.1 Where acts, bylaws and standards are referred to, they shall be current, amended and updated issues of such.
- 2.2 EPCOR will notify Alberta Environment and Sustainable Resources Development of the proposed construction as required by the Alberta Environmental Protection and Enhancement Act.
- 2.3 It shall be a responsibility of the Consultant undertaking a development project to be aware of the statutory requirements governing such works and for compliance with those requirements. The listing provided below is for guidance. Other statutory instruments, not included here, may be applicable. All work performed on the water distribution system shall meet the minimum requirements as set out in:
- Fisheries Act of Canada, pertaining to the prevention of discharge of chlorinated water and response (s.34 to 43)
 - The Standards and Guidelines for Municipal Water Supply, Wastewater and Storm Drainage Facilities - Alberta Environment and Sustainable Resources Development,
 - The Province of Alberta, Environmental Protection and Enhancement Act
 - The City of Edmonton, Water Services and Wastewater Treatment EPCOR Bylaw 15816
 - The City of Edmonton, Sewers Bylaw 9425
 - The City of Edmonton, Sewers Use Bylaw 9675
 - The City of Edmonton, Surface Drainage Bylaw 11501
 - National Plumbing Code of Canada
 - Alberta Building Code, pertaining to access to fire hydrants (Part 3)
- 2.4 It shall be a responsibility of the Consultant undertaking a development project to be aware of all the requirements of these Design and Construction Standards in their entirety and for compliance with those requirements. Some aspects of water design and construction require compliance with the requirements of other Volumes and Sections of these Design and Construction Standards. The listing provided below is for guidance. Other requirements, not included here, may be applicable. All work performed on the water distribution system shall meet the minimum requirements as set out in:
- Volume 1: General
 - Volume 2: Roadways, Section 02317 - Fillcrete
 - Volume 2: Roadways, Section 02318 - Trench and Backfill
 - Volume 2: Roadways, Section 02965 - Utility Cut Restoration
 - Volume 2: Roadways, Section 03210 - Reinforcing Steel
 - Volume 2: Roadways, Drawings 1020 to 1025 - Transverse Cut Restoration
 - Volume 2: Roadways, Drawings 2100-2710 - Utilities Location Plans
 - Volume 2: Roadways, Drawing 7980 to 7981 - Backfill Details with Valve Raised to Grade
 - Volume 3: Drainage, Section 02445 - Bored Undercrossings
 - Volume 3: Drainage, Section 02446 - Horizontal Directional Drilling

- Volume 3: Drainage, Section 02559 - Factory Applied Pipe Insulation
- Volume 3: Drainage, Section 02631 - Manholes and Catch Basins
- Volume 3: Drainage, Section 03310 - Concrete for Water and Drainage Structures
- Volume 3: Drainage, Drawings 7013, 7014, 7034, 7043 - Standard 1200 Manhole
- Volume 3: Drainage, Drawing 7063 - Standard Riser Connections

3. NOTICE

- 3.1** 48 hours written notice shall be given to the Engineer or Inspector before commencement of work, or changes in work schedules or working, to facilitate coordination with EPCOR or City inspection staff.
- 3.2** EPCOR Water Dispatch (780 412 6800) must be notified prior to the operation of water valves, located on City property or in easements, which are less than 350 mm in diameter. Valves 350 mm and larger can only be operated by Water Distribution staff. EPCOR Water Dispatch (780 412 6800) must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.

4. SUBMISSION AND APPROVAL OF ENGINEERING DRAWINGS AND DOCUMENTS

- 4.1** All drawings submitted for approval must be signed and sealed by a registered professional engineer indicating their proposals for sizes and routes of water distribution and transmission mains, locations of control valves and details of valve chambers, thrust blocks and other appurtenances. The drawings shall conform to the requirements of Volume 1 of these Standards and shall be subject to the approval of the Engineer.
- 4.2** In addition to the requirements in Volume 1 - General, all engineering drawings must include a drawing that shows the approved water network from the hydraulic network analysis (HNA) submitted at Neighbourhood Structure Plan (NSP) indicating mains as existing, proposed and/or future and indicating pipe sizes. Also include on this drawing a list of quantities in accordance with the submitted drawings. Quantities should include the length of main by size, number of hydrants, number of flush points and number of services by size.
- 4.3** Submit one copy of the geotechnical report with the first submission of engineering drawings.
- 4.4** Where the proposals include crossings (e.g. railways, high-pressure pipelines. etc.) the individual(s) responsible for the proposal shall also be fully responsible for:
- the preparation and submission of drawings to the owners and proper authorities;
 - obtaining the necessary permission or permits to enter upon, cross over, or construct under any crossing;
 - any work, extra costs, damage claims, or insurance costs related to any of the crossings; and
 - the submission of documentary evidence that such permits have been obtained prior to the approval of the drawings.
- 4.5** Should the Engineer not approve any part of the drawings or proposals, they will be returned for revision to the satisfaction of the Engineer and the period from return to re-submission of such drawings or proposals shall be deemed to be additional to that specified for first submission.
- 4.6** Two sets of approved drawings shall be submitted to the Engineer at least 48 hours prior to the commencement of construction. Additional submission requirements, media and formats are outlined in the Detailed Engineering Drawings Approval letter for each project.
- 4.7** The submissions described in the remainder of this section take place after the completion and approval of the design. The individual(s) responsible for the proposal must ensure that these submissions are completed. These requirements are listed here because the Consultant who prepared the design will normally provide these services.
- 4.7.1** Within six months after the C.C.C. inspection, revised drawings containing any changes made to the approved design shall be submitted to EPCOR for review. The as-built data that differs from the design shall be clearly identified on either an electronic or paper copy of the original design. The

drawings must identify the name of the Engineer that approved the design along with the date that the drawing was approved. Drafting, notes and dimensions shall comply with Section 5.3 - Drafting Guidelines. Any revisions shall be shown on all affected drawings.

- 4.7.2 Final as-built drawings shall be submitted on velum or mylar within 30 days of receipt of EPCOR's response to the revision drawings submission. Design data shall be erased on the original and replaced with as-built data in ink. The date of construction completion is to be shown by a note on each plan profile drawing. All quantities, lengths and sizes of water mains, appurtenances and fittings shall be tabulated on the as-built drawings. All as-built sewer information shall also be shown. Final as-built drawings shall comply with Section 5.3 - Drafting guidelines. As-built water facility reports are available at www.epcor.com. Additional submission requirements, media and formats, such as digital, are detailed in the Red-Line As-Built Drawings Reviewed letter for each project.
- 4.7.3 The following documentation shall be submitted by the deadlines as shown in Table 1 below.

Table 1: Submissions required after water main construction

ITEM	DEADLINE
Pressure and Leakage Test Results	Prior to C.C.C. inspection.
Chlorine Residual Test Results	Prior to C.C.C. inspection.
Bacteriological Test Results	Prior to C.C.C. inspection.
Taste and Odour Test Results	Prior to C.C.C. inspection.
URW Documentation & Crossing Permits	Prior to C.C.C. signing by Engineer.
As-Built Quantities and Costs Report	Prior to C.C.C. signing by Engineer.
Hydrant Flow Test Results	Prior to C.C.C. signing by Engineer.
Water Facility Reports (Valves, Hydrants, Blow offs, etc.)	Within three months after C.C.C inspection.
Water Service Reports	Within three months after C.C.C inspection.
Water Main Grade Sheets	Within three months after C.C.C. inspection.
As-Built Drawings (for EPCOR review)	Within six months after C.C.C inspection.
Final As-Built Drawings	30 days after receipt of EPCOR's response on as-built drawings.

5. **REFERENCE STANDARDS**

5.1 Organizations issuing standards include:

- American Society for Testing and Materials (ASTM)
- American National Standards Institute (ANSI)
- American Petroleum Institute (API)
- American Water Works Association (AWWA)
- Canadian Standards Association (CSA)
- National Association of Corrosion Engineers (NACE)
- National Sanitation Foundation (NSF)
- Underwriters Laboratories of Canada (ULC)

5.2 Technical standards and guidelines referenced:

Unless otherwise designated, all specification and standard references refer to the latest edition. The listing provided below is for guidance. Other standards, not included here, may be applicable, and other references may be of use to consultants and contractors.

Water mains and appurtenances shall conform to applicable standards, including the following:

- AWWA B300 – Hypochlorites
- AWWA C104 – Cement Mortar Lining for Ductile-Iron Pipe and Fittings

- AWWA C105 – Polyethylene Encasement for Ductile Iron Pipe Systems
- AWWA C110 – Ductile-Iron and Gray-Iron Fittings
- AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast
- AWWA C200 – Steel Water Pipe—6 In. (150 mm) and Larger
- AWWA C206 – Field Welding of Steel Water Pipe
- AWWA C207 – Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
- AWWA C208 – Dimensions for Fabricated Steel Water Pipe Fittings
- AWWA C209 – Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
- AWWA C210 – Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- AWWA C213 – Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
- AWWA C214 – Tape Coating Systems for Exterior of Steel Water Pipelines
- AWWA C215 – Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines
- AWWA C216 – Heat Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
- AWWA C217 – Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
- AWWA C219 – Bolted, Sleeve-Type Couplings for Plain-End Pipe
- AWWA C223 – Fabricated Steel and Stainless Steel Tapping Sleeves
- AWWA C301 – Pre-stressed Concrete Pressure Pipe, Steel-Cylinder type
- AWWA C303 – Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type
- AWWA C304 – Design of Prestressed Concrete Cylinder Pipe
- AWWA C500 – Metal-Seated Gate Valves for Water Supply Service
- AWWA C502 – Dry-Barrel Fire Hydrants
- AWWA C504 – Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm)
- AWWA C508 – Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS
- AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service
- AWWA C510 – Double Check Valve Backflow Prevention Assembly
- AWWA C511 – Reduced-Pressure Principle Backflow Prevention Assembly
- AWWA C512 – Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
- AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- AWWA C550 – Protective Interior Coatings for Valves and Hydrants
- AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances
- AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- AWWA C606 – Grooved and Shouldered Joints
- AWWA C651 – Disinfecting Water Mains
- AWWA C700 – Cold-Water Meters – Displacement Type, Bronze Main Case
- AWWA C701 – Cold-Water Meters – Turbine Type, for Customer Service
- AWWA C710 – Cold-Water Meters – Displacement Type, Plastic Main Case
- AWWA C800 – Underground Service Line Valves and Fittings
- AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
- AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service

- AWWA C903 – Polyethylene—Aluminum—Polyethylene & Cross-linked Polyethylene—Aluminum—Cross-Linked Polyethylene Composite Pressure Pipes, ½ In. (12 mm) Through 2 In. (50 mm), for Water Service
- AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm)
- AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- AWWA C907 – Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
- AWWA M9 – Concrete Pressure Pipe
- AWWA M11 – Steel Pipe - A Guide for Design and Installation
- AWWA M17 – Installation, Field Testing and Maintenance of Fire Hydrants
- AWWA M22 – Sizing Water Service Lines and Meters
- AWWA M23 – PVC Pipe—Design and Installation
- AWWA M32 – Computer Modeling of Water Distribution Systems
- AWWA M55 – PE Pipe—Design and Installation
- CSA B64 – Selection and installation of backflow preventers
- CSA B137.0 – Definitions, General Requirements and Methods of Testing for Thermoplastic Pressure Piping
- CSA B137.1 – Polyethylene (PE) Pipe, Tubing and Fittings for Cold-Water Pressure Services
- CSA B137.2 – Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications
- CSA B137.3 – Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications
- CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications
- CSA C22.2 No. 38 – Thermoset Insulated Wires and Cables
- CSA C22.3 No.4 – Control of Electrochemical Corrosion of Underground Metallic Structures
- CSA C22.3 No.6 – Principles and Practices of Electrical Coordination between Pipelines and Electric Supply Lines
- CSA W47.1 – Certification of Companies for Fusion Welding of Steel
- CSA Z662 – Oil and Gas Pipeline Systems
- API Standard 1104 – Welding of Pipelines and Related Facilities
- ASTM A48 – Standard Specification for Gray Iron Castings
- ASTM A105 – Standard Specification for Carbon Steel Forgings for Piping Applications
- ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- ASTM A536 – Standard Specification for Ductile Iron Castings
- ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings
- ASTM B88 – Standard Specification for Seamless Copper Water Tube
- ASTM B418 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes
- ASTM B843 – Standard Specification for Magnesium Alloy Anodes for Cathodic Protection
- ASTM C33 – Standard Specification for Concrete Aggregates
- ASTM C150 – Standard Specification for Portland Cement
- ASTM D3034 – Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- ASTM F1962 – Standard Guide for Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings
- ASTM F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- ASTM G57 – Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
- ASTM G97 – Standard Test Method for Laboratory Evaluation of Magnesium Sacrificial Anode Test Specimens for Underground Applications

- Canadian Electrical Code (CEC) C22.1 – Safety Standard for Electrical Installations, Parts 1 and 2
- National Sanitation Foundation (NSF) Standard 14 – Plastics Piping System Components & Related Materials
- National Sanitation Foundation (NSF) Standard 61 – Drinking Water System Components - Health Effects

5.3 Drafting guidelines

- 5.3.1 All streets and avenues shall be identified according to the name or number shown on the registered plan of the subdivision. Alleys shown on drawings where the adjacent street or avenue is not shown, shall be identified as the alley east or west of a street, or the alley north or south of an avenue; e. g. LW 115 Street, LN 145 Avenue.
- 5.3.2 The position of all hydrants, valves, plugs, bends, crosses, tees, reducers and other fittings or appurtenances shall be noted and dimensioned in two directions from the property line(s). Co-ordinates given in NAD83 3TM will be accepted in place of dimensions.
- 5.3.3 Water main annotation shall include pipe size, pipe material, manufacturer and dimension ratio (DR).
- 5.3.4 A detailed description of all fittings must be indicated, for example: 200 mm x 150 mm reducer 200 mm x 22.5° bend. Tees and crosses must be indicated with a minimum of 2 sizes as shown in the following examples:
- For a 250 mm x 200 mm Tee the run is 250 mm and the branch is 200 mm in diameter.
 - For a 250 mm x 200 mm Cross the run is 250 mm and the branches are 200 mm in diameter.
- 5.3.5 If the sizes of the through branches differ, each of the four branch sizes must be shown.
- 5.3.6 All applicable Standard Details for water mains and appurtenances are shown or listed on the drawings.
- 5.3.7 All boundary valves must be clearly identified on the engineering drawings.

6. WATER MAINS

6.1 Location

- 6.1.1 Where a water main, less than or equal to 450 mm in diameter, is installed in a street or avenue, it shall be located in the carriageway at a centre-line alignment of 1.5 m from the curb face on the side of the carriageway opposite to where the main power, street light cable and telephone lines are to be installed. If the carriageway allows, for a water main 600mm in diameter or more, it shall be located similarly to the smaller main, but at a centre line alignment of 2.0 m from the curb face.
- 6.1.2 A minimum horizontal distance of 2.5 m must be maintained between a water main centre-line and any sewer main centre-line. Where room is available, 3.0 m is preferred. Additional clearance may be required at the Engineer's discretion, including when pipe diameters are greater than 300 mm. Minimum vertical separations of 0.30 m and 0.50 m must be maintained for water mains crossing above sewers and below sewers respectively. These clearances also apply to catch basin leads.
- 6.1.3 A minimum horizontal distance of 1.8 m must be maintained between a water main centre-line and any gas main, power cable, telecommunications cable, ductline, manhole shaft, pedestal, grounding rod, or deciduous tree. A minimum 3.5 m of horizontal clearance should be maintained between a water main centre-line and any coniferous tree. A minimum 3.5 m of horizontal clearance must be maintained between a hydrant centre-line and any tree. All major or primary power cables must be located on the opposite side of the road as the water main.
- 6.1.4 A minimum horizontal distance of 1.0 m must be maintained between a valve, hydrant or curb cock and any power cables, telecommunication cables, gas mains or ductlines. A minimum separation of 1.8 m is required on one side where a water valve or appurtenance is crossed on both sides.

- 6.1.5 Where a water main is installed in an alley, utility lot, walkway or easement it shall be located at a minimum of 1.2 m from a property line. A separation of 2.0 m from property line is preferred.
- 6.1.6 Where a catch basin is installed, a minimum horizontal distance of 1.5 m shall be maintained for water main centre-lines and 3.0 m for water service centre-lines.

6.2 Depth

- 6.2.1 Pipe grades shall be shown on the engineering drawings. Table 2 shows the minimum depth of water main invert below the curb top, excluding those areas considered by the Engineer to be of greater risk of freezing based due to soil conditions.

Table 2: Minimum water main depths

Diameter	Minimum depth of invert below curb top
150 mm	2.59 m
200 mm	2.62 m
250 mm	2.64 m
300 mm	2.67 m
350 mm	2.70 m
400 mm	2.72 m
450 mm	2.75 m

- 6.2.2 For areas considered by the Engineer to be of greater risk of freezing, generally shown by the shaded regions in Figure 1, position water infrastructure an additional 300 mm below curb top relative to the depths shown in Table 2.

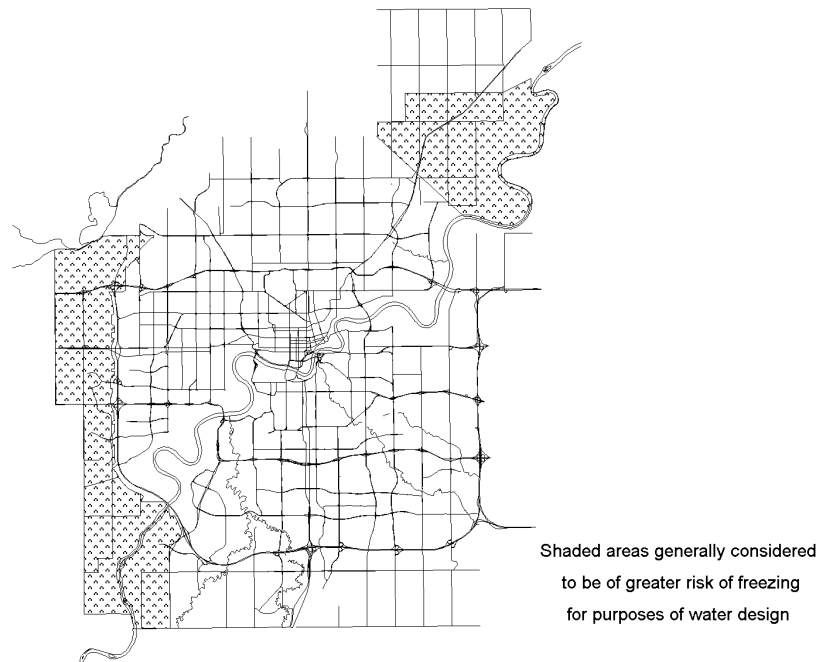


Figure 1: Areas in Edmonton where water mains are generally considered to have a greater risk of freezing due to soil conditions.

- 6.2.3 All hydrant leads are to be designed level. The bottom of the hydrant flange is to be set a minimum of 50 mm above finished grade. Hydrant tees should be installed at the water main depths shown in Table 2 when possible to avoid the need for hydrant extensions.

- 6.2.4 Water mains must be designed so that the depth of the valve operating nut is between 1.8 m and 2.5 m from finished grade.
- 6.2.5 At the Engineer's discretion, installation at less than the minimum depth may be permitted with the provision of appropriate insulation. Refer to drawing 2511-08.

6.3 Sizing

- 6.3.1 Sizing of water mains will be determined by hydraulic network analysis as set out in Chapter 12.
- 6.3.2 The same water main diameter and material specification shall be used from intersection to intersection of pipe.
- 6.3.3 The minimum diameter of a distribution main shall be 200 mm unless its only purpose is to provide service, not fire protection, to an area. After the last hydrant tee on a dead end, the water main diameter should be reduced to 150 mm.

6.4 Dead-ends

- 6.4.1 Temporary dead-ends shall be plugged with standard plugs or caps and shall be provided with reaction or thrust blocks, in accordance with Drawing 2511-06. Where required, caps or plugs shall be tied to fittings with clamps and tie rods.
- 6.4.2 Permanent dead ends shall be plugged and tapped with a flush point in accordance with Drawing 2511-11.

6.5 Cathodic protection for buried steel pipe and fittings

- 6.5.1 All steel pipe and fittings require cathodic protection. Refer to Section 02516.
- 6.5.2 In order to calculate the type, weight and spacing of the anodes, a soil resistivity analysis shall be conducted along the length of the pipeline. A report on soil resistivities and the weight and spacing of anodes is to be provided to the Engineer along with the first submission of engineering drawings.
- 6.5.3 All existing steel pipes being connected to must have at least two 7.7kg (17lb) sacrificial magnesium anodes at the point of connection.

6.6 Cathodic protection for buried non-steel metallic fittings, valves and hydrants

- 6.6.1 All buried non-steel metallic fittings and valves shall be cathodically protected with 2.3 kg (5 lb) zinc anodes and all hydrants shall be cathodically protected with a 5.5 kg (12 lb) zinc anodes as per Drawings 2516-03 and 2516-04. Zinc anodes shall conform to ASTM B418-73 and the Construction Specifications.
- 6.6.2 All exterior bolts on valves, hydrants and couplings shall be Stainless Steel type 304 or an approved equivalent.
- 6.6.3 All existing cast iron or ductile iron pipes being connected to must have at least one 7.7 kg (17lb) magnesium anode at the point of connection.

6.7 Cathodic protection for water services

- 6.7.1 All copper services 50 mm and smaller in diameter shall have a 5.5 kg (12 lb) zinc anode attached to the copper service pipe and located 1.0 metre from the curb cock within the road right-of-way in accordance with Drawing 2516-06. The zinc anode shall be as specified in the Construction Specifications. The zinc anode wire is to be clamped to the copper pipe with an all-brass clamp or an approved equivalent.

6.8 Isolation Locations for Electrical Current

- 6.8.1 Where proposed construction includes a connection to existing piping at water reservoir or pump station sites, the engineering drawings shall include details for the electrical current isolation of the new steel, concrete cylinder pipelines or other metallic pipes from the reservoir or pump station piping, as required.
- 6.8.2 Test stations shall be provided at all isolation locations with one lead bonded on each side of the isolator so that isolation integrity can be checked. Test stations shall be constructed in accordance with Drawing 2516-01 and the Construction Specifications.

6.9 Thrust Blocks

- 6.9.1 Provide a concrete thrust block at each dead end, valve, tee, bend, hydrant, reducer, transition coupling, or fitting and at any change in pipe diameter or direction.
- 6.9.2 Thrust blocks must be designed to actual soil conditions. Refer to Drawings 2511-03, 2511-04, 2511-05, 2511-06, 2511-13 and 2513-01 as a guideline.
- 6.9.3 Joint restraints may also be required in conjunction with thrust blocks. Calculations must be submitted to EPCOR prior to drawing approval.

7. FIRE HYDRANTS

7.1 Location and Spacing

- 7.1.1 Hydrants are to be located 2.9 m behind the curb face where there is monolithic walk. If the monolithic walk is greater than 2.5 m wide, include a 90 degree bend in the hydrant lead and locate the hydrant and the control valve 0.3 m behind the back edge of the walk.
- 7.1.2 Hydrants are to be located 1.5 m behind the curb face where the walk is greater than 2.0 m into the boulevard or where no walk exists.
- 7.1.3 Hydrants are to be located not greater than 3.0 m from the curb face, except in the case of a wider monolithic walk as per Item 7.1.1.
- 7.1.4 Hydrants are to be located on the opposite side of the property as the existing or proposed driveway, where possible, and a minimum 1.8 m from the edge of any existing or proposed driveway regardless of the property side.
- 7.1.5 Where a fire hydrant is installed at a corner of an intersection, it shall be installed at the beginning of the curve of the curb return where not in conflict with Item 7.1.4.
- 7.1.6 In cul-de-sacs which are 90 m or less in length, the fire hydrant shall be installed on the intersecting street at or near the intersection with the cul-de-sac.
- 7.1.7 Where a public and emergency access is provided to a top-of-the-bank walkway, a fire hydrant shall be located within the road right-of-way in close proximity to the public and emergency access.
- 7.1.8 Each fire hydrant shall be connected to the main with a 150 mm PVC branch controlled by an independent 150 mm gate valve. The valve shall be installed entirely out of the sidewalk and shall be located a minimum of 0.9 m from the hydrant.
- 7.1.9 If hydraulically required, hydrant leads may be upsized to 200 mm using a reducer 4 m from the hydrant.
- 7.1.10 At no time shall any power cables, gas lines, telecommunications cables or ductlines cross between a hydrant and its control valve.
- 7.1.11 The maximum allowable spacing between fire hydrants shall be 150 m in single-family and semi-detached residential areas and 90 m in all other areas (i.e. multiple-family residential, school, industrial/commercial areas).

- 7.1.12 Where the water table is located above the fire hydrant drain, the hydrant drain ports may require plugging. These hydrants must be clearly identified on the engineering drawings and as-built submission. Consult with the EPCOR Water engineer to determine drain plugging requirements. The hydrant must be pumped after each use.
- 7.1.13 Hydrant numbers shall be painted with black or blue colour Benjamin Moore rust inhibitive alkyd paint just below the dome on the side of the barrel that points away from the street. A 50-mm font shall be used for all numbering.

8. **VALVES**

8.1 **Location and Spacing**

- 8.1.1 The location and spacing of valves in the water system should be such that when in operation:
- No more than two hydrants are taken out of service by a water main shutdown;
 - No more than four valves are required to achieve a shutdown;
 - No more than 150 single-family lots are taken out of service by a water main shutdown in the interim; and
 - No more than 30 single-family lots are taken out of service by a water main shutdown in the ultimate design.
- 8.1.2 Valves will be located a maximum of 800 m apart on water transmission mains, defined as 450 mm diameter and larger.
- 8.1.3 Valves must be located a minimum of 30 m away from arterial and collector road intersections, unless approved by the Engineer.
- 8.1.4 Valves will be located at both ends of a water main passing through a utility lot, walkway or easement and will be placed a minimum of 0.5 m from the property line or its projection.
- 8.1.5 Mainline valves at intersections of water mains and mid-block mainline valves shall be located on projections of the property lines, where possible, or dimensioned to a property line.
- 8.1.6 Where a catch basin is installed a minimum horizontal distance of 3.0 m shall be maintained from the catch basin lead centre line to the valve casing centre line.
- 8.1.7 Tapping valves require a minimum spacing of 1.5 m from all pipe joints.

9. **WATER SERVICES**

9.1 **General**

- 9.1.1 The scope of work described in this section pertains only to that portion from the connection at the distribution main between the main stop and curb stop, for services 50 mm and smaller. EPCOR is not responsible for ownership or maintenance of the portion of the service on the private side of the service valve.
- 9.1.2 Water services must also comply with the requirements of the Edmonton Waterworks Bylaw and all applicable bylaws as amended. Table 3 indicates the minimum size of service that shall be installed in order to ensure adequate flow and residual pressure for residential customers:

Table 3: Minimum water service size required for residential customers

Class of Building	Minimum Service Size - Internal Diameter	
	Peak Hour Pressures \geq 350 kPa	Peak Hour Pressures < 350 kPa
Single-Family Dwelling	20mm	25mm
Two-Family Dwelling (Duplex)	Two separate 20mm	Two separate 25mm
Four-Family Dwelling (Fourplex)	40mm	40mm

- 9.1.3 A larger service size than that indicated in Table 3 will be required where, in the opinion of the Engineer, the length of the service pipe, the potential demand, the supply pressure or other conditions warrant an increase.
- 9.1.4 Water services for industrial, commercial, or institutional applications shall be sized and located according to all relevant codes and regulations and in accordance with current industry standards as presented in AWWA Manual M22 and shall be subject to approval by the Engineer.
- 9.1.5 Some building complexes may require more than one service pipe to be installed. The design and construction of such service pipes (including considerations for cross-connections and backflow prevention) shall be in accordance with the National Plumbing Code of Canada. Private mains that are connected to the public network at two or more locations, creating a looped system, must have check valves installed to prevent any backflow to the public system.
- 9.1.6 For water services 100 mm and larger, valves shall be of the same size as the water service piping and shall be gate valves in accordance with the Construction Specifications, Section 02519 – Product Approval Procedures. Valves shall be of the non-rising stem type, equipped with a 50 mm operating nut and shall turn counter-clockwise to open. Large service valves shall be either TVS installations or the valve shall be strapped to the tee in accordance with Drawing 2512-09.
- 9.1.7 No water service intermediate in size (between 50 mm and 100 mm) shall be permitted.
- 9.1.8 Where the water service is 50 mm or smaller, it shall be laid in the same trench as the sanitary and stormwater services and to the right of the sanitary service when facing the lot being served. Where the water service is 100 mm or larger in size, it shall be laid in a separate trench and at a minimum separation of 3.0 m from any sanitary or storm sewer, and 1.8 m from any gas or electrical service.
- 9.1.9 A minimum horizontal distance of 1.8 m must be maintained between a water service centre line and any gas main, power cable, telecommunications cable, ductline, manhole shaft, pedestal, grounding rod, catch basin or deciduous tree.
- 9.1.10 The invert of the water service shall be 2.59 m below finished grade at property line.
- 9.1.11 Single water services shall be normally laid in the middle of the property and shall intersect the property line at an angle as near 90° as possible. The installation of single water service connections is governed by Drawings 2514-05 and 2514-08. The installation of dual water services shall be in accordance with Drawings 2514-06 and 2514-07.
- 9.1.12 The minimum allowable distance between mainstops shall be 600 mm. The minimum allowable distance from a mainstop to an adjacent bell, collar, plug or coupling shall be 600 mm.
- 9.1.13 Water and sewer services are to be extended into private property 1.2 metres beyond the edge of the 2.0 metre wide gas easement furthest from the street, to reduce the risk of damage to the gas main during installation of private building services. Installation shall be in accordance with Drawing 2514-09.

10. MANUAL AIR VENTS (MAV)

- 10.1.1 A manual air vent is required at the high point(s) of a transmission water main, and on either side of a valve where the pipe diameter is 450 mm or greater. Refer to drawings 2512-14 through 2512-18.
- 10.1.2 Place manual air vents within the boulevard. Manual air vents may be placed in the roadway, subject to prior approval, in the following cases:
 - The available space in the boulevard is more than 4 m away from the water main;
 - There is not enough room in the boulevard to install a manual air vent; or
 - It is otherwise deemed necessary by the engineer.

11. BLOW OFFS

- 11.1.1 A blow off hydrant or chamber is required at the low point(s) in a transmission water main. Refer to drawings 2512-19 and 2511-09.
- 11.1.2 Design and install transmission water mains with a slope of 0.4% or greater, unless otherwise approved by the Engineer.
- 11.1.3 Blow off hydrants are preferred, although a blow off in a chamber may be accepted in the following cases:
 - A hydrant cannot be installed at its final alignment due to a future sidewalk or road widening;
 - The blow off is located outside of the road right of way;
 - There is not enough room in the boulevard to install a hydrant; or
 - It is otherwise deemed necessary by the Engineer.

12. HYDRAULIC NETWORK ANALYSIS (HNA)

12.1 Submissions

- 12.1.1 In general, a hydraulic network analysis (HNA) is required for any new development for which a hydraulic analysis has not been previously approved, or for any development that significantly alters the servicing scheme such that a previously approved hydraulic network analysis is no longer applicable. A hydraulic network analysis report, signed and sealed by a registered professional engineer, should be submitted for approval by the Engineer at the following stages in the planning process:
 - Area Structure Plan (ASP);
 - Neighbourhood Structure Plan (NSP);
 - Subdivision Approval; and
 - Interim Staging Analysis.
- 12.1.2 The HNA report must be supported by the results of computer modeling of the proposed distribution system. Refer to AWWA Manual M32 for more information on computer modeling of a water network.
- 12.1.3 If the Area Structure Plan and Neighbourhood Structure Plan stages are omitted or superseded, a hydraulic network analysis (which meets the requirements of a Neighbourhood Structure Plan hydraulic network analysis) must be submitted at the Neighbourhood Area Structure Plan, Subdivision Plan, Zoning Bylaw or Servicing Concept Design Brief stage.
- 12.1.4 If a subdivision or stage is covered in sufficient detail by a hydraulic network analysis submitted and approved at a previous stage then, at the discretion of the Engineer, the responsible party may be released from the obligation to submit a further analysis.
- 12.1.5 If the responsible party, acting reasonably, is unable to produce a hydraulic network analysis report in the early stages of the planning process, they may apply in writing to the Engineer to defer production of the analysis to a later stage. The responsible party must submit a hydraulic network analysis, which meets the requirements of a Subdivision hydraulic network analysis, a minimum of 30 days before the submission of detailed engineered drawings. The Engineer must approve the relevant analysis prior to approving the drawings.
- 12.1.6 The Engineer, acting reasonably, may require additional hydraulic network analysis reports to demonstrate satisfactory performance of the water distribution system. Similarly the Engineer may require electronic copies of the hydraulic network analysis to incorporate into EPCOR's hydraulic model for further analysis.

12.2 Area Structure Plan and Neighbourhood Structure Plan Requirements

- 12.2.1 The Area Structure Plan HNA report must at a minimum include the simulation of all pipes 450 mm or larger in diameter. The Neighbourhood Structure Plan or equivalent level HNA report must at a minimum include the simulation of all pipes 300 mm or larger in diameter. Both types of analysis must also include the following requirements:
- An introduction with a general description of the proposed development.
 - A section defining the population densities and commercial/industrial flow rates used along with an explanation of how they were determined and assigned to the individual model nodes. Please refer to AWWA Manual M22 for methods to calculate demand required.
 - A section describing the boundary conditions used for the analysis and how they were obtained.
 - A section indicating the staging and approximate timing for development of each stage to help EPCOR identify Land Development Application (LDA) requirements and to ensure looping.
 - A section indicating the estimated timing for the construction of transmission mains
 - A section indicating assumptions used for modelling, e.g., pipe material, Hazen William's C-factor, demand / consumption rates and minimum allowable pressures.
 - A figure showing the pipe network and the proposed land use zoning.
 - A figure showing the location of the study area.
 - A figure showing the proposed staging of development.
 - A figure showing the site topography.
 - A figure showing the node demand boundaries.
 - A figure or figures showing the assigned pipe and node numbers and pipe diameters and any other hydraulic elements modelled into the system, e.g. check valves and booster pumps.
 - A table or tables showing the node names, pipe names and lengths, location of fire flow simulations, node elevations and properties of any other hydraulic elements modelled into the system, e.g. check valves and booster pumps.
 - The identification of nodes where peak hour pressures are less than 280 kPa and less than 350 kPa, including any multi-family or commercial areas with on site grading that results in peak hour pressures below 280 kPa at ground level. (See Item 12.4.2 regarding node elevation.)
 - The identification of nodes where maximum pressures are greater than 550 kPa.
 - An appendix containing model runs for the interim and / or ultimate stages of development for the following conditions:
 - peak hour;
 - maximum day plus fire flow runs at all critical locations (i.e., high value properties, remote locations, high elevation locations); and
 - other simulations as requested by the Engineer.

12.3 Subdivision Approval and Interim Staging Analysis Requirements

- 12.3.1 The Subdivision level HNA report must at a minimum include the simulation of all pipes 200 mm or larger in diameter and include the following requirements:
- An introduction with a general description of the proposed development.
 - A section describing the boundary conditions used for the analysis and how they were obtained.
 - A section indicating the assumptions used for modelling, e.g. pipe material, Hazen William's C-factor, demand consumption rates and minimum allowable pressures.
 - A section describing the results of all simulations.
 - A figure showing the location of the development.
 - A figure showing the zoning and lot count.
 - A figure showing the node demand boundaries.
 - Figures showing the assigned pipe and node numbers, pipe diameters and lengths, location of fire flow simulations, node elevations and any other hydraulic elements modelled into the system, e.g. check valves, pressure or flow regulators and booster pumps.

- The identification of nodes where peak hour pressures are less than 280 kPa and less than 350 kPa, including multi-family or commercial areas with on-site grading which results in peak hour pressure below 350 kPa at the node. (See Item 12.4.2 regarding node elevation.)
- The identification of nodes where maximum pressures are greater than 550 kPa.
- An appendix containing model runs for the following conditions:
 - peak hour;
 - maximum day plus fire flow runs at all critical locations (i.e., high value properties, remote locations, high elevation locations); and
 - other simulations as requested by the Engineer.

12.4 Standards and guidelines

- 12.4.1 The applicable standards and guidelines used in the preparation of hydraulic network analyses are listed in the following table:

Table 4: Guidelines for Hydraulic Network Analysis

Parameter	Value
Minimum Peak Hour Pressure (See Item 12.4.2)	280 kPa (At isolated locations only)
Minimum Maximum Day + Fire Flow Pressure	140 kPa (At isolated locations only)
Minimum Maximum Day Pressure (For Operation of Residential Fire Sprinklers)	350 kPa
Maximum Allowable Pressure in Distribution System	700 kPa
Maximum Allowable Pressure for Water Services (See Item 12.4.2)	550 kPa
Average Day Demand (ADD)	250 L/c/d
Maximum Day Demand (MDD)	425 L/c/d
Peak Hour Demand (PHD)	750 L/c/d
Maximum Hazen-William's Coefficient	120
Fire Flow for Single Family Residential (RF1, RF2, RPL, RSL, RF4)	100 L/s
Fire Flow for Mid-Value Multi Family Residential (RF3, RF5)	180 L/s
Fire Flow for High-Value Multi Family Residential (RF6, RA7, RA8, RA9, UCRH)	300 L/s
Fire flow for High-Value Properties (including school, institutional, commercial, industrial, mixed use sites – all zonings not included above)	300 L/s
Maximum velocity	3 m/s (At isolated locations only)

- 12.4.2 Pressures in the above table are relative to node elevation. Node elevation is to be set at the ground elevation of the highest point of service within the demand boundary for that node.
- 12.4.3 Where a proposed water servicing scheme requires pressure regulating devices (including but not limited to booster pump stations, check valves, pressure reducing and sustaining valves) then the report should include a copy of the peak hour and maximum day simulations without these devices to facilitate evaluation of the need, operational characteristics and consequences of failure.
- 12.4.4 Where a proposed water servicing scheme requires the installation or removal of any temporary water infrastructure, the responsible party shall, at their sole expense, design, install, remove and abandon any temporary water main and its associated appurtenances to the satisfaction of the Engineer.

13. MATERIALS

- 13.1.1 Approved materials for water mains, fittings, valves, fire hydrants, valve casings and water services are listed in the Section 02519 of the Construction Specifications. Only materials listed in the Section 02519 are to be included in the design.
- 13.1.2 Deviation from the Approved Materials for use in the water transmission and distribution system shall only be permitted on a case by case basis with the written approval of the Engineer.

14. EASEMENTS, UTILITY RIGHT OF WAYS, RESTRICTIVE COVENANTS AND CAVEATS

- 14.1.1 Water mains constructed outside of public road right of way require maintenance and operation. Service roads may be required, and shown on the engineering drawings, to ensure this infrastructure can be accessed in the future.
- 14.1.2 Water easements must be a minimum of 6.0 m wide unless otherwise specified. Water mains shall be located at a minimum of 1.2 m from a property line. A separation of 2.0 m from property line is preferred.
- 14.1.3 Signage is required to identify water mains and appurtenances outside of the public road right of way. Consult the Engineer to determine signage requirements and clearly identify them on the engineering drawings.
- 14.1.4 Upon request by EPCOR Water, tracer wire is required to be installed on buried water mains in easements where a straight alignment cannot be maintained between valves. Tracer wire must be installed as specified on the engineering drawings and provide a continuous signal path that can be used to determine pipe alignment after installation.
- 14.1.5 Sidewalks and multi-use paths may be constructed within EPCOR Water easements, at the sole discretion of the Engineer. Trees and structures are not permitted inside an easement. A 6.0 m wide gate must be installed on all fences that cross an easement. Fencing running parallel to water infrastructure is not permitted within the easement.
- 14.1.6 Restrictive covenants by means of a caveat must be registered, and shown on the engineering drawings, in the following cases:
 - Construction, abandonment and/or removal of a water main will cause soil disturbance in a proposed lot; or
 - Privately owned and maintained backflow prevention devices are required on multiple services to a site.

END OF SECTION



PROVIDING MORE

Construction Standards

Section 02511 Water Mains

January 2013



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1. **GENERAL**

1.1 **SCOPE**

This section covers material and installation requirements for water mains and associated fittings and appurtenances for the following pipe materials:

- Polyvinyl Chloride;
- Polyethylene (PE) / High Density Polyethylene (HDPE); *
- Steel;
- Concrete; and
- Ductile Iron. *

** Note: Project specific approval is required for use of this material.*

Trench and backfill shall be undertaken in accordance with Volume 2: Roadways, Section 02318 – Trench and Backfill. Utility cut restoration shall be undertaken in accordance with Volume 2: Roadways, Section 02965 – Utility Cut Restoration. Fillcrete backfill shall be undertaken in accordance with Volume 2: Roadways, Section 02317 – Fillcrete. Pipe bedding shall be undertaken in accordance with Volume 4: Water, Section 02515 – Pipe Bedding.

1.2 **PRODUCT ACCEPTANCE**

- 1.2.1 Products coming into contact with potable water may have the potential to impart contaminants and impurities. In order to minimise potential adverse health effects, this specification endorses the use of the National Sanitation Foundation (NSF) Standard 61 - Drinking Water System Components: Health Effects and NSF Standard 14 – Plastics Piping System Components and Related Materials, for determining the suitability of various products for use in the City of Edmonton's water distribution system. NSF Standards provide basic criteria to promote and protect public health and covers products that are produced by good manufacturing practices and generally recognized manufacturing processes. Products certified to these standards ensure that public health concerns related to their use have been properly addressed.
- 1.2.2 All water main piping and lining shall be certified to NSF Standards 14 and 61 as acceptable for drinking water system components, whenever possible.
- 1.2.3 Products are specified to be in accordance with a recognized standard such as AWWA, CSA, ASTM or ANSI.
- 1.2.4 Determining that a product complies with a standard requires:
 - certification from the supplier or manufacturer that the product does meet the standard; and/or
 - testing in accordance with a recognized procedure such as the appropriate ASTM Standard.
- 1.2.5 In general EPCOR will accept certification, if available, while reserving the right to call for additional testing as necessary without incurring extra costs to EPCOR or the City.
- 1.2.6 A list of materials approved for use in the water distribution system is included as Section 02519. In making this determination, EPCOR is not strictly bound by the specified standards, but instead reserves the right to exercise its judgement. Unless prior written approval is obtained from EPCOR, all material supplied shall be included on this List of Approved Materials.
- 1.2.7 Unless otherwise designated, all specification and standard references refer to the latest edition.

1.3 **STANDARDS**

- 1.3.1 Water mains and appurtenances shall conform to the following standards:
 - AWWA C104 - Cement Mortar Lining for Ductile-Iron Pipe and Fittings

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- AWWA C105 - Polyethylene Encasement for Ductile Iron Pipe Systems
- AWWA C110 - Ductile-Iron and Gray Iron Fittings
- AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast
- AWWA C200 - Steel Water Pipe—6 In. (150 mm) and Larger
- AWWA C206 - Field Welding of Steel Water Pipe
- AWWA C207 - Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
- AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings
- AWWA C209 - Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
- AWWA C210 - Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
- AWWA C214 - Tape Coating Systems for Exterior of Steel Water Pipelines
- AWWA C215 - Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines
- AWWA C216 - Heat Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
- AWWA C217 - Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
- AWWA C219 - Bolted Sleeve Type Couplings for Plain End Pipe
- AWWA C301 - Pre-stressed Concrete Pressure Pipe, Steel-Cylinder Type
- AWWA C303 - Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type
- AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances
- AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- AWWA C606 - Grooved and Shouldered Joints
- AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
- AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm)
- AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- AWWA C907 - Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
- AWWA M9 - Manual of Water Supply Practices for Concrete Pressure Pipe
- AWWA M11 - Steel Pipe - A Guide for Design and Installation
- AWWA M23 - Manual of PVC Pipe—Design and Installation
- AWWA M55 - Manual of PE Pipe—Design and Installation
- CSA B137.0 - Definitions, General Requirements and Methods of Testing for Thermoplastic Pressure Piping
- CSA B137.3 - Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications
- ✱ CSA W47.1 - Certification of Companies for Fusion Welding of Steel
- CSA Z662 - Oil and Gas Pipeline Systems
- ANSI B16.1 - Gray Iron Pipe Flanges and Flanged Fittings
- API Standard 1104 - Welding Pipelines and Related Facilities
- ASTM A48 - Standard Specification for Gray Iron Castings
- ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications
- ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- ASTM A536 - Standard Specification for Ductile Iron Castings

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- ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
- ASTM D1330 - Standard Specification for Rubber Sheet Gaskets
- ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings
- ASTM F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
- Plastics Pipe Institute Handbook of Polyethylene Pipe
- National Sanitation Foundation (NSF) Standard 14 - Plastics Piping System Components and Related Materials
- National Sanitation Foundation (NSF) Standard 61 - Drinking Water System Components - Health Effects

1.3.2 All products shall be installed strictly in accordance with the recommended installation procedures provided by the manufacturer.

1.4 QUALITY CONTROL

1.4.1 Test and inspect materials during the course of the work in accordance with Section 3.17 - Inspection and Testing.

1.4.2 Retain certified copies of in-plant quality control test data and make them available for inspection by EPCOR if requested.

2. MATERIALS

2.1 WATER MAIN PIPE

2.1.1 Polyvinyl Chloride (PVC) Pipe

- PVC water main shall have standard nominal diameters as indicated on the drawings, based on cast iron outside diameters (C.I.O.D.), unless otherwise specified.
- Pipe materials and fabrication shall conform to AWWA C900 or C905, as applicable. An Affidavit of Compliance to the AWWA C900 or C905 standards must be provided to EPCOR upon request.
- PVC water main 100 mm through 300 mm diameter shall conform to AWWA C900 and shall have a dimension ratio (DR) of 18, unless otherwise specified.
- PVC water main greater than or equal to 350 mm in diameter shall conform to AWWA C905 and shall have a dimension ratio (DR) of 25, unless otherwise specified.
- PVC water main used to convey a potable water supply must be blue. No other pipe colour may be used. Other utilities, including sewer gravity and force mains, and non-potable water mains, must use a different colour of PVC pipe.
- Test PVC pipe in accordance with AWWA C900 or C905 and CSA B137.3. The manufacturer shall maintain a record of all quality control tests for a period of not less than two years and shall submit pertinent records to EPCOR upon request.
- Gasket material shall be in accordance with the physical requirements specified in ASTM F477.
- Joint lubricants must be certified for potable water use in accordance with National Sanitation Foundation Standard 61.
- Pipe age must not exceed two years at time of installation.

2.1.2 Polyethylene (PE) and High Density Polyethylene (HDPE) Pipe

- PE / HDPE pipe shall have standard nominal diameters based on cast iron outside diameters (CIOD) unless otherwise specified. Pipe size shall be selected according to internal diameter. Project specific approval is required.
- Pipe materials and fabrication shall conform to AWWA C906 for polyethylene pipe.

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- PE / HDPE pipe shall conform to AWWA C906 for working pressure rating as applicable and shall have a dimension ratio (DR) of 11, unless otherwise specified.
- Use only suitable mechanical connections or heat fusion welding to attach all fittings.
- Flanged fittings and connections are to be used on the branch side of the pipe at tees, wyes, elbows, etc.

2.1.3 Steel Pipe

- 2.1.3.1 Steel water main to conform to AWWA C200.
- 2.1.3.2 The minimum yield strength of the steel shall be as specified, but shall not be less than 207 MPa.
- 2.1.3.3 Pipe materials and fabrication shall conform to AWWA C200. Documentation indicating pipe ASTM/CSA standard used, a mill certificate and an Affidavit of Compliance to the AWWA C200 standard shall be provided to EPCOR for all steel pipe supplied.
- 2.1.3.4 Pipe wall thickness shall be as specified, but shall not be less than 6.35 mm (¼ inch).
- 2.1.3.5 Bevel ends of pipe for field butt welding, unless specified otherwise on the drawings or in the special provisions. Bevel ends to an angle of 30° from a line drawn at right angles to the axis of the pipe, with a tolerance of +5 to -0°. The root face for butt welding shall be 1.6 mm ± 0.8 mm (1/16 in ± 1/32 in).
- 2.1.3.6 Use couplings only where designated on the drawings.
- 2.1.3.7 Random pipe lengths may be supplied unless otherwise specified on the drawings or in the special provisions. Random pipe lengths must have an average length of at least 8.84 m (29 ft) and have a minimum length of 6.1 m (20 ft). Pipe lengths containing girth welds shall not be permitted without written authorization from EPCOR.
- 2.1.3.8 End welding of longitudinal seams shall be done with automatic submerged-arc welding or automatic shielded-arc welding. Alternatively, end welding may be done manually by a qualified welder within Alberta with prior written approval from EPCOR. Manual welding of special sections and fittings is only permitted when it is impractical to use an automated welding machine.
- 2.1.3.9 Each length of pipe shall be hydrostatically tested by the manufacturer to a test pressure not less than that determined by the following formula:

$$P = 2 * S * t / D$$

where:

P = minimum hydrostatic test pressure (kPa)

S = stress in pipe wall during hydrostatic test (kPa), which shall be 0.75 times the specified yield point of the steel used, unless otherwise specified

t = wall thickness (mm)

D = outside diameter (mm)

Other requirements for hydrostatic testing shall conform to AWWA C200.

- 2.1.3.10 Unless otherwise specified on the drawings, coat and line pipe in accordance with Section 2.3 - Water Main Linings and Coatings.
- 2.1.3.11 Load and handle steel pipe prior to coating and lining in accordance with AWWA C200. In order to prevent damage to the coating and lining after they have been applied, follow the storage and handling procedures outlined below:
 - Handle sections with double belt slings or other suitable devices that provide uniform bearing and avoid metal bearing contact with the pipe;
 - The width of belts or other handling devices shall be adequate to prevent damage to the pipe coating;
 - Lower pipes carefully into position and do not drag them along the ground; and
 - Place pipes that are to be temporarily strung along the trench on suitable padded supports.
- 2.1.3.12 Each pipe shall be marked to identify the manufacturer and shipment number.
- 2.1.3.13 Manual welding of girth seams on straight pipe sections will not be permitted.
- 2.1.3.14 Drawings and calculations in accordance with Sections 4.3 – Drawings and 4.4 – Calculations, of AWWA C200 are not required.

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2.1.3.15 EPCOR may retain the services of a Third Party to conduct inspections at the manufacturer's plant in accordance with Section 5.1 – Inspection, of AWWA C200.

2.1.4 Concrete, Steel Cylinder Pipe

2.1.4.1 Use concrete water pipe in accordance with AWWA C301, AWWA C303, or as specified on the drawings.

2.1.4.2 The minimum operating pressure shall be 690 kPa plus a 350 kPa allowance for transient over-pressure, unless otherwise noted on the drawings.

2.1.4.3 Use push-on bell and spigot joints with single rubber-gaskets, unless otherwise specified on the drawings.

2.1.4.4 Supply the following:

- Detailed shop drawings and layout schedules;
- Details of all specials and fittings;
- Manufacturer's design calculations, including all assumptions; and
- An Affidavit of Compliance to AWWA C301 or AWWA C303.

2.1.4.5 Steel connections shall be lined and coated with cement mortar.

2.1.4.6 Use sulphate-resistant type 50 cement.

2.1.4.7 The use of concrete admixtures will not be permitted.

2.1.4.8 The use of retarders in cement-slurries will not be permitted.

2.1.5 Ductile Iron (DI) Pipe

- The use of ductile iron pipe requires prior approval from EPCOR.
- Pipe materials and manufacture shall conform to AWWA C151 and ASTM A536.
- Use the class and wall thickness specified on the drawings.
- Use single rubber-gasket push-on joints in accordance with AWWA C111.
- The use of mechanical joints requires prior approval from EPCOR.
- Minimum operating pressure shall be 1035 kPa.
- Pipe Joint Lubricants

2.2 PIPE JOINT LUBRICANTS

2.2.1 Joint lubricants must be certified for potable water use in accordance with NSF Standard 61 and must:

- Impart no taste or odour to potable water containing free or combined chlorine disinfectants;
- Create no turbidity in potable water;
- Promote no bacterial growth; and
- Be compatible with rubber and neoprene gasket materials.

2.3 WATER MAIN LININGS AND COATINGS

2.3.1 General

This section applies to coatings and linings for steel and ductile iron pipe which are defined as follows:

- **Lining:** a protective layer of material applied to the interior of products, in contact with the water being conveyed.
- **Coating:** a protective layer of material applied to the exterior of pipe, fittings, valves, hydrants or other products, which is normally used for surfaces in contact with soil or pipe bedding material.

2.3.2 Cement Mortar Lining

- Use for ductile iron pipe only
- Conform to AWWA C104 for ductile iron pipe.

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- Provide double thickness lining with standard seal coat.

2.3.3 Polyethylene Coating

- Use for steel and ductile iron pipe and fittings.
- Polyethylene coatings to be Shaw Pipe Protection Ltd.'s Yellow Jacket No. 1 or an approved equivalent.
- Provide polyethylene heat shrink sleeves for joints, Shaw Pipe Protection Ltd.'s Canusa or an approved equivalent.

2.3.4 Cold Applied Tape Coating

- Use where specifically designated on the drawings for steel and ductile iron specials, joints and repairs.
- Conform to AWWA C209 or AWWA C217 for hand-applied tape or AWWA C214 for shop-applied tape.

2.3.5 Epoxy Coating and Lining

- Use for cast iron, ductile iron and steel pipes and fittings.
- Coating to conform to AWWA C210 or AWWA C213.
- Lining to conform to AWWA C210 (non-coal tar).
- All linings to be certified to NSF Standard 61 for potable water.

2.3.6 Specified Plant Coating and Lining

- Where a special coating or lining is not specified in this section obtain the approval of EPCOR before ordering the pipe.

2.3.7 Heat-Shrinkable Coating

- Shall conform to AWWA C216.

2.4 FITTINGS**2.4.1 PVC Injection-Moulded and Fabricated Fittings**

- Use with PVC or ductile iron pipe.
- Injection moulded fittings to conform to AWWA C907 for C.I.O.D. pipe.
- Fabricated fittings to conform to CSA B137.3.
- Use "push-on" type ends complete with one gasket for each bell.

2.4.2 Cast Iron Fittings

- Use with PVC or ductile iron pipe.
- Conform to ASTM A48, Class 30B.
- Conform to AWWA C110, minimum 1720 kPa working pressure. Laying lengths as per AWWA C110.
- Castings to have no cracks, gas holes or flaws. Surfaces shall be reasonably smooth with no burnt on sand. Casting runners, risers and fins shall be removed.
- Castings shall be true to pattern, and within industry standard dimensional tolerances with no excessive shrinkage or deformity.
- Use single rubber gasket push-on joints, in accordance with AWWA C111. The use of mechanical joints requires prior approval from EPCOR.
- Each fitting must have a pair of 25 mm lugs cast into each bell end.

2.4.3 Steel Fittings

- Use with PVC pipe, steel pipe or concrete pressure pipe.
- Shop fabricated and standard fittings may be used.
- Fittings for steel pipe, to conform to AWWA C200 and AWWA C208, minimum working pressure 1035 kPa, minimum 207 MPa yield point strength.
- For concrete pressure pipe, fittings to conform to AWWA C200, working pressure to 1035 kPa, dimensions to be as shown on the drawings.

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- Use for pipes with diameters equal to or greater than 100 mm.
- Ends shall be as shown on the drawings.
- Use slip-on flanges of forged steel, in accordance with AWWA C207, Class D, flat faced or weld-neck flanges to ANSI B16.1, class 125.
- Use stainless steel (Type 304) double threaded studs, with 2 nuts, treated to prevent binding.
- Use full-faced rubber gaskets for 1035 kPa working pressure.
- Use weldolets and threadolets of forged steel in accordance with ASTM A105.
- Welding of shop fabricated fittings to conform to CSA Z662.
- Submit manufacturers design calculations including all assumptions.

2.4.4 Concrete, Steel Cylinder Fittings

- Use fittings conforming to AWWA C301 for pre-stressed concrete steel cylinder pressure pipe.
- Use fittings conforming to AWWA C303, for bar-wrapped, steel cylinder pressure pipe.
- Use push-on, bell and spigot joints with single rubber-gaskets.
- Use other joint types only where specially designated on the drawings.
- Supply detailed shop drawings and layout schedules.
- Supply Affidavit of Compliance to AWWA C301 or AWWA C303.
- Cement to be sulphate-resistant type 50.
- Submit manufacturer's design calculations including all assumptions.
- Steel connections shall be lined and coated with cement mortar.
- Submit details of all specials and fittings.
- The use of concrete admixtures will not be permitted.
- The use of retarders in cement-slurries shall not be permitted.
- For use with concrete pressure pipe, steel cylinder type.

2.5 COUPLINGS AND SPECIAL FITTINGS

2.5.1 PVC Couplings

- Conform to AWWA C900 or AWWA C907 for cast iron outside diameter (CIOD) pipe.
- "Push-on" type ends complete with two gaskets per coupling.

2.5.2 Bolted-Sleeve Couplings

- Do not use unless specifically identified on drawings.
- Conform to AWWA C219, or as specified in the approved list of materials.
- Bodies to be ductile iron or carbon steel. Carbon steel bodies shall be provided for all couplings whose nominal diameter is greater than 300 mm.
- Bodies shall have fusion-bonded epoxy coating to either AWWA C213 or AWWA C550.
- Unless otherwise specified nuts and bolts to be Type 304 stainless steel with threads treated to prevent binding.
- Suitable for use with a 1035 kPa (150 psi) working pressure. Centre sleeve or body shall have a minimum thickness of 6 mm (1/4").
- Linings to be in accordance with AWWA C210, AWWA C213 or AWWA C550. For linings to AWWA C210 or AWWA C213, certification shall be provided to confirm suitability for use in potable water service.
- See Section 02512 – Water Valves, Clause 3.3.4 for use of couplings in chambers.

2.5.3 Flange Adapters

- Do not use unless specifically identified on the drawings

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- Conform to AWWA C219.
- Bodies to be ductile iron or carbon steel with bonded epoxy coating to AWWA C210, AWWA C213 or AWWA C550.
- Flanges are to be in accordance with AWWA C207, Class D, unless otherwise specified.
- Nuts and bolts to be stainless steel, Type 304, with threads treated to prevent binding.
- Suitable for use with a 1035 kPa (150 psi) working pressure.
- Linings to be in accordance with AWWA C210, AWWA C213 or AWWA C550. For linings to AWWA C210 or AWWA C213, certification shall be provided to confirm suitability for use with potable water.
- See Section 02512 – Water Valves, Clause 3.3.4 for use of flange adapters in chambers.

2.5.4 Couplings for Grooved and Shouldered Joints

- Do not use unless specifically identified on drawings.
- Conform to AWWA C606.
- Suitable for use with a 1035 kPa (150 psi) working pressure.
- Bodies to have fusion bonded epoxy coating to AWWA C210, AWWA C213 or AWWA C550.
- Linings to be in accordance with AWWA C210, AWWA C213 or AWWA C550. For linings to AWWA C210 or AWWA C213, certification shall be provided to confirm suitability for use with potable water.

2.6 TAPPING SLEEVES

2.6.1 For all types of pipe except concrete cylinder pipe:

- Outlet flange to AWWA C207, Class D.
- Carbon steel body with fusion bonded epoxy coating or Type 304 stainless steel.
- Nuts and bolts to be Type 304 stainless steel treated to prevent binding.
- Gaskets to be of synthetic rubber suitable for potable water.
- Include a 20 mm NPT test plug for pressure testing of sleeve and tapping valve.

2.6.2 For concrete cylinder pipe:

- Separate body and tapping gland.
- Outlet flange to AWWA C207, Class D.
- In accordance with AWWA Manual M9.
- Body and tapping gland to be fusion epoxy coated to AWWA C213.
- Seals and grout horn to be provided to facilitate filling the space between the sleeve and the pipe.
- Tapping gland to have a gusseted pressure plate.
- Tapping gland to have a minimum of 3 load-bearing set screws for tightening the gland to the sleeve.
- Provide a broad cross section gasket (minimum 22 mm width) for sealing the tapping gland to the steel cylinder.
- Include a 20 mm NPT test plug for pressure testing of sleeve and tapping valve.

2.7 INSULATION AND WATER PROOFING

- 2.7.1 Any insulation/water proofing that is used must be manufactured using a process that does not utilize ozone-depleting chemicals in any way.
- 2.7.2 For insulating pipes, use DOW HI-40 Styrofoam or similar approved board as shown on Drawing 2511-08.
- 2.7.3 For insulating structures use DOW HI-40 Styrofoam, or similar approved board, or Urecon sprayed-in-place Portafoam Polyurethane with Insul-Mastic I-M7505 heavy-duty roof coating.
- 2.7.4 For water proofing use Urecon sprayed-in-place Portafoam Polyurethane with Insul-Mastic I-M7505 heavy-duty roof coating.

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2.8 VALVE CHAMBERS AND BLOW-OFFS**2.8.1 Mainline Valve Chambers**

- 2.8.1.1 Provide a pre-cast or cast-in-place reinforced concrete structure in accordance with Volume 3: Drainage, Section 03310 of the Construction Specifications (Concrete for Water and Drainage Structures) and Water Drawings 2512-10 and 2512-11.
- 2.8.1.2 Provide a removable slab top roof.
- 2.8.1.3 Provide a 300 mm vertical separation between the chamber floor and all pipeline drain flanges.
- 2.8.1.4 Provide screw type valve casings for the mainline and pipeline drain valves.

2.8.2 Air Valve Chambers

- 2.8.2.1 Use 1800 mm diameter precast concrete manhole barrels to ASTM C478 for water mains up to 900 mm diameter. Installation is to conform to Drawings 2512-12 and 2512-13.
- 2.8.2.2 For larger diameter water mains, use precast or cast-in-place concrete chambers.

2.8.3 Blow-Offs

Provide blow off hydrants or chambers as specified on the engineering drawings or in accordance with detail drawings 2511-09, or 2512-19.

2.9 PIPE CASING**2.9.1 Steel pipe casing:**

- Conform to the requirements of AWWA C200, minimum tensile strength 207 MPa.
- Wall thickness to be as specified.

2.9.2 PVC pipe casing:

- To conform to the requirements of Section 02535 - Sanitary Sewers for plastic pipe.
- Inside diameter of casing must be at least 50 mm greater than maximum outside diameter of carrier pipe bell and insulator runners.

2.9.3 Use plastic/polyethylene carrier pipe insulators or approved equal.

2.9.4 See Drawing 2511-07 for a typical pipe-in-casing configuration.

2.10 EXPANSION JOINTS

- 2.10.1 For use with steel pipe only.
- 2.10.2 Slip-type made of carbon steel.
- 2.10.3 Packing gland to consist of 5 rings of rubber and 4 rings of jute or an approved equal.
- 2.10.4 Stainless steel or chrome plated slip-pipe.

2.11 FLANGED PIPE GASKETS

- 2.11.1 Use for steel pipe flanges and steel, cast iron or ductile iron fitting flanges.
- 2.11.2 Use rubber sheet gaskets, 3.2 mm (1/8") thick, conforming to ASTM D1330, Grade I.
- 2.11.3 Gasket material to be natural or SBR type rubber.

2.12 CLAMPS, ANCHORS AND JOINT HARNESSSES

- 2.12.1 Do not use unless specifically identified on drawings.
- 2.12.2 Joint Harness, for pipe fittings 150 mm to 600 mm, to consist of:

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- A socket clamp and washers
 - A yoke
 - Straight stainless steel tie rods.
- 2.12.3 Joint Harness for 150 mm to 600 mm pipe only or for pipe and fittings without lugs, provide:
 - Two socket clamps and washers
 - Straight stainless steel tie rods.
- 2.12.4 For long sets provide approved tie rod couplers.
- 2.12.5 For concrete, steel cylinder type pipe, use bell bolt joints or welded joints on either side of fittings or at valve chambers.

3. EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

The manufacturer's recommended installation procedure is to be obtained and followed for all materials installed. In the case of discrepancy between the manufacturer's requirements and these specifications, advise EPCOR and request instruction before proceeding.

3.2 INSPECTION OF MATERIAL BEFORE INSTALLATION

3.2.1 Receiving material

- 3.2.1.1 Before unloading, inspect the general condition of load for adequacy of packing and bracing, any signs of shifting and any signs of damage to materials.
- 3.2.1.2 Where the load has shifted badly and material appears significantly damaged, reject the entire load.
- 3.2.1.3 While unloading check each piece of pipe and/or each fitting for:
 - The required manufacturers markings;
 - The mark of the manufacturers testing agency;
 - Damage to joint ends or surfaces;
 - Damage to coating or lining; and
 - Other visually apparent damage.
- 3.2.1.4 For steel pipe and fittings, provide 100% coverage of coated surfaces with an approved Holiday detector to detect damage and defects before stockpiling or stringing steel pipe.
- 3.2.1.5 If EPCOR is supplying the materials, note all damage and defects in writing and submit a copy of the receiving inspection report to EPCOR. Rejected pipe will be replaced by EPCOR or EPCOR's supplier. However, unless the piece is rejected entirely, damage and defects discovered at the time of receiving shall be repaired by the Contractor. All materials, once accepted by the Contractor, become the responsibility of the Contractor until EPCOR accepts the installation.
- 3.2.1.6 If the Contractor is supplying the materials, submit a receiving inspection report as noted in Clause 3.2.1.5. Repair damages or defects and replace rejects.
- 3.2.1.7 Maintain a continuous file of all receiving inspection reports at the job site, to be accessible for review by the EPCOR.
- 3.2.1.8 The Contractor is responsible for the safe storage of pipe after delivery and before installation and for handling and transportation between the storage site and the final location.

3.2.2 Installing material

- 3.2.2.1 Visually inspect joint ends and surfaces for damage or defects immediately before installation. Reject and remove from site any unacceptable pipe or fittings.
- 3.2.2.2 For steel materials, provide 100% coverage of coatings with an approved Holiday detector immediately before installation paying particular attention to repaired areas. Mark defective areas for further repair.
- 3.2.2.3 Re-check repairs to coatings with an approved Holiday detector before laying. If necessary, reject the piece and remove it from the job site.

3.3 HANDLING PIPE AND FITTINGS

- 3.3.1 String pipe and fittings along the trench in the order designated on the Construction Drawings.
- 3.3.2 Use proper belt slings and equipment for handling pipe and fittings at all times.
- 3.3.3 Support pipe and fittings in suitably shaped wooden blocks to prevent damage to the coating.
- 3.3.4 Keep joint ends and the inside of the pipe clean. Cover the joint ends with burlap or caps and plugs until required.
- 3.3.5 Inspect pipe and fittings for defects in the coating and lining before placing in the trench.
- 3.3.6 Repair defects in coating and lining as follows:
 - Polyethylene - by priming and cold taping.
 - Cement mortar - by patching with mortar to AWWA C104
 - Epoxy - in accordance with AWWA C210, AWWA C213 or AWWA C216
 - Others – in accordance with suppliers instructions and applicable standards, with EPCOR approval

3.4 OPERATION OF BOUNDARY VALVES

- 3.4.1 Advise EPCOR Water Dispatch (780 412 6800) prior to operating any boundary valve.
- 3.4.2 Operate boundary valves in a manner that prevents contamination of the water supply in adjacent water mains.
- 3.4.3 Review operation procedures and requirements for boundary valves with the EPCOR Inspector at the pre-construction meeting.

3.5 LAYING PIPE

- 3.5.1 Lay and join PVC pipe in accordance with AWWA Manual M23 and AWWA Standard C605.
- 3.5.2 Lay and join PE/HDPE pipe in accordance with Plastics Pipe Institute Handbook of Polyethylene Pipe and AWWA Manual M55. Install in accordance with Section 02531 – Sewage Force Mains, subsection 3.3.3. Polyethylene Pipe.
- 3.5.3 Lay and join concrete, steel cylinder pipe in accordance with AWWA Manual M9.
- 3.5.4 Lay concrete, steel cylinder pipe and PVC pipe with bell ends in the direction of laying.
- 3.5.5 Lay and join ductile iron pipe and cast iron fittings in accordance with AWWA C600.
- 3.5.6 Apply pipe joint lubricant approved for potable water systems in strictly accordance with the manufacturer's recommended application procedure. Do not apply excessively.
- 3.5.7 Lay pipes on prepared bedding with excavated joint holes that allow the joint ends to be kept clean of soil and bedding material, to facilitate making the joint and to avoid load concentration on the bells or couplings. Pipe bedding shall be undertaken in accordance with Volume 3: Drainage - Section 02515 of the Construction Specifications.
- 3.5.8 Lay the pipes in lengths shorter than the standard where disturbed ground is encountered or where designated on the drawings.
- 3.5.9 Test bolting for mechanical joints, bolted couplings and flanges on completion using a torque wrench. Torque shall conform to recommendations of the pipe or fitting manufacturer. Bolt in sequence.
- 3.5.10 Cut pipes as required to install fittings, valves or hydrants. Make cuts using the recommended tools to ensure square cut and correctly bevelled ends.

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- 3.5.11 Provide a concrete thrust block at each dead end, valve, tee, bend, hydrant, reducer, transition coupling, or fitting and at any change in pipe diameter or direction. Construct concrete thrust blocks against undisturbed soil and in conformance with Drawings 2511-03, 2511-04, 2511-05, 2511-06, 2511-13 and 2513-01 or as shown on the construction drawings.
- 3.5.12 At the request of EPCOR Water, joint restraints may also be required in conjunction with thrust blocks. Calculations must be submitted to EPCOR prior to drawing approval.

3.6 WELDING OF PIPE

- 3.6.1 Field welding of steel pipe and concrete cylinder pipe shall be in accordance with the following requirements:
- 3.6.1.1 Call a meeting 2 weeks in advance of any welding to clarify terms of reference, welding procedures and inspection parameters.
 - 3.6.1.2 Perform welding using weld procedures developed in accordance with CSA Z662. Submit a copy of those welding procedures to EPCOR at least one week prior to commencing welding.
 - 3.6.1.3 Welders shall hold a current "Grade B Pressure Welder Certificate of Competency" issued by the Alberta Boilers Safety Association (ABSA).
 - 3.6.1.4 Use radiography of a welder's initial weld to confirm that the welder is capable of welding to the appropriate welding procedure.
 - 3.6.1.5 For cement mortar lined steel pipe, cut the lining back at the joint to the distance recommended by the manufacturer and make good with an approved mortar after welding.
 - 3.6.1.6 Repair welds, if allowed by the EPCOR Inspector, to CSA Z662.
 - 3.6.1.7 Coat welded joints in steel pipe in accordance with AWWA C209.
 - 3.6.1.8 Inspect and test the pipe coating with an approved high voltage Holiday detector prior to backfill.

3.7 JOINTING PIPE

- 3.7.1 For joints other than welded joints in steel pipe follow the manufacturer's recommended procedure and use gauges and/or other approved devices to check the joint during installation and after completion.
- 3.7.2 **For Couplings:** Install couplings in accordance with applicable standards (e.g. AWWA C219 for Bolted Sleeve Couplings) and manufacturer's instructions or guidelines. All reducer couplings and transition couplings require thrust blocks, pipe stops or restraint, as designated on drawings or as instructed by the EPCOR inspector.
- 3.7.3 **For welded joints on steel pipe:**
- 3.7.3.1 Make mill certificate copies available to the EPCOR at least 2 weeks in advance of any field welding.
 - 3.7.3.2 Radiographic inspection of the welded joints shall be conducted. The welded joints must meet the standard of acceptability in accordance with CSA Z662. In the event that more than 10% of the joints radiographically inspected required repairs or replacements, 100% inspection of welds will be performed until a satisfactory weld production is established.
 - 3.7.3.3 The radiographic interpretation of the welded joints shall be final.
 - 3.7.3.4 All initial and subsequent inspection costs incurred for testing weld repairs or replacements are the responsibility of the Contractor.
 - 3.7.3.5 For welded joints on steel pipe do the following additional testing, if ordered at random or based upon the X-ray or radiographic inspection data:
 - Select joints for coupon testing and cut eight coupons at 45° intervals from the welded joint.
 - Test four coupons for tensile strength, two for bending strength and one for nick-break strength. If a coupon fails any one of these tests, test the remaining coupon with that same test.
 - Failure of any coupon test is cause for rejecting the weld.
 - 3.7.3.6 If a weld is rejected for coupon test failure another joint made by the same welders shall be subjected to the coupon test immediately; if the second joint fails to pass the coupon test, that welder will not be allowed to continue welding on this Contract.

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3.8 CONNECTING TO EXISTING MAINS

- 3.8.1 Notify the EPCOR Inspector at least 72 hours before starting a connection to an existing water main. Present a written plan identifying necessary valve closures plus a contingency plan detailing steps to be taken in the event of problems occurring during the connection process. The plan should show customers that will be affected by the work and how service will be maintained to those customers. In addition it should detail the precautions to be taken to ensure that there is no contamination of the water system. Obtain approval from EPCOR to make the connection. Note that connections to existing water mains 450 mm diameter or greater require a Shutdown Permit at least 72 hours prior to the commencement of construction of the proposed connection. Coordinate with the EPCOR inspector to obtain a Shutdown Permit.
- 3.8.2 Notify EPCOR Water Dispatch (780 412 6800) 24 hours prior to making a connection to the existing system.
- 3.8.3 Ensure that all required equipment, tools, products, plans, procedures and manpower required to make the connection expeditiously are on the site before starting.
- 3.8.4 Shut off boundary valves in the existing water main and make the necessary cut to connect. Advise EPCOR Water Dispatch (780 412 6800) of any valve operations.
- 3.8.5 Use a tapping sleeve and valve where specifically designated to make a connection without taking the existing water main out of service.
- 3.8.6 Tapping of PVC pipe must be in accordance with Section 02518 - PVC Pipe Tapping Guidelines. Tap other pipe materials generally in accordance with Section 02518, and in accordance with the instructions of the tapping equipment supplier for the specific pipe material.
- 3.8.7 Replace the gasket in the existing pipe at the point of connection.
- 3.8.8 Make electrical conductivity or isolation connections, if required. Install sacrificial anodes and test leads as designated for cathodic protection, if required.
- 3.8.9 Install joint harness or thrust block as designated on the drawings.

3.9 SETTING FITTINGS

- 3.9.1 Install fittings, at the locations designated. Support all fittings on concrete blocks, or as designated on the drawings.
- 3.9.2 Provide a concrete thrust block at each dead end, valve, tee, bend, hydrant, reducer, transition coupling or fitting and at any change in pipe diameter or direction. Construct concrete thrust blocks against undisturbed soil and in conformance with Drawings 2511-03, 2511-04, 2511-05, 2511-06, 2511-13 and 2513-01 or as shown on the construction drawings.
- 3.9.3 At the request of EPCOR Water, joint restraints may also be required in conjunction with thrust blocks. Calculations must be submitted to EPCOR prior to drawing approval.

3.10 SETTING BLOW-OFFS

- 3.10.1 Install blow-off hydrant or chamber in accordance with the construction drawings or standard drawings 2511-09, or 2512-19. Support all valves and fittings.
- 3.10.2 Do not connect the blow-off to a sewer, submerge it in any stream or install it in any other manner that may permit back-siphonage into the distribution system.

3.11 WATER MAIN RENEWALS

- 3.11.1 Maintain alignments and grades of water mains in accordance with the Design Standards and as detailed on the drawings.

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- 3.11.2 When an existing water main is to be abandoned, and:
- it does not conflict with a new water main's horizontal alignment, it can be abandoned in-place if it is capped or sealed at each end to prevent it from allowing soil or water migration.
 - it conflicts with a new water main's horizontal alignment, the proposed abandonment method must be approved by the Engineer. Removal or grouting of the existing main may be required.
- 3.11.3 Remove and dispose of asbestos cement water main in accordance with Occupational Health & Safety and Environmental requirements. Asbestos cement water mains located outside of road right-of-way must be removed.
- 3.11.4 Ask EPCOR Water Services Distribution Operations to carry out a pre-construction inspection in order to identify work required to isolate the site and rectify all service line deficiencies. Any repair work identified during this inspection is not normally shown on the drawings and, if required, will be covered by change orders. The inspection request must be made at least one week prior to the intended construction start-up.
- 3.11.5 Prior to any construction activities, the Contractor shall provide written notification to every customer who will be directly affected, at least one week in advance of construction. Two weeks notice will be required for any commercial, industrial, or public building, unless otherwise directed by EPCOR.
- 3.11.6 Should it be necessary to interrupt water service to any customer for a short period during the course of construction, the Contractor shall give at least 24 hours written notice of the intended service interruption to all affected customers.
- 3.11.7 All planned temporary service interruptions shall not exceed 8 hours in duration. All customers impacted by planned interruptions greater than 8 hours shall be provided with a temporary water supply.
- 3.11.8 It is the Contractor's responsibility to identify any obvious non-interruptible customers (hospitals, restaurants, day care centres, schools, businesses that rely on process water, etc.) that may be impacted by a planned temporary shut-down. These customers should be provided with temporary water supply at the beginning of the construction project.
- 3.11.9 Temporary water supply may only be installed by EPCOR Water or EPCOR Water's pre-qualified long-term contractors.
- 3.11.10 Piping for temporary services shall conform to NSF STANDARD 14 for potable water use and consist of a temporary main (header) having a diameter not less than 40 mm and laterals not less than 13 mm in diameter. Existing 40 mm to 50 mm services will require at least two laterals and 100 mm to 200 mm services will require two 40 mm laterals.
- 3.11.11 Prior to setting up temporary service piping the contractor shall request (minimum of 1 week notice) to have the hydrant checked by EPCOR to confirm it is in good operating condition. The Contractor will be responsible for any subsequent damage resulting from improper operation of the hydrant until temporary services are removed. The contractor must notify EPCOR Water Distribution Operations after removing temporary piping for inspection of the hydrant.
- 3.11.12 The contractor is responsible for metering all temporary water use on each project. Approved meters are available from EPCOR Water Services. Meters must not be installed directly on the hydrant nozzles and appropriate back flow preventers must be used. The Contractor must ensure their backflow preventers are tested and certified annually. Copies of the annual certifications must be provided to EPCOR.
- 3.11.13 If a temporary shut-down is required, orange hydrant disks must be installed on all hydrants rendered out of service by the shut-down. Once the shut-down is completed, the disks must be removed. Out of service hydrants must be reported to EPCOR's construction inspector.
- 3.11.14 Isolate the site prior to construction. Replace boundary valves identified during the inspection as faulty, i.e. not operable or not providing a tight shut off. If a valve cannot be repaired prior to construction, the planned temporary shut-down may need to be extended to the next available boundary valves. The Contractor is responsible for identifying any customers impacted by this extension and providing adequate notification or temporary water supplies if required.

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- 3.11.15 Replace faulty service valves. Replace all service valves, main stops and service piping for services where the distance from the water main to the property line is less than 1.5 m.
- 3.11.16 Replace services that are not copper or PVC material from the main to the property line, including the service valves.
- 3.11.17 Prior to the water main being placed back in service, the main should be flushed from the closest available point to the tie-in location. If possible, a separate bleeder should be installed to assist with this flushing and sampling. Field turbidity samples shall be below 1.0 NTU and chlorine samples between 1.0 and 2.4 mg/L prior to commissioning.
- 3.11.18 Bacteriological samples must be taken after every temporary shut-down if the water main has been depressurized.
- 3.11.19 Once the new main has been installed it must pass a pressure and leakage test. If the new water main is isolated with existing main line or service valves, it will be pressure tested at 690kpa (100psi) for one hour. The maximum allowable leakage will be 10L/100m of water main. The Contractor shall provide EPCOR with 24 hours notice of any pressure test so that an EPCOR Inspector can be on-site to witness and record the test.

3.12 PIPE CASINGS

- 3.12.1 Install casings by open trench, augering, or other trenchless installation method in conformance with Volume 2: Roadways, Section 02318 – Trench and Backfill of the Construction Specifications.
- 3.12.2 Alignment and grade tolerances shall conform to Section 3.15 - Alignment and Grade.
- 3.12.3 Install PVC casings to the bedding and backfill requirements for PVC sewers in accordance with Volume 2: Roadways, Section 02318 – Trench and Backfill of the Construction Specifications. Install other casing to the same bedding and backfill specifications required for water mains of the same material as the casing.
- 3.12.4 Securely strap 6 mil minimum polyethylene sheeting to carrier and casing pipe at both ends of casing, or install approved purpose made casing boot. Do not grout the annular space between the carrier pipe and casing.

3.13 INSULATION

Install insulation in accordance with manufacturer's recommended installation procedures and as shown on the drawings. Refer to drawing 2511-08.

3.14 VALVE AND BLOW OFF CHAMBERS

- 3.14.1 Waterproof chamber using materials and methods approved by EPCOR.
- 3.14.2 Position the appurtenances on the pipe to provide sufficient room for removal of the coupling.
- 3.14.3 Provide ventilation piping for the automatic air valve at locations where the groundwater elevation is expected to be above the elevation of the air valve.

3.15 ALIGNMENT AND GRADE

- 3.15.1 Install the pipe to the line and grade designated and check by means of a laser or off-set line and batter boards.
- 3.15.2 Use a procedure for checking the alignment and grade of the trench, installed pipe and fittings, so that specified tolerances and joint deflections are not exceeded. The Engineer will check alignment and grade at his or her discretion. Supply grade sheets for the Engineer to check.
- 3.15.3 Upon inspection, EPCOR may order completed pipe, fittings, valves or hydrants to be removed and reinstalled because of unacceptable deviations from specified line and grade. The cost of repairs or consequent damage attributable to excessive deviations is the responsibility of the Contractor.

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- 3.15.4 Use a detailed layout as outlined in Volume 1: General, Section 01520, Section 1.8 – Survey.
- 3.15.5 For water main renewals, see also Section 3.11 – Water Main Renewals.
- 3.15.6 Unless otherwise marked on the drawings, install the water main according to the depths specified in the Design Standards.
- 3.15.7 Obtain prior written direction from EPCOR for insulation requirements for water mains and water services if the water main cannot be installed at the specified depth.
- 3.15.8 Lay out the location of and install all fittings, valves, hydrants and other appurtenances as identified on the drawings.
- 3.15.9 Deflection at any joint shall not exceed the manufacturer's allowable deflection for that diameter, length of pipe and type of joint.
- 3.15.10 Maximum allowable tolerances in alignment and grade are as follows:
 - Grade: ± 40 mm
 - Alignment: ± 100 mm

Any horizontal alignment variation in excess of ± 600 mm will require reconstruction and the submission of a detailed written incident report.
- 3.15.11 Alignment, grade and location of fittings and specials shall be in accordance with the drawings.

3.16 CLEANING OF WATER MAINS

- 3.16.1 Securely cover exposed ends of pipe at the end of every workday. Do not stow or store materials, tools or accessories inside pipe.
- 3.16.2 Sweep, swab or pig the water main to ensure dirt, debris, excess gasket lubricant and other deleterious materials are removed prior to commissioning. All construction must be carried out in clean and sanitary conditions.

3.17 INSPECTION AND TESTING**3.17.1 Before backfill**

- 3.17.1.1 Before coating and backfilling over the joints, the Contractor may, for the Contractor's own assurance, carry out a low pressure air test (welded steel pipe only), a water test or any other test deemed necessary. Any such testing will be at the sole risk and cost of the Contractor.
- 3.17.1.2 Before backfilling over the joints do the following inspection and testing:
 - Visual inspection of mortared joints for structural integrity and absence of cracking or spalling.
 - 100% coverage of the joint coatings (other than mortar) with an approved Holiday detector.

3.17.2 Pressure and leakage testing

Pressure and leakage testing shall be performed in accordance with Section 02517 - Guidelines for Acceptance Testing. All documentation referenced in these guidelines is to be completed and submitted to the Engineer.

3.17.3 Deflection testing of flexible water transmission mains

- 3.17.3.1 A mandrel, as defined below, shall be pulled through flexible pipe greater than or equal to 600 mm diameter and less than 1200 mm diameter to demonstrate that the pipe deflection does not exceed the maximum allowable in the applicable AWWA Standard or Manual.
- 3.17.3.2 If an alternative method of pipe deflection determination, such as an electronic gauging pig, is proposed by the Contractor, the inspection method must be approved by EPCOR prior to testing.

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- 3.17.3.3 The device shall be pulled manually through the pipe 24 hours or more after the completion of backfilling to surface for roadway subgrade, prior to the installation of main line valves and in conjunction with the closed circuit television inspection.
- 3.17.3.4 The mandrel shall be cylindrical in shape and constructed with an odd number of evenly spaced arms or prongs (a minimum of 9) generally conforming to Drawing 2511-10. The minimum diameter of the circle scribed around the outside of the mandrel arms shall be equal to the allowable computed deflected internal diameter minus 1.0 mm. The contact length of the mandrel shall be measured between the points of contact on the mandrel arm or between sets of prongs. This length shall not be less than that shown in **Table 1**.

Table 1: Minimum contact length for mandrel testing

Nominal Pipe Diameter (mm)	Minimum Contact Length (mm)
600	500
750	600
900	750
1050	850

- 3.17.3.5 The mandrel shall be checked with a go-no go proving ring. The proving ring shall have a diameter equal to the computed deflected diameter ± 2 mm. An acceptable mandrel shall not pass through the proving ring. The proving ring shall be fabricated from 6 mm minimum thick steel.
- 3.17.3.6 Any section of pipe that does not allow the mandrel to pass shall be considered to have failed the deflection test.

3.17.4 Inspection of larger diameter pipes

- 3.17.4.1 For pipes 1200 mm diameter or larger, assist the Engineer in performing a physical walk-through inspection to ensure all interior joints are satisfactorily completed and no visible damage to the pipe is evident. Vertical and horizontal measurements will be taken at mid-length of each pipe length to confirm that any pipe deflections are less than the maximum allowed by the applicable AWWA Standard. A report will be prepared by the Engineer describing the observed pipe condition and discussing the implications of the pipe measurements taken. Colour photographs will be taken by the Engineer to show general pipe condition and any abnormalities encountered. All confined space entry safety procedures shall be observed. Inspection must be carried out in clean and sanitary conditions.

3.17.5 Televised inspection

- 3.17.5.1 For television inspections of pipes 600 mm to 1050 mm diameter, the television camera used shall be specifically designed and constructed for the purpose. Inspection must be carried out in clean and sanitary conditions.
- 3.17.5.2 Lighting for the camera shall provide a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing picture quality to the satisfaction of EPCOR. If unsatisfactory, equipment shall be removed and no payment will be made for that inspection.
- 3.17.5.3 The camera shall be moved through the main at the main's spring line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the pipeline condition. In no case will the television camera be pulled at a speed greater than 9 metres per minute. Manual winches, power winches, television cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the pipe conditions shall be used to move the camera through the water main. If, during the inspection operation, the television camera will not pass through the entire section between valves, the Contractor shall set up the equipment so that the inspection can be performed from the opposite valve location. If, again, the camera fails to pass through the entire section, the inspection shall be considered complete and no additional inspection work will be required until the Contractor corrects the problem.
- 3.17.5.4 Suitable means of communication shall be set up between the two ends of the section being inspected to ensure good communications between members of the crew.

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- 3.17.5.5 The importance of accurate distance measurements is emphasised. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable or the like, which would require interpolation will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape or other suitable device to the satisfaction of EPCOR.
- 3.17.5.6 Disinfect equipment to AWWA Standards and to the satisfaction of the Engineer prior to using it to inspect the water main.
- 3.17.5.7 Documentation of the televised inspection shall be as follows:
- Television Inspection Logs: Keep printed location records that clearly show the location of all pipe defects observed during inspection. In addition, record other points of significance such as unusual conditions, broken pipe, presence of scale and corrosion and other discernible features. Provide one copy of all records to EPCOR.
 - Photographs: Take instant developing, standard-size or digital photographs of the television picture of problems if so requested by EPCOR.
 - Video Recordings: The purpose of video recording shall be to supply a visual and audio record of problem areas of the mains that may be replayed. The video recording shall be of an appropriate media format. The practice of dubbing and mixing of video shall not be permitted. The Engineer will only view the original unedited tapes. Title to the video shall be with EPCOR and only the original (first generation) unedited video shall be forwarded to EPCOR. Video recording playback shall be at the same speed that it was recorded. Colour, slow motion or stop-motion playback features may be supplied at the option of the Contractor. The Contractor shall have all video and necessary playback equipment readily accessible for review by the Engineer during the project.

3.18 CLEAN-UP

- 3.18.1 Remove all surplus materials and products when the work has been installed and finished.
- 3.18.2 Remove all Contractor's plant, equipment and temporary facilities.
- 3.18.3 Provide a final grading of all bare soil and gravel surfaces.
- 3.18.4 Flush and sweep all pavements, sidewalks, curbs and gutters clean of dirt and debris due to construction.

3.19 FLUSHING AND DISINFECTING

- 3.19.1 Perform flushing and disinfection in accordance with Section 02517 - Guidelines for Acceptance Testing. Submit completed copies of documentation referenced in the guidelines.
- 3.19.2 Flushing and disinfection procedures are to be reviewed with the EPCOR Water Inspector at the pre-construction meeting.
- 3.19.3 Prior to flushing and disinfection of water mains, prepare a plan for the procedure addressing:
- water supply and discharge locations;
 - chlorine injection points;
 - testing locations for chlorine residual and bacteriological sampling; and
 - dechlorination of water discharges.
- 3.19.4 Submit the plan to EPCOR with construction drawings and obtain approval prior to commencing flushing and disinfection operations. Obtain applicable permits.
- 3.19.5 At no time during flushing and disinfection operations should more than one boundary valve between the water system under construction and adjacent water systems be open.
- 3.19.6 Do not dispose of water containing chlorine or volatile or waste materials, such as mineral spirits and paint thinner, into any surface waterway or storm or sanitary sewer. All discharges must comply with all applicable Acts, Regulations, Bylaws and Standards. This requirement may be relaxed only if written approval to exceed the limit concerned, from the authority having jurisdiction over the waterway or sewer, is provided to the Engineer.

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3.20 SAMPLING

- 3.20.1 Perform sampling in accordance with Section 02517 - Guidelines for Acceptance Testing.
- 3.20.2 Assist the Inspector in taking water samples for quality control testing purposes.
- 3.20.3 No more than 72 hours prior to putting a newly constructed water main into service, the following water quality parameters must be measured and found to be within the limits specified in Table 2.

Table 2: Required water quality parameters for new water mains

PARAMETER	VALUE	UNIT
E.Coli (EC)	Absence	
Total Coliform (TC)	Absence	
Residual Chlorine	1.0 to 2.4	mg/L
Free Chlorine	< 0.1	mg/L
pH	7.3 to 8.3	
Turbidity	0 to 3.0	NTU
Colour	0 to 2.0	TCU
V.O.C.'s	< 0.010 (GCDWQ MACs for components)	mg/L
Pipe Lubricant	Negative	
Taste and Odour	Inoffensive	
UV Scan	Negative Vs. Plant Water	

- 3.20.4 Should any of the above parameters be outside the limits shown in Table 2, notify EPCOR and obtain directions for remedial action.
- 3.20.5 If the first taste and odour sample fails, all subsequent flushing must be done through a hydrant use permit. Contact 780 412 3003 to obtain a permit.

3.21 TRAINING

- 3.21.1 Provide training to EPCOR staff, as required, to ensure that operations and maintenance personnel are adequately prepared to operate the system as installed.
- 3.21.2 Training is to be provided prior to the commissioning of the project.

3.22 OPERATION AND MAINTENANCE MANUALS

- 3.22.1 Provide operation and maintenance manuals for uncommon infrastructure, and water transmission mains or appurtenances at the request of EPCOR.
- 3.22.2 Provide an organized compilation of operation and maintenance data including detailed technical information, documents and records describing the operation and maintenance of individual products or systems as specified:
 - gate valves and butterfly valves in chambers;
 - air and vacuum release valves;
 - cathodic protection system;
 - flushing and disinfection procedure;

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- pressure reducing valves, flow control valves and/or backflow prevention valves.
- 3.22.3 Assemble, coordinate, bind and index required data into the operation and maintenance manual.
- 3.22.4 Submit 4 copies of the complete operation and maintenance manuals to EPCOR 2 weeks prior to application for construction completion certificate for project.
- 3.22.5 Organize data into the same numerical order as the contract specifications.
- 3.22.6 For the manual, label each section with tabs protected with celluloid covers fastened to hard paper dividing sheets.
- 3.22.7 Type lists and notes.
- 3.22.8 Drawings, diagrams and manufacturers literature must be legible.
- 3.22.9 Binders are to be vinyl, hard covered, 3 "D" rings, sized for 215 x 280 mm loose leaf paper, with a spine pocket.
- 3.22.10 Identify contents of each binder on spine.
- 3.22.11 Minimum binder requirements are shown in Table 3.

Table 3: Operation and Maintenance Manual Requirements

Binder	Requirements:
1	<ul style="list-style-type: none"> ▫ Cover sheet containing: <ul style="list-style-type: none"> - the submission date; - the project title, location, project number; - the names and addresses of the Contractor and all subcontractors; and - a Table of Contents of all binders. ▫ Warranties, guarantees. ▫ Copies of approvals and certificates. ▫ Data as specified in individual sections of the specifications. ▫ List of equipment including service depot. ▫ Nameplate information including equipment number, make, size, capacity, model number and serial number. ▫ Parts list and availability. ▫ Installation details. ▫ Operating instructions. ▫ Maintenance instructions for equipment. ▫ Maintenance instructions for finishes
2	<ul style="list-style-type: none"> ▫ Separate and complete set of reviewed shop drawings and product data.

3.23 CONSTRUCTION COMPLETION INSPECTION

- 3.23.1 Boundary valves must be closed and secured until new water-mains are accepted except for the following construction activities:
 - filling water-mains for wet-tapping of services;
 - pressure and leakage testing; and
 - disinfection and subsequent flushing.
- 3.23.2 Request EPCOR to make an inspection when all installations have been completed and tested satisfactorily and all clean up has been completed. Set a time and date for the inspection.

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- 3.23.3 Carry out the inspection. The Inspector shall make an agreed list of deficiencies and submit it to the Contractor. EPCOR shall issue a construction completion certificate if there are no deficiencies.
- 3.23.4 Rectify the deficiencies listed on the agreed deficiency list resulting from the inspection. Request the Inspector to make another inspection.
- 3.23.5 EPCOR shall issue a construction completion certificate when all deficiencies have been rectified.

3.24 PLACING WATER MAINS INTO SERVICE

- 3.24.1 Water mains must be commissioned as soon as reasonably possible after completion of construction. Comply with all applicable requirements of Section 02517 Acceptance Testing prior to placing a water main into service.
- 3.24.2 Coordinate with the EPCOR inspector to obtain approval of Transmission Operations prior to the commissioning of water mains greater than 450 mm diameter.
- 3.24.3 Submit for approval a detailed written commissioning procedure outlining the following:
 - Sequence of boundary valve operation;
 - Water quality monitoring to be performed to ensure water quality in the existing water system is not adversely affected by the commissioning;
 - Dechlorination of water discharges; and
 - Any other activities necessary to ensure satisfactory commissioning of the water main.
- 3.24.4 Notify the EPCOR Inspector 24 hours in advance of putting a newly constructed water main into service.
- 3.24.5 Notify EPCOR Water Dispatch (780 412 6800) prior to operating any boundary valves. Operate boundary valves in a manner that prevents contamination of adjacent water mains. All valves 350 mm and larger in diameter must be operated by EPCOR Water Services Distribution Operations personnel only. EPCOR Water Dispatch (780 412 6800) must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.
- 3.24.6 Maintain a watch for the event of a break in the new main to ensure that service in the surrounding areas will not be unduly interrupted.
- 3.24.7 Standby and be prepared to perform any necessary sampling in the event that water quality concerns arise.

END OF SECTION



PROVIDING MORE

Construction Standards

Section 02512 Water Valves

January 2013



Section 02512 – WATER VALVES

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Section 02512 – WATER VALVES

1. **GENERAL**

1.1 **SCOPE**

This section refers to:

- Buried Gate valves 100 mm to 1200 mm in diameter;
- Gate valves in valve chambers;
- Buried Tapping valves;
- Buried Butterfly valves;
- Butterfly valves in chambers; and
- Check valves, air relief valves, flow control valves, pressure reducing valves and backflow preventers.

1.2 **PRODUCT ACCEPTANCE**

- 1.2.1 Products coming into contact with potable water may have the potential to indirectly impart contaminants and impurities. In order to minimize potential adverse health effects, this specification endorses the use of the National Sanitation Foundation (NSF) Standard 61 - Drinking Water System Components: Health Effects and NSF Standard 14 – Plastics Piping System Components and Related Materials, for determining the suitability of various products for use in the City of Edmonton's water distribution system. NSF Standards provide basic criteria to promote and protect public health and covers products produced by good manufacturing practices and generally recognized manufacturing processes. Products certified to these standards ensure that public health concerns related to their use have been properly addressed.
- 1.2.2 All water main valves shall be certified to NSF Standards 14 and 61 as acceptable for drinking water system components, whenever possible.
- 1.2.3 Products are specified to be in accordance with a recognized standard such as AWWA, CSA, ASTM or ANSI. EPCOR must approve exceptional cases before these products can be used.
- 1.2.4 Determining that a product complies with a standard requires:
 - Certification from the supplier or manufacturer to the effect that the product does meet the standard; and/or
 - testing in accordance with a recognized procedure such as the appropriate ASTM Standard.
- 1.2.5 In general, EPCOR will accept certification, if available, while reserving the right to call for additional testing as necessary without incurring extra costs to EPCOR or the City.
- 1.2.6 A list of materials approved for use in the water distribution system is included as Section 02519 – Product Approval Procedures. In making this determination, EPCOR is not strictly bound by the specified standards, but instead exercises judgement in the best interests of the City of Edmonton in conjunction with EPCOR's specific requirements. Unless prior written approval is obtained, only materials that appear on this list shall be supplied.
- 1.2.7 Unless otherwise designated, all specification and standard references shall refer to the latest edition.

1.3 **STANDARDS**

- 1.3.1 Valves and appurtenances shall conform to the following standards:
 - ANSI B16.1 – Gray Iron Pipe Flanges and Flanged Fittings
 - ASSE 1013 – Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers
 - ASTM A48 – Standard Specification for Gray Iron Castings

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- ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels for General Applications
- ASTM A536 – Standard Specification for Ductile Iron Castings
- ASTM B148 – Standard Specification for Aluminum-Bronze Sand Castings
- AWWA C207 – Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In. (100 mm Through 3600 mm)
- AWWA C500 – Metal Seated Gate Valves for Water Supply Service
- AWWA C504 – Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm)
- AWWA C508 – Swing Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS
- AWWA C509 – Resilient Seated Gate Valves For Water Supply Service
- AWWA C510 – Double Check Valve Backflow Prevention Assembly
- AWWA C511 – Reduced-Pressure Principle Backflow Prevention Assembly
- AWWA C512 – Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
- AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- AWWA C550 – Protective Epoxy Interior Coatings for Valves and Hydrants
- CSA A23.2 – Test Methods and Standard Practices for Concrete
- CSA B64 – Selection and Installation of Backflow Preventers / Maintenance and Field Testing of Backflow Preventers
- AWWA Canadian Cross Connection Control Manual
- National Sanitation Foundation (NSF) Standard 14 – Plastics Piping System Components and Related Materials
- National Sanitation Foundation (NSF) Standard 61 – Drinking Water System Components - Health Effects
- Volume 3: Drainage, Section 03310 - Concrete for Water and Drainage Structures

1.3.2 All products shall be installed in accordance with the recommended installation procedures provided by the manufacturer.

2. **PRODUCTS**

2.1 **GATE VALVES**

2.1.1 **Direct-Bury Gate Valves**

- Use only for pipes 100 mm to 1200 mm in diameter. Use a valve size equal to the pipe size, or as directed on the approved construction drawings.
- Sizes 100 mm to 400 mm: bell ends, single ring gasket, push-on joints for connecting to ductile iron or PVC pipe (C.I.O.D.).
- Sizes 450 mm to 1200 mm: mechanical joints (MJ), single ring gasket, for connecting to ductile iron or PVC pipe (C.I.O.D.).
- Conform to AWWA C500, C509 or C515; non-rising stem.
- For valves 450 mm and larger, provide a by-pass and a gate valve to equalize pressure upon opening and closing the main valve. By-pass valves shall conform to AWWA C500.
- For blow-offs, valves to be flanged to AWWA C207, Class D.
- All external nuts and bolts to be Type 304 stainless steel or better.
- Provide a 50 mm square operating nut; that turns clockwise to close.
- Provide "O" Ring seals for the valve stem.
- Valve stem is to be Type 304 stainless steel or grade B, C, D, or E bronze as per AWWA C509.

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- Provide Type B (Screw Type) valve casing set with plug in accordance with Drawings 2512-01 to 05.
- Provide Type B (Screw Type) middle extension for valves with depths in excess of 3.0 meters from top of operating nut to surface grade of valve box.
- Castings are to have no cracks, gas holes or flaws. Surfaces shall be reasonably smooth with no burnt on sand. Casting runners, risers and fins shall be removed.
- Castings shall be true to pattern, and within industry standard dimensional tolerances with no excessive shrinkage or deformity. Gray iron castings shall conform to ASTM A48, Class 30B. Ductile iron castings (plugs and bonnets) shall conform to ASTM A536, grade 60-40-18.

2.1.2 Gate Valves in Chambers

- Use only for valves 450 mm to 1500 mm diameter. Match valve size to main pipe size.
- Conform to AWWA C500, C509 or C515; non-rising stem, 50 mm square operating nut with hand wheel, turning clock-wise to close, horizontal setting, bevel gears and position indicator.
- Flanged ends to be in accordance with AWWA C207, Class D.
- Valve stem is to be Type 304 stainless steel or grade B, C, D, or E bronze as per AWWA C509.
- Provide "O" Ring seals for the valve stem.
- Provide a by-pass and a gate valve to equalize pressure upon opening and closing the main valve. By-pass valves shall conform to AWWA C500.
- Where required, provide Type B screw type valve casing in accordance with Drawings 2512-01 to 05.
- Provide shop drawings and test data sheets.

2.1.3 Tapping Valves

- Conform to Item 2.1.1 or Item 2.1.2 depending on the application.
- Inlet ends are to be in accordance with AWWA C207, Class D.
- Outlet joints are to be as specified on the drawings.

2.2 BUTTERFLY VALVES

2.2.1 Direct-Bury Butterfly Valves

- Use only for valve sizes 450 mm diameter and larger. Match valve size to main pipe size.
- Short body flanged, wafer, or fully lugged conforming to AWWA C504, class 150B.
- Body and disc shall be cast iron, with rubber seat or an approved equal.
- Provide "O" ring shaft seals in a removable corrosion resistant recess to allow seals to be replaced without removing the valve shaft.
- Provide a manual geared or travelling nut buried service actuator conforming to AWWA C504, turning clock-wise to close with the following:
 - An actuator name plate mounted directly on the actuator indicating the actuator manufacturer, year of manufacture and model number.
 - A 50 mm square operating nut on top of the actuator.
 - A Type 304 stainless steel actuator input shaft.
 - Actuator to transmit required valve opening and closing torque at an input torque of 100 ft-lb.
 - Actuator to be third party certified for conformance to AWWA C504.
- Provide a Type B Screw Type valve casing set with a plug in accordance with Drawing 2512-01 to 05.
- Provide Type B (Screw Type) middle extension for valves with depths in excess of 3.0 meters from top of operating nut to surface grade of valve box.
- Provide shop drawings of the valve and installation.

2.2.2 Butterfly Valves in Chambers

- Use only for valve sizes 450 mm diameter and larger; match valve size to main pipe size.
- Short-body flanged or wafer type conforming to AWWA C504, class 150B.

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- Body and disc of cast iron, with rubber seat or an approved equivalent.
- Provide "O" ring shaft seals in a removable corrosion resistant recess to allow seals to be replaced without removing the valve shaft.
- Provide a manual geared or travelling nut actuator conforming to AWWA C504, 90% grease packed turning clock-wise to close, with the following:
 - An actuator name plate mounted directly on the actuator indicating actuator manufacturer, year of manufacture and model number.
 - A horizontal hand wheel on a 50 mm square operating nut, on the top of the actuator.
 - A valve position indicator facing upward.
 - A Type 304 stainless steel actuator input shaft
 - Actuator to transmit required valve opening and closing torque at an input torque of 100 ft-lb.
 - Actuator to be third party certified for conformance to AWWA C504.
- Provide a Type B Screw Type valve casing set with a plug in accordance with Drawing 2512-01 to 05.
- Provide shop drawings and test sheets of the valve and installation.

2.3 CHECK VALVES

2.3.1 Swing check valves

- Do not use for pipes larger than 300 mm.
- Conform to AWWA C508.
- Cast iron body with bronze trimmed cast iron disc.
- Flanged end to ANSI B16.1 (flat faced).
- Bronze seat rings.
- Valve shall have bolted cover, with an outside lever and adjustable spring assembly if designated on the drawings.
- Stainless steel shaft with double "O" rings and grease fittings at each end of shaft.
- Minimum 1035 kPa working pressure.

2.3.2 Slanting disc check valves

- Do not use for pipes 300 mm and under.
- Cast iron body ASTM A126 Grade B.
- Flanged ends (flat faced) to ANSI B16.1.
- Ductile iron disc to ASTM A536.
- Bronze seat ring and disc ring.
- Stainless steel pivot pins to ASTM T303.
- Stainless steel pivot pin bushing.
- Valve position indicator with micro switch and mounting bracket.
- Bottom mounted buffer for controlled closing.
- Minimum 1035 kPa working pressure.

2.3.3 Double door check valves

- Cast iron body to ASTM A126.
- Gates aluminium bronze to ASTM B148 Grade B.
- Stainless steel spring – type 316.
- Stainless steel stop pin.
- Mount between ANSI 125# flanges.
- Wafer or threaded lug type.
- Valve seat Buna N.
- Minimum 1035 kPa working pressure.

Section 02512 – WATER VALVES

- 2.3.4 **Silent check valves**
- Wafer style or globe type.
 - Cast iron ASTM A126 Grade B body.
 - Bronze trim.
 - Stainless steel spring – type 316.
 - Valve seat Buna N.
 - Replaceable seat and plug.
 - Suitable for horizontal or vertical flow.
 - Mount between ANSI 125 # flanges.
 - Minimum 1035 kPa working pressure.

- 2.3.5 **Rubber flapper check valves**
- Cast iron body.
 - Rubber lined, Buna N flapper.
 - Replaceable flapper with top cover plate.
 - O-ring seating.
 - Minimum 1035 kPa working pressure.

2.4 AIR VALVES

- 2.4.1 **Automatic air release valves**
- Conform to AWWA C512.
 - Single lever type.
 - Cast iron body.
 - Stainless steel float and other internal parts.
 - Threaded inlet.
 - Minimum 1035 kPa working pressure.
 - Except where specified otherwise.
- 2.4.2 **Automatic air and vacuum valves**
- Conform to AWWA C512.
 - Cast iron body.
 - Stainless steel float, ASTM A240.
 - Stainless steel guide shaft and bushing.
 - Flanged inlet and outlet to ANSI B16.1 Class 125 for valves 100 mm and larger.
 - Screwed inlet and outlet for valves 80 mm and smaller.
 - Sizes 80 mm and smaller to be equipped with a stainless steel diffuser screen.
 - Minimum 1035 kPa working pressure.
 - Except where specified otherwise.
- 2.4.3 **Automatic combination air valves**
- Conform to AWWA C512.
 - Cast iron body, cover and lever frame.
 - Stainless steel float.
 - Buna N seat.
 - Inlets up to 100 mm in diameter are to be threaded.
 - Inlets 100 to 200 mm in diameter are to be flanged to ANSI B16.1 Class 125.
 - Outlet to be plain with hood, threaded or flanged as shown.
 - Single or duplex body design, as indicated on the drawings.

Section 02512 – WATER VALVES

- Sizes 100 mm and larger to be equipped with an anti-slam device (surge check) mounted under combination air valve.
- Minimum 1035 kPa working pressure.

2.4.4 Manual air valves

- Use full port gate valves with non-rising stem. Use 50 mm valves unless specified otherwise.
- All stainless steel and/or bronze construction suitable for 1035 kPa operating pressure.
- Provide threaded cap or plug or blank flange on each valve.
- Refer to standard details 2512-14 to 18.

2.5 FLOW CONTROL VALVES

- Provide a diaphragm type, in globe or angle pattern.
- Valve body shall be cast iron, with bronze trim.
- The diaphragm shall be fully supported.
- Provide an "O" ring seat seal on main valve.
- Flow shall be measured by an orifice in the inlet flange, and modulation shall be achieved by a single adjustment pilot valve.
- Provide a strainer and needle valve on pilot inlet lines.

2.6 PRESSURE REDUCING VALVES

- Diaphragm type: single diaphragm for up to 200 mm valves and double diaphragm for 250 mm valves and larger.
- Hydraulically operated.
- Pilot controlled.
- Globe style.
- Flanged cast iron body to ANSI B16.1, Class 125.
- Type 304 stainless steel seat and stem.

2.7 BACKFLOW PREVENTERS

- 2.7.1 Premise isolation backflow prevention devices are mandatory on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in accordance with CSA B64.
- 2.7.2 Double check valve assemblies shall consist of two force-loaded independently acting check valves.
- 2.7.3 A reduced-pressure principle backflow preventer shall have an independently acting hydraulic dependent relief valve, situated in a chamber between two independently acting check valves. The intermediate chamber pressure shall always be lower than the supply pressure when there is a positive pressure on the supply side.
- 2.7.4 All internal metal parts included in the check assemblies shall be of Series 300 stainless steel, and shall not contain any dissimilar metals.
- 2.7.5 Elastomeric seat disc must be reversible, seat rings shall be B-61 bronze or Series 300 stainless steel, affixed to the valve bodies incorporating an "O" ring seal to facilitate ease of field removal and replacement.
- 2.7.6 The check assembly shall be guided at the seat ring and at the cover by replaceable non-corrosive bushings to assure positive check seating.
- 2.7.7 Head loss through a double check valve assembly shall not exceed that indicated in CSA B64.5. Head loss through a reduced-pressure principle backflow preventer shall not exceed that indicated in CSA B64.4. The R.P. relief port shall discharge water from the intermediate chamber as indicated in CSA B64.4. Flow curves shall be documented by independent laboratory testing.



Section 02512 – WATER VALVES

- 2.7.8 Valve bodies and cover shall be manufactured of ductile iron ASTM A536, Grade 65-45-12 and shall be designed to withstand a 10-1 safety factor over rated cold water working pressure.
- 2.7.9 Ductile iron bodies shall be flanged ANSI B16.1 Class 125 and epoxy coated internally 10-20 mils and prime coated externally.
- 2.7.10 The assembly shall include flanged, full port resilient wedge shut-off valves or 1/4 turn, full port, resilient seated, bronze ball shut-off valves and four vandal resistant full port ball valve test cocks. Assemblies must be factory assembled and backflow tested.
- 2.7.11 All assemblies shall be constructed so all internal parts, including seat rings, can be serviced without removing the device from the line. Assemblies shall be rated 0 to 1035 kPa. Assemblies intended for cold water service shall operate between 1°C and 45°C and assemblies intended for hot water service shall operate between 1°C and 82°C.
- 2.7.12 Double check valve assemblies shall meet or exceed requirements of CSA B64.5, ASSE Standard 1013, AWWA Standard C510, and the AWWA Canadian Cross Connection Control Manual.
- 2.7.13 Reduced pressure principle backflow preventers shall meet or exceed requirements of CSA B64.4, ASSE Standard 1013, AWWA Standard C511, and the AWWA Canadian Cross Connection Control Manual.
- 2.7.14 Backflow preventers used in fire systems shall also be Underwriters Laboratories of Canada (ULC) approved.

3. **EXECUTION**

3.1 INSPECTION OF MATERIAL BEFORE INSTALLATION

- 3.1.1 Before unloading, inspect the general condition of load for adequacy of packing and bracing, any signs of shifting, and any signs of damage to materials. Where the load has shifted badly and material appears significantly damaged, reject the entire load.
- 3.1.2 While unloading check each valve for:
 - The required manufacturer's markings;
 - The mark of the manufacturer's testing agency;
 - Damage to joint ends or surfaces;
 - Damage to coating or lining; and
 - Other visually apparent damage.
- 3.1.3 If the EPCOR is supplying the materials, note all damage and defects in writing and submit a copy of the receiving inspection report to the EPCOR Inspector. EPCOR or the EPCOR's supplier will replace rejected materials. However, unless the piece is rejected entirely, damage and defects discovered at the time of receiving shall be repaired by the Contractor. All materials, once accepted by the Contractor, become the responsibility of the Contractor until EPCOR accepts the installation.
- 3.1.4 If the Contractor is supplying the materials, submit a receiving inspection report as in Item 3.1.3, above. Repair damages or defects, and replace rejects.
- 3.1.5 The Contractor shall maintain a continuous file of all receiving inspection reports at the job-site, accessible for review by EPCOR.
- 3.1.6 The Contractor is responsible for the safe storage of materials after delivery and before installation and for handling and transportation between the storage site and the final location.
- 3.1.7 Valves shall be kept drained and stored before installation in a manner protecting them from damage due to freezing of trapped water. Prior to installation, valves shall be stored in a manner that protects them from damage from the environment in which they are stored. Manufacturer's recommendations for storage shall be adhered to.

Section 02512 – WATER VALVES

- 3.1.8 Visually inspect all joint ends and surfaces for damage or defects immediately before installation and reject and remove from site any unacceptable valves.

3.2 SETTING VALVES

- 3.2.1 Install valves at the locations designated; support all valves on concrete blocks or as designated on the approved construction drawings.
- 3.2.2 Construct concrete thrust blocks to be installed in conformance with Drawings 2511-03, 2511-04, 2511-05, 2511-06, 2512-09 and 2513-01 or as shown on the approved construction drawings. Make joints in accordance with manufacturer's recommendations and requirements.
- 3.2.3 Install valves and valve casings in accordance with Drawings 2512-XX, 2513-01 and 2513-02. Ensure that valve casing cannot transmit loading to the valve or water main. Install valve casing plumb. Do not cause valve casing to move out of plumb or out of position while placing and compacting backfill.
- 3.2.4 Depth of operating nut must be between 1.8 to 2.5 meters to surface grade. Use valve stem risers (extensions) with stone catcher flange, as required.
- 3.2.5 Valve casings must be set to finished grade as shown in Table 1.

Table 1: Acceptable depth of valve casing at finished grade

Location	Depth Below Finished Grade (mm)	Acceptable Depth at Final Inspection (mm)
Paved Surfaces	0 – 15	0 – 15
Sidewalks	0 – 5	0 – 5
Boulevards	5 - 10	0 – 15

3.3 VALVES IN CONCRETE CHAMBERS

- 3.3.1 Unless cast-in-place concrete construction is specifically requested, install standard pre-cast concrete manholes or chambers as detailed on the drawings. Refer to Volume 3: Drainage, Section 03310 - Concrete for Water and Drainage Structures.
- 3.3.2 Provide removable top slab with lifting hooks.
- 3.3.3 Pipe work and valves are to be anchored as shown on the drawings and supported to prevent movement due to valve closure.
- 3.3.4 Incorporate flexible couplings in the pipe work as designated on the drawings. Couplings or flange adapters to have epoxy coating and painted carbon steel nuts and bolts.
- 3.3.5 Waterproof exterior of chambers with XYPEX or an approved equal.
- 3.3.6 Insulate chambers to a minimum depth of 2.0 m below final grade using spray applied foam insulation or as indicated on the drawings.
- 3.3.7 The pipe shall be adequately supported within the chamber utilizing adjustable galvanized pipe supports, or as indicated on the drawings.
- 3.3.8 Manhole covers shall have the markings "WATER" cast into the cover for easy identification. Lettering shall be a minimum of 25 mm in height.

3.4 INSPECTION OF VALVE CASINGS AND SERVICE BOXES

- 3.4.1 Upon completion of backfill and surface restoration, check all valve casings and service boxes, to determine that they are plumb, straight, not broken and at proper grade level.
- 3.4.2 Insert a valve key to check that unobstructed connection to the operating nut can be made and that top of operating nut does not exceed 2.5 m and is not less than 1.8 m in depth. Operate all valves



Section 02512 – WATER VALVES

on and then off again to check for free rotation and smooth operation. Rectify any unacceptable aspects of the installations.

- 3.4.3 Request a final inspection by EPCOR.

3.5 INSPECTION OF CONCRETE STRUCTURES

- 3.5.1 Refer to Volume 3: Drainage, Section 03310 - Concrete for Water and Drainage Structures.
- 3.5.2 Request EPCOR to make inspections of the following items:
- the ground immediately before formwork or steel is placed;
 - the formwork and reinforcing steel immediately before pouring concrete;
 - the concrete finish before applying curing compound, sealer, or insulation; and
 - the construction joints before adjacent concrete is poured.
- 3.5.3 Take one pair of concrete test samples for each 25 m³ of concrete poured and at least one pair for each pour or location. For each pair of samples, test one at 7 days and one at 28 days. Use the method detailed in CSA A23.2. Prepare a written report and submit a signed copy to EPCOR within 24 hours of testing the sample.
- 3.5.4 Make an air test for each truckload of concrete delivered using the method detailed in CSA A23.2.19. If an air test shows an air content outside of the limits specified reject the load and remove it from the site.
- 3.5.5 Make a slump test for each load of concrete; if the slump is too high, reject the load and remove it from the site.
- 3.5.6 If the strength of concrete test samples is below that which is specified, EPCOR may order the portion of the work represented by the sample to be removed and replaced.

3.6 INSPECTION OF PRECAST CONCRETE INSTALLATIONS

- 3.6.1 Arrange for EPCOR to inspect the excavated ground prior to placing bedding.
- 3.6.2 Check sufficient depth of bedding has been laid before setting base unit into position.
- 3.6.3 Check alignment and seal between units.

END OF SECTION



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Section 02513 Hydrants

January 2013



Section 02513 – HYDRANTS

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Section 02513 – HYDRANTS

1. GENERAL

1.1 SCOPE

This section refers to fire hydrants.

1.2 PRODUCT ACCEPTANCE

1.2.1 Products coming into contact with potable water may have the potential to impart contaminants and impurities. In order to minimise potential adverse health effects, this specification endorses the use of the National Sanitation Foundation (NSF) Standard 61 - Drinking Water System Components: Health Effects and NSF Standard 14 - Plastics Piping System Components and Related Materials, for determining the suitability of various products for use in the City of Edmonton's water distribution system. NSF Standards provide basic criteria to promote and protect public health and covers products produced by good manufacturing practices and generally recognized manufacturing processes. Products certified to these standards ensure that public health concerns related to their use have been properly addressed.

1.2.2 All water main piping and lining shall be certified to NSF Standards 14 and 61 as acceptable for drinking water system components, whenever possible.

1.2.3 Products are specified to be in accordance with a recognized standard such as AWWA, CSA, ASTM or ANSI. EPCOR must approve exceptional cases before these products can be used.

1.2.4 Determining that a product complies with a standard requires:

- certification from the supplier or manufacturer to the effect that the product does meet the standard and/or
- testing in accordance with a recognized procedure such as the appropriate ASTM Standard.

1.2.5 In general, EPCOR will accept certification, if available, while reserving the right to call for additional testing as necessary without incurring extra costs to EPCOR or the City.

1.2.6 A list of materials approved for use in the water distribution system is included in Section 02519 – Product Approval Procedures. In making this determination, EPCOR is not strictly bound by the specified standards, but instead exercises judgement in the best interests of the City of Edmonton in conjunction with EPCOR's specific requirements. Unless prior written approval is obtained all material supplied shall be included on this list.

1.2.7 Unless otherwise designated, all specification and standard references shall refer to the latest edition.

1.2.8 Reference Standards and Guidelines

Fire Hydrants and appurtenances shall conform to the following standards and guidelines:

- AWWA C502 – Dry-Barrel Fire Hydrants
- AWWA C550 – Protective Interior Coatings for Valves and Hydrants
- AWWA M17 – Installation, Field Testing and Maintenance of Fire Hydrants
- NFPA 291 – Recommended Practice for Fire Flow Testing and Marking of Hydrants

2. PRODUCTS

2.1 FIRE HYDRANTS

2.1.1 Provide dry barrel hydrants that conform to AWWA C502. Hydrants shall have a centre operating stem and shall be a traffic model, with a breakable ground flange and a breakable stem coupling. Nozzle section must be able to rotate 360 degrees.

Section 02513 – HYDRANTS

- 2.1.2** Provide compression type hydrants, which close with the line pressure, complete with bottom connection and drip valve.
- 2.1.3** The barrel of the hydrant to be a minimum of 150 mm inside diameter in two flanged sections with the upper section being 300 mm in length and terminating at the ground flange, 50 mm above ground level. The lower section is to be of sufficient length to provide a minimum of 2.59 m from ground surface to the invert of the inlet pipe. Flanges are to have a minimum of 4 bolts.
- 2.1.4** The hydrant head is to have one 4.5" pumper connection and two 2.5" nozzle connections at least 415 mm above the ground flange; nozzle connections must be at 90 degrees on each side of the pumper connection. Pumper and nozzle connections are to be provided with caps, without chains or cables. The valve stem in the hydrant head is to have "O" ring seals and to be equipped with a thrust bearing. Lubrication, where required, to be applied by regular automotive style grease gun.
- 2.1.5** Hydrant connections shall have threads conforming to Table 1.

Table 1: Hydrant Connection Thread Requirements

Requirement	Pumper	Nozzles
Nominal Size	114.3 mm (4 ½")	63.5 mm (2 ½")
Thread Designation	4.5 – 4NH*	AMA**

*NH - American National Fire Protection hose connection screw threads

**AMA - Alberta Mutual Aid thread.

- 2.1.6** Pumper and nozzle caps are to be threaded into the hydrant head, rather than leaded in, unless a positive locking device is provided to prevent blow-out of the caps.
- 2.1.7** The operating nut on the hydrant valve stem and on the pumper and nozzle caps, to be 3 sided, each side being an arc, with 1.5" between points (chord length) and 1.5" radius. The hydrant valve, pumper and nozzle caps shall open counter-clockwise.
- 2.1.8** All external nuts and bolts, excluding ground flange, are to be Type 304 stainless steel or better.
- 2.1.9** Provide a bottom connection, flanged to the barrel, with a single gasket, push-on type joint for ductile iron or PVC pipe, 150 mm diameter only (cast iron outside diameter), complete with harnessing lugs.
- 2.1.10 Internal Paint**

Hydrant body, internal top section is to be painted to AWWA C502 and AWWA C550. Alternatively internal surfaces may be left bare.

2.1.11 External Paint

- 2.1.11.1** Hydrant bodies (external top section) are to be painted to AWWA C502- yellow or the following:
- Primer – Benjamin Moore Industrial Maintenance Universal Metal Primer, White, or equivalent
 - Surface Coat – Benjamin Moore Alkyd Enamel Yellow, or approved equal, 1 coat.
- 2.1.11.2** Hydrant dome, both 2.5" nozzle caps, and 4.5" pumper cap are to be painted using Benjamin Moore Industrial Maintenance Rapid Dry Gloss Alkyd Enamel or an approved equal in accordance with NFPA 291 standards, as shown in Table 2.

Table 2: Hydrant paint colors

Hydrant Flow Capacity		Dome, Pumper and Nozzle Cap Colour
US gpm	L/s	
1500 or greater	95 or greater	Benjamin Moore Safety Blue or Approved Equal
1000 – 1500	60 – 95	Benjamin Moore Safety Green or Approved Equal
500 – 1000	30 – 60	Benjamin Moore Safety Orange or Approved Equal
< 500	< 30	Benjamin Moore Safety Red or Approved Equal



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- 2.1.11.3 Hydrant numbers to be painted on back of hydrant in black or safety blue at least 300 mm above the ground flange, preferably directly behind the 4.5" pumper cap. Font to be 50mm Arial.
- 2.1.11.4 Location of hydrant control valve is to be marked on hydrant showing distance of control valve from hydrant in meters (e.g. 2.5). Markings to be in direct alignment with valve. Control valve location number is to be marked at 250 mm above ground flange or higher, font to be 50mm Arial.

3. **EXECUTION**

3.1 **INSPECTION OF MATERIAL BEFORE INSTALLATION**

- 3.1.1 Before unloading, inspect the general condition of load for adequacy of packing and bracing, any signs of shifting and any signs of damage to materials; where the load has shifted badly and material appears significantly damaged, reject the entire load.
- 3.1.2 While unloading check each hydrant for:
 - The required manufacturer's markings;
 - The mark of the manufacturer's testing agency;
 - Damage to joint ends or surfaces;
 - Damage to coating or lining; and
 - Other visually apparent damage.
- 3.1.3 If EPCOR is supplying the materials, note all damage and defects in writing and submit a copy of the receiving inspection report to EPCOR. EPCOR or EPCOR's supplier will replace rejected materials. However, unless the piece is rejected entirely, the Contractor shall repair damage and defects discovered at the time of receiving. All materials, once accepted by the Contractor, become the responsibility of the Contractor until EPCOR accepts the installation.
- 3.1.4 If the Contractor is supplying the materials, submit a receiving inspection report as in Item 3.1.3, above. Repair damages or defects and replace rejects.
- 3.1.5 The Contractor shall maintain a continuous file of all receiving inspection reports at the job site, to be accessible for review by EPCOR.
- 3.1.6 The Contractor is responsible for the safe storage of materials after delivery and before installation and for handling and transportation between the storage site and the final location.
- 3.1.7 Hydrants shall be kept drained and stored before installation in a manner protecting them from damage due to freezing of trapped water. Prior to installation, hydrants shall be stored in a manner that protects them from damage from the environment in which they are stored. Manufacturer's recommendations for storage shall be adhered to.
- 3.1.8 Visually inspect all joint ends and surfaces for damage or defects immediately before installation and reject and remove from site any unacceptable hydrants.

3.2 **INSTALLING HYDRANTS**

- 3.2.1 Install hydrants at the locations designated. Support base on treated fir blocks or as designated on the construction drawings.
- 3.2.2 Construct concrete thrust blocks in conformance with Drawings 2511-03, 2511-04, 2511-05, 2511-06 and 2513-01 or as shown on the construction drawings.
- 3.2.3 Make joints in accordance with manufacturer's recommendations and requirements.
- 3.2.4 Install hydrants in accordance with Drawings 2513-01 and AWWA M17. Install protection posts in accordance with Drawing 2513-02 as needed. Provide a minimum of 0.3 cu. m. of washed gravel media (25mm nominal single size washed rock) to allow unobstructed draining of the hydrant. Washed gravel media is to be covered with polythene sheet, minimum 0.15 mm (6 mils) thick, to



Section 02513 – HYDRANTS

prevent infiltration of backfill materials. All non standard depth of bury installations require approval of the engineer or the EPCOR inspector. A maximum of one extension only may be installed. A lower barrel and valve assembly adapted for deep bury may be required.

- 3.2.5** Install hydrant plumb, with ground flange horizontal and true. Do not cause the hydrant to move out of plumb or out of position while placing and compacting backfill.
- 3.2.6** Where the water table is above the hydrant drain, the hydrant drain ports may require plugging. Consult the Engineer to determine drain plugging requirements and clearly identify these hydrants on the engineering drawings and as-built submission. Hydrants with plugged drain ports must be pumped free of standing water after each use.
- 3.2.7** Where specifically designated on the drawings or as directed by EPCOR, provide a joint harness consisting of tie rods and clamps.

END OF SECTION



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Section 02514 Water Services

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Section 02514 – WATER SERVICES

1. GENERAL

1.1 SCOPE

This section applies to water services from the water main to the property line as follows:

- Service pipe 20 mm to 50 mm in diameter;
- Brass fittings, and service boxes for 20 mm to 50 mm diameter services;
- Service Saddles for 40 mm and 50 mm diameter services; and
- Service pipe and fittings 100 mm in diameter and larger.

1.2 PRODUCT ACCEPTANCE

- 1.2.1** Products coming into contact with potable water may have the potential to indirectly impart contaminants and impurities. In order to minimize potential adverse health effects, this specification endorses the use of the National Sanitation Foundation (NSF) Standard 61 - Drinking Water System Components: Health Effects and NSF Standard 14 - Plastics Piping System Components and Related Materials, for determining the suitability of various products for use in the City of Edmonton's water distribution system. NSF Standards provide basic criteria to promote and protect public health and covers products produced by good manufacturing practises and generally recognized manufacturing processes. Products certified to these standards ensure that public health concerns related to their use have been properly addressed.
- 1.2.2** All water service piping, lining, fittings and valves shall be certified to NSF Standards 14 and 61 as acceptable for drinking water system components, whenever possible.
- 1.2.3** Products are specified to be in accordance with a recognized standard such as AWWA, CSA, ASTM or ANSI. EPCOR must approve exceptional cases before these products can be used.
- 1.2.4** Determining that a product complies with a standard requires certification from the supplier or manufacturer to the effect that the product does meet the standard or testing in accordance with a recognized procedure such as the appropriate ASTM Standard.
- 1.2.5** In general EPCOR will accept certification, if available, while reserving the right to call for additional testing as necessary without incurring extra costs to EPCOR.
- 1.2.6** A list of material approved for use in the water distribution system is included as Section 02519. In making this determination, EPCOR is not strictly bound by the specified standards, but instead exercises judgement in the best interests of the City of Edmonton in conjunction with EPCOR's specific requirements. Unless prior written approval is obtained, only materials that appear on this list shall be supplied.
- 1.2.7** Unless otherwise designated, all specification and standard references shall refer to the latest edition.

1.3 STANDARDS

- 1.3.1** Water services and appurtenances shall conform to all applicable standards, including but not limited to the following:
- AWWA C800 – Underground Service Line Valves and Fittings.
 - AWWA C903 – Polyethylene—Aluminum—Polyethylene & Cross-linked Polyethylene—Aluminum—Cross-Linked Polyethylene Composite Pressure Pipes, ½ In. (12 mm) Through 2 In. (50 mm), for Water Service
 - ASTM B88 – Standard Specification for Seamless Copper Water Tube
 - ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings
 - ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications
 - CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications



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- CSA B137.1 - Polyethylene (PE) Pipe, Tubing and Fittings for Cold-Water Pressure Services
- National Sanitation Foundation (NSF) Standard 14 - Plastics Piping System Components and Related Materials
- National Sanitation Foundation (NSF) Standard 61 - Drinking Water System Components: Health Effects

1.4 REGULATIONS

All applicable regulations shall be adhered to, including but not limited to the following:

- City of Edmonton Water Services and Wastewater Treatment Bylaw 15816
- City of Edmonton Sewers Bylaw 9425
- City of Edmonton Sewers Use Bylaw 9675
- City of Edmonton Surface Drainage Bylaw 11501
- The Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems - Alberta Environment
- City of Edmonton Regulation of Work and Equipment Installation Bylaw 12846
- Alberta Environmental Protection and Enhancement Act and associated Regulations
- National Building Code of Canada
- Alberta Building Code
- National Plumbing Code of Canada
- National Fire Code of Canada
- Alberta Fire Code

- 1.4.1 All products shall be installed in accordance with the recommended installation procedures provided by the manufacturer.

2. PRODUCTS

2.1 COPPER SERVICE PIPE

- 2.1.1 Conform to AWWA C800, Type K copper pipe to ASTM B88.
- 2.1.2 Provide third party certification with the symbol of the certifier permanently marked at 0.5 m intervals on all certified tubing. The third party certifier shall be an accredited certification agency recognized by the Standards Council of Canada.
- 2.1.3 Copper service pipe can be used for services 20 mm to 50 mm in diameter.

2.2 FITTINGS FOR COPPER SERVICE PIPE

- 2.2.1 Provide main stops, curb cocks, service boxes and couplings listed in Section 02519 - Approved Materials and according to AWWA C800.
- 2.2.2 All fittings to withstand a test pressure of 1035 kPa.
- 2.2.3 Provide service boxes, as per Drawings 2514-03 and 2514-04.

2.3 ALTERNATE SERVICE PIPE

- 2.3.1 Provide alternate service pipe according to Section 02519 – Product Approval Procedures.
- 2.3.2 Composite PE-Al-PE can be used for services 20 mm and 25 mm in diameter. Cross linked PE can be used for services 20 mm to 50 mm nominal diameter. Sizing is by internal diameter.

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2.4 FITTINGS FOR ALTERNATE SERVICE PIPE

- 2.4.1 Provide main stops, curb cocks, service boxes and couplings according to Section 02519 – Product Approval Procedures and AWWA C800.
- 2.4.2 All fittings to withstand a test pressure of 1035 kPa.
- 2.4.3 Provide service boxes, as per Drawings 2514-03 and 2514-04.

2.5 LARGE SERVICE PIPE AND FITTINGS

- 2.5.1 Large Service means sizes 100 mm nominal diameter and larger.
- 2.5.2 Generally use the same materials of service pipe, fittings, and valves as the distribution main pipe.
- 2.5.3 Provide valve boxes, as per Drawings (2512-01 to 09).

2.6 SERVICE SADDLES

- 2.6.1 To be of stainless steel Type 304 and / or bronze construction.
- 2.6.2 Bronze components shall be Waterworks Bronze (85-5-5-5) in conformance with ASTM B62.
- 2.6.3 Single or double band design with a minimum total band width of 90 mm.
- 2.6.4 Nuts and bolts to be Type 304 stainless steel with threads treated to prevent binding.
- 2.6.5 Gaskets shall be of synthetic rubber suitable for potable water use.
- 2.6.6 Use for all pipe types except steel and concrete cylinder pipe.

2.7 SERVICE RODS

- 2.7.1 Operating rods for 20mm and 25 mm curb cocks shall be Type 304 stainless steel. The rod shall be attached to a manganese bronze or stainless steel clevis with a stainless steel rivet. Refer to Drawing 2514-03.
- 2.7.2 Operating rods for 40mm and 50 mm curb cocks shall be mild steel. Refer to Drawings 2514-04.
- 2.7.3 One stainless steel cotter pin shall be supplied with each operating rod (packaged separately).
- 2.7.4 Table 1 shows alternative material specifications that shall apply for each component:

Table 1: Material specifications for service rods

Component	Specification	Type of Alloy UNIS No.	Composition (%)	Minimum Yield Strength (MPa)
Stainless Steel Rod, Rivet and Cotter Pin	AISI	304	C, 0.08 max. Cr., 18.0 to 20.0 Ni., 8.0 to 10.0 Mn, 2.0 max. Si., 1.0 max. P, 0.045 max. S, 0.03 max.	242
Manganese Bronze Clevis	ASTM B584	C86200	Al, 3.0 to 4.9 Cu, 60 to 66 Fe, 2.0 to 4.0 Mn, 2.5 to 5.0 Ni, 1.0 Max	310

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	ASTM B584	OR C86300	Pb, 0.2 Max. Sn, 0.2 Max. Zn, 22.0 to 28.0 Al, 5.0 to 7.5 Cu, 60 to 66 Fe, 2.0 to 4.0 Mn, 2.5 to 5.0 Ni, 1.0 Max. Pb, 0.2 Max. Sn, 0.2 Max. Zn, 22.0 to 28.0	414
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3. **EXECUTION**

3.1 **INSPECTION OF MATERIAL BEFORE INSTALLATION**

- 3.1.1** Inspect the general condition of load for adequacy of packing and bracing, any signs of shifting and any signs of damage to materials before unloading materials. Reject the entire load where the load has shifted badly and material appears significantly damaged.
- 3.1.2** While unloading check each piece of pipe and/or each fitting for:
- The required manufacturers' markings;
 - The mark of the manufacturer's testing agency;
 - Damage to joint ends or surfaces;
 - Damage to coating or lining; and
 - Other visually apparent damage.
- 3.1.3** If EPCOR is supplying the materials, note all damage and defects in writing and submit a copy of the receiving inspection report to EPCOR. All materials, once accepted, become the responsibility of the Contractor until EPCOR accepts the installation. However, unless the piece is rejected entirely, the Contractor shall repair damage and defects discovered at the time of receiving. Rejected materials are to be replaced by EPCOR or EPCOR's supplier.
- 3.1.4** If the Contractor is supplying the materials, submit a receiving inspection report as in Item 3.1.3 above. Repair damages or defects, and replace rejects.
- 3.1.5** Maintain a continuous file of all receiving inspection reports at the job-site. Allow EPCOR access to these reports for review.
- 3.1.6** The Contractor is responsible for the safe storage of materials after delivery and before installation and for handling and transportation between the storage site and the final location.
- 3.1.7** Visually inspect all joint ends and surfaces for damage or defects immediately before installation. Reject and remove from the site any unacceptable pipe or fittings.
- 3.1.8** Check brass water service fittings for damaged end threads before installation.

3.2 **WATER SERVICES**

- 3.2.1** Refer to Section 02518 – PVC Tapping Guidelines. Tap other pipe materials generally in accordance with Section 02518, and in accordance with the instructions of the tapping equipment supplier for the specific pipe material.
- 3.2.2** Carefully and evenly support exposed sections of water main pipe during tapping operations and carefully restore the pipe bedding to provide even support on completion. Existing water mains shall not be subjected to excessive point loadings, deflection, rotation or displacement, at any time during the construction process. Where Asbestos Cement water main pipe is encountered, extra caution is required. Review plans and procedures on site with the EPCOR Inspector.

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- 3.2.3** Curb cock shall be located 0.1 m from the property line, on the city side, except for lots serviced from the side, where curb cocks must be 0.3 m from the property line, on the city side. Ensure that the curb cock is installed in the proper direction. The invert of the service pipe shall be at 2.59 m below finished grade at the property line.
- 3.2.4** All curb cocks installed on water service connections to properties shall be of the non-bleeder (not self draining) type unless specifically approved. Self draining (bleeder type) curb cocks will be installed only on seasonal water services with prior written approval on a project specific basis.
- 3.2.5** Valves for large services shall be installed by TVS in accordance with Section 02518 – PVC Tapping Guidelines, or strapped to tee in accordance with Drawing 2512-09.
- 3.2.6** Water and sewer services shall be extended into property beyond the gas easement in accordance with Drawing 2514-09.
- 3.2.7** Minimum size of water service shall be as shown in Table 2.

Table 2: Minimum water service sizes

Class of Building	Minimum Service Size - Internal Diameter	
	Peak Hour Pressures \geq 350 kPa	Peak Hour Pressures < 350 kPa
Single-Family Dwelling	20 mm	25mm
Two-Family Dwelling (Duplex)	Two separate 20mm	Two separate 20mm
Four-Family Dwelling (Fourplex)	40 mm	40 mm

- 3.2.8** For residential complexes larger than a duplex, and for non-residential buildings install water services as designated by EPCOR or as shown on the drawings.
- 3.2.9** For services 100 mm and larger use the same material systems as the distribution mains to which they are connected. Do not install services sized between 50 mm and 100 mm in diameter.
- 3.2.10** Provide a “goose-neck” at each mainstop in accordance with Drawings 2514-01 and 2514-02. Provide an additional “goose-neck” at each sewer crossing. Avoid kinking or crimping the water service tubing. Bend to 300 mm radius. Support and protect service tubing to prevent damage or displacement.
- 3.2.11** Install a service box or valve casing in accordance with Drawings 2514-03, 2514-04 or 2512-01 to 08. Set vertically and brace to remain vertical during backfilling and compaction. For small services, set the top of service box below grade at sufficient depth to avoid damage during the maintenance period. The contractor shall raise the top section to finished grade prior to requesting FAC inspection.
- 3.2.12** Install dual services in one trench in accordance with Drawing 2514-06.
- 3.2.13** All service pipes are to be in one continuous piece. Use couplings only when the service pipe exceeds the length of a standard roll of service tubing. Locate double unions outside of paved areas if possible, usually in the boulevard.
- 3.2.14** Allow at least 600 mm between mainstops. No mainstop to be within 600 mm of a bell, coupling or collar.
- 3.2.15** Backfill around curb cock and casing bottom section with clay, not with granular material.
- 3.2.16** Test water services in accordance with Section 02517 – Guidelines for Acceptance Testing.
- 3.2.17** Where the water service is 50 mm diameter or smaller, install it in the same trench as the sewer services and to the right of the sanitary sewer service when facing towards the property being served. Refer to Drawings 2514-05 to 2514-08, sewer bylaws and water bylaw.
- 3.2.18** Where the water service is 100 mm diameter or larger, install it in a separate trench at least 2.5 m from any sewer, in accordance with sewer and water bylaws, and 1.8 m from gas or power lines.



Section 02514 – WATER SERVICES

- 3.2.19** Install services in accordance with all applicable Drawings (2514-01 to 2514-13) unless indicated otherwise on the construction drawings.

3.3 SERVICES INSTALLED BY AUGERING, BORING OR TUNNELLING

- 3.3.1** Auger, bore or tunnel under existing sidewalks, curb and gutter, etc.
- 3.3.2** For augering, boring or tunnelling, refer to applicable Sections in Volume 3, Drainage, including 02445 Bored Undercrossings, 02441 Microtunnelling, and 02446 Horizontal Directional Drilling.
- 3.3.3** Install water, sanitary and storm sewer service pipe.
- 3.3.4** If the service is installed in a tunnel, place and hand tamp Class B bedding to fill tunnel cross-section; if the service is installed by augering or boring, fill the auger or bore hole with a dry or slurry mixture of sand/cement.

3.4 RECORD OF SERVICES

- 3.4.1** Obtain the approved method of delivering as-built information from the Water and Sewer Services Section (WASS) of Drainage Services, showing locations related to property lines and street and avenue designations, coordinates and elevations of curb cocks (c.c.) and valves, main stops, and pipe sizes / lengths / materials. Complete required information in accordance with WASS' instructions. For further information, contact (780) 496 5444.

3.5 REPLACEMENT AND/OR RECONNECTION OF EXISTING WATER SERVICES

- 3.5.1** All existing non-approved water service materials (lead, galvanized, etc.) shall be replaced with copper or an approved alternative service piping from the main to the property line, including the curb cock or valve.
- 3.5.2** Replace any part of an existing service exposed during construction that is found to be in poor condition. Extent of replacement to be as directed by EPCOR. The charges for this extra work shall be consistent with the unit prices quoted in the Contractor's bid, and subject to EPCOR's approval.
- 3.5.3** Replace all existing water services and curb stops that service properties on the side of the lane closest to the water main when the water main is replaced.
- 3.5.4** All water services encountered during construction shall be reconnected to the new water main. If a water service that is not identified on the drawings is encountered, obtain written authorization from EPCOR prior to connecting it to the new water main.
- 3.5.5** Where water service to two or more properties is provided by a single water service line and is encountered during construction, it is to be replaced with individual water service pipes for each property from the property line to the water main.

3.6 CATHODIC PROTECTION

- 3.6.1** Install cathodic protection for metallic components of water services in accordance with Section 02516 – Cathodic Protection.
- 3.6.2** Install sacrificial anodes on all existing and replaced copper services in accordance with Section 02516 – Cathodic Protection and Drawing 2514-01.

3.7 REPLACEMENT OF EXISTING CURB COCKS

- 3.7.1** All faulty curb cocks, as identified during pre-construction inspection, will be replaced with new curb cocks. If the new curb cock is to be reconnected to an existing copper service piping less than 1.5 m long, the copper service piping will be replaced in its entirety together with the installation of the new curb cock.



Section 02514 – WATER SERVICES

3.8 TURNING ON SERVICES

- 3.8.1** Do not operate any service control valves unless specifically authorized to do so. Only EPCOR Water Services Distribution Operations personnel or contractual agents, either under direct supervision of or with prior approval from EPCOR Water Services, can operate services.
- 3.8.2** Work with EPCOR Water Services Distribution Operations personnel to maintain a watch in case a leak develops on those services utilized within 3 days of bringing a new water main into operation. Be prepared to deal promptly with a service leak.
- 3.8.3** Be prepared to perform additional water sampling and testing in the event that water quality concerns arise. Dechlorinate discharges of chlorinated water as required under federal law and local bylaws.

END OF SECTION



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Section 02515 Pipe Bedding

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Section 02515 – PIPE BEDDING

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Section 02515 – PIPE BEDDING

1. **GENERAL**

1.1 **SCOPE**

This section covers bedding and structural support for water pipe in excavations and all material under and around the pipe to 300 mm above the top-of-pipe.

1.2 **ASSOCIATED WORK**

Trench and backfill shall be undertaken in accordance with Volume 2: Roadways, Section 02318 – Trench and Backfill. Utility cut restoration shall be undertaken in accordance with Volume 2: Roadways, Section 02965 - Utility Cut Restoration. Fillcrete backfill shall be undertaken in accordance with Volume 2: Roadways, Section 02317 - Fillcrete.

2. **PRODUCTS**

2.1 **PIPE BEDDING MATERIAL**

2.1.1 **Fine Granular:** Provide granular material clean and free of organic matter, pit-run or crushed within the gradation limits shown in Table 1.

Table 1: Gradation limits for fine granular

Sieve Size (mm)	Percent Passing by Mass
10.000	100
5.000	70 to 100
0.150	5 to 20
0.075	0 to 12

2.1.2 **Coarse Granular:** Provide granular material clean and free of organic matter, pit-run or crushed within the gradation limits shown in Table 2.

Table 2: Gradation limits for coarse granular

Sieve Size (mm)	Percent Passing by Mass
25.000	100
20.000	95 to 100
10.000	60 to 80
5.000	40 to 60
0.150	5 to 15

2.1.3 **Washed Gravel:** Washed, crushed or screened, stone or gravel consisting of hard and durable particles, meeting the gradation limits in Table 3, and free from sand, clay, cementitious, organic and other deleterious material.

Table 3: Gradation limits for washed gravel

Sieve Size (mm)	Percent Passing by Mass
25.00	100
5.00	10 max
0.08	2 max

2.1.4 Use washed gravel only if approved by EPCOR.

Section 02515 – PIPE BEDDING

3. EXECUTION

3.1 CLASSES OF TRENCH BEDDING

- 3.1.1** Use the class of bedding specified on the construction drawings. If there is no specific designation, use Class B bedding, with fine granular bedding material. Refer to Drawing 2511-02.
- 3.1.2 Class A** – Place a cradle of plain concrete or reinforced concrete, minimum 15 MPa, under the pipe, across the entire width of the trench, and along the sides of the pipe to provide a support angle of 120°. Place and compact fine granular bedding material above the concrete to 300 mm above the top-of-pipe. Compact to 95% of Standard Proctor Density.
- 3.1.3 Class B** – Place and compact 75 mm (minimum depth) of fine granular bedding material under the pipe (maximum depth 400mm) and around the pipe to 300 mm above the top-of-pipe. Compact to 95% of Standard Proctor Density.
- 3.1.4 Class C** – Place and compact 75 mm (minimum depth) of fine granular bedding material under the pipe (maximum depth 400 mm) and around sides of the pipe up to the spring line. Compact to 95% of Standard Proctor Density. Place and compact suitable backfill material from the spring line to 300 mm above the top-of-pipe. Compact to 95% of Standard Proctor Density.
- 3.1.5 Class D** – Shape the bottom of the trench to fit the pipe over a 90° support angle. Place and compact suitable backfill material around the pipe to 300 mm above the top-of-pipe. Compact to 95% of Standard Proctor Density.
- 3.1.6** All bedding and backfill material is to be placed in 150 mm layers and compacted.
- 3.1.7** For pipes larger than 450 mm, with Class A, B, or C bedding, place and compact 1.0 m long clay cut-off walls to an undisturbed bottom across the entire trench at intervals of 150 m.

3.2 BEDDING FOR PIPE IN EXCAVATIONS FOR STRUCTURES

- 3.2.1** Where the depth from the underside of the pipe to solid, undisturbed ground is less than 0.5 m, place and compact fine granular bedding material under and around the pipe to 300 mm above the top-of-pipe, extending across the entire width of the excavation to the undisturbed wall of the excavation. Compact to 95% of Standard Proctor Density.
- 3.2.2** If the depth to undisturbed ground is between 0.5 and 1.0 m, place suitable material below the pipe bedding zone. Place in 150mm layers and compact to 95% of Standard Proctor Density.
- 3.2.3** Where the depth from the underside of pipe to undisturbed, solid, ground is greater than 1.0 m, provide structural support as shown on the drawings or as directed by EPCOR.
- 3.2.4** If there is over-excavation beyond the specified limits, advise EPCOR and obtain instructions.

END OF SECTION



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Construction Standards

Section 02516 Cathodic Protection

January 2013



Section 02516 – CATHODIC PROTECTION

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Section 02516 – CATHODIC PROTECTION

1. GENERAL

1.1 SCOPE

This section pertains to cathodic protection of metallic water system components by the use of sacrificial anodes and deals with the following materials:

- Magnesium Anodes;
- Zinc Anodes;
- Water Main Wires;
- Conductivity (Jumper) Cables;
- Electrical Isolation Devices; and
- Test Stations.

1.2 SPECIFICATIONS

1.1.1 Cathodic protection shall conform to the following standards and recommended practices:

Standards

- CSA C22.2 No. 38– Thermoset Insulated Wires and Cables
- CSA C22.3 No. 4 – Control of Electrochemical Corrosion of Underground Metallic Structures
- CSA C22.3 No. 6 – Principles and Practises of Electrical Coordination between Pipelines and Electric Supply Lines
- ASTM G97 – Standard Test Method for Laboratory Evaluation of Magnesium Sacrificial Anode Test Specimens for Underground Applications
- ASTM G57 – Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
- ASTM B418 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes
- ASTM B843-07 - Standard Specification for Magnesium Alloy Anodes for Cathodic Protection
- CEC C22.1 – Safety Standard for Electrical Installations, Parts 1 and 2

Recommended Practices

- NACE SP0169 (2002) - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- NACE TM0497 (2002) - Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems

2. PRODUCTS

2.1 ANODES

2.1.1 **Magnesium anodes:** Magnesium anodes shall be high potential (type M1C) in accordance with ASTM B843-07. The open circuit potential of the anode versus a saturated copper/copper sulphate reference electrode shall be a minimum of 1.65 volts. Anodes shall have a minimum efficiency rating of 40% as measured by ASTM G97 using a theoretical maximum current capacity of 1150 amp-hrs / kg.

2.1.2 **Zinc anodes:** Zinc anodes shall be Type II in accordance with ASTM B418. The open circuit potential of the anode versus a saturated copper/copper sulphate reference electrode shall be a minimum of 1.05 volts. Anodes shall have a minimum efficiency rating of 95% using a theoretical maximum current capacity of 810 amp-hrs / kg.

Section 02516 – CATHODIC PROTECTION

- 2.1.3 **Core:** Perforated galvanized steel core not exceeding 0.15 kg/m. The core length shall be a minimum of 75% of the anode length and should be centered in the diameter of the anode. Other core types may be acceptable but must be approved by EPCOR.
- 2.1.4 **Lead Wire:** No. 10 AWG, Type RWU, XLPE stranded copper conforming to CSA C22.2 No. 38-M1986, 6 m long; insulation colour – blue for magnesium, white for zinc.
- 2.1.5 **Lead Wire Connection:** The anode lead wire shall be silver-soldered (brazed) to the steel core using a suitable filler material and flux such as Easy-Flo 45 and Handy Flux respectively. The joint shall be cleaned before brazing by removal of zinc from the core and after brazing by removal of all flux. The completed connection shall be sealed using an acceptable electrical potting compound.
- 2.1.6 **Anode Container:** The anode container shall consist of a water permeable cardboard tube or bag. The container shall have **EPCOR** labelled or stamped on it. The anode shall be centred in the tube and backfilled with material sufficient to cover all parts of the anode to a minimum thickness of 25 mm. The backfill material shall possess a maximum resistivity of 50 ohm-cm when wet and as measured by the soil box method in ASTM G57. The water used for wetting the backfill should be distilled or demineralised and no more than 15% - 20% water by weight should be added. All backfill components shall form a homogeneous mixture having a minimum compacted bulk density of 1440 kg per m³ and consist of:
- | | |
|------------------------------|-----|
| ▫ Ground Hydrated Gypsum | 75% |
| ▫ Powdered Wyoming Bentonite | 20% |
| ▫ Anhydrous Sodium Sulphate | 5% |
- 2.1.7 **Shipping Container:** All anodes shall be shipped in watertight plastic bags. Anodes shall carry a label identifying the casting manufacturer, packaging company, anode metal, anode weight, date packaged and supplier reference number.
- 2.1.8 Supply magnesium and zinc anodes in the sizes shown on the drawings.

2.2 WIRES

2.2.1 Water main wires

Unless otherwise indicated on the drawings, water main wires used at test stations (Drawing 2516-01) shall be No. 12 AWG, type RWU, XLPE, stranded copper conforming to CSA C22.2 No. 38 - M1986; length as designated on the drawings or as required under Section 3.6, colour - black.

2.2.2 Anode header cables and anode lead wires

Unless otherwise indicated on the drawings, anode header cables (on which rows of anodes are spliced) and anode lead wires, extending from the anode header cable to the test station, shall be No. 6 AWG, type RWU, XLPE, stranded copper conforming to CSA C22.2 No. 38-M1986; length as required on the drawings, colour – blue for magnesium, white for zinc.

2.2.3 Conductivity (jumper) cables

Unless otherwise indicated on the drawings, jumper cables used for bonding across couplings, valves, etc. shall be No. 6 AWG, type RWU, XLPE, stranded copper conforming to CSA C22.2 No. 38 - M1986; length as designated on the drawings or as required under Section 3.8, colour - green.

2.3 ELECTRICAL ISOLATION DEVICES

- 2.3.1 Where it is deemed necessary to electrically isolate one section of main from another, electrical isolation devices such as a 600 mm long piece of PVC pipe, an isolation coupling or an isolation flange kit should be installed.
- 2.3.2 Isolation couplings shall be Romac style IC501, IC400, Smith-Blair Style 416 or an approved equal.
- 2.3.3 Flange isolation kits shall have full faced, plain face phenolic gaskets and polyethylene sleeves and washers. Use Advance Products and Systems kits or approved equal.



Section 02516 – CATHODIC PROTECTION

2.4 TEST STATIONS

2.4.1 Unless otherwise designated on the drawings, test stations shall be in accordance with Drawings 2512-01 to 2512-08 inclusive, 2516-01 and 2516-05.

2.4.2 The test station wiring configuration shall be in accordance with Drawing 2516-01.

3. EXECUTION

3.1 GENERAL

3.1.1 Provide cathodic protection for steel, cast and ductile iron pipe, cast iron fittings, valves, hydrants, copper services, and where shown on the drawings.

3.1.2 Cathodic protection including anode location, size and spacing must be in accordance with the construction drawings and Drawings 2516-01 to 2516-08.

3.2 ANODES

3.2.1 Install anodes as shown on the drawings using an auger, hydrovac or backhoe if required, to achieve the specified bury depth.

3.2.2 Remove any plastic covers from anodes before installing.

3.2.3 Diameter of vertically drilled anode holes is to be 25 mm larger than the anode diameter. Pack original excavated soil firmly around anodes to eliminate air pockets, where possible.

3.2.4 For vertically installed anodes and remote main attachment, use a remote stud-welding procedure approved by EPCOR.

3.2.5 Extend anode wire for anodes connected to water mains along the main to the test station, taping the wire to the main at 1 m intervals for protection.

3.3 WATER MAIN WIRES

3.3.1 At a test station location, exothermic weld (ex. cadweld or thermoweld) using the appropriate moulds and sleeves, stud weld, or pin braze two separate water main wires to the crown of the water main, 300 mm apart. Where possible, wrap lead wires around the pipe to reduce strain on the weld connection.

3.3.2 Protect each weld area from corrosion by the use of either:

- Royston Roybond 747 primer and Handy Cap IP; or
- Polyken 1027 primer and three layers of Polyken 931 filler tape.

3.4 ANODE HEADER CABLES AND ANODE LEAD WIRES

3.4.1 Trench header cables at the depth indicated on the drawings. Trim excess cable at each end past the point where the last anode wire has been attached. Install cables relatively straight - avoid excessive "snaking."

3.4.2 Install anode lead wires as designated on the drawings. Lead wires enclosed in PVC conduit shall conform to the requirements as shown in Table 1.

Table 1: Requirements for anode lead wires in PVC conduit

Wire Number & Type per Conduit	Conduit Size Required (mm)
2 - #6	25
4 - #6	30
8 - #6	40
8 - #6 & 4 - #12	50

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- 3.4.3 Conduits for lead wires shall conform to CSA C22.2.
- 3.4.4 Splices in conduit shall not be allowed.
- 3.4.5 Connect header cables, anode lead wires and anode wires by the methods stated in Section 3.5.

3.5 SPLICES & CONNECTIONS

- 3.5.1 Connections to the structure or pipe being cathodically protected shall be made by one of the following methods:
 - Exothermic weld (cadweld or thermoweld);
 - Pin brazing; or
 - Stud welding.
- 3.5.2 Splices in cables or wires to connect anodes to header cables or extend leads shall be completed by one of the following methods:
 - Exothermic weld (cadweld or thermoweld) using the appropriate mould and sleeve;
 - Crimp type connectors as manufactured by Burndy, T&B, AMP or equivalent;
 - Servit or split-bolt type connectors as manufactured by Burndy, T&B or equivalent; or
 - Soldering the wires using a 60/40 lead-tin resin core solder.
- 3.5.3 Protect each splice from corrosion by using one of the following methods:
 - 3M 8420 Series Cold Shrink Connector (for anode wires only);
 - Two layers of 3M Scotch 130C Linerless Rubber Splicing Tape and two layers of 3M Super 33+ Vinyl Plastic Electrical Tape; or
 - Raychem WCSM - 9/3 heat shrink sleeve.

3.6 TEST STATIONS

- 3.6.1 Unless otherwise indicated on the drawings, install test stations in accordance with Drawing 2516-01. Test stations backfilled with granular material or fillcrete shall conform to the requirements of Drawing 2512-08.
- 3.6.2 Extend separate anode/anode lead and water main wires through casing.
- 3.6.3 Fill test station casing with sand to within 400 mm of grade and provide a minimum of 1 m of slack anode, anode lead and water main wire for connection and testing purposes.

3.7 CONNECTIONS AT TEST STATIONS

- 3.7.1 Terminate all lead wires on a suitable fixture with a means of identifying each lead and a shunt between the anode lead(s) and pipe lead to enable anode currents and potentials to be measured. A typical test station fixture is detailed on Drawing 2516-08.

3.8 CONTINUITY (JUMPER CABLE) CONNECTIONS

- 3.8.1 Provide continuity bond where specified on the drawings.
- 3.8.2 Attach wires as outlined in Item 3.5.1.
- 3.8.3 For couplings in chambers, locate jumper cable connections at 150 mm from each wall leaving sufficient slack in the cable to allow for easy removal of the valve or coupling.

3.9 INSPECTION OF CATHODIC PROTECTION

- 3.9.1 A visual inspection of each anode and its test lead wire must be completed before backfilling.



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- 3.9.2 A resistance measurement of all pairs of anode lead wires is required. This measurement shall be taken with an ohmmeter after the installation of header cables, anode lead wires and test stations has been completed. A resistance value of less than 0.5 ohms shall be considered satisfactory.

END OF SECTION



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Section 02517 Guidelines for Acceptance Testing

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Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

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Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

1. INTRODUCTION

1.1 BACKGROUND

The consulting engineer and contractor are responsible for pressure testing and disinfecting new water mains in the City of Edmonton. Bacteriological sampling for total coliforms is performed by the engineer or contractor and the samples are submitted to the Provincial Laboratory of Public Health for analysis. The results are then forwarded to EPCOR through the Edmonton Board of Health before the water main can be placed in service.

Water main acceptance testing is required to ensure that new water infrastructure is able to perform to acceptable standards and provide clean drinking water to EPCOR customers. For proper acceptance testing of new water mains, the parties involved should do the following:

- design the water network to incorporate appurtenances which can be used for acceptance testing as well as routine maintenance later;
- obtain proper authorization and follow applicable procedures before operating boundary valves separating the new construction from the existing water network;
- follow proper pressure testing and leakage determination procedures;
- understand the requirements for preparing water mains for disinfection;
- distribute chlorine uniformly in newly disinfected water-mains;
- follow proper sampling protocol for chlorine and bacteriological analysis;
- understand the limitations of chlorine field test kits; and
- perform testing with properly trained and experienced personnel.

The purpose of these guidelines is to provide a uniform set of acceptance testing criteria and procedures which are presented in a way which is easily understood and can be readily used in the field. The guidelines are organized into five main sections:

1. An introduction to the pipe materials and associated specifications which are in use in The City of Edmonton
2. Pressure and leakage testing specifications and procedures
3. Disinfection specifications and procedures
4. Boundary valve operation
5. Design guidelines

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2. PIPE MATERIALS IN THE CITY OF EDMONTON

To understand the requirements for pressure and leakage testing, it is important to know the range of pipe materials, which are approved for use in the water network.

2.1 DISTRIBUTION PIPES

Distribution water mains include all pipes less than 450 mm in diameter. Materials approved for use in Edmonton are shown in Table 1.

Table 1 Distribution water main materials.

Material	Standard
Polyethylene (PE) ¹	AWWA C906
Polyvinyl Chloride (PVC)	AWWA C900/C905
Ductile iron ¹ (DI)	AWWA C151
HDPE ¹	AWWA C906

¹ On a project specific basis only

2.2 TRANSMISSION PIPES

Transmission water mains include all pipes greater than or equal to 450 mm in diameter. Materials approved for use in Edmonton are shown in Table 2.

Table 2 Transmission water main materials.

Material	Standard
Polyethylene (PE) ¹	AWWA C906
Polyvinyl Chloride (PVC)	AWWA C905
Concrete Steel Cylinder	AWWA C303/C301
Ductile iron ¹ (DI)	AWWA C151

¹ On a project specific basis only

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3. GUIDELINES FOR PRESSURE AND LEAKAGE TESTING

3.1 PURPOSE

The purpose of pressure and leakage testing a new water main is to determine if the installation is capable of withstanding ordinary operating transient pressure conditions without failure or excessive leakage at the joints and service connections. The two tests are related and are usually performed at the same time. The guidelines are intended to provide the performance criteria and testing protocol necessary for routine pressure and leakage testing to ensure that the new water-main installation meets the design specifications.

3.2 METHODS

3.2.1 Pressure Testing

Pressure testing consists of slowly charging a new section of water main to the distribution system pressure from a boundary main. The valves are then closed on the test section. A tank of water and a purpose-specific pump are used to pressurize the main to the specified test pressure. The main is typically left in this condition for 1 to 3 hours. The pressure is normally measured at the lowest elevation on the section of water main being tested.

3.2.2 Leakage Testing

Leakage testing is normally conducted at the same time as pressure testing using the same apparatus. The test is conducted for 2 h during which time the pump is periodically operated to maintain the pressure at the specified level. The volume of water added to the water main from the tank is presumed to be equal to that which has leaked from the water main during the test. Figure 1 illustrates the conceptual layout of the apparatus required for pressure and leakage testing.

Portland cement based materials such as asbestos-cement, concrete, or cement-lined ductile iron pipes are porous and absorb water during the initial charging of the water main. Consequently, it is usual to require 24 to 48 h of soaking to ensure that apparent water leakage is due to joints and service leakage, not the absorption of water by the pipe material.

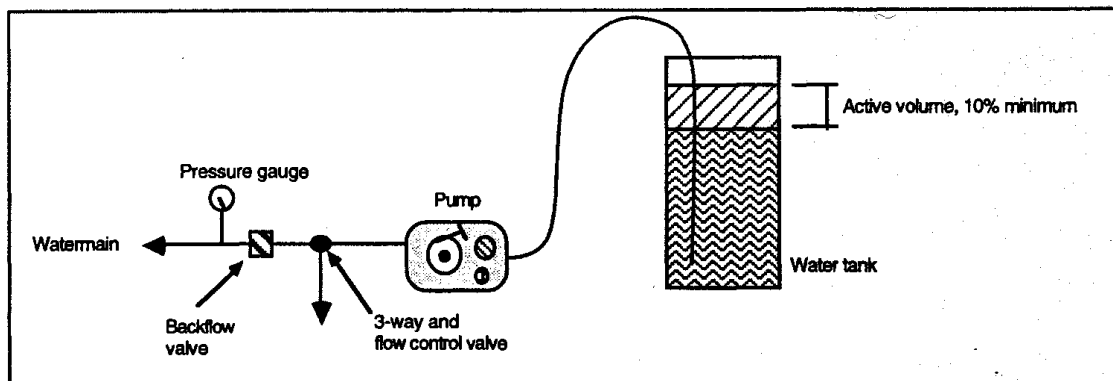


Figure 1 Apparatus for Pressure and Leakage Testing

3.2.3 Required Equipment

The equipment requirements are straightforward; however, it must be dedicated for only one purpose; pressure and leakage testing. The recommended specification is as follows:

- a) ANSI Standard B40.1-1974 Grade A, or equivalent, Bourdon tube pressure gauge, range of 0 to 1 400 kPa, with an accuracy of 1% of the full-scale reading, 7 kPa divisions, a minimum diameter of 90mm, and a scale which can be read in an arc of 270° (Walski, 1984). The pressure gauge calibration shall be certified by the consulting engineer.
- b) Hand or motor-powered pump capable of meeting required test pressures including necessary plumbing accessories for preventing backflow and for enabling the flow rate to be controlled (City of Edmonton, 1988). The pump should be provided with a pressure relief valve or should have an upper pressure limit of 1



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- 400 kPa. The pump will be dedicated to water-main pressure testing and will not be used for other construction activities.
- c) Water storage tanks will be of non-corrosive material dedicated to water main testing. The volume of the tank shall not be more than 10 times the allowable leakage for the duration of the test. A depth gauge will be attached to the inside of the tank and will be calibrated for the volume of the tank.

4. PROCEDURE FOR HYDROSTATIC PRESSURE AND LEAKAGE TESTING

The procedures for pressure and leakage testing are outlined in the following sections and are organized into two parts:

1. General Procedures (independent of pipe material and size) and
2. Procedures that are influenced by the pipe material and size

4.1 GENERAL PROCEDURES (INDEPENDENT OF PIPE MATERIAL AND SIZE)

1. Install all water services, air relief services, and blowoffs.
2. Partially or completely backfill the excavation before testing
3. Wait for concrete thrust blocks to cure: minimum of 3 days in the case of high early strength concrete or a minimum of 7 days in the case of normal concrete.
4. Ensure that main stops are open and curb stops are closed.
5. Inform EPCOR inspectors of the date, time, and location of the hydrostatic tests at least 24 h prior to the test time. **Failure to notify inspectors may result in the tests being unacceptable.**
6. Open all main valves in the test section.
7. Open all hydrant control valves in the test section and be sure hydrants are closed. (All hydrants should be inspected prior to pressure testing to ensure that they are properly installed and that nipples are threaded or locked in place.)
8. Inform other construction crews or contractors and check that no valves are being operated during the test.
9. Test duration will be 2 h.
10. Maximum length of distribution water main test sections will be 450m unless otherwise directed by EPCOR.
11. Maximum length of transmission water main test sections will be 800 m unless otherwise directed by EPCOR.
12. Ensure air is expelled from the section of water main by exhausting trapped air at high points and dead-ends. Air content can be minimized through the following procedure:
 - a. lay the pipeline to grade when possible
 - b. air relief valves should be provided at all high points
 - c. bleed air from the pipe slowly
 - d. fill the water-main at a velocity of less than 0.6 m /s
 - e. the diameter of the air relief valve should be such that d / D is 0.01 to 0.1 where d is the diameter of the air relief valve and D is the diameter of the pipe.

Air relief valves are essential at high points on mains larger than 450mm in diameter (Figure 2). Hydrants are not useful for removing all of the air (Figure 3).

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Figure 2 Air relief valve arrangement

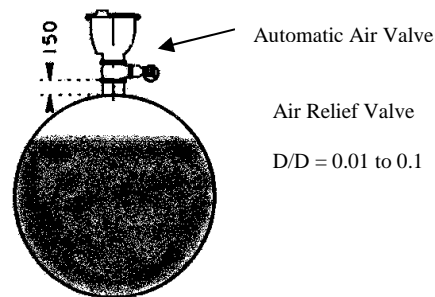
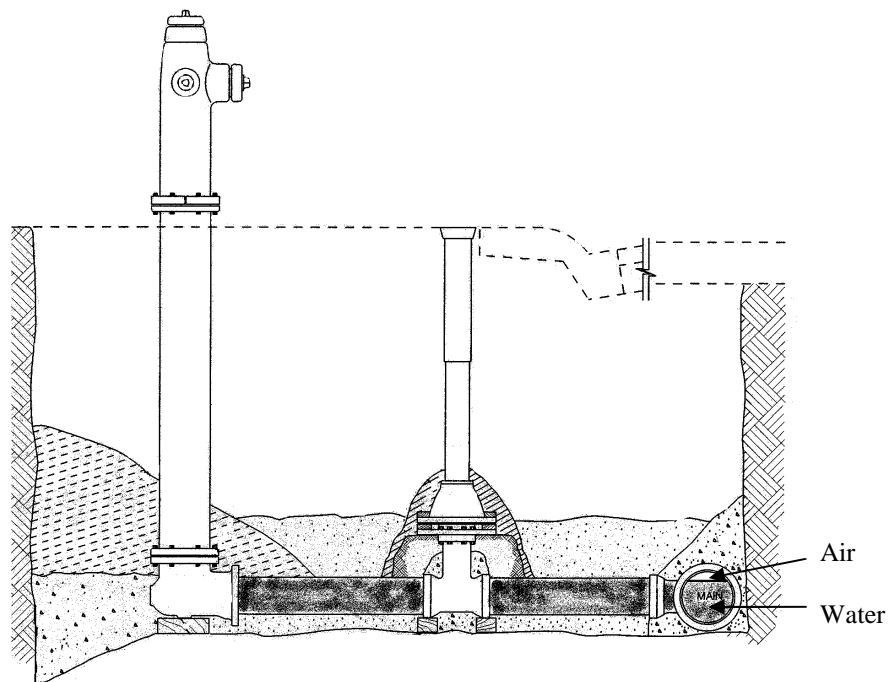


Figure 3 Hydrants Act as Poor Air Relief Devices



13. Raise the water-main pressure to the appropriate test pressure (see the section for the appropriate pipe material) using either a hand or motor-powered pump located at a hydrant or approved blow-off. The hydrant valve will be completely opened and the flow rate will be controlled by the valve at the pump.
14. Mark the gauge and the level of water in the storage barrel at the beginning of the test. Take care in these marks since it is the basis for calculating water loss.
15. Maintain the test pressure within ± 20 kPa of the specified test pressure for the duration of the test.
16. Pump the test section back to the test pressure at the end of the first 30 min. If the allowable leakage is exceeded, air may be trapped. Remove trapped air and repeat the test.
17. During the test, walk along the test section and check for signs of leakage or distress at all exposed appurtenances or fittings.



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18. No allowance can be made for services or in-line valves. (Water main renewal projects may be exempt under some circumstances.)
19. When testing against closed metal-seated valves, add an additional leakage allowance of :
$$\frac{0.0012 L}{h \bullet \text{mm of valve size}}$$
20. Calculate the allowable leakage and record this with the observed leakage on the standard pressure and leakage testing form (see Appendix A).

4.2 DUCTILE IRON

AWWA Standard C600 contains the AWWA specifications for pressure and leakage testing of ductile iron water-mains and appurtenances including distribution and transmission pipelines. Specific procedures for ductile iron pipe and appurtenances include all of the General Procedures (Section 5.1) plus the following:

1. Fill cement mortar lined pipes with water 24 h prior to hydrostatic testing.
2. Test the water main at a pressure of greater than 125% of the working pressure at the highest point in the test section. The maximum test pressure will be 150% of the working pressure measured at the lowest elevation.
3. Do not operate valves in either direction when the differential pressure exceeds the rated pressure of the valve. Consult AWWA C500 for rated pressures of valves that conform to AWWA standards.
4. The test pressure cannot exceed the rated valve pressure (see AWWA C500) when resilient-seated gate valves or butterfly valves are at the pressure boundary.
5. The allowable leakage can be calculated from the following equation:

$$\text{Allowable leakage, } L_m = \frac{HSD \sqrt{P}}{715,317}$$

where:

- L_m = testing allowance (make up water), L/h
- S = length of pipe tested, m
- D = nominal diameter of the pipe, mm
- P = average test pressure, kPa
- H = test duration in hours

This formula is based on a testing allowance of 11.65 gpd/mi/in. (1079 L/d/km/mm) of nominal diameter at a pressure of 150 psi (1,034 kPa).

4.3 POLYVINYL CHLORIDE

Refer to AWWA standard C605 and AWWA manual M23 for information on pressure and leakage testing.

Pressure capacity of PVC pipe involves of two types of pressure: internal hydrostatic pressure; and pressure transients during operation. Temperature greatly influences the ability of PVC pipe to contain hydrostatic pressure. The AWWA C900 and C905 specifications are based on 23°C. Temperatures lower than this increase the hydrostatic pressure capacity. Alternatively, temperatures greater than 23°C decrease the pressure capacity. PVC differs from other materials in that it can resist momentary excessive pressures better than sustained long-term excessive pressures.

Specific procedures for PVC pipe include all of the General Procedures (Section 5.1) plus the following:



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1. Test pressure will be 150% of the working pressure or 1036 kPa, whichever is greater, at the point of test but not less than 125% of normal working pressure at the highest elevation on the test section (AWWA, M23).
2. Allowable leakage will be calculated from the following formula:

$$\text{Allowable leakage } Lm = \frac{HJD \sqrt{P}}{128300}$$

where: J = number of joints
D = diameter of the pipe in mm
P = average test pressure, kPa
H = test duration in hours

4.4 STEEL

AWWA C206 for field welding of steel water pipe addresses hydrostatic pressure testing of new steel water mains for both distribution and transmission applications. However, no specific details are given except that leaks are not permitted. Steel pipe has a very high capacity to resist hoop stresses and can withstand high operating pressures. Therefore, a conservative test pressure in steel water mains could be 120% of the design operating pressure. Cement mortar lined steel pipes need to be filled with water 24 h prior to hydrostatic testing.

Butt-welded joints can be tested with a vacuum "look box" which involves placing a soap solution on the joint and then placing a vacuum box over the joint. Bubbles indicate a leak.

Double-welded lap joints can be tested by shop-drilling and tapping a 1/8" or 1/4" NPT hole in the lap or bell end of the pipe and applying 280 kPa of air or other suitable gas to the joint between the two fillet welds. Apply a soap solution to the joint and look for bubbles caused by escaping gas.

Do not pneumatically test the pipeline since compressed air can be very hazardous to testing personnel.

4.5 CONCRETE

AWWA C300, C301, C302, and C303 are the applicable AWWA standards relating to concrete pressure pipe. These standards refer to an AWWA Manual M9 for additional information regarding the design and construction of concrete pressure pipe. The information on pressure and leakage testing is not as specific as the information on ductile iron and AC pressure pipe.

Specific procedures for concrete pressure pipe include all of the General Procedures (Section 5.1) plus the following:

1. Fill the water main with water 24 h prior to hydrostatic testing.
2. Test pressure will be 120% of the working pressure.
3. The allowable leakage can be calculated from the following equation:

$$\text{Allowable leakage } Lm = \frac{HLD \sqrt{P}}{2.16 \times 10^6}$$

where: L = length of test section in m
D = diameter of the pipe in mm
P = average test pressure in kPa
H = test duration in hours

4.6 HDPE



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1. Pressure the pipe section to 1.5 times the pressure class. Vent and bleed off trapped air as needed.
2. Initial Expansion: Maintain 1.5 times the pressure class for 4 hours and add water as needed. Do not measure this volume. Hydrostatic pressure expands pipe.
3. Begin Test: Reduce pressure to 10psi (70kPa) below 1.5 times pressure class. Monitor pressure for 1 hour.
4. The pipe is acceptable if the pressure drop over 1 hour is 5% or less.

4.7 FIRE HYDRANTS

EPCOR normally prefers that pressure and leakage tests be performed against the hydrant valve with the main shutoff valve open. However, in cases where the hydrant shutoff valves are closed during hydrostatic testing of the pipeline, it is necessary to test the hydrants for leaks and mechanical defects separately. Consult the AWWA manual M17 for details on hydrant installation, testing, and maintenance. Hydrant pressure and leakage testing is described as follows:

1. Remove the highest nozzle cap and open the hydrant valve a few turns and allow the water to rise in the barrel to the bottom of the nozzle.
2. Replace the nozzle cap securely, but leave it loose. Continue to fill the hydrant slowly, expelling the air through the loose cap.
3. Tighten the nozzle cap when all of the air has been expelled.
4. Open the hydrant valve completely. Failing to do so will cause significant water flow through the drain holes, undermining the performance of the hydrant.
5. Check visually for leakage at the flanges, nozzles, operating stem, and at any joints on the hydrant body. Also use a listening device to detect any leaks below grade.
6. No leaks are permitted. Repair all faults.

4.8 REPORTING PROCEDURES AND RECORD KEEPING

The pressure and leakage testing results will be recorded at the location using the EPCOR standard form shown in Appendix A. This form will be certified by the consulting engineer and the contractor before submitting to the EPCOR inspector.

4.9 HINTS & TIPS

1. Always check that the pipe is restrained before filling.
2. Always check that all valves are open in the test section.
3. Always use a pressure gauge that is accurate and precise.
4. Calibrate the pressure gauge regularly.
5. Have an appropriately sized water reservoir and accurate depth gauge.
6. Obtain the design pressure or normal operating pressure before the test.



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7. Always watch the pressure gauge during the test.
8. Be sure to use air relief valves at high points and at dead-ends.
9. Always notify inspectors in advance of the test.
10. Never backfill the water-main excavation until it has been inspected.
11. Never backfill until concrete thrust blocks have cured.
12. Never operate boundary valves without proper training.
13. Never fill water-mains from boundary mains without notifying the Inspector and EPCOR Water Dispatch (780 412 6800) (two calls are required).
14. Never fill water main at rates exceeding 0.6 m/s.
15. Never fill water mains so as to trap air – fill slowly from one valve, carefully and thoroughly vent air.
16. Never leave air in dead-ends or house services.
17. Never use water pumps used for draining excavations, pumping sewage, *etcetera* to pressurize a potable water main.
18. Do not use a 200 L barrel if the allowable leakage is less than 20 L.
19. Never use a damaged or un-calibrated pressure gauge.
20. Never use a pressure gauge with a range greater than 0 to 1400 kPa.
21. Never continue to increase pressure during a test if large quantities of water are required.
22. Never operate valves in either direction when the differential pressure exceeds the rated pressure of the valve.

4.10 CITED LITERATURE

AWWA, Concrete pressure pipe. Manual M9, American Water Works Association, Denver, CO.

AWWA, Installation, operation, and maintenance of fire hydrants. Manual M17, American Water Works Association, Denver, CO.

AWWA, PVC pipe - design and installation. Manual M23, American Water Works Association, Denver, CO.

Uni-Bell, Handbook of PVC pipe, design and construction, Uni-Bell Plastic Pipe Association, Dallas, TX.

Walski, T.M., 1984. Analysis of water distribution systems. Van Nostrand Reinhold Company, New York, NY.

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5. GUIDELINES FOR DISINFECTION

5.1 PURPOSE

The purpose of disinfection is to destroy pathogenic microorganisms, which may occupy the water main after construction is complete. Chlorine is usually used as the disinfectant either as a compressed gas, calcium hypochlorite tablets/solution, or as a sodium hypochlorite (bleach) solution.

5.2 DISINFECTION SPECIFICATION

A performance criterion for water main disinfection has been specified using the American Water Works Association (AWWA) Standard C651. This standard comprehensively describes the minimum procedures to be followed when preparing a water main for disinfection, disinfecting the water main, testing for chlorine residual, and conducting bacteriological sampling. It refers to the latest edition of Standard Methods for the Examination of Water and Wastewater for detailed methods for testing water quality and chlorine residual.

5.3 PROCEDURES

Disinfection consists of the following four tasks:

1. Preventing contamination of the new pipe during shipping, storage, and construction;
2. Flushing the water main to remove loose debris and dirt which may have entered the water-main during construction. (**Do not** flush if hypochlorite tablets have been placed);
3. Chlorination of the water main to destroy pathogenic microorganisms; and
4. Bacteriological testing of the disinfected water to ensure that the microbiological water quality is adequate.

5.3.1 Water-main preparation

Water main flushing is the most common form of preparation for disinfection except where hypochlorite tablets have been used. The flushing flow rate should be sufficient to achieve a minimum velocity of 0.8 m/s. Table 1 summarizes the flow conditions required to achieve this velocity for various pipe sizes.

Table 3 Required flow and number of openings to flush water mains.**

Pipe diameter (mm)	Required flow (L/s) for 0.8 m/s velocity	Size of tap, mm				OR	Number of nozzles (2.5")
		20	30	40	50		
		Number of taps					
50	1.6	1					NA
100	6.5	NA	1				1
150	13	NA	NA	1			1
200	26	NA	NA	2	1		1
250	38	NA	NA	3	2		1
300	57	NA	NA	NA	3	2	
450	100	NA	NA	NA	4	2	

Source: (After AWWA C651-86)

NOTES for Table 1:

NA not applicable

* With 280 kPa residual pressure, a hydrant flowing to atmosphere will discharge 63 L/s from a 2.5" nozzle and 158 L/s from a 4.5" steamer nozzle.

** Assumes 280 kPa residual main pressure.

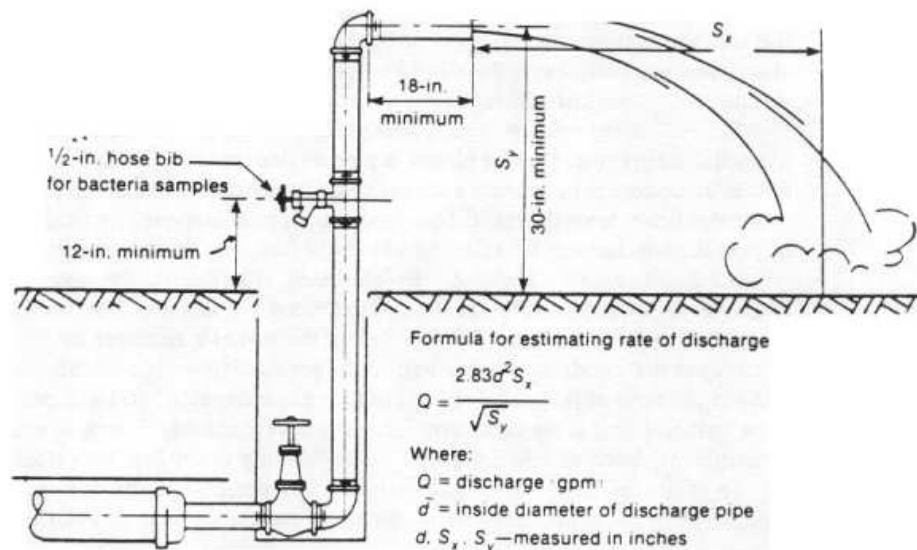
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The discharge from the flushing pipe can be quickly estimated (± 3 L/s) from the following equation (see Figure 4):

$$Q = \frac{5.5 \times 10^{-5} d^2 S_x}{\sqrt{S_y}}$$

where;

- Q = discharge, L/s
- d = discharge nozzle inside diameter, mm
- S_x = the horizontal distance of discharge, mm
- S_y = the vertical distance from the ground to centre of nozzle, mm



Note: This figure applies to pipes up to and including 8 in (200 mm) diameter.

Source: (AWWAC651-99)

Figure 4 Estimating discharge from a hydrant or blowoff

Water mains larger than 600 mm can be broom swept as an alternative to flushing. Care must be taken in removing the sweepings from the pipe before filling.

When care has been exercised in the shipping, storage, and construction of new water mains, the above procedures will normally remove contaminants, which remain in the pipe. However, on occasion, flushing will not be satisfactory and a more thorough cleaning method will be required. This will typically involve foam swabbing of the water main.

A foam swab is a bullet-shaped piece of polyurethane foam, available in a variety of densities, which is cut approximately 50 mm larger in diameter than the pipe to be cleaned. The swab is usually launched through hydrant leads and pushed through the new water main hydraulically. The soft foam gently scours the walls of the pipe, removing stubborn contaminants. It should be determined that the swab is not compressing contaminants into the pipe joints. The equipment and procedure for foam swabbing is somewhat specialized and should only be undertaken by properly trained personnel. Some authorities require foam swabbing prior to acceptance of new water mains.

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5.3.2 Occupational Health and Safety

Comply with all applicable Occupational Health and Safety requirements including the Workplace Hazardous Materials Information System (WHMIS). The storage and handling of chlorine compounds requires due diligence and careful attention. Chlorine is very toxic to living organisms. Chlorine gas can be produced very easily if the wrong chemicals come into contact with chlorine compounds. WHMIS requires that Material Safety Data Sheets (MSDS's) be supplied with the chemical. The MSDS's describe in detail the hazards associated with the chemical, safe storage requirements, PPE, handling procedures and first aid for each specific chemical compound.

The responsibility for the implementation of WHMIS lies with the employer. However, all workers and all persons involved with supervising workers handling hazardous materials should be aware of their roles and responsibilities.

5.3.3 Chlorination

The choice of chemical to use for chlorination is limited to sodium hypochlorite or calcium hypochlorite. Free chlorine is the most potent form of chlorine in water. It is formed when hypochlorite is added to water. When hypochlorite is added in the presence of ammonia, combined chlorine is formed. Combined chlorine is much slower acting than free chlorine.

There are three accepted methods for adding the chlorine chemicals to new water mains (AWWA C651-99):

1. Calcium hypochlorite tablets placed during construction. This method provides an average dose of 25 mg/L.
2. Continuously fed sodium or calcium hypochlorite solution. This method provides a minimum chlorine residual of 10 mg/L for 24 h
3. A slug of high concentration chlorine solution. This method provides a high concentration of chlorine, 100 mg/L, for a contact time of greater than 3h.

Calcium hypochlorite tablets

Calcium hypochlorite tablets are placed in the water main during construction. The tablets are usually 5 g and are placed at the beginning of the new main, at 150 m intervals, at each hydrant lead, in each hydrant, and at other appurtenances. The required number of 5 g tablets can be calculated from:

$$\text{No. of tablets} = 6.28 \times 10^{-6} D^2 L$$

where; D = pipe diameter, mm
L = length of pipe being disinfected, m

The tablet method cannot be used with solvent-welded plastic or screwed-joint steel since the joint chemicals are incompatible with calcium hypochlorite.

The water main is slowly filled after construction keeping the velocity below 0.3 m/s to prevent disturbing the tablets. Removal of air from the water main requires particular care as was noted in the section on pressure and leakage testing. The contact time should be 24 h at water temperatures greater than 5°C, and should be increased to 48 h when the water temperature is less than 5°C.

Continuous-feed

A solution of calcium hypochlorite or liquid bleach (sodium hypochlorite) may be continuously fed as the water-main is discharged at the end of the section being disinfected. The objective is to fill the water main with a uniform concentration of chlorine so that at the end of 24 h, a minimum chlorine residual of 10 mg/L remains. The usual dose to achieve this residual is 25 to 30 mg/L.

The following equipment is required when performing continuous-feed hypochlorination:

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1. A gasoline or electrical chemical-feed pump designed for feeding chlorine solutions. The usual type is a positive-displacement diaphragm pump that is available in two styles; mechanically or hydraulically actuated. The chemical feed rate can be adjusted by altering either the stroke length or stroke speed.

Maintenance of chlorine feed equipment is important since the high pH, which characterizes hypochlorite solutions causes valve seats to fail from scaling, hardening, or swelling. Calcium carbonate scale (lime) can be removed from the equipment by passing 5% hydrochloric (muriatic) acid through equipment. **Be sure to flush chlorine from equipment with water first since HIGHLY TOXIC CHLORINE GAS can be produced.**

2. All hose and fittings should be constructed of material, which is oxidant resistant and strong enough to withstand the maximum pressure of the chemical-feed pump.
3. A high concentration chlorine test kit should be used to make chlorine residual determinations at the discharge end of the water main being tested.

The chlorination procedure consists of the following steps:

1. Calcium hypochlorite tablets may be placed in the water main during construction as an option. This permits a strong chlorine solution to flow down the pipe during filling, penetrating annular spaces at pipe joints. See the above section for the procedure for placing calcium hypochlorite tablets.
2. Prepare 1% chlorine feed solution from dry calcium hypochlorite or sodium hypochlorite bleach solution. Refer to Table 2 for information on the amounts of solution which are required for various pipe sizes. Wear protective clothing, face shield, and filter facemask. **CHLORINE IS EXTREMELY HAZARDOUS.** Do not store chlorine near acid or petroleum products. **EXPLOSION HAZARD.**

Table 4 Chlorine required to produce 25 mg/L concentration in 100 m of water main

Pipe diameter, mm	100% chlorine, g/100 m†	1% chlorine solution, L/100 m*†
50	5	0.5
100	20	2.0
150	45	4.5
200	81	8.1
250	130	13
300	180	18
450	323	33

Source: (After AWWAC65 1-86)

* 1.5 kg Ca(OCl)₂ per 100 L

†adjust for available chlorine of chemical used (see Appendix C for details)

3. **Ensure all boundary valves are closed.** Use a water distribution system drawing to highlight all valves and pipes involved in the area to be disinfected.
4. Set-up chlorination equipment in such a way that the feed point is not more than 3 m downstream from the beginning of the new water main.
5. **DO NOT** use fire hydrants for chemical feed. The high concentration chlorine solution will damage the hydrant.
6. Notify EPCOR Water Dispatch (780 412 6800) and open one boundary valve and the discharge valve permitting water from the distribution system or other approved source to flow through the new water-main at a constant, measured rate. Use a pitot gauge, a bucket of known volume and stopwatch, or the approximate method shown in Figure 4 to calculate the rate of discharge. **Valves 350 mm and larger can only be operated by Water Distribution staff.** EPCOR Water Dispatch (780 412 6800) must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.



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7. Adjust the chemical feed pump rate to produce a chlorine dose of 25 mg/L free chlorine. For example, if the water flow rate in the water-main is 40 L/min., the chemical feed pump should be set to deliver 1.0 g/min. (100 mL/min. if a 1% solution is being used).
8. Frequently monitor the discharge location for chlorine residual using an approved field test kit.
9. Once the 25 mg/L residual has been achieved, stop the flow and chlorine feed. Retain the chlorinated water in the test section for 24 h or more.
10. Operate all valves and hydrants in the test section to ensure they are disinfected.
11. After 24 h check the free chlorine residual. If the residual is less than 10 mg/L, flush and re-chlorinate.

Slug

The slug method involves slowly flowing a slug of high concentration chlorine, 100 mg/L, through the water main, exposing all surfaces to the chlorine for a minimum time of 3 h.

The procedure for slug chlorination is as follows:

1. During construction, place calcium hypochlorite tablets in the water main. This permits a strong chlorine solution to flow down the pipe during filling, penetrating annular spaces at pipe joints. See the section on calcium hypochlorite tablets for details.
2. **Ensure all boundary valves are closed.** Use a water distribution system drawing to highlight all valves and pipes involved in the area to be disinfected.
3. Set-up chlorination equipment in such a way that the feed point is not more than 3 m downstream from the beginning of the new water main.
4. **DO NOT** use fire hydrants for chemical feed. The high concentration chlorine will damage the hydrant.
5. Notify EPCOR Water Dispatch (780 412 6800) and open one boundary valve and the discharge valve permitting water from the distribution system or other approved source to flow through the new water-main at a constant, measured rate. Use a pitot gauge, a bucket of known volume and stopwatch, or the approximate method shown in Figure 4 above to calculate the rate of discharge. **Valves 350 mm and larger can only be operated by Water Distribution staff.** EPCOR Water Dispatch (780 412 6800) must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.
6. Adjust the chemical feed pump rate to produce a chlorine dose of 100 mg/L free chlorine. For example, if the water flow rate in the water main is 10 L/min., the chemical feed pump should be set to deliver 1.0 g/min. (100 mL/min. if a 1% solution is being used).
7. The flow of the slug, which moves along the water main, should be controlled so that the pipe and appurtenances are exposed to 100 mg/L for 3 h.
8. Frequently monitor the free chlorine residual in the slug using an approved field test kit. If it falls below 50 mg/L, move the chlorination equipment to the head of the slug and start the flow again, increasing the concentration to 100 mg/L.
9. Operate all valves and hydrants as the slug passes to ensure they are disinfected.

5.3.4 Sampling

The purpose of sampling a water main is to obtain information on the water quality in the pipe. The underlying assumption which is important is that the sample is **representative** of the water in the water main. Good sampling procedures are intended to provide the best opportunity for obtaining a representative sample.



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Chlorine

Sampling for chlorine residual includes two basic tests: high concentration chlorine residual at the beginning and end of the primary disinfection period; and sampling for low concentration chlorine residual once the water main has been flushed. The best location for sampling residual chlorine during the primary disinfection period is at the discharge blowoff and at the service connections intended for bacteriological sampling. Low level chlorine can be determined at the bacteriological sampling locations, at an approved blowoff, and, as a last resort, at fire hydrants.

Hach Water Quality Test Strips

Procedure

1. Dip the Test Strip into your sample.
2. Wait for the colour to develop.
3. Compare the colour of the reagent pad to the colour component chart on the package label for results.

Shelf Life

Each bottle bears an expiration date. Test strips average a shelf life of 24 months from the manufacture date. Test strips should be discarded once the expiration date on the bottle is reached to ensure reliable results. Available chlorine test strips are described below in Table 5.

Table 5 Available Chlorine Test Strips

Parameter	Range	Steps	Qty	Cat No.
Total Chlorine	0 - 10 ppm	0,0.5,1.0,2.0,4.0,10.0 ppm	50	27552-50
Free Chlorine	0 - 10 ppm	0,0.5,1.0,2.0,4.0,10.0 ppm		

Suppliers

PrairieChem Inc.

11750 180 St.
Edmonton, Alberta
T5S 1N7
Tel: 780 452-6000
Fax: 780 452-4600
Web: www.prairiechem.com

Anachemia Science

15006 116 Ave.
Edmonton, Alberta
T5M 3T4
Tel: 780 451-0665
Fax: 780 452-2478
Web: www.anachemia.com

Bacteriological

Bacteriological samples in the City of Edmonton are normally collected 16 h after the chlorine test is passed. This requirement may be waived under special circumstances.

Sampling for bacteriological water quality parameters requires a great deal of care since it is very easy to contaminate a sample. Of utmost importance is to recognize that bacteria are organisms which live everywhere including air, soil, water, clothing, and all parts of the human body. Therefore, good sampling protocol is necessary to ensure reliable results. The following procedure will ensure reliable results are obtained in the laboratory (Standard Methods for the Examination of Water and Wastewater):

1. Obtain approved bacteriological sample bottles from the Provincial Laboratory of Public Health or the local Health Unit.
2. Keep the bottles closed until immediately prior to obtaining the sample. These bottles are sterilized and contain a tablet of dechlorination reagent. **NEVER** rinse the sample bottles.



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3. **DO NOT** sample from fire hydrants. Use a service connection or blowoff especially designed for sampling the new water-main. Sample taps should be one-piece brass without aerators or other types of screens.
4. Flow the sample line at high rate for a minimum of 5 min. to flush the line thoroughly before sampling.
5. While the sample line is flowing, complete the Provincial Laboratory of Public Health Form PH 108 (example shown in Appendix A).
6. Reduce the flow rate in the sample line, but maintain a water flow.
7. Carefully break the seal on the sample bottle cap and unscrew. Take great care not to contaminate the cap or the neck of the bottle with fingers or dirt.
8. Avoiding splashes, cut the water stream with the sample bottle and fill it until there is a head-space of approximately 20 mm in the sample bottle (roughly to the shoulder of the sample bottle). Replace the cap securely.
9. Shake the bottle 5 times to help the dechlorination reagent to dissolve.
10. Remove the sample identification number from the Provincial Laboratory of Public Health Form PH 108 and attach it to the sample bottle.
11. Bacteriological samples cannot be stored. If the sample cannot be delivered to the Provincial Laboratory within 1 h of sampling, use an iced cooler for storage during transport. In no case, should the samples be delivered to the Provincial Laboratory more than 6 h after the sample was collected. **NEVER** leave sample bottles in the sunshine or expose them to elevated temperatures.

5.4 REPORTING PROCEDURES AND RECORD KEEPING

The chlorination and bacteriological test results for the section of water-main being tested will be recorded using the form shown in Appendix A. A sketch should be provided indicating the following locations:

- chlorine application point;
- chlorine sampling points; and
- bacteriological sampling points.

The information recorded on the form includes the total and free chlorine residuals obtained at the beginning and end of the disinfection period and the final results of the bacteriological testing. The form will be completed and stamped by the engineer or professional technologist responsible for disinfection and bacteriological sampling.

Complete Provincial Laboratory of Public Health Form PH 108, shown in Appendix A, at the same time as the bacteriological sample is taken. This form should accompany the bacteriological samples, which are submitted to the Provincial Laboratory. The results will be forwarded to the Edmonton Board of Health and from there to EPCOR inspectors. EPCOR will provide a water main Construction Completion Certificate if pressure, leakage, and bacteriological tests have been satisfactory.

5.5 HINTS & TIPS

1. Always use a new sample bottle for each sample.
2. Always flow the sample line at high rate for a minimum of 5 min.
3. Never leave bacteriological samples exposed to sunshine or elevated temperatures.
4. Sample from fire hydrants only if other sampling points are unavailable.
5. Never rinse sample bottles.
6. Never reuse sample bottles.
7. Never touch the cap or inside of the sample bottle.



Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

5.6 CITED LITERATURE

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Gordon, G., Cooper, W.J., Rice, R.G., and Pacey, G.E. 1988. Methods of measuring disinfectant residuals. *Journal of the American Water Works Association* 80(9):94-108.

Greenberg, A.E., L.S. Clesceri, and A.D. Eaton editors. 1992. *Standard Methods for the Examination of Water and Wastewater*. 18th edition. Washington, DC: American Public Health Association, American Water Works Association, Water Environment Federation.

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Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

6. DECHLORINATION**6.1 GENERAL**

Water discharged from the water distribution system and released to water bodies, either directly or indirectly (e.g., via the storm-water sewer system), is to be dechlorinated at the point of discharge in accordance with the applicable federal legislation. This includes dechlorination of water released due to main breaks once the risks to public safety and property damage have been controlled. For water disposed to the sanitary sewer system, there are limits on the chlorine concentration and volume of water discharged as set by the City of Edmonton.

Refer to Chapter 2 of the Design Standards for applicable regulations.

The Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment, 1999) sets a guideline residual chlorine concentration of 0.5 micrograms per litre ($\mu\text{g/L}$), which is below the reliable limits of detection (i.e., chlorine should be neutralised to the point where no chlorine is detected). Depending on the method of dechlorination, the chemicals used may impact on the dissolved oxygen concentration of receiving waters, which may be a concern for the aquatic health of receiving wetlands and/or creeks¹.

The Developer and their Agents, Engineers and Contractors, are responsible for the water quality impacts of water discharged during construction activities, including dechlorination of water disposed as part of acceptance tests and disinfection.

Refer to AWWA C655 for information on standard industry practices. The methods described are provided for guidance only.

6.2 DECHLORINATION METHODS

Dechlorination may be performed by adding a neutralizing chemical to the chlorinated water as it is discharged.

Two common methods for applying the neutralising chemicals are:

- Continuous-feed, where neutralising chemicals are applied at the point of water discharge; or
- Dechlorination tank, where chlorinated water is discharged to a tank then treated to dechlorinate. The tank may be mounted on a mobile trailer.

The table below provides general information on various chlorine-neutralizing chemicals that can be used as guidance in the field. Note that the chemical reaction time may be temperature-dependent. The choice and amount of dechlorination chemical will be impacted by project or site specific issues such as water release, temperatures, strength of chlorine, volume of water release and distance from receiving waters. Dechlorination must always be verified through field sampling of discharge waters.

Follow all manufacturer's recommendations and safe work procedures when handling dechlorination chemicals. Adhere to all applicable safety regulations including: Workplace Hazardous Materials Information System (WHMIS), Occupational Health and Safety (OH&S) and Transportation of Dangerous Goods (TDG).

¹ The Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment, 1999) set a lowest acceptable concentration of dissolved oxygen in cold water of 9.5 milligrams per litre (mg/L) to protect aquatic life in their early life stages.

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Table 6 – Summary of Dechlorination Chemicals

Name of Chlorine-neutralising chemical	Chemical formula	Approximate parts of chemical required to neutralize 1 part of chlorine	Comments*
Sulfur dioxide	SO ₂	1.1	<ul style="list-style-type: none"> Reducing agent; may deplete dissolved oxygen in the water. Can reduce the pH of the water significantly. Extremely irritating gas. Best suited for use in treatment plants and pumping stations, not field use.
Sodium bisulfite	NaHSO ₃	1.5	<ul style="list-style-type: none"> Reducing agent; depletes dissolved oxygen in the water. Available as a white powder, granule or clear liquid solution. Highly corrosive, and a skin, eye and respiratory tract irritant.
Sodium sulfite	Na ₂ SO ₃	1.8	<ul style="list-style-type: none"> Reducing agent; may deplete dissolved oxygen in the water. Available in powder/crystalline and tablet form. Dechlorination tablets are effective for constant, low flow rate chlorinated releases. Currently used by EPCOR (LPD-CHLOR tablets). Suitable for chlorine concentrations of less than 4 mg/L.
Sodium thiosulfate	Na ₂ S ₂ O ₃	2.0 Varies with pH	<ul style="list-style-type: none"> Reducing agent; may deplete dissolved oxygen in the water. Skin, eye, nose and throat irritant. Low toxicity to aquatic species (USEPA toxicity study) May react slowly and requires more time for dechlorination. Over-dechlorination can encourage bacterial growth in the receiving streams.
Ascorbic acid	C ₆ H ₈ O ₆	2.5	<ul style="list-style-type: none"> No known impact on dissolved oxygen. May decrease pH of water. Available in tablet form. Skin, eye and lung irritant. Store in a dry state and prepare solution at the time of use.
Sodium Meta-bisulfite	Na ₂ S ₂ O ₅	1.4	<ul style="list-style-type: none"> Reducing agent; depletes dissolved oxygen in the water. Available as crystal, powder or solution form. Eye, throat, skin and lung irritant. Used by EPCOR to neutralize super-chlorinated water during the commissioning of a 1500 mm transmission main at EL Smith.
Calcium thiosulfate	CaS ₂ O ₃	Varies with pH	<ul style="list-style-type: none"> No known impact on pH or dissolved oxygen. Not toxic to aquatic species. Over-dechlorination can cause high turbidity and encourage bacterial growth in the receiving streams. Dechlorination reactions require nearly 5 minutes for complete neutralization. Currently used by EPCOR for high chlorine concentrations (CAPTOR, 20 to 300 mg/L)

*Information sources: Tikkanen et al., Guidance Manual for Disposal of Chlorinated Water and AWWA C655

6.3 CURRENT EPCOR PRACTICE

EPCOR Water dechlorinates all discharge waters that result from its construction, operations and maintenance activities. To dechlorinate water discharged from hydrants, EPCOR uses sodium sulfite tablets inserted into a dechlorinating diffuser hydrant attachment. For large quantities of water discharge, EPCOR uses a 33% solution of sodium metabisulfite (Na₂S₂O₅) injected into the discharge stream at an approximate rate of 1.4 parts of sodium metabisulfite to neutralize 1 part of free chlorine.

6.4 FIELD SAMPLING

Verify that the water discharge stream is sufficiently dechlorinated to meet applicable legislation and bylaws via field sampling of residual chlorine concentration.

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7. GUIDELINES FOR BOUNDARY VALVE OPERATION

7.1 PURPOSE

Boundary valves are valves which isolate new water-main construction from existing water-mains serving people with potable water. These valves protect the public from accidental contamination of their drinking water caused by backflow from contaminated water-mains or mains which have excessive residual chlorine concentrations. In addition, boundary valves prevent excessive hydrostatic pressure being applied to domestic water services during pressure testing of new water-mains. Care must be taken when opening and closing boundary valves to ensure that the water serving houses remains safe for consumption and that the customer is not inconvenienced.

Boundary valves may be on existing City property or in the new development. In some cases, the boundary valve may be one or more valves away from the development. Regardless of the boundary valve location, boundary valves should not be turned unless the operator fully understands the location and function of the valves.

OPERATING RULES

1. Have only one boundary valve open at one time to prevent backflows.
2. The Engineer is responsible for the operation of boundary valves in both new developments and renewal projects. **Valves 350 mm and larger can only be operated by EPCOR Water Distribution staff.** EPCOR Water Dispatch (780 412 6800) must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.
3. Water-main design drawings should have all boundary valves clearly marked prior to construction.
4. Prior to construction, the Engineer will designate a site representative who will be responsible for ensuring that operation of boundary valves, pressure and leakage testing, and disinfection are properly performed. This individual must be competent and demonstrate knowledge of the water distribution system in the vicinity of the construction.
5. Boundary valves will be closed and stoppered before construction starts and **EPCOR Water Dispatch (780 412 6800) must be notified.**
6. EPCOR Water Dispatch (780 412 6800) must be notified prior to the operation of boundary valves. **Valves 350 mm and larger can only be operated by EPCOR Water Distribution staff.** EPCOR Water Dispatch (780 412 6800) must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.
7. Boundary valves will be closed and secured until new water-mains are accepted except for the following construction activities:
 - filling water-mains for wet-tapping of services;
 - pressure and leakage testing; and
 - disinfection and subsequent flushing.
8. The consulting engineer is responsible for notifying EPCOR Water Dispatch (780 412 6800) of any change in boundary valve status.

7.2 TAPPING VALVES AND SLEEVES (TVS)

A common form of connection for new developments is by means of a tapping valve and tapping sleeve arrangement whereby the contractor will make a wet tap into an existing potable water-main which is servicing customers. This operation is the responsibility of the contractor and the supervising consulting engineer. The contractor must provide 24 h notice to EPCOR inspectors to observe the operation and to provide system support in the event of a failure.



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EPCOR does not take responsibility of tapping valves until the warranty period expires. Improper use of any boundary valves before or after the warranty period can result in system wide problems and therefore care in operation of these valves should be consistent.

Installation of TVS's should follow good water works practices including swabbing the pipe at the tapping location, tapping valve, and tapping sleeve with 1% chlorine bleach solution prior to assembling the TVS. Support for the tapping sleeve and thrust blocks should be provided as per the Engineer's specification.

7.3 HINTS & TIPS

1. Always appoint a knowledgeable site representative to oversee water-main testing and boundary valve operation.
2. Always mark the boundary valves on design drawings.
3. Always close all boundary valves and install stoppers before construction starts.
4. Always notify EPCOR Water Dispatch (780 412 6800) of any changes in boundary valve status.
5. Never have more than one valve open at one time.
6. Never operate boundary valves during construction except when filling water mains for service tapping, pressure and leakage testing, or disinfection.

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8. DESIGN GUIDELINES FOR ACCEPTANCE TESTING OF NEW WATER-MAINS**8.1 OBJECTIVES**

The objective of the design guidelines is to help designers consider the means of achieving effective acceptance testing procedures during the construction of new water mains. Many times designers are most interested in the most economical layout of new water mains without any consideration for subsequent testing and long-term, routine maintenance. The following sections are design requirements for new developments in the City of Edmonton. Following these guidelines will help speed the approval process, reduce delays during construction, and will help prevent accidents from occurring which could adversely affect the quality of water supplied to the residents of Edmonton.

8.2 GENERAL CONSIDERATIONS

Test locations need to be identified early in the design stage to permit the proper appurtenances to be incorporated into the water network design. Experienced field personnel will be able to quickly identify appropriate locations. Pressure and leakage testing apparatus can be used at the same location as chlorination equipment. However, because of the corrosive nature of chlorine, the location of pressure and leakage testing will be determined by the disinfection constraints. Suggested considerations include the following:

1. Clearly identify all boundary valves on the overall water-main plan. Identify boundary valves that are to be operated for acceptance testing of the new water mains.
2. On the overall water-main plan, tentatively identify areas to be pressure and leakage tested and disinfected at one time. If the whole project can be done at one time, identify this on the drawing notes. Clearly identify the incoming and the outgoing water points.
3. Locate a suitable main stop and service connection within 3 m of the boundary valve from which the water will flow into the new system. This service connection will carry the chlorine solution into the water main to be disinfected. This can be a temporary main stop and can be abandoned at the discretion of EPCOR after the water main has been successfully tested. The copper should be crimped and soldered and the main stop closed.
4. Locate a hydrant or blowoff near the end of each section to be disinfected. Large areas of a new water distribution system can be disinfected at one time provided there are enough sampling points to determine the uniformity of the chlorine residual over the area. By operating the valves carefully, the entire area can be flowed through one hydrant. A hydrant will also be able to provide the wide range of flow rates required to flush the water-main (see Table 1). If it is not possible to provide a hydrant or blowoff as the outlet, refer to Table 1 for the required type of outlets on a water main to achieve an adequate flushing velocity.
5. Provide air relief valves at the high points of water mains greater than or equal to 450 mm in diameter. For water mains less than or equal to 300 mm diameter, locate a hydrant near the high point. These appurtenances will provide relief of trapped air and will also provide a location for pressure testing the water-main in accordance with the guide-lines in Section 3.
6. Identify service connections that can double as pressure test points and chlorine and bacteriological sampling points in the area to be tested.
7. Remember that hydrants cannot be used for adding chlorine or for bacteriological sampling.
8. Identify the location of dechlorination points considering where the flushed water will go.



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8.3 DEAD-ENDS

Permanent

Permanent dead-ends can be the most significant routine maintenance problem that a water utility can deal with. In addition, available fire flows are greatly reduced when hydrants are only fed from one direction. During the planning and pre-engineering phases of development every effort should be made to have a looped water distribution system which provides the best fire protection and facilitates routine maintenance. However, modern land use planning techniques inevitably result in permanent dead-end water-main sections. These pose a challenge for the designer since they need to be flushed, pressure and leakage tested, and disinfected to the same standard as looped mains. The designer can evaluate the following suggestions:

1. Refer to Table 1 for the required outlets on a water-main to achieve an adequate flushing velocity.
2. Locate the proper size outlet on the dead-end main. Since many dead-end mains are 150 or 200 diameter, a minimum single 40 mm or 50 mm copper service will be adequate, respectively. In situations where a 50 mm dead-end is provided, a 20 mm blowoff is necessary. Permanent blowoffs are an asset for future maintenance needs. Use a chamber, self-draining riser, or bury the blowoff in a landscaped area for future use. Refer to EPCOR Standard Drawings for Flush Point and Blowoff arrangements.

At Limits of Construction

Frequently, new construction is bounded by undeveloped property or property which is owned by others. This situation involves the design of temporary dead ends which may be linked to other water mains in the near or very distant future. These dead ends require the same attention to acceptance testing as do permanent ones. The major difference is that they are not necessarily permanent. Good design can involve leaving a boundary valve and hydrant at the limits of construction. Otherwise, the same suggestions apply as for the permanent dead ends above.

Never service a lot from a temporary dead-end that cannot be isolated from new construction by a boundary valve.

8.4 DRAWING NOTES

While contract specifications contain references to the appropriate AWWA standards, it is rare that field personnel have access to these. Important information regarding the construction of new water mains is generally placed on the contract drawings. The overall plan of the water distribution system is an ideal place to have special notes regarding the requirements for acceptance testing of new water mains. Minimum notes that should be attached include:

1. The pressure and leakage testing specifications for the pipe materials used in the project.
2. Design operating pressure at the low point and high point of the system. This information will be obtained from the required network analysis for distribution mains. For transmission lines, the pressures will be available from EPCOR.
3. The need for dechlorination during flushing should be noted.



9. APPENDICES

9.1 APPENDIX A - STANDARD FORMS FOR ACCEPTANCE TESTING

Water Pressure and Leakage Test Calculations

Sample Combined Water Pressure and Leakage Test

Sample Chlorine Residual and Bacterial Sampling Report

Sample Provincial Laboratory Bacteriological Sample Form PH 108



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Water Pressure and Leakage Test Calculations

Project: _____
Client: _____
Prepared For: _____

$$\text{Allowable Leakage} = L_m = \frac{(H \cdot J \cdot D \cdot P^{0.5})}{128300}$$

Where: H= Test duration in hours J= Number of joints
D = Pipe diameter (mm) P = Average test pressure in kPa

If test pressure is 1035 kPa and test duration is 2 hours then:

$$L_m = J \cdot D / 1994$$

<input type="text"/> mm C900 PVC Pipe		Number of Joints	
Pipe	<input type="text"/> /6m/joints = Round to the nearest integer	<input type="text"/>	
Fittings	Number	Joints/Fitting	
Plugs	<input type="text"/>	* 1 =	<input type="text"/>
Bends	<input type="text"/>	* 2 =	<input type="text"/>
Valves	<input type="text"/>	* 2 =	<input type="text"/>
Tees	<input type="text"/>	* 3 =	<input type="text"/>
Cross	<input type="text"/>	* 4 =	<input type="text"/>
Hydrants	<input type="text"/>	* 4 =	<input type="text"/>
		Total Joints	<input type="text"/>
		Allowable Leakage (Litres)	<input type="text"/>

<input type="text"/> mm C900 PVC Pipe		Number of Joints	
Pipe	<input type="text"/> /6m/joints = Round to the nearest integer	<input type="text"/>	
Fittings	Number	Joints/Fitting	
Plugs	<input type="text"/>	* 1 =	<input type="text"/>
Bends	<input type="text"/>	* 2 =	<input type="text"/>
Valves	<input type="text"/>	* 2 =	<input type="text"/>
Tees	<input type="text"/>	* 3 =	<input type="text"/>
Cross	<input type="text"/>	* 4 =	<input type="text"/>
Hydrants	<input type="text"/>	* 4 =	<input type="text"/>
		Total Joints	<input type="text"/>
		Allowable Leakage (Litres)	<input type="text"/>

<input type="text"/> mm C900 PVC Pipe		Number of Joints	
Pipe	<input type="text"/> /6m/joints = Round to the nearest integer	<input type="text"/>	
Fittings	Number	Joints/Fitting	
Plugs	<input type="text"/>	* 1 =	<input type="text"/>
Bends	<input type="text"/>	* 2 =	<input type="text"/>
Valves	<input type="text"/>	* 2 =	<input type="text"/>
Tees	<input type="text"/>	* 3 =	<input type="text"/>
Cross	<input type="text"/>	* 4 =	<input type="text"/>
Hydrants	<input type="text"/>	* 4 =	<input type="text"/>
		Total Joints	<input type="text"/>
		Allowable Leakage (Litres)	<input type="text"/>

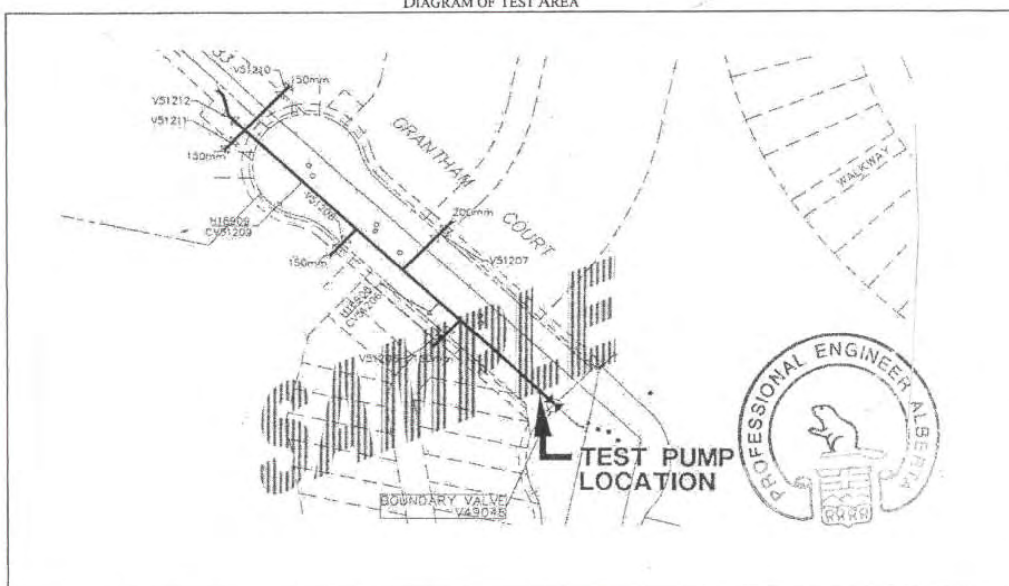
Total Allowable Test Section leakage (Lm) =
Allowable Drop = Total allowable leakage /2.6 litres (cm) =

Sample Combined Water Pressure and Leakage Test



SUBDIVISION:	Glastonbury Stage 19
DATE:	Oct-25-08
PUMP LOCATION:	Copper at Boundary Valves

DIAGRAM OF TEST AREA



	Time	Read	Pressure "P" (kPa)
Start	14:00	140	1035 kPa
Finish	16:00	148	1035 kPa
Millimeters Drop	8mm		
Total Actual Leakage (litres)	2.19		

Length (m)	Size "D" (mm)	Type	Number of Joints "J"	Leakage Allowed "L _M " (litres)
134	300	PVC	22 + 20 = 42	6.32
20	200	PVC	3 + 4 = 7	0.70
50	150	PVC	8 + 16 = 24	1.81
	50	Copper	0	0.00
2	150	Hydrant	8	0.60
Total Allowable Leakage (litres)				9.43

CONTRACTOR'S REPRESENTATIVE: _____
CONSULTANT'S REPRESENTATIVE: _____

**TEST TO BE WITNESSED BY CONSULTANT'S REPRESENTATIVE WITH RESULTS
CERTIFIED BY A PROFESSIONAL ENGINEER**



Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

Sample Chlorine Residual and Bacteriological Sampling Report

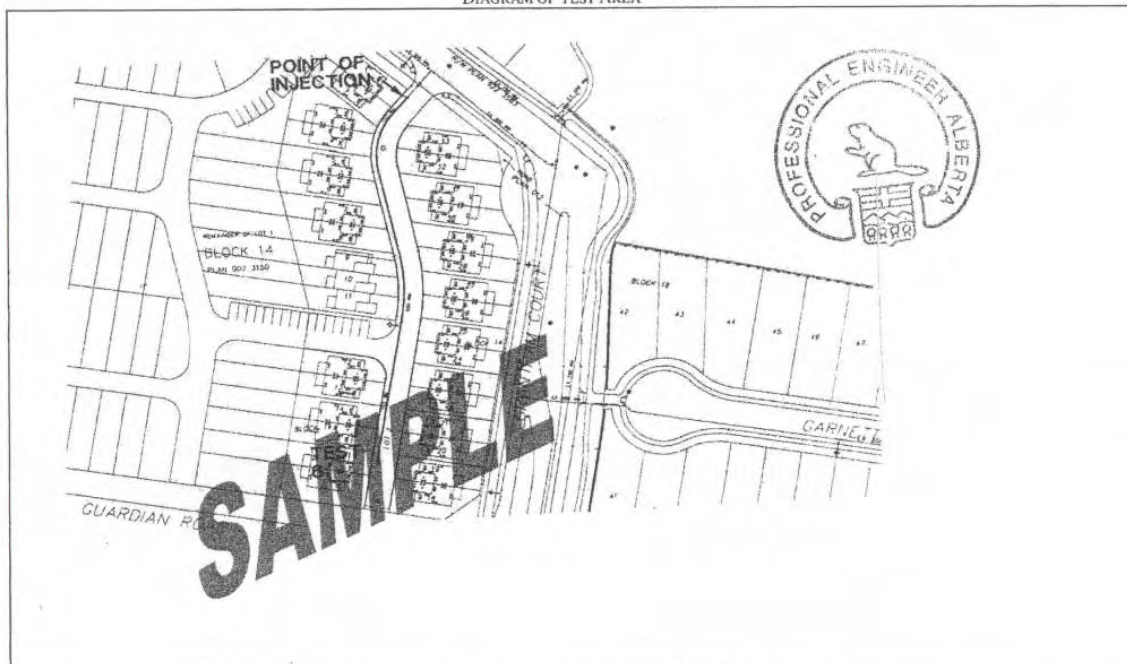


CHLORINE RESIDUAL AND BACTERIOLOGICAL SAMPLING REPORT
FOR
EPCOR WATER SERVICES

DEVELOPER: Grange Property Development
CONSULTANT: _____
CONTRACTOR: _____
LOCATION: Glastonbury Stage 19

SUBDIVISION: Glastonbury Stage 19
REPORTING DATE: Nov-13-08
PUMP LOCATION: Copper at North Tie-in Valve

DIAGRAM OF TEST AREA



	DATE	TIME START	TIME STOP
CHLORINE INJECTION	OCT-29-08	14:37	16:42

LOCATION	INITIAL STRENGTH (HIGH RANGE) Cl ₂ (mg/L)	24 HR RES. (HIGH RANGE) Cl ₂ (mg/L)	TOTAL (LOW RANGE) Cl ₂ (mg/L)	BACTI SAMPLE DATE	TOTAL COLIFORMS (per 100ml)	E.COLI (per 100ml)
6. Copper at Service	50	40	2.0	Nov-01-08	Absent	Absent

CHLORINATED WATER DISPOSED OF ACCORDING TO ALL LEGISLATIVE REQUIREMENTS?

(YES OR NO)

TEST TO BE WITNESSED BY CONSULTANT'S REPRESENTATIVE WITH RESULTS
CERTIFIED BY A PROFESSIONAL ENGINEER

Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

Sample Provincial Laboratory Bacteriological Sample Form PH 108

PLEASE WRITE OR PRINT PLAINLY AND FIRMLY

DETACH

Provincial Laboratory of Public Health
Division of Clinical Microbiology
Dept. of Medical Micro. & Infect. Diseases
University of Alberta Hospitals
Edmonton, Alberta T6G 2J2
Telephone: (780) 407-8925
Fax: (780) 407-8984

Trace Elements/Environmental Toxicology Laboratory
Division of Medical Biochemistry
Dept. of Laboratory Medicine and Pathology
University of Alberta Hospitals
Edmonton, Alberta T6G 2B7
Laboratory: (780) 407-8653
Fax: (780) 407-6267

REQUEST FOR MICROBIOLOGICAL / CHEMICAL ANALYSIS OF WATER

TO ORDER SAMPLE BOTTLES CONTACT THE DISTRIBUTION CENTRE AT 407-8971.

INSTRUCTIONS FOR COLLECTING WATER SAMPLES

1. Care should be taken to avoid touching the inside of the screw-cap or mouth of the bottle. Use **only** the special bottle(s) available from your Health Unit or this laboratory.
NOTE: THE MICROBIOLOGY BOTTLE IS STERILE AND CONTAINS A SMALL AMOUNT OF POWDER – DO NOT DISCARD.
2. If water is collected from pump or tap allow water to flow for about five minutes before taking sample.
3. For microbiological examination, fill the appropriate bottle to line only. Replace cap.
4. For chemical analysis rinsing both the PET 500 bottle and cap with sample (two or three times) is strongly recommended. Submit drinking water sample from the primary residence **only**. Where water treatment or purification systems are used, submit **only** the raw water supply.
5. **DETACH THIS SHEET AND ATTACH CORRECT ID No. LABEL(S) BELOW TO THE CORRECT SPECIMEN BOTTLE(S).**
6. Complete the requisition including your telephone number, address and postal code.
LEGAL LAND DESCRIPTION MUST BE IDENTIFIED.
7. For chemical analysis complete the PET 500 bottle label.

INSTRUCTIONS FOR DELIVERY OF WATER SAMPLES

1. Water samples are accepted at your Health Unit (Phone for days and times) or the Provincial Laboratory, University of Alberta Hospitals (114 Street and 83 Avenue) Edmonton, Monday to Friday.
2. Samples should be delivered to the Laboratory as soon as possible following collection. Where a delay of more than 6 hours is unavoidable, the sample should be chilled (**not frozen**) until it reaches the Laboratory. **Do not add ice to the sample.** Samples received more than 24 hours after collection are generally unsuitable for microbiological examination and may not be tested.

IF THE ABOVE INSTRUCTIONS ARE NOT CAREFULLY FOLLOWED THE SAMPLE(S) MAY NOT BE PROCESSED.

ID NO.

- DETACH NUMBERED LABEL AT PERFORATIONS

ID NO.

N 840961
MICROBIOLOGICAL

- PEEL TAPE AND AFFIX LABEL TO PROPER BOTTLE

N 840961
CHEMICAL☐ Pool (6)Free Cl₂ _____☐ Raw ☐ Treated☐ Pool ≥ 30°C (7)Total Cl₂ _____☐ Beach (8)

pH _____

☐ Other _____

Temperature _____

RAW WATER / SEWAGE / EFFLUENT☐ Sewage / Effluent Chlorinated (11)☐ Sewage / Effluent Unchlorinated (12)☐ River (13)☐ Creek (14)☐ Lake (9)☐ Other _____**OTHER SAMPLE TYPES**☐ Distilled water (10)☐ Deionized water (34)☐ Other _____ (999)**SOURCE (Check one only)**

Well (90) _____

River (93) _____

Lake (96) _____

Dugout (91) _____

Creek (94) _____

Canal (97) _____

Cistern (92) _____

Spring (95) _____

Other (98) _____

Well Depth _____ feet

WELL DEPTH MUST BE SPECIFIED

Well ID No. _____

REMARKS OR REQUESTS FOR SPECIAL TESTS☐ Resample (previous confluent growth)☐ Other (specify) _____

Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

WATER	
Provincial Laboratory of Public Health Division of Clinical Microbiology Dept. of Medical Micro. & Infect. Diseases University of Alberta Hospitals Edmonton, Alberta T6G 2J2 Telephone: (780) 407-8925 Fax: (780) 407-8984	Trace Elements/Environmental Toxicology Laboratory Division of Medical Biochemistry Dept. of Laboratory Medicine and Pathology University of Alberta Hospitals Edmonton, Alberta T6G 2B7 Laboratory: (780) 407-8653 Fax: (780) 407-6267
ACCESS NUMBER	
ID NO.	
REQUEST FOR MICROBIOLOGICAL / CHEMICAL ANALYSIS OF WATER (Please print clearly)	
Water supply for (NAME) _____	
Address _____	
City, Town, Village _____	
Postal Code _____ Telephone _____	
COLLECTION SITE _____	
Legal land description MUST be identified _____ 1/4 Section _____ Township _____ Range _____ w of _____ th Meridian Lot _____ Blk _____ Plan _____	
Date and time of collection DD MM YY HOUR	
Reason for sampling _____ LOCAL HEALTH UNIT / AGENCY AND ADDRESS IN FULL _____ _____ _____	
SAMPLE COLLECTED BY: Name _____	
<input type="checkbox"/> MICROBIOLOGICAL ANALYSIS SAMPLE TYPE: DRINKING WATER <input type="checkbox"/> Municipal <input type="checkbox"/> Public <input type="checkbox"/> Private <input type="checkbox"/> Chlorinated <input type="checkbox"/> Unchlorinated <input type="checkbox"/> U.V. Sterilized Total Cl ₂ _____ Free Cl ₂ _____ SOURCE OF DRINKING WATER (Check one only) Well (90) _____ River (93) _____ Lake (96) _____ Dugout (91) _____ Creek (94) _____ Canal (97) _____ Cistern (92) _____ Spring (95) _____ Other (98) _____ <input type="checkbox"/> Distilled Drinking Water (10) <input type="checkbox"/> Bottled Drinking Water (Finished Product) (5) <input type="checkbox"/> Ice (26) RECREATIONAL WATER <input type="checkbox"/> Pool (6) Free Cl ₂ _____ <input type="checkbox"/> Pool ≥ 30°C (7) Total Cl ₂ _____ <input type="checkbox"/> Beach (8) pH _____ <input type="checkbox"/> Other _____ Temperature _____ RAW WATER / SEWAGE / EFFLUENT <input type="checkbox"/> Sewage / Effluent Chlorinated (11) <input type="checkbox"/> Sewage / Effluent Unchlorinated (12) <input type="checkbox"/> River (13) <input type="checkbox"/> Creek (14) <input type="checkbox"/> Lake (9) <input type="checkbox"/> Other _____ OTHER SAMPLE TYPES <input type="checkbox"/> Distilled water (10) <input type="checkbox"/> Deionized water (34) <input type="checkbox"/> Other _____ (999)	<input type="checkbox"/> CHEMICAL ANALYSIS OF DRINKING WATER FOR HUMAN CONSUMPTION (See Note on Reverse) TEST REQUESTED <input type="checkbox"/> Routine analysis <input type="checkbox"/> Nitrate and Nitrite (only) <input type="checkbox"/> Fluoride (only) <input type="checkbox"/> Sodium (only) Other tests require prior approval by lab (407-6648) SAMPLE TYPE (Select ONE box only) <input type="checkbox"/> Private Supply (WP) <input type="checkbox"/> Municipal Supply (WM) Is this for licence purposes? (WR) _____ _____ Raw _____ Treated SOURCE (Check one only) Well (90) _____ River (93) _____ Lake (96) _____ Dugout (91) _____ Creek (94) _____ Canal (97) _____ Cistern (92) _____ Spring (95) _____ Other (98) _____ Well Depth _____ feet WELL DEPTH MUST BE SPECIFIED Well ID No. _____
REMARKS OR REQUESTS FOR SPECIAL TESTS _____ Resample (previous confluent growth) _____ Other (specify) _____	



Section 02517 – GUIDELINES FOR ACCEPTANCE TESTING

9.2 APPENDIX B – STANDARDS AND MANUALS RELEVANT TO GUIDELINES

Unless otherwise designated, all specifications and standard references refer to the latest edition.

- AWWA B300 – Hypochlorites
- AWWA C206 – Field Welding of Steel Water Pipe
- AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances
- AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- AWWA C651 – Disinfecting Water Mains
- AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
- AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service
- AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm)
- AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- AWWA C907 – Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution

END OF SECTION



PROVIDING MORE

Construction Standards

Section 02518 PVC Tapping Guidelines

January 2013



Section 02518 – PVC TAPPING GUIDELINES

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Section 02518 – PVC TAPPING GUIDELINES

1. GENERAL

1.1 SCOPE

This section covers the guidelines for the tapping of PVC potable water pipe manufactured to AWWA Standards C900 and C905. EPCOR presently uses C900 and C905 pipe in 150 mm to 300 mm and 350 mm to 1200 mm nominal diameters respectively. The intent of these guidelines is not to provide detailed field instructions but to highlight critical aspects of tapping and to clarify EPCOR's position on tapping equipment and procedures. The manufacturer's recommended installation procedure is to be obtained for all materials installed. In the case of discrepancy between the manufacturer's requirements and these specifications, advise EPCOR and request instruction before proceeding.

The critical aspects of tapping equipment and procedures which are covered in the guidelines, and to which specific attention should be paid, are:

- using the proper shell cutter, in good condition;
- using a drilling machine with a feed nut independent of the boring bar;
- monitoring the depth of the cut;
- observing minimum 600 mm from pipe ends, minimum 600mm separation and 30 degree stagger ;
- avoid distorting the pipe when mounting the tapping machine;
- cutting and tapping at a slow and steady feed rate;
- always retrieving the coupon;
- checking for leaks;
- tapping of curved pipe under pressure may increase the possibility of failure during tapping;
- whenever practicable, taps should be made on the inside radius of longitudinally bent pipe; and
- OH & S due diligence regarding the specific hazards of this task.

1.2 RESOURCES

Unless otherwise designated, all specifications and standard references refer to the latest edition.

- AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- AWWA M23 – PVC Pipe—Design and Installation
- Uni-Bell Handbook of PVC Design and Construction
- Uni-Bell UNI-B-8 – Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters 6-12 Inch)
- Uni-Bell UNI-PUB-8 – Tapping Guide for PVC Pressure Pipe
- Manufacturer/Supplier Manual/Installation Guide for the specific tapping equipment used

The training video, "Tapping PVC Pressure Pipe" by the Uni-Bell PVC Pipe Association is mandatory for all personnel directly involved in the tapping of PVC pipe.

For further details on equipment and procedures, please contact the specific suppliers of the pipe materials and the tapping equipment that are in use on the job site.

2. CONSIDERATIONS

2.1 RISK OF TRENCH FLOODING

- 2.1.1 The Contractor should be aware of the specific hazards pertaining to working around pressurized water mains. There is a risk of rapid ingress of a large volume of water into an excavation in the event of a failure.
- 2.1.2 Ladders extending above the trench wall should be easily accessible by all personnel.

Section 02518 – PVC TAPPING GUIDELINES

- 2.1.3 It is recommended that all of the water main isolating valves on either side of the proposed tap be closed, except for one which may be left minimally opened, so that the effect of any failure will be mitigated.
- 2.1.4 Prior to the tap, the water main isolating valves must be located and contingency plans made for their immediate shut off should a failure occur.
- 2.1.5 EPCOR Water Dispatch (780 412 6800) must be made aware of any valve operations and "out of service" fire hydrants. Affected customers must be notified. Valves 350 mm and larger can only be operated by EPCOR Water Services Distribution Operations personnel. EPCOR Water Dispatch (780 412 6800) must be contacted a minimum of 48 hours in advance to make arrangements for the operation of these valves. More notice may be required on a case by case basis.
- 2.1.6 A protective blanket with a hole in the center to permit installation of the tapping machine should be used to cover the exposed area of the pipe.

2.2 TAPPING CATEGORIES

- 2.2.1 Table 1 based on the existing field parameters such as the pipe type, pipe size, tap type and tap size.

Table 1: Pipe tapping categories

Category	Pipe Type	Pipe Size (mm)	Tap Diameter (mm)	Tap Type	Type Allowable
1	AWWA C900	100 to 300	20,25	direct	wet
2	AWWA C900	100 to 300	40,50	saddle	wet
3	AWWA C900	100 to 300	150 to 300	sleeve	wet
4	AWWA C905	350 to 600	20,25,40,50	saddle	dry or isolated wet
5	AWWA C905	350 to 1200	150 to 750	sleeve	wet

- 2.2.2 Equipment specifications and procedures for each category are generally described in Table 2, Table 3, and Table 4. Direct and saddle dry tapping will be allowed only on a site specific basis, with the prior review and documented approval of the EPCOR Water representative. The Contractor must demonstrate that dry tapping is the best practice for the specific conditions. Examples of conditions that may support dry tapping include sub-zero ambient temperature and limited working space in shored excavations.
- 2.2.3 The Contractor must ensure that the tapping machines, drill bits, shell cutters and associated equipment are properly maintained and in sound working condition, for safe operation. The Contractor must ensure that personnel are properly trained and are competent to operate the equipment and perform the task completely and safely.
- 2.2.4 The Uni-Bell PVC Pipe Association "Tapping Guide for PVC Pressure Pipe" and "Recommended Practice for the Direct Tapping of PVC Pressure Water Pipe" are posted along with this document for reference purposes.

Section 02518 – PVC TAPPING GUIDELINES

Table 2: Pipe tapping equipment and procedures for Category 1

EQUIPMENT	PROCEDURE	
<p>Pipe</p> <ul style="list-style-type: none"> - AWWA C900 PVC, DR 18, DR 14 - C.I.O.D. - Allowable temperature bands: <ul style="list-style-type: none"> -18°C to 38°C (dry tap) 0°C to 32°C (wet tap) <p>Main Stop</p> <ul style="list-style-type: none"> - AWWA C800 (tapered) inlet thread <p>Saddle or Sleeve</p> <ul style="list-style-type: none"> - not required 	<p>I. Planning</p> <ul style="list-style-type: none"> - Do not tap closer than 600 mm from the end of the pipe. - Stagger multiple taps at least 600 mm apart with adjacent taps and offset 30° with respect to each other - Do not tap a discolored surface. - Do not tap a curved pipe where bend radius is less than 300 times the pipe O.D. - Check the cutter condition. It should be in good condition and be kept sharp. - Determine tapping depth. Perform "bench" test and note position of top of threaded feed sleeve relative to thrust collar or other datum point 	<p>IV. Inserting Main Stop</p> <ul style="list-style-type: none"> - Attach an E-Z screw plug to the end of the boring bar. - Screw mainstop into E-Z release plug. - Ensure main stop is closed. - Apply 2 spiral wraps of "Teflon" tape clockwise to the inlet threads of the mainstop. Do not use liquid sealants. - Replace boring bar in machine and proceed to insert mainstop into pipe. Exercise care and do not force or punch first few threads. - Remove ratchet handle as soon as stop has firmly engaged the threads in the pipe wall. - Use a torque wrench and tighten to 27 foot-pounds (36.6 newton-metres). - Turn the wrench counter clockwise to release E-Z plug from stop. Remove machine. - At correct insertion, 1 to 3 threads should be visible. - If leaking occurs, tighten to 35 foot-pounds (47.5 newton-metres). - If leaking persists, remove pressure from line, unscrew mainstop to clear away cuttings and replace stop with new teflon tape to 27 foot-pounds (36.6 newton-metres).
<p>Tapping Machine</p> <ul style="list-style-type: none"> - Standard ratchet handle on boring bar - Feed nut or feed screw and yoke - Machine saddle must be compatible with pipe O.D. - Acceptable machines are: <ol style="list-style-type: none"> 1. Footage Tool/Mainline Tap 2. Mueller/B-100, B, A2, A3 3. Romac/Transmate B-1 	<p>II. Machine Mounting</p> <ul style="list-style-type: none"> - Sit machine firmly on drilling site. The pipe should not be distorted as a result of mounting machine - Adjust nuts on chain hooks so nuts are even with tops of threads. Position chain hooks on machine and loop chain links snugly. This process should ensure that machine remains correctly seated in the saddle and saddle gasket. - Tighten nuts alternately so the same number of threads show when the machine is correctly mounted. Over-tightening on one side may distort the pipe wall. Tighten only enough to hold machine in place - no more. - Do not use wrench extenders. 	
<p>Shell Cutter or Tapping Tool</p> <ul style="list-style-type: none"> - Must be classified as a core cutting tool - Double or multiple slot design - Must retain coupon - Must have sufficient throat depth to accommodate DR14 pipe wall - Shank of cutter must be adaptable to the tapping machine - Acceptable cutters/tapping tools are: <ol style="list-style-type: none"> 1. Utility Services/4 point 2. Anderson Metals Combination Cutter and Tap 3. Romac/Transmate 353-04-206/351-01-206, 353-04-208/351-01-208 	<p>III. Cutting and Tapping</p> <ul style="list-style-type: none"> - Rotate ratchet handle 1 complete turn for every 1/8 turn of feed yoke. A slow feed rate will help to ensure a good tap. - The use of a cutting lubricant is recommended. If an increase in boring bar resistance is encountered, remove the boring bar, clean shavings out of the cutter, re-lubricate and resume cutting - On wall penetration use feed yoke to engage first few turns of tapping tool in the hole. Feed yoke can be disengaged at this point. - The feed rate should be less in cold weather. Judge correct feed rate by "finger pull". - Tap remainder of hole and re-engage feed yoke when reversing tapping tool until tap clears threads. - Examine PVC coupon for abnormalities 	<p>V. Dry Tapping</p> <ul style="list-style-type: none"> - Follow the procedures as outlined above with the following exceptions: <ol style="list-style-type: none"> 1. Remove cuttings from hole before inserting mainstop. 2. Insert the mainstop by hand. 3. Do not cross-thread teflon-wrapped threads.

Section 02518 – PVC TAPPING GUIDELINES

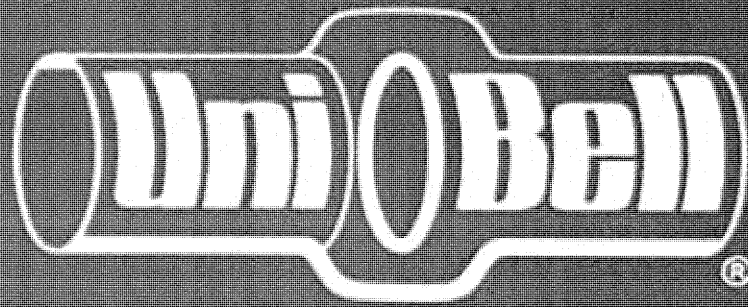
Table 3: Pipe tapping equipment and procedures for Categories 2 and 4

EQUIPMENT		PROCEDURE
Pipe <ul style="list-style-type: none"> - AWWA C900, DR18, DR14 - AWWA C905 PVC, DR25 - C.I.O.D. - Allowable temperature bands: <ul style="list-style-type: none"> -18°C to 38°C (dry tap) 0°C to 32°C (wet tap) 	Tapping Machine <ul style="list-style-type: none"> - Standard ratchet handle on boring bar - Feed nut or feed screw and yoke - Machine saddle must be compatible with pipe O.D. - Acceptable machines are: <ol style="list-style-type: none"> 1. APAC/Drillmaster 901 2. Footage Tool/Main line tap, Mini tap 3. Ford/77 4. Mueller/D5, E5 5. Romac/Transmate 5930, 5935 	I. Planning <ul style="list-style-type: none"> - The following procedures are for dry and wet tapping. - Prior approval from EPCOR is required for dry tapping. - Do not tap closer than 600 mm from the end of the pipe. - Stagger multiple taps at least 600 mm apart with adjacent taps and offset 30° with respect to each other - Do not tap a discolored surface. - Do not tap a curved pipe where bend radius is less than 300 times the pipe O.D. - Check the cutter condition. It should be in good condition and be kept sharp.
Main Stop <ul style="list-style-type: none"> - AWWA C800 (tapered) inlet thread 		
Saddle <ul style="list-style-type: none"> - Provide full support around pipe circumference - Have total minimum band width of 50 mm (2 inches) - Should not have lugs that dig into pipe when saddle is tightened - Should not have U-bolt type of strap 	Shell Cutter <ul style="list-style-type: none"> - Must be classified as a core cutting tool - Double or multiple slot design - Must retain coupon - Must have sufficient throat depth to accommodate DR14 pipe wall - Shank of cutter must be adaptable to the tapping machine - Acceptable cutters/tapping tools are: <ol style="list-style-type: none"> 1. Footage Tools/T500-2, T700-2, T408-11, T409-11 2. Ford/DMSC3, DMSC4, DMHS-6, DMHS-7 3. Pipeline Products PWL 3/4, 1, 1 3/4, 2 4. Romac/Transmate 351-01-206, 350-01-208, 351-01-212, 35-01-216 5. Utility Services/4 point 	II. Machine Mounting <ul style="list-style-type: none"> - Evenly tighten saddle to pipe. Install as per manufacturer's instructions and do not over-tighten. - Apply thread sealant and screw inlet side of main stop into the saddle. Retain stop hardware. - Do not use liquid sealants. - Use an appropriate adapter and gasket. - Attach drilling machine to main stop outlet threads. Ensure main stop is open.
		III. Cutting and Tapping <ul style="list-style-type: none"> - Rotate ratchet handle 1 complete turn for every 1/8 turn of feed yoke. A slow feed rate will help to ensure a good tap. - The feed rate should be less in cold weather. Judge correct feed rate by "finger pull". - The use of a cutting lubricant is recommended. - Withdraw cutter and close main stop. - Remove drilling machine. - Examine PVC coupon for abnormalities.

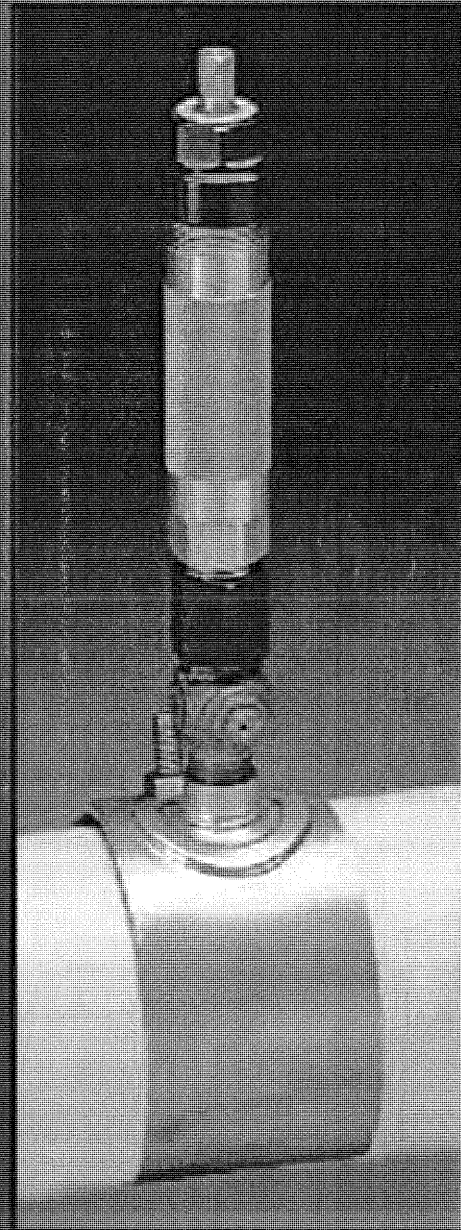
Section 02518 – PVC TAPPING GUIDELINES

Table 4: Categories 3 and 5 pipe tapping equipment and procedures

EQUIPMENT		PROCEDURE																																				
Pipe <ul style="list-style-type: none"> - AWWA C900, DR18, DR14 - AWWA C905 PVC, DR25 - C.I.O.D. - Allowable temperature bands: <ul style="list-style-type: none"> -18°C to 38°C (dry tap) 0°C to 32°C (wet tap) 	Tapping Machine <ul style="list-style-type: none"> - Must be compatible with tapping valve being used. - Should have an automatic over travel protection device which disengages tool feed. - Acceptable machines are: <ol style="list-style-type: none"> 1. Mueller/CL-12, CC25, C1-36 2. Romac/Transmate Tapmate 3. T.D. Williamson Model 660 	I. Planning <ul style="list-style-type: none"> - An EPCOR Water Inspector must be on site to witness the tap. - Check the cutter condition. It should be in good condition and be kept sharp. 																																				
Valve <ul style="list-style-type: none"> - Should be AWWA C500 or C509 tapping valve 		II. Sleeve Mounting <ul style="list-style-type: none"> - Install as per manufacturer's instructions. - Ensure no pipe distortion occurs. - Sleeve should be well supported independently from pipe. - In the absence of manufacturer's instructions, minimize bolt torque to 25 foot-pounds and adjust as necessary in field. 																																				
Sleeve <ul style="list-style-type: none"> - Should provide full support around pipe circumference. - Should not distort pipe when tightened. - Should not have lugs that will dig into pipe when sleeve is tightened. - Should not have a clamping arrangement which is not fully contoured to pipe O.D. - Should have the following laying lengths: <table border="1"> <thead> <tr> <th>Main (mm)</th><th>Tap (mm)</th><th>Length (mm)</th></tr> </thead> <tbody> <tr><td>150</td><td>150</td><td>457</td></tr> <tr><td>200</td><td>150</td><td>483</td></tr> <tr><td>200</td><td>200</td><td>533</td></tr> <tr><td>250</td><td>150</td><td>483</td></tr> <tr><td>250</td><td>200, 250</td><td>584</td></tr> <tr><td>300</td><td>150</td><td>483</td></tr> <tr><td>300</td><td>200</td><td>533</td></tr> <tr><td>300</td><td>250, 300</td><td>635</td></tr> <tr><td>450</td><td>150 to 450</td><td>*</td></tr> <tr><td>600</td><td>150 to 600</td><td>*</td></tr> <tr><td>750</td><td>150 to 750</td><td>*</td></tr> </tbody> </table> <p>* contact pipe manufacturers for recommended laying lengths</p>	Main (mm)	Tap (mm)	Length (mm)	150	150	457	200	150	483	200	200	533	250	150	483	250	200, 250	584	300	150	483	300	200	533	300	250, 300	635	450	150 to 450	*	600	150 to 600	*	750	150 to 750	*	Shell Cutter <ul style="list-style-type: none"> - Must be a toothed core cutter which retains the coupon. - Must have sufficient throat depth to accommodate DR14 pipe wall - Acceptable cutters are: <ol style="list-style-type: none"> 1. Footage Tools T376-11, T320-1, T321-1, T322-1, T323-1 2. Romac/Transmate 350-01-1032, 350-01-1048, 350-01-1064, 350-01-1080, 350-01-1096 3. T.D. Williamson Insert Tip Shell Cutter 4. Utility Services 	III. Machine Mounting and Cutting <ul style="list-style-type: none"> - Bolt adaptor to front of machine and to valve outlet flange. - A slow feed rate will help to ensure a good tap, feed rate should not exceed .08 mm per revolution of cutter - The use of a cutting lubricant is recommended. - Position the necessary support blocks to level valve. - Open the tapping valve. - Cut hole into water main through sleeve by following manufacturer's instructions. - Retract cutter, close tapping valve and remove tapping machine.
Main (mm)	Tap (mm)	Length (mm)																																				
150	150	457																																				
200	150	483																																				
200	200	533																																				
250	150	483																																				
250	200, 250	584																																				
300	150	483																																				
300	200	533																																				
300	250, 300	635																																				
450	150 to 450	*																																				
600	150 to 600	*																																				
750	150 to 750	*																																				



**Tapping
Guide
For
PVC
Pressure
Pipe**



**UNI-BELL
PVC PIPE ASSOCIATION**

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The statements contained in this recommended practice are those of the Uni-Bell PVC Pipe Association and are not warranties, nor are they intended to be warranties. Inquiries for information of specific products, their attributes and recommended uses and the manufacturer's warranty should be directed to member companies.

INTRODUCTION

This booklet has been developed by the Uni-Bell PVC Pipe Association for use as a field tapping guide. Detailed information regarding recommended procedures and equipment for tapping PVC pressure pipe is included.

The Uni-Bell PVC Pipe Association, formed in 1971, conducts research and development, provides technical service and support, develops recommended standards and promotes proper use of PVC pipe with gasketed joints.

Its members are manufacturers who are dedicated to producing high quality PVC pipe products for the industry.

Note: This Tapping Guide is not intended to take the place of the designer's judgement. The illustrations used in this Guide depict specific tooling for the sake of clarity. They are not intended to promote specific types of equipment or the equipment of a particular manufacturer. Other equipment meeting the requirements called for may be equally satisfactory.

DIRECT TAPPING

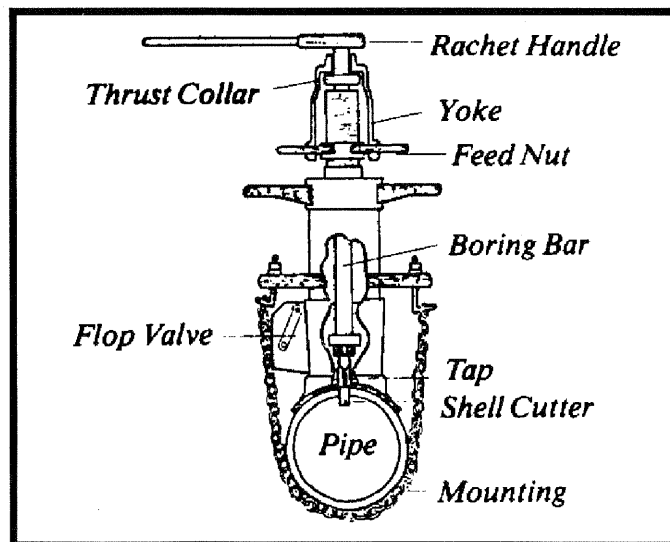
GENERAL

Direct tapping involves the tapping of threads into the pipe wall and the insertion of a corporation stop. Direct tapping is recommended for PVC water distribution pipe manufactured in accordance with AWWA C900 in nominal sizes 6 inch through 12 inch (150mm through 300mm) pressure classes 150 and 200.

Direct tapping is not recommended for pressure class 100 pipe. Nor is it recommended for 4 inch pressure class 150 and 200 pipe. In these cases service clamps or saddles should be used.

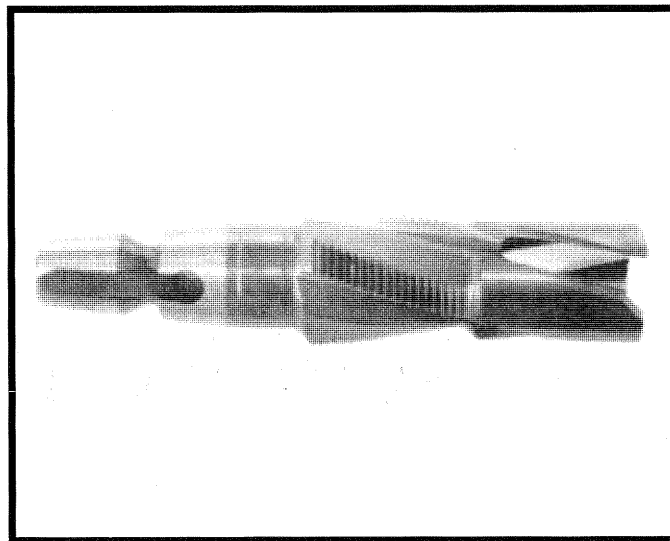
EQUIPMENT

A tapping machine is a mechanical device used to install the direct tapped connection into water mains. The tapping machine may vary in design and operation depending on the specific machine manufacturer. The tapping machine shall provide a standard ratchet handle on the boring bar and be of a design such that the cutting and tapping are controlled by feed nut and yoke.



IN NO CASE SHOULD A HAND-HELD DRILL BE USED. The machine must operate with a cutting / tapping tool suitable for PVC pipe. This tool should be of a shell-type design, have a minimum of two slots, and shall retain the cut coupon after penetrating the PVC pipe wall.

Cutting/Tapping Tool:



This combination drill and tap tool, in the above picture, illustrates the recommended features of the cutter. A core drill is essential and is singularly recommended. Slotted core drills allow an easier cut, but not a faster cut. DO NOT DRILL A HOLE IN PVC PIPE WITH A TWIST DRILL OR AUGER BIT.

The core drill must retain the plug of material removed from the pipe wall (the “coupon”). A simple means of removing the coupon from the core drill should be provided. The core drill must be designed to accommodate walls as heavy as DR 14 (pressure class 200, AWWA C900). Sufficient throat depth is required.

The shank of the cutter must be adaptable to the tapping machine being used.

The tap must cut AWWA C800 tapered threads. Iron pipe threads are not recommended for the pipe wall. The depth of travel of the cutter as the threads are cut must be carefully adjusted in order to ensure the proper insertion of the corporation stop—with 2-3 threads showing after an insertion torque of 27-35 ft.-lbs. (36.6-47.5 newton meters).

Corporation Stop: The corporation stops should be AWWA tapered with thread complying with AWWA C800 in sizes $\frac{5}{8}$, $\frac{3}{4}$ and 1 inch. When sizes larger than 1 inch are required, tapping saddles or sleeves should be used.

PROCEDURES

Planning the Direct Tap:

- Only AWWA C900 Class 150 and 200 PVC pipes 6" (150mm) through 12" (300 mm) can be direct tapped.
- Taps up to 1-inch maximum can be made directly (i.e. $\frac{5}{8}$ ", $\frac{3}{4}$ " and 1").
- Wet taps or dry taps (pipe filled or pipe empty) are allowed. Wet taps are preferred.
- The maximum allowable pressure in the pipe at the time the wet tap is being completed is the rated pressure class of the pipe (i.e. DR 18, PC 150; DR 14, PC 200).
- Corporation stops must have AWWA C800 thread. Iron pipe threads are not recommended for the pipe wall.
- Use a combination core drill and tap when tapping direct.
- Recommended temperatures:
 - Successful tapping can be accomplished at any temperature in which personnel and equipment can reasonably operate.
 - Operators should note that PVC pipe becomes less resistant to impact at very low temperatures. Extra care

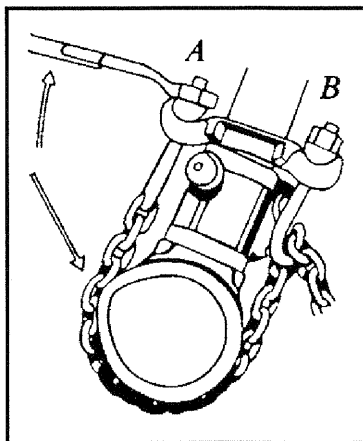
should be exercised in handling equipment and in cutting. At very high temperatures, PVC pipe becomes more flexible, and thus more susceptible to over-tightening of tapping machines or saddles.

- Placement
 - Tap not closer than 24 in. (600 mm) from both the back of the bell and the spigot insertion line.
 - Stagger multiple taps and keep them at least 18" (450 mm) apart lengthwise.
 - Avoid tapping into a discolored surface.
 - Do not tap a curved pipe if the radius of the bend is less than 300 times the pipe outside diameter.
- Do a test tap in the shop before starting field tapping.
 - Do a couple of dry bench taps to establish the mark on the boring bar corresponding to the correct tapping depth.
 - Firmly seat the cutter in the holder of the tapping machine. Secure it well. Any wobbling or looseness of either the cutter or the boring bar will cause problems.
 - Make a final check of thread compatibility. AWWA C800 threads are required for both the tap and the corporation stop.
- Observe basic tapping precautions when tapping pressurized pipes:
 - Have a second worker close by.
 - Wear protective goggles.
 - Provide a quick exit.
 - Cover the pipe area with a protective blanket (without obstructing machine operation).
 - Follow local regulations.

When tapping pressurized pipes, the personnel on the surface should have a clear understanding of the valve operation necessary to isolate the tapping site, if required to do so.

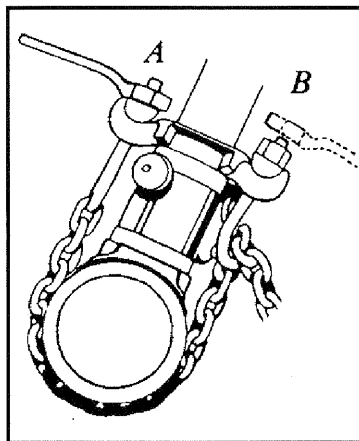
Mounting the Machine

WRONG



Over-tightening only one side may distort wall and stress pipe. Never use wrench extensions.

RIGHT



Both sides evenly tightened using only the wrench supplied.

Make sure the outside diameter of the pipe (listed below) falls within the range of O.D.'s for which the tapping machine saddle is designed.

Nominal Pipe Size	Pipe O.D.
6	6.90 in.
8	9.05 in.
10	11.10 in.
12	13.20 in.

The machine should sit on the drilling site firmly, but not in a way that will set up wall stresses by distorting the pipe. The actual placement of the tapping machine on the pipe is to be done in accordance with the recommendations of the machine manufacturer.

Even when taps are being made on the horizontal plane (the preferred location because it keeps the gooseneck of the service pipe as far below the frostline as possible) it is important that the tightening nuts be turned down evenly on each side.

Follow this procedure:

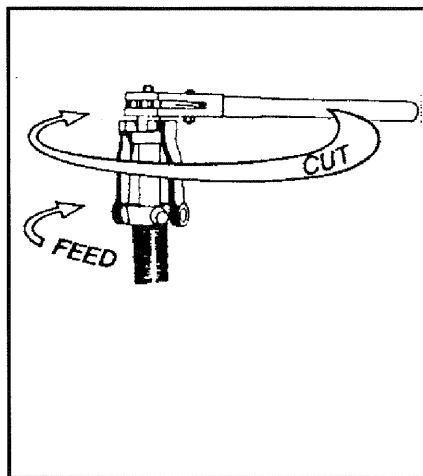
- Adjust the nuts on the chain hooks so that they are even with the tops of the threads.
- Position the chain hooks on the machine and loop the chain links into the hooks snugly.
- Tighten nuts A and B alternately so that the same number of threads are showing when the machine is correctly and firmly mounted.
- During the process make sure the machine remains correctly seated in the saddle and saddle gasket.

Overtightening on only one side may distort the wall and set up wall stresses.

Wrench extenders should not be used.

Cutting the Hole and Tapping the Threads:

RIGHT



Feed lightly—just enough to keep the cutter engaged.

PVC is easy to machine. So it is a temptation to overfeed the cutter because it is comparatively easy to turn the ratchet handle. The principle is to allow the cutter to work as a cutter. Rotate the ratchet handle one complete turn for every $\frac{1}{8}$ turn of the feed yoke.

The feed rate should be less in cold weather. Judge the correct feed rate by “finger pull”—the effort should be about the same as used to open a desk drawer. This rule of thumb applies in any temperature.

Upon wall penetration the upward thrust on the boring bar (assuming a pressurized pipe) will be about 1 lb.-force per 1 psi of water pressure.

Use the feed yoke to engage the first few turns of the tapping tool in the hole. After this the tap is self-feeding and the feed yoke can be disengaged from the boring bar.

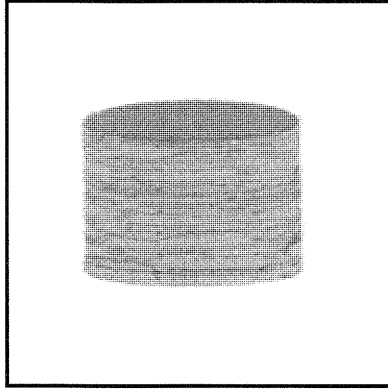
The “Cast Iron” mark on the boring bar is not a reliable indicator of how deep to tap. Tapping to the correct depth is important and should be determined by performing bench tests in advance and carefully noting the position of the top of the threaded feed sleeve, relative to the thrust collar or other datum point, when the corporation stop is correctly inserted.

As the tapping tool is reversed out of the hole, re-engage the feed yoke or hold the boring bar until the tap clears the threads. Release the bar slowly so as not to damage the threads, or injure the machine operator.

Examine the coupon of PVC after it is knocked out of the cutter head. A clean edge means good cutting action. A raised crown means the cutter was fed through too fast.

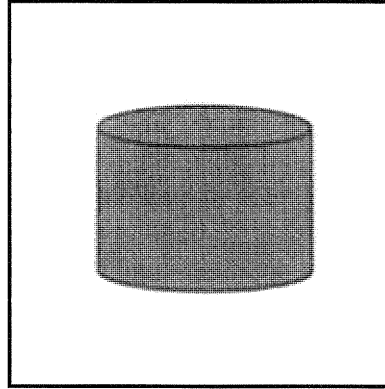
If the cutter is fed too fast, a plug of material is pushed out of the I.D. of the pipe where the tool emerges. The condition of the “coupon” provides a check of correct tapping procedure.

WRONG



Rough striations indicate a dull cutter or too rapid feed.

RIGHT



Clean edge means good cutting action.

At the first sign of a “crown” on the coupons, the tapping procedure or the condition of the tools should be re-examined and corrected before more taps are attempted. Scored edges or melted plastic indicates a dull tool or too rapid feed.

Inserting the Stop:

Attach the E-Z screw plug to the end of the boring bar. Screw the corporation stop into the E-Z release plug. The exposed end of the main stop will be the inlet end with tapered (AWWA) threads. Check to BE SURE THE STOP IS CLOSED.

Apply two spiral wraps of “Teflon ” tape clockwise to the AWWA threads. Other thread lubricants are not recommended. Do not use liquid sealants (even though they may contain Teflon).

Replace the boring bar assembly in the machine and insert the stop into the main. Use care to start the first few threads in the hole so that they are not forced or punched. Using the feed yoke for this operation requires only light finger pressure on the feed nut while the ratchet handle is rotated.

Disengage the feed yoke and remove the ratchet handle as soon as the stop has firmly engaged the threads in the pipe wall. Complete the insertion using a torque wrench.

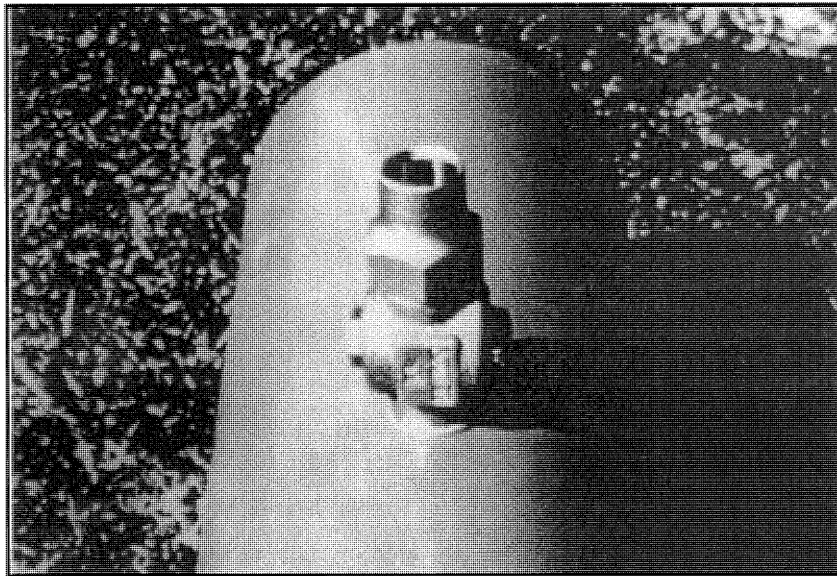
Tighten the stop to 27 foot-pounds (36.6 newton meters).

Snap the wrench counterclockwise to release the E-Z plug from the stop. Remove the tapping machine in the usual way.

If there is leaking past the threads, tighten the stop to 35 foot-lbs. (47.5 newton meters). At correct insertion, 2-3 threads should be visible.

If leaking past the threads persists, remove pressure from the line, unscrew the main stop to clear away cuttings and replace the stop to 27 foot-lbs. (36.6 newton meters), making sure the "Teflon " thread lubricant has been restored.

Direct Dry Tapping:



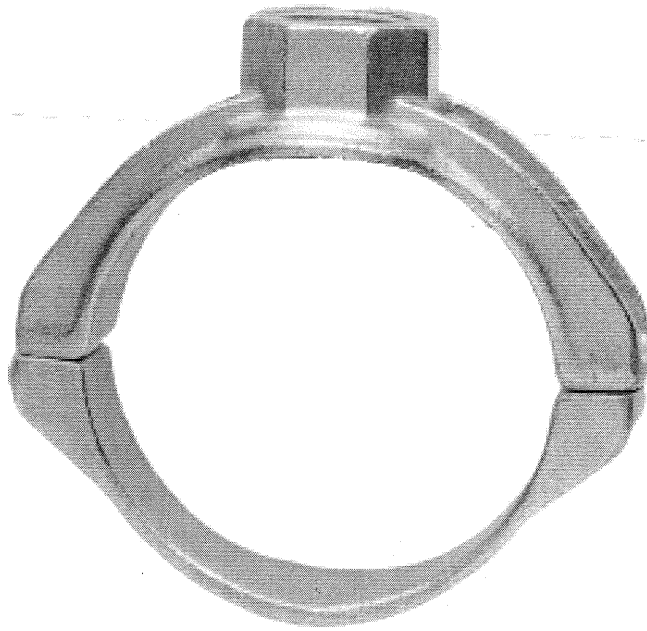
When direct tapping AWWA C900 DR 18 Pressure Class 150 or DR 14 Pressure Class 200 PVC pipe 6"-12" that is empty, or not in service, or not yet under pressure, the procedure given for making wet taps under pressure should be followed with a few exceptions:

- Remove the machine from the pipe after the hole has been drilled and tapped. Carefully remove the cuttings from the hole before inserting the main stop.
- Prepare the stop as described in "Inserting the Stop" and insert it by hand. Caution: Take special care not to crossthread the fine, "Teflon" wrapped AWWA C800 threads.
- Tighten the stop to the point where 2-3 threads are showing at 27 foot-lbs. (36.6 newton meters).

SADDLE TAPPING

GENERAL

The use of saddles to make taps in PVC pressure pipe can be recommended for any size or class of pipe. Service connections may be made using a service clamp or saddle. Maximum outlet size recommended with service clamps or saddles is 2 inches (50 mm). When making this type of connection, equipment is used which attaches to the corporation stop permitting a cutting tool to be fed through the corporation stop to cut a hole in the pipe. No tapping of the pipe wall is required since the corporation stop is threaded into the service clamp.



EQUIPMENT

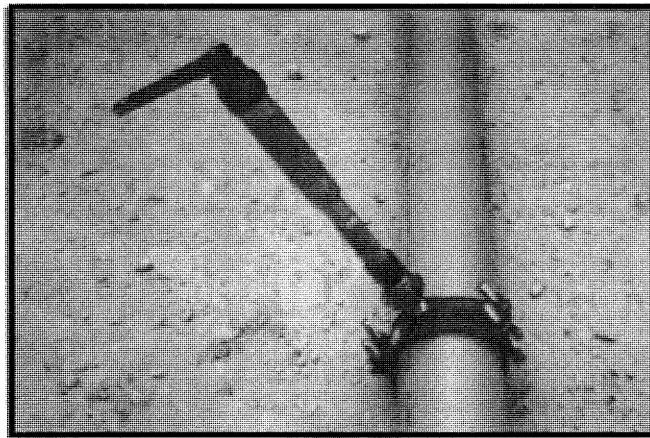
Service Clamps or Saddles: Service clamps or saddles used for attaching service connections to PVC water pipe should:

- Provide full support around the circumference of the pipe.
- Provide a bearing area of sufficient width along the axis of the pipe, insuring that the pipe will not be distorted when the saddle is tightened. For taps up to 1 in. (25 mm), a minimum of 2 in. (50 mm) total width along the axis of the pipe is required. Taps 1¼ in. (32 mm) through 2 in. (50 mm) should have a minimum 3 in. (75 mm) total band-width with full circumferential support.

Service Clamps should not:

- Have lugs that will dig into the pipe when the saddle is tightened.
- Have a U-bolt type of strap that does not provide sufficient bearing area.
- Have a clamping arrangement that is not fully contoured to the outside diameter of the pipe.

Tapping Machine: A number of tapping machines are available which will cut through a corporation stop. The tapping machine may vary in design and operation depending on the specific machine manufacturer. The machine must operate with a cutting tool which is classified as a core cutting tool (with slots) of the shell design suitable for PVC pipe. The tapping machine shall provide a standard ratchet handle on the boring bar and be of a design such that cutting and tapping are controlled by feed nut and yoke. **IN NO CASE SHOULD A HAND-HELD DRILL BE USED.**



Cutting Tool: This tool shall be of a shell-type design, have a minimum of two slots, shall retain the cut coupon after penetrating the PVC pipe wall, and be designed to accommodate walls as heavy as DR 14 (pressure class 200, AWWA C900).

Many shell cutters are designed only for thin walled PVC. Consequently, they do not have sufficient throat depth to handle the heavier walled pipe. **DO NOT DRILL A HOLE IN PVC PIPE WITH A TWIST DRILL OR AUGER BIT.** The shank of the cutter must be adaptable to the cutting machine being used.

Corporation Stop: Because the corporation stop is inserted into the service clamp or saddle, it must have threads which match that of the clamp or saddle, which may be either IPS O.D. or C.I.O.D.

The maximum size of corporation stop which may be used with a service clamp or saddle is 2 inches. If a tap larger than 2 inches is required, a tapping sleeve and valve are required.

PROCEDURES

Evenly tighten the saddle to the pipe, taking care not to exceed the torque recommendations of the saddle manufacturer. Screw the inlet side of the main stop into the saddle threads. Retain the stop hardware as supplied.

Open the main stop. Using the appropriate adapter and gasket, attach the drilling machine to the main stop outlet threads. Use a machine with an operator-controlled feed rate. The use of a core drill is essential. Follow the machine manufacture's instructions.

Lower the boring bar to the main and rotate the cutter while exerting finger-pull on the feed handle. The principle is to allow the cutter to work as a cutter. Rotate the ratchet handle one complete turn for every $\frac{1}{8}$ turn of the feed yoke. Withdraw the cutter, close the main stop and remove the drilling machine.

TAPPING SLEEVE AND VALVE

GENERAL

Tapping sleeves and valves are used when service connections larger than 2 inches (50 mm) must be made in PVC water main. Tapping sleeves may be used for making large taps under pressure. The use of tapping sleeves and valves to make taps in PVC pressure pipe can be recommended for any size or class of pipe. When making this type of connection, equipment is used which attaches to the valve permitting a cutting tool to be fed through the valve to cut a hole in the pipe. No tapping of the pipe wall is required since the valve is attached to the tapping sleeve.

EQUIPMENT

Tapping Sleeves and Valves: When tapping sleeves are ordered from the manufacturer, the outside diameter of the pipe being tapped, the size of the outlet desired and the working pressure should be specified to insure that the sleeve furnished will be satisfactory. Lead-joint sleeves should not be used.

Tapping sleeves should:

- Provide full support around the circumference of the pipe.

Tapping sleeves should *not*:

- Distort the pipe when tightened.
- Have lugs that will dig into the pipe when the sleeve is tightened.
- Have a clamping arrangement which is not fully contoured to the outside diameter of the pipe.

When ordering tapping valves, dimensions and attaching mechanisms consistent with the tapping sleeves should be specified.

Cutting Tool: A toothed core cutter which retains the coupon, similar to those used for other materials, should be used. The cutter should have sufficient throat depth to cut heavy walled PVC, such as DR 14.

Tapping Machine: A number of tapping machines are available which will cut through a tapping valve. The tapping machine may vary in design and operation depending on the specific machine manufacturer. The tapping machine must be attached to the valve and must be ordered according to the valve specified. Tapping equipment can be purchased or rented from sleeve manufacturers who furnish instructions and/or instructors trained in making such taps. (Contractors who specialize in this type of work are also available in some areas.) **IN NO CASE SHOULD A HAND-HELD DRILL BE USED.**

PROCEDURES

The tapping sleeve should be assembled on the pipe in accordance with the manufacturer's directions, insuring that no pipe distortion occurs. The tapping valve is then connected to the sleeve.

Tapping sleeves should be well supported independently from the pipe during the tapping. Support used should be left in place after tapping. Thrust blocks should be used as with any other fitting or appurtenance.

Attach the drilling machine and adaptor to the valve outlet flange. Position the necessary support blocks. Open the tapping valve, advance the cutter and cut the hole into the main through the sleeve. Retract the cutter and then close the tapping valve. Remove the drilling machine and attach the new line or lateral.

FREQUENTLY ASKED QUESTIONS

Q. Can you tap PVC pipe under pressure?

A. *Yes, and it is preferable because it allows you to make sure the corporation stop threads (and the corp. stop itself) do not leak in service.*

Q. When we run out of Teflon tape thread sealant, what can we substitute?

A. *We're certain about this: There is **no** substitute for Teflon tape! Keep extra supplies on hand.*

Q. We think we've followed your recommendations, but we had a tapping failure. What went wrong?

A. *Decades of experience with direct tapping of PVC pipes show that the incidence of failures is virtually zero. When problems do occur they can usually be traced to three general causes:*

- 1. The use of the wrong tools (see pages 3 and 4).*
- 2. Taking short cuts—failure to prepare for the job (see page 5).*
- 3. Wrong approach. Feeding the cutter too fast (see pages 9 and 10)*

Q. How about direct taping PVC pressure pipes 14" or over? For air release valves, for example?

A. *We recommend that a saddle be used for taping pipe 14" and larger.*



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UNI-B-8-00

RECOMMENDED PRACTICE FOR THE DIRECT TAPPING OF POLYVINYL CHLORIDE (PVC) PRESSURE WATER PIPE (NOMINAL DIAMETERS 6-12 INCH)

June 2000

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Recommended Practice for the

DIRECT TAPPING OF POLYVINYL CHLORIDE (PVC) PRESSURE WATER PIPE (NOMINAL DIAMETERS 6-12 INCH)

SECTION 1 – SCOPE

This recommended practice specifies general procedures for direct tapping PVC pressure water pipe (AWWA C900), but is subject to other limitations as may be specified by the pipe manufacturer in its installation instructions concerning the direct tapping of PVC water pipe. This recommended practice is not intended to serve as a design guideline. The general procedure recommended for installation of a corporation stop in PVC water pipe will vary depending upon the type of tapping equipment used. Recommendations include: PVC pipe products which may be direct tapped, required corporation stop design and maximum permissible size, temperature limitations, direct tapped connection placement and procedures for installing direct tapped connections.

SECTION 2 – DEFINITIONS

2.1 PVC PRESSURE PIPE FOR WATER

Polyvinyl Chloride (PVC) pipe manufactured in accordance with AWWA C900, AWWA Standard for polyvinyl chloride (PVC) pressure pipe for water. Only PVC pipe manufactured to this specification is considered in this recommended practice.

2.2 CORPORATION STOP

Device used to provide connection between water service pipe and the water main. The device is provided with a built in valve, which can be turned to shut off flow from the water main into the service line. The corporation stop shall be provided with AWWA tapered thread only as specified in AWWA C800, Threads for Underground Service Line Fittings.

2.3 DIRECT TAPPING

Insertion of a corporation stop into a water main, normally while the main is in service and under pressure. Direct tapping under pressure is

commonly termed a “wet connection” or “hot tap.” Direct tapping when the water main is not in service or under pressure is commonly termed a “dry connection” or “dry tap.”

2.4 TAPPING EQUIPMENT

2.4.1. TAPPING MACHINE

Mechanical device used to install direct-tapped connection into water mains. The tapping machine may vary in design depending on the specific machine manufacturer. The tapping machine shall be of a design where cutting and tapping are controlled by a yoke and either a feed nut or feed screw.

2.4.2 CUTTING/TAPPING TOOL

Device specifically designed for cutting a hole through PVC pipe and then cutting threads into the pipe wall. The cutting/tapping tool must be a core-cutting tool with double slots to allow the cut material to exit the hole. The tool must retain the cut coupon after penetrating the wall of the pipe.

SECTION 3 – COMPONENT MATERIALS

As specified in Section 1 – Scope, the component materials for which this recommended practice applies are as follows:

3.1 PVC PRESSURE PIPE

PVC Pressure Pipe manufactured in accordance with AWWA C900 only in Pressure Classes 150 or 200 and only in nominal diameters 6 through 12 inch.

3.2 CORPORATION STOP

Corporation stops in sizes 5/8, 3/4, and 1 inch with AWWA tapered thread complying with AWWA C800.

SECTION 4 – APPLICATION LIMITATIONS

4.1 TEMPERATURE

Temperature of the pipe wall to be direct tapped will affect the tapping operation. The colder the

pipe wall becomes, the more care shall be exercised to ensure against impact damage. The hotter the pipe wall, the more care shall be exercised to avoid deformation of the pipe (See Section 5).

4.2 PLACEMENT

In general, the direct tap connection shall be at least 24" (600 mm) from both the back of the bell and the spigot insertion line. The following specific restrictions shall be observed:

4.2.1 Multiple Tap: For two or more taps on one length of PVC pipe, direct tapped connections shall be no closer than 18 inches (460 mm) to each other measured longitudinally and shall be alternately offset at least 45 degrees from one another on lines parallel to the longitudinal axis of the pipe.

4.2.2 Surface Condition: Select the tapping site to be sure of clean, reasonably blemish-free surface. Avoid areas where surface imperfections might allow leaks between the pipe and the saddle gasket of the tapping machine after normal chain tightening. Avoid tapping into discolored portions of the pipe surface.

4.2.3 Bending: Do not place a direct tap where PVC pipe has been bent to a radius of curvature less than the recommended minimum of 300 times the nominal pipe size.

SECTION 5 – RECOMMENDED PROCEDURE

5.1 DIRECT TAPPING – WET CONNECTION

The following procedures shall be followed when installing a direct tapped connection in a water main, which is in service and under pressure.

5.1.1 Pre-operation Inspection: Prior to initiating tapping procedures, inspect the PVC pipe and corporation stop to insure use of component materials acceptable for direct tapping. Inspect the direct tapping machine and cutting/tapping tool to insure use of acceptable, well maintained equipment. The cutting/tapping tool must be sharp, without apparent damage, and have a throat depth greater than the wall thickness of the pipe. The tap threads must match the corporation stop AWWA threads.

5.1.2 Bench Testing: It is recommended that "bench" tests of the direct tapping procedure be conducted prior to installing a direct tapped wet connection in a live water main. Through "bench" testing the operator will: (1) develop familiarity with the tapping machine and the component materials, (2) determine the proper depth to which he should tap and (3) gain valuable operating experience. The tap depth is correct if one to three (1-3) threads remain showing on the corporation stop in a completed direct tapped connection, with an insertion torque of about 27 foot-pounds.

5.1.3 Placement of Tapping Machine: Adequate workspace to safely and efficiently perform the tap should be provided and is somewhat dependent on size of pipe and size of tap. This provision will also allow for verification of needed pipe and placement information (e.g. DR, distance from bell-end, bending radius, etc.). The tapping machine shall be placed on the pipe in accordance with recommendations of the machine manufacturer. During placement and preparation, avoid stripping or damaging threads. Insure that the boring bar does not wobble. Both sides of the mounting chain or strap shall be tightened equally, thereby preventing deformation of the PVC pipe. Avoid over-tightening which causes obvious deformation of the pipe. Failure to tighten the mounting chain or strap properly could cause direct tapping failure.

5.1.4 Cutting Operation: The cutting operation shall be performed with a sharp shell-cutter tool. The operator shall perform the cutting operation without forcing the tool. Light one-finger pressure shall be applied on the feed nut. Excessive pressure on the feed nut can result in direct tapping failure. The cutting tool shall be lubricated prior to cutting to minimize any frictional heat generated. Follow the tool manufacturer's instructions and use only the lubricant supplied.

5.1.5 Tapping Operation: The tapping operation shall be accomplished immediately after the cutting operation. The proper depth of tapping shall be achieved based on investigation previously conducted with the tapping machine during "bench" testing. While performing the tapping operation, do not permit the feed nut to become over tight or to prevent the advance of the

tapping tool. The tap is self-feeding. It is recommended that the yoke be removed from the boring bar when two or three (2 or 3) threads have been cut in the PVC pipe.

5.1.6 Removal of the Cutting/Tapping Tool: Avoid damage to threads, and injury to the machine operator, during removal by restraining the boring bar with feed yoke or by holding down the boring bar and releasing it slowly. When withdrawing the cutting/tapping tool, the upward force is about one pound force per psi of line pressure. The plastic coupon shall be removed from the cutter.

5.1.7 Installation of Corporation Stop: The tapered thread on the corporation stop shall be spirally wrapped with two or three (2 or 3) layers of tetrafluoroethylene pipe thread tape (e.g., Teflon® Tape). No other sealant is recommended. Do not use any liquid thread sealants. The corporation stop valve shall be closed during installation. During insertion, insure that tapped threads in the pipe are not damaged. Tighten the inserted corporation stop using a torque wrench with a torque of 27 foot-pounds. Upon completion of installation, the torque wrench shall be snapped in a counterclockwise rotation to release the corporation stop from the release screw plug. Remove the tapping machine from the pipe. The tap depth is correct if one to three (1 to 3) threads remain showing on the corporation stop.

5.1.8 Post-operation Inspection: Inspect the completed direct tapped connection for leakage at the threads. If leakage is apparent, it is probable that cuttings have been caught in the threads during corporation stop installation. Using the torque wrench, tighten the corporation stop to a torque of 35 foot-pounds. If leakage remains apparent, the water main must be taken out of service. When pressure is shut off by main-line valves, the corporation stop shall be removed. The threads shall be cleaned. The corporation stop shall be again installed to a torque of 27 foot-pounds. After restoring water main pressure, again conduct post-operation inspection.

5.2 DIRECT TAPPING - DRY CONNECTION

When installing a direct tapped connection in a PVC water main, which is not in service or under pressure, procedures similar to those

recommended in Subsection 5.1 shall be used with the following exceptions:

5.2.1 Removal of Cuttings: The tapped hole shall be cleared of all cuttings prior to insertion of the corporation stop. The tapping machine must be removed from the pipe to permit proper cleaning of threads and clearing of cuttings.

5.2.2 Installation of Corporation Stop: Procedures established in 5.1.7 shall be followed; however, since alignment is not provided by the tapping machine, insure that cross-threading does not occur during insertion.

SECTION 6 - SAFETY PRECAUTIONS

6.1 TAPPING SAFETY PRECAUTIONS

When drilling or tapping any pressurized water pipe, basic safety precautions are advised to assure personal safety to the worker in the event of a sudden and unexpected pipe failure. Although such failures are extremely infrequent, nevertheless, the following safety precautions are recommended:

6.1.1 Second Worker Present: When drilling or tapping pipe under pressure, a second worker or supervisor should be present in the immediate vicinity.

6.1.2 Clothing and Eye Protection: In addition to normal protective clothing, goggles, or a face shield should be worn.

6.1.3 Quick Exit Available: Provide a sturdy ladder in place, in the immediate work area for quick exit.

6.1.4 Protective Blanket: The exposed pipe in the area of the tap or saddle should be covered with a heavy protective blanket. The protective blanket should be approximately 4 x 6 feet in size and should have a hole in the center to permit installation and operation of the tapping or drilling machine.

6.1.5 Isolation Procedure: The supervisor or an appointed member of the surface crew should in each case be familiar with the appropriate valve operations required to isolate the tapping site.



PROVIDING MORE

Construction Standards

Section 02519 Product Approval Procedures

January 2013



Section 02519 – PRODUCT APPROVAL PROCEDURES

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Section 02519 – PRODUCT APPROVAL PROCEDURES

1. GENERAL

1.1 SCOPE

This section covers the procedures for the approval of products to be used in Edmonton's potable water distribution system. The information has been broken down into the following segments:

- Product Approval Procedures, which shall act as guidelines for processing applications from manufacturers or distributors who wish to have their product approved;
- Product Evaluation Form, which is to be completed by the manufacturer or distributor prior to their application; and
- Approved Products List, which is updated by EPCOR to show the products approved for use in the City of Edmonton.

2. PRODUCT APPROVAL PROCEDURES

2.1 APPLICATION

The manufacturer or distributor is to submit a Product Evaluation Form along with a covering application letter to Product Approvals, Network Services and Operations, EPCOR Water Services.

The applicant shall:

- Provide permanent representation in the province of Alberta for the product under consideration;
- Co-operate in the submission of product documentation necessary to evaluate the product;
- Assume all incidental costs (such as testing by a third party) to demonstrate compliance with EPCOR Water specifications; and
- Attach all drawings, photographs, catalogues, warranties, notarized affidavits of compliance, etc.

2.2 REVIEW

EPCOR will review the suitability of the product by:

- a) soliciting comments from sections within the corporation
- b) reviewing all promotional details provided by the manufacturer/distributor
- c) soliciting comments from agencies outside of the corporation such as:
 - 1) The City of Edmonton Construction Branch
 - 2) The City of Edmonton Materials Engineering
 - 3) Testing Agencies
 - 4) Private Contractors
 - 5) Other Municipalities
- d) meeting with suppliers as necessary
- e) conducting field trials or pilot installations

2.3 APPROVAL/REJECTION

2.3.1 Approval can be granted to a product on a temporary, conditional, or trial basis based on the results of the review. All approvals will be communicated via written notification to the requesting manufacturer or distributor. Copies of this notification will also be forwarded to the EPCOR Supply Chain Management, the City of Edmonton and other interested parties when required.

2.3.2 EPCOR reserves the right to reject any product submitted for approval based on inadequate results or suitability discovered during the review process. Rejection of a product along with a full explanation will be communicated to the requesting manufacturer or distributor via written notification.

2.3.3 Temporary, conditional or trial approval will be issued in writing with a start and end date. Prior to the end date documented trial results and field experience will be gathered and reviewed. At the end date

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following the review, a permanent approval, a rejection, or a further temporary, conditional or trial approval may be issued.

2.4 APPEALS

- 2.4.1** All requesting manufacturers or distributors have the right to appeal the rejection of their product. An appeal can be made by forwarding supporting evidence along with a cover letter that rebuts the statements made in the letter of rejection. Upon receiving this letter, EPCOR will review the product again, and issue a written decision.
- 2.4.2** If a product is accepted upon appeal, a temporary or conditional approval will be issued for a 1-year time frame. After this period, a review will occur at which time a permanent approval may be issued.
- 2.4.3** If a product is rejected upon appeal, the manufacturer or distributor cannot re-submit the same product for approval unless a three year time period has passed and there has been significant upgrades to the product that warrant a new review, by EPCOR's judgement.

2.5 REQUIRED NOTIFICATION

EPCOR Water Services must be notified by the manufacturer or distributor of any change to an approved product. This includes, but is not limited to, a change in the following:

- material, available diameter or performance rating;
- manufacturing process;
- design or configuration;
- part number; or
- availability.

Significant changes may result in the need for a new evaluation, review and approval.

2.6 REMOVAL OF A PRODUCT FROM THE APPROVED MATERIALS LIST

EPCOR Water services reserves the right to remove any product from the approved materials list that

- a) No longer meets the current standards;
- b) Has, after initial approval, undergone a change to design or configuration that renders the product incompatible with other EWSI approved products;
- c) Has received numerous documented complaints from contractors or staff;
- d) Is found to be below the standard of similar products that are readily available; or
- e) Is no longer reasonably available.

The applicable supplier will be contacted in writing prior to product removal in order to provide them with the opportunity to respond to complaints, comments or issues. The applicable supplier will be provided with documentation supporting the decision to remove the product from the list.



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3. PRODUCT EVALUATION FORM

PRODUCT INFORMATION

Product Name: _____
Model No: _____
Manufacturer Name: _____
Manufacturer Address and Phone #: _____
Manufacturer Part Number: _____

Description (size(s), weight(s), material composition, etc. or attached brochure/promotional materials):

Use:

Year Items in Production:

Availability (typical delivery, local distributors, etc.):

Field Support (expertise, experience):

Has this product ever been used in the City distribution/transmission main system: Y/N

If so, state project and date:

General Comments (include any information which may effect the operation, maintenance, or installation of the product, safety aspects, advantages, cost effectiveness vs. benefits derived, etc.):



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Performance History References (municipalities > 100,000 population approving use of this product)

City:	City:
Name:	Name:
Phone	Phone
City:	City:
Name:	Name:
Phone	Phone

PRODUCTION STANDARDS

Standard(s) complied with – Manufacturing, Installation, Field Tests, (include AWWA, CSA, ASTM, NSF, etc.):

Certification for Potable Water Service (NSF standard No. 14, 61, etc.):

Production Standards of component material(s) (if applicable):

Notarized Affidavit(s) of compliance available? Y/N
Warranties Available? Y/N

Warranty Duration: _____

Comments:

Installation Procedure Used (if applicable):

Specialized Equipment Required: _____



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Availability and terms of reference for installation/maintenance training to City Employees:

Inspection Required:

Corrosion Protection Recommended (if applicable):

Compatibility of components with similar products:

MAINTENANCE DETAILS

Required Maintenance: (Calibrations – Who does it? What training is required?)

Specialized Equipment Required:

Parts Availability (specify typical delivery periods):

Comments (include capabilities of your firm to undertake repairs, provision of spare parts and on site technical expertise. Please specify resources and time frames):

QUALITY CONTROL

Manufacturer's Testing Procedures

Test Types and Frequencies:



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Test Result Availability: _____

How long are records kept: _____

Terms of reference for plant inspection:

Independent Test(s) conducted:

By: _____

Address: _____

Phone: _____

Availability of Test Data: _____

Comments:

Certified by:
(Manufacturer)

Name: _____

Company: _____

Position: _____

Phone No: _____

Fax No: _____

Date: _____

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4. Approved Product List

Table 1 Polyvinyl Chloride (PVC) Water Pipe

Manufacturer	Model/Type	Size (mm)	Remarks
IPEX	Blue Brute	100 to 300	AWWA C900, DR18, C.I.O.D.
IPEX	Terra Brute	100 to 300	AWWA C900, C.I.O.D. directional bore and casing applications
IPEX	Centurion	350 to 900	AWWA C905, DR25, C.I.O.D.
IPEX	Centurion	950 to 1050	AWWA C905, DR32.5, C.I.O.D.
IPEX	Fusible Brute*	100 to 400	AWWA C900, DR18, C.I.O.D.
Next Polymer [ex-Rehau]	AQUALOC	100 to 300	AWWA C900, DR18, C.I.O.D.
Royal Pipe Systems	Royal Seal C900	100 to 300	AWWA C900, DR18, C.I.O.D.
Royal Pipe Systems	Royal Seal C905	350 to 450	AWWA C905, DR18, C.I.O.D.
Royal Pipe Systems	Cobra Lock	100 to 300	AWWA C900, C.I.O.D., directional bore and casing applications
Northern Pipe Products Inc.	C900	100 to 300	AWWA C900, DR18, C.I.O.D.
Northern Pipe Products Inc.	C905	350 to 750	AWWA C905, DR25, C.I.O.D.

*On a project specific basis only

Table 2 Polyethylene (PE) Water Pipe *

Manufacturer	Model/Type	Size (mm)	Remarks
Driscopipe	4000 or 4100	All	AWWA C906 DR11
KWH Pipe	Sclairpipe	100 to 1200	AWWA C906 DR11

* On a project specific basis only

Table 3 Concrete Steel Cylinder Water Pipe

Manufacturer	Model/Type	Size (mm)	Remarks
Hyprescon	Hyprescon C303	450	AWWA C303
Hyprescon	Hyprescon C301	600 to 1350	AWWA C301

Table 4 Ductile Iron Water Pipe *

Manufacturer	Model/Type	Size (mm)	Remarks
Canada Pipe	Tyton Joint	150 to 600	AWWA C151

* On a project specific basis only

Table 5 Lubricants

Manufacturer	Model/Type	Remarks
J.C. Whitlam Manufacturing Co.	Blue Lube Pipe Gasket Lubricant	NSF 61 Paste
G.P. Chemicals	Rehau Pipe Lubricant	NSF 61 Paste
G.P. Chemicals	Pipe Lubricant	NSF 61 Paste
G.P. Chemicals	Ipx Pipe Lubricant	NSF 61 Paste
Liquid Ease*	One Bolt Fitting Lubricant	Spray
Robar	Slykstix	NSF 61 Spray

* For use on one-bolt fittings only. This product is not a pipe lubricant.

Table 6 Couplings (PVC)

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Manufacturer	Model/Type	Size (mm)	Remarks
CertainTeed	HD	100 to 300	AWWA C900
Royal Pipe Systems	PVC Machined Repair Couplings	250, 300	AWWA C900 Min DR 14, rated DR18
IPEX	Blue Brute	100 to 300	AWWA C907
Royal Pipe Systems	PVC Coupling (Harco)	100 to 200	AWWA C907
IPEX	PVC Tapped Couplings	150 to 200 x 20 to 50 Single or double tap	AWWA C907 Injection Moulded
IPEX	PVC Repair Couplings (without pipe stop)	100 to 300	AWWA C907 Injection Moulded
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Reducer Couplings DR18	200 to 600	CSA B137.3 Up to 4 sizes of reduction only.
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Repair Couplings (without pipe stop) DR18	350 to 600	CSA B137.3
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Reducer Couplings DR25	762 to 914	CSA B137.3 Up to 4 sizes of reduction only.
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Repair Couplings (without pipe stop) DR25	762 to 914	CSA B137.3

Table 7 Bolted Sleeve Couplings and Adaptors

Manufacturer	Model/Type	Size (mm)	Remarks
Besco	Dresser Style 38	Up to 1800 +	AWWA C219
Canada Pipeline Acc.	CDB	100 to 300	AWWA C219
Canada Pipeline Acc.	200	100 to 1350	AWWA C219
Canada Pipeline Acc.	Quantum Model 461	100 to 300	AWWA C219
EBAA Iron Works	Series 3800	100 to 300	AWWA C219
Glynwed Pipe Systems	GPS Couplings	50 to 600	AWWA C219
Hymax	2000	100 to 600	AWWA C219
Mueller	MaxiRange	100 to 400	AWWA C219
Robar	1500 Series	100 to 600	AWWA C219 Epoxy Coated. T304 SS Fasteners
Robar	Vantage	100 to 300	AWWA C219 Epoxy Coated. T304 SS Fasteners
Robar	1800 Series	Up to 1800 +	AWWA C219 Epoxy Coated. T304 SS Fasteners
Robar	1900 Series	300 to 1350	AWWA C219 Epoxy Coated. T304 SS Fasteners
Robar	7500 Series FCA	100 to 300	AWWA C219 Epoxy Coated. T304 SS Fasteners
Robar	7900 Series FCA	100 to 600	AWWA C219 Epoxy Coated. T304 SS Fasteners
Romac	400	450 to 600	AWWA C219
Romac	FC 400	450 to 600	AWWA C219
Romac	TC 400	300 to 600	AWWA C219
Romac	501	100 to 600	AWWA C219
Romac	FCA 501	100 to 300	AWWA C219
Romac	Macro	100 to 300	AWWA C219

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Smith Blair	411	100 to 1350	AWWA C219
Smith Blair	413	100 to 600	AWWA C219
Smith Blair	441	100 to 300	AWWA C219
Smith Blair	912	100 to 300	AWWA C219
Smith Blair	913	100 to 600	AWWA C219
Viking Johnson	Maxifit	50 to 600	AWWA C219

Table 8 Water Main Fittings

Manufacturer	Model/Type	Size (mm)	Remarks
IPEX	PVC Tees Branch same dia. or smaller	Run: 100 to 200 Branch: 100 to 200	AWWA C907 Injection Moulded
IPEX	PVC Elbows	100 to 200	AWWA C907 Injection Moulded
IPEX	PVC plugs	100 to 300	AWWA C907 Injection Moulded
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Tees DR18 Branch same dia. or smaller	Run: 250 to 300 Branch: 100 to 300	CSA B137.3
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Tees DR18 Branch smaller dia. than run	Run: 350 to 600 Branch: 100 to 500	CSA B137.3 Branch same dia. as run NOT APPROVED
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Crosses DR18 Branch same dia. or smaller	Run: 150 to 300 Branch: 100 to 300	CSA B137.3
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Crosses DR18 Branch smaller dia. than run	Run: 350 to 600 Branches: 100 to 500	CSA B137.3 Branches same dia. as run NOT APPROVED
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Bends (90°, 45°, 22½°, 11¼°, 5°) DR18	250 to 600	CSA B137.3
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Caps DR18	100 to 600	CSA B137.2
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Plugs DR18	350 to 600	CSA B137.3
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Tees DR25 Branch smaller dia. than run	762 to 914	CSA B137.3 Branch same dia. as run NOT APPROVED
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Crosses DR25 Branch smaller dia. than run	762 to 914	CSA B137.3 Branches same dia. as run NOT APPROVED
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Bends (90°, 45°, 22½°, 11¼°, 5°) DR25	762 to 914	CSA B137.3
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Caps DR25	762 to 914	CSA B137.3
IPEX/ Royal Pipe Systems/ Galaxy Plastics	Fabricated PVC Plugs DR25	762 to 914	CSA B137.3
Royal Pipe Systems	PVC Plugs and Caps By Harco	100 to 200	AWWA C907 Injection Moulded
Royal Pipe Systems	PVC Elbows By Harco	100 to 200	AWWA C907 Injection Moulded
Royal Pipe Systems	PVC Tees By Harco	100 to 200	AWWA C907 Injection Moulded
Clow / McAvity	CI Water Main Fittings	100 to 300	AWWA C110

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Norwood Foundry	CI Water Main Fittings	100 to 600	AWWA C110
Sigma	CI Tyton Joint Fittings	100 to 600	AWWA C110
Terminal City	Grey Iron Fittings	100 to 900	AWWA C110
Tyler	Grey Iron Fittings	100 to 600	AWWA C110
One Bolt Inc.*	One Bolt Fitting	100 to 300	AWWA C111

* On a project specific basis only

Table 9 Butterfly Valves

Manufacturer	Model/Type	Size (mm)	Remarks
DeZurik	BAW	450 to 3000	AWWA C504
DeZurik	BAW	100 to 200	Air/Vacuum control
K Flow (Crispin)	500 Series	75 to 600	AWWA C504
K Flow (Crispin)	47 Series	750 and up	AWWA C504
M&H (Clow)	4500	100 to 600	AWWA C504
M&H (Clow)	1450	750 to 1200	AWWA C504
Pratt / Mueller	Lineseal / MKII, 2FII	450 to 500	AWWA C504
Pratt / Mueller	Lineseal / XR-70	600 to 3600	AWWA C504
Pratt / Mueller	Lineseal / HP-250	450 to 1350	AWWA C504
Pratt / Mueller	Lineseal / 2FII	100 to 200	Air/Vacuum control

Table 10 Gate Valves

Manufacturer	Model/Type	Size (mm)	Remarks
American AVK	Series 25	100 to 400	AWWA C509, NRS
Clow	McAvity/Solid Wedge	100 to 750*	AWWA C500, NRS
Clow	Resilient Wedge 2640	100 to 300	AWWA C509, NRS
Clow	Resilient Wedge 2638	350 to 450	AWWA C515, NRS
Mueller	RW A2360 / A2362	100 to 300	AWWA C509, NRS
Mueller	Resilient Wedge A2361	350 to 1200*	AWWA C515, NRS
Terminal City	Solid Wedge	100 to 300	AWWA C500, NRS
East Jordan Iron Wks	Resilient Wedge	100 to 400	AWWA C515, NRS
American Flow Control	RW Series 2500, 2500-1	100 to 1200*	AWWA C515, NRS

* Bevel Gear required for 600 mm & larger valves to allow horizontal installation.

Table 11 Check Valves

Manufacturer	Model/Type	Size (mm)	Remarks
Mueller	A 2600 / 52 SCS-1	100 to 300	or equivalent
APCO Willamette	5800, 5800B	450 to 1500	or equivalent
APCO Willamette	9000, 9000L	100 to 1500	or equivalent
APCO Willamette	300 Series	100 to 250	or equivalent
APCO Willamette	600 Series	100 to 1050	or equivalent
APCO Willamette	100 Series	100 to 600	or equivalent

Table 12 Automatic Air Valves

Manufacturer	Model/Type	Size (mm)	Remarks
APCO Willamette	50 Series	12 to 25	or equivalent
APCO Willamette	140 Series	10 to 75	or equivalent
APCO Willamette	143C to 151C	25 to 200	or equivalent
APCO Willamette	150 Series	100 to 750	or equivalent
APCO Willamette	200A Series	25, 50	or equivalent
ARI Flow Control Accessories	K, S and D Models	20 to 50	NSF 61

Table 13 Manual Air Valves

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Manufacturer	Model/Type	Size (mm)	Remarks
Crane	438	15 to 80	Full Port Bronze Gate Valve
Crane	1701	6 to 80	Full Port Bronze Gate Valve
Boshart	814	15 to 100	Full Port Bronze Gate Valve
Newman Hattersly	33	15 to 50	Full Port Bronze Gate Valve
Jenkins	310J	15 to 80	Full Port Bronze Gate Valve
Kitz	40	10 to 50	Full Port Bronze Gate Valve
Nibco	T - 113	8 to 80	Full Port Bronze Gate Valve
Toyo	206A	10 to 100	Full Port Bronze Gate Valve

Table 14 Pressure Reducing Valves

Manufacturer	Model/Type	Size (mm)	Remarks
Singer	106 PR	100 to 400	or equivalent

Table 15 Flow Control Valves

Manufacturer	Model/Type	Size (mm)	Remarks
Cla-Val Co.	Hytrol	10 to 900	or equivalent

Back-Flow Preventers

Where backflow prevention is required, in accordance with the Plumbing Code of Canada, and the City of Edmonton Waterworks Bylaw, backflow prevention devices shall be selected and installed in compliance with CSA Manual B64 (current edition).

Table 16 Insulation

Manufacturer	Model/Type	Pipe Size (mm)	Remarks
DOW	HI-40	N/AP	CAN/ULC-S701 25 mm to 100 mm thickness
Terrafoam	HS40	N/AP	CAN/ULC-S701 Expanded Polystyrene Up to 600 mm thickness
Owens Corning	FOAMULAR 400	N/AP	CAN/ULC-S701 25 mm to 100 mm thickness
Urecon	Pre-Insulated Pipe	150 to 300	Rigid Polyurethane Coating Certain restrictions apply
Urecon	Spray On Insulation	N/AP	For chamber vault applications

Table 17 Tapping Sleeves

Manufacturer	Model/Type	Size (mm)	Remarks
Ford	FAST	100 to 600	AWWA C207
Ford	FTSC	100 to 750	AWWA C207
JCM	415		AWWA C301, C303 Concrete Cylinder Pipe only
Robar	6000 Series	100 to 600	AWWA C223
Romac	FTS 420	150 to 750	AWWA C223
Romac	FTS 445		AWWA C223, Steel Pipe Only
Romac	SST Series	100 to 750	AWWA C223
Smith-Blair	600 Series 622 Series (Steel) 626 Series (Steel)	100 to 750	AWWA C223

Table 18 Fire Hydrants

Manufacturer	Model/Type	Size (mm)	Remarks
American AVK	2700 (Series)	150	AWWA C502
Canada Valve (Mueller)	Darling - Century	150	AWWA C502



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McCavity (Clow)	Brigadier (M67)	150	AWWA C502
Mueller	Modern Centurion	150	AWWA C502
East Jordan Iron Works	Watermaster (5CD250)	150	AWWA C502

Note: Most suppliers offer a modern or a heritage style body, with the same working parts.

Table 19 Expansion Joints

Manufacturer	Model/Type	Size (mm)	Remarks
Romac	EJ400	100 to 600	AWWA C221
Robar	8808	100 to 600	AWWA C221
Smith-Blair	611/612	100 to 600	AWWA C221

Table 20 Epoxy Coatings and Linings

Manufacturer	Model/Type	Size (mm)	Remarks
International Protective Coatings	Interzone 954	-	AWWA C210
Valspar	78 Series	-	AWWA C210
3M	Scotchkote 134	-	AWWA C213 and C550

Table 21 Plant Coatings

Manufacturer	Model/Type	Size (mm)	Remarks
Fusion Bonded Epoxy (FBE)		-	AWWA C116, NSF 61
Shaw Pipe	Yellow Jacket 1 External Coating	Up to 600	Steel and DI Pipe

Table 22 Tape Coatings (Cold Applied)

Manufacturer	Model/Type	Size	Remarks
Denso	Primer and Tape	-	AWWA C217
Interprovincial Corrosion Control	Primer, Mastic and Tape	-	AWWA C217
Polyguard	600 Primer & Tape	-	AWWA C209
Polyken	1027 or 1029 Primer and 930 Tape	-	AWWA C209
Polyken	YGIII Tape	-	AWWA C214
Premier Coating	Primer and LT Tape	-	AWWA C217
Renfrew	327 Primer and 303-35 Tape	-	AWWA C209, C214
Royston	747 Primer and Greenline Tape	-	AWWA C209
Trenton	Tec-Tape	-	AWWA C217

Table 23 Heat-Shrinkable Sleeves (Exterior Protection – Joints/Flanges/Fittings)

Manufacturer	Model/Type	Size (mm)	Remarks
Canusa - CPS	Aqua - Shield	-	AWWA C216 NACE Std. RP0303-2003

Table 24 Main Stops - Select connections to suit Service Tubing material

Manufacturer	Model/Type	Size (mm)	Remarks
Cambridge Brass	301Series	20 to 50	AWWA C800 Compression or Kitec ends
Ford	FB, QJ and QJNK Series	20 to 50	AWWA C800 Compression or Kitec ends
Mueller	B2500 Series	20 to 50	AWWA C800 Compression or Kitec ends

Table 25 Service Saddles (Includes Tapped Repair Clamps)

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Manufacturer	Model/Type	Size (mm)	Remarks
Cambridge Brass	810, 811, and 812 Series	Tapped Outlet 20 to 50 Pipe Size 100 to 300	AWWA C800 Service Saddles
Canada Pipeline Acc.	CR8	Tapped Outlet 20 to 50 Pipe Size 100 to 300	Tapped Boss Repair Clamp
Canada Pipeline Acc.	SC1	Tapped Outlet 20 to 50 Pipe size 100 to 300	AWWA C800 Service Saddle
Canada Pipeline Acc.	SC2	Tapped Outlet 20 to 50 Nom. Pipe OD 100 to 400	AWWA C800 Service Saddle
Robar	2406, 2408, 2506, 2616, 2626, 2706	100 to 600	AWWA C800 Service Saddles
Romac	200 Series	100 to 400	AWWA C800 Service Saddles
Romac	300 Series	100 to 750	AWWA C800 Service Saddles
Romac	SS1	Tapped Outlet 20 to 50	Tapped Boss Repair Clamp Single Bolt Assembly
Romac	SS2	Tapped Outlet 20 to 50	Tapped Boss Repair Clamp Double Bolt Assembly
Romac	SS3	Tapped Outlet 20 to 50	Tapped Boss Repair Clamp Triple Bolt Assembly
Smith-Blair	264, 265		Tapped Boss Repair Clamps
Smith-Blair	313, 317, 331, 325, 357	100 to 300	AWWA C800 Service Saddles
Smith- Blair	662, 663		AWWA C800 Tapping Sleeve

Table 26 Water Service Unions - Select connections to suit Service Tubing material

Manufacturer	Model/Type	Size (mm)	Remarks
Cambridge Brass	118 Series	20 to 50	AWWA C800 Compression or Kitec ends
Ford	Q and C Series	20 to 50	AWWA C800 Compression Ends
Mueller	110 Compression	20 to 50	AWWA C800 Compression or Kitec ends
Philmac	Universal Transition Coupling (UTC)	20 to 50	AWWA C800 Plastic Compression Coupling for all service tubing

Table 27 Polyvinyl Chloride (PVC) Service Pipe

Manufacturer	Model/Type	Size (mm)	Remarks
IPEX	Blue Brute	100	AWWA C900, DR18, C.I.O.D.
IPEX	Blue Brute	100	AWWA C900, DR14, C.I.O.D.
Next Polymers [ex-Rehau]	AQUALOC	100	AWWA C900, DR18, C.I.O.D.
Flex-Lox	Pressure Flex	100	AWWA C900, DR18, C.I.O.D.
Royal Pipe Systems	PVC C900	100	AWWA C900, DR18, C.I.O.D.

Table 28 Service Tubing

Section 02519 – PRODUCT APPROVAL PROCEDURES

Manufacturer	Model/Type	Size (mm)*	Remarks
Wolverine or Great Lakes	Type K	20 to 50	Third Party Certified to ASTM B88 NSF 61
Cerro	Type K	20 to 50	Third Party Certified to ASTM B88 NSF 61
Halstead	Type K	20 to 50	Third Party Certified to ASTM B88 NSF 61
IPEX	Q- Line PE-AL-PE	20, 25	AWWA C903, CSA-B137.10, NSF 61
Rehau	Municipex*	25 to 50	Cross Linked Polyethylene CSA B 137.5, NSF 61, NSF 14

* Select size by INTERNAL diameter, not by nominal diameter, see Section 02514.

Table 29 Curb Stops - Select connections to suit Service Tubing material

Manufacturer	Model/Type	Size (mm)	Remarks
Cambridge Brass	202 Series	20, 25, 40, 50	AWWA C800 Compression or Kitec ends
Ford	BH Ball Valves with QJ or QJNK Connection	20, 25, 40	AWWA C800 Compression or Kitec ends
Mueller	B-25209 Series	20, 25, 40, 50	AWWA C800 Compression or Kitec ends

Table 30 Service Boxes Including Chairs and Rods

Manufacturer	Model/Type	Size (mm)	Remarks
Norwood Foundry	Complete Service Box	20, 25	Conforms to Dwg 2514-03
Norwood Foundry	Complete Service Box	40, 50	Conforms to Dwg 2514-04
Trojan Industries	Complete Service Box	20, 25	Conforms to Dwg 2514-03
Trojan Industries	Complete Service Box	40, 50	Conforms to Dwg 2514-04
Westview Sales	Complete Service Box	20, 25	Conforms to Dwg 2514-03
Westview Sales	Complete Service Box	40, 50	Conforms to Dwg 2514-04

Table 31 Valve Casings and Middle Extensions

Manufacturer	Model/Type	Size (mm)	Remarks
Norwood Foundry	Type B (Screw)	-	Conforms to Dwg 2512-01 to -05
Trojan Industries	Type B (Screw)	-	Conforms to Dwg 2512-01 to -05
SIGMA	Type B (Screw)	-	Conforms to Dwg 2512-01 to -05
Westview Sales	Type B (Screw)	-	Conforms to Dwg 2512-01 to -05

Table 32 Pipe Casing Spacers

Manufacturer	Model/Type	Size (mm)	Remarks
APS	SIM	100 to 600	
APS	SI12	600 to 3000	
BWM	SS-8	100 to 600	Supplier: B&A Mfg.
BWM	SS-12	750 to 1500	Sizes >900 Consult Factory
PSI	Uni-Flange Restrained Casing Spacers	100 to 600	ASTM A536, ASTM A242, AWWA C111
PSI	Booster, A8GI, A12GI	-	-
PSI	Ranger Midi 65	150 to 300	65 mm runner height only
Raci		-	-

Table 33 CC Support Block

Manufacturer	Model/Type	Size (mm)	Remarks
Re-Plastics Ltd.		40x180x300, 40x140x300	



Section 02519 – PRODUCT APPROVAL PROCEDURES

Table 34 Alarms (Hatch)

Manufacturer	Model/Type	Size (mm)	Remarks
Municipal Solutions	HG (Hatch Guard)	N/AP	Remote intrusion alarm

END OF SECTION



PROVIDING MORE

Construction Standards

Section 02520 Water Meters

January 2013



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Section 02520 – WATER METERS

1. **GENERAL**

1.1 **SCOPE**

This section covers material and installation requirements for water meters up to 600 mm in size.

1.2 **PRODUCT ACCEPTANCE AND STANDARDS**

1.2.1 Products are to be in accordance with recognized standards, such as AWWA, CSA, ASTM or ANSI.

1.2.2 Water meters are to comply with the following standards:

- AWWA C700 - Cold Water Meters – Displacement Type, Bronze Main Case
- AWWA C701 - Cold Water Meters – Turbine Type, for Customer Service
- AWWA C703 - Cold Water Meters – Fire-Service Type
- AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold Water Meters
- AWWA C707 - Encoder-Type Remote Registration Systems for Cold-Water Meters
- AWWA C710 - Cold Water Meters – Displacement Type, Plastic Main Case
- International Organization of Legal Metrology (OIML) Standard for Mag Meters
- National Sanitation Foundation (NSF) Standard 14 - Plastics Piping System Components and Related Materials
- National Sanitation Foundation (NSF) Standard 61 - Drinking Water System Components - Health Effects
- National Sanitation Foundation (NSF) Standard 61 Annex G - 2008

1.2.3 Compliance with a standard requires:

- Certification from the supplier or manufacturer that the product meets the standard; and/or
- Testing in accordance with a recognized procedure, such as the appropriate ASTM Standard.

1.3 **QUALITY CONTROL**

1.3.1 Retain certified copies of in-plant quality control test data. Provide copies to EPCOR if requested.

1.3.2 All water meters when supplied will have the contractor's accuracy test results and serial numbers of each meter.

2. **MATERIALS**

2.1 **WATER METERS**

2.1.1 Water meters are to conform to the standards listed in Item 1.2.2 above, along with Standard Details 02520-01 to 02520-07.

2.1.2 The size, capacity and meter lengths for displacement type meters must conform to AWWA C700.

2.1.3 The size, capacity and meter lengths for turbine type meters must conform to AWWA C701.

2.1.4 The size, capacity and meter lengths for electromagnetic flow meters (mag meters) must conform to OIML standards.

2.1.5 Suppliers must provide complete manuals complete with recommended installation procedures, a list of replacement parts and prices, for all meters supplied.

Section 02520 – WATER METERS

- 2.1.6 All meters to have manufacturer's accuracy test results and serial numbers of each meter included at the time of delivery.
- 2.1.7 The main meter casing, including the inlet and outlet connections, are to be made of low-lead brass ($\leq 0.25\%$ lead). Refer to NSF Standard 61 Annex G – 2008.
- 2.1.8 The meter size and direction of flow through the meter must be cast in raised characters on the body of the meter.
- 2.1.9 Each meter must be identified by a unique 8 mm (5/16") serial number, marked permanently on the outer meter body.
- 2.1.10 Each meter must have a unique meter register identification code, which consists of six to ten digits. Register codes must be electronically read from each individual meter register.
- 2.1.11 The measuring meter chamber piston must not exceed 1160 nutations at 75 L/min, or 580 nutations at 37.8 L/min.
- 2.1.12 Encoder water meters must be comparable to:
 - the Sensus Technologies Incorporated touchpad; or
 - the Ellster C700 Invision style coder touchpad.A pin type alignment is not acceptable.
- 2.1.13 Provide physical tamper detection and locking devices to all meters and meter registers.
- 2.1.14 Install grounding wires as per manufacturer's specifications.
- 2.1.15 **Registers for 50 mm to 150 mm (2" to 6") meters:**
 - 2.1.15.1 Single direct reading encoder type totalizing register per meter.
 - 2.1.15.2 Encoder registers to measure cubic meters to six digits. Digits to be electronically read to the lowest ten m^3 values.
 - 2.1.15.3 The digit on the right-hand side must represent a single m^3 unit, i.e. one complete revolution of the test dial indicator to increase the digit on the right-hand side by one m^3 .
- 2.1.16 **Registers for 200 mm to 600 mm (8" to 24") meters:**
 - 2.1.16.1 Single direct reading encoder type totalizing register per meter.
 - 2.1.16.2 Encoder registers shall have six digits measured in cubic metres, and a fixed zero. The fixed zero shall represent zero to nine m^3 values. Digits are to be electronically read to the lowest 100 m^3 values.
 - 2.1.16.3 All wheels and the fixed zero shall be in a white background with black numbering.
 - 2.1.16.4 Test dials to be calibrated in one m^3 values.

3. EXECUTION**3.1 MANUFACTURER'S RECOMMENDATIONS**

Install according to the manufacturer's recommendations. In case of discrepancy with these specifications, advise EPCOR and request instruction before proceeding.

END OF SECTION



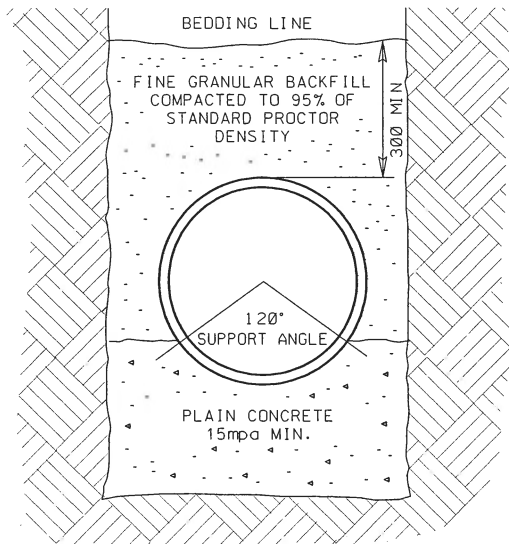
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2511-03	Horizontal Concrete Thrust Block Details	January 2013
2511-04	Vertical Bend and Offset Thrust Block Detail	January 2013
2511-05	Special Thrust Block for Disturbed Areas	January 2013
2511-06	Typical Dead End up to 300 mm	January 2013
2511-07	Typical Casing and Pipe with Spacer	January 2013
2511-08	Insulation Requirements for Water Mains / Services	January 2013
2511-09	Typical Blow-Off Manhole Detail	January 2013
2511-10	Mandrel & Proving Ring for Deflection Testing of Water Transmission Mains	January 2013
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2514-10	100 mm to 300 mm Water Service for Unsuitable Foundation Condition (Building Abutting Property Line)	January 2013
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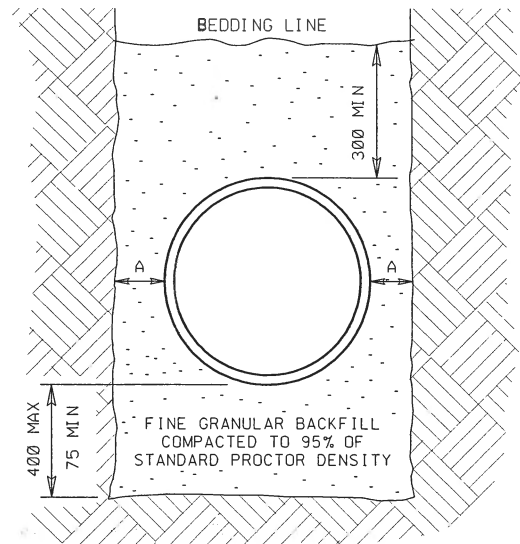


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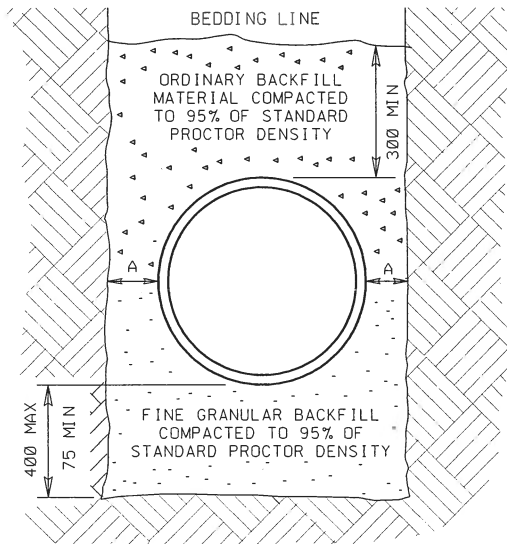
2516-03	Anode Installation at Hydrant & Connection to Existing Cast Iron Mains	January 2013
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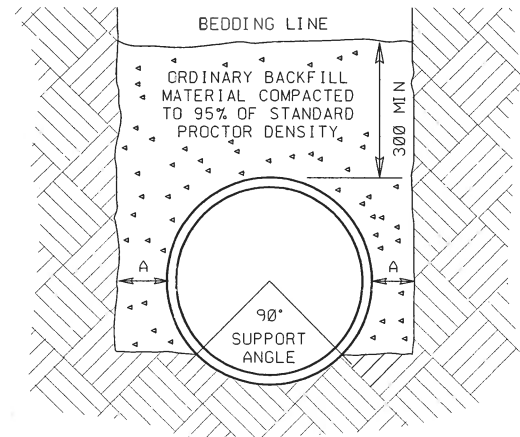
CLASS "A"



CLASS "B"



CLASS "C"



CLASS "D"

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL MATERIAL TO BE PLACED AND COMPACTED IN 150mm LAYERS.
3. WHERE INSTRUCTED OR AS SHOWN ON DRAWINGS
REPLACE FINE GRANULAR WITH COARSE GRANULAR MATERIAL.
4. TRENCH WALL CLEARANCE: $200 \leq A \leq 300$
5. IF $A > 300$ BACKFILL MUST BE COMPACTED
TO 100% OF STANDARD PROCTOR DENSITY.
6. APPLICABLE ONLY TO SINGLE PIPE INSTALLATIONS IN
TRENCHES EXCAVATED IN UNDISTURBED GROUND
7. REFER TO SPECIFICATIONS SECTION 02515
8. UNLESS OTHERWISE INSTRUCTED USE CLASS "B"
BEDDING WITH FINE GRANULAR MATERIAL

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EPCOR

STANDARD TRENCH BEDDING FOR CIRCULAR PIPE

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

[Signature]

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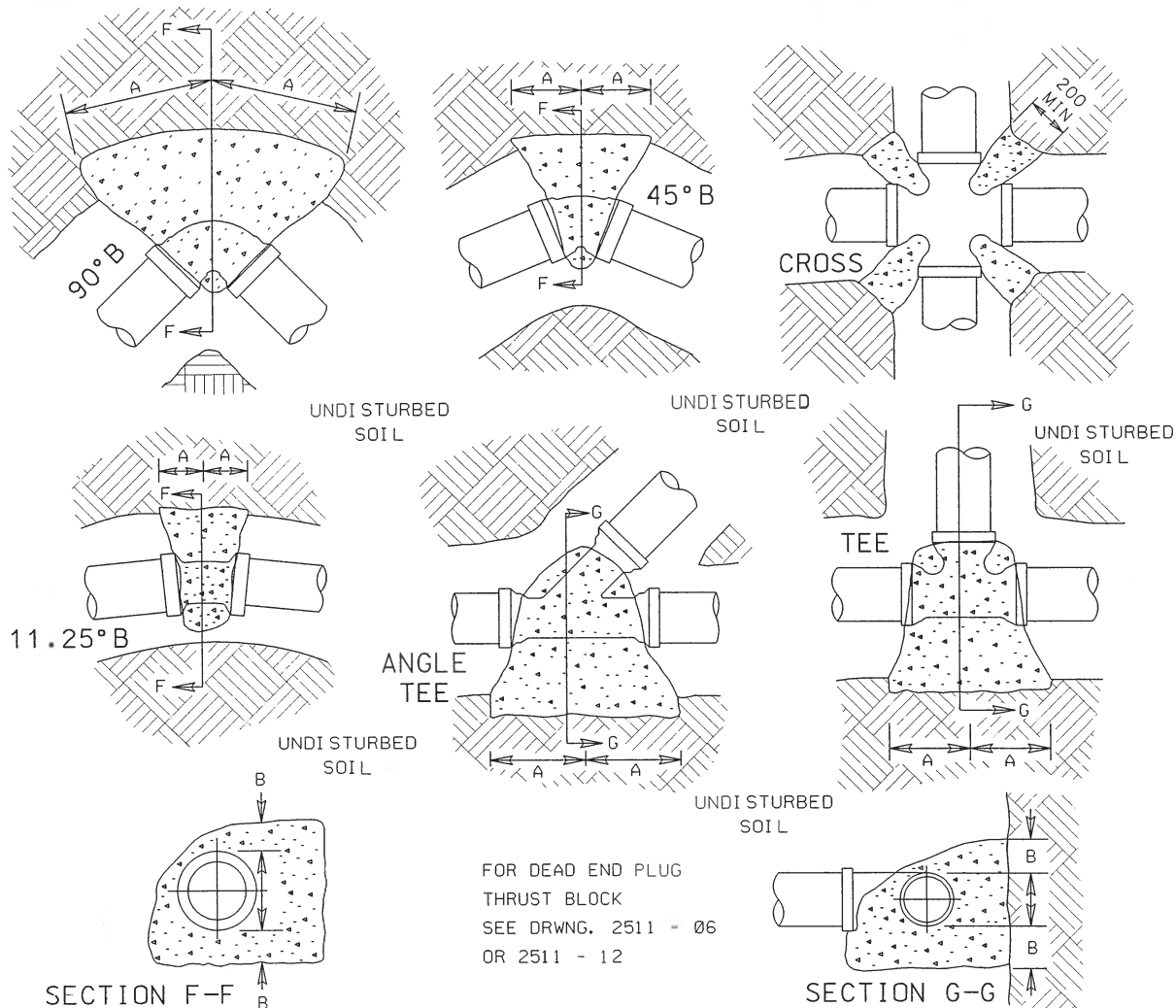
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Doug S.

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DRAWING NUMBER

2511-02

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REQUIRED DIMENSIONS & BEARING AREA

TEE & DEAD END										
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	250	370	550	740	930	920	1000	1000	1000	1000
B (mm)	75	100	100	100	100	200	250	350	450	700
AREA (m ²)	0.14	0.28	0.47	0.71	1.00	1.44	1.87	2.35	2.88	4.11
90° BEND										
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	350	520	770	860	960	940	1000	1000	1000	1020
B (mm)	75	100	100	150	200	350	450	600	750	1100
AREA (m ²)	0.19	0.39	0.67	1.00	1.41	2.04	2.65	3.32	4.08	5.81
45° BEND										
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	190	280	420	470	600	700	850	820	960	950
B (mm)	75	100	100	150	150	200	200	300	300	500
AREA (m ²)	0.12	0.21	0.36	0.54	0.77	1.11	1.44	1.80	2.21	3.15

22.5° BEND										
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	100	170	220	290	310	410	440	510	540	640
B (mm)	75	75	100	100	150	150	200	200	250	300
AREA (m ²)	0.06	0.11	0.19	0.28	0.39	0.57	0.73	0.92	1.13	1.61
11.25° BEND										
DIA (mm)	100	150	200	250	300	350	400	450	500	600
A (mm)	100	100	120	160	200	260	310	330	380	470
B (mm)	75	75	75	75	75	75	75	100	100	100
AREA (m ²)	0.03	0.06	0.10	0.14	0.20	0.29	0.37	0.46	0.57	0.81

NOTES:

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
- DESIGN BASIS:
 - HYDRAULIC PRESSURE 1035kPa (150 psi)
 - SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft.) (MEDIUM SOFT CLAY)
- TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
- CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
- CONCRETE TO BE CLEAR OF BELLS.
- CONCRETE TO BE PLACED UNDER ALL FITTINGS.
- CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS..
- BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

EPCOR

HORIZONTAL CONCRETE THRUST BLOCK DETAILS

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan Paul

SCALE
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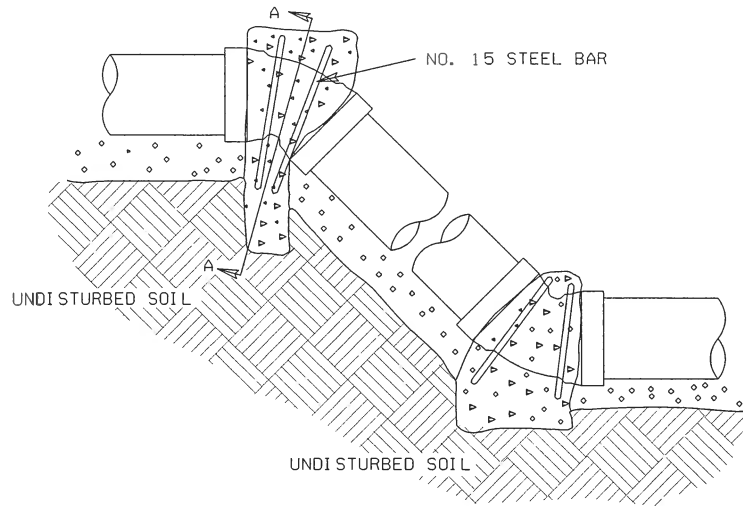
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Doug S.

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DRAWING NUMBER

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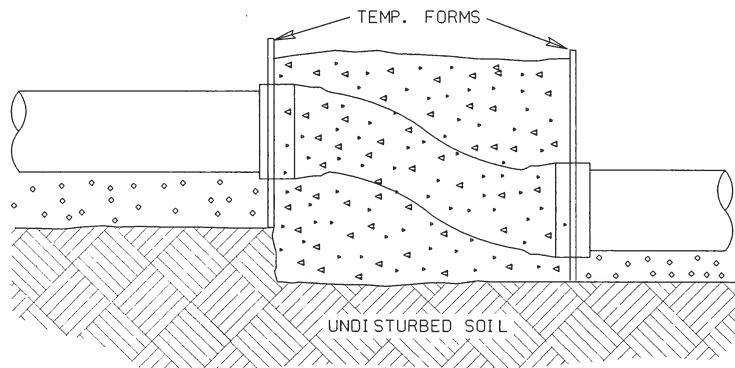
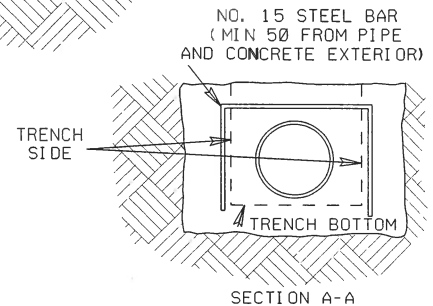
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VERTICAL BEND

REQUIRED BEARING AREA

	45° BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
AREA(m ²)	0.101	0.208	0.360	0.540	0.762	1.101	1.431	1.797	2.204	3.142
	22.5 BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
AREA(m ²)	0.051	0.106	0.183	0.275	0.389	0.561	0.730	0.916	1.123	1.602
	11.25 BEND									
DIA (mm)	100	150	200	250	300	350	400	450	500	600
AREA(m ²)	0.026	0.053	0.092	0.138	0.195	0.282	0.367	0.460	0.564	0.805



VERTICAL OFFSET

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
 - a. HYDRAULIC PRESSURE 1035kPa (150 psi)
 - b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE CLEAR OF BELLS AND PIPE.
6. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
7. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS..
8. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

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VERTICAL BEND AND OFFSET THRUST BLOCK DETAIL

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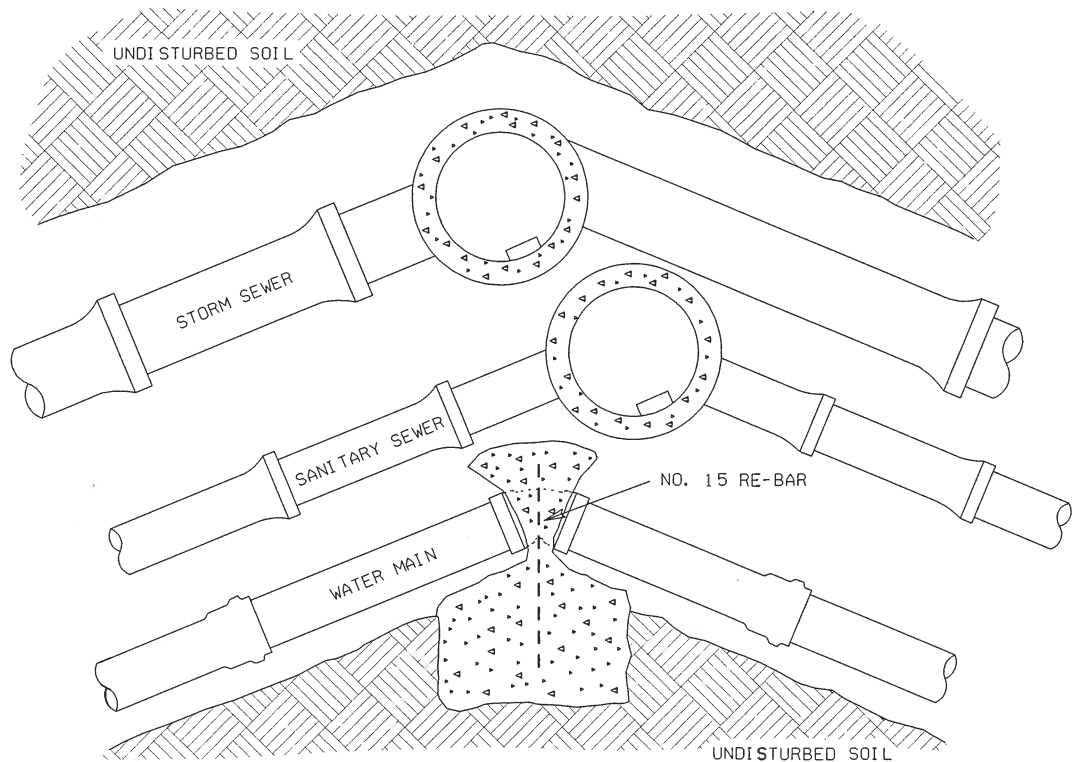
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A Susan
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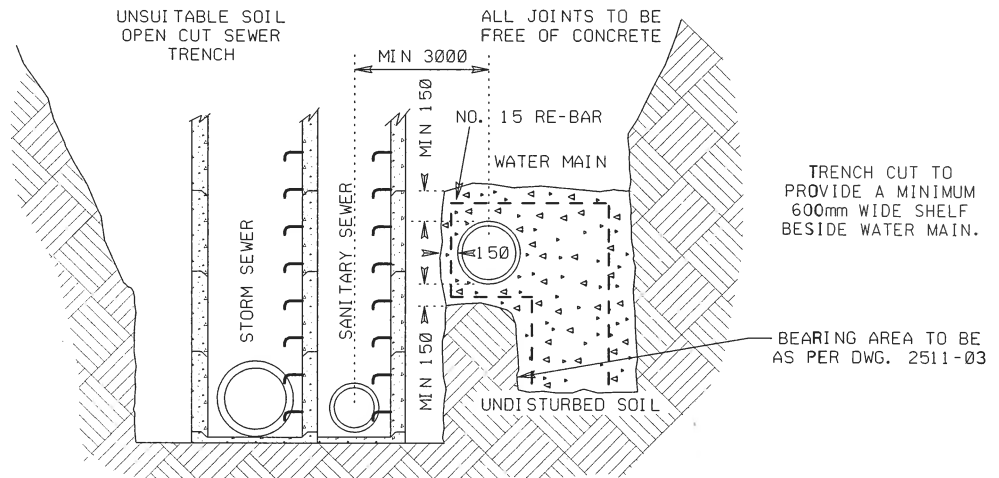
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PLAN VIEW



CROSS SECTION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
 - a. HYDRAULIC PRESSURE 1035kPa (150 psi)
 - b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft.) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE CLEAR OF BELLS AND PIPE.
6. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
7. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS..
8. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

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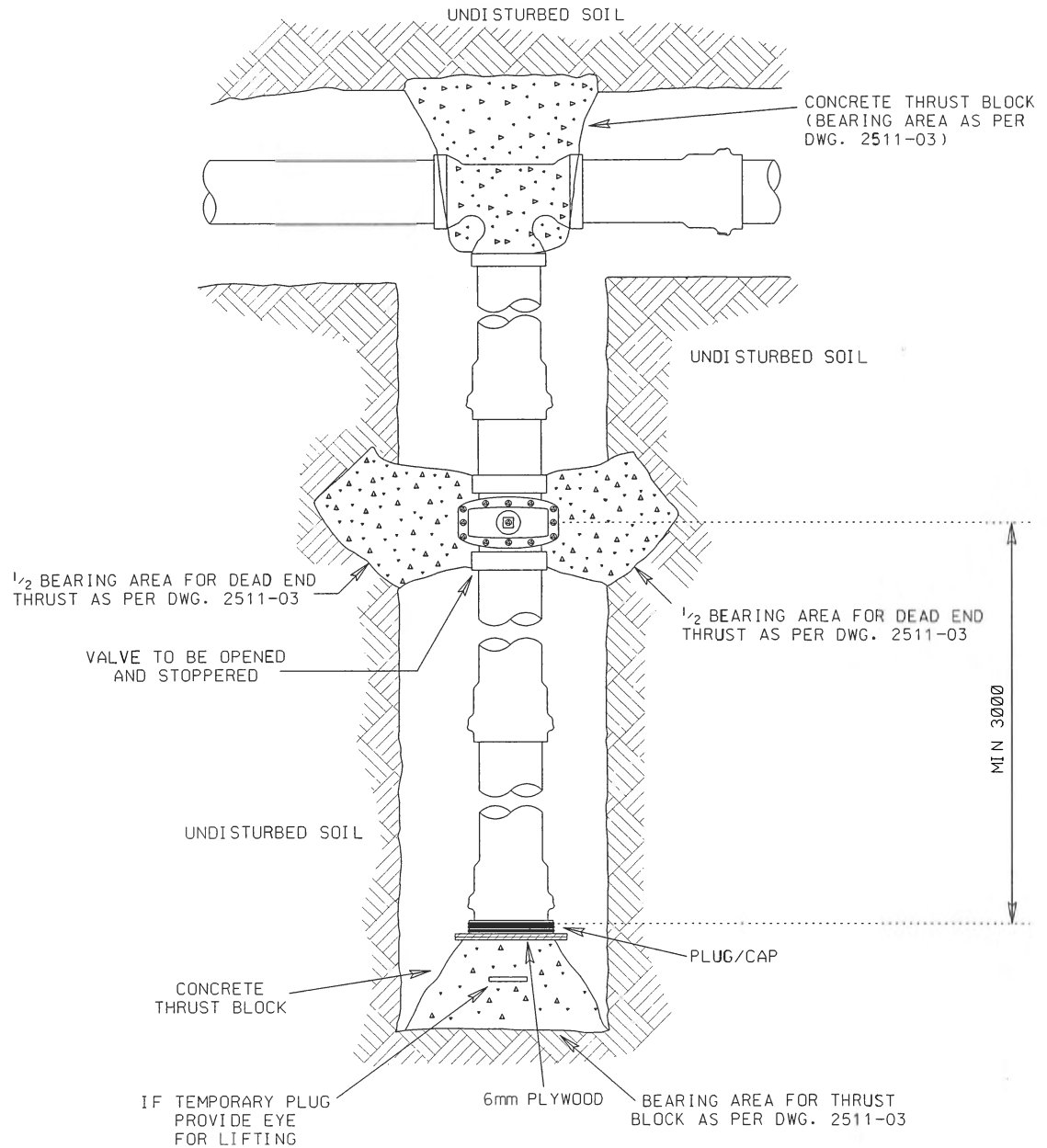
SPECIAL THRUST BLOCK FOR DISTURBED AREAS

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APPROVED
Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

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2511-05
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PLAN VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
 - a. HYDRAULIC PRESSURE 1035kPa (150 psi)
 - b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE CLEAR OF BELLS.
6. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
7. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS..
8. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

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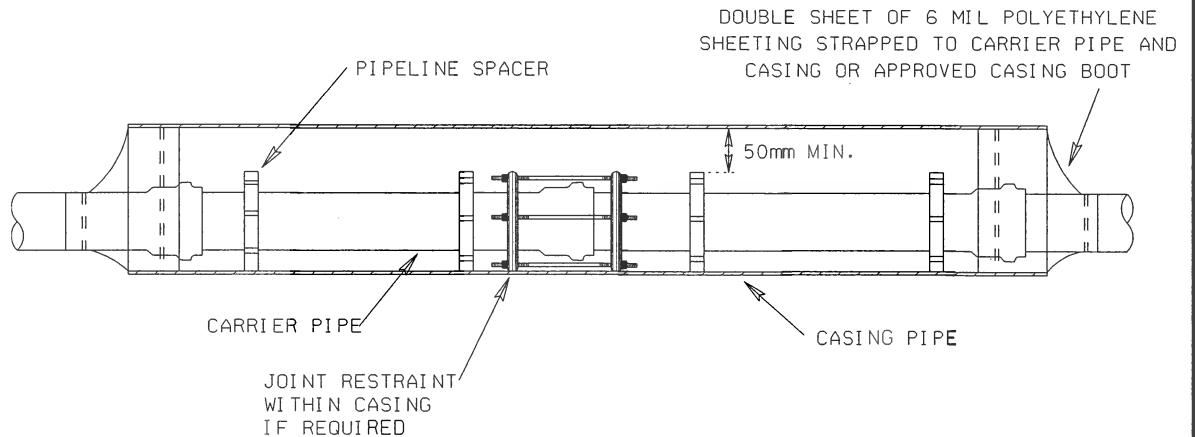
TYPICAL DEAD END UP TO 300mm

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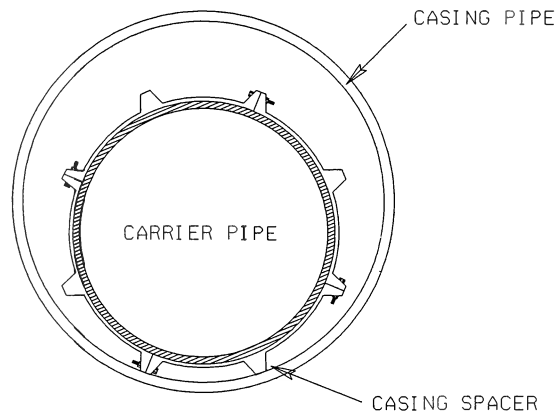
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2511-06
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ELEVATION



SECTION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. CASING MATERIAL AND THICKNESS TO BE AS SPECIFIED ON CONSTRUCTION DRAWINGS.
3. DISTANCE BETWEEN SPACERS TO BE DETERMINED BY THE MATERIAL AND JOINT TYPE OF CARRIER PIPE BEING USED.
4. CASING COATING AND CATHODIC PROTECTION REQUIREMENTS TO BE AS SPECIFIED ON CONSTRUCTION DRAWINGS.
5. JOINT RESTRAINT REQUIREMENTS TO BE SPECIFIED ON CONSTRUCTION DRAWINGS.

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EPCOR

TYPICAL CASING AND PIPE WITH SPACER

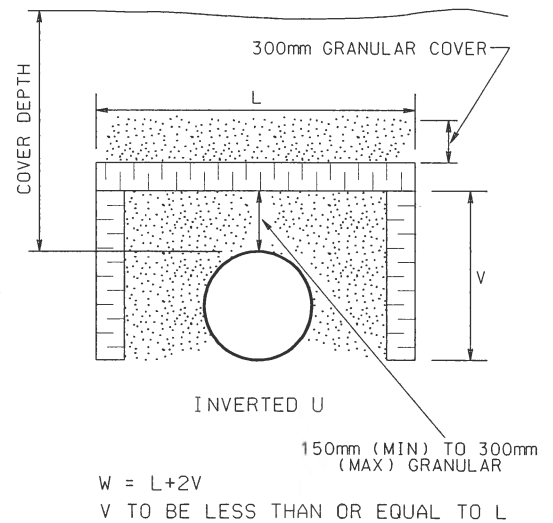
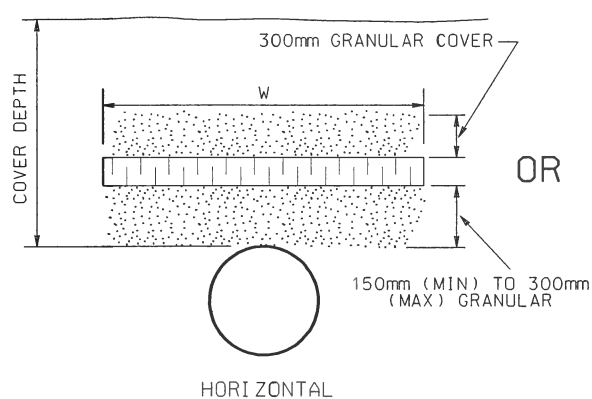
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JANUARY 2013
SCALE
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Doug S.

APPROVED
Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2511-07
REVISION 0

COVER DEPTH m	THICKNESS mm (IN)	WIDTH (W) m
1.1 - 1.4	90 (3.5)	3.4
1.4 - 1.7	75 (3.0)	2.8
1.7 - 2.0	75 (3.0)	2.2
2.0 - 2.3	50 (2.0)	1.6
2.3 - 2.9	40 (1.5)	1.0
BELOW 2.9	-	-



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. APPLICABLE WHEN USING FILLCRETE, GRANULAR OR CLAY BACKFILL FOR WATER MAINS WITH DEPTH OF COVER LESS THAN THE MINIMUM, AS DESCRIBED IN THE DESIGN STANDARDS, SECTION 6.2
3. USE DOW HI-40 STYROFOAM BOARD, OR APPROVED EQUAL.

EPCOR

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

SCALE
N T S

CHECKED BY
Doug S.

APPROVED

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2511-08

REVISION 0

3-100 GRADE RINGS
(ONE LADDER RUNG)

914 DIA

LADDER RUNGS
AS REQ'D AT
400 MAX. SPACING

1219 DIA.

WELD 50 SQUARE
OPERATING NUT
TO VALVE STEM

300

900

300x300x200
SUMP

20mm CRUSHED
WASHED ROCK

PRECAST
MANHOLE BASE

PRECAST 1200 MANHOLE BARRELS
WITH SLAB TOP OR 1200 x 914
CONICAL TOP. ALL JOINTS
TO BE SET WITH RUBBER
GASKET, NON-SHRINK GROUT
INSIDE & OUTSIDE FOR
FULL CIRCUMFERENCE

150/200 DIA. (BELL X BELL)
GATE VALVE & BOX

STL PIPE 1200 MAX

LINK SEAL & CEMENT
MORTAR OPENING (TYP)

168/219 OD STL

150/200

150/200 TRANSITION
COUPLING

2-19mm SST THREADED RODS AND ANCHORED TO
WALL OUTSIDE WITH 50 x 75 PLATES.
TIE-ROD RESTRAINTS c/w 2 FLANGES WELDED
AT 3 & 9 O'CLOCK, BOLTS & WASHERS

CAST IN PLACE CONCRETE
2% SLOPE TO SUMP

VALVE
CASING

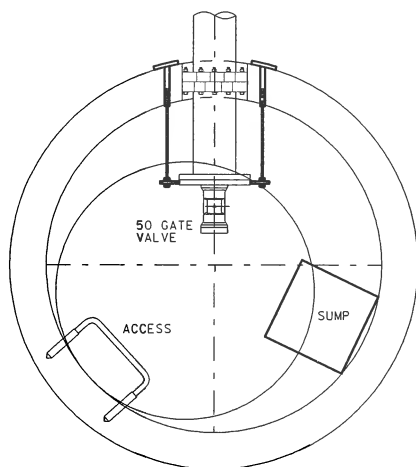
150/200 FLANGED
ADAPTOR

PVC

TRANSMISSION MAIN
BELL x 150 FLG TEE
TIPPED DOWN 45°

150/200 x 45° FLG
VERTICAL BEND

25 MPa CONCRETE SUPPORT
TO UNDISTURBED GROUND



LINK SEAL & CEMENT MORTAR OPENING (TYP)

168/219 OD STEEL


SCHEDULE 40 STEEL FUSION BOND EPOXY COATED AND LINED (AWWA C-210)

2-19mm SST THREADED RODS AND ANCHORED TO WALL OUTSIDE WITH 50 x 75 PLATES. TIE-ROD RESTRAINTS c/w 2 FLANGES WELDED AT 3 & 9 O'CLOCK, BOLTS & WASHERS

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. BACKFILL AS PER CITY DESIGN AND CONSTRUCTION STANDARDS.
3. ENSURE ADEQUATE HORIZONTAL THRUST RESTRAINT FOR 150/200 GATE VALVE.
4. CONCRETE TO BE CLEAR OF ALL BELLS AND FLANGES.

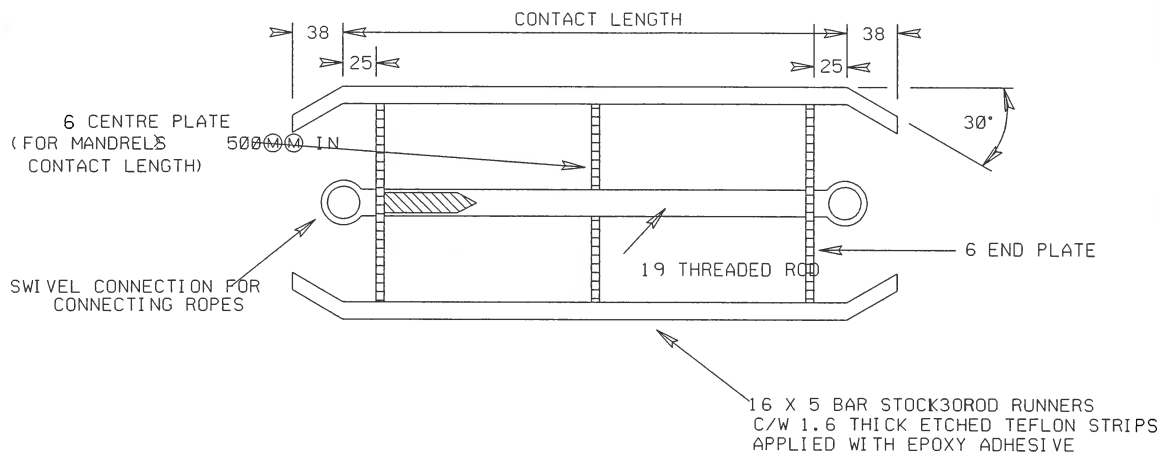


APPROVED JANUARY 2013	DRAWN BY Dale Vandenberg
SCALE N T S	CHECKED BY Doug S.

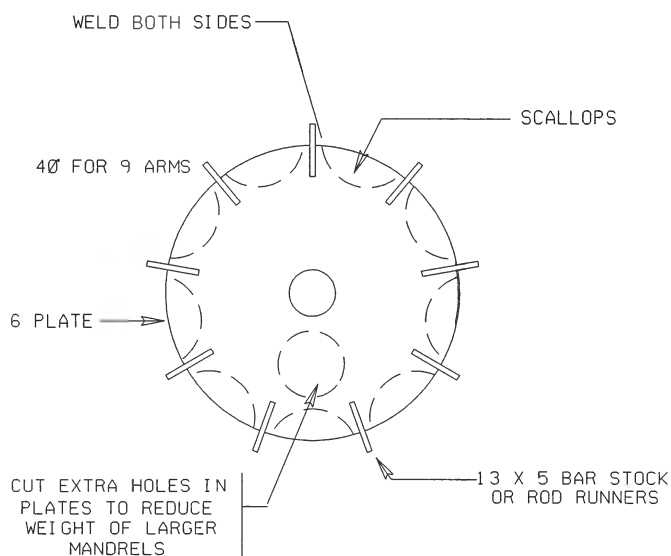
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2511-09
REVISION 0

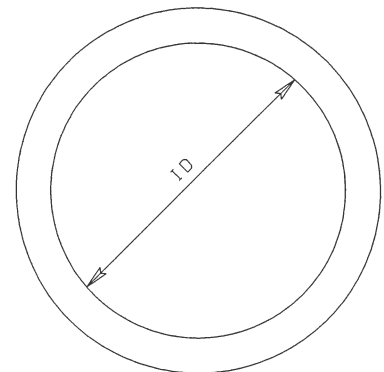


LONGITUDINAL SECTION
OF MANDREL



TRANSVERSE SECTION
OF MANDREL

INTERNAL DIAMETER (ID) =
(DESIGN MINIMUM INTERNAL PIPE DIAMETER)
-(MAXIMUM ALLOWABLE PIPE DEFLECTION)



END VIEW OF
PROVING RING

2012/12/18 11:39 dvandenb 2511-10.DGN

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.

EPCOR

MANDREL & PROVING RING FOR DEFLECTION TESTING OF WATER TRANSMISSION MAINS

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

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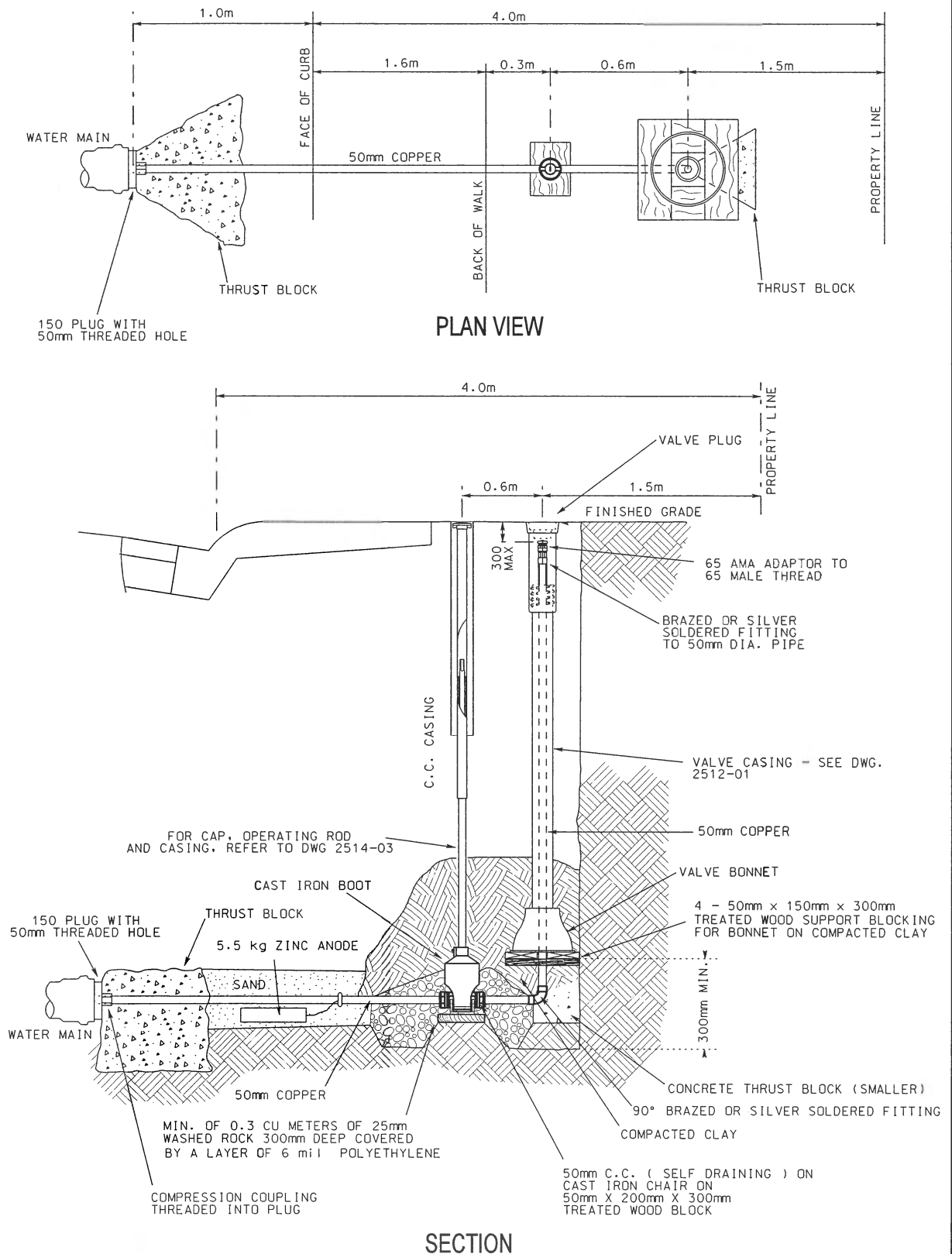
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S P

Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2511-10

REVISION 0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. BRAZED OR SILVER SOLDERED FITTINGS MAY BE REPLACED WITH EPCOR APPROVED ALTERNATIVE

EPCOR

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JANUARY 2013

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Dale Vandenberg

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Doug S.

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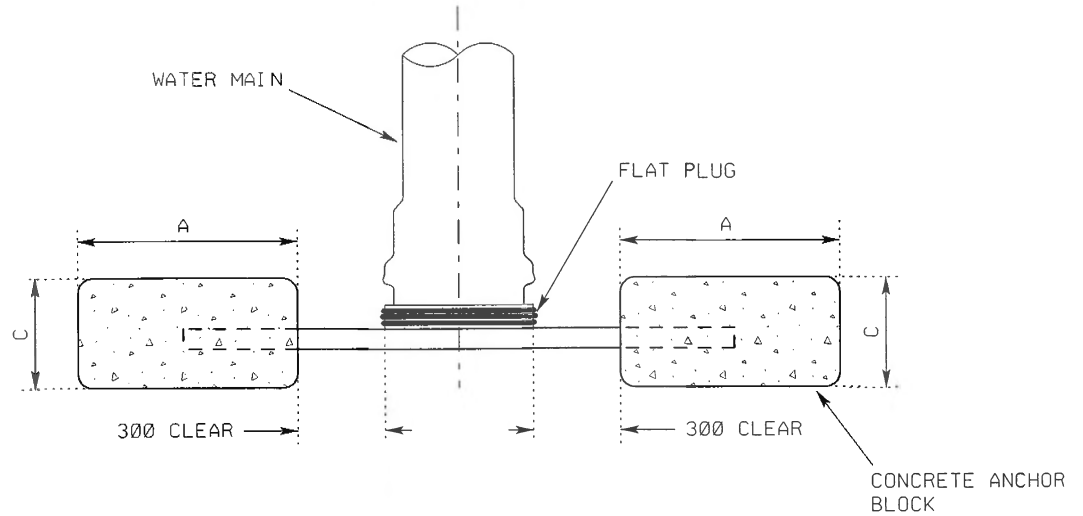
DRAWING NUMBER

2511-11

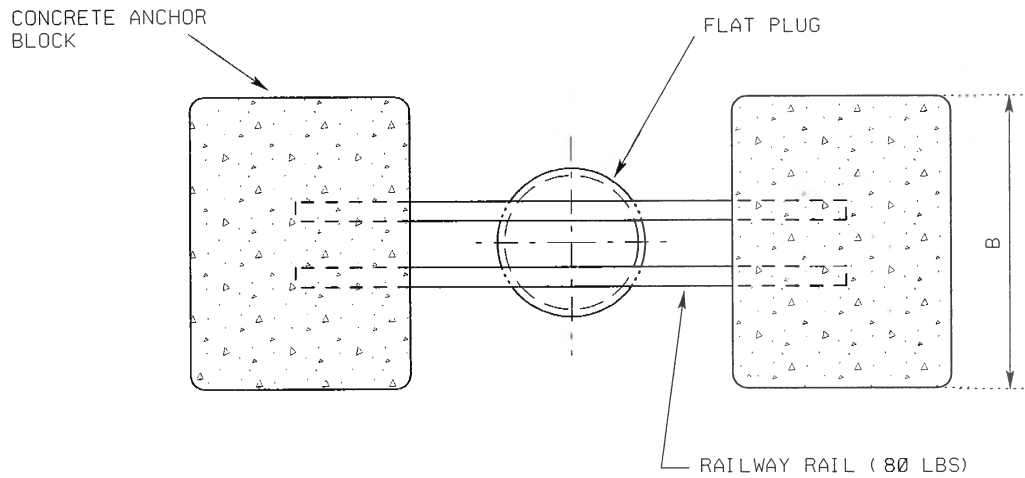
REVISION 0

TYPICAL FLUSH POINT DETAIL

20130531 06:34 dvandenb 2511-11.DGN



PLAN VIEW



ELEVATION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
 - i. 450 & 600 DIA - HYDRAULIC PRESSURE 1035kpa (150 psi)
 - ii. SOIL BEARING CAPACITY 72 kpa (1500 lb/sq. ft) MEDIUM SOFT CLAY.
3. CONCRETE STRENGTH SHALL BE 25 MPa AT 28 DAYS.
4. CONCRETE TO BE CLEAR OF ALL BELLS AND PIPE.

DIA (mm)	450	600
A (mm)	1100	1400
B (mm)	1100	1500
C (mm)	800	900
Area m ²	2.348	4.105

2012/12/18 12:01 dvandenb 2511-12.DGN

EPCOR

450mm AND 600mm BLOCK AND RAIL PLUG DETAIL

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JANUARY 2013

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Dale Vandenberg

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Doug S.

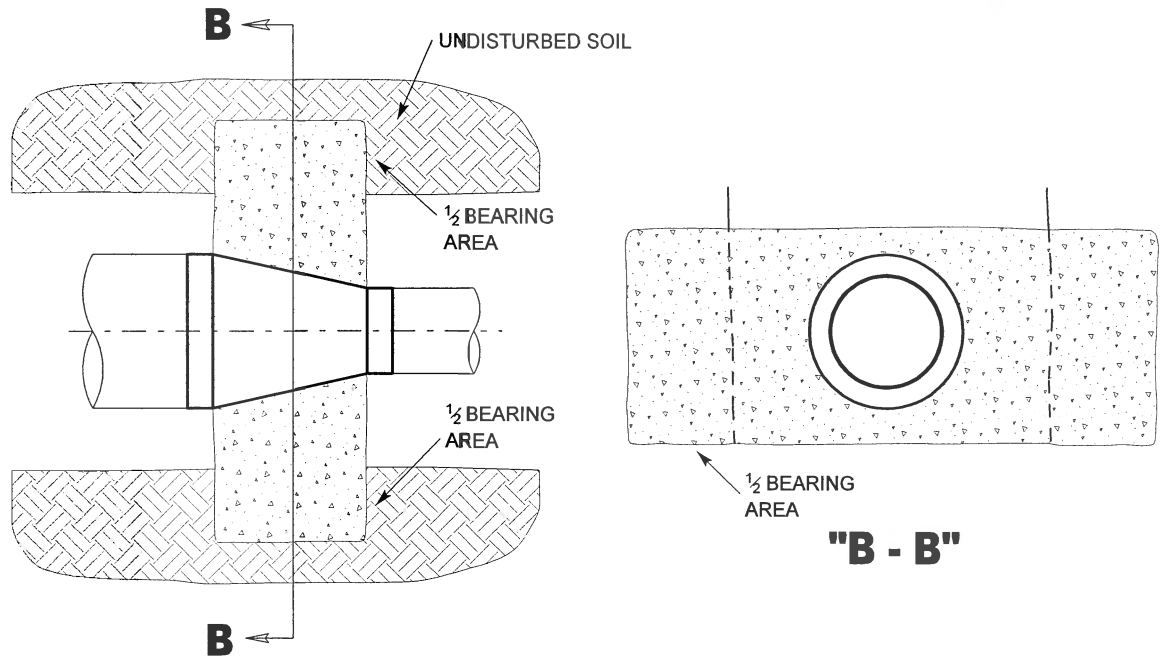
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DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2511-12

REVISION 0



REDUCERS - Required bearing area in sq. m										
	600	500	450	400	350	300	250	200	150	100
600	—	1.23	1.76	2.24	2.70	3.11	—	—	—	—
500	1.23	—	0.54	1.01	1.44	1.89	2.18	—	—	—
450	1.76	0.54	—	0.48	0.91	1.36	1.65	1.88	—	—
400	2.24	1.01	0.48	—	0.44	0.88	1.17	1.40	1.60	—
350	2.67	1.44	0.91	0.44	—	0.45	0.74	0.97	1.17	1.31
300	3.11	1.89	1.36	0.88	0.45	—	0.29	0.53	0.73	0.87
250	—	2.18	1.65	1.17	0.74	0.29	—	0.24	0.44	0.58
200	—	—	1.88	1.40	0.97	0.53	0.24	—	0.20	0.34
150	—	—	—	1.60	1.17	0.73	0.44	0.20	—	0.14
100	—	—	—	—	1.31	0.87	0.58	0.34	0.14	—

TRANSITION COUPLINGS (CI OD TO OTHER)- Required bearing area in sq. m										
CI OD to:	600	500	450	400	350	300	250	200	150	100
IPS	0.65	0.49	0.41	0.35	0.28	0.09	0.09	0.09	0.09	0.09
AC ME	0.85	0.55	0.43	0.28	0.21	0.15	0.10	0.09	0.09	0.09
AC BL	0.96	0.64	0.47	0.42	0.33	0.21	0.15	0.09	0.09	0.09

IPS - IRON PIPE SIZE
AC ME - ASBESTOS CEMENT MACHINED END
AC BL - ASBESTOS CEMENT BARREL
CI OD - CAST IRON OUTSIDE DIAMETER

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. DESIGN BASIS:
 - a. HYDRAULIC PRESSURE 1035kPa (150 psi)
 - b. SOIL BEARING CAPACITY 72kPa (1500 lb/sq.ft.) (MEDIUM SOFT CLAY)
3. TEMPORARY BLOCKING MUST BE APPROVED BY THE ENGINEER.
4. CONCRETE STRENGTH SHALL BE 25MPa AT 28 DAYS.
5. CONCRETE TO BE CLEAR OF BELLS.
6. CONCRETE TO BE PLACED UNDER ALL FITTINGS.
7. CONCRETE THRUST BLOCK REQUIRED FOR ALL FITTINGS..
8. BEARING SURFACE MUST BE ON UNDISTURBED SOIL.

EPCOR

THRUST BLOCKS FOR REDUCERS AND TRANSITION COUPLINGS

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan [Signature]
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

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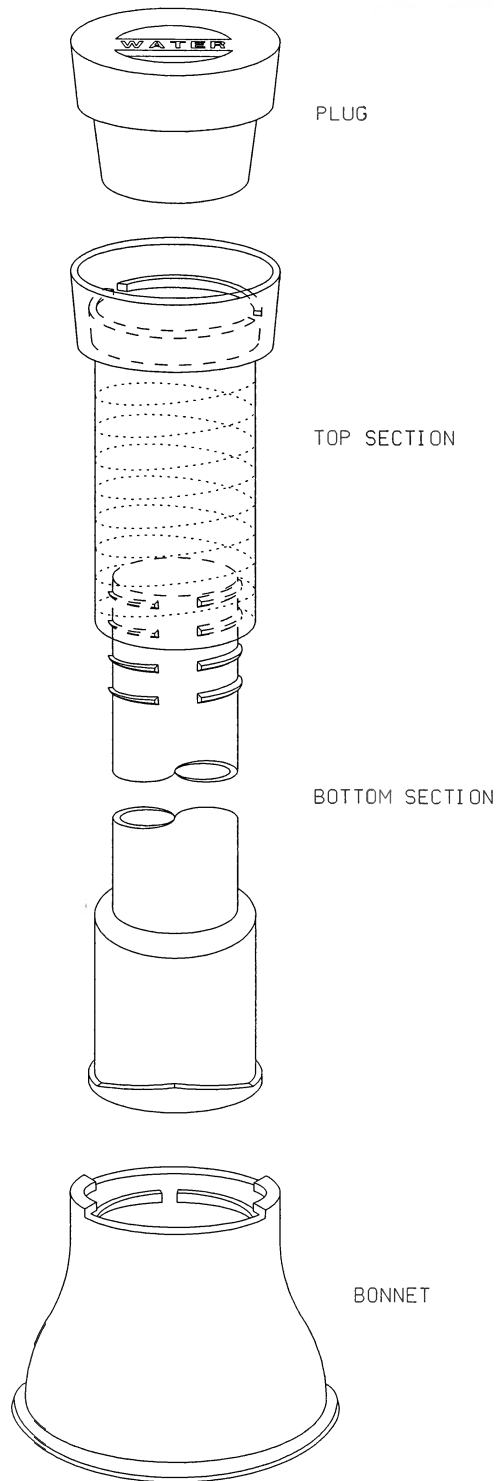
2511-13

REVISION 0

SCALE
N T S

CHECKED BY
Doug S.

20121218 13:43 dvanderb 2512-1.DGN



MANUFACTURING TOLERANCES:

- ± 2mm FOR INDICATED CASTING DIMENSIONS OF 190mm OR LESS
- ± 3mm FOR INDICATED CASTING DIMENSIONS OF 191mm TO 280mm
- ± 4mm FOR INDICATED CASTING DIMENSIONS OF 281mm TO 380mm

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.



APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

SCALE
N T S

CHECKED BY
Doug S.

VALVE CASING

APPROVED

Susan Gil
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2512-01

REVISION 0

Technical drawing of a mechanical part, showing front and top views with dimensions.

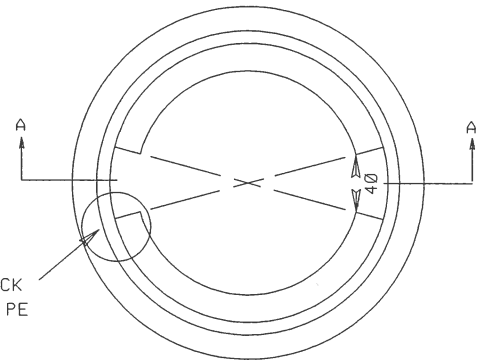
Front View (Bottom):

- Overall width: 180
- Overall height: 102 (50 + 52)
- Top flange width: 115
- Top flange thickness: 50
- Internal cavity width: 110
- Internal cavity height: 52
- Bottom flange width: 165
- Bottom flange thickness: 57

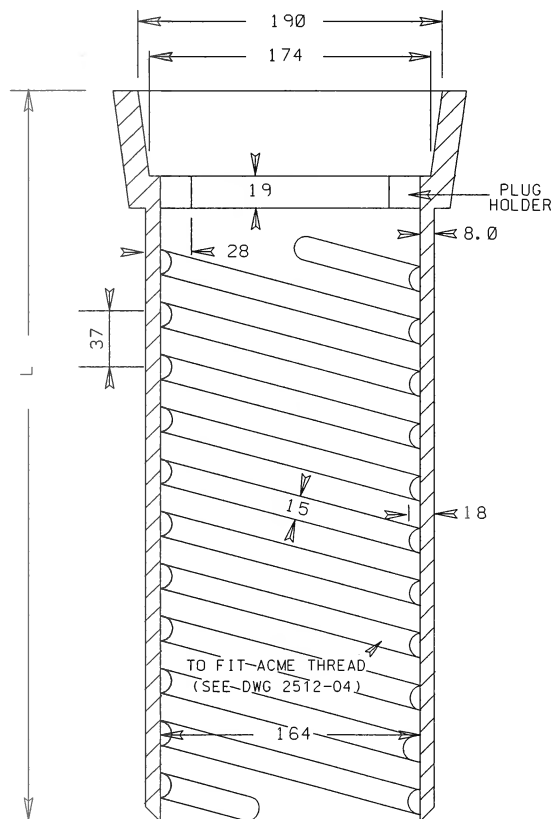
Top View (Top):

- Overall diameter: 180
- Central slot width: 45
- Slot depth: 70
- Feature labeled "WATER" is located in the center of the slot.

± 2mm	FOR INDICATED CASTING DIMENSIONS OF 190mm OR LESS
± 3mm	FOR INDICATED CASTING DIMENSIONS OF 191mm TO 280mm
± 4mm	FOR INDICATED CASTING DIMENSIONS OF 281mm TO 380mm



TOP VIEW



Technical drawing of a mechanical part, likely a nut or washer, showing dimensions and a note.

Dimensions:

- Overall width: 220
- Overall height: 300
- Top flange height: 73
- Inner diameter (top): 180
- Inner diameter (bottom): 200

Note: THREADS HAVE A 40mm SLOT

ELEVATION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. L (LENGTH) SIZES ARE 600, 900 AND 1200mm.
3. PLUG: DUCTILE IRON TO ASTM 536 GRADE 60-40-18

20121218 13:46 dvandenb 2512-2.dgn



VALVE CASING TOP SECTION AND PLUG

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

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Doug S.

APPROVED _____

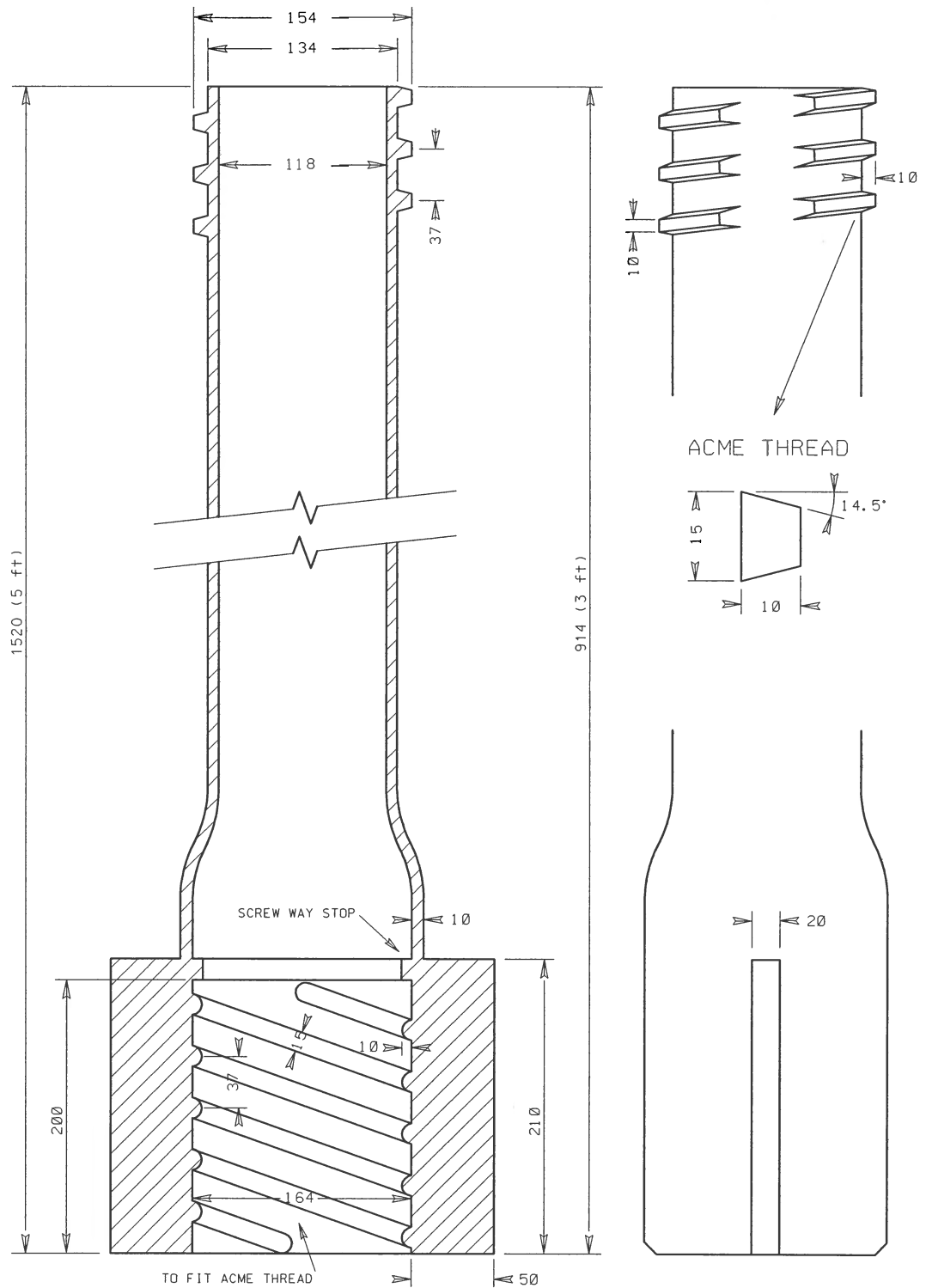

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DRAWING NUMBER

2512-02

REVISION 0

20130315 09:38 dvanderb 2512-3.DGN



MANUFACTURING TOLERANCES:

- ± 2mm FOR INDICATED CASTING DIMENSIONS OF 190mm OR LESS
- ± 3mm FOR INDICATED CASTING DIMENSIONS OF 191mm TO 280mm
- ± 4mm FOR INDICATED CASTING DIMENSIONS OF 281mm TO 380mm

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. TWO STANDARD OVERALL LENGTHS: 1520 (5 ft) AND 914 (3 ft).

EPCOR

VALVE CASING MIDDLE EXTENSIONS

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan

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Doug S.

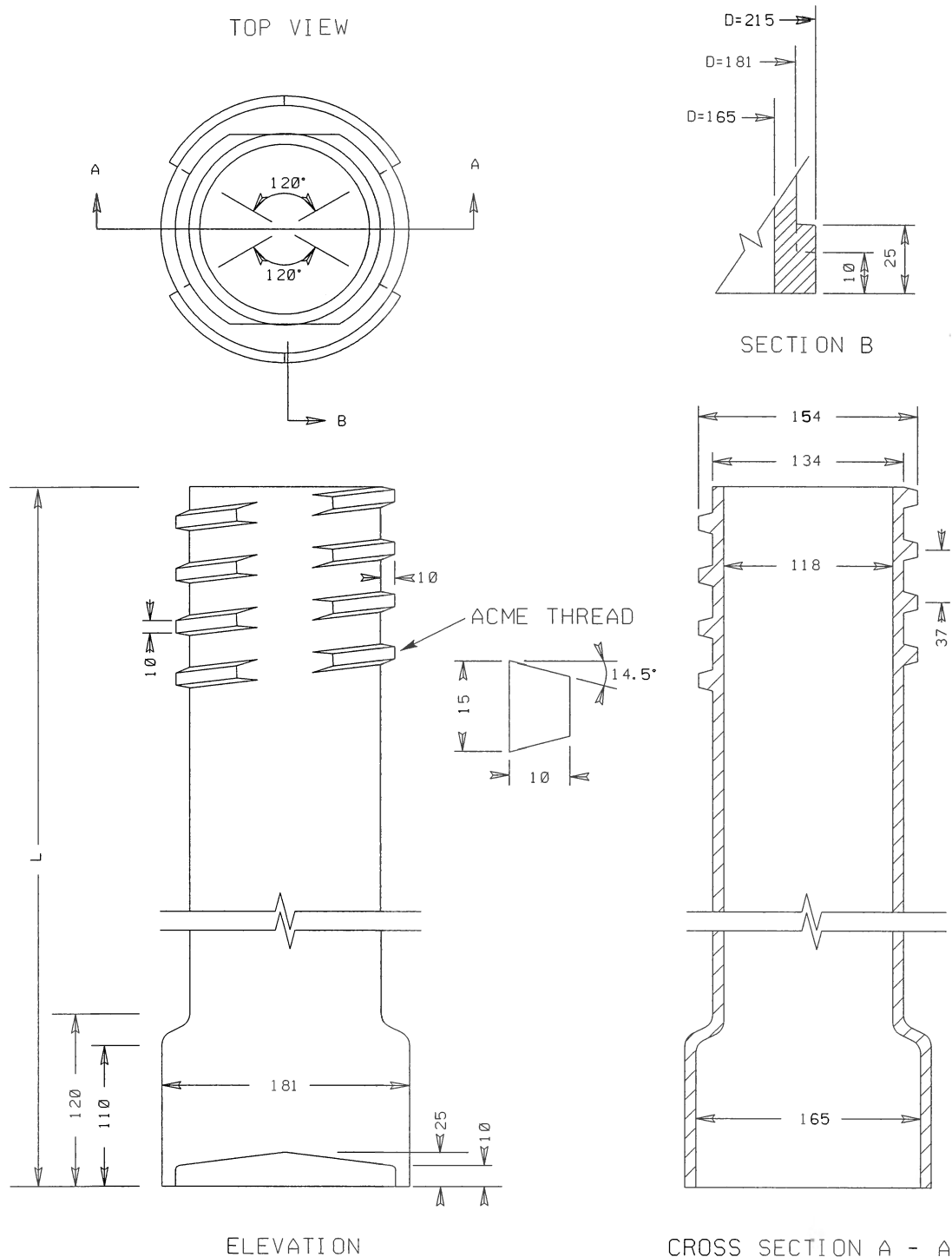
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2512-03

REVISION 0

20121218 14:04 dvandenb 2512-4.DGN



MANUFACTURING TOLERANCES:

- ± 2mm FOR INDICATED CASTING DIMENSIONS OF 190mm OR LESS
- ± 3mm FOR INDICATED CASTING DIMENSIONS OF 191mm TO 280mm
- ± 4mm FOR INDICATED CASTING DIMENSIONS OF 281mm TO 380mm

NOTES:

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
- L (LENGTH) SIZES ARE 900, 1200 AND 1500mm



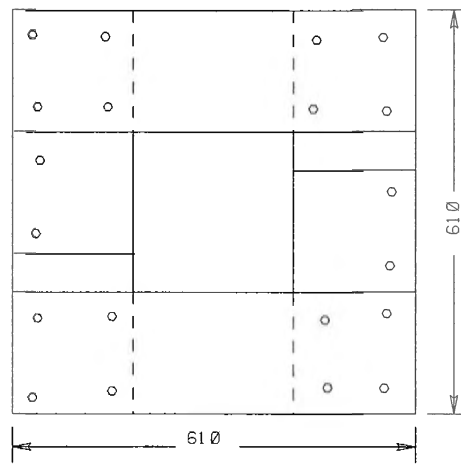
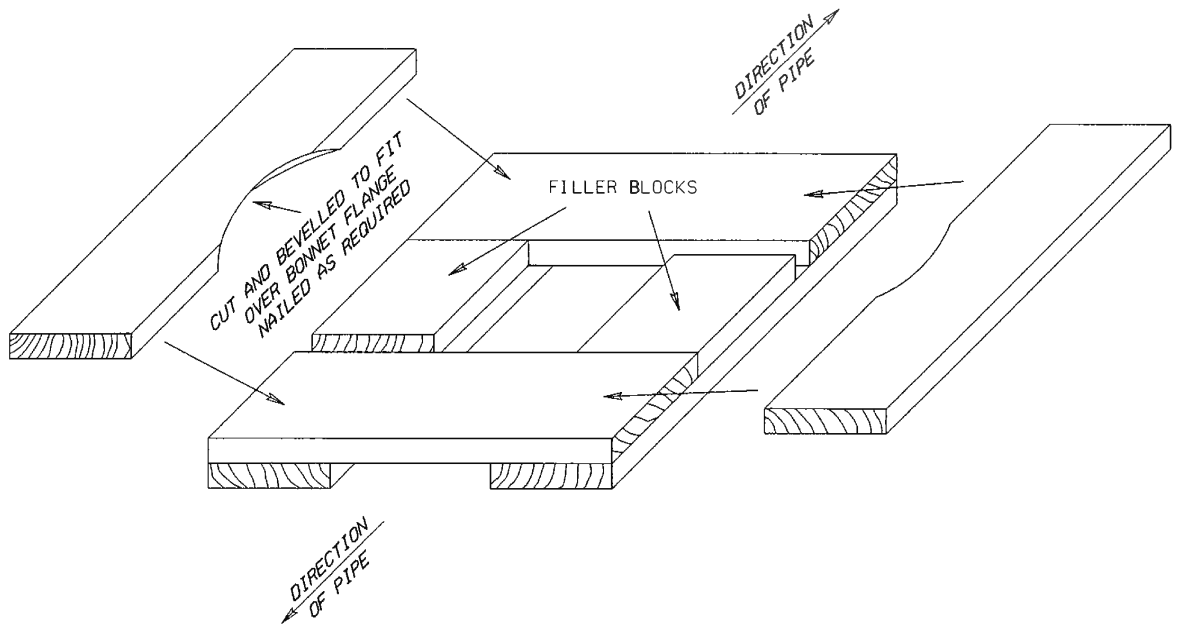
VALVE CASING BOTTOM SECTION

APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan Ol
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2512-04
REVISION 0

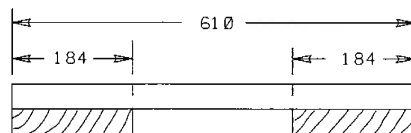


PLAN VIEW

CONSTRUCTED FROM 38mm X 184mm
CONSTRUCTION GRADE LUMBER
(SPRUCE, PINE, FIR)

ALL WOOD MEMBERS ARE
TO BE TREATED WITH GREEN
COPPERWOOD PRESERVATIVE #580025

USE 89mm COATED NAILS (3 1/2")



FRONT VIEW



SIDE VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SEE ALSO DRAWING 2512-07

20121218 14:10 dvandenb 2512-6.DGN



VALVE BOX MATERIAL DETAIL

APPROVED
JANUARY 2013

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Dale Vandenberg

APPROVED

Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

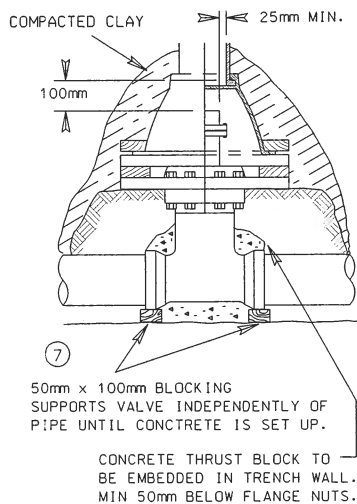
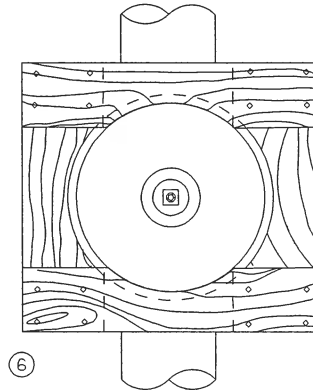
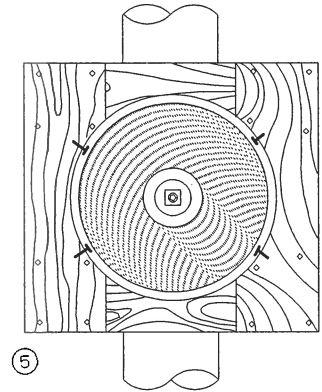
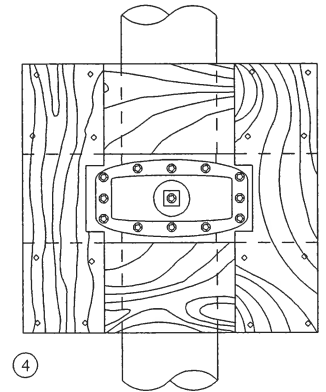
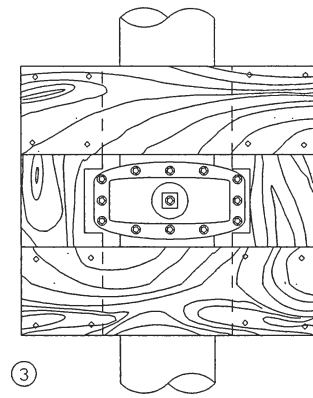
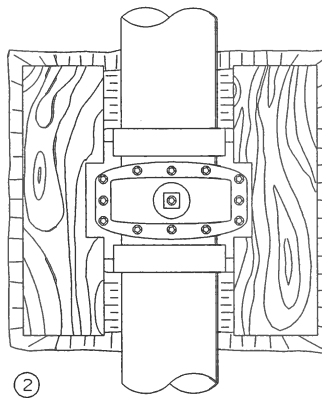
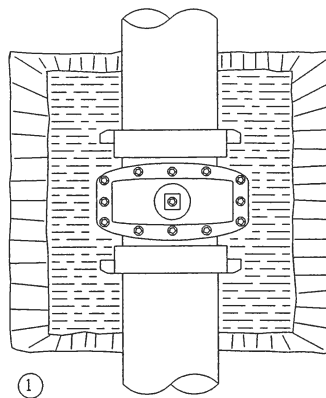
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2512-06

REVISION 0

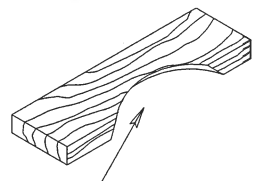
SCALE
N T S

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Doug S.



PROCEDURE (ALSO REFER TO DWG 2512-06)

- (FIG. 1) BUILD A 600mm x 600mm LEVEL BASE OF COMPACTED CLAY USING A FLAT TAMPER UP TO WITHIN 10mm OF THE TOP OF THE TOP FLANGE.
- (FIG. 2) CUT OR NOTCH OUT TWO OF THE 50mm x 200mm x 600mm TREATED BOARDS THE WIDTH OF VALVE FLANGE AND LAY ON BASE PARALLEL TO PIPE.
- (FIG. 3) INSTALL TWO 50mm x 200mm x 600mm TREATED BOARDS TRANSVERSELY OR AT RIGHT ANGLES TO THE FIRST SET AND NO CLOSER TO THE FLANGE THAN THE CUTOUT SO THAT THEY DO NOT PROTRUDE OVER THE FLANGE, NAIL WITH GALVANIZED COATED NAILS AS ILLUSTRATED. APPROX. 5mm CLEARANCE TO FLANGE.
- (FIG. 4) ADD AND NAIL ALTERNATE LAYERS OF BOARDS MAKING SURE EDGES ARE NO CLOSER TO VALVE THAN CUTOUT. CONTINUE UNTIL MINIMUM REQUIRED CLEARANCE (100mm) FROM TOP OF VALVE BONNET TO VALVE NUT IS OBTAINED.
- (FIG. 5) CENTER VALVE BONNET SECTION OVER OPERATING NUT AND FASTEN WITH FOUR NAILS WITH THE TOP 15-20mm BENT OVER TO SECURE IN PLACE.
- (FIG. 6) TWO PIECES OF BOARD ARE NOW CUT OUT TO OUTSIDE CIRCUMFERENCE OF BONNET AND UNDERCUT TO ACCOMMODATE BONNET THICKNESS. THESE ARE NOW NAILED TRANSVERSELY TO LAST LAYER OF BOARDS.
- (FIG. 7) APPROPRIATE LENGTHS OF BOTTOM AND TOP SECTION OF CASING ARE NOW INSTALLED AND BACKFILLED WITH COMPACTED CLAY TO ABOVE JOINT.



CUT TO CIRCUMFERENCE OF VALVE BONNET AND BEVEL

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.

20121218 14:22 dvandenb 2512-7.DGN

VALVE BOX CONSTRUCTION DETAIL

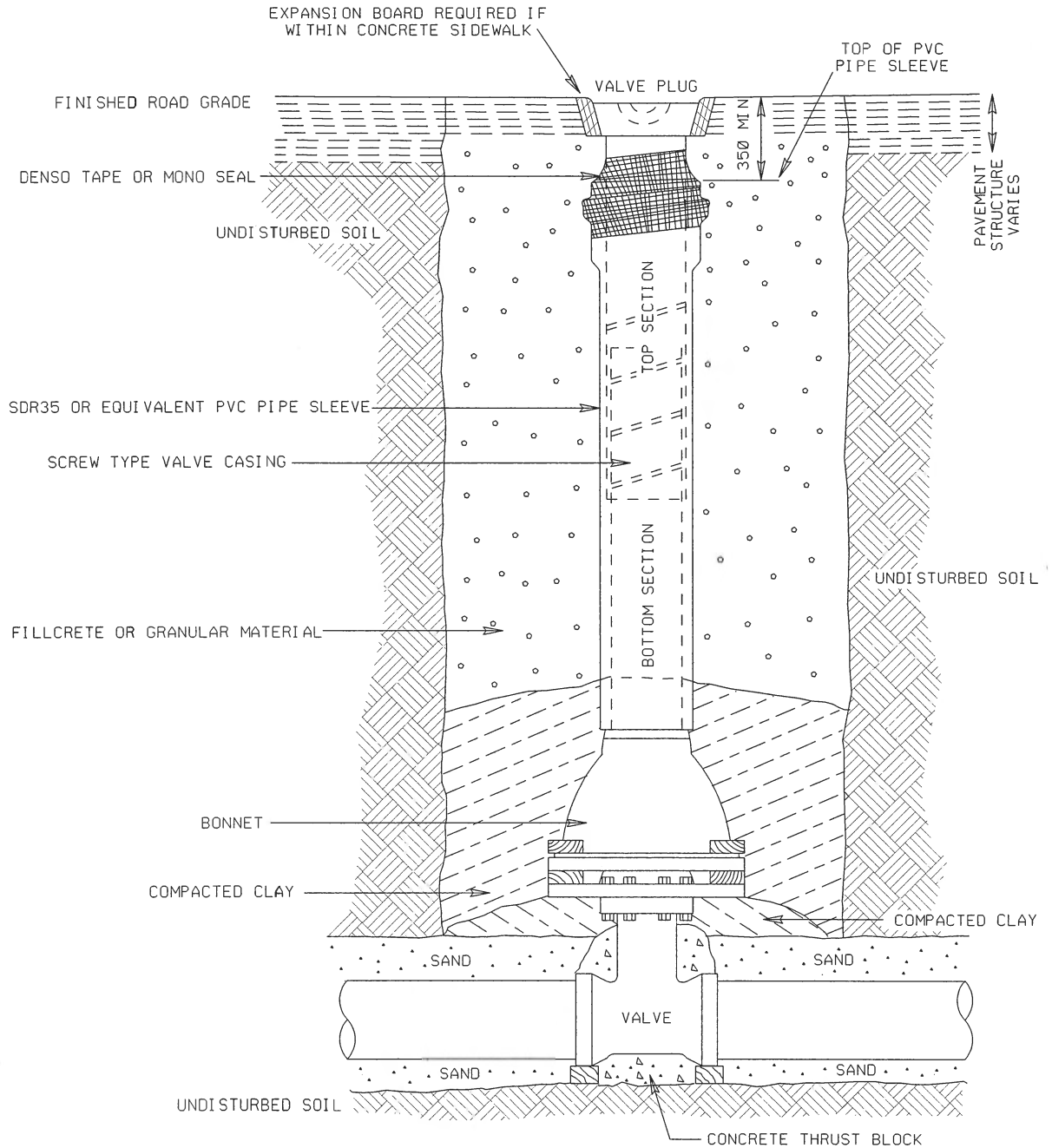
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JANUARY 2013
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Doug S.

APPROVED
Susan Oak
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

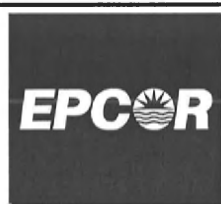
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2512-07
REVISION 0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.

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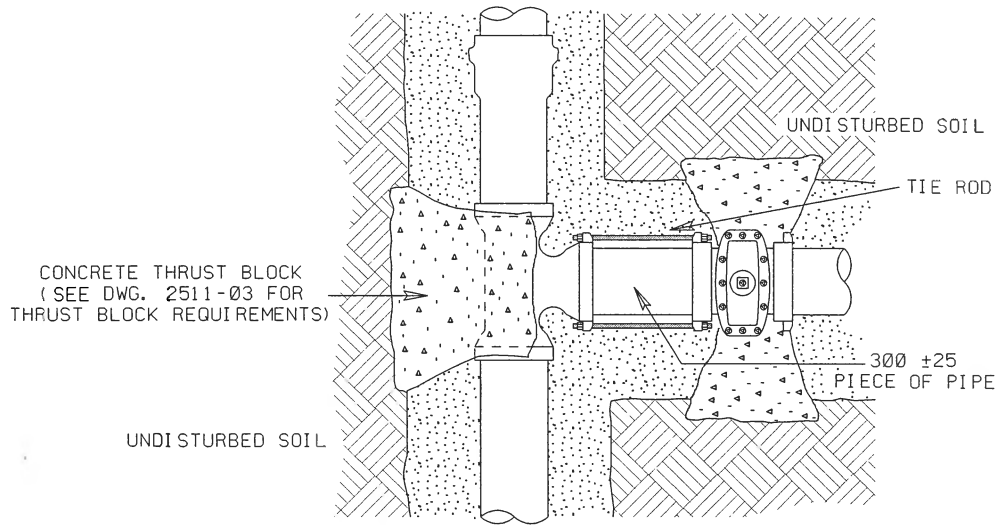
VALVE CASING DETAIL FOR FILLCRETE AND GRANULAR MATERIAL

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JANUARY 2013
SCALE
N T S

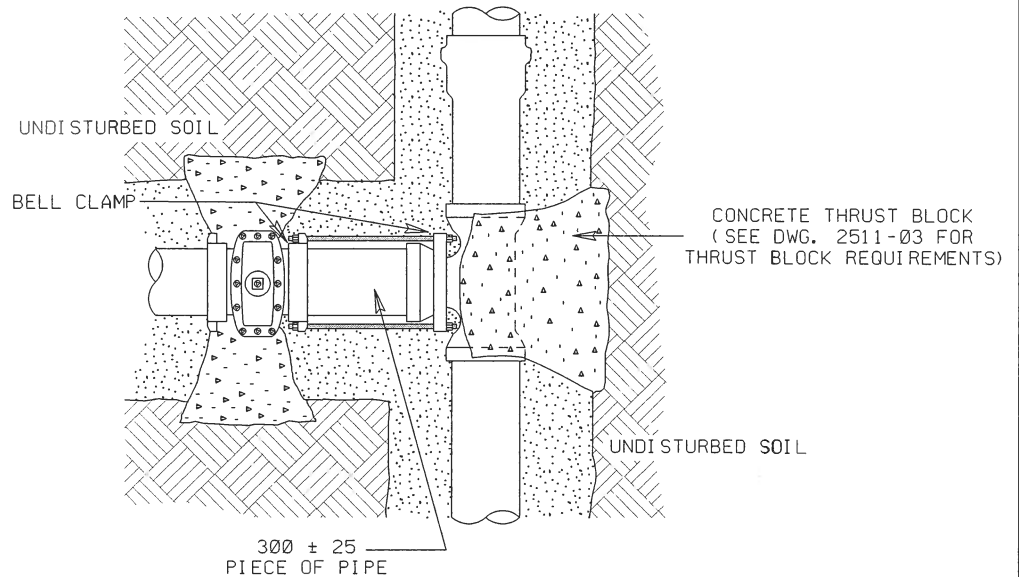
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Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan Ol
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2512-08
REVISION 0



VALVE STRAPPED TO TEE WITH LUGS (PLAN VIEW)



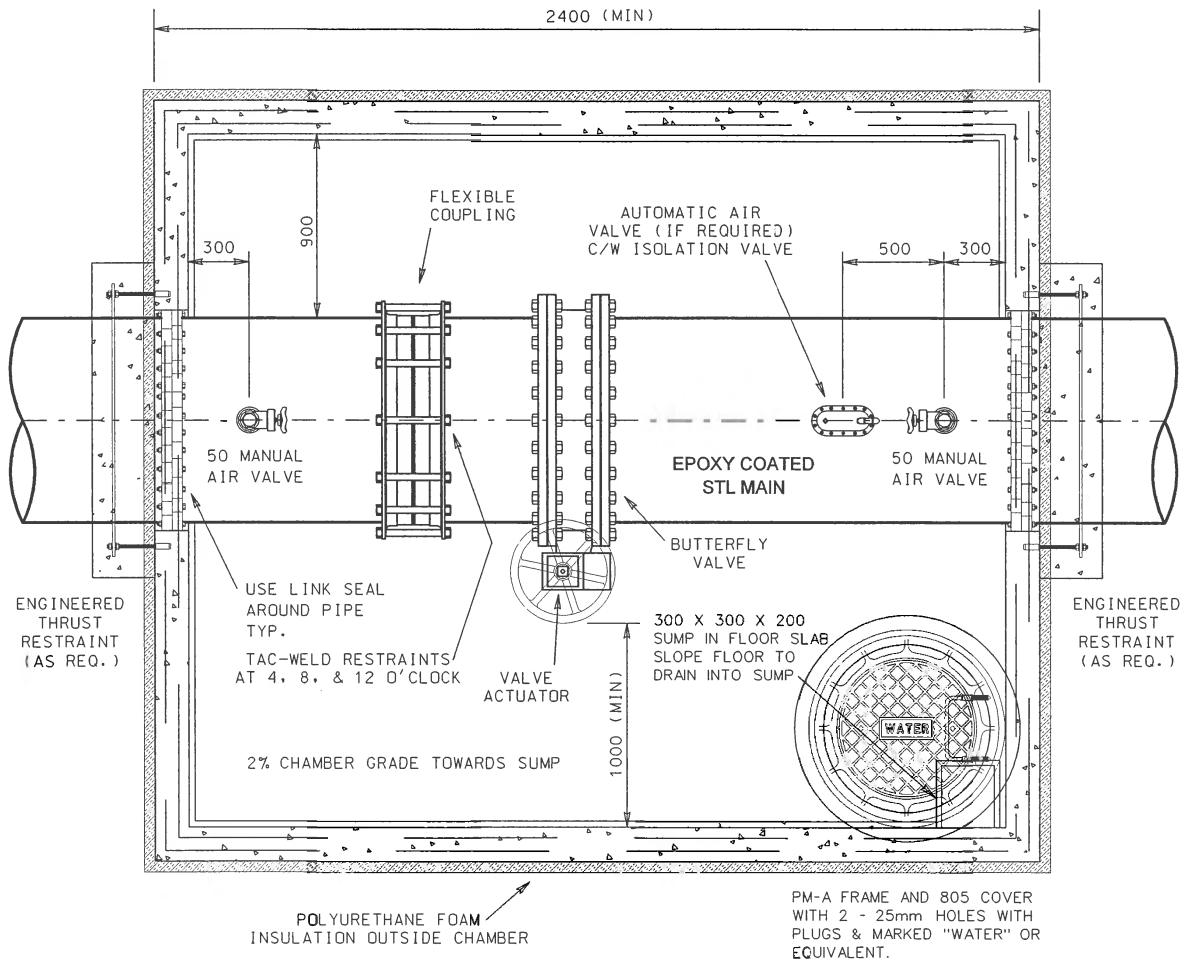
VALVE STRAPPED TO TEE WITH CLAMP (PLAN VIEW)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. TIE RODS, WASHERS, BOLTS, TO BE STAINLESS STEEL.
3. BELL CLAMPS TO BE DUCTILE IRON.
4. CORROSION PROTECTION BY MEANS APPROVED BY THE ENGINEER.

2012/12/18 14:37 dvandenb 2512-9.DGN

VALVE STRAPPED TO TEE DETAILS			
	APPROVED	DRAWN BY	APPROVED
	JANUARY 2013	Dale Vandenberg	
	SCALE	CHECKED BY	DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION
N T S	Doug S.		
DRAWING NUMBER			2512-09
REVISION			0



PLAN

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. PROVIDE 100mm THICK POLYURETHANE FOAM INSULATION AROUND EXTERIOR OF CHAMBER WALLS, ROOF AND MANHOLE RISER FOR CHAMBERS UTILIZING AUTOMATIC AIR VALVES. PROVIDE A FROST COVER FOR MANHOLE FRAME. COVER ALL INSULATION WITH APPROVED WATERPROOFING COMPOUND.
3. ALSO SEE DRAWING 2512-11
4. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE AN ELECTRICAL CONTINUITY BOND ACROSS THE VALVE AND COUPLING WHEN DIRECTED BY THE ENGINEER.
5. MANUAL AIR VALVE: BRONZE OR STAINLESS STEEL GATE VALVE, 1035 kPa WORKING PRESSURE.

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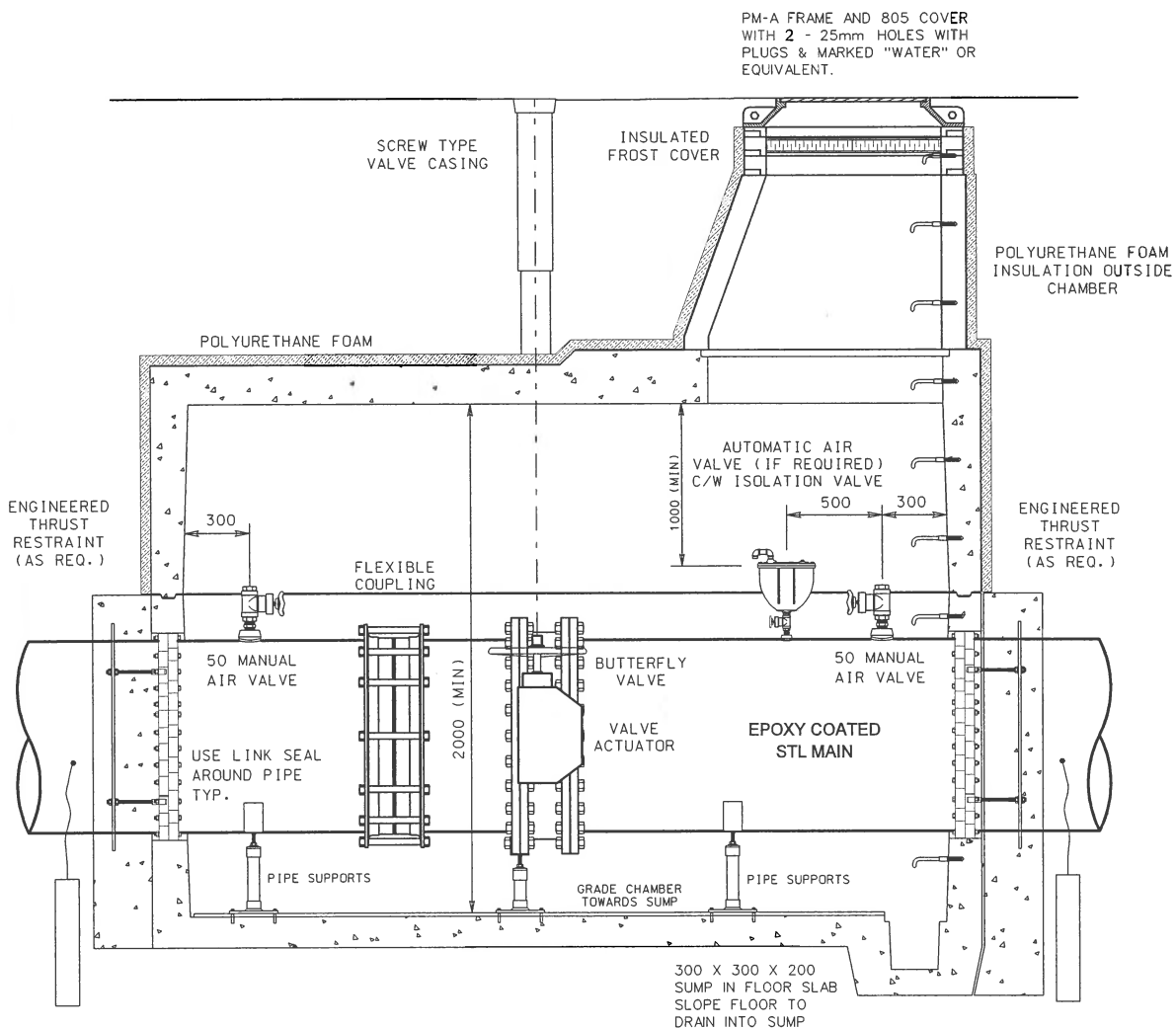
VALVE CHAMBER DETAIL (PLAN)

APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan Ol
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2512-10
REVISION 0



PROFILE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. PROVIDE 100mm THICK POLYURETHANE FOAM INSULATION AROUND EXTERIOR OF CHAMBER WALLS, ROOF AND MANHOLE RISER FOR CHAMBERS UTILIZING AUTOMATIC AIR VALVES. PROVIDE A FROST COVER FOR MANHOLE FRAME. COVER ALL INSULATION WITH APPROVED WATERPROOFING COMPOUND.
3. ALSO SEE DRAWING 2512-10
4. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE AN ELECTRICAL CONTINUITY BOND ACROSS THE VALVE AND COUPLING WHEN DIRECTED BY THE ENGINEER.
5. MANUAL AIR VALVE: BRONZE OR STAINLESS STEEL GATE VALVE, 1035 kPa WORKING PRESSURE.

EPCOR

VALVE CHAMBER DETAIL (PROFILE)

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan Ol

DRAWING NUMBER

2512-11

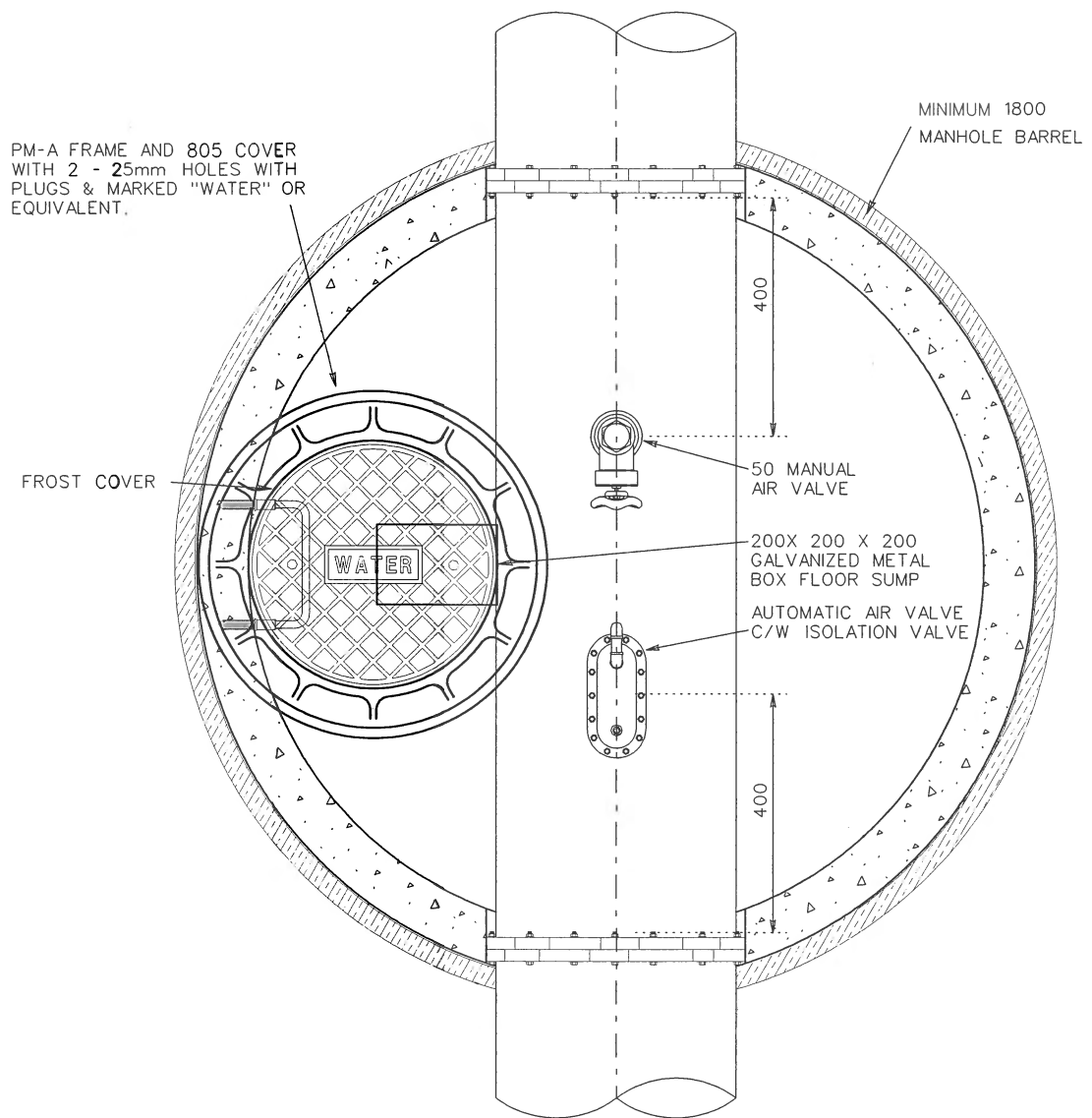
SCALE
N T S

CHECKED BY
Doug S.

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

REVISION 0

2012/12/19 08:30 dvandenb 2512-12.DGN



PLAN

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. INSULATE EXTERIOR OF MANHOLE AND RISER WITH 100mm THICK POLYURETHANE FOAM INSULATION. TREAT WITH APPROVED WATERPROOFING COMPOUND.
3. ALSO SEE DRAWING 2512-13
4. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE ELECTRICAL ACCESS WIRES WHEN DIRECTED BY THE ENGINEER.
5. MANUAL AIR VALVE: BRONZE OR STAINLESS STEEL GATE VALVE, 1035 kPa WORKING PRESSURE.



AUTOMATIC AIR VALVE CHAMBER DETAIL (PLAN)

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan

DRAWING NUMBER

2512-12

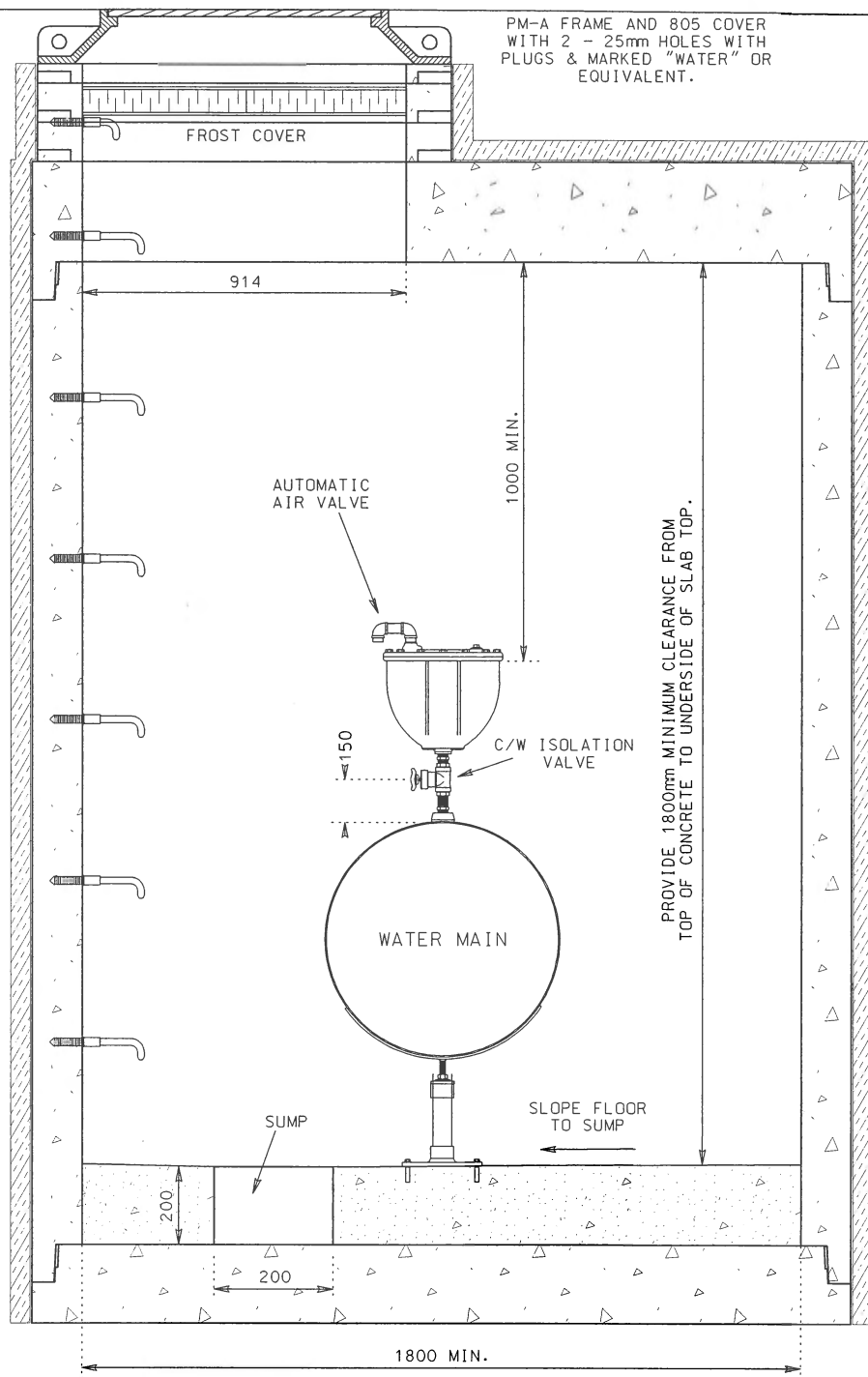
SCALE
N T S

CHECKED BY
Doug S.

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

REVISION 0

20121219 08:39 dvandenb 2512-13.DGN



PROFILE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. INSULATE EXTERIOR OF MANHOLE AND RISER WITH 100mm THICK POLYURETHANE FOAM INSULATION. TREAT WITH APPROVED WATERPROOFING COMPOUND.
3. ALSO SEE DRAWING 2512-12
4. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE ELECTRICAL ACCESS WIRES WHEN DIRECTED BY THE ENGINEER.

EPCOR

AUTOMATIC AIR VALVE CHAMBER DETAIL (PROFILE)

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

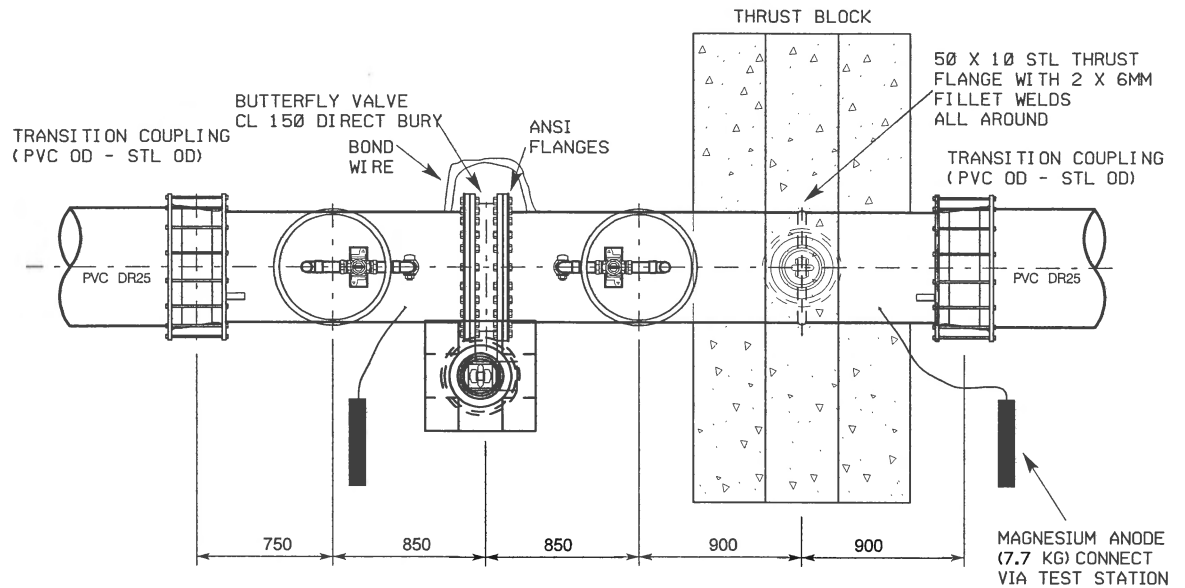
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2512-13

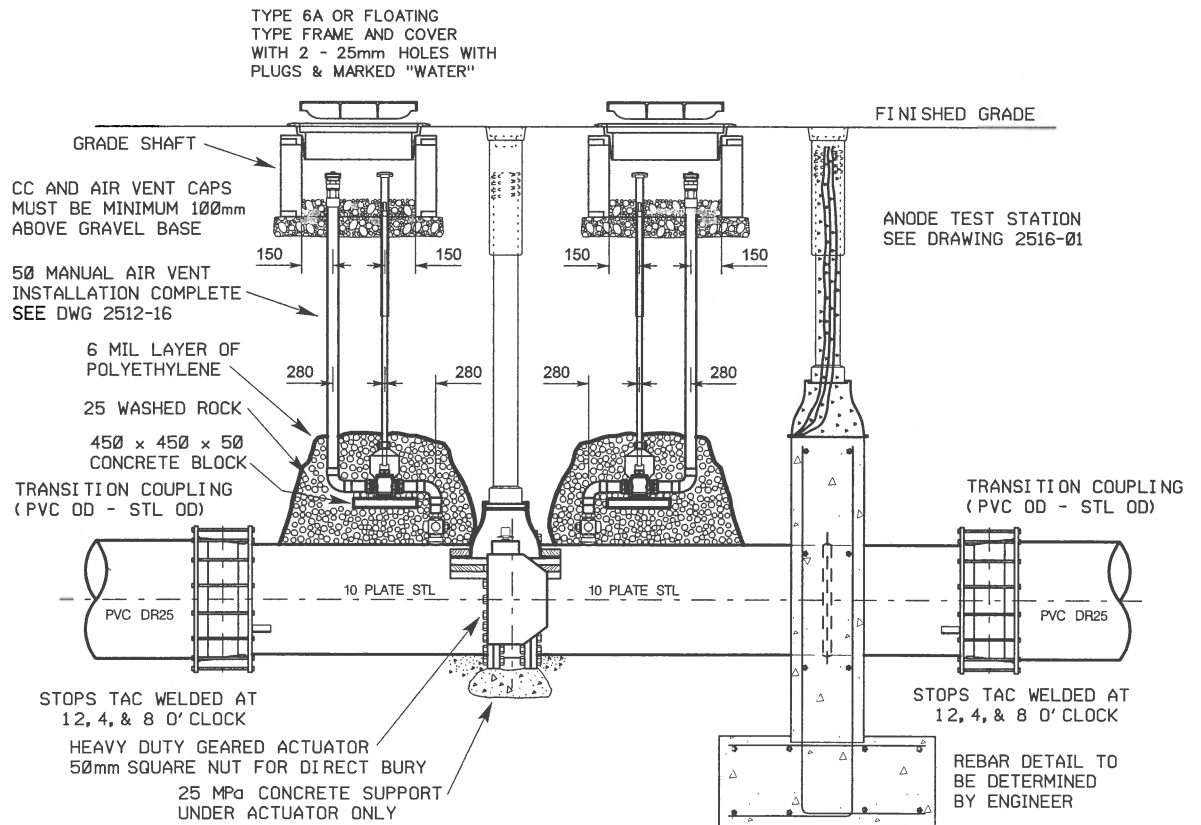
SCALE
N T S

CHECKED BY
Doug S.

REVISION 0



PLAN



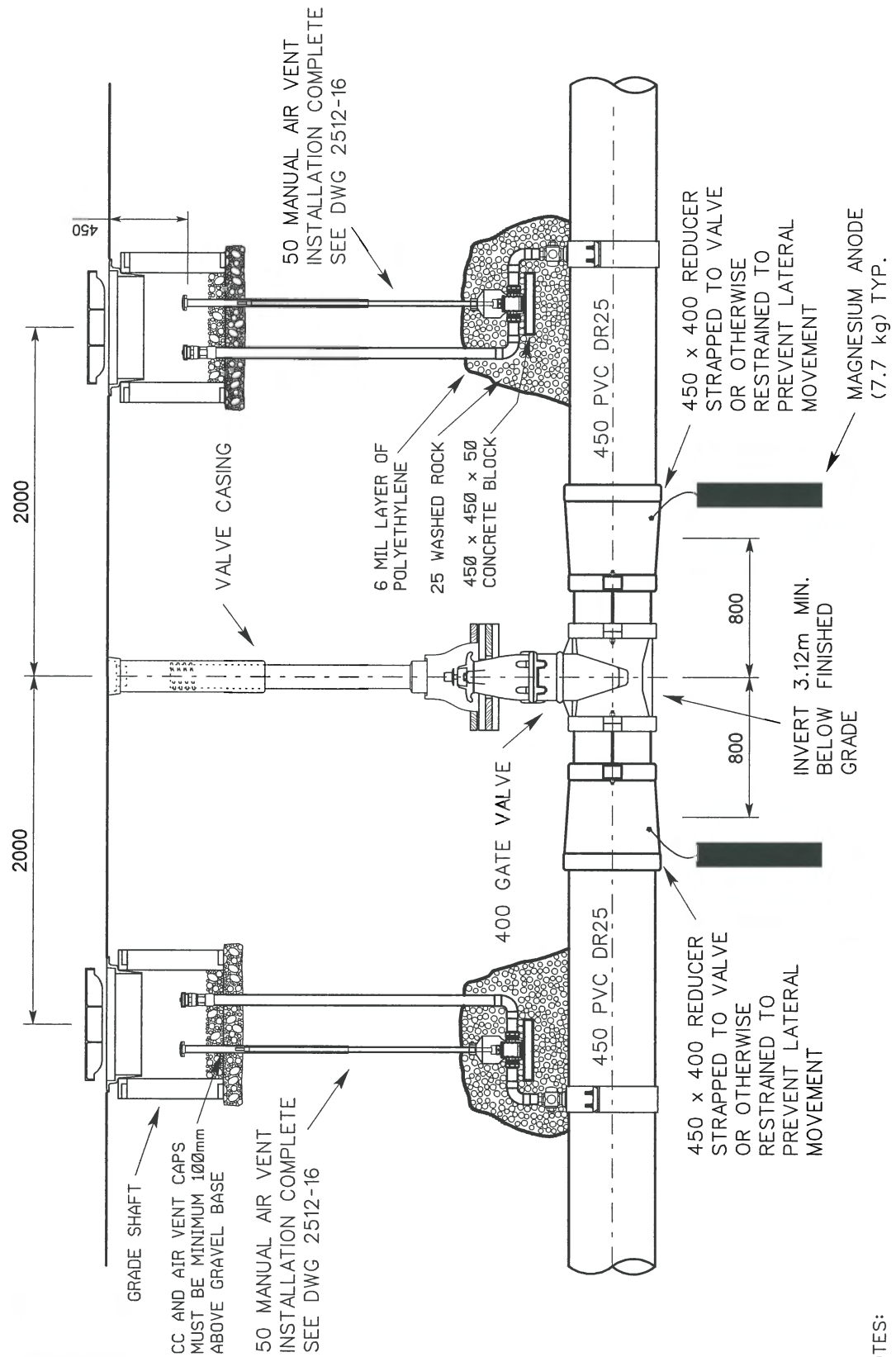
PROFILE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. AIR VENTS MAY ALSO BE LOCATED IN THE BOULEVARD. SEE DWG 2512-17 AND 2512-18
3. LOCATION OF AIR VENTS MUST BE SHOWN ON THE ENGINEERING DRAWINGS AND AS-BUILTS
4. ACTUATOR NUT MUST BE LOCATED ON THE SIDE OPPOSITE THE FACE OF CURB.
5. COMPACT GRAVEL BASE TO A MINIMUM 100% OF THE MAXIMUM DENSITY IN THE ROADWAY, AND 95% IN THE BOULEVARD.

450mm TO 750mm DIRECT BURY BUTTERFLY VALVE WITH AIR VENTS			
	APPROVED	DRAWN BY	APPROVED
	JANUARY 2013	Dale Vandenberg	
	SCALE	CHECKED BY	DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION
	N T S	Doug S.	
DRAWING NUMBER			2512-14
REVISION 0			

20130531 06:37 dvandenb 2512-15.dgn



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. AIR VENTS MAY ALSO BE LOCATED IN THE BOULEVARD. SEE DWG 2512-17 AND 2512-18
3. LOCATION OF AIR VENTS MUST BE SHOWN ON THE ENGINEERING DRAWINGS AND AS-BUILTS
4. COMPACT GRAVEL BASE TO A MINIMUM 100% OF THE MAXIMUM DENSITY IN THE ROADWAY, AND 95% IN THE BOULEVARD.

EPCOR

450 MAIN WITH 400 GATE VALVE AND MANUAL AIR VENTS

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan

DRAWING NUMBER

2512-15

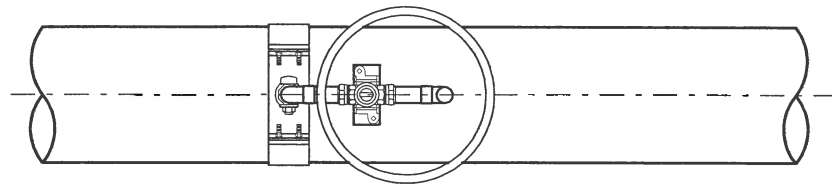
SCALE
N T S

CHECKED BY
Doug S.

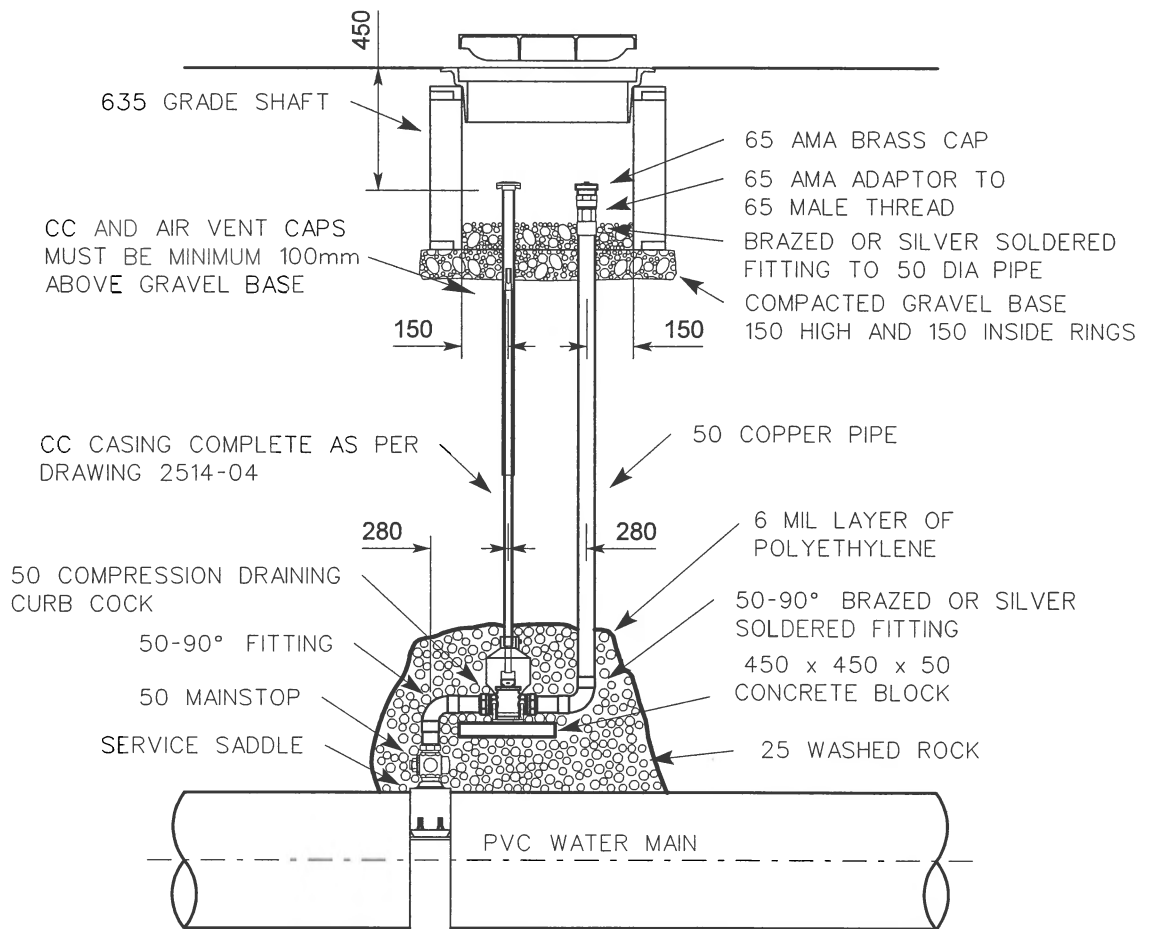
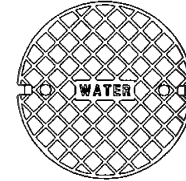
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

REVISION 0

TYPE 6A OR FLOATING
TYPE FRAME AND COVER
WITH 2 - 25mm HOLES WITH
PLUGS & MARKED "WATER".



PLAN



PROFILE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. COMPACT GRAVEL BASE TO A MINIMUM 100% OF THE MAXIMUM DENSITY IN THE ROADWAY.
3. BRAZED OR SILVER SOLDERED FITTINGS MAY BE REPLACED WITH EPCOR APPROVED ALTERNATIVE.



TYPICAL 50mm MANUAL AIR VENT IN ROADWAY

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

SCALE
N T S

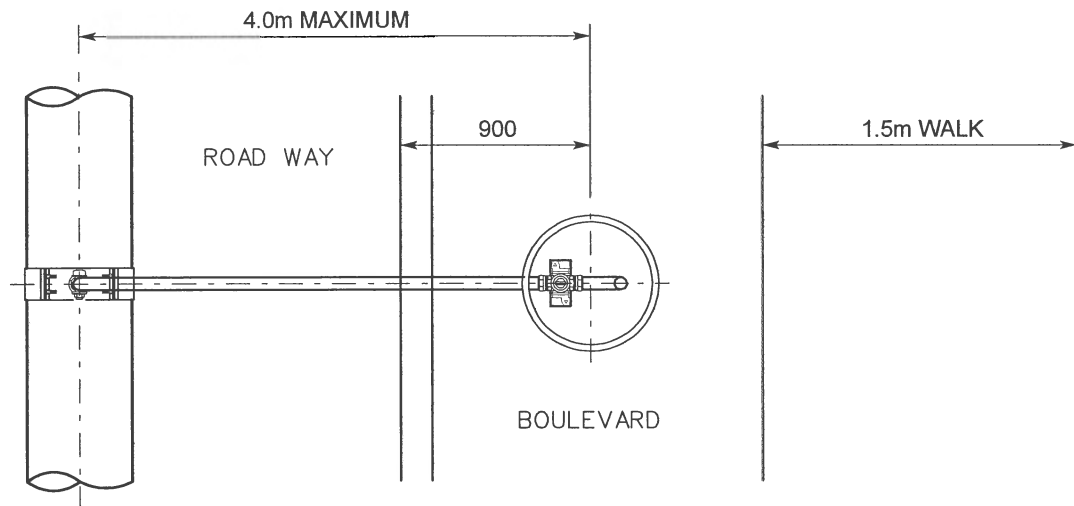
CHECKED BY
Doug S.

Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

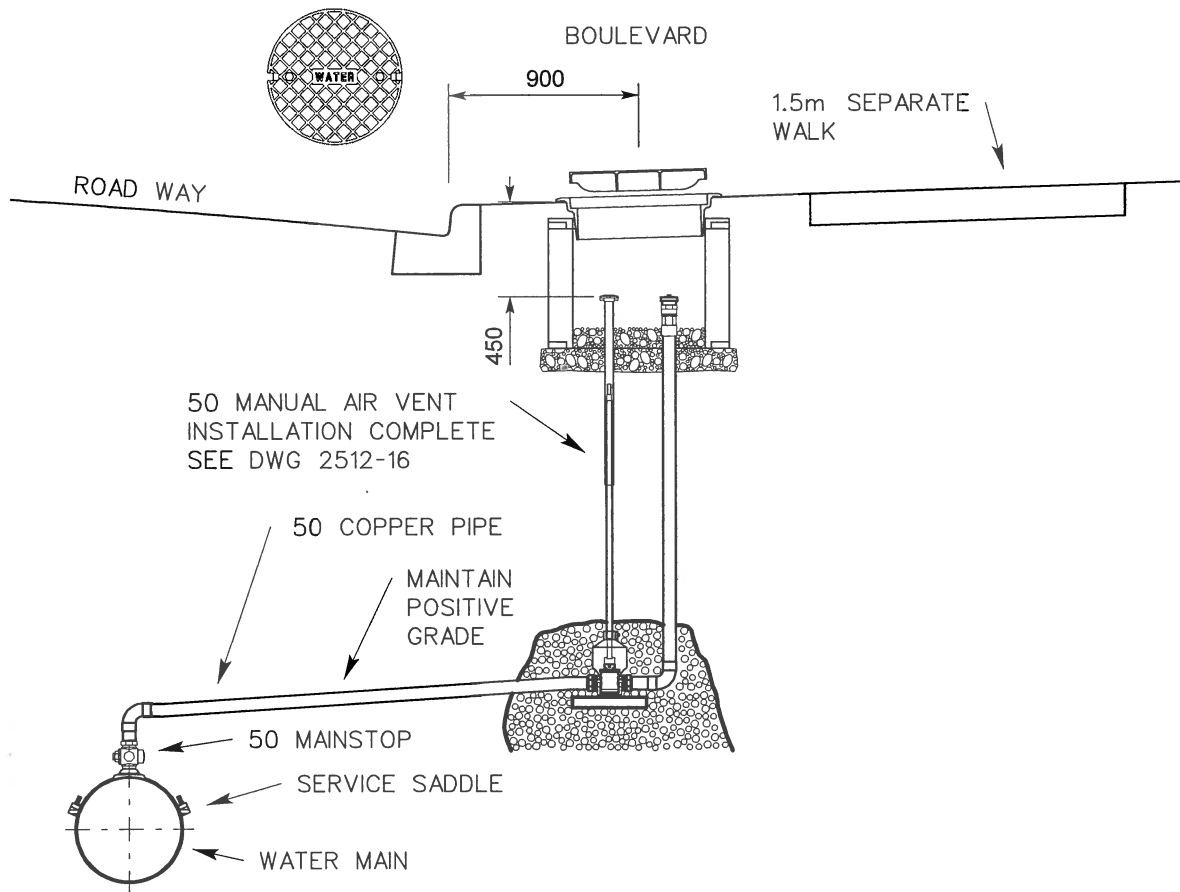
DRAWING NUMBER

2512-16

REVISION 0



PLAN

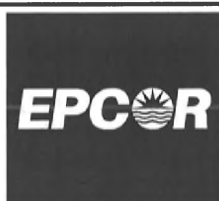


PROFILE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. COMPACT GRAVEL BASE TO A MINIMUM 95% OF THE MAXIMUM DENSITY IN THE BOULEVARD.
3. IF COVER ON COPPER PIPE IS 2.0m OR LESS, INSTALL INSULATION AS PER DWG 2511-08.

20130315 10:40 dvandenb 2512-17.dgn



TYPICAL 50mm MANUAL AIR VENT IN BOULEVARD
WITH 1.5 m SEPARATE WALK

APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2512-17
REVISION 0



1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. COMPACT GRAVEL BASE TO A MINIMUM 95% OF THE MAXIMUM DENSITY IN THE BOULEVARD.
3. IF COVER ON COPPER PIPE IS 2.0m OR LESS, INSTALL INSULATION AS PER DWG 2511-08.

EPCOR

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

SCALE
N T S

CHECKED BY
Doug S.

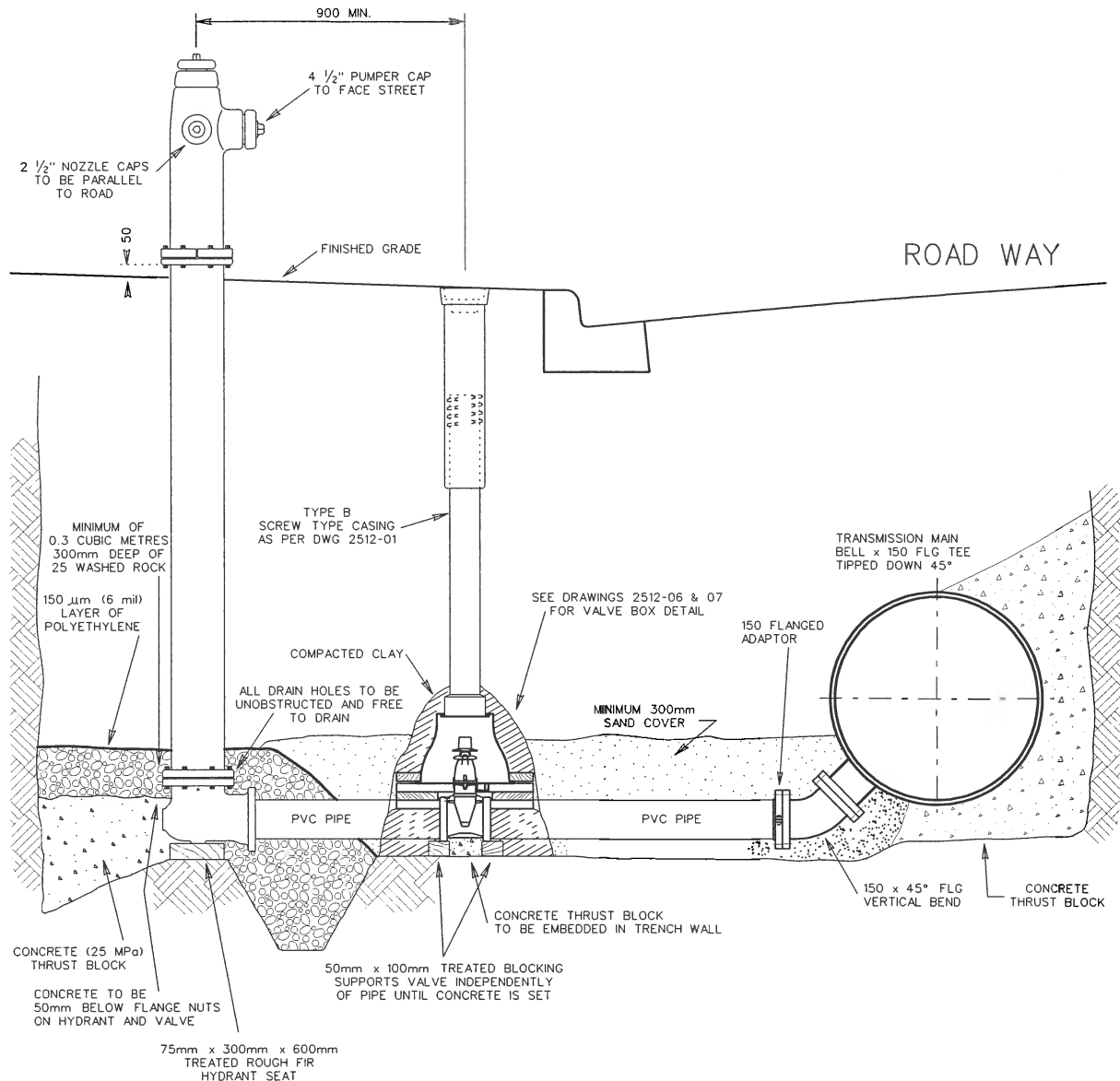
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2512-18

REVISION 0

20130315 12:40 dvandenb 2512-19.dgn



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SEE DRAWING 2516-03 FOR CATHODIC PROTECTION REQUIREMENTS.
3. INSTALL A HYDRANT BARREL EXTENSION AS NECESSARY.

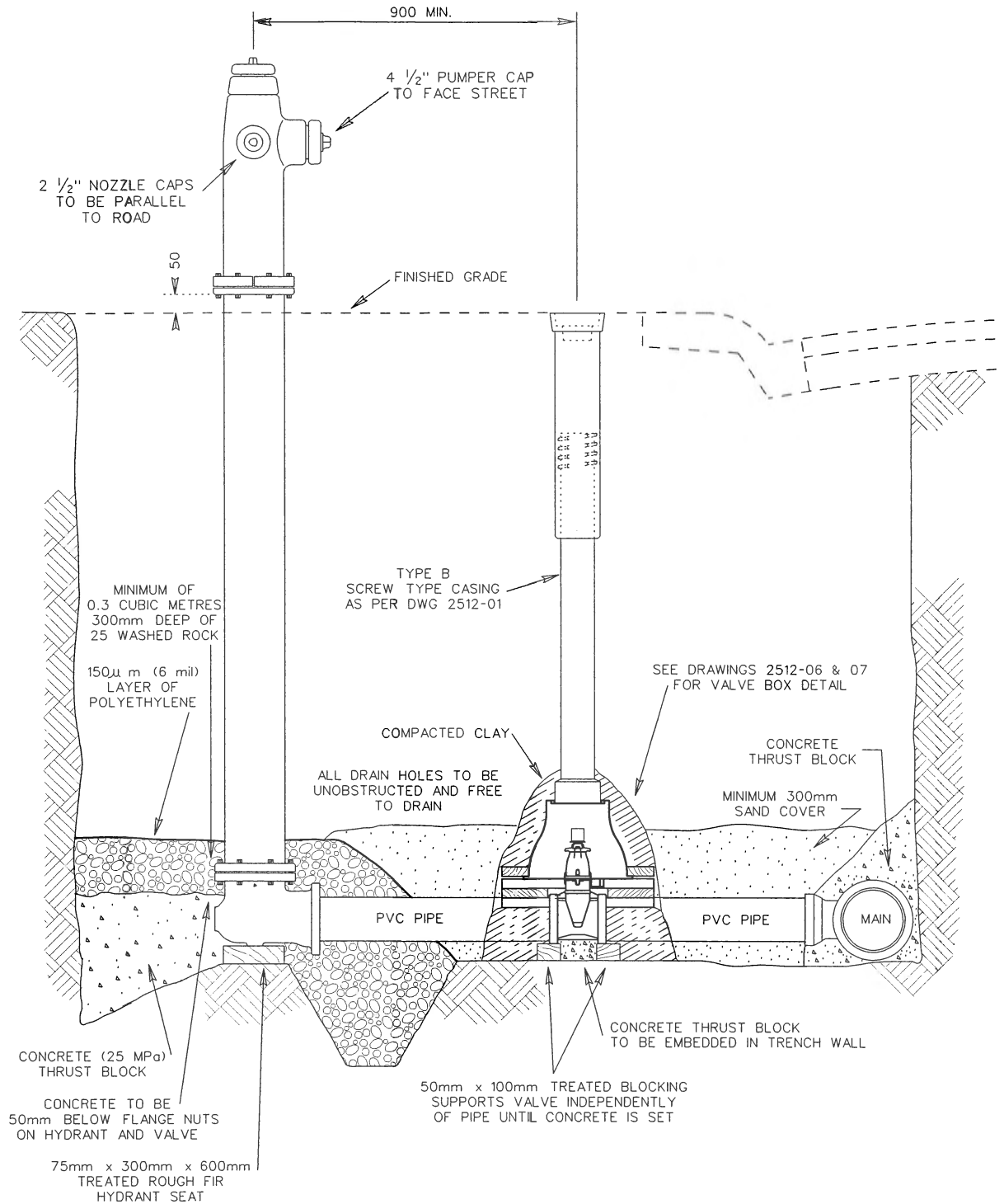
EPCOR

APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2512-19
REVISION 0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SEE DRAWING 2516-03 FOR CATHODIC PROTECTION REQUIREMENTS

20130315 12:53 dvandenb 2513-1.DGN

FIRE HYDRANT PLACEMENT (TYPICAL)

EPCOR

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan Orl

DRAWING NUMBER

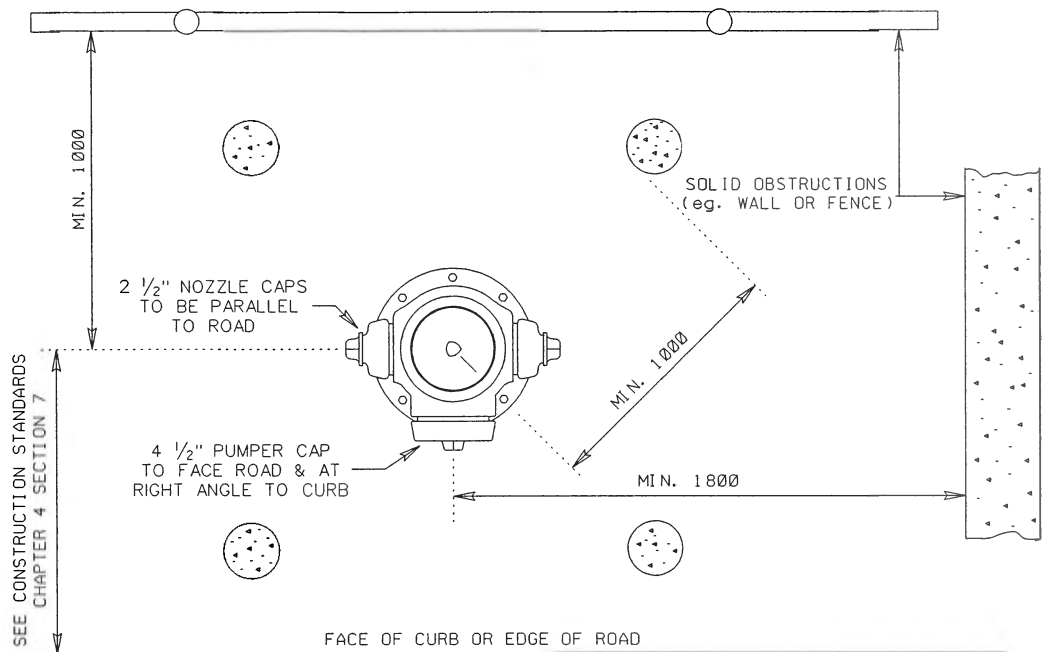
2513-01

SCALE
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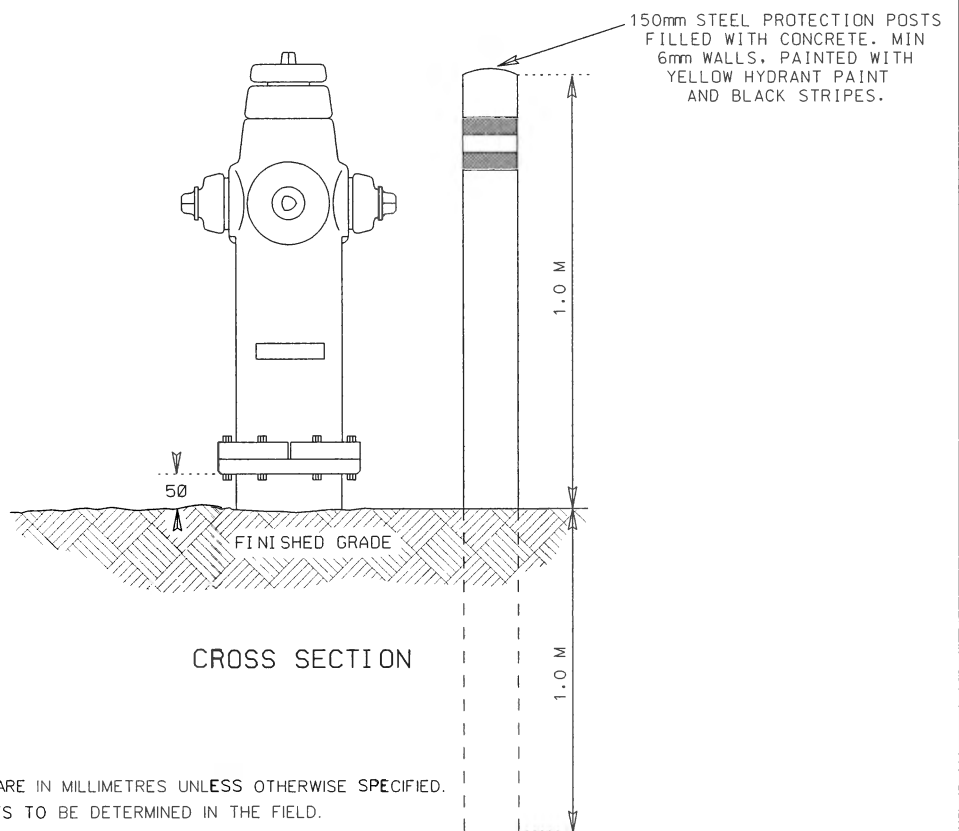
CHECKED BY
Doug S.

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

REVISION 0



PLAN VIEW



CROSS SECTION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. NUMBER OF POSTS TO BE DETERMINED IN THE FIELD.

20130318 08:34 dvandenb 2513-2.DGN

EPCOR

FIRE HYDRANT PROTECTION PLACEMENT

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2513-02

REVISION 0

SCALE
N T S

CHECKED BY
Doug S.

50mm X 100mm X 750mm SERVICE
MARKER WITH 450mm ABOVE
GROUND PAINTED RED

(MARKER AT P/L
PAINTED GREEN
IF SEWERS ONLY)

CAP

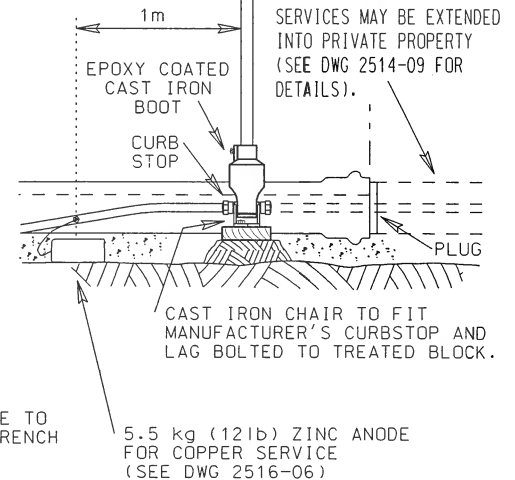
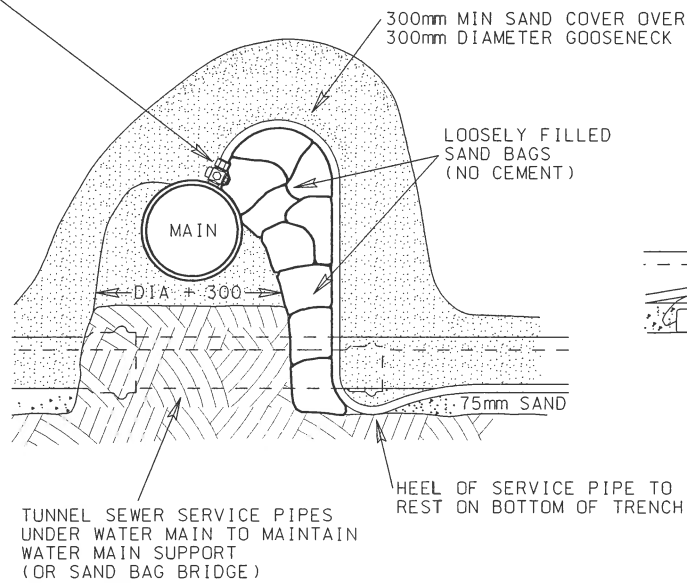
PROPERTY LINE

CI AND AC PIPE

MAINSTOPS TAPPED AT CROWN UP TO
30° OF PIPE WITH 1-3 THREADS SHOWING.
STAGGER MAINSTOPS.

PVC PIPE

MAINSTOPS TAPPED ARE TO BE STAGGERED FROM
CROWN TO 30° OF PIPE WITH 1-3 THREADS SHOWING.
TEFLON TAPE TO BE USED ON THREADS OF MAINSTOP.
40mm AND 50mm TAPS REQUIRE THE USE OF A SERVICE SADDLE.
PIPE GREATER THAN 300mm REQUIRES THE USE OF A SERVICE SADDLE.



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. AN ADDITIONAL GOOSENECK IS REQUIRED AT EACH SEWER CROSSING.
3. MAINSTOP TAPS SHALL BE A MINIMUM OF 600mm APART, AND NO LESS THAN 600mm FROM A COUPLING OR COLLAR.
4. COPPER SERVICE PIPE SHALL BE ONE CONTINUOUS PIECE. SHOULD LENGTH EXCEED 20m, A DOUBLE UNION WILL BE ALLOWED AND SIZE OF COPPER SERVICE MUST BE 25mm MINIMUM.
5. INVERT ELEVATION OF WATER SERVICE PIPES AT PROPERTY LINE SHALL BE 2.59m BELOW ESTABLISHED FINISHED GRADE.
6. WHERE ENGINEER APPROVED COVER OVER WATER SERVICE TO BE LESS THAN 2.59m SERVICE IS TO BE INSULATED IN ACCORDANCE WITH DWG. 2511-08.
7. ZINC ANODE SHALL BE ATTACHED TO COPPER PIPE 1.0m FROM CC WITH AN ALL BRONZE (INCLUDING NUTS AND BOLTS) CLAMP OR APPROVED EQUIVALENT.
8. ZINC ANODE TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR MIN. 50mm OF NATIVE CLAY SURROUNDING ANODE.

20121220 14:56 dvandemb 2514-1.DGN

50mm AND SMALLER COPPER WATER SERVICE

EPCOR

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

SCALE
N T S

CHECKED BY
Doug S.

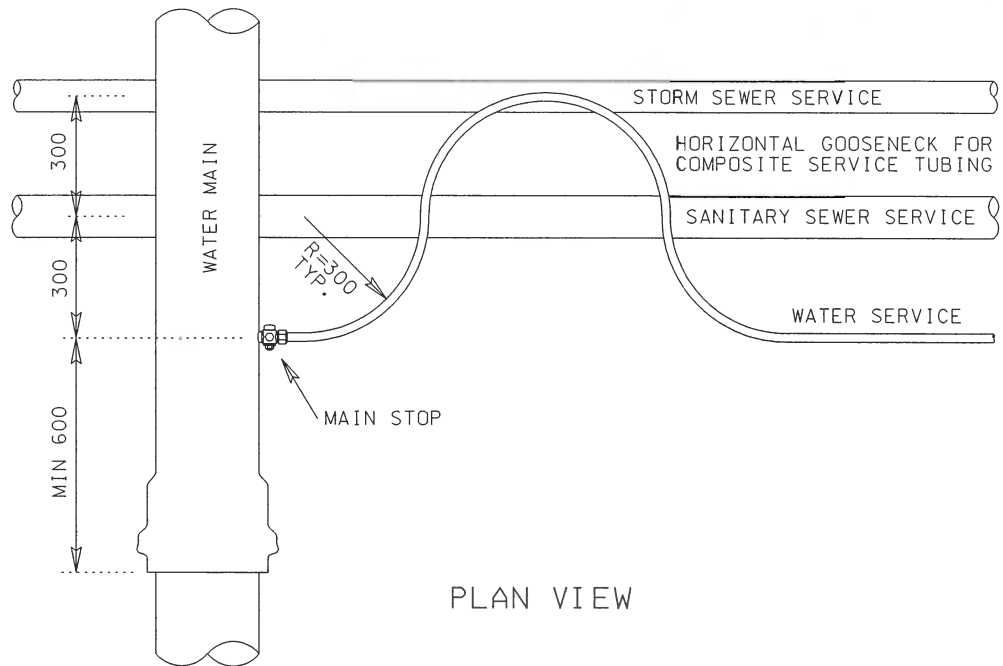
APPROVED

Susan Ol
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2514-01

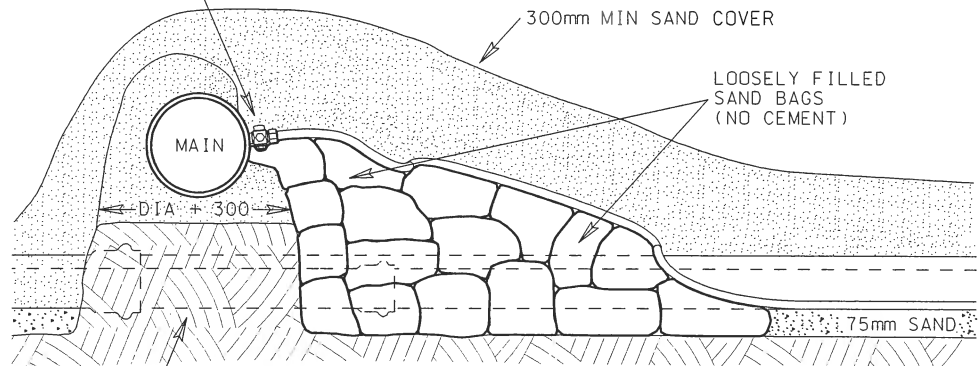
REVISION 0



PLAN VIEW

PVC PIPE

MAINSTOPS TO BE STAGGERED FROM SPRING LINE TO 15° OF PIPE WITH 1-3 THREADS SHOWING. TEFLON TAPE TO BE USED ON THREADS OF MAINSTOP. TAPS ON PIPE GREATER THAN 300 DIAMETER REQUIRE A SERVICE SADDLE. SUPPORT SERVICE TUBING ON LEDGE FORMED IN TRENCH WALL OR ON LOOSELY FILLED SAND BAGS.



TUNNEL SEWER SERVICE PIPES
UNDER WATER MAIN TO MAINTAIN
WATER MAIN SUPPORT
(OR SAND BAG BRIDGE)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. AN ADDITIONAL GOOSENECK IS REQUIRED AT EACH SEWER CROSSING.
3. MAINSTOP TAPS SHALL BE A MINIMUM OF 600mm APART, AND NO LESS THAN 600mm FROM A COUPLING OR COLLAR.
4. COMPOSITE SERVICE TUBING SHALL BE SUPPORTED EVENLY ALONG ITS ENTIRE LENGTH WITH NO FREE SPANS.
5. INVERT ELEVATION OF WATER SERVICE PIPES AT PROPERTY LINE SHALL BE 2.59m BELOW ESTABLISHED FINISHED GRADE.
6. WHERE ENGINEER APPROVED COVER OVER WATER SERVICE TO BE LESS THAN 2.59m SERVICE IS TO BE INSULATED IN ACCORDANCE WITH DWG. 2511-08.
7. FOR CURB COCK AND CURB BOX ASSEMBLY SEE DWG 2514-03.

20121220 14:58 dvandenb 2514-2.dgn

20mm AND 25mm COMPOSITE WATER SERVICE

EPCOR

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

SCALE
N T S

CHECKED BY
Doug S.

APPROVED

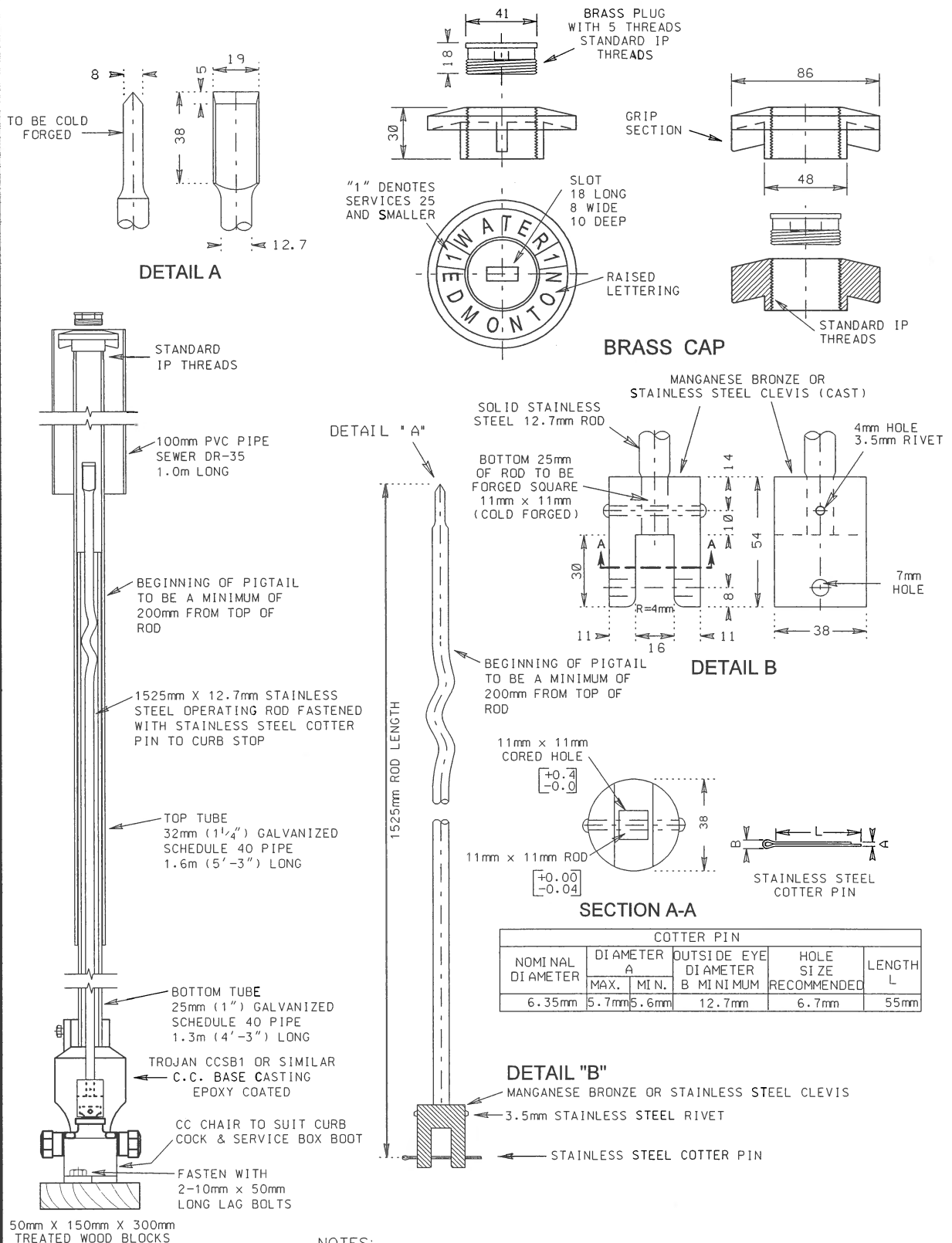
Susan Ol

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER

2514-02

REVISION 0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. OPERATING ROD SHALL BE SUPPLIED AS A SINGLE UNIT COMPRISED OF A SOLID STAINLESS STEEL ROD, ATTACHED TO CLEVIS WITH A STAINLESS STEEL RIVET.
3. THE MANUFACTURER'S NAME SHALL BE EMBOSSED ONTO THE CLEVIS.

EPCOR

SERVICE BOX DETAIL FOR 20mm, 25mm WATER SERVICE

APPROVED
JANUARY 2013
DALE VANDENBERG

DRAWN BY
DALE VANDENBERG

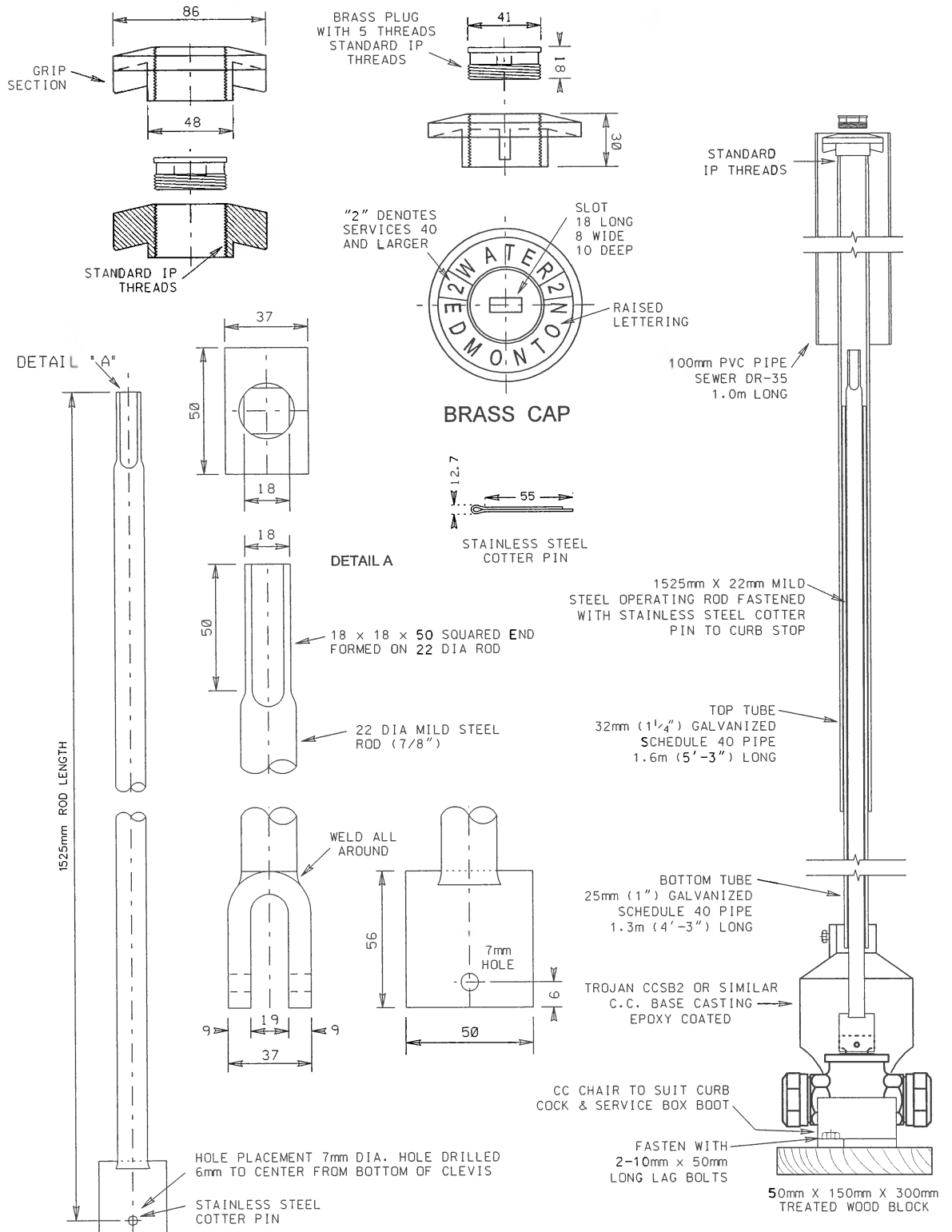
SCALE
N T S

CHECKED BY
DOUG S.

APPROVED
Susan Gul
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2514-03

REVISION 0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. OPERATING ROD SHALL BE SUPPLIED AS A SINGLE UNIT COMPRISED OF A SOLID MILD STEEL ROD WITH A MILD STEEL CLEVIS WELDED TO IT.
3. THE MANUFACTURER'S NAME SHALL BE STAMPED INTO THE CLEVIS.
4. CLEVIS FORMED FROM MILD STEEL FLAT 120mm x 50mm x 9mm ($4\frac{3}{4}'' \times 2'' \times \frac{3}{8}''$).

EPCOR

SERVICE BOX DETAIL FOR 40mm, 50mm WATER SERVICE

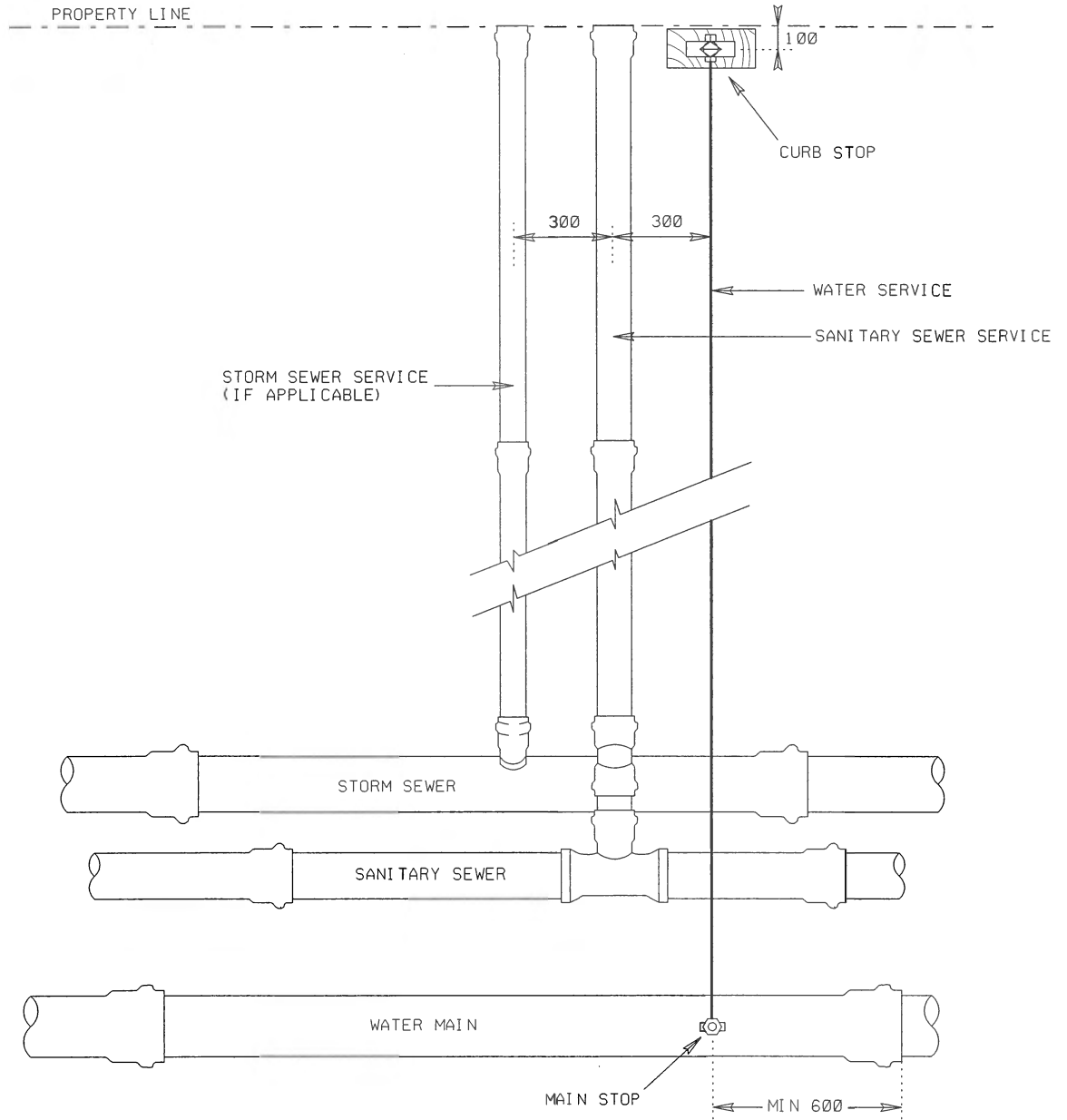
APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
[Signature]
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2514-04
REVISION 0

SERVICE NORMALLY LAID IN MIDDLE OF THE
PROPERTY AND INTERSECTS PROPERTY LINE AT 90°



PLAN VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY BEYOND GAS EASEMENT (SEE DWG 2514-09 FOR DETAILS).
3. SANITARY AND STORM SERVICES MUST HAVE A BELL AT PROPERTY LINE.

20121220 15:07 dvandenb 2514-5.DGN



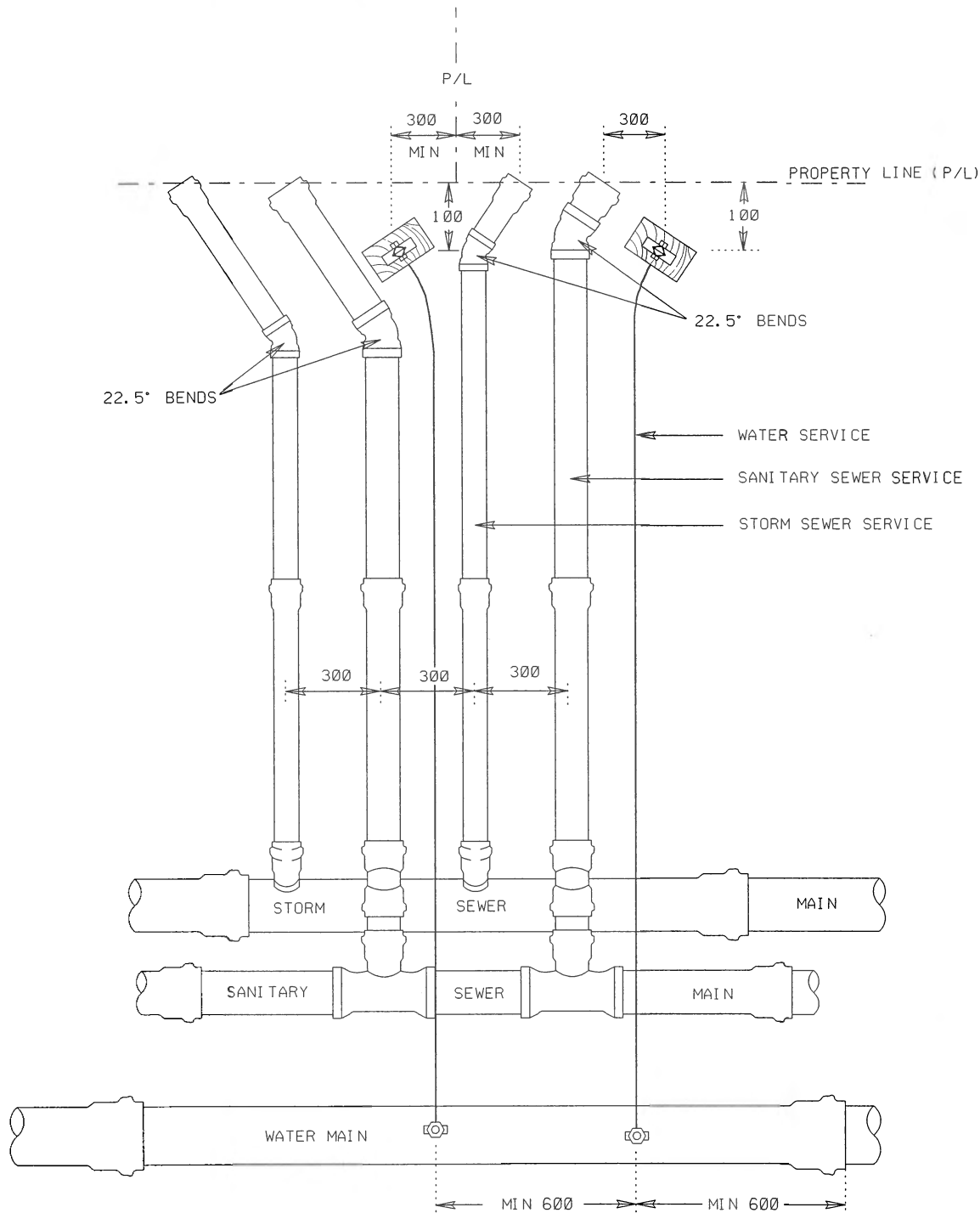
SINGLE SERVICE

APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan Ol
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2514-05
REVISION 0



PLAN VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY BEYOND GAS EASEMENT (SEE DWG 2514-09 FOR DETAILS).
3. SANITARY AND STORM SERVICES MUST HAVE A BELL AT PROPERTY LINE.

20121220 15:09 dvandenb 2514-6.DGN



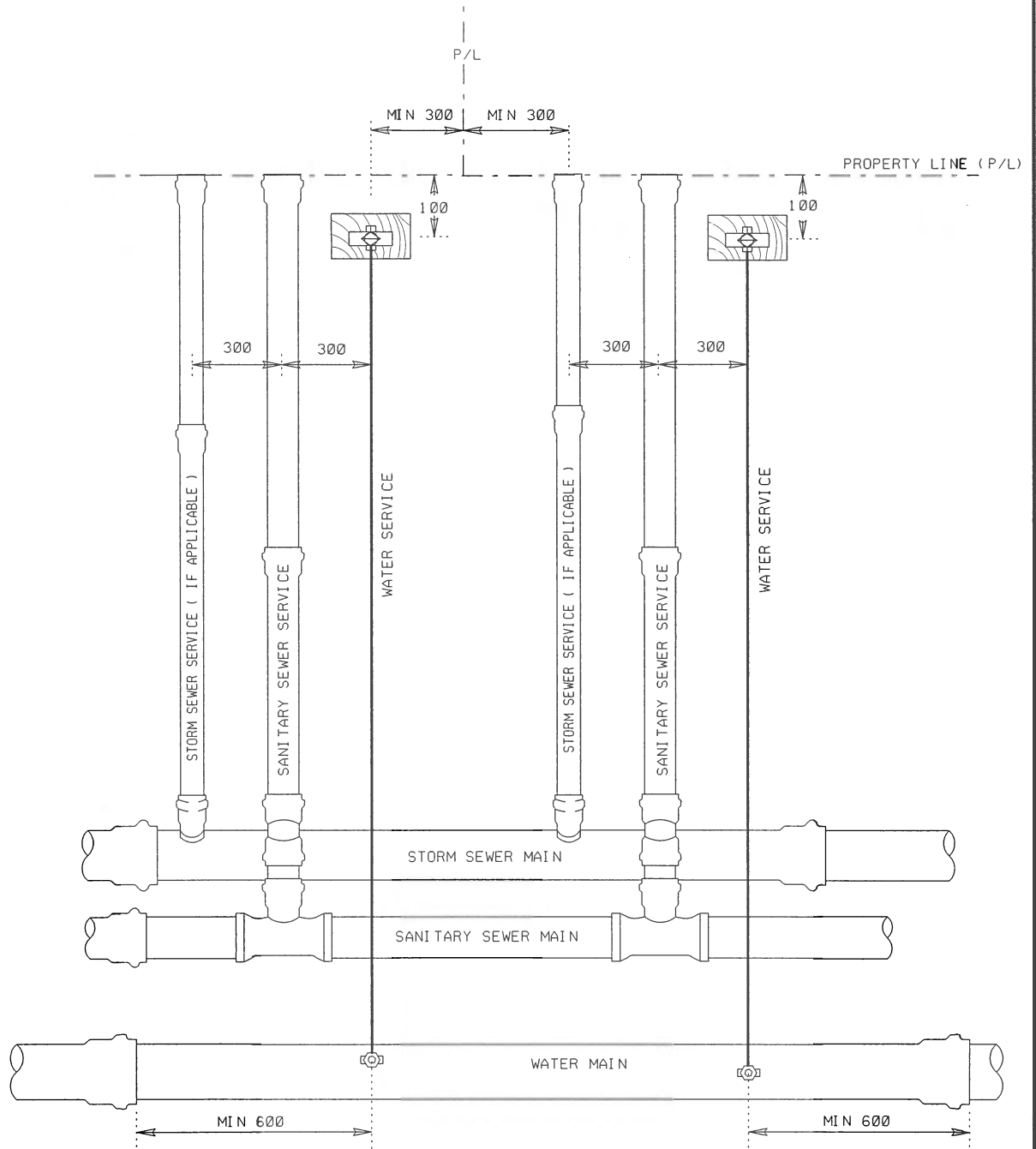
TYPICAL DUAL SERVICE (ONE TRENCH)

APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
[Signature]
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2514-06
REVISION 0



PLAN VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY BEYOND GAS EASEMENT (SEE DWG 2514-09 FOR DETAILS).
3. SANITARY AND STORM SERVICES MUST HAVE A BELL AT PROPERTY LINE.
4. REFER TO APPLICABLE SECTIONS FOR REQUIREMENTS FOR SEWER MAINS AND SEWER SERVICES.

20121220 15:12 dvandenb 2514-7.DGN



APPROVED
JANUARY 2013
SCALE
N T S

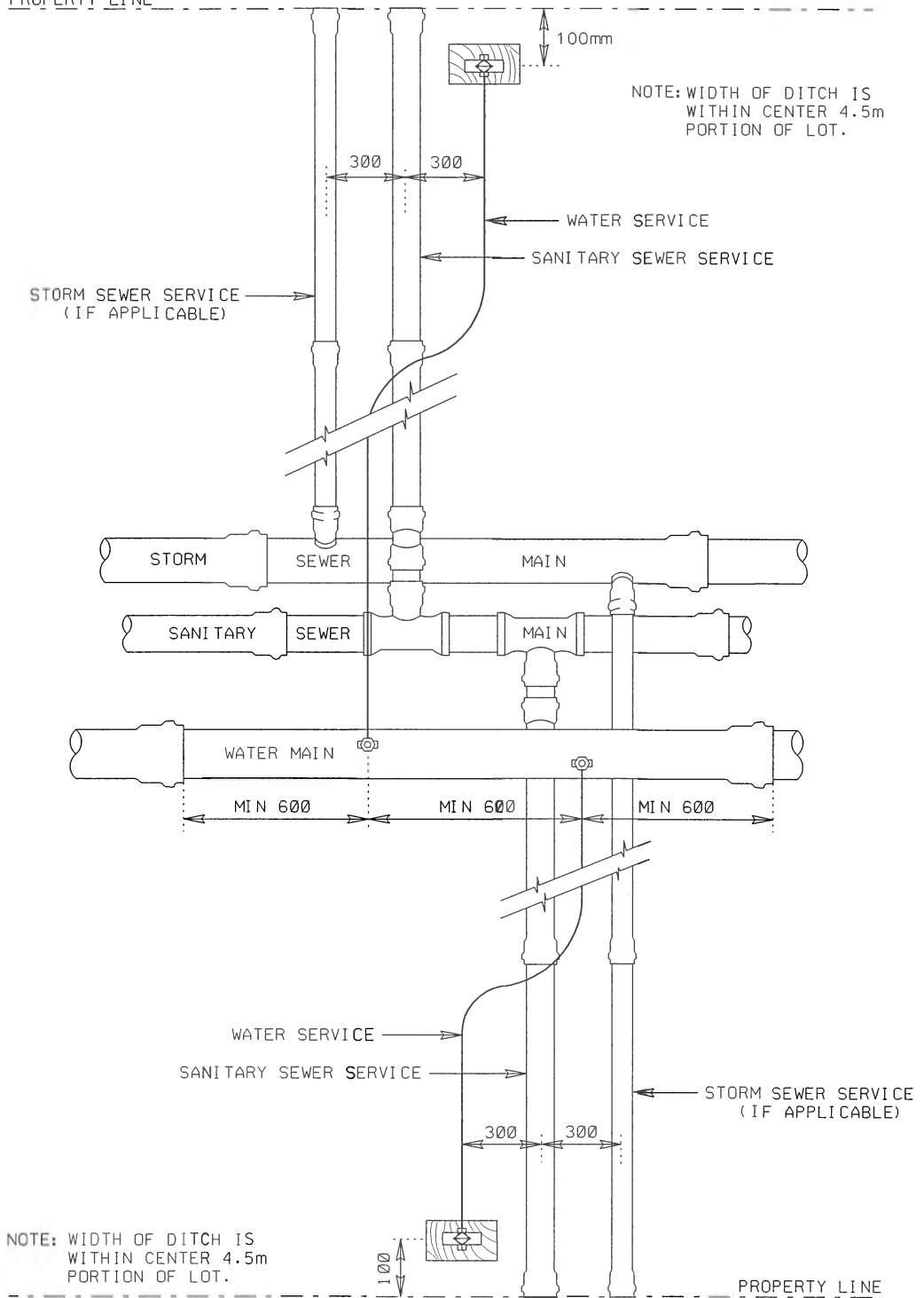
DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

TYPICAL DUAL SERVICE FOR DUPLEX / SEMI-DETACHED LOTS

APPROVED
Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2514-07
REVISION 0

PROPERTY LINE



PLAN VIEW

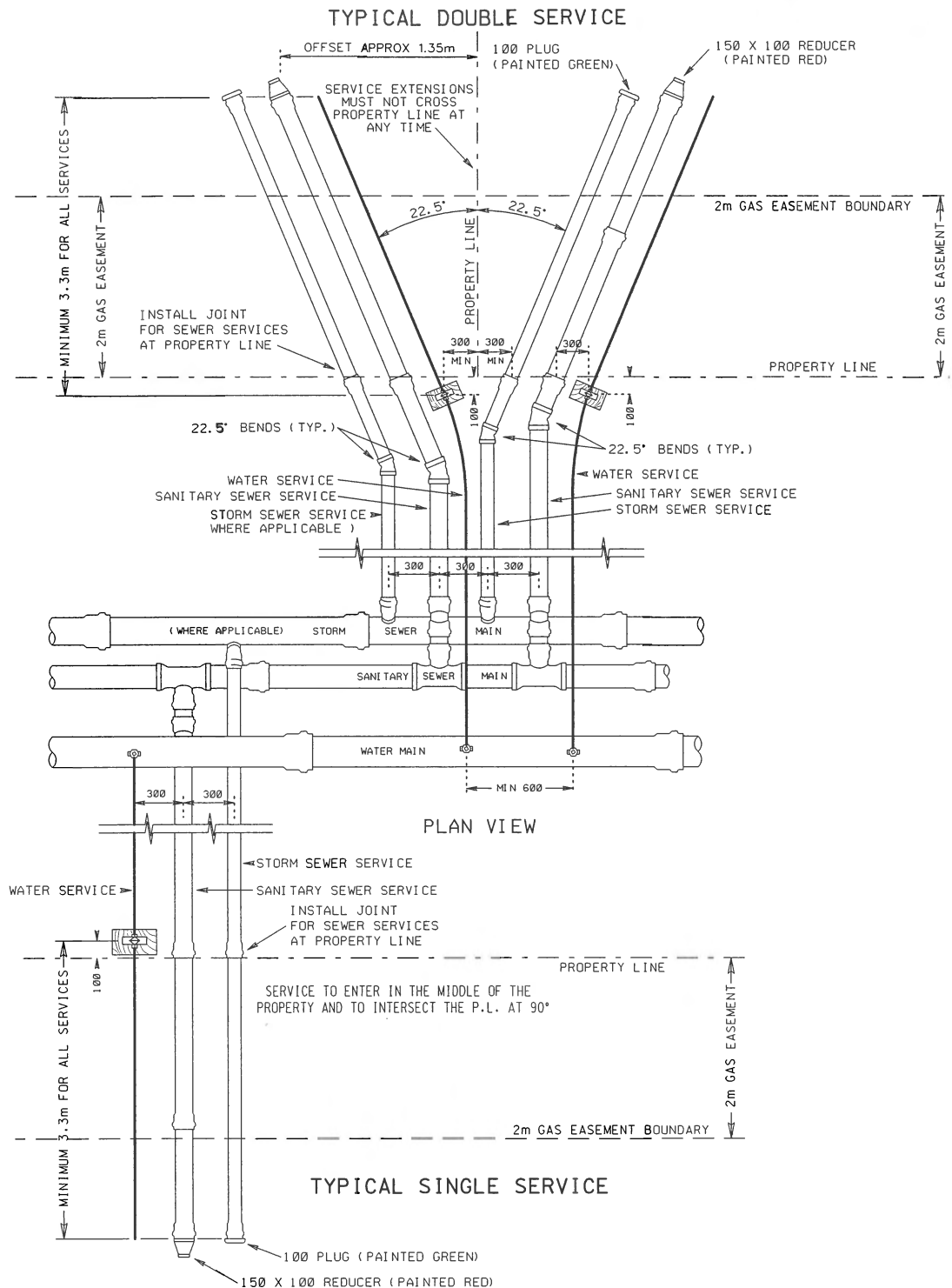
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY BEYOND GAS EASEMENT (SEE DWG 2514-09 FOR DETAILS).
3. SANITARY AND STORM SERVICES MUST HAVE A BELL AT PROPERTY LINE.

20121220 15:14 dvandenb 2514-8.DGN

EPCOR				TYPICAL SINGLE SERVICES	
APPROVED JANUARY 2013	DRAWN BY Dale Vandenberg	APPROVED <i>Ausan Ol</i>		DRAWING NUMBER 2514-08	
SCALE N T S	CHECKED BY Doug S.	DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION		REVISION 0	

2012/220 15:15 dvandenb 2514-9.DGN



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. WATER AND SEWER SERVICES MAY BE EXTENDED BEYOND GAS EASEMENT.
3. EPCOR AND THE CITY ACCEPT NO RESPONSIBILITY FOR THE CONSTRUCTION OR MAINTENANCE OF SERVICES INSTALLED WITHIN PRIVATE PROPERTY.
4. MARK ENDS OF SERVICES WITH A 50mm X 100mm X 750mm STAKE PROTRUDING 450mm ABOVE GROUND AND PAINTED BLUE. MARK THE CURB CONTROL VALVE WITH A SIMILAR STAKE PAINTED RED.
5. PERMEABLE FILTER CLOTH MUST BE USED ON THE END OF SERVICES TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW FLOW TESTING OF CURBSTOP.
6. REFER TO APPLICABLE SECTIONS OF THESE STANDARDS FOR REQUIREMENTS FOR SEWERS AND SEWER SERVICES.
7. SANITARY AND STORM SERVICES MUST HAVE A BELL AT PROPERTY LINE.

EPCOR

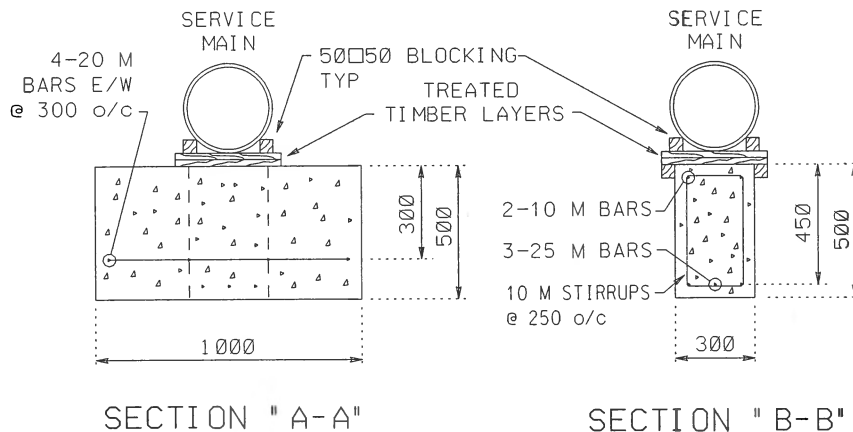
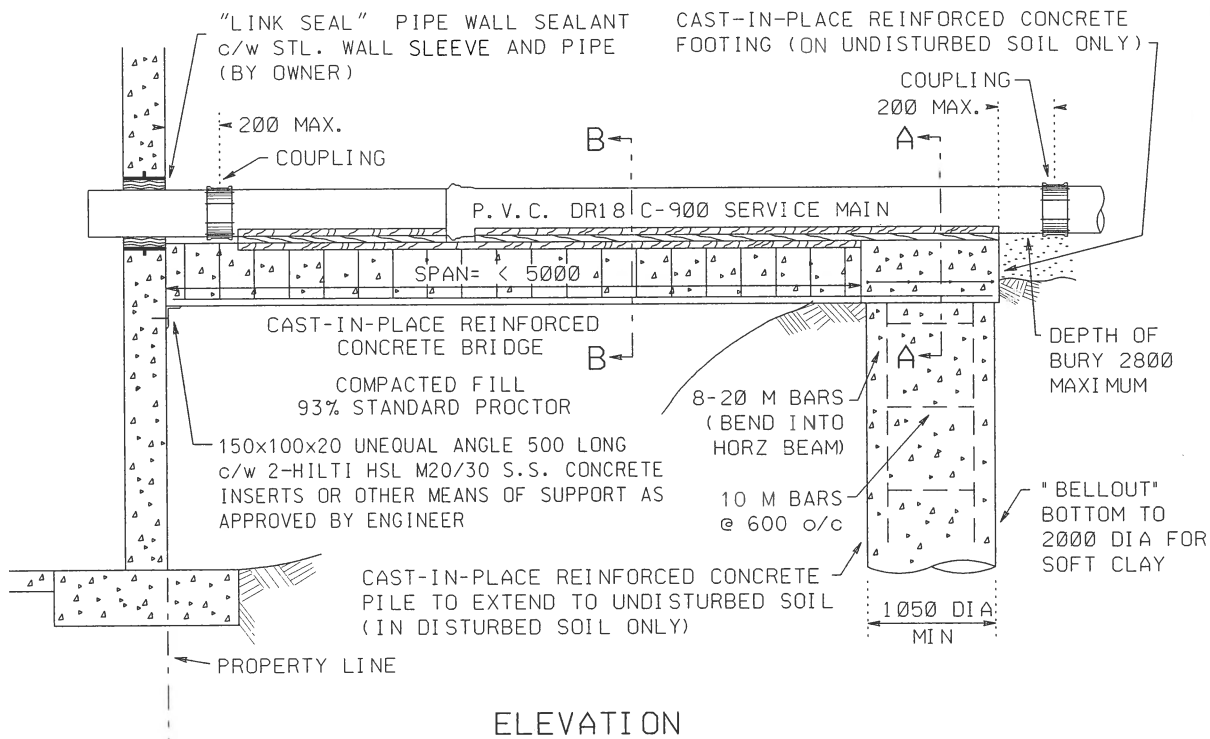
**SERVICE EXTENSION INTO PRIVATE PROPERTY
(BEYOND GAS EASEMENT)**

APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION


DRAWING NUMBER
2514-09
REVISION 0

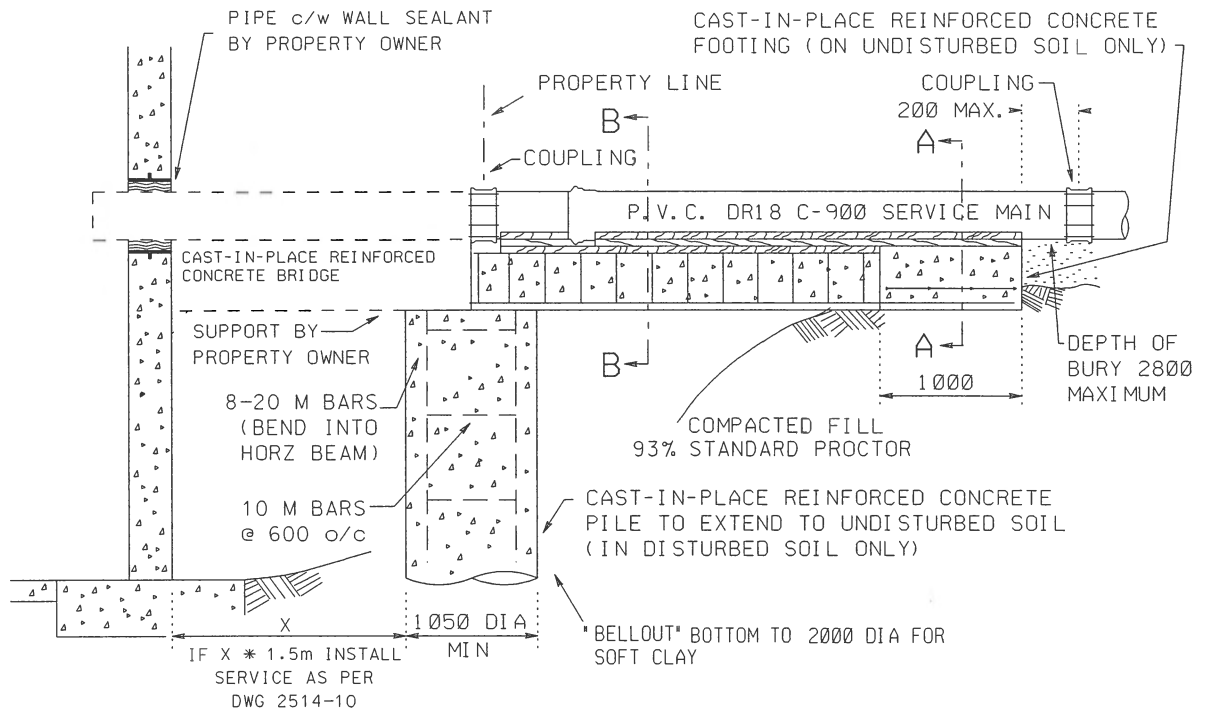


NOTES:

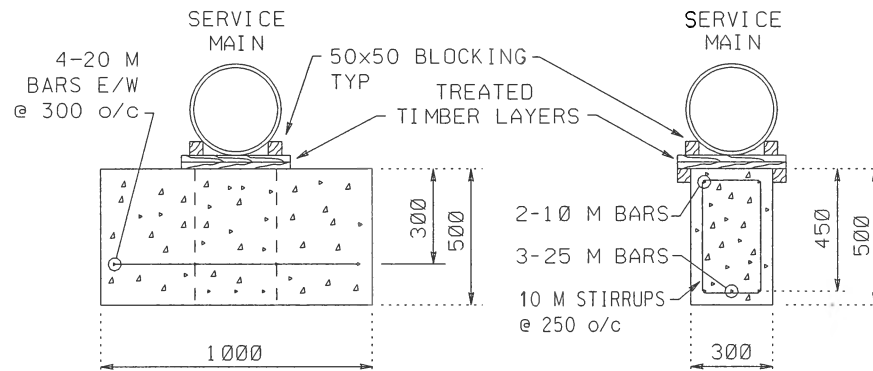
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL CONCRETE TO BE 20 MPa, REBAR TO BE 300 MPa.
3. CLEAR COVER ON ALL REINFORCING STEEL TO BE 50 mm.
4. ALL CONCRETE HIGH EARLY STRENGTH, SULPHATE RESISTANT.
5. ALL STRUCTURAL STEEL TO BE GALVANIZED.
6. ALL REBAR SPLICES TO BE 800 mm MINIMUM.
7. CONCRETE INSERTS TO BE INSTALLED AS PER MANUFACTURER'S GUIDELINES.

20121220 15:19 dvandenb 2514-10.DGN

	100mm TO 300mm WATER SERVICE FOR UNSUITABLE FOUNDATION CONDITION (BUILDING ABUTTING PROPERTY LINE)				
	APPROVED	DRAWN BY	APPROVED		DRAWING NUMBER
	JANUARY 2013	Dale Vandenberg			2514-10
	SCALE	CHECKED BY	DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION		
N T S	Doug S.			REVISION 0	



ELEVATION



SECTION "A-A"

SECTION "B-B"

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. ALL CONCRETE TO BE 20 MPa, REBAR TO BE 300 MPa.
3. CLEAR COVER ON ALL REINFORCING STEEL TO BE 50 mm.
4. ALL CONCRETE, SULPHATE RESISTANT, HIGH EARLY STRENGTH
5. COMBINED LENGTH OF CITY AND PRIVATE BRIDGES NOT TO EXCEED 5m FOR CITY INSTALLED PILE.

20121220 15:27 dvandenb 2514-11.DGN



100mm TO 300mm WATER SERVICE FOR UNSUITABLE FOUNDATION CONDITION (BUILDING REMOVED FROM PROPERTY LINE)

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JANUARY 2013
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N T S

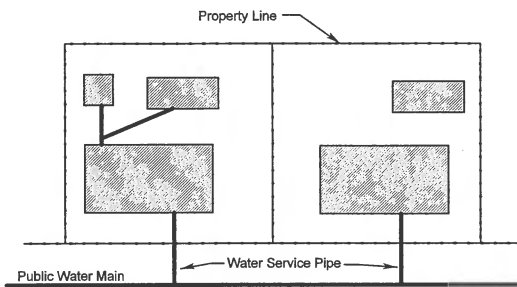
DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
[Signature]
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

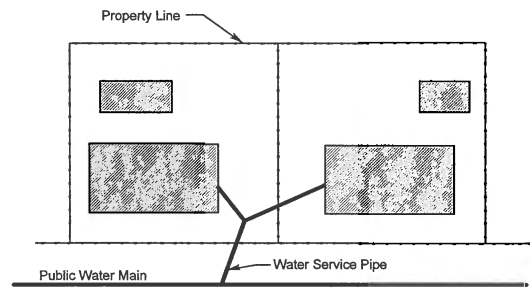
DRAWING NUMBER
2514-11
REVISION 0

20121220 15:25 dvandenb 2514-12.dgn

SINGLE FAMILY RESIDENCE

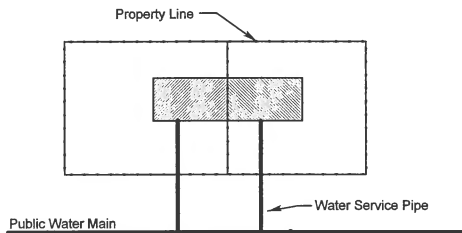


PERMITTED
Separate services to separately titled lots

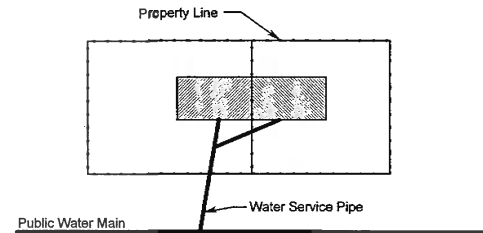


NOT PERMITTED
One separately titled lot serviced from another lot

SIDE - BY - SIDE DUPLEX

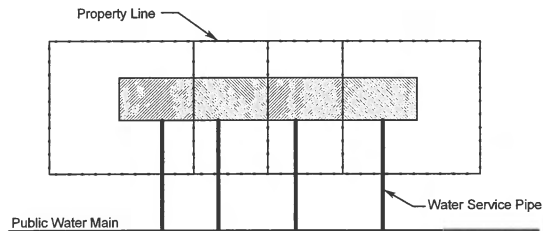


PERMITTED
Separate services to each unit

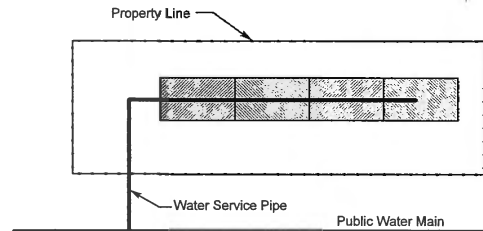


NOT PERMITTED
One service, split on private property

ROW HOUSING



PERMITTED
Separate services to each unit



PERMITTED
Only for multiple units on one lot

NOTES:

1. SEPARATE WATER AND SEWER SERVICES SHALL BE PROVIDED TO EACH SEPARATELY TITLED LAND PARCEL.
2. SINGLE WATER AND SEWER SERVICES SHALL NORMALLY BE AT THE CENTRE OF THE LOT AND SHALL CROSS THE PROPERTY LINE AT A RIGHT ANGLE (STRAIGHT OUT).



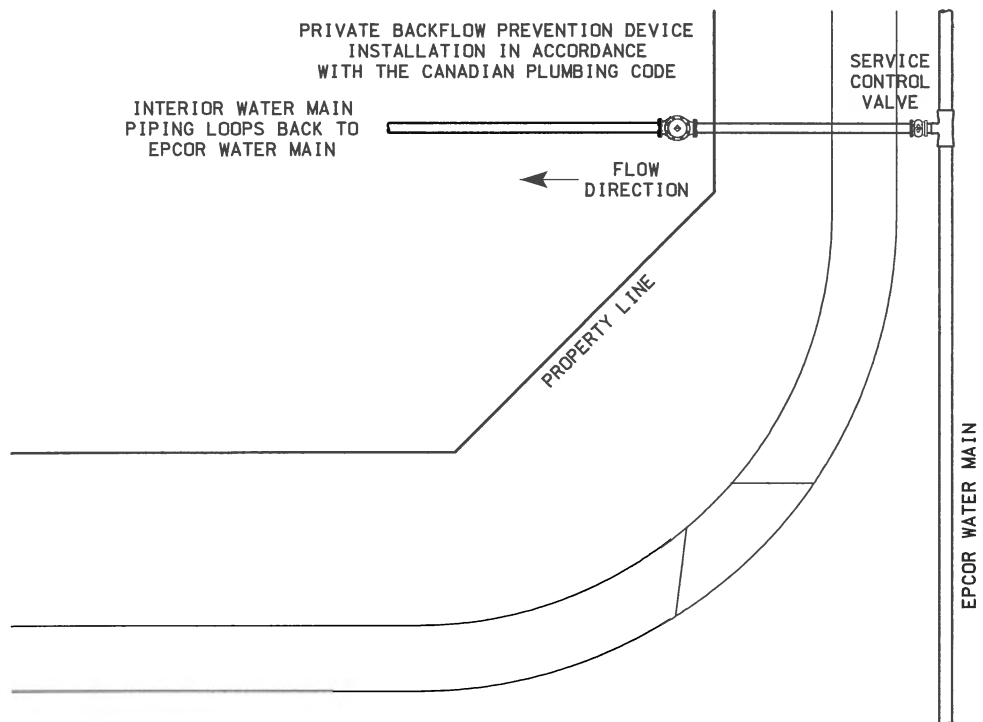
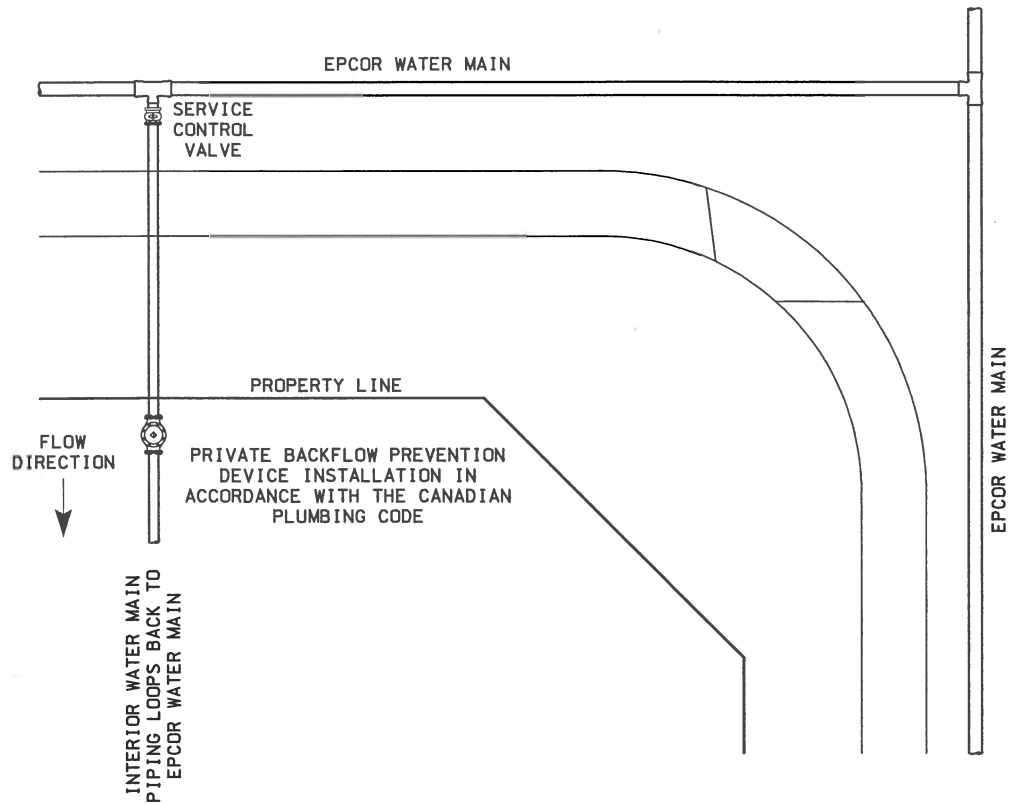
WATER SERVICING REQUIREMENTS

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JANUARY 2013
SCALE
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DRAWN BY
Dale Vandenberg
CHECKED BY
Doug S.

APPROVED
Susan Cal
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2514-12
REVISION 0



1. A RESTRICTIVE COVENANT MUST BE REGISTERED ON ALL LOTS WITH MULTIPLE SERVICES.
2. PRIVATE BACKFLOW PREVENTION DEVICE TO BE INSTALLED AND MAINTAINED BY PROPERTY OWNER.

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APPROVED
JANUARY 2013

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Dale Vandenberg

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Doug S.

APPROVED

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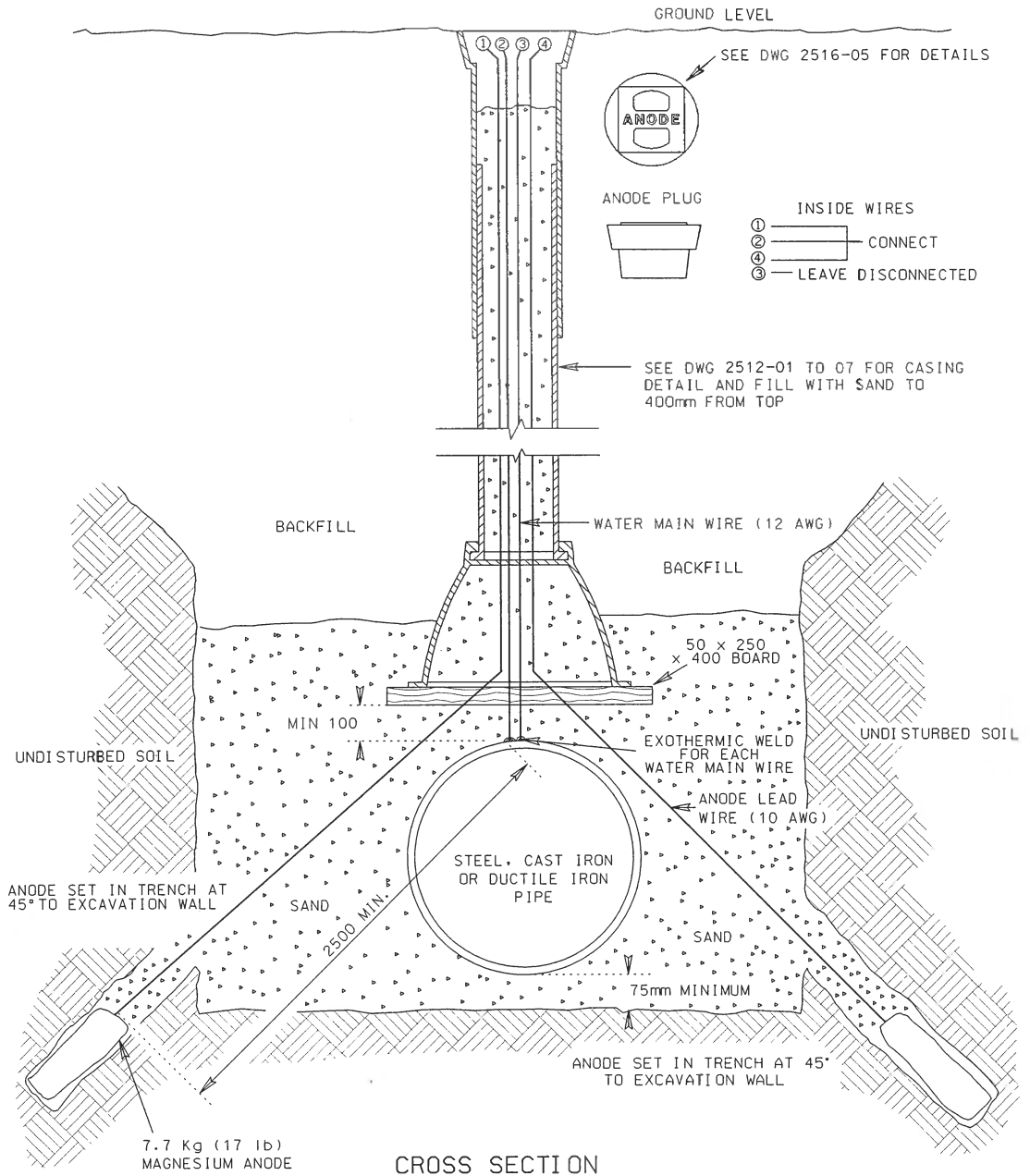
DRAWING NUMBER

2514-13

REVISION 0

20121220 15:48 dvandenb 2514-13.dgn



BACKFLOW PREVENTION FOR PRIVATE SERVICE LOOPING

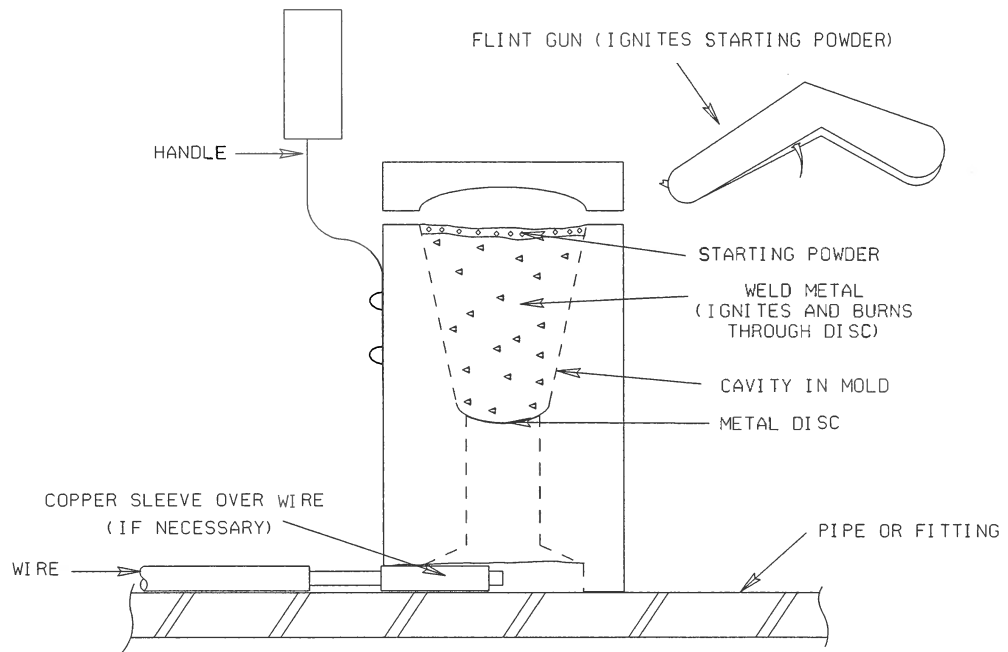


NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. NUMBER, SPACING, TYPE AND WEIGHT OF ANODES TO BE DETERMINED BY ENGINEER
3. NEW STEEL MAINS - INSTALLATION OF A THIRD ANODE TO BE SET IN TRENCH AT 45° TO EXCAVATION WALL WITH 3.0 M MINIMUM BETWEEN ANODES.
4. PLACE SAND AROUND PIPE IN 150 LIFTS AND COMPACT TO 95% STANDARD PROCTOR DENSITY.

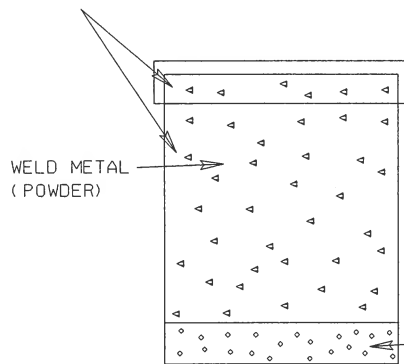
20121220 15:50 dvandenb 2516-1.DGN

ANODE TEST STATION INSTALLATION			
	APPROVED	DRAWN BY	APPROVED
	JANUARY 2013	Dale Vandenberg	
SCALE	CHECKED BY	DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION	
N T S	Doug S.		
DRAWING NUMBER			2516-01
REVISION 0			

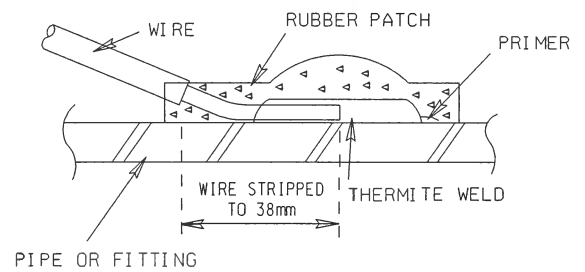


POSITIONING OF WIRE AND MOLD

WELD METAL CAPSULE



WELD METAL CAPSULE



FINISHED WELD

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. EXOTHERMIC WELDING SHALL BE PERFORMED TO MANUFACTURER'S SPECIFICATIONS.

20121220 15:51 dvandenb 2516-2.DGN

ANODE INSTALLATION - EXOTHERMIC WELDING

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Dale Vandenberg

APPROVED

Susan

DRAWING NUMBER

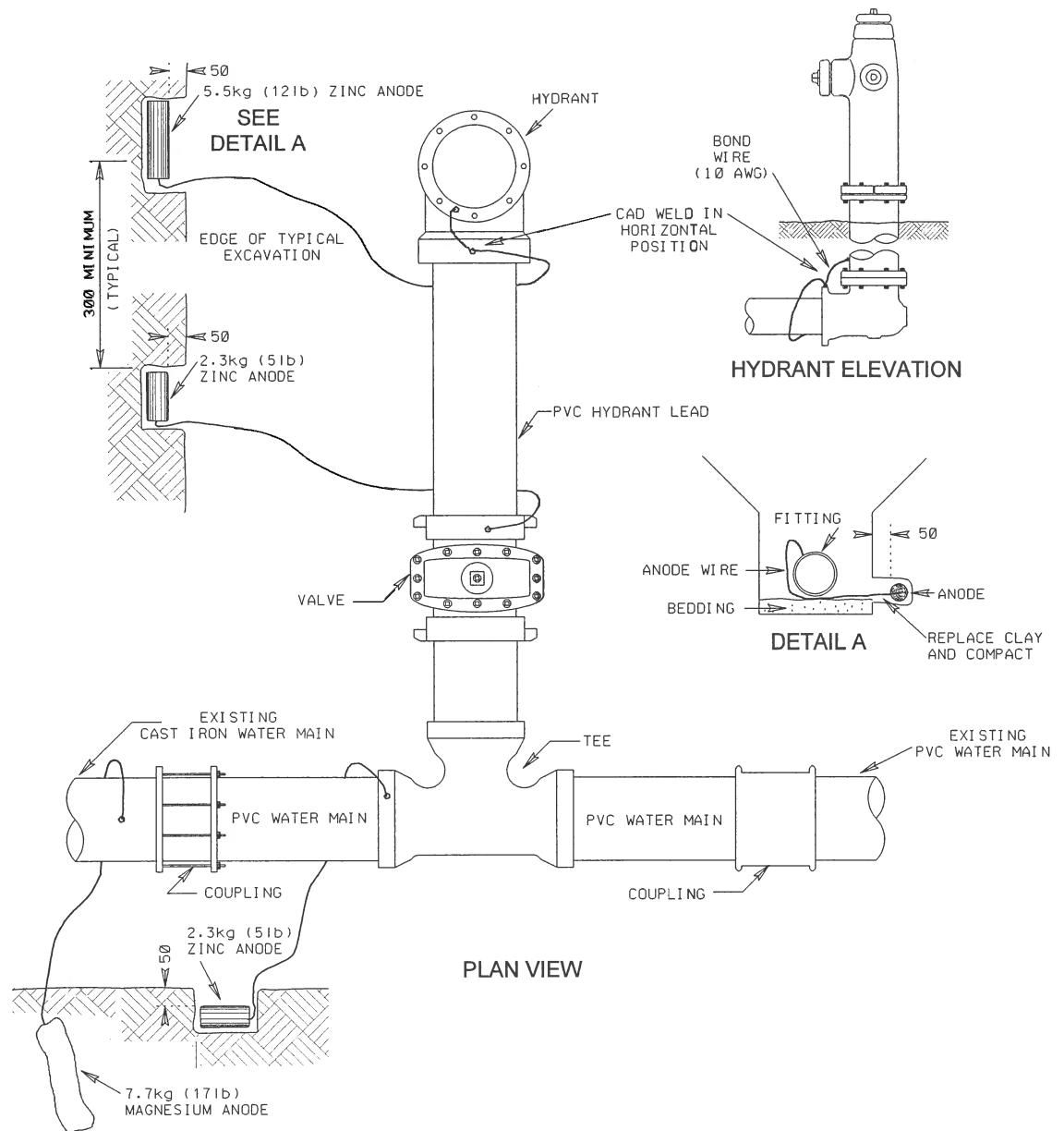
2516-02

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Doug S.

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

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NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. MIN. DISTANCE FROM ANODE TO PIPE IS 150mm.
3. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
4. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3kg (5lb).
5. ALL ZINC ANODES ON HYDRANTS ARE 5.5kg (12lb).
6. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
7. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK.

EPCOR

ANODE INSTALLATION AT HYDRANT AND CONNECTION TO EXISTING CAST IRON MAINS

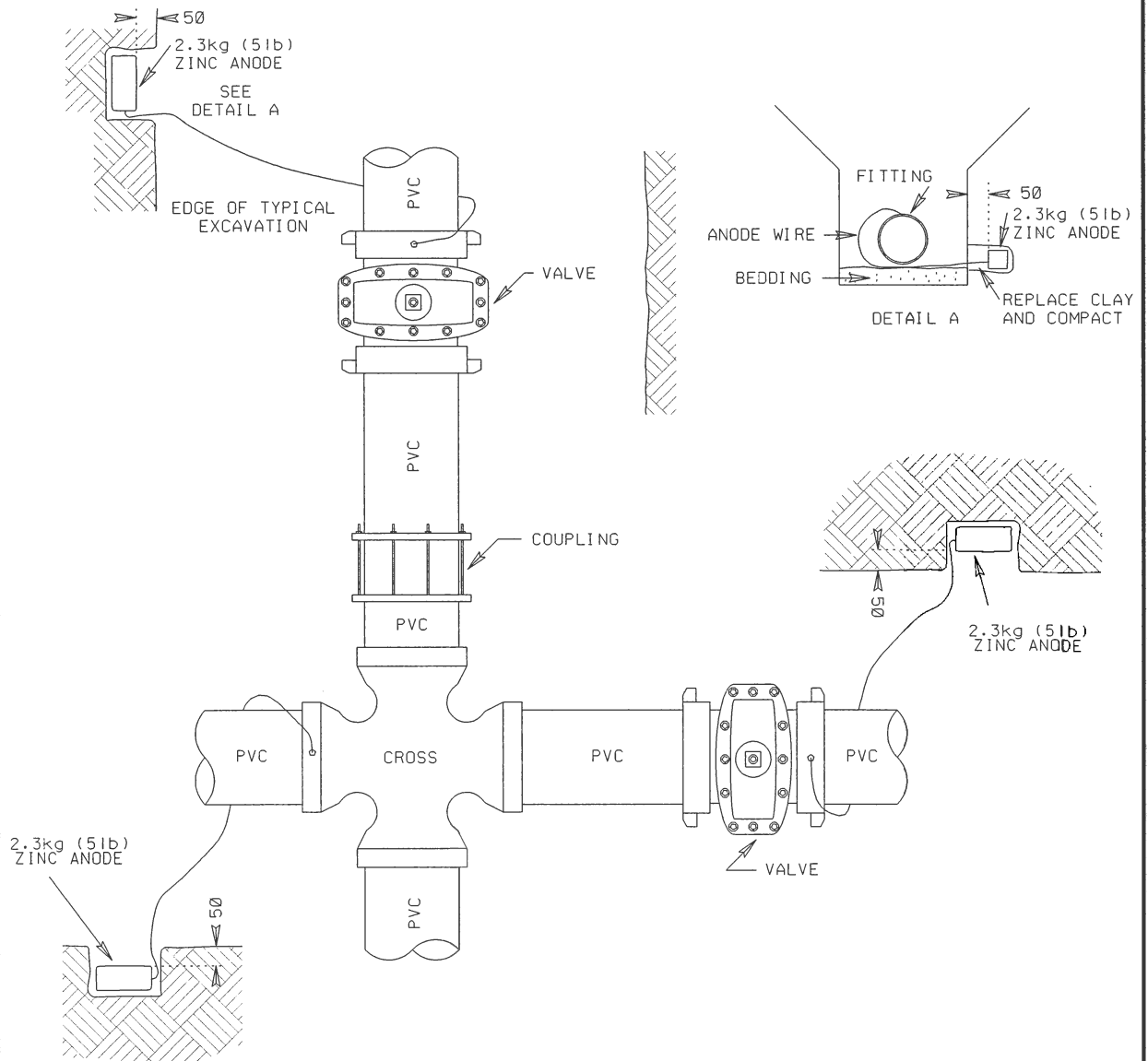
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DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2516-03
REVISION 0

20121220 15:55 dvandenb 2516-4.DGN



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. MINIMUM DISTANCE FROM ANODE TO PIPE, FITTING, VALVE OR HYDRANT IS 150mm.
3. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
4. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3kg (5lb).
5. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
6. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK

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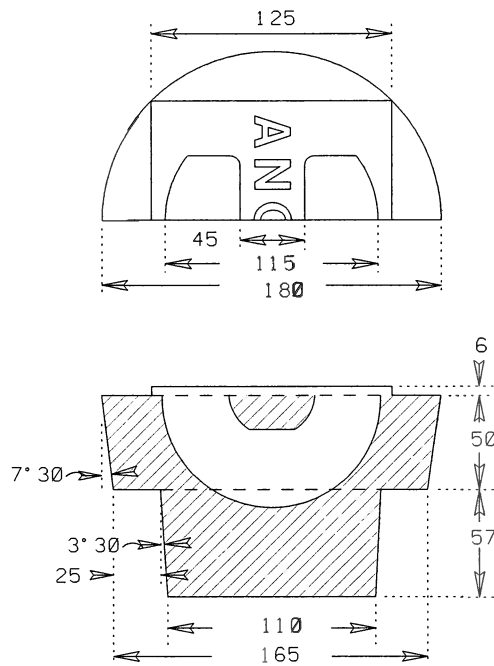
TYPICAL ANODE INSTALLATION FOR IRON FITTINGS USED WITH PVC WATER MAINS

APPROVED
JANUARY 2013
SCALE
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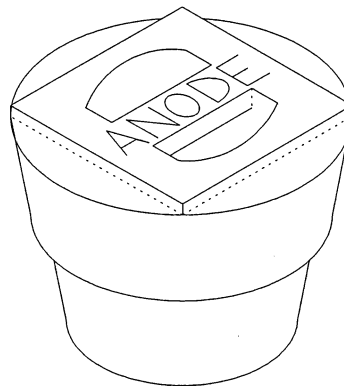
DRAWN BY
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Susan Ol
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2516-04
REVISION 0



ANODE WIRE CASING PLUG



DESIGN SPECIFICATIONS

1. TOLERANCES OF ± 3 mm ALLOWED FOR CASTING DIMENSIONS OF 25mm OR LESS.
2. TOLERANCES OF ± 6 mm ALLOWED FOR CASTING DIMENSIONS IN EXCESS OF 25mm.
3. ALL PLUGS TO BE DUCTILE IRON TO ASTM 536 GRADE 60-40-18.

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. SEE DRAWINGS 2512-01 TO 2512-07 FOR VALVE CASING DETAILS FOR USE AS ANODE WIRE CASINGS.

20121220 16:03 dvandenb 2516-5.DGN

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TEST STATION PLUG DETAIL

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Doug S.

DRAWING NUMBER

2516-05

REVISION 0



1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. PIPE CLAMP TO BE ALL BRASS OR APPROVED EQUIVALENT.
3. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPACTED COMPLETELY AROUND ANODES.

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JANUARY 2013

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DRAWING NUMBER

2516-06

REVISION 0



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Susan Ol
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DRAWING NUMBER
2516-07
REVISION 0

CATHODIC PROTECTION EXOTHERMIC WELDING COMPONENTS

CONNECTION TYPE	WIRE (AWG.) SPECIFICATION	CADWELD			THERMOWELD		
		MOLD	CARTRIDGE	SLEEVE	MOLD	CARTRIDGE	SLEEVE
WATER MAIN WIRE TO STEEL MAIN	# 12 STR # 6 STR ***	CAHAA - 1H CAHAA - 1H	CA15 CA15	CAB - 133 - 1H	M - 102 M - 102	15 15	A - 200 -
WATER MAIN WIRE TO CAST IRON FITTING**	# 12 STR	CAHBA - 1H - X **	CA25XF - 19	CAB - 133 - 1H	M - 157	25PCI	A - 200
SPLICING WATER MAIN WIRES	# 12 STR TO # 12 STR	CASST - 1H	CA25	CAB - 133 - 1H	M - 200	25	A - 200
SPLICING WATER MAIN OR LEAD WIRES	# 6 STR TO # 6 STR	CASST - 1H	CA25	-	M - 200	25	-
ANODE WIRE TO CAST IRON FITTING	# 10 SOL *	CAHBA - 1H - X **	CA25XF - 19	CAB - 133 - 1H	M - 157	25PCI	A - 200
	# 10 STR	CAHBA - 1K - X **	CA45XF - 19	CAB - 133 - 1K	M - 158	45PCI	A - 208
ANODE WIRE TO HEADER CABLE ***	# 10 STR TO # 6 STR	CAPCT - 1H1B	CA25	-	SPECIAL ORDER		
LEAD WIRE TO HEADER CABLE ***	# 6 STR TO # 6 STR	CAPCT - 1H1H	CA25	-	M - 1271	25	-
SPLICING ANODE WIRES	# 10 SOL TO # 10 SOL # 10 STR TO # 10 STR	CASST - 1H CASST - 1K	CA25 CA25	CAB - 133 - 1H CAB - 133 - 1K	M - 200 M - 201S	25 25	A - 200 A - 208
JUMPER CABLE TO STEEL MAIN	# 6 STR	CAHAA - 1H	CA15	-	M - 102	15	-
JUMPER CABLE TO HYDRANT BARREL (H) JUMPER CABLE TO HYDRANT BARREL (V)	# 6 STR # 6 STR	CAHBA - 1H - 6 CAVHT - 1H - 6	CA25XF - 19 CA25XF - 19	-	M - 157 M - 2594	25PCI 25PCI	- -

NOTES:

* - DENOTES PRE - 1994 WIRE SPECIFICATION

** - WHERE X = NOMINAL PIPE SIZE IN INCHES

*** - USE ONLY WHEN SPECIFIED ON DRAWINGS

SOL - SOLID CONDUCTOR

STR - STRANDED CONDUCTOR

(H) - WELDING TO HORIZONTAL BARREL

(V) - WELDING TO VERTICAL BARREL

1. CONTACT THERMOWELD AT 918 - 663 - 1440 FOR FURTHER INFORMATION

2. CONTACT ERICO/CADWELD AT 800 - 670 - 9089 FOR FURTHER INFORMATION

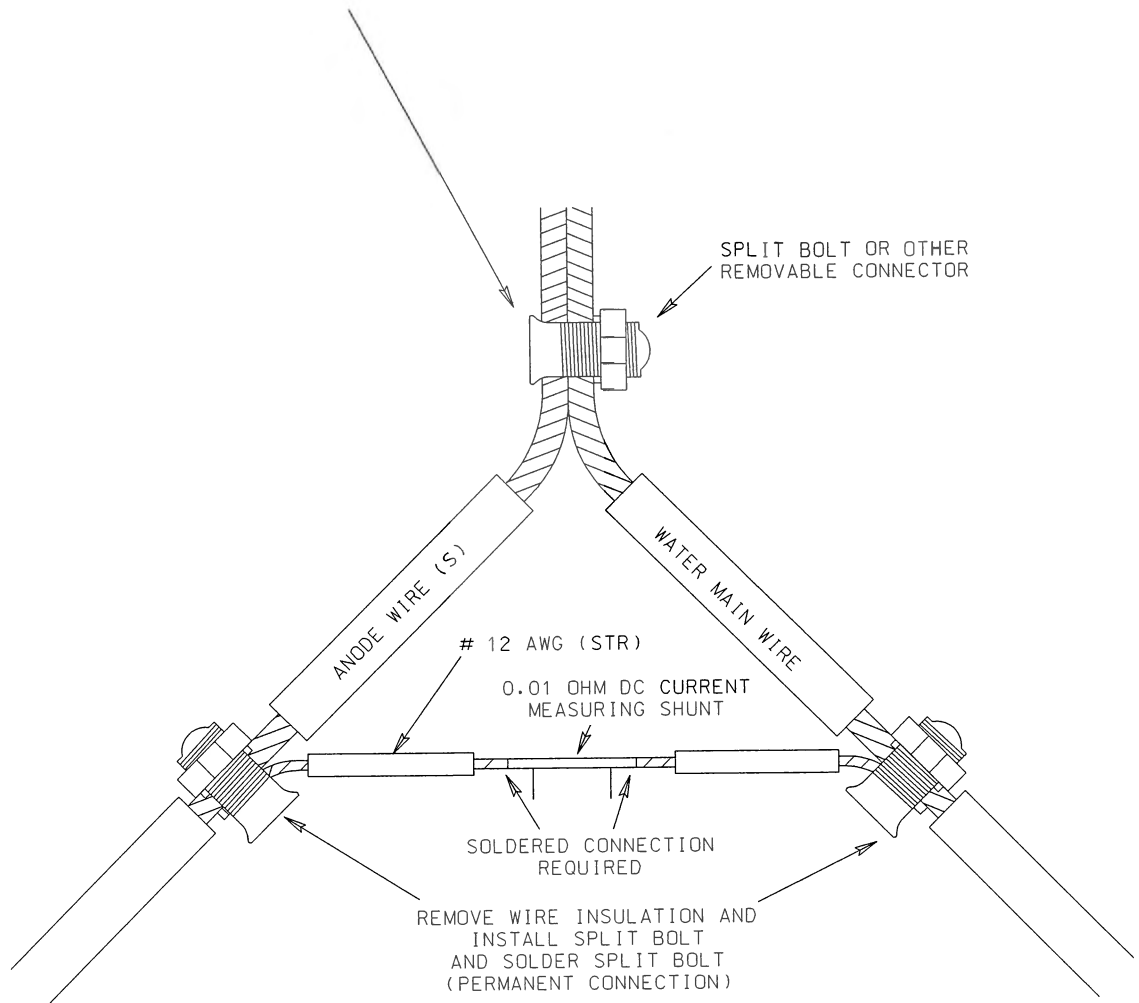
3. CATALOG REFERENCE - THERMOWELD, TW 1/93 AND CATHODIC PROTECTION FLYER

4. CATALOG REFERENCE - CADWELD, CA - 1A

5. DO NOT MIX CADWELD AND THERMOWELD PRODUCTS

6. USE TOOLS SUCH AS PIPE CLAMPS, PACKING, ETC. WHEN RECOMMENDED BY MANUFACTURER

PRIMARY ANODE/WATER MAIN WIRE CONNECTION
(TEMPORARILY DISCONNECT WHEN TAKING CURRENT MEASUREMENT)



NOTES:

1. SOLDERED CONNECTIONS TO BE MADE WITH 60/40 TIN/LEAD RESIN CORE SOLDER
2. WRAP ALL CONNECTIONS WITH ELECTRICAL TAPE
3. ALWAYS RECONNECT ANODE AND WATER MAIN WIRE(S) AFTER TAKING CURRENT MEASUREMENTS

20121220 16:11 dvandenb 2516-8.DGN

EPCOR

CATHODIC PROTECTION - TEST STATION CONNECTION FOR PIPELINES WITH INDUCED VOLTAGE

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan Ol.

DRAWING NUMBER

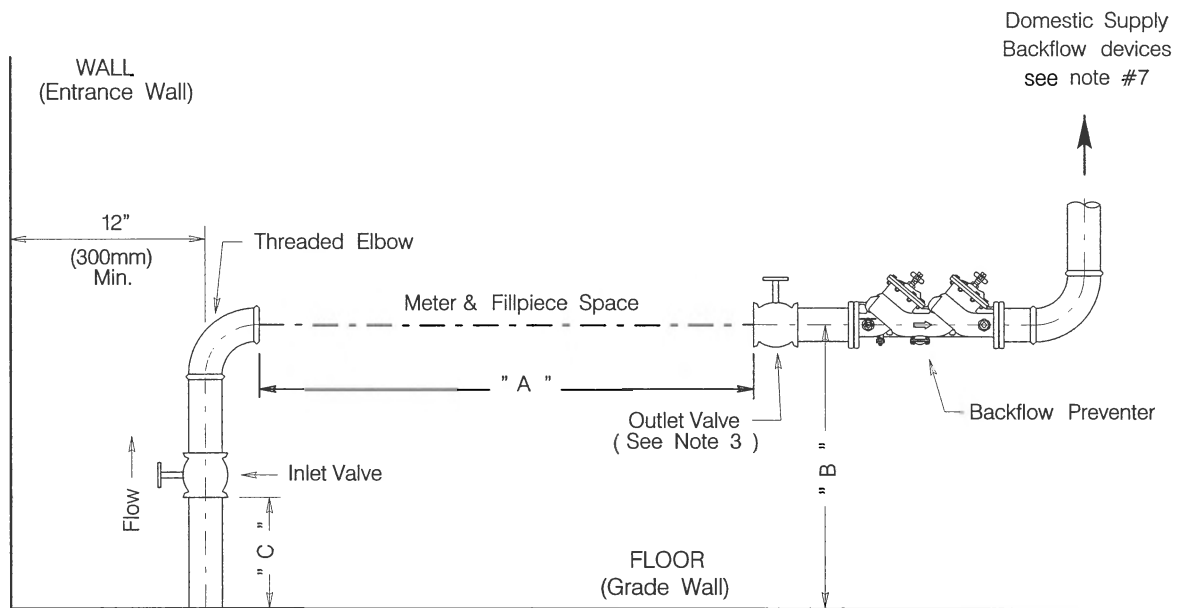
2516-08

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CHECKED BY
Doug S.

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

REVISION 0



PIPE SIZE	" A "	" B " Max.	" B " Min.	" C " Min.
$\frac{5}{8}$ " (16mm)	11 $\frac{1}{2}$ "-12" (292-305mm)	36" (900mm)	24" (600mm)	18" (450mm)
$\frac{3}{4}$ " (20mm)	13 $\frac{1}{2}$ "-14" (343-356mm)	36" (900mm)	24" (600mm)	18" (450mm)
1" (25mm)	15 $\frac{1}{2}$ "-16" (394-406mm)	36" (900mm)	24" (600mm)	18" (450mm)
1 $\frac{1}{2}$ " (40mm)	30" (762mm)	24" (610mm)	18" (450mm)	12" (300mm)

NOTE:

1. Meter settings constructed using plastic piping shall have adequate anchoring on each side of the meter capable of keeping the pipe in alignment and supporting the weight of the meter, pipe and all other components.
2. Minimum distance of centerline of piping adjacent to meter setting to be 12" (300mm) from any entrance, wall or grade wall.
3. Valve is required on outlet side of meter setting on piping 1" (25mm) and over. Valve optional on piping under 1" (25mm).
4. Piping for "A" must be in a horizontal plane.
5. Valves or fittings on sides connecting to meter must be female threaded in $\frac{1}{2}$ " (13mm) for $\frac{5}{8}$ " (16mm) meter; $\frac{3}{4}$ " (20mm) for $\frac{3}{4}$ " (20mm) meter; and 1" (25mm) for 1" (25mm) meters. If $1\frac{1}{4}$ " (32mm) piping is used, spacing and fittings for a $1\frac{1}{2}$ " (40mm) pipe must be provided.
6. Buildings with more than one meter must have a metal or plastic tag securely attached to the control valve handle of the meter it serves. The tag must have the service address engraved on it in letters or numbers at least 5mm ($\frac{3}{16}$ ") in height. Lawn services must also be identified with tags.
7. Premises isolation backflow prevention devices are MANDATORY on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in conformance with CSA B64.

20130318 13:04 dvandentb 2520-01.DGN

EPCOR

SPECIFICATIONS FOR METER SETTINGS WITHOUT FIRE PROTECTION SYSTEM

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan

DRAWING NUMBER

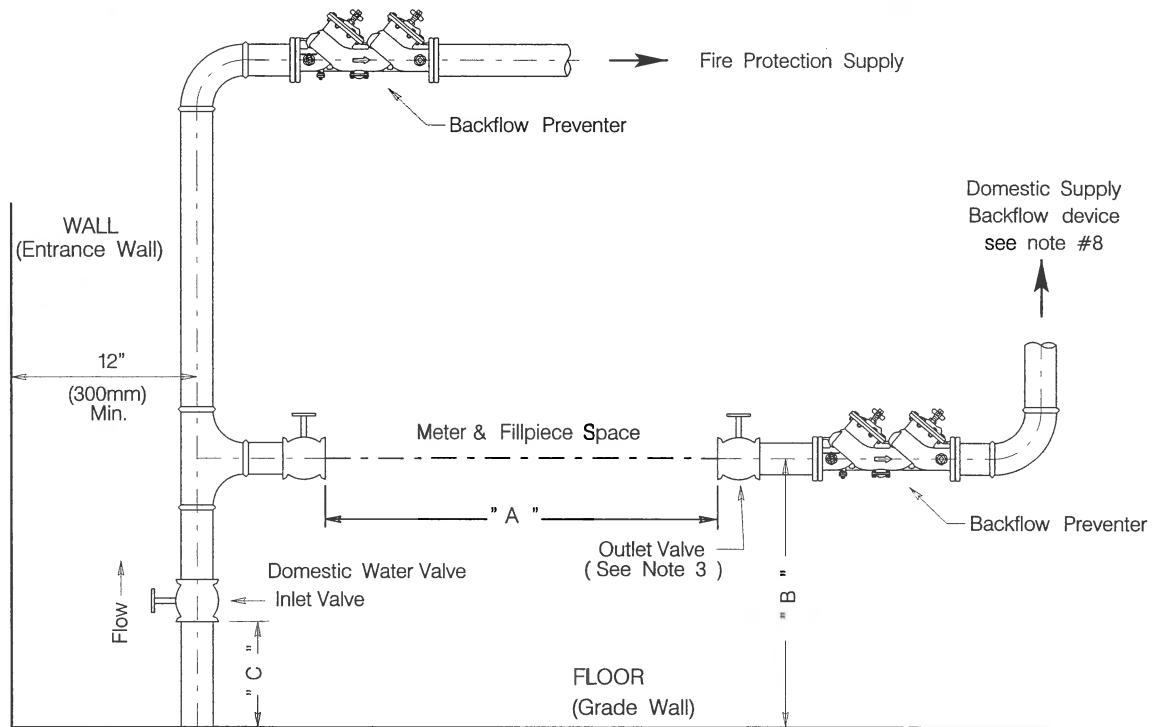
2520-01

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CHECKED BY
Doug S.

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

REVISION 0




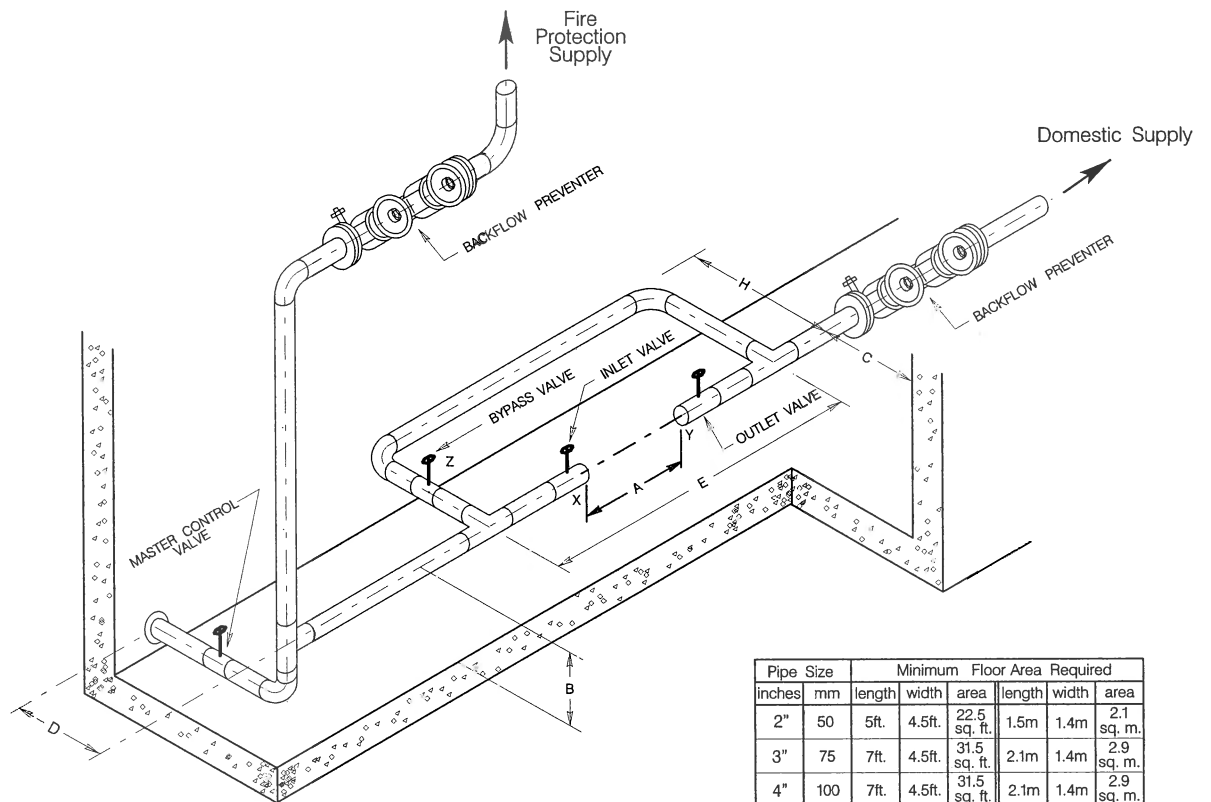
PIPE SIZE	" A "	" B " Max.	" B " Min.	" C " Min.
5/8" (16mm)	11 1/2"-12" (292-305mm)	36" (900mm)	24" (600mm)	18" (450mm)
3/4" (20mm)	13 1/2"-14" (343-356mm)	36" (900mm)	24" (600mm)	18" (450mm)
1" (25mm)	15 1/2"-16" (394-406mm)	36" (900mm)	24" (600mm)	18" (450mm)
1 1/2" (40mm)	30" (762mm)	24" (610mm)	18" (450mm)	12" (300mm)

NOTE:

1. Meter settings constructed using plastic piping shall have adequate anchoring on each side of the meter capable of keeping the pipe in alignment and supporting the weight of the meter, pipe and all other components.
2. Minimum distance of centerline of piping adjacent to meter setting to be 12" (300mm) from any entrance, wall or grade wall.
3. Valve is required on outlet side of meter setting on piping 1" (25mm) and over. Valve optional on piping under 1" (25mm).
4. Piping for "A" must be in a horizontal plane.
5. Valves or fittings on sides connecting to meter must be female threaded in 1/2" (13mm) for 5/8" (16mm) meter; 3/4" (20mm) for 3/4" (20mm) meter; and 1" (25mm) for 1" (25mm) meters. If 1 1/4" (32mm) piping is used, spacing and fittings for a 1 1/2" (40mm) pipe must be provided.
6. Contact Epcor Water Services Inc. at 412-3800 prior to installation of a system which will meter both fire supply and domestic supply lines.
7. Buildings with more than one meter must have a metal or plastic tag securely attached to the control valve handle of the meter it serves. The tag must have the service address engraved on it in letters or numbers at least 5mm (3/16") in height. Lawn services must also be identified with tags.
8. Premises isolation backflow prevention devices are MANDATORY on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in conformance with CSA B64.

20130318 13:14 dvandenb 2520-02.dgn

		<h2 style="margin: 0;">SPECIFICATIONS FOR METER SETTINGS WITH FIRE PROTECTION SYSTEM</h2>		DRAWING NUMBER <h1 style="margin: 0;">2520-02</h1>	
		APPROVED JANUARY 2013 SCALE N T S	DRAWN BY Dale Vandenberg CHECKED BY Doug S.		



Pipe Size		A				B				C		D		E		H	
		minimum		maximum		minimum		maximum		minimum		maximum		minimum		maximum	
inches	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
2"	50	36	900	15	375	18	450	36	900	18	450	48	1200	15	375		
3"	75	42	1050	15	375	18	450	36	900	18	450	54	1350	15	375		
4"	100	42	1050	15	375	18	450	36	900	18	450	60	1525	15	375		
6"	150	48	1200	18	450	18	450	36	900	18	450	66	1675	15	375		

NOTE:

- Meter settings constructed using plastic piping shall have adequate anchoring on each side of the meter capable of keeping the pipe in alignment and supporting the weight of the meter, pipe and all other components.
- Valve X & Y must be female threaded or flanged and cannot be Butterfly valves.
- Pipe sizes from 1/2" (16mm) to 2 1/2" (62.5mm) to be threaded. Pipe sizes 3" (75mm) and larger to be flanged.
- Valve Z may be located at any point on the bypass, provided that it is always within the 66" (1675mm) maximum distance from the floor.
- The main pipe alignment must be a minimum 18" (450mm) from any wall, partition, fixture, or other piping.
- The space above floor area C x E must be free from obstructions to a height of 78" (1980mm).
- All combined domestic and fire protection supply services must have a master control valve before domestic supply take - off. No other valve to control fire protection supply except backflow preventer.**
- Water service piping outside building and through building wall to be installed in accordance with the EPCOR WATERWORKS BYLAW #12585, AS AMENDED.
- Contact Epcor Water Services Inc. at 412-3800 prior to installation of a system which will meter both fire supply and domestic supply lines.
- Buildings with more than one meter must have a metal or plastic tag securely attached to the control valve handle of the meter it serves. The tag must have the service address engraved on it in letters or numbers at least 5mm (3/16") in height. Lawn services must also be identified with tags.
- Premises isolation backflow prevention devices are MANDATORY on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in conformance with CSA B64.

20121220 16:55 dvandenb 2520-03.dgn

SPECIFICATIONS FOR METER SETTINGS WITH HORIZONTAL BYPASSES

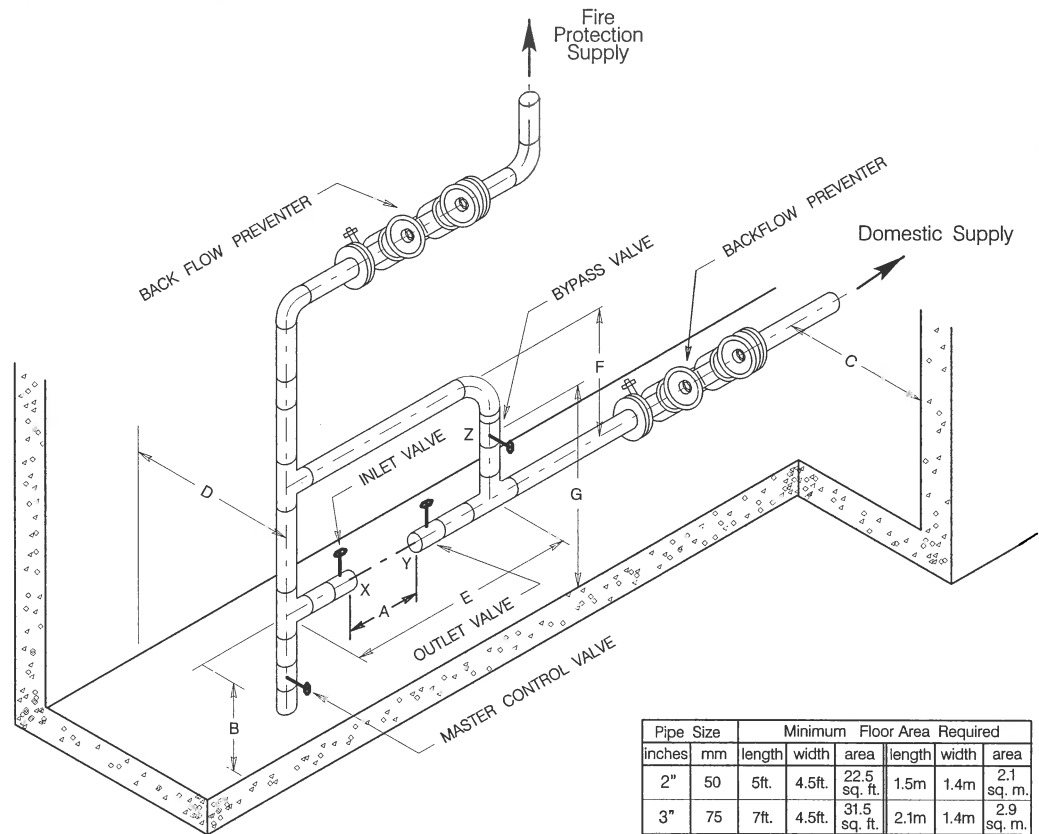
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JANUARY 2013
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Doug S.

APPROVED
Susan Ol
DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

DRAWING NUMBER
2520-03
REVISION 0



Pipe Size		Minimum Floor Area Required					
inches	mm	length	width	area	length	width	area
2"	50	5ft.	4.5ft.	22.5 sq. ft.	1.5m	1.4m	2.1 sq. m.
3"	75	7ft.	4.5ft.	31.5 sq. ft.	2.1m	1.4m	2.9 sq. m.
4"	100	7ft.	4.5ft.	31.5 sq. ft.	2.1m	1.4m	2.9 sq. m.
6"	150	8ft.	4.5ft.	36.0 sq. ft.	2.4m	1.4m	3.4 sq. m.

Pipe Size		A		B				C		D		E		F		G	
inches	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
2"	50	36	900	15	375	18	450	36	900	18	450	48	1200	18	450	24	610
3"	75	42	1050	15	375	18	450	36	900	18	450	54	1350	18	450	24	610
4"	100	42	1050	15	375	18	450	36	900	18	450	60	1525	18	450	24	610
6"	150	48	1200	18	450	18	450	36	900	18	450	66	1675	18	450	24	610

NOTE:

1. Meter settings constructed using plastic piping shall have adequate anchoring on each side of the meter capable of keeping the pipe in alignment and supporting the weight of the meter, pipe and all other components.
2. Valve X & Y must be female threaded or flanged and cannot be Butterfly valves.
3. Valve Z may be located at any point on the bypass, provided that it is always within the 66" (1675mm) maximum distance from the floor.
4. The main pipe alignment must be a minimum 18" (450mm) from any wall, partition, fixture, or other piping.
5. The space above floor area C x E must be free from obstructions to a height of 78" (1980mm).
6. **All combined domestic and fire protection supply services must have a master control valve before domestic supply take - off. No other valve to control fire protection supply except backflow preventer.**
7. Water service piping outside building and through building wall to be installed in accordance with the EPCOR WATERWORK BYLAW*12585, AS AMENDED..
8. Contact Epcor Water Services Inc. at 412-3800 prior to installation of a system which will meter both fire supply and domestic supply lines.
9. Buildings with more than one meter must have a metal or plastic log securely attached to the control valve handle of the meter it serves. The tag must have the service address engraved on it in letters or numbers at least 5mm (3/16") in height. Lawn services must also be identified with tags.
10. Premises isolation backflow prevention devices are MANDATORY on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in conformance with CSA B64.

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SPECIFICATIONS FOR METER SETTINGS WITH VERTICAL BYPASSES

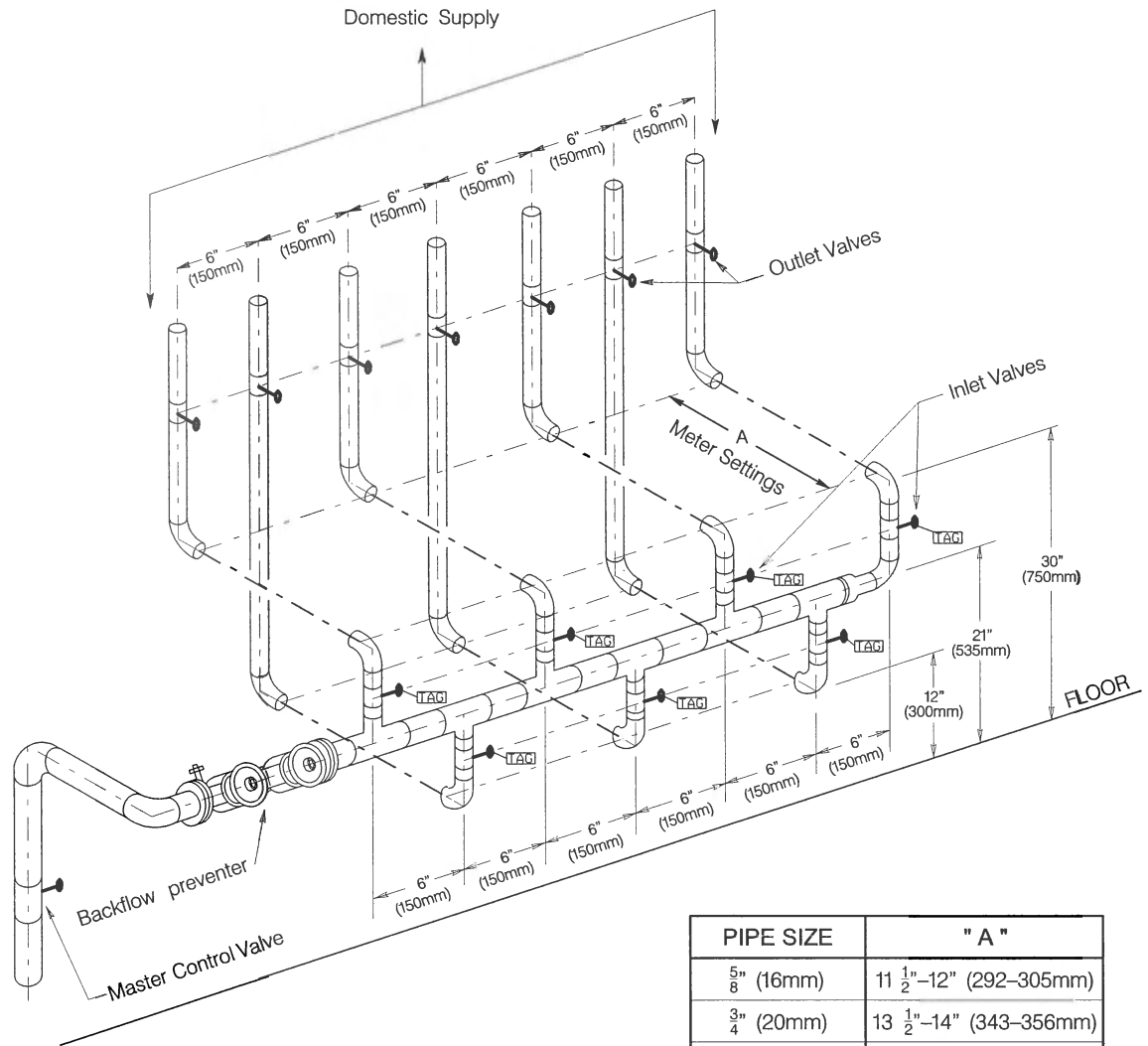
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APPROVED
JANUARY 2013
SCALE
N T S

DRAWN BY
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CHECKED BY
Doug S.

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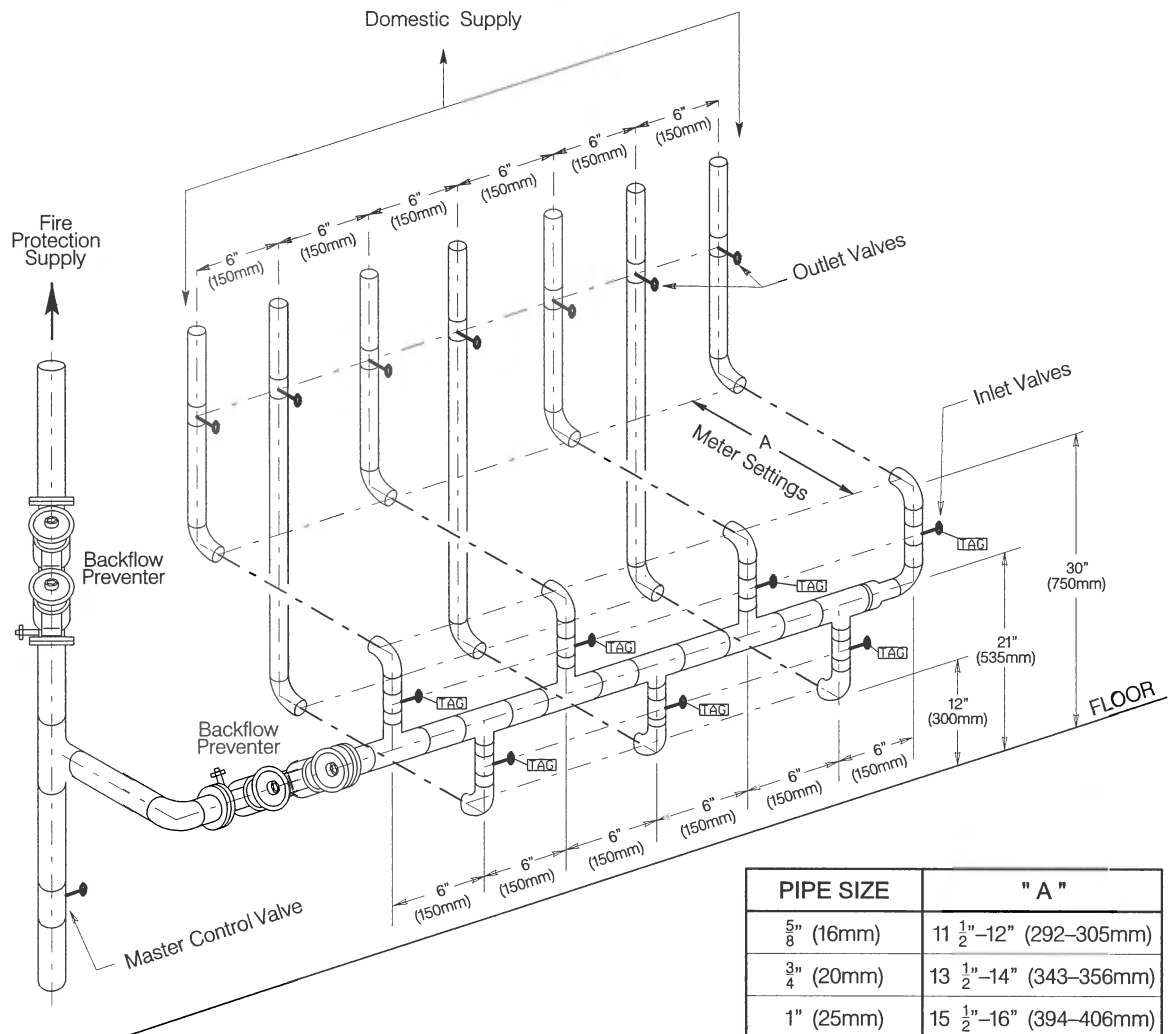
PIPE SIZE	" A "
$\frac{5}{8}$ " (16mm)	11 $\frac{1}{2}$ "-12" (292-305mm)
$\frac{3}{4}$ " (20mm)	13 $\frac{1}{2}$ "-14" (343-356mm)
1" (25mm)	15 $\frac{1}{2}$ "-16" (394-406mm)
1 $\frac{1}{2}$ " (40mm)	30" (762mm)

NOTE:

1. Meter settings constructed using plastic piping shall have adequate anchoring on each side of the meter capable of keeping the pipe in alignment and supporting the weight of the meter, pipe and all other components.
2. Plumbers are requested to advise Epcor Water Services Inc. at 412-3800 in advance regarding each individual installation.
3. Master control valve to be installed.
4. An inlet valve and an outlet valve must be installed for each meter setting.
5. Valves or fittings on sides connecting to meter must be female threaded in $\frac{1}{2}$ " (13mm) for $\frac{5}{8}$ " (16mm) meter; $\frac{3}{4}$ " (20mm) for $\frac{3}{4}$ " (20mm) meter; and 1" (25mm) for 1" (25mm) meters. If $1\frac{1}{4}$ " (32mm) piping is used, spacing and fitting for a $1\frac{1}{2}$ " (40mm) pipe must be provided.
6. For meters larger than $1\frac{1}{2}$ " (40mm) contact Epcor Water Services Inc. at 412-3100 for further information.
7. Buildings with more than one meter must have a metal or plastic tag securely attached to the control valve handle of the meter it serves. The tag must have the service address engraved on it in letters or numbers at least 5mm (3/16") in height. Lawn services must also be identified with tags.
8. Premises isolation backflow prevention devices are MANDATORY on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in conformance with CSA B64.

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<h2 style="margin: 0;">SPECIFICATIONS FOR MULTIPLE METERS (METER BANK) WITHOUT FIRE PROTECTION SYSTEM</h2>				
	APPROVED JANUARY 2013	DRAWN BY Dale Vandenberg		DRAWING NUMBER 2520-05
	SCALE N T S	CHECKED BY Doug S.		DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

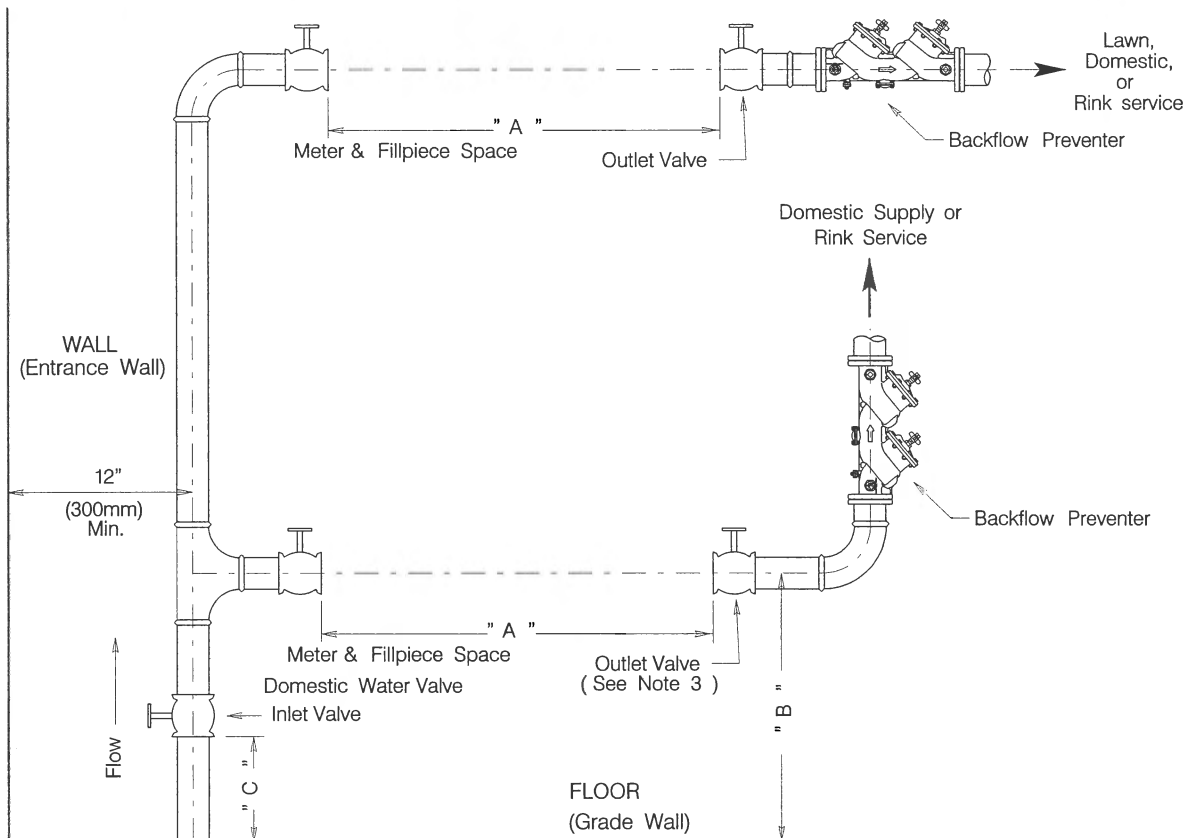


NOTE:

1. Meter settings constructed using plastic piping shall have adequate anchoring on each side of the meter capable of keeping the pipe in alignment and supporting the weight of the meter, pipe and all other components.
2. Plumbers are requested to advise Epcor Water Services Inc. at 412-3800 in advance regarding each individual installation.
3. Master control valve to be installed.
4. An inlet valve and an outlet valve must be installed for each meter setting.
5. Valves or fittings on sides connecting to meter must be female threaded in 1/2" (13mm) for 5/8" (16mm) meter; 3/4" (20mm) for 3/4" (20mm) meter; and 1" (25mm) for 1" (25mm) meters. If 1 1/4" (32mm) piping is used, spacing and fitting for a 1 1/2" (40mm) pipe must be provided.
6. For meters larger than 1 1/2" (40mm) contact Epcor Water Services Inc. at 412-3800 for further information.
7. Contact Epcor Water Services Inc. at 412-3800 prior to installation of a system which will meter both fire supply and domestic supply lines.
8. Buildings with more than one meter must have a metal or plastic tag securely attached to the control valve handle of the meter it serves. The tag must have the service address engraved on it in letters or numbers at least 5mm (3/16") in height. Lawn services must also be identified with tags.
9. Premises isolation backflow prevention devices are MANDATORY on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in conformance with CSA B64.

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<h2 style="margin: 0;">SPECIFICATIONS FOR MULTIPLE METERS (METER BANK) WITH FIRE PROTECTION SYSTEM</h2>			
	APPROVED JANUARY 2013	DRAWN BY Dale Vandenberg	APPROVED
	SCALE N T S	CHECKED BY Doug S.	 DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION
			DRAWING NUMBER <h1 style="margin: 0;">2520-06</h1> REVISION 0



PIPE SIZE	" A "	" B " Max.	" B " Min.	" C " Min.
$\frac{5}{8}$ " (16mm)	11 $\frac{1}{2}$ "-12" (292-305mm)	36" (900mm)	24" (600mm)	18" (450mm)
$\frac{3}{4}$ " (20mm)	13 $\frac{1}{2}$ "-14" (343-356mm)	36" (900mm)	24" (600mm)	18" (450mm)
1" (25mm)	15 $\frac{1}{2}$ "-16" (394-406mm)	36" (900mm)	24" (600mm)	18" (450mm)
1 $\frac{1}{2}$ " (40mm)	30" (762mm)	24" (610mm)	18" (450mm)	12" (300mm)

NOTE:

- Meter settings constructed using plastic piping shall have adequate anchoring on each side of the meter capable of keeping the pipe in alignment and supporting the weight of the meter, pipe and all other components.
- Minimum distance of centerline of piping adjacent to meter setting to be 12" (300mm) from any entrance, wall or grade wall.
- Valve is required on outlet side of meter setting on piping 1" (25mm) and over. Valve optional on piping under 1" (25mm).
- Piping for "A" must be in a horizontal plane.
- Valves or fittings on sides connecting to meter must be female threaded in $\frac{1}{2}$ " (13mm) for $\frac{5}{8}$ " (16mm) meter; $\frac{3}{4}$ " (20mm) for $\frac{3}{4}$ " (20mm) meter; and 1" (25mm) for 1" (25mm) meters. If $1\frac{1}{4}$ " (32mm) piping is used, spacing and fittings for a $1\frac{1}{2}$ " (40mm) pipe must be provided.
- Contact Epcor Water Services Inc. at 412-3800 prior to installation of a system which will meter both fire supply and domestic supply lines.
- Buildings with more than one meter must have a metal or plastic tag securely attached to the control valve handle of the meter it serves. The tag must have the service address engraved on it in letters or numbers at least 5mm ($\frac{3}{16}$ ") in height. Lawn services must also be identified with tags.
- Premises isolation backflow prevention devices are MANDATORY on all fire protection supply piping and potable water service supply piping in commercial and industrial buildings. Backflow preventers shall be selected and installed in conformance with CSA B64.

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SPECIFICATIONS FOR METER SETTINGS WITH FIRE RINK SERVICE

EPCOR

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APPROVED

Susan

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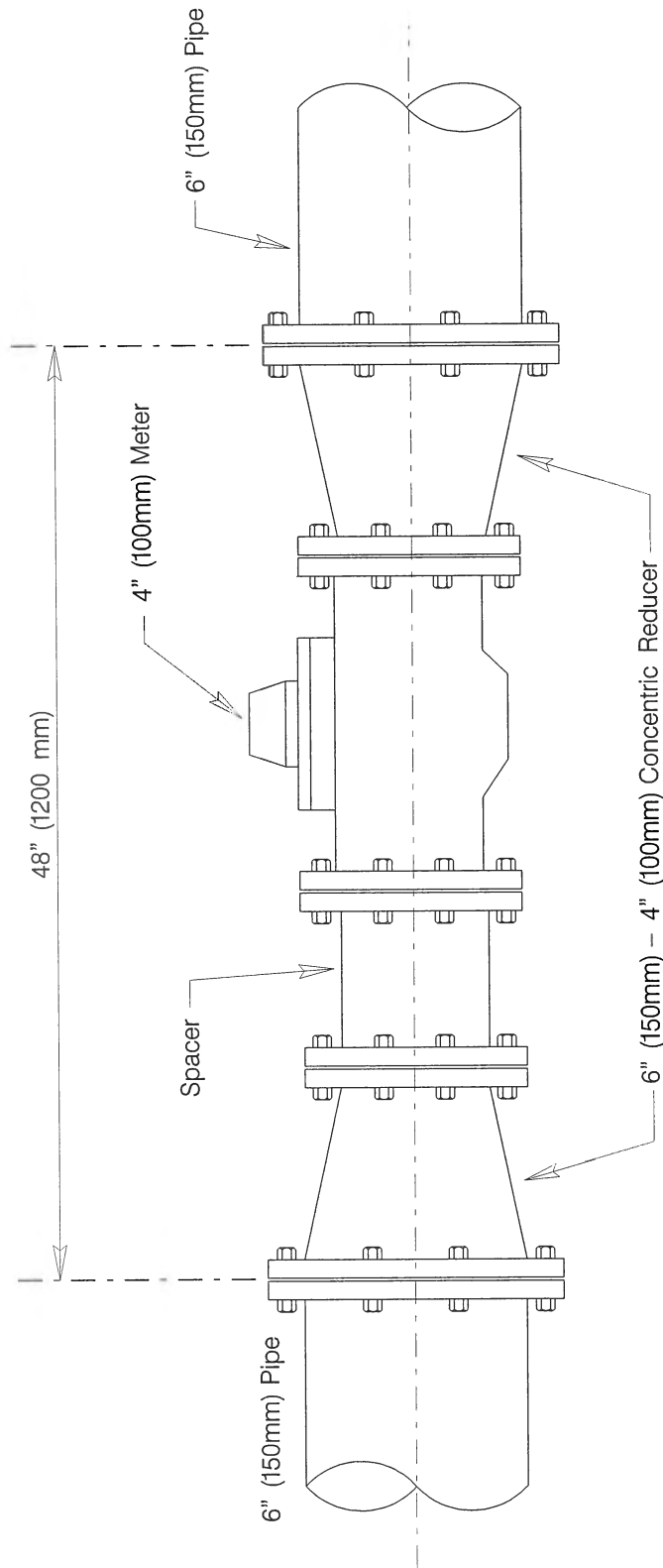
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CHECKED BY
Doug S.

DIRECTOR, WATER DISTRIBUTION AND TRANSMISSION

REVISION 0

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EPCOR

TYPICAL INSTALLATION OF A 100mm (4") WATER METER

APPROVED
JANUARY 2013

DRAWN BY
Dale Vandenberg

APPROVED

Susan Q

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Doug S.

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DRAWING NUMBER

2520-08

REVISION 0