MOORHEAD PUBLIC SERVICE

WATER DIVISION

STANDARDS FOR WATER UTILITY INSTALLATION

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PUBLIC SERVICE
connecting our community

Revisions to the 2021 Standards for Water Utility Installation

Division	Title
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Description of Work

The work to be performed under these standards and accompanying plans and specifications consists of the furnishing of all labor, materials, and equipment to install or replace watermains in the city of Moorhead. The work includes excavation and removal of paving where encountered; furnishing, laying and jointing pipe; making connections to existing watermains as necessary; installing new valves, valve boxes, or valve manholes; installing hydrants; protecting existing utilities and public and private property; backfilling trenches; and other work as may be necessary in order that the work may be completed in accordance with these specifications and the plans and specifications accompanying them.

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DIVISION 1000
STANDARDS AND DEFINITIONS

1100 Reference Standards

1101 American Water Works Association (AWWA)

A. B300, Hypochlorites
B. B301, Liquid Chlorine
C. C100, Thickness Design of Cast Iron Pipe
D. C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
E. C105, Polyethylene Encasement for Ductile-Iron Pipe Systems
F. C110, Ductile-Iron and Gray-Iron Fittings
G. C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
H. C153, Ductile-Iron Compact Fittings
I. C502, Dry-Barrel Fire Hydrants
J. C504, Rubber-Seated Butterfly Valves, 3 in. through 72 in.
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M. C550, Protective Interior Coatings for Valves and Hydrants
N. C600, Installation of Ductile Iron Water Mains and Their Appurtenances
O. C605, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
P. C651, Disinfecting Watermains
Q. C800, Underground Service Line Valves and Fittings
R. C900, PVC Pressure Pipe and Fabricated Fittings, 4 in. through 12 in., for Water Transmission and Distribution
S. C905, PVC Pressure Pipe and Fabricated Fittings, 14 in. through 48 in., for Water Transmission and Distribution

1102 American National Standards Institute (ANSI)

A. A21.4, American National Standard for Cement Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water
B. A21.10, American National Standard for Gray-Iron and Ductile-Iron Fittings, 2-inch through 48-inch, for Water and Other Liquids
C. A21.11, American National Standard for Rubber-Gasket Joints for Cast-iron and Ductile-Iron Pressure Pipe and Fittings

1103 American Society of Testing Materials (ASTM)

A. A48, Standard Specification for Gray Iron Castings
B. D1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds (Type 1, Grade 1)
C. D2241, Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR and Class T)

D. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
E. D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
F. F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1104 United States Environmental Protection Agency (US EPA)

A. Safe Drinking Water Act
B. Reduction of Lead in Drinking Water Act

1105 NSF International

A. NSF 14, Plastics Piping System Components and Related Materials
B. NSF 60, Drinking Water Treatment Chemicals—Health Effects
C. NSF 61, Drinking Water System Components—Health Effects

1106 Plastic Pipe Institute (PPI)

A. TR-2, PVC Range Composition Listing of Qualified Ingredients

1200 Definitions

1201 Moorhead Public Service (MPS)

The purveyor of water used in the city and the drinking water utility that maintains the water distribution system in the city.

1202 City of Moorhead

The municipality in which the project is located.

1203 Contractor

The Contractor awarded the project by the City or MPS.

1204 Engineer

The consultant engineer or City/MPS engineering staff and/or their designated inspector assigned the engineering of the project.

1205 Engineer's Inspector

The inspector assigned to the project by the consultant or City/MPS engineering staff to inspect the installation of watermains and appurtenances.

– END OF SECTION –

DIVISION 2000
ENGINEERING DESIGN STANDARDS

2100 Plan Review

Plans and specifications shall be submitted to MPS a minimum of four weeks before a contract is advertised for bids. Any changes to the approved plans must be resubmitted for review and approval. Plans must show both plan and profile views of the facility to be constructed. Fittings shall be identified and located by station or other suitable dimensions. The plan should also indicate both existing and proposed utilities located within the construction area.

2200 Water Service Design

2210 Water Service Material

Two (2)-inch and smaller water service connections shall be copper pipe or Cross-linked Polyethylene (PEX) pipe. Four (4)-inch and larger water service connections shall be PVC or ductile iron pipe. Refer to Division 3000 for water service material specifications.

2300 Watermain Design

2310 Grade

The permanent finished street grade established by the City shall be used to determine the depth and grade directly over the watermain. No reduction in earth cover is allowed over any watermain or service connection that has a previous history of freezing, unless the pipe is adjusted to the proper depth under the new finished grade.

2320 Depth

The depth of cover over the crown of the pipe shall be as described below. Variations in pipe depth may be considered and approved. However, protective measures to prevent freezing may be required, depending on the conditions.

Pipe Size	Minimum Depth
< 12”	8.0’
12”	7.5’
16”	7.0’
> 20”	6.5’

2400 General

2410 Insulation

Insulation shall be used when a watermain offset or utility crossing is required because of a frost generating structure. Frost generating structures include, but are not limited to, catch basins, manholes,

and other outlets. The minimum guidelines for the placement of insulation shall be as follows:

A. If a water pipe crosses within 3 feet above or below a storm sewer, insulation shall be placed between the water pipe and storm sewer.
B. If a water pipe is offset over a storm sewer, insulation shall be placed both between the water pipe and storm sewer and over the top of the water pipe.
C. If a water pipe is within 4 feet of a frost generating structure, insulation shall be placed between the structure and water pipe.

Insulation shall be placed parallel to the water pipe and 2 feet beyond either side of the water pipe. For guidelines A and B above, insulation shall also extend 2 feet beyond either side of the storm sewer. For guideline C above, insulation shall extend 2 feet beyond either side of the water pipe and 2 feet beyond either side of the structure.

2420 Approved Equal

Material specifications to be used for watermain installations shall be submitted to MPS' Water Division for review and approval. MPS' Water Division will review material requested to be substituted as an approved equal on a case-by-case basis.

– END OF SECTION –

DIVISION 3000
MATERIALS

All products (treatment chemicals and material) that may come into contact with water intended for use in a public water system shall meet ANSI/NSF Standards 60 & 61, as appropriate. A product will be considered as meeting these standards if so certified by NSF, The Underwriters Laboratories, or other organizations accredited by ANSI to test and certify such products. All materials used for underground service line valves and fittings shall comply with the latest revision of ANSI/AWWA C800. All materials shall be new and unused.

3100 Pipe and Appurtenances

3110 Polyvinyl Chloride Pipe (PVC)

The PVC material shall conform to the requirements of ASTM D1784, Class 12454. The pipe shall be marked to indicate compliance with NSF 61, Factory Mutual (FM), and either be marked or tagged with the Underwriter Laboratory (UL) approval. All PVC watermain pipe material shall be blue in color. PVC pressure pipe shall be manufactured in accordance with the latest AWWA Standard revision, pressure class, and dimension ratio as follows:

Pipe Size	AWWA Standard	Pressure Class (psi)	Dimension Ratio (DR)
4”–12”	C900	235	18
14”–48”	C905	235	18

PVC Pipe Joints

Bell-end pipe, couplings, and fittings designed for making PVC joints using elastomeric gaskets to affect the pressure seal shall be tested as assembled joints and shall meet the laboratory performance requirements specified in the latest revision of ASTM D3139.

Gaskets and lubricants intended for use with PVC pipe, couplings, and fabricated fittings shall be made from materials that are compatible with the pipe and with each other when used together. Gaskets and lubricants shall not adversely affect the potable quality of the water that is to be transported.

3115 Fusible PVC (FPVC) Pipe

FPVC pipe shall conform to the latest revision of AWWA C900, AWWA C905, or ASTM D1784 for standard dimensions and material, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.

The FPVC pipe shall be extruded with plain ends, which shall be square to the pipe and free of any bevel or chamfer. No bell or gasket, of any kind, shall be incorporated into the pipe. FPVC shall be manufactured in a standard 40-foot nominal length, or custom length as specified, and shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults or physical damage. FPVC pipe shall be blue in color for potable water use.

FPVC pipe shall be marked as follows:

A. Nominal pipe size;
B. Material type (PVC);
C. Dimension Ratio, Standard Dimension Ratio, or Schedule;
D. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable;
E. AWWA standard designation number, or pipe type for non-AWWA pipe, as applicable;
F. Extrusion production-record code;
G. Trademark or trade name; and
H. Cell Classification.

Fusion Technician Requirements

The FPVC fusion technician shall be fully qualified by the pipe supplier to install fusible PVC pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

FPVC Pipe Joints

Fusible PVC pipe lengths shall be assembled in the field with butt-fused joints, unless otherwise specified. Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed per the pipe supplier's guidelines.

FPVC Pipe and Joint Warranty

FPVC pipe installed shall be warranted for one year per the pipe supplier's standard terms. In addition to the standard pipe warranty, the fusion services shall be warranted for one year per the fusion service provider's standard terms.

Saddle/Tapping Connections

Tapped connections through the use of a saddle will require the installation of a Bell Restraint Harness (EBAA Series 6500 or approved equal) prior to tapping of the Fusible pipe.

3120 Ductile Iron Fittings

Ductile iron, mechanical joint fittings shall be used with both mechanical joint and push-on joint pipe and shall conform to the latest revision of AWWA C153. Ductile iron fittings must be used for fittings having an 4-inch diameter or larger.

All ductile iron fittings shall be:

- Mechanical joint, except as noted.
- Attached to the pipe using restraint devices, as specified in **Section 3150**.
- Wrapped, including the restraint devices, as specified in **Section 3160**.
- Bid complete with gaskets, glands, and bolts. All bolts shall be stainless steel.

All fittings shall be cement mortar lined on the interior and bituminous coated on the exterior. Cement lining shall conform to AWWA C104. Joints shall conform to the latest requirements of AWWA C111.

3130 PVC Fittings

PVC fittings shall conform to the requirements of AWWA C907, carry a working pressure of 150 psi, and be of the slip-joint type. Only fittings 4- inches in diameter, or less, may be PVC.

Acceptable PVC fittings include:

A. IPEX Blue Brute; or
B. Approved equal.

3140 Mechanical Joint Restraint

All connections between PVC pressure pipe and ductile iron fittings, valves, and/or hydrants shall be made with installing a mechanical joint restraint.

All bolts and ties shall be stainless steel. All factory-installed bolts shall also be stainless steel. All bolts shall be tightened to manufacturer's recommended tightness and verified with a torque wrench. After the installation of the fitting, the bolts shall be rechecked with a torque wrench to ensure tightness.

Acceptable mechanical joint restraints include:

A. EEBA Iron Series 2000 PV;
B. Sigma ONE-LOK Series SLCE;
C. Star Series; or
D. Approved equal.

3150 Transition Couplings

Transition couplings shall be used for connection of new watermains to existing watermains. All necessary bolts to install transition couplings shall be stainless steel. Transition couplings shall be PVC, ductile iron, carbon steel, or approved equal, and shall be coated inside and out with epoxy or nylon coating.

Acceptable transition couplings include:

A. HYMAX® Grip;
B. Romac Alpha;
C. Approved equal.

3160 Polyethylene Wrap

All ductile iron fittings, restraint devices, gate valves, butterfly valves, valve boxes, buried sections of hydrants, transition couplings, and/or other devices that contain metal shall be wrapped according to the latest revision of AWWA C105. The polyethylene plastic film must have an 8-mil minimum thickness. Cross-woven polyethylene plastic film having a 4-mil minimum thickness is also allowed.

3200 Valves

3210 Gate Valves

Gate valves shall be used on pipe sizes 4- through 12-inch. Ductile iron resilient-seated gate valves and tapping valves shall conform to the latest requirements of AWWA C515. Valve seats shall be able to withstand 200 psi and the body shall withstand 400 psi.

All valves shall be mechanical joint and attached to PVC pressure pipe with approved joint restraints listed in **Section 3150**.

Gaskets shall be rubber.

Valves shall be left-hand (counter-clockwise) opening with 2-inch operating nut.

The stem shall be made of bronze and shall use O-ring type stem seals.

All valves shall be coated inside and out in accordance with the latest revision of AWWA C550.

All bolts shall be stainless steel.

Acceptable manufacturers include:

A. American Flow Control;
B. U.S. Pipe;
C. Waterous; or
D. Approved equal.

3220 Butterfly Valves

Butterfly valves shall be used on pipe sizes larger than 12-inch. Butterfly valves shall be mechanical joint end valves, Class 150B, rubber-seated, suitable for buried service, and shall conform to the latest revision of AWWA C504. Epoxy coating shall be applied to all surfaces of the valve body and vane to an average film thickness of 10-mils, or conforming to the latest revision of AWWA C550. All body and operator bolts shall be stainless steel.

Valves shall by left-hand opening (counter-clockwise) with 2-inch operating nut.

Shaft seals shall be O-ring type.

Acceptable manufacturers include:

A. DeZURIK; or
B. Approved equal.

3230 Valve Boxes and Adaptors

Valve boxes are required on all gate valves and butterfly valves.

All valve boxes shall be made of cast-iron in accordance with ASTM A48 Class 30B material specification with a minimum tensile strength of 30,000 psi, have screw-type adjustment, be of the three-piece, 5 ¼-inch shaft, size G, and be furnished with cast iron bonnets and covers. The valve box shall be suitable for a depth of cover as specified. Valve box adaptors shall be installed for all valve boxes.

Drop lids shall be marked “WATER” and be American-made, or be heavy-duty foreign-made boxes that meet or exceed the weight of the American-made box.

Acceptable valve box manufacturers include:

A. Tyler 6850/668S;
B. Star® heavy-duty series boxes; or

C. Approved equal.

Acceptable valve box adaptors include:

A. Valve Box Adaptor II (Adaptor, Inc.); or
B. Approved equal.

3240 Tapping Sleeves and Valves

Tapping valves shall be in accordance with the latest revision of AWWA C509. Tapping sleeves shall be stainless steel with a stainless steel flange. Tapping sleeve gaskets shall provide sealing across the full pipe circumference and the full area of the sleeve. Bolts and nuts shall be stainless steel. All tapping sleeves shall be wrapped in polyethylene plastic film as specified in **Section 3170**.

3300 Fire Hydrants

Fire hydrants shall be non-jacket type meeting the latest revision of AWWA C502. Hose and pump nozzle connections shall be supplied with O-ring seals, nozzle caps, and nozzle cap chains.

Hydrants shall be Waterous Pacer WB67 Traffic Models, or approved equal, meeting the following specifications:

Main Valve Opening	5¼-inch valve opening
Hydrant Barrel	7⅜-inch minimum inside diameter
Shut-off type	Compression
Inlet Connection	6-inch size, mechanical joint fitting
Bury Length	As specified on the plan sheets
Bury Depth	Maximum bury depth of 9 feet, unless approved by Engineer
Traffic Flange	22-inch breakable flange
Hose Nozzles	Two 2½-inch National Standard Thread (NST) hose connections
Pumper Nozzle	One 5-inch Storz Nozzle, pre-installed on hydrants upon delivery to site, provided with a cap containing a 1½-inch National Standard Pentagonal operating nut
Cap Nuts	1½-inch National Standard Pentagonal operating nut, counter-clockwise open
Operating Nut	1½-inch National Standard Pentagonal operating nut, counter-clockwise open
Finish Paint	Standard Red above Ground Line

Installation of fire hydrants shall include the installation of a hydrant post measuring 1¾-inch square by 9 feet long. The trade name shall be Telespar®, or approved equal. Installation shall include a hydrant sign on both sides of the top of the hydrant post. MPS will provide additional signs as needed.

3400 Water Service Connections

The Contractor shall be required to furnish and install all stainless steel service saddles, corporation stops, copper pipe, curb stops, and fittings, as specified, necessary to connect existing services to the new

watermain. All materials used for underground service line valves and fittings shall comply with the latest revision of AWWA C800.

3410 Corporation Stop Valves

Corporation stop valves for water services 2-inch and smaller shall have the inlet threads protected in shipment by a plastic coating or other equally satisfactory means. Corporation valve inlets shall be threaded with standard AWWA/CC Taper. Corporation valve outlets shall be for use with flared copper tubing or approved compression style fittings listed below.

Acceptable corporation stop valves include:

A. Mueller Co. H-15000;
B. Ford F600 Series;
C. A.Y. McDonald (74701B);
D. A.Y. McDonald (74701BQ);
E. A.Y. McDonald (74701BQA); or
F. Approved equal.

3420 Curb Stop Valves

Curb stop valves for copper service connections 2-inch and smaller shall be without drain and shall have a Minneapolis thread pattern. End connections shall be for use with flared copper tubing or approved compression style fittings listed below.

Acceptable curb stop valves include:

A. Mueller Co. Oriseal;
B. Ford B22 Series;
C. A.Y. McDonald (76104);
D. A.Y. McDonald (74701BQ);
E. A.Y. McDonald (74701BQA); or
F. Approved equal.

3430 Curb Stop Boxes

Curb stop boxes shall be telescoping and be capable to extend 6 inches above grade with an 8-foot bury.

Acceptable curb stop tops include:

A. Copperhead BoaBox-Water
B. Approved Equal

Acceptable curb stop boxes include:

A. Mueller Co. H-10302;
B. Ford (EM2-80-46-78R); or
C. Approved equal.

3440 Water Service Pipes

Water service 2-inch and smaller shall be Type “K” soft copper or Cross-linked Polyethylene (PEX) pipe, or approved equal.

PEX pipe shall meet the following criteria:

- Manufactured using high-pressure peroxide method of cross-linking.
- Manufactured to SDR9 copper tube sizes (CTS) according to ASTM F876, AWWA C904, and CSA B137.5.
- Certified to AWWA C904 Cross-linked Polyethylene (PEX) Pressure Pipe for Water Service
- Certified to CSA B137.5 Cross-linked Polyethylene (PEX) tubing for Pressure Applications
- Certified to NSF/ANSI Standards 14 and 61 (NSF-pw-g) for Potable Water Applications
- Certified to PPI TR-3 Category 3306 for long-term hydrostatic strength, chlorine and UV resistance.
- Co-extruded UV Shield made fro, UV-resistant high-density polyethylene, color Blue
- Minimum recommended UV exposure time of one (1) year when tested in accordance with ASTM F2657.
- Pressure-rated for continuous use at 200 psi @ 73.4 degrees Fahrenheit based on a 0.63 design factor.
- Minimum markings: PEXa 3306, CSA B137.5, ASTM F876, F2023 and F2080, NSF-pw.
- Approved by manufacturer for use with manual plastic pipe squeeze-off tools for temporary stoppage of flow.

- Underground fittings and insert-stiffeners used with PEX pipe must comply with the material and performance requirements of ANSI/AWWA C800 and must be recommended for use by the fitting manufacturer for CTS SDR9 PEX pipe per the ANSI/AWWA C904 standard. Insert-stiffeners shall be stainless steel.

PVC water service pipe must conform to the standards in **Section 3110**.

3450 Service Saddles

All service saddles shall be double-bolt (minimum) stainless steel band-type with full half-circle gaskets. Service saddles shall have stainless steel washers between the nut and the plastic washer to equalize tightening stress. Rubber tapered gaskets shall be required to resist circumferential and longitudinal forces, along with O-rings or flat gaskets for hydraulic seal. Saddle bolts shall be tightened to the manufacturer's recommended tightness using a torque wrench. Bolt tightness shall be rechecked with a torque wrench after the pipe tap is complete.

Approved service saddles include:

A. Romac Industries Style 306;
B. Ford FS303;
C. PowerSeal Model 3412 AS;
D. Cascade CSC2; or
E. Approved equal.

3460 Service Fittings

Fittings at the property line shall be straight three-part unions or approved compression style fitting listed below. Soft soldered joints are not permitted.

A. Mueller Co. H-15400;
B. A. Y. McDonald “Q” style fitting; or
C. Approved equal.

3500 Miscellaneous

3510 Insulation

Insulation used for watermain offsets and utility crossings shall be rigid extruded polystyrene insulation board having a minimum compressive strength of 40 psi. The insulation material shall be furnished in panels 2 inches thick and shall be laid over top of each other to form a 4-inch layer of insulation. A minimum of two (2) wood skewers per board in each layer driven flush with the surface of the material shall be utilized to hold the insulation material in place during backfill operations.

Approved insulation types include:

A. Dow STYROFOAM™ HIGHLOAD 40; or
B. Approved equal.

– END OF SECTION –

DIVISION 4000
CONSTRUCTION

4100 General Requirements

Pipe and fittings shall be handled and laid in accordance with the latest revision of AWWA C600. Pipe and fittings shall be laid in the location shown on the plans—the exact location being designated by the Engineer during construction. Before laying any pipe, it shall be cleaned of all foreign matter and kept clean thereafter. Open ends shall be protected at all times to prevent the entrance of dirt, trench water, animals, or foreign material into the pipe. The bell and spigot shall be wiped clean and sufficient lubrication placed on the gasket and spigot before the pipe is pushed fully into the bell. Field cut spigot ends of push-on joints shall be beveled prior to being pushed into the bell. All handling, field cuts, and jointing shall be done per the manufacturer's recommendation.

4110 Preconstruction Requirements

A preconstruction meeting attended by the Contractor, Engineer, and MPS representative is required prior to the start of construction. If water facilities are proposed for installation in or across a state or county highway, the appropriate state or county engineer shall be invited to the meeting. Representatives of utility companies having facilities within the project area shall also be invited to the meeting.

4120 Notification

The Contractor shall notify MPS at least 48 hours in advance of construction so that an inspector may be assigned to the project. An MPS representative will also be assigned to the project to mark the location of watermain appurtenances, valves, and water service equipment using GPS equipment.

4130 Temporary Water Service

This work shall include providing, installing, maintaining, and removing all hosing, piping connections, and fittings necessary to provide continuous water service to water users during construction of the project. This shall also include any disinfection required by this specification.

Contractor shall be responsible to notify affected property owners, cleaning and disinfecting all materials used for temporary water connections, operating water shut-off valve inside the building, and back flushing all services before connecting to the new watermain.

Contractor is required to have two passing bacteria tests on all temporary water service connections before it shall be turned on to provide temporary water service. This shall include all hosing, piping, and fittings required to provide temporary connections. Coordination between the Contractor and MPS will be required to complete the bacteria testing.

Contractor shall provide personnel who will be available at all times (including evenings and weekends) to correct interrupted temporary water service or other problems associated with the project. The Contractor shall coordinate the contact information for these identified personnel with MPS before beginning the project.

Contractor shall be required to employ a registered and licensed master plumber who will be responsible for all plumbing connections on this project. Contractor shall provide backflow prevention devices on the temporary water supply.

Contractor will be required to remove all handles on valves within the temporary water service connections before the commencement of construction—this is to prevent the unintentional distribution of water service to water users.

4140 Materials

The Contractor shall furnish and install only the specified materials approved by MPS in these standards or those approved in **Division 2000**. MPS will be responsible for furnishing material that is required for work to be performed by MPS.

4150 Abandoning of Watermains, Hydrants, and Valves

The Contractor shall plug the ends of abandoned watermains with concrete whenever it is not practical to remove the abandoned pipe. When it is not practical to remove the existing hydrant, the Contractor shall remove the hydrant to 18 inches below grade and fill the stand pipe with concrete. If a valve is being abandoned in place, the Contractor shall close the valve, remove the valve box to the road grade, and fill the valve box with concrete.

4200 Pipe Installation

PVC pipe and associated fittings shall be installed in accordance with the latest revision of AWWA C605.

4210 Pipe Alignment and Grade

The pipe shall be laid to the horizontal alignment and depth as directed by the Engineer. The minimum bury depth shall be determined based on **Section 2320**.

Deflection of the pipe joints will be permitted up to a 5-degree maximum. A 5-degree deflection equals an offset of approximately 1-inch per foot of pipe. Any deflection exceeding 5 degrees will require the use of bends and fittings, which shall be furnished and installed by the Contractor.

At locations where a watermain crosses a sewer pipe, a full-length section of watermain pipe shall be centered over the sewer pipe to place joints as far away from the sewer pipe as possible. Contractor shall maintain 18 inches of vertical clearance between watermain pipe and sewers.

4220 Pipe Bedding and Backfilling

The pipe shall be bedded and backfilled with clean pit run material. No particle size may exceed 1 inch. The pipe shall be placed on a 3-inch layer of material and backfilled 3 inches over the top of the pipe. A uniform support shall be provided for the entire length of the pipe.

4300 Setting Valves, Valve Boxes, Service Stops, Hydrants, and Fittings

4310 Valves and Valve Boxes

Valves will be installed where shown on the plans or as directed by the Engineer. Before installing the valve, care should be taken to ensure that all foreign material has been removed from the inside of the valve.

The body of the valve shall be wrapped with polyethylene in accordance with the latest revision of AWWA C105. Also see **Section 3160**.

The stuffing boxes shall be tightened and the valve opened and closed to see that all parts are in first-class working order. Valves and valve boxes must be plumb. Valves shall be set on pre-cast concrete blocks.

The valve box adapter shall be installed on the valve, and the valve box shall be placed directly over the operating nut. The top of the box being placed 4 inches below final grade, and rose flush to final grade with one 2-inch and two 1-inch valve box insert risers.

The box shall be backfilled and thoroughly tamped around the box. After backfilling, a wrench shall be dropped on the valve to ensure that it is operable.

4320 Fire Hydrants

Hydrants shall be set at such an elevation that the specified pipe cover is provided throughout the length of the supply line and that the pumper nozzles are a minimum of 30 inches above the surrounding finished ground.

Contractor can either provide hydrants meeting the required elevations or provide hydrants with hydrant extensions (incidental to the hydrants) as approved by the Engineer. The breakaway flange shall be between 3 and 6 inches above finished ground elevation.

All hydrants shall be vertically plumb and shall have their pumper nozzle facing at right-angles to the street, unless otherwise specified.

Each hydrant shall be set on a concrete block and blocked behind with concrete blocks(s) of sufficient size to prevent settling and horizontal movement. Hydrant bases shall be backfilled with at least one-third cubic yard of crushed rock to facilitate drainage. The crushed rock shall extend to 6 inches above the weep hole.

4330 Water Service Stops

All curb boxes shall be wrapped in polyethylene having a minimum thickness of 8 mils, as specified in **Section 3160**.

Each water curb box shall be marked with a 2"x 2" x 4' wooden marker. The upper 24 inches of said markers shall be painted with blue paint in a manner satisfactory to the Engineer.

4340 Fittings

All fittings shall be PVC or ductile iron, and shall be "push-on" or "slip-joint," unless specified otherwise in the plans or special instructions to bidders.

4350 Thrust Blocks

All fittings shall be braced by means of poured concrete or concrete thrust blocks. No wood thrust blocks will be allowed. Poured concrete shall be 3,000 psi concrete poured against undisturbed earth. Care shall be taken not to cover up joints, bolts, flanges, and fittings with concrete.

Thrust restraint at the joints may be used in lieu of concrete thrust blocking with the permission of the Engineer. Restraint devices for PVC pipe shall meet or exceed the requirements of the latest revision of ASTM F1674 (Standard Test Method for Joint Restraint Products for use with PVC Pipe).

4400 Horizontal Directional Drilling (HDD) Requirements

A project safety and contingency plan shall include, but shall not be limited to, drilling fluid containment and cleanup procedures, equipment and plan for compromised utility installations, including electrical and power lines, watermain, sanitary sewer, storm sewer, and any other subsurface utility in the area. An HDD schedule identifying daily work hours and working dates for each installation is required.

4500 Tracer Wire and Installation

4510 Tracer Wire Installation and Termination

Open Trench- Tracer wire shall be No. 12 AWG Copper Clad Steel, high strength with minimum 450 lb. break load with minimum 30 ml HDPE insulation thickness (blue colored) as manufactured by Copperhead Industries (High Strength Tracer wire) or approved equal. Tracer wire should be continuous and shall be placed on the crown of the pipe and attached to the pipe every 10 feet. If splicing is needed, the use of splice caps approved by the Engineer will be required.

Trenchless Installation- Trace wire shall be No. 10 AWG high carbon 1055 grade steel extra-high strength copper-clad steel with a minimum 2,000 lb. break load with a minimum 45 ml HDPE insulation thickness (blue colored) as manufactured by Copperhead Industries (Soloshot Extra-High Strength-1045) or approved equal.

Main Line Connectors- All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.

Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.

Tracer wire must be continuous to maintain connectivity. In-line splices shall be Copperhead, DryConn, or approved equal. The main line tracer wire shall not be broken or cut. Wire nut splices will not be allowed. Wire splices must be made to assure proper connectivity of the wire.

Grounding- Trace wire must be properly grounded at all dead ends/stubs unless notified otherwise. Grounding of tracer wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20 ft. of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the watermain. Grounding anode must be driven into undisturbed soil (burying anodes with disturbed soil is not allowed). When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.

On fire hydrants, main line tracer wire and grounding rod wire must be installed inside a 1-inch galvanized or plastic conduit brought up alongside the hydrant and then attached to a 2 terminal access box as manufactured by Copperhead Industries (Blue 2 terminal Cobra Access point), or approved equal.

On water services, the trace wire must be run from the watermain to the curb boxes. All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire as manufactured as Copperhead Industries (Mainline to Service Connector) or approved equal. The tracer wire must come up the outside of all curb boxes. The tracer wire must be taped to the curb boxes and inserted and connected to the Copperhead BoaBox-Water Access Point or approved equal. ..

A. As part of the final inspection and acceptance of newly-installed watermains, all new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the Contractor, Engineer and MPS staff, prior to completion of any street construction or completion of the project, acceptance. Continuity testing in lieu of actual line tracing shall not be accepted.
B. If the tracer wire fails, the Contractor will be responsible for providing some means of tracing out newly-installed watermain including, but not limited to, re-installing tracer wire.

4520 Polystyrene Insulation Installation

Rigid extruded polystyrene conforming to the material requirements of this specification shall be installed with two layers of 2-inch thick insulation board at the locations designated in the plans. The insulation material shall be furnished in panels 2 inches thick and shall be placed on a smooth level foundation. If joints are required, they shall be in a staggered manner that will provide overlaps a minimum of 6 inches on the underlying sheets. The edges shall be trim and square. The insulation shall be held together by a minimum of two wood skewers per board in each layer—driven flush with the surface of the material. If the bedding procedure is not adequate to properly support the insulation, an additional treated wood shell will be required.

Backfilling and compaction of material over the insulation board shall be accomplished in a manner that will not damage the insulation material. Construction equipment of any kind shall not operate directly on the insulation board. The Contractor shall replace, at their own expense, sections of insulation damaged by the Contractor’s construction operations.

4600 Operation of Valves and Hydrants

The Contractor shall notify MPS Water Division staff when gate valves need to be opened or closed. Only MPS Water Division staff shall operate existing valves and hydrants.

New valves that are installed by the Contractor shall not be opened adjacent to an existing watermain unless the following conditions have been met:

1. MPS Water Division staff have been notified and are available to operate the valve and flush adjacent watermains in the area, if necessary.
2. All testing is complete and approved, including pressure testing, disinfection, and bacteriological testing.

Unauthorized valve operations resulting in a labor or material cost to the City or MPS will be either invoiced (when not currently under City contract) or deducted from the payment due the Contractor. Charges to the Contractor, in either case, will be calculated at the City or MPS employee's direct wage rate times a 2.0 multiplier.

4700 As-Built Requirements

The Contractor shall notify MPS at least 48 hours in advance of construction so that an MPS representative can be assigned to the project to mark the location of watermain appurtenances, valves, and water service equipment using GPS equipment.

– END OF SECTION –

DIVISION 5000
PIPE, SERVICE CONNECTION, AND APPURTENANCE TESTING

5100 General Testing Requirements

The Contractor shall notify MPS Water Division staff when valves need to be opened or closed. MPS personnel must be onsite to supervise operation of the valves. The new watermain must be isolated from the existing mains until the new pipe passes the bacteriological testing requirements.

5200 Pressure and Hydrostatic Testing

It is the Contractor's responsibility to pass the pressure and hydrostatic testing. It is at the Contractor's own risk to pressure test against an existing valve in the water system. If the Contractor chooses to pressure test against an existing valve and they cannot pass the test, the valve will have to be replaced at the Contractor's expense.

Following the installation of a new watermain, all newly-laid pipe or valved sections shall be subjected to a hydrostatic test.

Each valved section of the pipeline shall be slowly filled with water. When venting air from pipelines, it is important to limit the pipeline fill rate to avoid excessive surge pressures when the water reaches the air venting openings.

Before applying the specified test pressure, air shall be expelled completely from the pipeline section under test. Before pressure testing can commence, any heavily-chlorinated water in the line must be thoroughly flushed.

The pipeline shall be allowed to stabilize at the test pressure before conducting the hydrostatic test. This may require several cycles of pressurizing and bleeding trapped air prior to beginning the test.

The hydrostatic test shall be at least 2 hours in duration with no drop in pressure during the test with a minimum pressure reading of 150 psi.

An additional curb stop shall be installed in the service line within the trench. The curb stop shall be closed when performing the pressure test. The curb stop shall have a temporary access pipe installed at or above grade to allow the curb stop to be opened after the pressure test is performed. The temporary access pipe shall be removed after the pressure test and bacteria test have been completed and approved, and the additional curb stop has been opened. The water service shall be back-flushed before restoring service to residences to remove any scaling or debris that is in the service line.

5300 Watermain Disinfection

Disinfection shall conform to Minnesota Department of Health requirements and the latest revision of AWWA C651. Thoroughly flush watermain prior to disinfection in order to remove all foreign matter that may have entered the pipe during construction.

A 50 mg/L (ppm) chlorine solution shall be used for disinfection.

5310 New Watermain Installation Disinfection

Hypochlorite tablets or liquid chlorine may be used on new watermain projects.

5320 Watermain Replacement Disinfection

Hypochlorite tablets shall not be used on watermain replacement projects—liquid chlorine is to be used and may be inserted through a hydrant or a corporation installed on the new watermain.

Location of the corporation shall generally be placed at a location such that the chlorine solution can be injected into a water supply stream and the chlorine mixture is carried through the entire length of the new watermain. Location of the corporation must meet approval of the Engineer.

Cost of corporation and disinfecting work shall be incidental to the watermain installation.

The corporation valves are to be closed at the main prior to the backfilling of the trench areas.

Maintain chlorine solution in watermain for a minimum of 24 hours.

Thoroughly flush line after retention time has expired until the chlorine content is at acceptable levels. The environment to which the heavily-chlorinated water is to be discharged shall be inspected. If deemed necessary, a reducing agent shall be added to neutralize the chlorine residual remaining in the water.

5330 Dechlorination

Heavily-chlorinated water that is flushed from the watermain, after disinfection, shall be disposed of according to the latest revision of AWWA C651.

5340 Bacteriological Testing

Upon completion of disinfecting and flushing the watermain, but prior to placing the watermain into service, the Contractor will coordinate with MPS to test for bacteriological quality.

Prior to acceptance, MPS will collect and test samples in accordance with Standard Methods of the Examination of Water and Wastewater, and shall show the absence of coliform organisms.

Two bacteriological tests shall be performed per 1,200 linear feet of watermain pipe. These tests shall be taken 24 hours apart. Two (2) consecutive samples must pass in order for the work to be accepted.

Bacteria sampling will not be allowed through a fire hydrant or fire hose. The sampling line must be dedicated and cleaned, disinfected, and flushed prior to sampling.

If tests indicated the presence of coliform bacteria, the Contractor shall re-flush the watermain and new samples will be collected. At the Contractor's option and cost, the watermain may be re-disinfected prior to re-flushing and re-sampling. If the re-test fails, Contractor shall repeat the disinfecting, flushing, sampling, and testing process until test results indicate absence of coliform bacteria. If the re-test fails, Contractor will be responsible for the additional costs of flushing, disinfecting, and re-testing for bacteria. Only after bacteriological test results are favorable shall the watermain be placed in service.

– END OF SECTION –

DIVISION 6000
FINAL INSPECTION, ACCEPTANCE, AND PAYMENT

6100 Final Inspection and Acceptance

Before any pavement operations may commence, the Contractor shall be required to request a final inspection with the Engineer and MPS.

As part of this inspection, the Engineer and MPS shall inspect all aspects of the watermain project including, but not limited to, valve operation and location, hydrant operation and location, tracer wire continently, curb stop operation and location. Once the Engineer and MPS have signed off and accepted the newly-installed watermain, the Contractor shall be paid for work completed.

6200 Measurement and Payment

All measurements and payments will be based on completed and accepted work. The payments listed below shall be full compensation for all labor, materials, equipment, and incidental items necessary to complete work.

Pipe will be measured in units of lineal feet along the center line of the pipe without deductions for fitting or valves. Payments shall be made at the Contract unit price per lineal foot for “Watermain” for each respective size and type listed in the proposal. Pay items shall include excavation bedding, backfill, thrust blocks, disinfection, and testing. Payment for installation of watermain shall not be paid in full until the main has been flushed, pressure tested, disinfected, and tested for bacteriological content and final inspection has been completed.

PVC or ductile-iron fittings and connections to existing facilities will not be measured for separate payment but will be considered a subsidiary item to the installation of the watermain unless a pay item is specifically included on the bid form.

Fire hydrants will be measured in units of each. Payment will be made at the contract unit price per each of the item “Fire Hydrants.”

All valves will be measured in units of each, which shall include the valve box and cover. Payment will be made at the contract unit price per each for “Gate Valves or Butterfly Valves and Valve Box” of the size indicated.

Hydrant leads will be measure in units of lineal feet along the centerline of the pipe. Payment shall be made at the contract unit price per lineal foot for the size of pipe as indicated.

Fittings will be measured for separate payment as a lump sum. Payment will be made on the basis of the contract lump sum for “Fittings.”

Measurement of water services shall be from the centerline of the watermain to connection to the existing services. Payment for said water services shall include all costs for installation of the water service,

including, but not limited to, copper water pipe, labor, and incidentals necessary to complete the work in accordance with these standards.

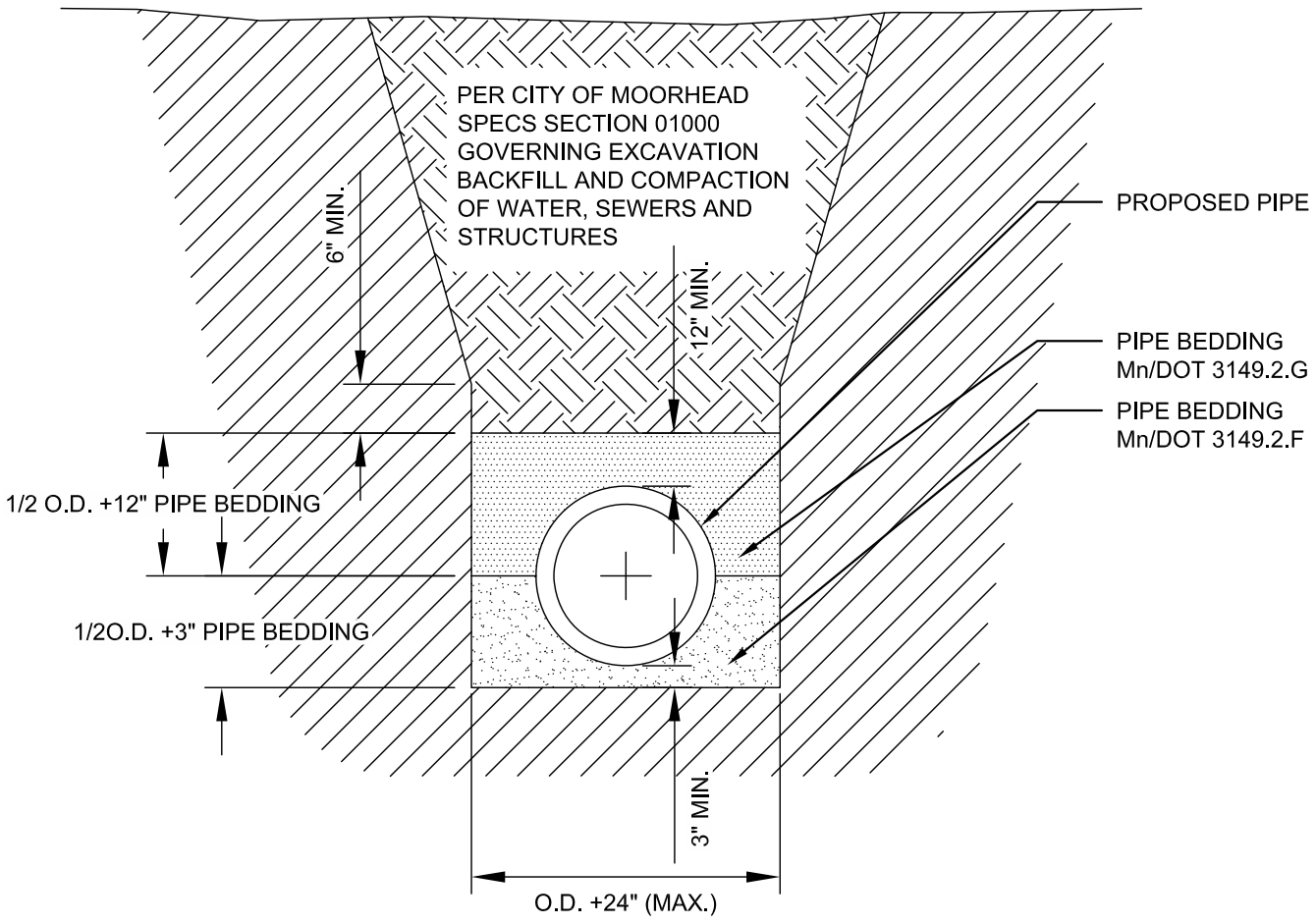
Payment for furnishing and installing corporation stops will be at the unit price bid on the proposal form. The unit price bid for corporation stops shall include the specified saddle.

Payment for furnishing and installing curb stops and curb boxes shall be at the unit price bid on the proposal form.

Temporary Water Service bid item shall include all work necessary for providing temporary water connections to water users affected by this project.

– END OF SECTION –

DRAWING INDEX



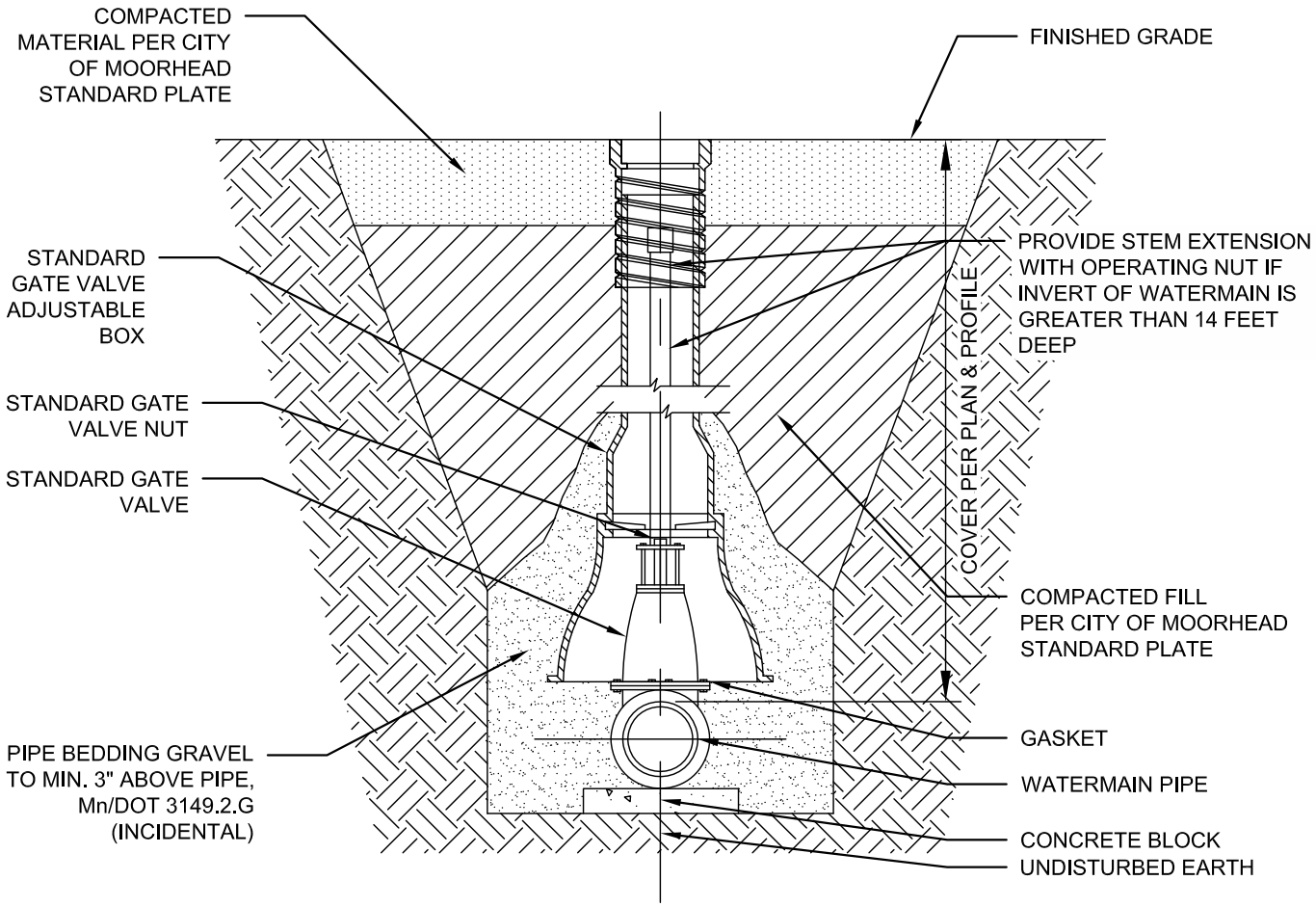
COORDINATE BACKFILL
REQUIREMENTS WITH THE
CITY OF MOORHEAD
STANDARD REPAIR PLATES

MOORHEAD PUBLIC SERVICE

WATERMAIN TRENCH DETAIL

MOORHEAD PUBLIC SERVICE
STANDARD DETAILS

D-1



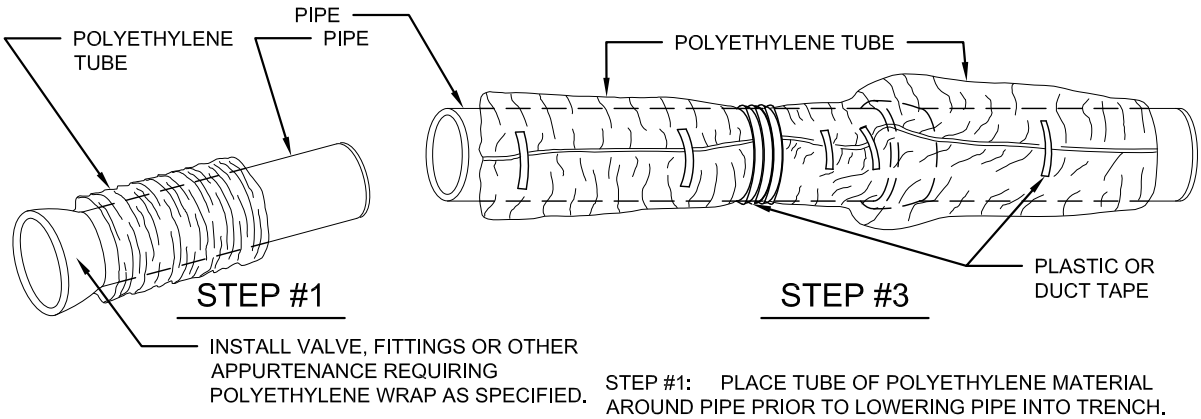
COORDINATE BACKFILL REQUIREMENTS WITH THE CITY OF MOORHEAD STANDARD REPAIR PLATES

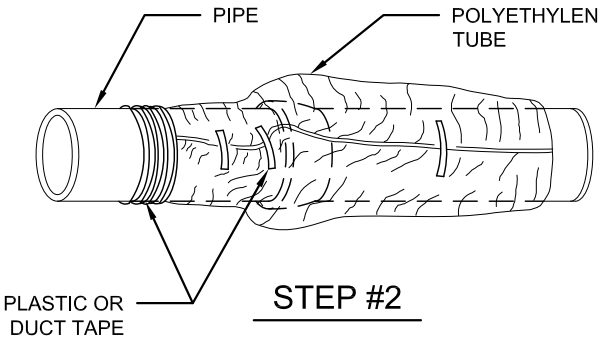
MOORHEAD PUBLIC SERVICE

GATE VALVE WITH EXTENSION AND SUPPORT DETAIL

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-2





STEP #1: PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH.

STEP #2: PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF TWO-INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END.

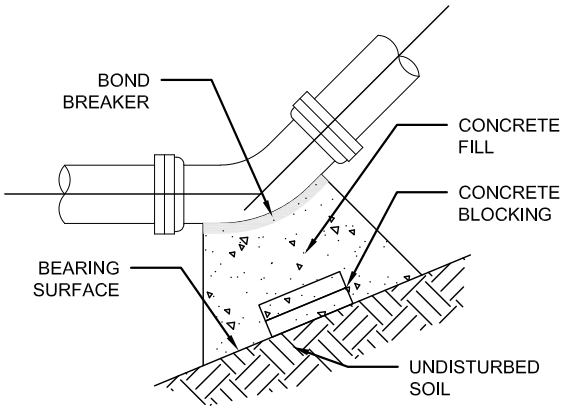
STEP #3: ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROXIMATELY THREE TO FIVE FT INTERVALS.

MOORHEAD PUBLIC SERVICE

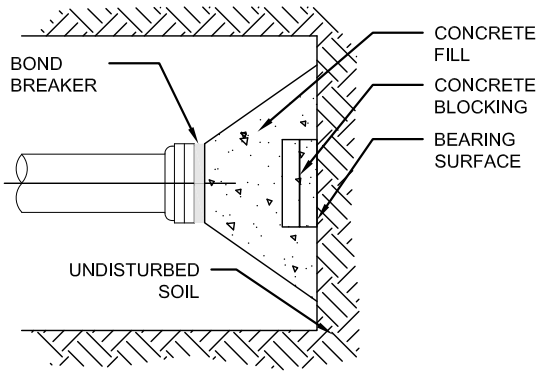
POLYETHELENE PIPE WRAP DETAILS

MOORHEAD PUBLIC SERVICE
STANDARD DETAILS

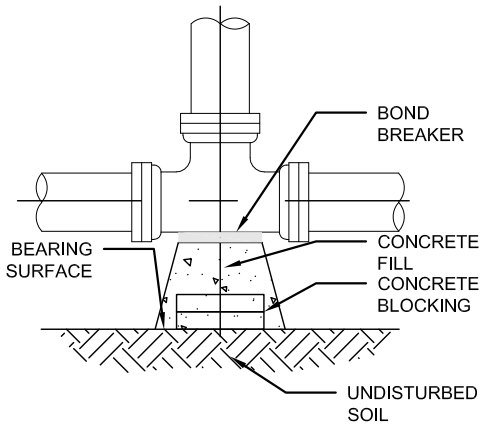
D-3



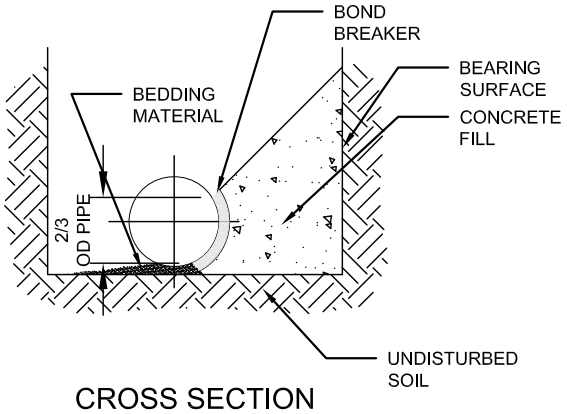
11-1/4°, 22-1/2°, 45° & 90° BENDS



DEAD END SECTION



TEE SECTION



CROSS SECTION

NOTES:

1. BEARING SURFACES SHOWN IN CHART ARE MINIMUM
2. BASED ON 150 PSI INTERNAL PIPE PRESSURE PLUS WATER HAMMER. 4", 6", 8" AND 12" WATER HAMMER = 110 PSI 16", 20" AND 24" WATER HAMMER = 70 PSI
3. BASED ON 3,000 PSF SOIL BEARING CAPACITY.
4. CONCRETE BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH. BELLS AND BOLTS TO BE KEPT FREE OF CONCRETE. CONCRETE IN PLACE TO BE INCLUDED IN PRICE BID FOR WATERMAIN.
5. IF APPROVED BY THE ENGINEER, SOLID CONCRETE BLOCKS MAY BE USED FOR BLOCKING ON 8" DIA PIPE AND BELOW. 10" DIA. PIPE AND ABOVE WILL CONFORM TO CONCRETE POURED IN PLACE AREAS SHOWN ABOVE.

TABLE OF REQUIRED BEARING AREAS

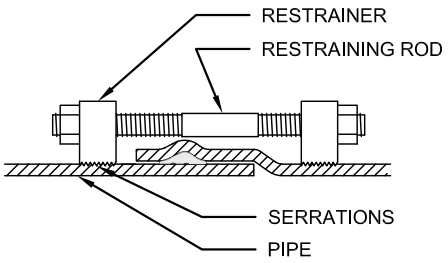
SIZE OF PIPE	90°	45°	22 1/2°	11 1/4°	TEES, PLUGS & TAPPING SLEEVE
4"	2' SQ.	2' SQ.	2' SQ.	2' SQ.	2' SQ.
6"	3' SQ.	2' SQ.	2' SQ.	2' SQ.	3' SQ.
8"	5' SQ.	3' SQ.	2' SQ.	2' SQ.	4' SQ.
10"	8' SQ.	4' SQ.	3' SQ.	2' SQ.	6' SQ.
12"	11' SQ.	6' SQ.	3' SQ.	2' SQ.	8' SQ.
16"	20' SQ.	11' SQ.	6' SQ.	4' SQ.	15' SQ.
18"	25' SQ.	14' SQ.	7' SQ.	4' SQ.	18' SQ.
20"	22' SQ.	12' SQ.	10' SQ.	4' SQ.	15.5' SQ.
24"	61' SQ.	33' SQ.	17' SQ.	9' SQ.	43' SQ.
30"	75' SQ.	41' SQ.	21' SQ.	11' SQ.	53' SQ.

MOORHEAD PUBLIC SERVICE

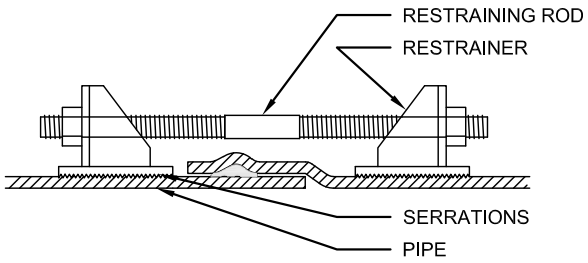
THRUST BLOCKING DETAILS

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

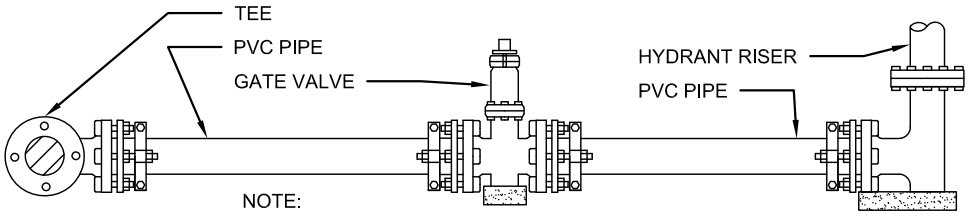
D-4



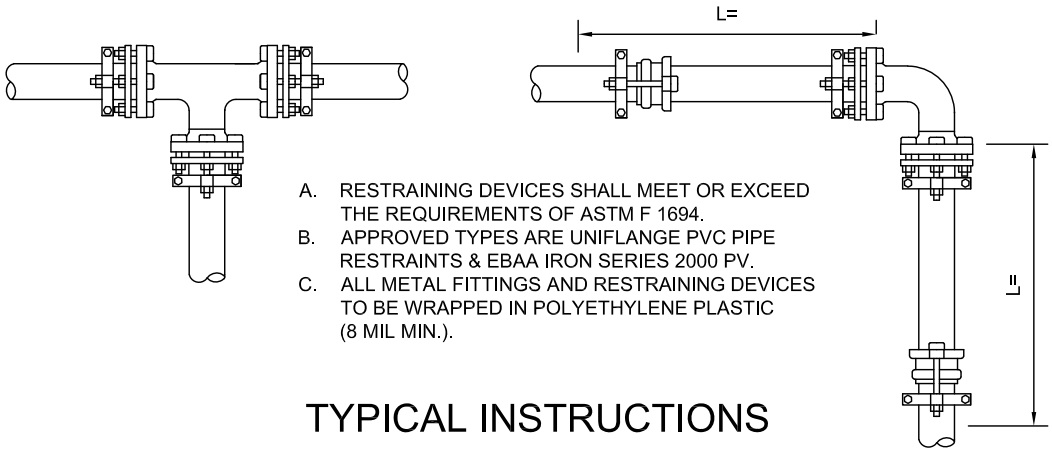
2" TO 12" DIA.



14" TO 36" DIA.



NOTE:
ADDITIONAL LENGTH OF PIPE TO BE RESTRAINED ON EACH SIDE OF ANY RESTRAINED FITTINGS (SEE TABLE BELOW).



A. RESTRAINING DEVICES SHALL MEET OR EXCEED THE REQUIREMENTS OF ASTM F 1694.
B. APPROVED TYPES ARE UNIFLANGE PVC PIPE RESTRAINTS & EBAA IRON SERIES 2000 PV.
C. ALL METAL FITTINGS AND RESTRAINING DEVICES TO BE WRAPPED IN POLYETHYLENE PLASTIC (8 MIL MIN.).

TYPICAL INSTRUCTIONS

RESTRAINED LENGTHS OF PVC PIPE

NOM. PIPE SIZE	90° BEND (L)	45° BEND (L)	22.5° BEND (L)	11.25° BEND (L)	SIZE ON SIZE TEE(L)*	VALVE/ DEAD-END(L)
6"	19'	8'	4'	2'	2'	35'
8"	25'	11'	5'	3'	13'	45'
10"	31'	13'	6'	3'	23'	55'
12"	36'	15'	8'	4'	33'	65'
16"	47'	20'	10'	5'	52'	84'
18"	49'	21'	10'	5'	62'	96'
20"	53'	22'	11'	6'	73'	106'
24"	61'	26'	13'	6'	95'	125'
30"	72'	30'	15'	8'	125'	152'
36"	82'	34'	17'	9'	155'	180'

* RECOMMENDED RESTRAINED LENGTHS FOR TEES ARE FOR THE BRANCH OUTLET AND ASSUME A MINIMUM 10 FT. SECTION OF PIPE ATTACHED TO EACH SIDE OF THE RUN. RESTRAINT DEVICES ARE ALSO REQUIRED ON BOTH RUN JOINTS OF THE TEE ITSELF.

SIZE	45° VERT. OFFSET* (L)	22 1/2° VERT. OFFSET* (L)
6"	15'/8'	7'/4'
8"	19'/11'	9'/5'
10"	23'/13'	11'/6'
12"	27'/15'	13'/8'
16"	35'/20'	17'/10'
18"	58'/12'	28'/6'
20"	64'/13'	31'/6'
24"	74'/15'	36'/7'
30"	89'/17'	43'/9'
36"	103'/20'	50'/10'

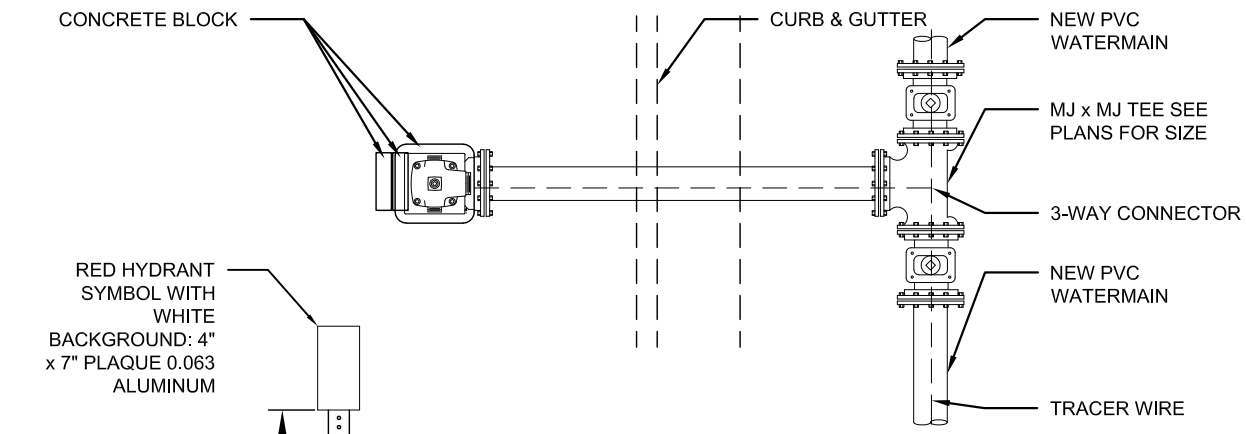
* FIRST NUMBER IS THE RECOMMENDED RESTRAINED LENGTH ON EACH SIDE OF THE DOWN BEND, THE SECOND NUMBER IS THE LENGTH FOR EACH SIDE OF THE UP BEND.

MOORHEAD PUBLIC SERVICE

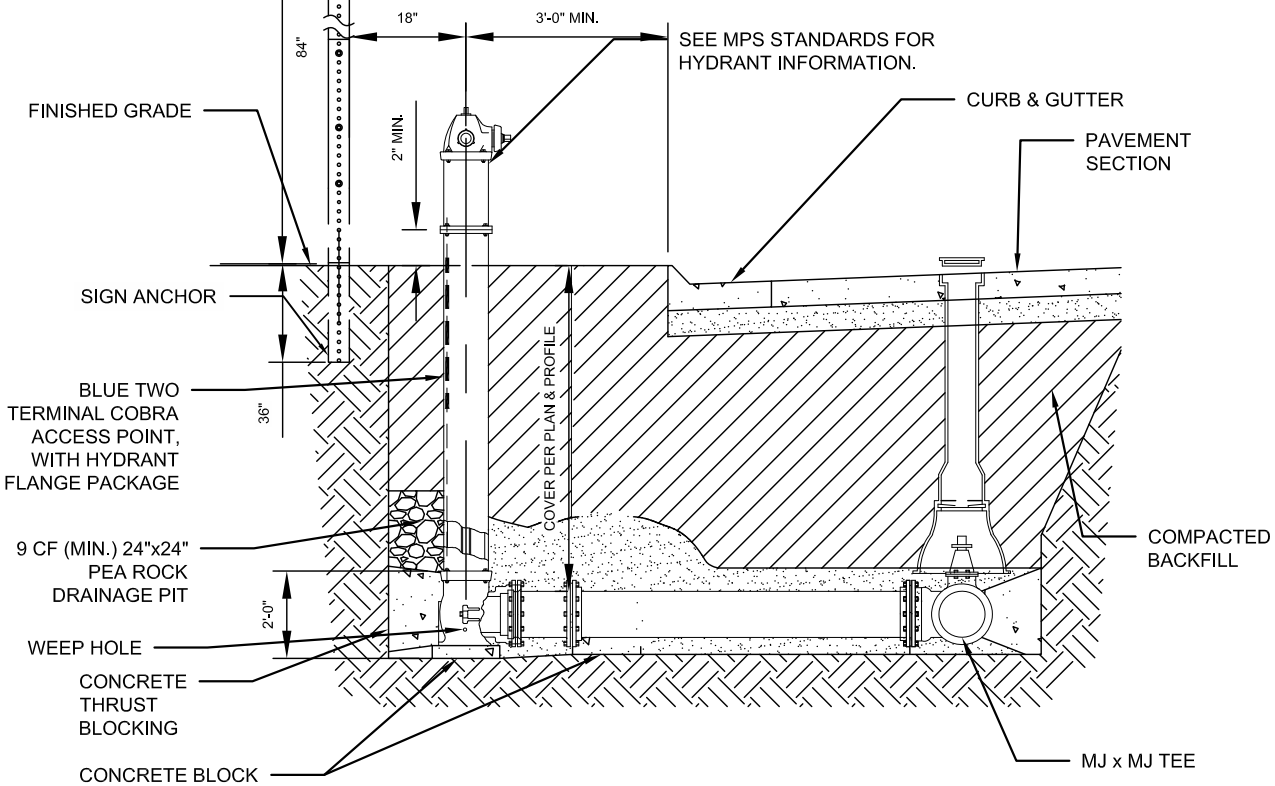
RESTRAINT DEVICE FOR PVC PIPE BELL DETAILS

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-5



PLAN VIEW



SECTION VIEW

NOTE:

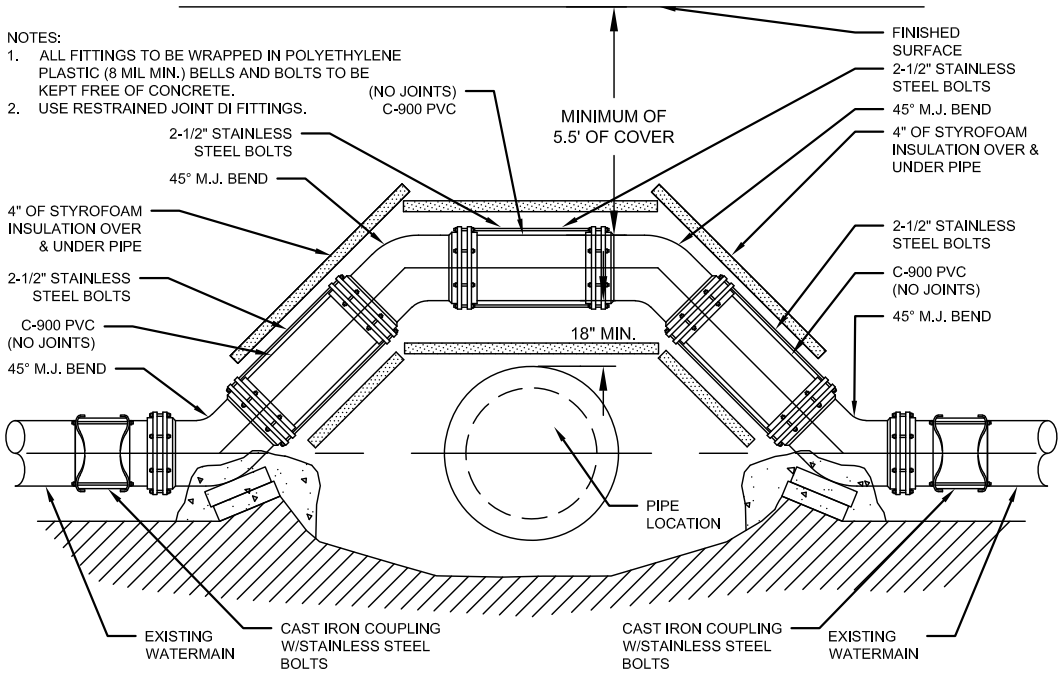
1. ALL BURIED CAST AND DUCTILE IRON MUST BE WRAPPED IN POLYETHYLENE (MIN. 0.008 INCH THICK)

MOORHEAD PUBLIC SERVICE

FIRE HYDRANT CONNECTION WITH GATE VALVES

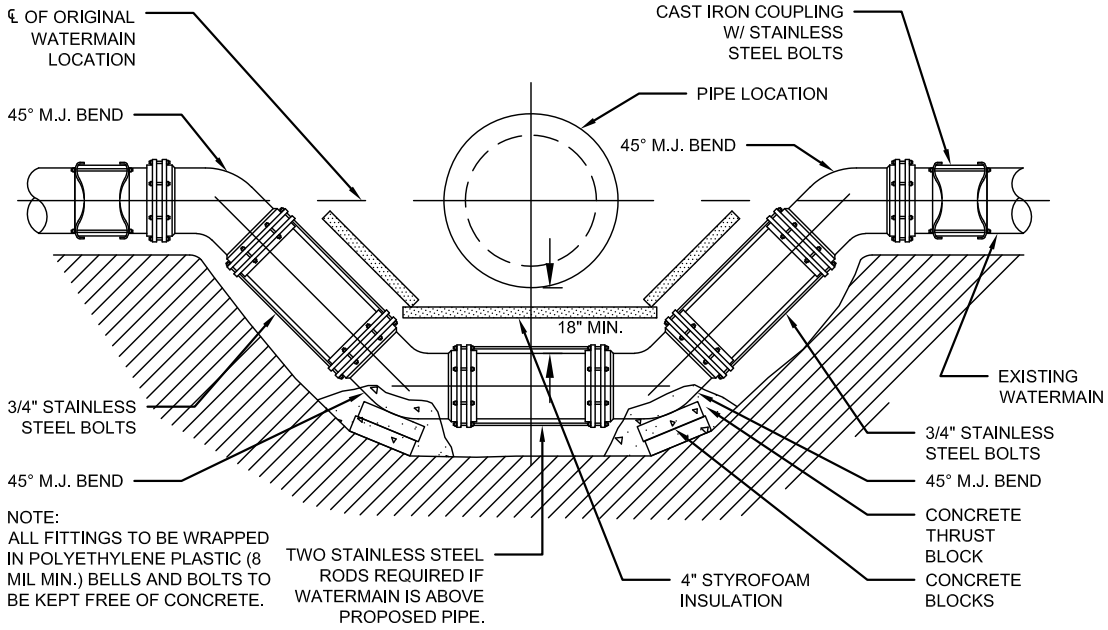
MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-6



1 WATERMAIN RELOCATION OVER PIPE DETAIL

NO SCALE



2 WATERMAIN RELOCATION UNDER PIPE DETAIL

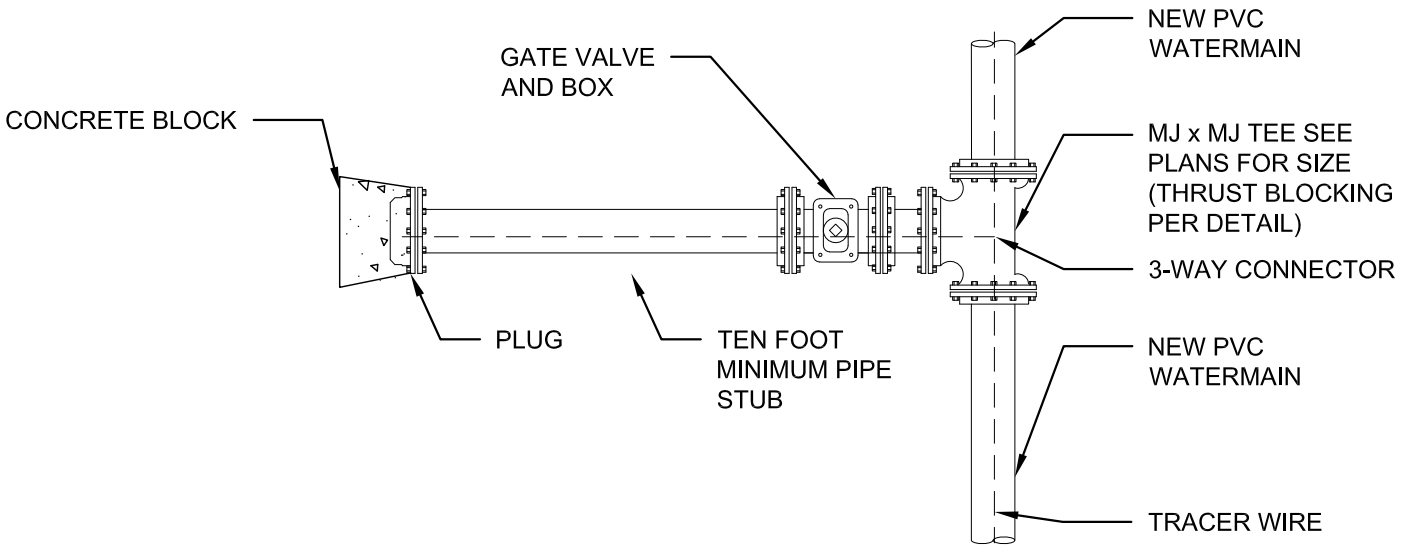
NO SCALE

MOORHEAD PUBLIC SERVICE

WATERMAIN RELOCATION OVER AND UNDER PIPING

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-7



PLAN VIEW

NOTE:

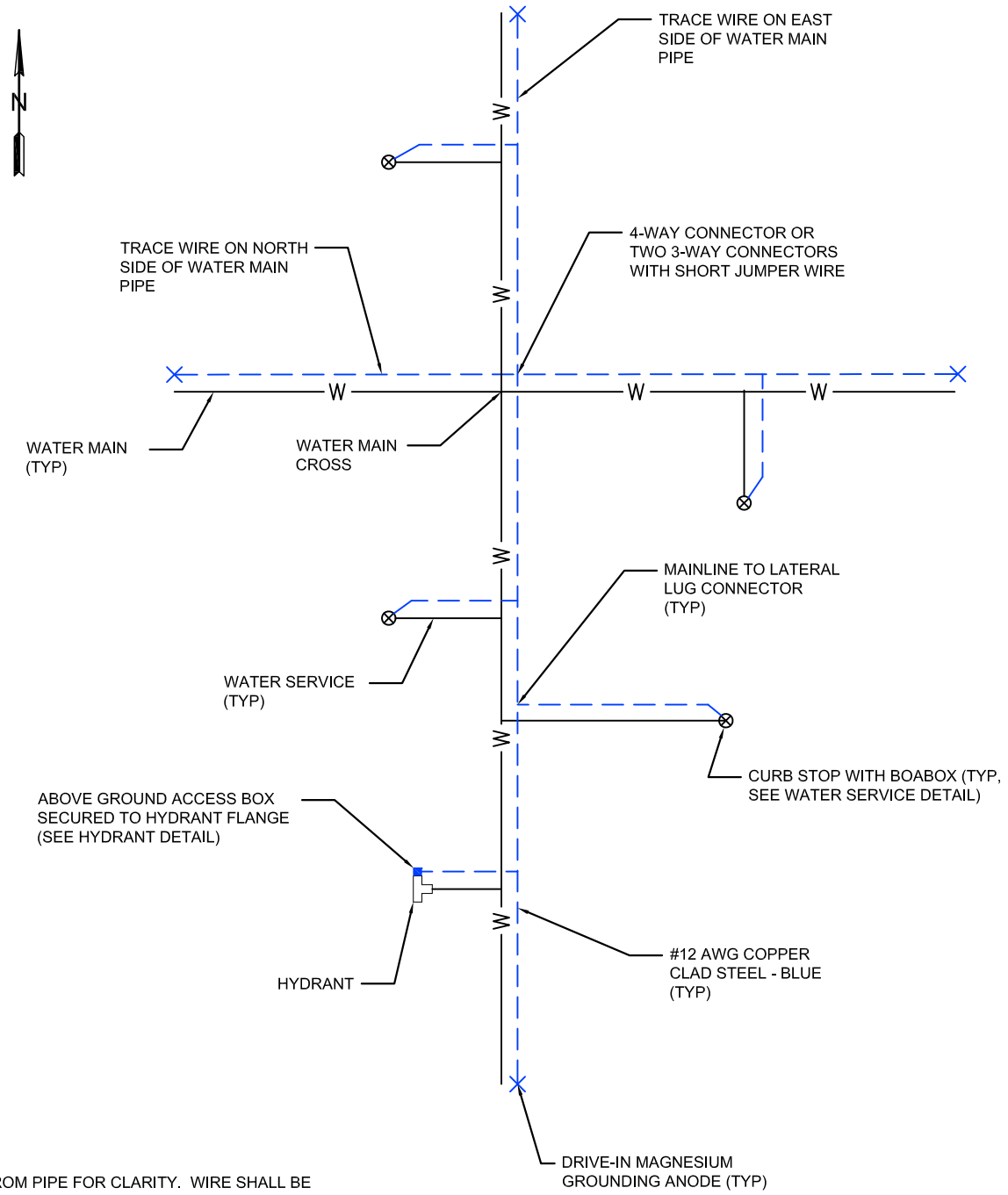
1. ALL BURIED CAST AND DUCTILE IRON MUST BE WRAPPED IN POLYETHYLENE (MIN. 0.008 INCH THICK)

MOORHEAD PUBLIC SERVICE

WATERMAIN STUB DETAIL

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-8



NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE BELOW THE SPRING LINE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.

TRACE WIRE PLAN (WATER)

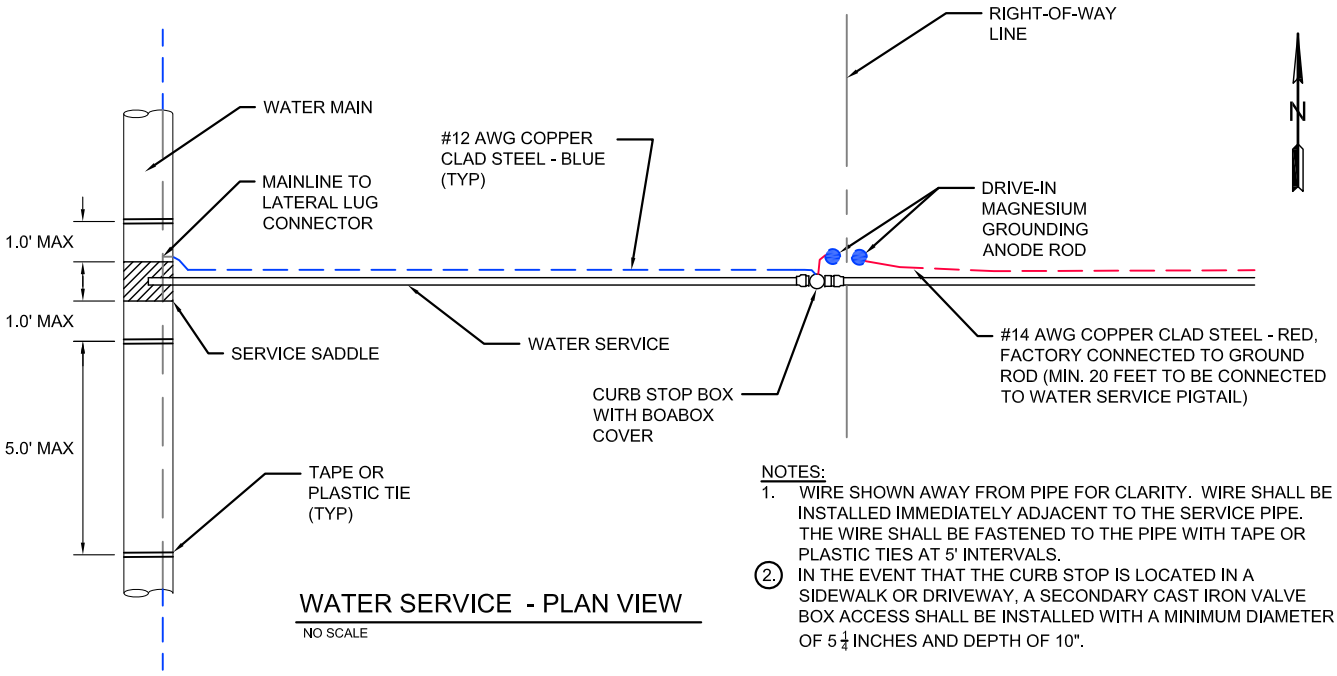
NO SCALE

MOORHEAD PUBLIC SERVICE

TRACER WIRE DETAIL - STANDARD WATER PLAN

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-9

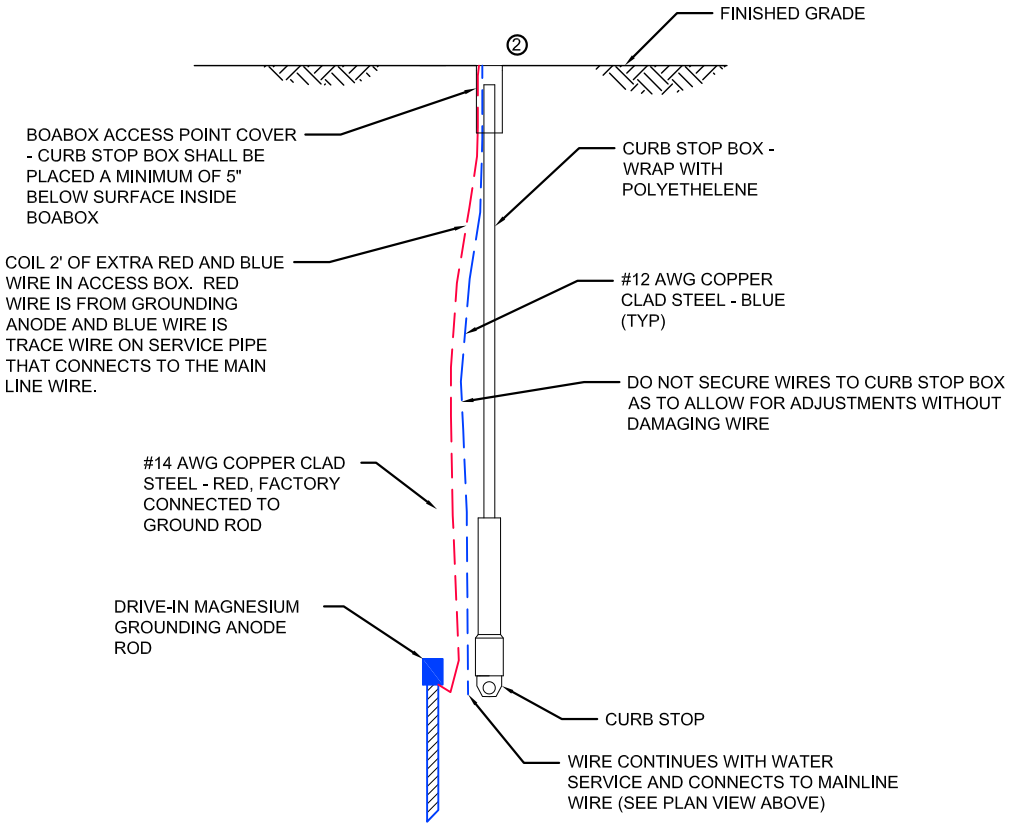


WATER SERVICE - PLAN VIEW

NO SCALE

NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE INSTALLED IMMEDIATELY ADJACENT TO THE SERVICE PIPE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.
2. IN THE EVENT THAT THE CURB STOP IS LOCATED IN A SIDEWALK OR DRIVEWAY, A SECONDARY CAST IRON VALVE BOX ACCESS SHALL BE INSTALLED WITH A MINIMUM DIAMETER OF 5 1/4 INCHES AND DEPTH OF 10".



WATER SERVICE - SECTION VIEW

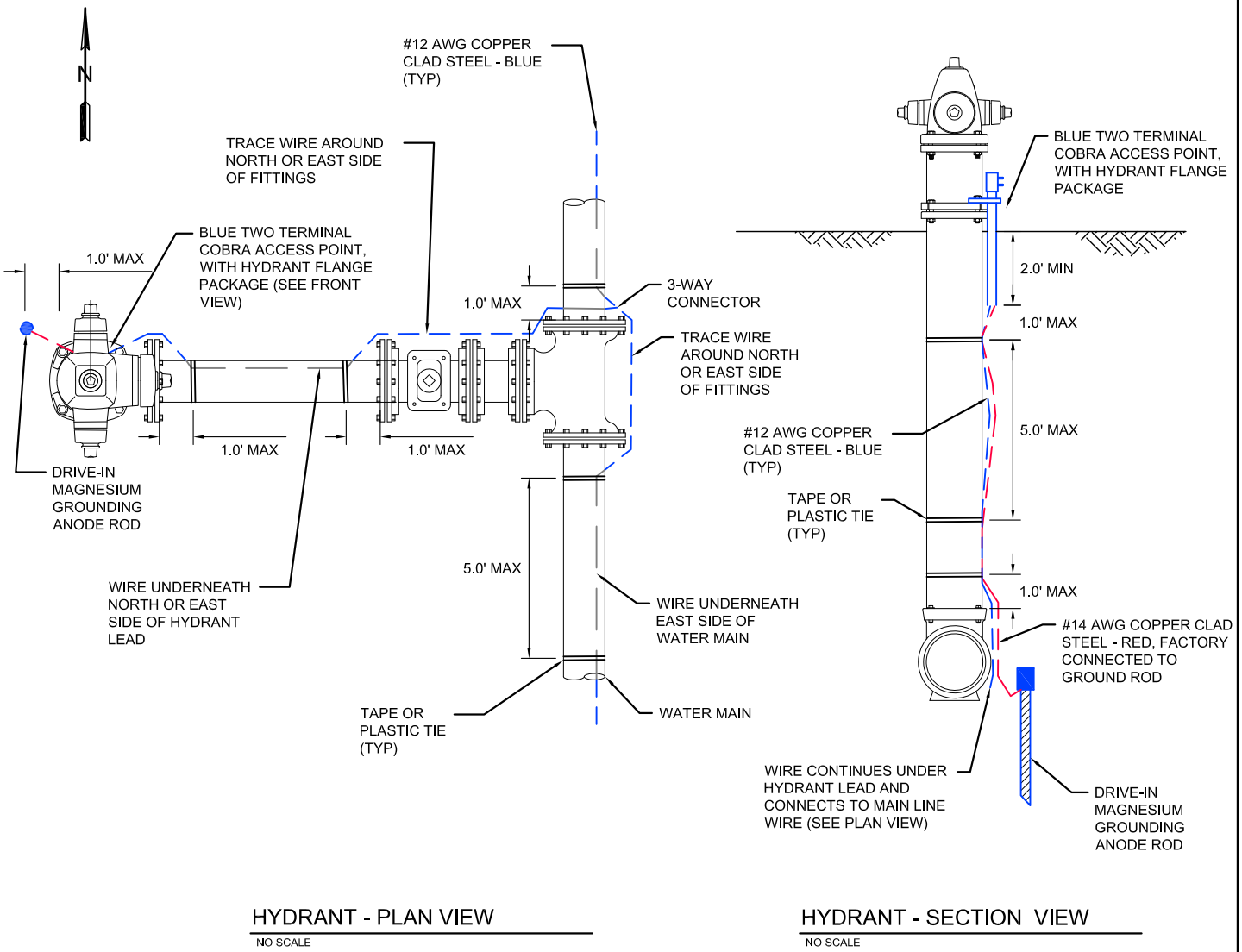
NO SCALE

MOORHEAD PUBLIC SERVICE

TRACER WIRE DETAIL - WATER SERVICE - SECTION VIEW

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-10



HYDRANT - PLAN VIEW
NO SCALE

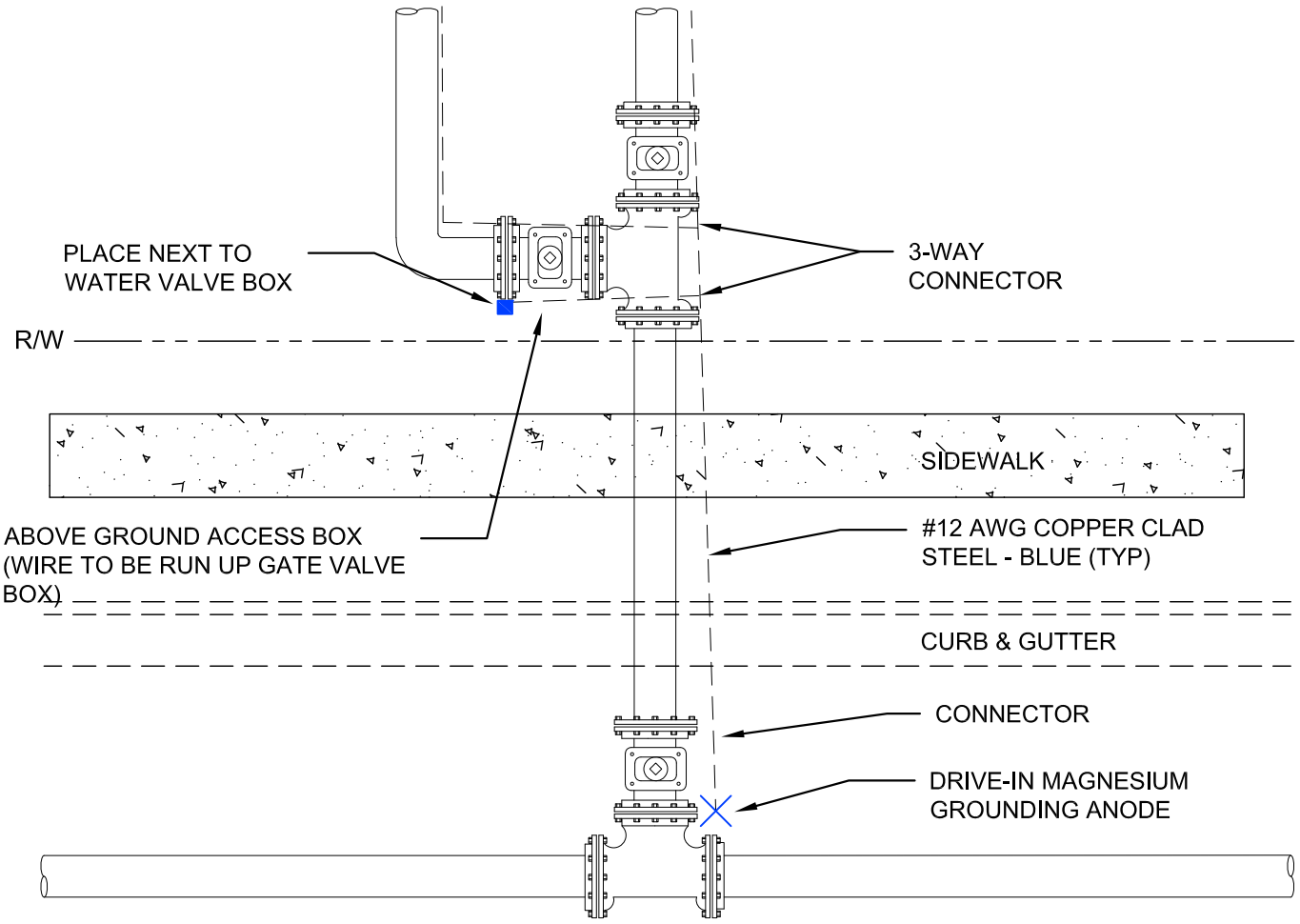
HYDRANT - SECTION VIEW
NO SCALE

MOORHEAD PUBLIC SERVICE

TRACER WIRE DETAIL - HYDRANT

MOORHEAD PUBLIC SERVICE STANDARD DETAILS

D-11



MOORHEAD PUBLIC SERVICE

TRACER WIRE DETAIL - RESIDENTIAL/ COMMERCIAL/INDUSTRIAL TAP

MOORHEAD PUBLIC SERVICE
STANDARD DETAILS

D-12