DS-01027
(Replaces DS-01019)

Iowa Department of Transportation

DEVELOPMENTAL SPECIFICATIONS

FOR

WATER MAIN

(Des Moines Water Works)

Effective Date
July 15, 2003

THE STANDARD SPECIFICATIONS, SERIES 2001, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

I.GENERAL INFORMATION

A. Submittals

The Des Moines Water Works (DMWW) will review all shop drawings for materials related to water main construction. Shop drawings shall be provided to the DMWW two weeks prior to any water main construction. The Contractor shall submit these shop drawings to:

Des Moines Water Works
Attn.: Kyle Danley
2201 George Flagg Parkway
Des Moines, Iowa 50321

B. Preparation

Notify the DMWW (515-283-8725) 48 hours prior to the start of any water main related construction.

Verify proposed grades prior to construction to ensure adequate finished cover will be provided over all water mains.

The Contractor shall arrange for all survey required to install water main on line and grade as shown on the plans.

The Contractor shall arrange, with DMWW, for all valves and hydrants to be operated only by DMWW's personnel.

C. Connections to the Existing Water System

Connections to the existing DMWW 's system shall be coordinated with the Engineer and scheduled a minimum of 48 hours in advance. Customers who will be without water shall be notified by the Contractor a minimum of 24 hours in advance. Water main shutdowns may need to be completed outside normal working hours to minimize impact on affected customers. No additional compensation will be paid for work outside normal working hours.

Taps larger than 2 inches (50 mm) required for connections to existing mains shall be made by DMWW. The Contractor shall schedule the taps a minimum 24 hours in advance and prepare the necessary excavation, including shoring. DMWW will provide the tapping sleeve, the tapping valve, and the valve box.

Field locate tapping sleeves so that the tap is centered 3 to 6 feet (1 to 2 m) from the joint that will be capped/plugged.

D. Abandonment of Existing Facilities

Existing water mains shall be abandoned as shown on the plans; mains shall be capped and hydrant assemblies and valve boxes shall be removed incidental to water main construction.

II.WARRANTY

The Contractor shall protect and save harmless the Des Moines Water Works' Board from claims and damages of any kind caused by the operation of the Contractor, warranty materials and quality of work to be free of defects for a period of 2 years after the date of successful completion of testing as stated in Sections 02674 and 02675, and Part 3.7 of Section 02220 all contained within this Developmental Specification and shall otherwise in all respects comply with Chapter 573, Code of Iowa. Should defects be discovered during this period, the Contractor shall repair the defect at its sole cost and expense upon notice from the DMWW.

Submit written report stating intentions and schedule for completing repairs within seven calendar days after being notified of need for repairs.

If Contractor fails to make needed repairs the DMWW will contact the Office of Contracts and their bidding qualifications may be jeopardized according to Article 1102.03 of the Standard Specifications.

DMWW reserves the right to make emergency repairs that are necessary to keep the water main facilities serviceable or to provide immediate action to prevent further damage to the water main or surrounding area. The Contractor shall reimburse the cost incurred by DMWW for any emergency repairs.

III. BASIS OF PAYMENT

No other payment will be made for work covered by this Developmental Specification, but will be considered incidental to the contract unit price bid for the individual items for which the work was done. Payment for each item shall be considered full compensation for furnishing all material, equipment, tools, labor, and warranty for the construction of each item including excavation, backfill, compaction, and other incidental work to complete the construction in accordance with the contract documents.

SECTION 02220 EXCAVATING, BACKFILLING, AND COMPACTING FOR WATER MAINS

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PART 1GENERAL

1.1 Summary of Work

A. Trenching, backfilling, and compacting Specifications as applicable for installation of water main.

1.2 Related Sections

A. Section 02610 - Ductile Iron Pipe for Water Mains.

B. Section 02640 - Valves and Hydrants.

1.3 Quality Assurance

A. Prior to the placement of any excavated or borrowed soils, each soil type shall be approved by the Engineer for use as backfill.

B. The DMWW will commission and compensate a qualified soils engineer to develop Proctor curves indicating moisture-density relationships, as necessary, for soils to be used as backfill in water main trenches.

C. Proctor curves and soil analysis information shall be used in determining proper compaction of the soils placed.

1.4 References

A. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate Mixtures in Place by Nuclear Methods (Shallow Depth).

B. ASTM D 3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft^3 (600kN-m/m^3)).

1.5 General Safety

A. Blasting shall not be permitted.

B. Safety and protection:

1. Shoring, sheeting, and bracing shall be provided, as required, to protect the work, adjacent property, private or public utilities, and workers.
2. Laws and ordinances regulating health and safety measures shall be strictly observed.
3. All excavations, which the Engineer is required to enter, shall comply with OSHA standards.

1.6 Soil Testing

A. Field tests for density and moisture content will be performed by the Engineer to ensure that the specified density is being obtained. Testing will be done using ASTM D 2922 nuclear methods or another method approved by the Engineer.

B. Density tests will be taken at finished grade, at 3 feet (1 m) below finished grade, and as directed by the Engineer under special conditions. Test locations will be selected by the Engineer immediately prior to performing tests. The Contractor shall excavate, as directed by the Engineer, for tests at intermediate depths. As a minimum, density tests will be taken at approximately 200 foot (65 m) intervals along the trench. Additional tests will be required at the following locations:

1. Over jacking pits where casing was installed.
2. Immediately adjacent to all structures.

C. When test results indicate compaction is not as specified:

1. Additional tests shall be required in both directions from the failed test until satisfactory results are obtained.
2. All material between the satisfactory tests shall be removed, replaced, and recompacted in lifts to meet specifications. No additional compensation will be paid for compaction corrections.
3. Recompacted areas shall receive density tests provided at the same frequency as the original tests.

D. If petroleum-based materials are detected in the soils, the Contractor shall notify the Engineer. Appropriate action will be taken by the Contracting Authority.

E. Any tests that are not conducted in the presence of the Engineer, or are conducted at locations not selected by the Engineer, will be rejected.

PART 2PRODUCTS

2.1 Excavated Materials

A. Topsoil shall be stripped, grubbed, and stockpiled for finished grading.

B. Backfill material shall be:

1. Approved for use by the Engineer.
2. Selected material taken from the excavation or select borrow material, if sufficient quantities of compliant excavated material are not available.

3. Inorganic clays, clayey sands, or inorganic and clayey silts, compatible with and having an obtainable density no less than adjacent soils.
4. Free of lumps or clods over 3 inches (75 mm) in the largest dimension.
5. Free of foreign debris including rocks, organic materials, and human-made debris.
6. Material that is not frozen.

2.2 Bedding Material

A. Bed pipe using selected material taken from the excavation.

B. Bedding material shall be:

1. Inorganic clay, clayey sand, or inorganic and clayey silt.
2. Free of lumps or clods over 3 inches (75 mm) in the largest dimension.
3. Free of foreign debris including rocks, organic materials, and human-made debris.
4. At or near optimum moisture content.
5. Material that is not frozen.

2.3 Stabilization Material

A. When required by field conditions, stabilization material shall be crushed limestone, dolomite, or quartzite generally meeting the following characteristics:

1. 2 inch (50 mm) nominal maximum size.
2. 95% retained on a 3/4 inch (19 mm) screen.
3. Generally free from deleterious substances as determined by the Engineer.

2.4 Borrow Materials

A. If sufficient quantity of suitable material is not available from excavations, material shall be obtained from approved off-site sources.

B. Borrow materials including topsoil and backfill material shall conform to all specifications for excavated materials in Part 2.1.

C. Topsoil borrow material shall be:

1. Natural loam and humus with characteristics consistent with the existing topsoil on site.
2. Finely graded and free of clumps larger than 2 inches (50 mm) in the largest dimension.
3. Free of human-made materials and debris.
4. Free of rock or organic matter, including wood and roots, greater than 3/4 inch (20 mm) in the largest dimension.
5. Comprised of less than 0.5% clay.

PART 3EXECUTION

3.1 Trench Excavation

A. Trenches shall be excavated so as to:

1. Follow lines and grades as indicated on the plans.
2. Provide uniform bearing on undisturbed soil and continuous support along the entire length of the pipe.
3. Prevent over-excavation in locations where suitable subgrade conditions exist.
4. Provide vertical trench walls to an elevation no less than 12 inches (300 mm) above the pipe

B. Unstable trench bottoms, as determined by the Engineer, shall be corrected as follows:

1. Over-excavate the trench to stable soil or to a maximum of 24 inches (600 mm) below the bottom of the pipe.
2. If stable soil is reached, the trench shall be brought back to grade using suitable backfill material or bedding material compacted to 90% Standard Proctor Density.
3. If stable soil is not reached after 24 inches (600 mm) of over-excavation, 12 inches (300 mm) of the specified trench stabilization material shall be placed in the trench bottom and compacted. The trench shall then be brought back to grade using suitable backfill material or bedding material compacted to 90% Standard Proctor Density.
4. Pipe shall be placed only after the trench bottom has been fully stabilized.

C. Stones encountered during excavation shall be completely removed. When large rocks are encountered, they shall be broken away to an elevation 6 inches (150 mm) below the bottom of the proposed improvement. Voids created through removal of stones shall be filled with approved backfill material and thoroughly compacted to 90% Standard Proctor Density.

D. Trench bottoms shall be excavated deeper at the location of all bell joints to permit the body of the pipe to rest uniformly supported upon the trench bottom. Bell holes shall be no longer than is necessary for practical installation of the pipe.

E. The length of trench to be opened at one time shall be as follows:

1. In extended runs, open trench length shall not exceed 100 feet (30 m).

F. Excavated material shall be placed:

1. As approved by the Engineer when this Developmental Specification does not apply.
2. Compactly along sides of excavation.
3. To provide continuous access to fire hydrants and utility valves.
4. To provide as little inconvenience as possible to public travel.
5. To minimize damage to adjacent lawns and planted areas.

3.2 Pipe Bedding

A. All piping shall be bedded with the specified bedding material.

B. Bedding shall be placed alongside of the pipe to an elevation above the springline (no lower than half the height of the pipe).

C. Bedding material shall be mechanically tamped in the immediate vicinity of the pipe to assure uniform support of the pipe beneath the springline.

D. All bedding shall be compacted to 90% Standard Proctor Density.

E. Obtain required compaction within a soil moisture range of optimum moisture to four percentage points above optimum moisture content.

3.3 Backfilling

A. Backfilling of trenches shall be done only after pipe installation, jointing, and bedding are complete, inspected, and approved.

B. Backfill material shall comply with Part 2 above.

C. All backfill shall be mechanically tamped with impact or vibrating compaction equipment.

D. Backfill shall be:

1. Placed in lifts of 6 inches (150 mm) or less from the bottom of the trench to 12 inches (300 mm) above the top of the pipe.
2. Compacted to 90% Standard Proctor Density at, or near, optimum moisture to a level 12 inches (300 mm) above the pipe.
3. Compacted to 95% Standard Proctor Density in the rest of the trench.
4. Within a soil moisture range of optimum moisture to four percentage points above optimum moisture content.

E. Hydraulic compaction or water jetting of the pipe trenches will not be permitted.

F. Adjust moisture content of material that exceeds optimum moisture, but is otherwise acceptable, by spreading and aerating or otherwise drying as necessary until moisture content is within required moisture range and required compaction can be obtained.

G. Adjust moisture content of material that is below optimum moisture, but is otherwise acceptable, by wetting as necessary until moisture content is within required moisture range and required compaction can be obtained.

3.4 Grading

A. All surfaces shall be finish-graded with a well-compacted, free-draining, uniform surface without obstructive protrusions or depressions.

B. Place topsoil at a uniform depth equal to the surrounding topsoil, but not less than 4 inches (100 mm).

C. Place topsoil to a minimum depth of 6 inches (150 mm) when ample native topsoil is available.

D. Place topsoil only under lawn and planted areas.

3.5 Control of Water

A. Pipe shall be installed in the dry.

B. Dewater as necessary to prevent water from entering the pipe or rising around the pipe.

C. Water pumped or diverted from the excavation site shall not be:

1. Pooled anywhere on the site.
2. Removed in such a manner as to disperse silt.
3. Placed on surfaces heavily traveled by pedestrian traffic.

D. Installed pipe shall not be used as a conduit for trench dewatering.

E. Surface water shall be controlled as follows:

1. Surface water shall be diverted to prevent entry into the pipe trenches.
2. Surface water accumulated in the pipe trenches and other excavations shall be removed prior to continuation of excavation work.
3. Surface water saturated soil shall be completely removed from the excavation.

F. Groundwater shall be controlled as follows:

1. Where groundwater is encountered, trenches and other excavations shall be dewatered, as necessary, to permit proper construction.
2. When large quantities of groundwater are encountered, trenches shall be stabilized with the specified stabilization material, and pipe shall be bedded as specified.

3.6 Disposal of Unsuitable or Excess Material

A. Surplus material and all material not suitable for backfill shall be disposed of off-site at a location provided by the Contractor. Transportation of such material shall be provided by the Contractor.

3.7 Cleanup and Restoration

A. The site in and around the excavation shall be cleared of mud and construction debris to a condition equal to, or better than, that existing prior to trenching work.

B. All construction remnant materials shall be removed completely from the site.

C. Damage to adjacent property suffered during installation work shall be repaired to a condition equal to, or better than, that existing prior to trenching work.

SECTION 02227 AUGERED PIPE CASING

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PART 1GENERAL

1.1 Summary of Work

A. Machine-augered casing for pipe.

1.2 Related Sections

A. Section 02220 - Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02610 - Ductile Iron Pipe for Water Mains.

1.3 References

A.ASTM D 139 - Standard Test Method for Float Test for Bituminous Materials.

1.4 Measurement and Payment

A. Tunneling with casing pipe shall include the casing pipe and carrier pipe, measured to the nearest 0.1 foot (0.1 m), properly installed along centerline of casing.

B. Maximum quantity shall be plan quantity, unless lengths are extended by the Engineer.

1.5 Qualifications

A. Installer: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.6 Submittals

A. Provide dimensional drawings, details, and catalog data for casing pipe and casing chocks.

B. Submit calculations justifying number and location of casing chocks for pipe support within casing pipe.

1.7 Geotechnical Information

A. Refer to Soils Plan Sheets for information.

1. Such information has not been prepared by and is not warranted by DMWW.
2. DMWW is not responsible for the accuracy, completeness, or sufficiency of such data.

B. Bidders are encouraged to conduct their own pre-bid tests, investigations, or research at the site.

PART 2PRODUCTS

2.1 Casing Pipe

A. Provide rolled or seamless steel casing pipe, ASTM D 139 steel with a minimum yield point of 35,000 psi (241,500 kPa).

B. Casing pipe shall be new with not more than one butt welded joint per 20 feet (7 m length).

C. Interior and exterior coatings are not required.

D. Casing pipe diameter and wall thickness shall be as specified below.

NOMINAL PIPE SIZE	CASING OUTSIDE DIAMETER MINIMUM	WALL THICKNESS UNDER ROADWAY MINIMUM
8 inch (200 mm)	16 inch (400 mm)	¼ inch (7 mm)
12 inch (300 mm)	20 inch (500 mm)	¼ inch (7 mm)
16 inch (400 mm)	30 inch (750 mm)	3/8 inch (10 mm)
20 inch (500 mm)	36 inch (900 mm)	3/8 inch (10 mm)
24 inch (600 mm)	42 inch (1050 mm)	½ inch (12.7 mm)
30 inch (750 mm)	48 inch (1200 mm)	½ inch (12.7 mm)
36 inch (900 mm)	60 inch (1500 mm)	5/8 inch (16 mm)

2.2 Casing Chocks

A. Casing chocks shall be bolt-on style fabricated of 304 stainless steel.

B. Provide spacing as specified by pipe manufacturer.

C. Runners in contact with casing shall be fabricated of high-density plastic with a low co-efficient of friction. Design runners to provide electrical discontinuity between water main pipe and casing pipe.

D. Provide chocks with an insulating liner.

2.3 Concrete

A. Comply with requirements for C4 concrete in Section 2301 of the Standard Specifications.

PART 3EXECUTION

3.1 Examination

A. Examine site conditions to assure that augering operations pose no hazards to adjacent utilities, structures, or site improvements.

B. Stage work so as to prevent encroachment on traveled roadways.

C. Proposed pit construction and staging of work will be reviewed by the Engineer.

3.2 Preparation

A. Place barricades around the perimeter of the equipment pit.

B. Equipment pits shall be:

1. No larger than necessary for proper installation.
2. Adequately sheeted and shored prior to commencement of augering work.
3. Front-shielded to control unstable or fluid soils.

C. Protect adjacent structures or site improvements to prevent damage from casing operations.

3.3 Installation

A. Augering equipment shall:

1. Operate using guideways to maintain line and grade of casing.
2. Provide encasement of the bored void as earth is removed.
3. Provide casing throughout the bore length.
4. Provide clean and complete removal of earth from within the casing.

B. Casing shall be installed:

1. Maintaining the tolerances specified herein.
2. With all joints continuously welded around the complete circumference of the pipe to form a watertight seal between adjacent casing pipes.
3. Continuously throughout the bore length.

C. Pipe shall be installed within the casing as follows:

1. Clean dirt and debris from casing and carrier pipe.
2. Grade and alignment tolerances shall conform to those specified.
3. Pipe shall be pushed into the casing to avoid separation of joints. Provide timbers or similar type of cushioning between pushed end of carrier pipe and jacking equipment.
4. Position jacks so the resultant force is applied along the centerline of the carrier pipe. Apply force uniformly to the entire end of the carrier pipe.
5. Pipe shall be supported on casing chocks with minimum of 3 per 20 foot (7 m) length of pipe. Lubricate pipe guides of casing chocks. Caution: Do not use petroleum-based lubricants or oils.
6. After a proper grade has been established and supported, pipe shall be bedded with the bedding material specified herein.

D. Close casing pipe on the ends with bulkheads constructed of the specified concrete. Bulkheads shall be no less than 16 inches (400 mm) thick. Fully close the annular space between the pipeline and the casing.

3.4 Tolerances

A. Initial entry point:

1. Alignment: Maximum 6 inches (150 mm) off true alignment.
2. Grade: Maximum 0.1 feet (30 mm) off true grade.

B. Exit point:

1. Alignment: Maximum 24 inches (600 mm) off true alignment.
2. Grade: Maximum 6 inches (150 mm) off true grade.

3.5 Obstructions

A. When obstructions prohibit proper installation of the casing:

1. Minor adjustments to the grade or alignment may be made with the approval of the Engineer.
2. Casing may be terminated with a shorter length, with the approval of the Engineer, if smaller diameter of pipe alone enables bypassing the obstruction.
3. Casing pipe, if not serviceable, shall be fully withdrawn and the entire casing void shall be filled with the specified grouting material.

B. Withdrawn casings shall be compensated for at the same rate as a casing placed in service if undrillable obstruction was unforeseen at time of construction.

3.6 Backfill and Compaction

A. Backfill and compact equipment pits as specified in Section 02220.

3.7 Disposal, Cleanup, and Restoration

A. Dispose of excess materials, restore, and clean up site after casing placement operations as specified for disposal, restoration, and cleanup in Section 02220.

SECTION 02600 PROTECTION OF WATER SUPPLY

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PART 1 GENERAL

1.1 Summary of Work

A. This Section describes Iowa Department of Natural Resources requirements for protection of water supply systems.

1.2 Related Sections

A. Section 02220 - Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02610 - Ductile Iron Pipe for Water Mains.

1.3 References

A. Iowa Water Supply Facilities Design Standards.

PART 2 PRODUCTS

No permanent materials are required for this work.

PART 3 EXECUTION

3.1 General Installation Requirements

A. Lay water mains to avoid high points where air can accumulate. Grade all piping so that proposed hydrants will be at the highest points.

B. Do not locate hydrants within 10 feet (3 m) of sanitary sewers or storm drains.

C. Plug hydrant drain ports in areas where groundwater rises above the water main and pump the hydrant barrel dry following construction.

D. Pressure test and disinfect all new water mains prior to placing them in service.

3.2 Separation Distance

A. Horizontal separation of water mains from gravity sewers.

1. Provide a horizontal separation distance of at least 10 feet (3 m) between water mains and gravity sewer mains unless both of the following conditions can be met:
    - **a.** The bottom of the water main is at least 18 inches (460 mm) above the top of the sewer.
    - **b.** The water main is placed in a separate trench at a minimum horizontal separation of 3 feet (1 m) from the sewer.
2. When it is impossible to obtain the required 3 feet (1 m) horizontal clearance and 18 inches (460 mm) vertical separation, the sewer must be replaced with water main quality materials having a minimum pressure rating of 150 psi (1,034 kPa) and meeting the requirements of Section 02610. In no case shall the linear separation be less than 2 feet (0.6 m).

B. Horizontal separation of water mains from sewer force mains.

1. Provide a horizontal separation distance of at least 10 feet (3 m) between water mains and sewer force mains unless both of the following conditions can be met.
    - **a.** The force main is constructed of water main quality materials having a minimum pressure rating of 150 psi (1034 kPa) and meeting the requirements of Section 02610.
    - **b.** The water main is laid at least 4 feet (1.2 m) from the sewer force main.

C. Vertical separation of water mains from sewer crossovers.

1. Provide a vertical separation of at least 18 inches (450 mm) from the bottom of the water main to the top of the sewer whenever possible where water mains cross over sewer mains.
2. Provide a minimum vertical separation of at least 6 inches (150 mm) from the bottom of the water main to the top of the sewer in all cases where water mains cross over sewer mains.
3. Provide a minimum vertical separation of at least 18 inches (450 mm) from the bottom of the sewer to the top of the water main in all cases where water mains cross under sewer mains.
4. Center one full length of water main pipe over the sewer crossing so both joints are as far as possible from the sewer.
5. Adequately support both water and sewer pipes and provide watertight joints.
6. Use a low permeability soil to backfill within 10 feet (3 m) of the point of crossing.

D. Separation of water mains from sewer utility accesses.

1. No water pipe shall pass through or come in contact with any part of a sewer utility access.

2. Provide a horizontal separation distance of at least 3 feet (1 m) between water mains and sewer utility accesses.

E. Exceptions.

1. Should physical conditions exist such that exceptions to Part 3.2 of this Section are necessary, the Contracting Authority must detail how the water main and sewer installation are to be engineered to provide protection equal to that provided by Parts 3.2 A, B, C, and D of this Section.

3.3 Depth of Cover and Width of Trench

A. Provide 5 feet (1.5 m) minimum depth of cover from the top of the pipe to the ground surface.

B. Where possible provide an additional 1 foot (0.3 m) of cover under pavement. Insulate water mains as shown on the standard detail sheet where conditions prevent adequate earth cover.

C. Provide a trench width adequate to lay and joint pipe properly but not more than 1 foot (0.3 m) on either side of the pipe.

SECTION 02610 DUCTILE IRON AND POLYVINYL CHLORIDE PIPE FOR WATER MAINS

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PART 1 GENERAL

1.1 Summary of Work

A. This Section includes water mains, fittings, and specials as shown on the plans, complete with accessories.

1.2 Related Sections

A. Section 02220 - Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02600 - Protection of Water Supply.

C. Section 02674 - Pressure Testing Water Mains.

D. Section 02675 - Disinfection of Water Distribution Systems.

1.3 References

A. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

B. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

C. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

D. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 inch (75 mm) Through 48 inch (1200 mm), for Water
and Other Liquids.

E. AWWA C115 - Flanged Ductile-Iron Pipe With Threaded Flanges.

F. AWWA C150 - Thickness Design for Ductile-Iron Pipe.

G. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.

H. AWWA C153 - Ductile-Iron Compact Fittings 3 inch (75 mm) Through 24 inch (600 mm) and 54 inch (1350 mm) Through 64 inch (1600 mm) for Water Service.

I. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

J. AWWA C605 - Underground Installation of Polyvinyl Chloride Pressure Pipe and Fittings.

K. AWWA C900 - Polyvinyl Chloride Pressure Pipe, 4 inch (100 mm) Through 12 inch (300 mm), for Water Distribution.

1.4 Measurement and Payment

A. Water main shall be measured to the nearest 0.1 ~~inch~~ foot (0.1 m) of pipe of each size and type specified.

B. Open cut water main with casing pipe shall include the casing pipe and carrier pipe, measured to the nearest 0.1 foot (0.1 m), properly installed along centerline of casing.

C. Water main fittings shall be measured by the pound (kg) based on size and type of fitting installed in project.

D. Tapping sleeve, tapping valve, and valve box shall be considered one item measured per each installed.

1.5 Submittals

A. The following items shall also be submitted for materials provided by the Contractor:

1. Manufacturer's certification that all materials furnished are in compliance with this Developmental Specification and the applicable requirements of the Standards referenced in Part 1.3 above.
2. Drawings and manufacturer's data showing details of the pipe and fittings to comply with this Developmental Specification.
3. Design calculations for each class of pipe and fittings.
4. Materials test reports.
5. Restrained joint details for Engineer approval.

B. Provide dimensional drawings, fabrication details, functional description, and properly identified catalog data on all pipe and equipment to prove complete compliance with the contract documents.

1.6 Handling, Storage, and Shipping

A. The pipe shall be handled carefully.

B. Blocking and hold-downs shall be used during shipment to prevent movement or shifting.

C. Pipe with damage to the cement mortar lining will be rejected with field-patching not permitted.

D. For shipment and storage, small pipe shall not be telescoped inside larger pipe.

E. All pipe materials are to be handled by use of slings, hoists, skids, or other approved means.

F. Dropping or rolling of pipe material is not permitted.

PART 2PRODUCTS

2.1 Ductile Iron Pipe

A. Pipe shall be manufactured in accordance with AWWA C151.

~~**B.** Provide Pressure Class 350 pipe per AWWA C150.~~

B. Special Thickness Class 52 pipe per AWWA C150.

C. Provide asphalt outside coating per AWWA C151, 1 mil (25 μm) in thickness.

D. Cement Mortar Lining:

1. Provide pipe with standard thickness cement mortar lining per AWWA C104.
2. Seal-coat cement mortar lining in accordance with AWWA C104.

2.2 Polyvinyl Chloride Pipe

A. Pipe shall be manufactured in accordance with AWWA C900.

B. All pipe shall be Class 150 (DR 18) with cast iron pipe equivalent outside diameters.

~~2.2~~ 2.3 Fittings for Ductile Iron Pipe

A. Material of construction shall be ductile iron in accordance with AWWA C110.

B. Provide compact ductile iron fittings, per AWWA C153.

C. Joints shall be mechanical in accordance with AWWA C111, or restrained as indicated on the plans.

D. Pressure rating:

SIZE	PRESSURE RATING
3 inch – 24 inch (75 mm– 600 mm)	350 psi (2413 kPa)
30 inch – 48 inch (750 mm – 1200 mm)	250 psi (1724 kPa)
54 inch – 64 inch (1350 mm – 1600 mm)	150 psi (1034 kPa)

E. Provide asphalt outside coating per AWWA C110, 1 mil (25 µm) in thickness.

F. Cement Mortar Lining:

1. Provide standard thickness cement mortar lining per AWWA C104.
2. Seal-coat cement mortar lining in accordance with AWWA C104.

~~2.3~~ 2.4 Joints for Ductile Iron and Polyvinyl Chloride Pipe

A. Joints shall be push-on using an integral bell with a plastomeric gasket, mechanical in accordance with AWWA C111, or restrained joints as indicated on the plans.

B. Follower glands for mechanical joints shall be ductile iron.

C. Restrained joints for ductile iron pipe to consist of a mechanical joint with retainer gland or manufacturer's proprietary restrained joint having minimum 250 psi (1724 kPa) pressure rating.

D. Restrained joints for PVC pipe to consist of mechanical joint with retainer gland or manufacturer’s proprietary restrained joint having a minimum 150 psi (1034 kPa) pressure rating.

~~D~~ E. All T-bolts and hex-head nuts for mechanical joints shall be ductile iron, Cor-Ten steel, Teflon coated Cor-Ten steel, or approved equal.

~~E~~ F. Solvent cement joints are strictly prohibited.

~~2.4~~ 2.5 Restrained Joints

A. Retainer glands

1. Restraint for mechanical joints shall be incorporated into the design of the follower gland.
2. Follower gland design shall impart multiple wedging action against the pipe, increasing its resistance as pressure increases.
3. Twist-off nuts, the same size as nuts for tee-head bolts, shall be incorporated into the design to ensure proper actuating torque is applied during installation.
4. Retainer glands shall be ductile iron and shall be designed for a minimum working pressure of 250 psi (1724 kPa).

B. Groove and spline joints

1. Restraint for in-line PVC pipe joints shall be provided through the use of grove and spline pipe and couplings that provide full circumferential restrained joints.
2. Use grove dimensions and splines recommended by the manufacturer to obtain minimum 150 psi (1034 kPa) working pressure.

~~2.5~~ 2.6 Polyethylene Pipe Encasement Material

A. Polyethylene encasement material: manufactured in accordance with AWWA C105.

B. Minimum thickness: 8 mils (200 µm).

C. Tensile strength: 12,000 psi (82737 kPa), minimum.

D. Elongation: 300%, minimum.

E. Dielectric strength: 800 v / mil (32 v / µm), minimum.

F. Melt Index: 0.4, maximum.

G. Flat-width tubing of the following sizes shall be used:

PIPE SIZE	TUBING WIDTH
4 inch (100 mm)	24 inch (600 mm)
6 inch (175 mm)	24 inch (600 mm)
8 inch (200 mm)	24 inch (600 mm)
12 inch (300 mm)	27 inch (700 mm)
16 inch (400 mm)	34 inch (850 mm)
20 inch (500 mm)	41 inch (1050 mm)
24 inch (600 mm)	54 inch (1400 mm)
30 inch (750 mm)	77 inch (2000 mm)
36 inch (900 mm)	81 inch (2050 mm)

H. Sheet material can be used to wrap irregular-shaped valves and fittings.

I. 2 inch (50 mm) wide, 10 inch (250 mm) thick, pressure-sensitive polyethylene tape shall be used to close seams and hold overlaps.

~~2.6~~ 2.7 Tracer System

A. Tracer Wire: No. 12 solid single strand type copper conductor.

1. Insulation material: linear low-density polyethylene (LLDPE) insulation suitable for direct burial applications.
2. Insulation thickness: 0.045 inches (1 mm), minimum.
3. Insulation color: Blue.

B. Conduit: Rigid metal conduit: low carbon steel, zinc electroplated or hot-dip coated inside and outside; threaded joints.

C. Ground Rod: 3/8 inch (10 mm) diameter, 60 inch (1500 mm) long steel rod uniformly coated with metallically bonded electrolytic copper.

D. Ground-rod Clamp: High-strength, corrosion-resistant copper alloy.

E. Splice Kit: Inline resin splice kit with split bolt for 1kV and 5kV. Insulates and seals single conductor and unshielded cable splices for direct bury and submersible applications.

~~**F.** Electrical Box Support Bracket: Minimum 1/8 inch (3.175 mm) thick steel plate constructed of stainless steel or galvanized steel. Secure to hydrant breakaway flange.~~

~~**G.** Electrical Box: industrial grade conduit outlet box constructed of malleable iron.~~

1. ~~Meets UL Standard 489 and 514.~~
2. ~~Provide with single 1/2 inch (12 mm) threaded hub in bottom of box for conduit/tracer wire entry.~~
3. ~~Equip with hinged gasketed cover to provide weatherproof, rain tight, dust-tight enclosure.~~
   a. ~~Mount cover to outlet box with stainless steel screws.~~

F. Tracer Wire Test Station

1. internal terminals with shunt.
2. 4.5 foot (1.35 m) white plastic triangular post.
3. Removable top cap with lock
4. 2- 2 7/8 inch by 14 inch (75 mm by 350 mm) custom-vinyl decal No. SD-5594C.
5. Tri-grip anchor

PART 3EXECUTION

3.1General Pipe Installation

A. Protect pipe joints from injury while handling and storing.

B. Use no deformed, defective, gouged, or otherwise impaired pipe.

C. Excavate and prepare trench as specified in Section 02200.

D. Install ductile iron pipe in accordance with AWWA C600.

E. Install PVC pipe in accordance with AWWA C605.

F. Before the pipe is installed, the trench bottom shall have been prepared with sufficient exactness so that only minor movement of the pipe will be necessary after installation.

G. Clean pipe interior prior to placement in the trench.

H. All pipe shall be installed to the line and grade shown on the plans with an allowable tolerance of 6 inches (150 mm), plus or minus.

I. Uniform bearing along the full length of the pipe barrel shall be maintained at all times. Blocking the pipe up will not be acceptable. Trench bottoms shall be excavated deeper at the location of all bell joints to permit the body of the pipe to rest uniformly supported upon the trench bottom. Bell holes shall be no longer than is necessary for practical installation of the pipe.

J. Clean joint surfaces of dirt and foreign matter using a wire brush before jointing pipe.

K. Lubricate gasket and pipe bell. The Contractor shall furnish a vegetable-soap lubricant meeting manufacturer's recommendations. Lubricant shall be approved for use with potable water.

L. Make joints in strict accordance with manufacturer's recommendations.

M. All joint deflections shall be within the manufacturer's specifications for maximum deflections.

N. Bolts on mechanical joints shall be tightened evenly around the pipe by alternating from one side of the pipe to the other.

O. Cut pipe in a neat manner without damage to the pipe or the cement mortar lining, if any. Leave a smooth end at right angles to the axis of the pipe. Cut pipe ends shall be beveled for push-on-type joints in accordance with manufacturer's recommendations.

P. No pipe shall be installed in water, nor shall water be allowed to rise in the trench around the pipe.

Q. Watertight bulkheads shall be placed on the exposed ends of the pipe at all times when the pipe installation is not actually in progress.

R. Backfill and compact around pipe as outlined in Section 02220.

3.2Installation of Polyethylene Pipe Encasement Material

A. Polyethylene encasement material shall be used on all buried ductile iron pipe, fittings, rods, and appurtenances in accordance with AWWA C105, Method A.

B. Use polyethylene tubing to encase pipe.

C. Cut tubing 24 inches (600 mm) longer than pipe section. Overlap tubing 12 inches (300 mm) at each end of pipe.

D. Gather and lap tubing to provide a snug fit.

E. Secure lap at quarter points with polyethylene tape. Secure each end of tube with a complete wrap of polyethylene tape.

F. The polyethylene encasement shall prevent contact between the pipe and bedding material, but is not intended to be a completely airtight and watertight enclosure.

G. Damaged polyethylene encasement material shall be repaired using polyethylene tape, or the damaged section shall be replaced.

3.3 Thrust Blocks

A. The Contractor shall provide concrete thrust blocks at changes in alignment, tees, and dead ends. The concrete shall meet the requirements for C4 concrete in Section 2301 of the Standard Specifications.

B. Carry thrust blocks to undisturbed soil that will provide adequate bearing.

C. The bearing area of thrust blocks, in square meters, shall be as shown on the plans. Minimum thickness for any thrust block shall be 1.5 times outside pipe diameter or 18 inches (457 mm), whichever is greater.

D. Hold thrust blocks back 3 inches (75 mm) from all bolts, nuts, glands, or other jointing materials. Ensure joints could be remade without disturbing thrust block.

E. Provide bond breaker between thrust block and pipe. Polyethylene encasement material will be considered an acceptable bond breaker.

F. Provide thrust blocks at all connections to existing water mains.

3.4 Tracer System Installation

A. Install tracer wire with all buried piping.

B. Install wire along lower quadrant of pipe but not under pipe.

C. Install ground rods adjacent to connections to existing piping and in locations indicated on plans.

D. ~~Terminate wire in tracer wire receptacle box mounted on steel channel post adjacent to each fire hydrant~~.

Terminate wire in tracer wire test station adjacent to each fire hydrant.

E. Splice tracer wire only if approved by Engineer. Allow Engineer to inspect underground splices prior to backfilling.

F. See details in the plans.

3.5 Testing and Chlorination

A. Perform hydrostatic and leakage tests in accordance with Section 02674 - Pressure Testing Water Mains, at a test pressure of 150 psi (1034 kPa).

B. Disinfected all water mains in accordance with Section 02675 - Disinfection of Water Distribution Systems.

C. DMWW will conduct an electrical continuity test of the tracer system prior to acceptance of the project. The Contractor shall correct any discontinuities found, at the Contractor's expense.

SECTION 02640VALVES AND HYDRANTS

INDEX

PART 1GENERAL

PART 2PRODUCTS

PART 3EXECUTION

****

PART 1GENERAL

1.1Summary of Work

A. This Section includes valves and hydrants as shown on the Contract Drawings, complete with accessories.

1.2Related Sections

A. Section 02220 - Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02610 - Ductile Iron Pipe for Water Mains.

1.3 References

A. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.

B. AWWA C504 - Rubber-Seated Butterfly Valves.

C. AWWA C509 - Resilient-Seated Gate Valves for Water and Sewerage Systems.

D. AWWA C550 - Protective Epoxy Coatings for Valves and Hydrants.

E. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.4 Measurement and Payment

A. Water valves shall be measured per each based on size and type specified.

B. Fire hydrant assembly shall be measured per each installed in accordance with the details on the plans.

1.5 Submittals

A. Submit manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this Developmental Specification.

B. Provide dimensional drawings, fabrication details, functional description, and properly identified catalog data on all items to prove complete compliance with the contract documents.

1.6 Handling, Storage, and Shipping

A. Handle valves and hydrants carefully.

B. Use blocking and hold-downs during shipment to prevent movement or shifting.

PART 2PRODUCTS

2.1 Butterfly Valves

A. Buried valves shall open clockwise (to the right).

B. Provide butterfly valves manufactured in accordance with AWWA C504 Classification 150B.

C. Provide butterfly valves with mechanical joint ends or shouldered joint ends.

D. Provide operators equipped with 2 inch by 2 inch (50.8 mm by 50.8 mm) wrench nut and lifetime grease pack.

E. Coat interior and exterior non-finished surfaces with two-part, epoxy polyamide per AWWA C550.

F. Provide valves with V-type, wear compensating, shaft seal packing.

G. Materials of construction:

1. Body: Cast Iron ASTM A 126 Class B.
2. Disc: Cast Iron.
3. Shaft: 304 Stainless Steel.
4. Packing: Buna N.
5. Seats: Buna N.
6. Seat ring: 316 Stainless Steel.
7. Exposed bolts hex and nuts: low-alloy steel or electroplated with zinc or cadmium.

H. Valves and operators shall be for buried service.

I. Bubble-tight closure in both directions is required.

J. Manufacturers:

1. Pratt Groundhog.
2. DeZurik AWWA.
3. Approved equal.

2.2 Gate Valves

A. Provide gate valves for all valves 16 inches (400 mm) in diameter and smaller.

~~**B.** Buried valves shall open clockwise (to the right).~~

~~C~~ B. Provide resilient-seated gate valves manufactured in accordance with AWWA C509 or AWWA C515.

1. Type of service: buried service handling potable water with a pH range of 9.5 to 9.8.
2. Minimum pressure rating: 250 psi (1724 kPa).
3. Furnish valves with non-rising stem.
4. Provide 2 inch by 2 inch (25 mm by 25 mm) wrench operating nut that open valves when turned in clockwise direction (open to the right).

~~**D.** Furnish valves with 2 inch by 2 inch (50 mm by 50 mm) wrench nut.~~

~~**E**~~ **C.** Materials of construction:

1. Body and bonnet: ~~cast or~~ ductile iron.
2. Gate: cast or ductile iron fully encapsulated with synthetic rubber.
3. Stem and stem nut: bronze.
4. Exposed hex bolts and nuts: stainless steel.
5. O-rings: Buna N.

~~**F.** Valve shall be designed to allow replacement of upper O-ring while valve is under pressure in the full-open position.~~

D. Design valve to:

1. Allow replacement of upper O-ring while valve is under pressure in the full-open position.
2. Not permit metal-to-metal contact between gate and body.
3. Accommodate full size tapping machine shell cutter.

~~**G**~~ **E.** Interior and exterior valve coating shall be minimum 10 mil (25 μm) thick fusion-bonded epoxy per AWWA C550.

~~**H**~~ **F.** Operating valve through 500 cycles at rated pressure must not result in disbondment or degradation of the coating. Certification will be required for manufacturers not listed below.

~~**I.** Valve design shall not permit metal-to-metal contact between gate and body.~~

~~**J**~~ **G.** Indicate manufacturer, casting year, size, ~~and~~ working pressure, and body material (ductile iron) in valve casting.

~~**K**~~ **H.** Manufacturers:

1. U.S. Pipe and Foundry Co. Metroseal 250
2. Clow F6100
3. Mueller A2360
4. M & H Style 4067
5. Approved equal

2.3 Hydrants

A. Hydrants shall be manufactured in accordance with AWWA C502.

B. Hydrants shall be dry-barrel, break-away type designed to break near the ground line on impact. Breaking ring or flange shall be one piece or split and shall contact retaining ring for its full circumference.

C. Provide flanged connections for head and base to hydrant barrel.

D. Provide 6 inch (150 mm) mechanical joint shoe with harnessing lugs.

E. Provide 4 1/2 inch (112.5 mm) minimum-diameter main valve with bronze seat ring. Thread seat ring directly to bronze bushing or drain ring that is securely locked to hydrant shoe.

F. Provide pentagon-shaped operating nut with weather cap. Dimension from point to flat at top of operating nut: 1 3/16 inch (30.2 mm).

G. Provide two 2 1/2 inch (63.5 mm) hose nozzles and one 4 inch (101.6 mm) pumper nozzle with caps; nozzle caps shall have nut with dimensions identical to operating nut:

1. Hose nozzle threads
   - **a.** Outside diameter of male thread 3 1/16 inches (77.8 mm)
   - **b.** Diameter at root of male thread 2 7/8 inches (73.0 mm)
   - **c.** Threads per 1 inch (25.4 mm) 7-1/2
   - **d.** Length of nozzle threads 1 inch (25.4 mm)
   - **e.** Cut off at top of threads 1/4 inch (6.4 mm)
   - **2.** Pumper nozzle threads
   - **a.** Outside diameter of male thread 4 31/32 inches (126.2 mm)
   - **b.** Diameter at root of male thread 4 19/32 inches (116.7 mm)
   - **c.** Threads per 1 inch (25.4 mm) 4
   - **d.** Length of nozzle threads 1 1/2 inches (38.1 mm)
   - **e.** Cut off at top of threads 1/4 inch (6.4 mm)

H. Provide markings cast in bonnet that indicates direction of opening. Hydrants shall open clockwise (to the right).

I. Provide anti-thrust washers for ease of operation.

J. Provide grease chamber or oil reservoir, sealed by means of O-rings, for lubrication of operation threads. Provide lubricant suitable for contact with potable water.

K. Painting:

1. Prepare surfaces to be coated according to SSPC-SP6, commercial blast cleaning.
2. Coat hydrant in accordance with AWWA C502 and coating manufacturer's instructions.
3. Interior surfaces, other than machined surfaces, shall be coated with asphalt coating.
4. Exterior surfaces below grade shall be coated with two coats of asphalt coating.
5. Exterior surfaces above grade shall be primed using a polyamide epoxy system, similar to Tnemec Series 20, FC20 or 66, and painted using an aliphatic acrylic polyurethane system, Tnemec Series 75, or approved equal. Provide total dry thickness of 5 mils to 7 mils (125 µm to 175 µm).
6. Exterior surfaces above grade shall have 2 mils to 4 mils (50 µm to 100 µm) dry thickness of clear coat applied after paint has been allowed to dry thoroughly.
7. Color:
   - **a.** Asphalt coating: Black
   - **b.** Primer: White (AA83)
   - **c.** Paint: Bright Yellow (SC02)
   - **d.** Dome: Safety Green (SC07)

L. Materials of Construction:

1. Break away stem coupling: cast iron or brass.
2. Bonnet barrel, shoe, gate and nozzle caps: cast iron.
3. Threaded internal components exposed to water, valve seats, and nozzles: bronze.
4. Cotter pins, drive pins, bolts, and screws exposed to water: stainless steel or brass.
5. Exterior bolts, nuts, set screws, and other miscellaneous fasteners: stainless steel or bronze.

M. Manufacturers:

1. Clow F2500
2. Mueller Centurion
3. Waterous Trend WB-77

4. Approved equal

2.4 Joints for Valves and Hydrants

A. Joints shall be mechanical in accordance with AWWA C111, or restrained as indicated on the plans.

B. Follower glands for mechanical joints shall be ductile iron.

C. Restrained joints to consist of a mechanical joint with retainer gland or manufacturer's proprietary restrained joint having minimum 250 psi (1724 kPa) pressure rating.

D. Bolts:

1. All T-bolts and hex-head nuts for mechanical joints shall be ductile iron, Cor-Ten steel, Teflon coated Cor-Ten steel, or approved equal.
2. All bolts and hex nuts for flanged joints shall be stainless steel.

2.5 Valve Boxes

A. Provide cast iron screw-type adjustable valve box with cast iron stay-put cover marked "WATER" for each buried valve.

B. Minimum inside diameter of valve boxes shall be 5 1/8 inches (130.2 mm).

C. All valve boxes shall be installed upon the valve with the use of a rubber valve box adaptor that centers the valve over the operating nut and eliminates settling and shifting of the valve box.

2.6 Polyethylene Encasement Material

A. Polyethylene encasement material shall be manufactured in accordance with AWWA C105.

B. Minimum thickness shall be 8 mils (0.20 mm).

C. Tensile strength 12,000 psi (82737 kPa), minimum.

D. Elongation 300%, minimum.

E. Dielectric strength 800 v / mil (32 v / mm), minimum.

F. Melt Index 0.4, maximum.

G. Sheet material shall be used to wrap valves. 24 inch (600 mm) flat-width tubing shall be used to wrap the below-grade portion of hydrants.

H. 2 inch (50 mm) wide, 10 mil (250 μm) thick pressure-sensitive polyethylene tape shall be used to close seams or hold overlaps.

PART 3EXECUTION

3.1 General Installation Requirements

A. Protect valves and hydrants from injury while handling and storing.

B. Use no defective, damaged, or otherwise impaired materials.

C. Prepare excavation as outlined in Section 02220.

D. Install valves and hydrants in accordance with AWWA C600.

E. Clean valve or hydrant interior prior to placement in the trench.

F. Install valves and hydrants to the line and grade as shown on the plans.

G. Install valves and hydrants plumb.

H. Clean joint surfaces of dirt and foreign matter using a wire brush before jointing.

I. Lubricate gasket and bell. The Contractor shall furnish a vegetable-soap lubricant meeting manufacturer's recommendations. Lubricant shall be approved for use with potable water.

J. Make joints in strict accordance with manufacturer's recommendations.

K. Bolts on mechanical joints shall be tightened evenly around the pipe by alternating from one side of the pipe to the other.

L. Backfill and compact around hydrants and valves as outlined in Section 02220.

3.2 Valve Installation

A. Ensure that valve box is centered over operating nut.

B. Do not support valves off of piping.

3.3 Hydrant Installation (Including Relocated Hydrants)

A. Anchor auxiliary valve to hydrant tee.

B. Install hydrant with break flange more than 1 inch (25 mm) and less than 7 inches (175 mm) above finished grade.

C. Use all restrained joints in hydrant branch.

D. Set hydrant on a solid concrete cinder block not smaller than 8 inches by 16 inches by 4 inches (200 mm by 400 mm by 100 mm).

E. Provide poured concrete thrust blocks behind hydrant and hydrant tee.

F. Ensure hydrant drain is free flowing and unobstructed.

G. Provide not less than 1 cubic yard (1 m^3) of open-graded granular fill around base of hydrant for drainage.

3.4 Installation of Polyethylene Pipe Encasement Material

A. Polyethylene encasement material shall be used on all buried valves and the buried portion of all hydrants in accordance with AWWA C105.

B. Wrap valves using polyethylene sheet material to prevent contact with bedding. Secure sheet to adjacent pipe and just below valve operation nut using polyethylene tape.

C. Wrap all buried portions of hydrants using 24 inch (600 mm) flat-width polyethylene tubing. Secure tubing to hydrant barrel just below grade using polyethylene tape.

D. The polyethylene encasement shall prevent contact with bedding material, but is not intended to be a completely airtight and watertight enclosure.

E. Damaged polyethylene encasement material shall be repaired in a good quality manner using polyethylene tape, or the damaged section shall be replaced.

3.5 Thrust Blocks

A. The Contractor shall provide concrete thrust blocks at hydrants and hydrant tees.

B. Carry thrust blocks to undisturbed soil, which will provide adequate bearing.

C. The bearing area of thrust blocks, in square meters, shall be as shown on the plans. Minimum thickness for any thrust block shall be 1.5 times outside pipe diameter or 18 inches (450 mm), whichever is greater.

D. Hold thrust blocks back 3 inches (75 mm) from all bolts, nuts, glands, or other jointing materials.
Ensure joints could be remade without disturbing thrust block.

E. Provide bond breaker between thrust block and pipe or hydrant. Polyethylene encasement material will be considered an acceptable bond breaker.

SECTION 02674PRESSURE TESTING WATER MAINS

INDEX

****

PART 1GENERAL

1.1 Summary of Work

A. All water mains shall be pressure-tested in accordance with this Section.

1.2 Related Sections

A. Section 02610 - Ductile Iron Pipe for Water Mains.

1.3 References

A. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances.

1.4 Quality Assurance

A. Perform work in accordance with AWWA C600.

PART 2PRODUCTS

2.1 Materials

A. No permanent materials are required.

PART 3EXECUTION

3.1 Pressure Testing

A. All piping shall be tested at 150 psi (1034 kPa) for 2 hours.

B. Fill and flush new piping with potable water, ensuring that all trapped air is removed.

C. Isolate new piping from the existing system.

D. Pressurize the new piping to the test pressure at the highest point in the isolated system. Do not pressurize to more than 5 psi (35 kPa) over the test pressure at the lowest point in the isolated system.

E. Monitor pressure in the line being tested for a period of not less than 2 hours.

F. If at any point during that 2 hour period the pressure drops to 5 psi (35 kPa) below the test pressure, re-pressurize by pumping water into the line in sufficient quantity to bring the pressure back to between the test pressure and 5 psi (35 kPa) above the test pressure. Accurately measure the amount of water required to re-pressurize the main.

G. At the end of the 2 hour period, if pressure in the line has dropped below the test pressure, re-pressurize to the test pressure. Accurately measure the amount of water required to re-pressurize the main.

H. Allowable leakage in English units

$$L = \frac{(ND(P)^{1/2})}{7,400}$$

Where:

L = allowable leakage, in gallons per hour
N = number of joints in the length of pipe to be tested
D = nominal diameter of the pipe, in inches
P = average test pressure in psig

Allowable leakage in metric units

$$Lm = \frac{(SD(P)^{1/2})}{715{,}317}$$

Where:

Lm = allowable leakage, in liters per hour
S = length of pipe to be tested, in meters
D = nominal diameter of the pipe, in millimeters
P = average test pressure during the leakage test, in kPa

I. Leakage equals the total amount of water required to keep the line pressurized during the 2 hour test period and re-pressurize the line at the end of the test period.

J. If the average leakage per hour is less than the allowable leakage, the pressure test is acceptable.

K. If the average leakage per hour is more than the allowable leakage, the pressure test is not acceptable. The Contractor shall, at their own expense, locate and make approved repairs as necessary until leakage is within the specific allowance.

L. If pressure in the isolated line never drops to the test pressure, having started no more than 5 psi (35 kPa) above the test pressure, the pressure test is acceptable.

M. All visible leaks are to be repaired regardless of the amount of leakage.

SECTION 02675DISINFECTION OF WATER DISTRIBUTION SYSTEMS

INDEX

****

PART 1GENERAL

1.1 Summary of Work

A. All water mains shall be disinfected in accordance with this Section.

1.2 Related Sections

A. Section 02220 - Excavating, Backfilling. and Compacting for Water Mains.

B. Section 02610 - Ductile Iron Pipe for Water Mains.

1.3 References

A. AWWA B300 - Standard for Hypochlorites.

B. AWWA B301 - Standard for Liquid Chlorine.

C. AWWA C651 - Standard for Disinfecting Water Mains.

1.4 Quality Assurance

A. Perform work in accordance with AWWA C651.

B. Bacteriological samples will be taken and tested by DMWW to ensure satisfactory disinfection.

1.5 General

A. Contractor shall provide all equipment and materials necessary to complete chlorination.

B. Water for disinfection will be provided by DMWW for two disinfection attempts. If additional attempts are necessary, the Contractor will be billed for water used at the normal rate set for industrial customers.

PART 2PRODUCTS

2.1 Chlorine

A. Calcium hypochlorite granules conforming to AWWA B300.

B. Liquid chlorine conforming to AWWA B301.

PART 3EXECUTION

3.1 Examination

A. Disinfection of piping shall take place only after satisfactory pressure testing.

B. No chlorine shall be placed in the new main until after satisfactory completion of pressure testing.

C. Ensure piping to be disinfected is isolated from portion of the distribution system, which is in service.

D. Review procedures and coordinate disinfection with DMWW.

3.2 Chlorination of Piping

A. Use the continuous feed method as outlined in Section 5.2 of AWWA C651.

B. Prior to feeding chlorine, fill and flush new piping to remove trapped air and particulates. Provide equipment and materials necessary to obtain a minimum flushing velocity of 2.5 feet/second (1.5 m/second) in piping to be disinfected.

C. Induce flow of potable water through the new piping at required flushing velocity. Make provisions for diverting and disposing of flushing water in manner that does not damage surroundings. Repair any damage caused by flushing activities.

D. At a point within five pipe diameters of the connection to the existing distribution system, introduce highly chlorinated water in sufficient quantity to provide at least 25 mg/L free chlorine in the new piping. Provide all metering and feed equipment.

E. Introduce highly chlorinated water continuously until the entire section of new piping contains a minimum of 25 mg/L free chlorine. Do not exceed 100 mg/L free chlorine.

F. Isolate the newly chlorinated piping for a contact period of at least 24 hours, and not more than 48 hours, taking care not to backflow chlorinated water into the existing potable water system.

G. After the contact period, water in the new piping must have a residual-free chlorine content of not less than 10 mg/L. If the residual is less than 10 mg/L, rechlorinate as outlined in Part 3.2.

3.3 Flushing Chlorinated Piping

A. After the contact period, flush the recently chlorinated piping with potable water.

B. Continue flushing until the chlorine residual in the new piping is equal to the chlorine residual in the existing distribution system.

C. Isolate the new piping from the existing distribution system for a period of not less than 24 hours.

D. Chlorinated water, which is flushed from the new piping, shall be disposed of in such a manner as to not cause damage to the environment. Conform with Part 3.5 of Section 02220 and any other state or federal requirements.

3.4 Bacteriological Testing

A. At least 24 hours after flushing pipe lines, samples will be taken and tested by DMWW.

B. Approximately one sample will be taken for each 1,200 feet (365 m) of new water main.

C. Additional samples may be taken at the discretion of Engineer.

D. Samples must show the absence of coliform organisms and other contaminants and meet all requirements of the Iowa Department of Natural Resources to be considered acceptable.

E. If any sample is not satisfactory, the piping represented by that sample must be flushed and rechlorinated by the Contractor at the discretion of the Engineer.