

NORTH MARIN WATER DISTRICT

STANDARD SPECIFICATIONS

SECTION 15056 DUCTILE-IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of ductile-iron pipe and fittings for potable and recycled water systems.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

ASTM A 307	-	Standard Specification for Carbon Steel Bolts and Studs
ASTM C 150	-	Standard Specification for Portland Cement
ASTM A 536	-	Standard Specifications for Ductile Iron Castings
AWWA C104	-	Cement Mortar Lining for Ductile Pipe and Fittings for Water mains
AWWA C105	-	Polyethylene Encasement for Ductile Iron Pipe
AWWA C110	-	Ductile Iron Fittings
AWWA C111	-	Rubber-Gasket Joints for Ductile Iron Pipe and Fittings
AWWA C115	-	Flanged Ductile Iron Pipe with Threaded Flanges
AWWA C150	-	Thickness Design of Ductile Iron Pipe
AWWA C151	-	Ductile Pipe, Centrifugally Cast
AWWA C153	-	Ductile Iron Compact Fittings
AWWA C217	-	Cold-Applied Petroleum Wax Tape Coatings
AWWA C600	-	Installation of Ductile Iron Water Mains
AWWA C602	-	Cement-Mortar Lining of Water Pipelines
AWWA C606	-	Grooved and Shouldered Type Joints
AWWA M41		Ductile-Iron Pipe and Fittings

1.03 RELATED WORK SPECIFIED ELSEWHERE

NMWD Standard Drawings
NMWD Standard Specifications 01000, 02223, 03000, 09910, 13110, 15000, 15044, 15061, 15064, 15108, and 15112.

1.04 SERVICE APPLICATION

Ductile-iron pipe shall be used only in specific locations shown on the plans. If ductile-iron pipe is to be used in the place of PVC pipe, a cathodic protection system may be required.

1.05 DESIGN REQUIREMENTS

A. General:

1. Ductile-iron pipe and fittings shall be manufactured per AWWA C110,C115,
Ductile-Iron Pipe and Fittings

C150, C151, and C153. Gray-iron and cast-iron fittings or flanges shall not be used.

- i. Ductile iron pipeline fittings shall be in accordance with ANSI/WWA C110 or ANSI/AWWA C153. Ductile iron pipeline fittings shall have a petroleum asphaltic outside coating and shall be cement lined in accordance with ANSI/AWWA C104.
 - ii. Ductile iron pipeline fitting end connections shall be mechanical, flanged or push on, as designated by the Engineer.
 2. Joints for ductile-iron pipe and fittings shall be mechanical, flanged, or push-on in accordance with AWWA C110, and C153.
 3. Except as amended herein, or otherwise shown on the Approved Plans, joints for ductile-iron pipe and ductile-iron fittings shall have a pressure rating equal to or greater than the adjacent piping.
 4. Joints in buried piping may be of the mechanical, push-on or flanged type per AWWA C111 except where particularly specified on the Approved Drawings.
 5. Joints that are aboveground, within structures, or submerged shall be flanged unless otherwise shown on the Approved Plans.
- B. Unless otherwise specified, ductile-iron flanges shall be in accordance with AWWA C115, rated at a working pressure of 250 psi. Where required in order to connect to the flanges of 250 psi butterfly valves, or as otherwise shown on the approved plans, ductile-iron flanges shall be compatible with AWWA C207, Class "F".

Maximum working pressure of flanges shall as specified in AWWA or ASME/ANSI. Flanges shall be integrally cast per AWWA C110 or shop-threaded per AWWA C115. Flanges shall be solid. Hollow-back flanges are not permitted. Gray-iron or cast-iron flanges are not permitted. Threading of flanges in the field is not permitted.

Where threaded flanges are used, the pipe or spool piece to which they are connected will be hydrostatically tested in the presence of the Engineer prior to installation. The pipe section or spool piece shall be hydrostatically tested for 15 minutes at the pressure rating of the flanges. No leaks shall be permitted.

- C. Plain ends shall conform to the requirement of AWWA C151 and to the dimensions included within AWWA C110 to accept a push-on joint, flanged coupling adaptor, flexible coupling, or grooved coupling. Refer to Section 15000 for coupling descriptions.
- D. The exterior surfaces of all pipe and fittings shall be factory coated with a minimum one (1) mil thick petroleum asphaltic material per AWWA C110 and C151.
- E. All pipe and fittings shall be cement-mortar lined in accordance with AWWA C104. Cement-mortar shall be in accordance with ASTM C 150, Type II or Type V, and NSF 61 certified.

1.06 QUALITY ASSURANCE

- A. The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe and fittings has been subjected to and met the tests specified for ductile-iron pipe and fittings per AWWA C110, C115, C150, C151, and C153, as applicable.

- B. All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made.
- C. Ductile-iron pipe shall bear indelible identification markings as required by AWWA C151.

1.07 SUBMITTALS

The following items shall be submitted and reviewed by the District prior to shipping of ductile-iron pipe and fittings:

- A. An affidavit of compliance with AWWA C104, C110, C111, C115, C150, C151, C153, and the requirements of this specification.
- B. Typical joint details.
- C. Typical details and description of lining and coating.
- D. Calculations supporting selected wall thickness.
- E. Calculations demonstrating that each proposed restrained joint arrangement can resist the applied forces.
- F. Cathodic protection materials (for pipe only).

1.08 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling of ductile-iron pipe and fittings shall follow the recommendations of AWWA C600 and as specified herein:

- A. Handling of pipe shall be performed with lifts, cranes, or other suitable equipment and devices. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the pipe, linings, and coatings. The pipes shall not be dropped or dragged.
- B. During transport, the pipe shall be supported and secured against movement using padded devices in such a manner to prevent damage.
- C. Stored pipe shall be protected from damage and kept free from dirt and foreign materials by closing the ends of the pipe. Other pipeline materials shall be protected by appropriate packaging or wrapping. Gaskets shall be stored in a cool location out of direct sunlight. Bolts, nuts, and washers shall be handled and stored in a dry location in a manner that will ensure proper use with respect to types and sizes.
- D. Pipe laid out for installation shall be placed on earth berms or timber cradles adjacent to the trench in the numerical order of installation.
- E. Maintain plastic end caps on all pipe and fittings in good condition until the pipe is ready to be installed in the trench. Periodically open the plastic end caps and spray clean potable water inside the pipe for moisture control.
- F. Under no circumstances shall ropes or other handling devices be attached through the interior of fittings.

1.09 RECYCLED WATER IDENTIFICATION

Ductile-iron pipe and fittings for recycled water shall be identified with purple-colored coating, purple polyethylene sleeves, identification labels or signs in accordance with Section 15151.

1.10 POLYETHYLENE ENCASEMENT

When specified on approved plans, polyethylene encasement shall be installed for buried ductile-iron pipe and fittings in accordance with Section 15000.

1.11 TRACER WIRE

All main pipelines require tracer wire per Section 15000 General Piping System and Appurtenances.

1.12 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed for ductile-iron pipe and fittings in accordance with Section 15000.

PART 2 MATERIALS

2.01 DUCTILE-IRON

Ductile-iron pipe and appurtenant components and materials shall be selected from the Approved Materials List in accordance with the Standard Drawings.

- A. Ductile iron pipe having push-on, mechanical, or plain end connections shall be furnished within the following classes:

<u>Pipe Diameter</u>	<u>Minimum Pressure Class</u>	<u>Minimum Thickness Class</u>
Under 6-inch	350	52
6 to 16-inch	350	50
20 to 24-inch	300	50
30 to 36-inch	250	50
42 to 60-inch	200	50

- B. Minimum thickness class for pipe having threaded flanges or threaded shoulders shall be Class 53.

- C. Minimum thickness class for pipe having grooved end joints shall be as shown in the following table unless otherwise noted on the approved Drawings:

<u>Pipe and Fitting Size (Diameter, in.)</u>	<u>Wall Thickness per AWWA C606</u>
16 and smaller	Class 53
20	Class 54
24	Class 56

- D. Minimum push-on fitting "Stab Depths" for 6-inch, 8-inch, 10-inch, 12-inch and 16-inch fittings shall be 4.29", 4.78", 4.98", 4.98" and 5.40", respectively.

2.02 GASKETS

- A. Mechanical joint rubber gasket configuration and materials shall comply with AWWA C111 and shall be in accordance with the applicable joint type and pressure rating of the piping system.

- B. Flange gaskets shall be 1/8-inches thick acrylic or aramid fibers bound with nitrile for all sizes of pipe. Gaskets shall be full-face type with pre-punched holes.
- C. Push-on joint rubber gaskets shall be per AWWA C111.
- D. If organic solvents or petroleum products are encountered during the course of the work, alternate gasket materials or joint treatment may be required by the Engineer.

2.03 BOLTS AND NUTS FOR FLANGES

Bolts and nuts shall be in accordance with Section 15000 and shall be selected from the Approved Materials List.

2.04 JOINT BONDING AND CATHODIC PROTECTION

Joint bonding, flange insulation kits, internal epoxy linings, and cathodic protection materials shall be provided as indicated on the Approved Plans and in accordance with Section 13110.

2.05 PAINTING AND COATING

- A. Buried ductile-iron pipe shall receive an asphaltic coating in accordance with AWWA C151.
- B. The District may require alternative coatings based on special conditions and the Corrosion Engineer's recommendations. Additional coating requirements shall be shown on the drawings.
- C. Materials for coating of pipe and fittings located above ground and in structures shall be in accordance Section 09910 of the Approved project specifications.
- D. Materials for coating buried mechanical joint and hardware shall be in accordance Section 15000.

2.06 IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

Imported granular material for use in pipe and trench zones shall be in accordance with Section 02223.

2.07 CONCRETE

Concrete for thrust and anchor blocks shall be in accordance with Section 03000.

2.08 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be in accordance with Section 15000 and selected from the Approved Materials List.

2.09 TRACER WIRE (NOT USED)

2.10 WARNING/IDENTIFICATION TAPE

Warning/Identification tape materials shall be in accordance with Section 15000 and selected from the Approved Materials List.

PART 3 EXECUTION

3.01 GENERAL

At all times when the work of installing pipe is not in progress, including worker break times, ends of the pipe shall be closed with vermin-proof and child-proof caps or plugs. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials.

3.02 TRENCHING, BACKFILLING AND COMPACTING

Trenching, backfilling and compacting shall be performed in accordance with Section 02223.

3.03 DEWATERING

The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and dispose of all water from any source entering trench excavations or other parts of the work in accordance with Section 02223. Any damage caused by flooding of the trench shall be the Contractors responsibility.

Dewatering shall be performed by methods that will maintain a dry excavation, preservation of the final lines and grades and protection of all utilities. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipeline appurtenances or trench materials shall be repaired or replaced as directed by the Engineer.

Dewatering operations shall employ Best Management Practices (BMPs) and comply with local ordinances, approved Erosion and Sediment Control Plans, approved Stormwater Pollution Prevention Plans (SWPPP) or requirements of an encroachment permit issued by a local agency. Non-stormwater discharges to the storm drain system is typically prohibited. Uncontaminated pumped groundwater or accumulated rainwater may be discharged to the storm drain system but must be managed to minimize sediment reaching storm drains and ensure downstream creeks, wetlands, and the Bay or Ocean are not polluted. The storm drain system includes streets, gutters, storm drain inlets, ditches, creeks, and wetlands.

3.04 PIPE INSTALLATION

When the work requires entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter.

The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation. Install pipe in the trench as follows:

- A. Inspect each pipe and fitting before lowering the pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from inside of the pipe and keep pipe clean during and after installation.
- B. Install pipe according to the manufacturer's approved order of installation. Install pipes uphill if the grade exceeds 10%. Lower the pipe onto the bedding at the proper lines and grades.

- C. The manufacturer's printed installation guide outlining the radius of curvature that can be negotiated with pipe sections of various lengths shall be followed, except they shall not exceed the deflections allowed in AWWA C600 according to joint type. Combined deflections at rubber gasket or flexible coupling joints shall not exceed that recommended by the manufacturer.
- D. The pipe shall have firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.
- E. Pipe Assembly:
 - 1. Push-On Type: Assemble the pipe joint using a lubricant selected from the Approved Materials List. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer's recommendations. Stabbing shall not be permitted.
 - 2. Mechanical Joint Type: Install mechanical joint fittings per AWWA C600 and the manufacturer's recommendations. Prior to installation of the mechanical joint, clean socket and plain end of the pipe. Lubricate both the gasket and the plain end using a lubricant selected from the Approved Materials List.
 - 3. Flanged Joint type: install per paragraph 3.06 below.
- F. During installation operations, do not place tools, clothing, or other materials in the pipe.
- G. When pipe installation is not in progress, including worker break times, ends of the pipe shall be closed with vermin-proof and child-proof caps or plugs. Do not permit trench water, animals, or foreign material to enter the pipe.

3.05 POLYETHYLENE ENCASEMENT

When specified on approved plans, polyethylene encasement shall be used for the buried installation of ductile iron pipe and fittings and shall be installed in accordance with Section 15000.

3.06 FLANGED PIPE AND FITTINGS

Flanged connections shall be installed where indicated on the Approved Drawings.

- A. Bolt holes shall straddle the horizontal and vertical centerlines.
- B. The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.
- C. Bolts and nuts shall be lubricated with a District-approved anti-seize compound.
- D. Nuts shall be tightened in an alternating "star" pattern to the manufacturer's recommended torque.
- E. Coat the exterior of exposed flanges, bolts and nuts located aboveground or within vaults in accordance with Section 09910.

3.07 MECHANICAL JOINT CONNECTIONS

- A. Install mechanical-joint fittings per AWWA C600 and the manufacturer's recommendations.
- B. Prior to installation of the mechanical joint, clean the socket and plain end of the pipe. Lubricate both the gasket and plain end of the pipe with an approved lubricant per AWWA C111 immediately prior to slipping the gasket onto the plain end of the pipe.
- C. Tighten the bolts to the normal range of bolt torque per the manufacturer's recommendations and AWWA C600, Table 3, as follows:

<u>Pipe Diameter</u>	<u>Bolt Size</u>	<u>Range of Torque</u>
75 mm (3")	16 mm (5/8")	61-81 N-M (45-60 ft.-lb.)
100-600 mm (4-24")	19 mm (3/4")	102-122 N-M (75-90 ft.-lb.)
750-900 mm (30-36")	25 mm (1")	136-163 N-M (100-120 ft.-lb.)

- D. All stainless steel bolts shall be coated with anti-seize compound selected from the Approval Materials List.

3.08 CROSSES AND TEES

- A. The pressure class of ductile-iron pipe spools, if used, shall be equal to or greater than that of adjacent piping.
- B. The spools shall be 18" long for pipe sizes 8" through 12", and 24" long for pipe sizes 16" and larger.

3.09 JOINT BONDING AND CATHODIC PROTECTION

Bonding of joints to provide continuity, flange insulation kits, internal epoxy linings, and other cathodic protection items and materials shall be installed where shown on the Approved Plans in accordance with the Standard Drawings and Section 13110.

3.10 COUPLINGS FOR DUCTILE-IRON PIPE

Mechanical-type flexible joints shall be installed where shown on the Approved Drawings. Grooved couplings shall be used in vaults and above ground. Flexible couplings may be used, where indicated on the drawings, below ground, but may also be used above ground with restrained joints. Flanged coupling adapters shall be used for buried pipelines, where allowed by the District.

- A. Grooved joint couplings shall be installed per AWWA C606 and as indicated in Section 15000.
- B. Flanged coupling adapters, where allowed by the District, shall be installed per the manufacturer's recommendations.
- C. Flexible couplings shall be installed per Section 15000 and the manufacturer's recommendations.
- D. All couplings for ductile-iron pipe shall be shop-coated in accordance with Section 15000.

3.11 JOINT RESTRAINT SYSTEMS

Joint restraint systems shall be installed on ductile-iron fittings in accordance with Section 15000. Joint restraint lengths along new pipelines shall be as shown on the Approved Plans. If the installation of concrete thrust blocks is not practical and the use of joint restraint systems are approved by the District Engineer, calculations indicating joint restraint lengths along new pipelines shall be submitted to the District Engineer for approval. Joint restraints for ductile iron pipe shall be designed in accordance with AWWA M41.

3.12 CONCRETE

Concrete thrust and anchor blocks shall be installed in accordance with Section 03000 and the Standards Drawings. Prior to filling the pipeline with water, refer to Section 03000 for the minimum concrete curing time required.

3.13 TRACER WIRE

Tracer Wire shall be installed in accordance with Section 15000 and the Standard Drawings.

3.14 WARNING/IDENTIFICATION TAPE

Warning/Identification tape shall be installed in accordance with Section 15000 and the Standard Drawings.

3.14 DISINFECTION AND BACTERIOLOGICAL TESTING

Disinfection, bacteriological testing, and flushing shall be performed in accordance with Section 15041.

3.15 HYDROSTATIC TESTING

Field hydrostatic testing shall be performed in accordance with Section 15044.

END OF SECTION15056