

Approval Standard

for

Ductile Iron Pipe and Fittings, Flexible Fittings and Couplings

Class Number 1610

September 2006

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Foreword

Approvals are intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of Approval Standards is to present the criteria for Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for Approval shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

- a) Must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) Must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Master Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

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1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard states FM Approvals criteria for ductile iron pipe for use in underground fire protection mains. This standard also addresses rigid (elbows, tees, etc.) and flexible (swivel, etc.) fittings and couplings for joining pipe and fittings. The fittings and couplings may be rated for use below and above ground.
- 1.1.2 Displacements due to seismic events (earthquake) are beyond the scope of this standard.
- 1.1.3 FM Approvals criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up audit program.

1.2 Scope

- 1.2.1 This standard encompasses the design and performance requirements for:
 - Ductile iron water pipe, from 3 through 36 inch (80 to 915 mm) nominal sizes for underground use;
 - Rigid and flexible fittings for underground or aboveground use; and,
 - Rigid and flexible couplings for underground or aboveground use

Note: Aboveground use is limited to fitting products up to 12 in. NPS maximum. Ductile iron pipe is not permitted aboveground in fire protection systems.
- 1.2.2 In cases where metric sized ductile iron pipe and fittings are to be examined for Approval, test criteria comparable to the United States equivalent size shall be used.
- 1.2.3 Recognized pipe wall thickness classes or pressure classes are as defined in Standards American National Standards Institute (ANSI)/American Water Works Association (AWWA) C150/A21.50, *Thickness Design of Ductile-Iron Pipe*, or Standard ANSI/AWWA C151/A21.51, *Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids*. Other International Standards will be considered on a case by case basis.
- 1.2.4 Approval Standards are intended to verify that the product described will meet stated conditions of performance, safety and quality useful to the ends of property conservation.
- 1.2.5 FM Approvals will consider ductile iron pipe and fittings which are designed in accordance to national or international standards. Only after verification is made that the products to be reviewed are in conformance to ANSI/AWWA C150/A21.50, or Standard ANSI/AWWA C151/A21.51, or other nationally or internationally recognized standards will Approval testing commence. All Approval testing is to be conducted on production samples.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of ductile iron pipe, fittings and couplings for the purpose of obtaining FM Approval. These requirements are intended primarily as guides, and strict conformity is not always mandatory. Pipe, fittings and couplings having characteristics not anticipated by this standard may be FM Approved if performance equal, or superior, to that required by this standard is demonstrated, or if the intent of the standard is met. Alternatively, pipe,

fittings and couplings which meet all of the requirements identified in this standard may not be FM Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

1.4.1 Examination and tests on production samples shall be performed to evaluate:

- The suitability of the product;
- The performance of the product as specified by the manufacturer and required by FM Approvals; and as far as practical,
- The durability and reliability of the product.

1.4.2 An initial Facilities and Procedures Audit shall be conducted to evaluate the manufacturer's ability to consistently produce the product that was examined and tested as part of the Approval examination. The audit shall review the facility and in-place quality control procedures used in the manufacture of the product. Typically, areas of review are incoming inspection, work in progress, production testing, final quality control, marking, calibration of equipment, shipping procedures, and document and drawing control. These examinations are repeated as part of FM Approvals' product follow-up program. (Refer to Section 5.2, Facility and Procedures Audit.)

1.5 Basis for Continued Approval

1.5.1 Continued Approval is based upon:

- Production or availability of the product as currently FM Approved;
- The continued use of acceptable quality assurance procedures;
- Satisfactory field experience;
- Compliance with the terms stipulated in the Master Agreement;
- Satisfactory re-examination of production samples for continued conformity to requirements; and
- Satisfactory Facilities and Procedures Audits (F&PAs) conducted as part of FM Approvals' product follow-up program.

1.5.2 Also, as a condition of retaining Approval, manufacturers may not change an FM Approved product or service without prior authorization by FM Approvals. (Refer to Section 5.1.3 for further details regarding changes.)

1.6 Effective Date

The effective date of an Approval Standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or forfeit Approval.

The effective date of this Standard is **September 28, 2007** for compliance with all requirements.

1.7 System of Units

Units of measurement used in this standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in

accordance with the Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing and Materials (ASTM) SI 10-2002, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*. One unit of measurement (bar), outside of, but recognized by SI, is commonly used in international fire protection and is used in this standard.

1.8 Applicable Documents

The following standards, test methods, and practices are referenced in this standard:

ANSI/AWWA C104/A21.4-2003, *Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water*
ANSI/AWWA C105/A21.5-2005, *Polyethylene Encasement for Ductile-Iron Pipe Systems*
ANSI/AWWA C110/A21.10-2003, *Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids*
ANSI/AWWA C111/A21.11-2000, *Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings*
ANSI/AWWA C115/A21.15-2005, *Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges*
ANSI/AWWA C150/A21.50-2002, *Thickness Design of Ductile-Iron Pipe*
ANSI/AWWA C151/A21.51-2002, *Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids*
ANSI/AWWA C153/A21.53-2000, *Ductile-Iron Compact Fittings, 3 in. through 24 in. (76 mm Through 610 mm) and 54 in. through 64 in. (1,400 mm Through 1,600 mm), for Water Service*
ANSI/AWWA C600-2005, *Installation of Ductile-Iron Water Mains and Their Appurtenances*
ANSI/AWWA C606-2004, *Joints, Grooved and Shouldered Type*
ASTM A126-04, *Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings*
ASTM A536 -84(2004), *Standard Specification for Ductile Iron Castings*
AWWA M41-2003, Second Edition, *Ductile-Iron Pipe and Fittings*
FM Global Property Loss Prevention Data Sheets
IEEE/ASTM SI 10-2002, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*
ISO 17025-1999, *General Requirements for the Competence of Testing and Calibration Laboratories*
National Fire Protection Association (NFPA) 13-2002, *Standard for the Installation of Sprinkler Systems*

1.9 Definitions

For purposes of this standard, the following terms apply:

Accepted

This term refers to installations acceptable to the authority enforcing the applicable installation rules. When the authority is FM Global, such locations are termed “FM Global Accepted.” Acceptance is based upon an overall evaluation of the installation. Factors other than the use of FM Approved equipment impact upon the decision to accept, or not to accept. Acceptance is not a characteristic of a product. It is installation specific. A product accepted for one installation may not be acceptable elsewhere. (Contrast with FM Approved.)

Bell and Spigot Pipe

A general pipe design where one end of a length of pipe is straight (spigot) and the other larger end is bell shaped and contains a gasket seal. The spigot end of one pipe is designed to fit into the bell end of another pipe and to fit under the gasket seal. Generally, this joint uses an elastomeric gasket to obtain a seal. Older version of bell and spigot pipe used a poured seal made up of juke and lead. These joints are rarely used as of this writing.

Ductile Iron Fittings

A device, such as a tee or elbow, which is cast from ductile iron, in accordance with the material requirements of ASTM A536, *Standard Specification for Ductile Iron Castings*, Grade 65-45-12 or equivalent.

Flanged End Fitting

A device, such as a tee or elbow, which has an integral rim on each end that is drilled in a symmetric hole pattern and which is connected to a mating device by means of a gasket, bolts and hex nuts. Critical flange dimensions are as tabulated in AWWA C110, *Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids*, or other nationally or internationally recognized standard.

Flexible Fitting

A fitting which is rigid at the joint, but will tolerate misalignments in one or more sections.

Flexible Joint

A connection between two pipe sections, or a pipe section and a fitting, where misalignments may be tolerated when un-pressurized.

FM Approvals Certification Marks

The FM Approvals Certification Marks are detailed in Appendix B. Its use is mandatory on all FM Approved products. These registered marks cannot be used except as authorized by FM Approvals via the granting of Approval to a specific product.

FM Approved

This term refers to products FM Approved by FM Approvals. Such products are listed in the Approval Guide, a publication of FM Approvals, issued annually, or one of its supplements. All products so listed have been successfully examined by FM Approvals, and their manufacturers have signed and returned a Master Agreement to FM Approvals. This form obligates the manufacturer to allow re-examination of the product and audit of facilities and procedures at FM Approvals' discretion. It further requires the manufacturer not to deviate from the FM Approved configuration of the product without review by and agreement of FM Approvals. Approval is product and site specific.

Grey Iron Fittings

A device, such as a tee or elbow, which is cast from grey iron, in accordance with the material requirements of ASTM A126, *Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings*, Class A or equivalent.

Grooved Coupling, Flexible

A grooved coupling is an assembly that is used to join two similar sized grooved ends together. The flexible grooved coupling is characterized by its ability to allow for angular, or rotational differences between the components being joined after assembly. These products may provide greater system reliability in situations involving excessive vibration, difficult alignment, or seismic activity. They may also provide greater system flexibility than historic use of rigid systems of flanged pipe and fittings.

Grooved Coupling, Rigid

A rigid grooved coupling is an assembly that is used to join two similar sized grooved ends together. The rigid grooved coupling is characterized by its prevention of rotation of the joined ends, and reduced tolerance for angular variations after assembly.

Grooved End Pipe

Ductile iron pipe which contains cut grooves at the ends, to be joined by grooved couplings. Groove dimensions are per ANSI/AWWA C606 *Joints, Grooved and Shouldered Type*.

Push-On Joint

A joint which results from the method of joining pipe by forcing the spigot end of a pipe into the bell of another pipe suitably equipped with a "push-on" elastomeric gasket. The spigot end of one length of pipe passes into the bell end of the receiving pipe, which contains the gasket seal. When the spigot end is pushed to the bottom of the socket a seal is obtained. This joint is considered a non-restrained joint.

Rigid Fitting

A fitting which permits no flexibility at any joint or any segment when installed. An example would be flanged tees or elbows.

Rigid Joint

A connection between two pipe sections, or a pipe section and a fitting, where no flexibility is allowed when un-pressurized. An example would be a flanged end pipe connected to a flanged gate valve.

Restrained Joint

A joint design used to counteract unbalanced forces in a piping system which includes the joint gasket. In some designs, the rubber gasket contains toothed metal strips, in a cam shape, inserted along the perimeter of the gasket. The gasket is initially inserted into the bell end of the joint. The spigot end of the pipe is inserted into the bell and through the gasket to the bottom of the socket. The cam rotates and the metal teeth engage the grooved section of the spigot so that the joint is adequately secured as the pipe is pressurized. Other designs which incorporate other methods of restraint and sealing are also acceptable. This joint is considered a self-restrained joint.

Shoulder End Pipe

Pipe which ends in a raised shoulder, to be joined by specialized grooved couplings. Shoulder dimensions are per ANSI/AWWA C606, *Joints, Grooved and Shouldered Type*.

Standardized Mechanical Joint (SMJ)

A bolted joint of the stuffing box type, which when assembled, forces an elastomeric gasket into the joint, as detailed in ANSI/AWWA C111, *Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings*.

Standardized Mechanical Joint Retaining Gland

An additional ring fitting which is added to a bolted joint of the stuffing box type. The gland is secured to the spigot by tightening its setscrews against the pipe wall providing positive restraint. Bolt holes along the flanged section of the gland provide the means by which it is secured to the flanged bell of standardized mechanical joint pipe or fitting.

Thrust Block

A large block of concrete used to transfer reaction forces from water flow in piping systems to adjacent soil which would cause an unrestrained joint to open and leak. Thrust blocks are especially useful at changes of direction in buried piping systems. Thrust blocks should not prohibit access to the pipe joints.