



Designation: **F3226/F3226M – 16 F3226/F3226M – 16^{ε1}**

Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems¹

This standard is issued under the fixed designation F3226/F3226M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

^{ε1} NOTE—Editorial corrections were made throughout in April 2017.

1. Scope

1.1 This specification establishes the performance characteristics required for Metallic Press-Connect Fittings for use in piping and tubing systems with a maximum allowable working pressure of three-hundred pounds per square inch (300 psi). These fittings directly attach to pipe or tube by mechanical deformation of the pipe or tube or fitting, or a combination thereof, creating a seal and a restrained joint. The seal may be created via the mechanical deformation (of the pipe, tube or fitting) or created independently. Successful completion of the tests described herein constitutes completion of the technical portion of the qualification process.

1.2 The tests specified are applicable only to ascertain the performance characteristics. These tests are not intended for use in the evaluation of non-Press-Connect Fittings.

1.3 Refer to IACS UR P2.7.4, Table-7 for Metallic Press-Connect Fittings applications.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[A53/A53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless](#)

[A135/A135M Specification for Electric-Resistance-Welded Steel Pipe](#)

[A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels](#)

[A269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service](#)

[A276 Specification for Stainless Steel Bars and Shapes](#)

[A312/A312M Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes](#)

[A795/A795M Specification for Black and Hot-Dipped Zinc-Coated \(Galvanized\) Welded and Seamless Steel Pipe for Fire Protection Use](#)

[B16/B16M Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines](#)

[B62 Specification for Composition Bronze or Ounce Metal Castings](#)

[B75 Specification for Seamless Copper Tube](#)

[B88 Specification for Seamless Copper Water Tube](#)

[B124/B124M Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes](#)

¹ This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

Current edition approved Dec. 15, 2016. Published March 2017. DOI: 10.1520/F3226_F3226M-16.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[B140/B140M Specification for Copper-Zinc-Lead \(Red Brass or Hardware Bronze\) Rod, Bar, and Shapes](#)
[B283 Specification for Copper and Copper-Alloy Die Forgings \(Hot-Pressed\)](#)
[B371/B371M Specification for Copper-Zinc-Silicon Alloy Rod](#)
[B466/B466M Specification for Seamless Copper-Nickel Pipe and Tube](#)
[B467 Specification for Welded Copper-Nickel Pipe](#)
[B584 Specification for Copper Alloy Sand Castings for General Applications](#)
[B858 Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys](#)
[B967/B967M Specification for Copper-Zinc-Tin-Bismuth Alloy Rod, Bar and Wire](#)
[D2000 Classification System for Rubber Products in Automotive Applications](#)

2.2 *ASME Standards:*³

[B1.20.1 Pipe Threads, General Purpose \(Inch\)](#)
[B16.51 Copper and Copper Alloy Press-Connect Pressure Fittings](#)
[B36.10 Welded and Seamless Wrought Steel Pipe](#)
[B46.1 Surface Texture \(Surface Roughness, Waviness and Lay\)](#)

2.3 *IACS Document:*⁴

[UR P2.11 Type Approval of Mechanical Joints](#)
[UR P2.7.4 Mechanical Joints](#)

2.4 *ISO Standards:*⁵

[19921 Ships and marine technology – Fire resistance of metallic pipe components with resilient and elastomeric seals – Test methods](#)
[19922 Ships and marine technology – Fire resistance of metallic pipe components with resilient and elastomeric seals – Requirements imposed on the test bench](#)

2.5 *AWS Standards:*⁶

[ANSI/AWS A5.8M/A5.8 Specification for Filler Metals for Brazing and Braze Welding](#)
[AWS B2.2/B2.2M Standard for Brazing Procedure and Performance Qualifications](#)

2.6 *ISO Standards:*⁷

~~[ISO 19921 Ships and marine technology – Fire resistance of metallic components with resilient elastomeric seals – Test methods](#)~~
~~[ISO 19922 Ships and marine technology – Fire resistance of metallic pipe components with resilient and elastomeric seals – Requirements imposed on the test bench](#)~~

Teh Standards
 http://standards.teh.ai
 Document Preview

3. Terminology

3.1 *Definitions:*

3.1.1 *class, n*—a group of fitting of a particular design with the dimensions proportional to pipe or tube outside diameters, made from the same material grade (or combination of grades), for the same rated pressure, or for a rated pressure inversely proportional to the diameter.

3.1.2 *'FTG', n*—indicates a pipe-end or tube-end of a Press-Connect fitting (that is, FTG × NPT). A fitting ends configuration that is dimensionally the same as a pipe or tube and intended to insert into a Press-Connect fitting.

3.1.3 *failure, n*—the condition of not achieving the desired performance, as evidenced by leakage or joint separation.

3.1.4 *fitting, n*—connecting device used to join multiple pipes or tubes or other fittings together to create a working system.

3.1.5 *joint, n*—interface between the fitting and pipe or tube where the seal is maintained and mechanical holding strength is applied or maintained.

3.1.6 *leakage, n*—the escape of fluid or gas from any hole in the pressure containment wall, sufficient to drip or flow from the point of formation or gas bubbles rising to the surface after the first minute of submersion.

3.1.7 *'P' designation, n*—indicates a Press-Connect fitting end (that is, P × NPT).

3.1.8 *permanent, n*—cannot be disassembled and reused after initial assembly.

3.1.9 *pipe, n*—hollow cylindrical shape used to transport liquids, gases, or oil. Pipe is specified by nominal outside diameter (OD) and schedule (wall thickness).

³ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁴ Available from International Association of Classification Societies (IACS) Limited, Permanent Secretariat, 6th Floor, 36 Broadway, London SW1H 0BH, UK, <http://www.iacs.org.uk>.

⁵ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

⁶ Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, <http://www.aws.org>.

3.1.10 *press connection, n*—type of fitting joint that attaches directly to pipe or tube by mechanical deformation of the pipe, tube or fitting or combination creating a seal and restrained joint. The joint is created by use of an elastomeric seal or mechanical deformation, or both. Mechanical deformation is achieved by use of an electro-hydraulic pressing tool. Press-Connect ends may vary by design as found in Fig. 1.

3.1.11 *rated pressure, n*—the manufacturer’s recommended maximum in-service pressure at a defined temperature.

3.1.12 *re-test, n*—performed when the original test specimen leaks or separates during testing as a result of any cause that is not related to the design of the fittings being qualified.

3.1.13 *specimen, n*—a prepared assembly consisting of fittings assembled onto a preselected pipe or tube. The specimen is placed into a controlled environment and tested to determine if the assembly meets the specified test requirements.

3.1.14 *test pressure, n*—selected pressure used during testing, based upon the rated pressure of the fitting, pipe or tube.

3.1.15 *tube, n*—hollow thin-walled cylindrical product that is usually specified with respect to inside diameter (ID) and wall thickness.

4. Classification

4.1 Press-Connect fittings shall be classified into the following categories:

- 4.1.1 Material (see 4.2).
- 4.1.2 Rated operating pressure (see 4.3).
- 4.1.3 Elastomeric Seals (see 4.4).

4.2 Fittings shall be made from one or more of the following material grades:

- 4.2.1 *Grade A*—Carbon steel.
- 4.2.2 *Grade B*—Stainless steel.
- 4.2.3 *Grade C*—Copper and Copper-Alloy.
- 4.2.4 *Grade D*—Copper-nickel.
- 4.2.5 *Grade E*—Brass.

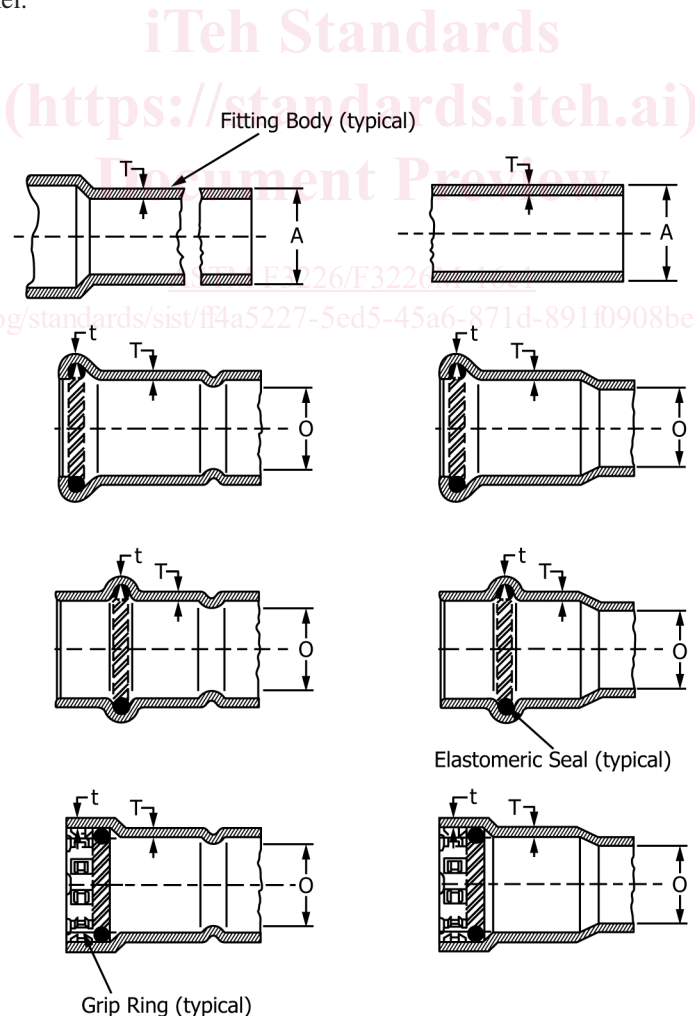


FIG. 1 Metallic Press-Connect Fitting Joints (Typical, But Not Limited To)

4.3 The fittings rated pressure shall be one of the following classes:

- 4.3.1 *Class 1*—100 psi (0.69 MPa) maximum.
- 4.3.2 *Class 2*—200 psi (1.38 MPa) maximum.
- 4.3.3 *Class 3*—300 psi (2.07 MPa) maximum.

4.4 Elastomeric seals:

- 4.4.1 *Type 1*—Ethylene Propylene Diene Monomer (EPDM).
- 4.4.2 *Type 2*—Hydrogenated Nitrile Butadiene Rubber (HNBR).
- 4.4.3 *Type 3*—Fluoro-Elastomer or Synthetic Fluorinated Rubber (FKM).

NOTE 1—When multiple components resulting in more than one material grade are specified within an assembly, the combination of grades used shall be galvanically compatible.

NOTE 2—Rated pressures may differ within the size range being qualified. Pressures indicated are at ambient temperature.

5. Ordering Information

5.1 Orders under this specification shall include the following:

- 5.1.1 ASTM designation, title, number, and year of issue;
- 5.1.2 Quantity of fittings;
- 5.1.3 Size;

5.1.3.1 Nominal pipe size (NPS) and wall thickness (schedule).

5.1.3.2 Tube size, outside diameter (OD) (actual or nominal) and wall thickness (dimension in decimal fraction of inches or type – K, L, M).

5.1.4 Material;

5.1.5 Class (operating pressure rating);

5.1.6 Configuration (elbow, cross, union, coupling, etc.);

5.1.7 Supplementary requirements, if any;

5.1.8 Other requirements agreed to between the purchaser and the manufacturer; and

5.1.9 Inspection and acceptance as agreed upon between the purchaser and the supplier.

5.2 *Optional Ordering Requirements:*

5.2.1 Certification (see Section 15).

6. Materials and Manufacture

6.1 *Material*—Material(s) shall conform to a nationally recognized standard or may be other materials as agreed to between the manufacturer and the purchaser.

6.1.1 Fittings may be manufactured from wrought bars, forgings, castings, pipe, or tube.

6.2 *Carbon Steel Fittings:*

6.2.1 Carbon steel fittings shall be made from material meeting the requirements of Specifications **A53/A53M**, Type E and S, **A135/A135M**, or **A795/A795M**.

6.3 *Stainless Steel Fittings:*

6.3.1 Stainless steel fittings shall be made from material meeting the requirements of Specifications **A312/A312M**, **A269**, or **A276**.

6.4 *Copper and Copper-Alloy Fittings:*

6.4.1 Wrought copper fittings shall be made from material meeting the requirements of Specifications **B584** or **B88**.

6.4.2 Cast coppers alloy fittings shall be made from material meeting the requirements of Specifications **B584** or **B62**.

6.5 *Copper-Nickel Fittings:*

6.5.1 Copper-nickel fittings shall be made from material meeting the requirements of Specifications **B466/B466M** or **B467**.

6.6 *Brass Fittings:*

6.6.1 Machined brass fittings shall be made from material meeting the requirements of Specifications **B140/B140M**, **B16/B16M**, **B124/B124M**, **B371/B371M**, or **B967/B967M**.

6.6.2 Forged brass fittings shall be made from material meeting the requirements of Specification **B283**.

6.7 *Flow of Grain*—If machined from hot- or cold-drawn bars fittings shall have their longitudinal axis parallel to the longitudinal axis of the bar with at least the center one third of the bar removed during the manufacturing process unless testing shows the center material to be free of injurious defects.

6.8 *Material Quality*—Material shall be of such quality and purity that the finished product shall have the properties and characteristics to meet the performance requirements of this specification.

NOTE 3—The term “recovered materials” is interpreted as those materials that have been collected or recovered from solid waste and reprocessed to become a source of raw material, as opposed to extra virgin raw materials.

6.9 *Seal Materials*—Seals shall be as specified in **4.4**.

6.9.1 Seal materials shall meet the minimum property and test requirements specified in Classifications **D2000**.

6.9.2 Only seal lubricants as specified by the manufacturer shall be used.

6.10 *Surface Applications and Coatings*—Surface applications and coatings if applicable, shall be applied and tested in accordance with a nationally recognized standard or may be other materials as agreed to between the manufacturer and the purchaser.

6.11 *Fabrication*—If fabricated from two or more parts, the components may be welded or brazed.

6.11.1 Welding procedure qualification and welding operator performance qualification shall be in accordance with ASME Section IX.

6.11.1.1 The welding procedure qualification test shall duplicate the joint configuration to be used in production.

6.11.2 Taper pipe threads shall conform to ASME B1.20.1.

6.11.3 Brazed copper connections shall conform to ANSI/AWS A5.8M/A5.8 and AWS B2.2/B2.2M.

6.12 *Processing Stainless Steel Forgings*—Austenitic stainless steel components manufactured by hot forge or other sensitizing processes shall be solution annealed and certified free of intergranular precipitation. Practice **A262** shall be used to evaluate carbide precipitation in stainless steels.

<https://standards.iteh.ai/catalog/standards/sist/f4a5227-5ed5-45a6-871d-891f0908bea8/astm-f3226-f3226m-16e1>

7. Performance Requirements

7.1 *Testing Requirements*—Fittings Shall be subjected to the standard performance tests specified in Section **13**.

7.1.1 Specimens can be reused for other primary tests as long as all requirements herein are complied with for each test.

7.1.2 Tests shall be repeated any time changes are made in the design, material, or manufacturing process, which in the opinion of the purchaser, may degrade performance.

7.2 *Intermixing of Subcomponents*—The intermixing by the purchaser of subcomponents of the same design, but of different brands or trade names, is not permitted.

7.3 *Qualification Requirements*—Testing shall use specimens of the same type, grade (or combination of grades), and class. The pipe or tube selected for the technical qualification to this specification shall meet the requirement specified in **7.3.3**. Technical qualification of the assemblies shall be based upon successful completion of all required testing. Each design is qualified for use with the pipe or tube material and the minimum to maximum wall thickness tested or extended by interpolation (see **7.3.1** and **7.3.2**).

7.3.1 Through reasonable interpolations between the sizes tested, all other sizes within the same type, grade (or combination of grades), and class, will be considered acceptable if the specimens pass all of the testing requirements specified by the purchaser. Extrapolation is not acceptable.

7.3.2 Acceptance of tees, elbows, and other shapes within the same class, may be accomplished by parametric analysis (see **7.3.2.1**) based on the acceptance of couplings, as agreed to between the manufacturer and the purchaser.

7.3.2.1 If tees, elbows, and other shapes are made from a different raw material form than the coupling (for example, tees and elbows manufactured from castings versus couplings manufactured from solid bar or round tube), this alternate material form shall undergo the same test regimen as the coupling. Once this is complete, parametric analysis may be used to qualify the remainder of the shapes as agreed to between the purchaser and the manufacturer.

7.3.3 Recommended pipe or tube for use with Press-Connect fittings shall be qualified throughout its wall thickness range.

7.3.4 Press-Connect fittings may incorporate other end configurations or features allowing for the transition when connecting to other piping and tube components (for example, bolted flanges, threaded, grooved, and others).

7.4 *Test Report*—Upon completion of testing, a test report shall be written and maintained on file during the life cycle of the design. A copy of this report shall be made available upon request from the purchaser.

7.4.1 Any failure during testing shall be analyzed and the failure analysis (see 11.3.1 and 11.3.2) and corrective action shall be included in the test report.

7.4.2 A retest as specified in Section 11 may be allowed when failure of the original assembly occurs during testing. When retesting the failure analysis and corrective action shall be included in the test report as specified in 7.4.1.

7.5 *Test Equipment and Inspection Facilities*—The manufacturer shall ensure that test equipment and inspection facilities are of sufficient accuracy, quality, and quantity established and maintained to permit the performance of required inspections.

7.5.1 *Calibration System Requirements*—The manufacturer shall maintain a calibration system for all measuring and test equipment (M & TE).

7.5.1.1 Accuracy of the M & TE used to measure allowable variables during testing shall be within one third of the tolerances permitted (see 7.6).

7.6 *Test Conditions*—Unless otherwise specified in the testing procedures, the following tolerances shall be used to control conditions of the testing.

7.6.1 *Ambient Conditions*—When ambient is specified, standard ambient conditions shall be maintained at $25 \pm 10^{\circ}\text{C}$ ($77 \pm 18^{\circ}\text{F}$).

7.6.2 *Pressure*—Unless otherwise specified, the tolerance for the internal pressure applied to the test specimen during testing shall be maintained at $\pm 5\%$.

7.6.3 *Test Fluids*—Water and other test fluids compatible with the sealing elastomer may be used without affecting the validity of the test.

7.6.4 *Temperature*—Unless otherwise specified, the allowable tolerance for temperature applied to the test specimen during testing shall be $\pm 5^{\circ}\text{C}$ ($\pm 10^{\circ}\text{F}$).

7.7 *Pass or Fail Criteria*—Pass or fail criteria for each test shall be based upon meeting or exceeding the performance requirements specified in each test.

8. Dimensions

8.1 Dimensions:

8.1.1 Dimensions shall be as specified by the Table 1 or Table 2 and the manufacturer.

8.1.1.1 Dimensions specified in Table 1 shall be utilized for copper tube sized (CTS, Specification B88) Press-Connect fittings.

8.1.1.2 Dimensions specified in Table 2 shall be utilized for iron pipe sized (IPS, Specification A53/A53M) Press-Connect fittings.

9. Workmanship, Finish, and Appearance

9.1 *Machined Surfaces*—Machined surfaces shall be free from burrs, cracks, laps, or seams which would affect the suitability for the intended service.

9.1.1 All machined surfaces shall be 3.2- μm roughness, average (Ra) (125- $\mu\text{in. Ra}$) as specified in ASME B46.1 or duplicate of that qualified.

9.1.1.1 External surfaces that do not affect overall function shall be excluded from the requirement specified in 9.1.1.

9.2 *Un-Machined Surfaces*—Un-machined surfaces, such as forging or casting surfaces and bar stock flats, shall be free from scale, blisters, fins, folds, seams, laps, segregations, or cracks which may be injurious to personnel or equipment or affect performance.

TABLE 1 Tube

Nominal Tube Size	Outside Diameter A		Internal Diameter O	
	in.	[mm]	in.	[mm]
1/2	0.625	[15.90]	0.627	[15.93]
5/8	0.75	[19.05]	0.752	[19.09]
3/4	0.875	[22.25]	0.877	[22.28]
1	1.125	[28.63]	1.279	[28.65]
1 1/4	1.375	[34.98]	1.378	[35.00]
1 1/2	1.6525	[41.33]	1.628	[41.35]
2	2.125	[54.03]	2.128	[54.05]
2 1/2	2.625	[66.73]	2.628	[66.75]
3	3.125	[79.43]	3.128	[79.45]
4	4.125	[104.83]	4.128	[104.85]