

IAPMO PS 51-2021



Industry Standard for
**Expansion Joints and Flexible
Expansion Joints for DWV Piping
Systems**



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Published by

International Association of Plumbing and Mechanical Officials (IAPMO)

4755 East Philadelphia Street, Ontario, California, 91761, USA

1-800-854-2766 • 1-909-472-4100

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Printed in the United States of America

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Preface

This is the seventh edition of IAPMO PS 51, Expansion Joints and Flexible Expansion Joints for DWV Piping Systems. This Standard supersedes IAPMO PS 51-2016, Expansion Joints and Flexible Expansion Joints for DWV Piping Systems. The previous editions of this standard are: October 2020, October 2016, January 2013, 1998, 1997, 1992

This Standard was developed by the IAPMO Standards Review Committee (SRC) in accordance with the policies and procedures regulating IAPMO industry standards development, Policy S-001, Standards Development Process. This Standard was approved as an IAPMO Industry Standard on January 11, 2021.

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 - (a) *standard designation (number);*
 - (b) *relevant section, table, or figure number, as applicable;*
 - (c) *wording of the proposed change, tracking the changes between the original and the proposed wording; and*
 - (d) *rationale for the change.*
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 - (a) *the edition of the standard for which the interpretation is being requested;*
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IAPMO PS 51-2021

Expansion Joints and Flexible Expansion Joints for DWV Piping Systems

1 Scope

1.1 Scope

This Standard covers plastic, elastomeric, and metallic expansion joints and flexible expansion joints intended for use in drain, waste, and vent systems and specifies requirements for materials, physical characteristics, performance testing, and markings.

1.2 Alternative Materials

The requirements of this Standard are not intended to prevent the use of alternative materials or methods of construction provided such alternatives meet the intent and requirements of this Standard.

1.3 Terminology

In this Standard,

- (a) “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy to comply with the Standard;
- (b) “should” is used to express a recommendation, but not a requirement;
- (c) “may” is used to express an option or something permissible within the scope of the Standard; and
- (d) “can” is used to express a possibility or a capability.

Notes accompanying sections of the Standard do not specify requirements or alternative requirements; their purpose is to separate explanatory or informative material from the text. Notes to tables and figures are considered part of the table or figure and can be written as requirements.

1.4 Units of Measurement

SI units are the primary units of record in global commerce. In this Standard, the inch/pound units are shown in parentheses. The values stated in each measurement system are equivalent in application, but each unit system is to be used independently. All references to gallons are to U.S. gallons.

2 Reference Publications

This Standard refers to the following publications, and where such reference is made, it shall be to the current edition of those publications, including all amendments published thereto.

ASTM International

ASTM A48/A48M

Standard Specification for Gray Iron Castings

ASTM A536

Standard Specification for Ductile Iron Castings

ASTM B584

Standard Specification for Copper Alloy Sand Castings for General Applications

ASTM D412

Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers — Tension

ASTM D471

Standard Test Method for Rubber Property — Effect of Liquids

ASTM D573

Standard Test Method for Rubber — Deterioration in an Air Oven

ASTM D1149

Standard Test Methods for Rubber Deterioration — Cracking in an Ozone Controlled Environment

ASTM D1784

Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D2240

Standard Test Method for Rubber Property — Durometer Hardness

ASTM D2661

Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings

ASTM D2665

Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

ASTM D3965

Standard Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings

ASTM D6147

Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomer — Determination of Force Decay (Stress Relaxation) in Compression

3 Definitions and Abbreviations

3.1 Definitions

The following definitions shall apply in this Standard:

Blow holes — holes in casting due to air or gas in the metal or mold.

Cold shuts (Incomplete castings) — casting defects occurring when two streams of metal become so cold that they do not fuse together upon meeting.

Fins — projections on castings due to imperfect joints.

Expansion joint — an assembly designed to absorb movement including expansion and contraction of DWV pipe.

Flexible expansion joint — an assembly designed, with the addition of articulating ball joints on the ends, to absorb movement including expansion, contraction, and offset of DWV pipe.

3.2 Abbreviations

The following abbreviations shall apply in this Standard:

ABS — acrylonitrile-butadiene-styrene

DWV — drain, waste, and vent

PVC — polyvinylchloride

UNS — unified numbering system

4 General Requirements

4.1 General

Expansion joints and flexible expansion joints shall

- (a) be free of defects that can adversely affect their functionality or cause leaks;
- (b) not restrict the flow capacity of the drainage system; and
- (c) not obstruct the flow.

4.2 Plastic Expansion Joints and Plastic Flexible Expansion Joints

4.2.1 General

Plastic expansion joints and flexible expansion joints shall be made from

- (a) a single virgin compound procured from a single manufacturer; or
- (b) a blend of virgin compound and clean reworked material generated from the manufacturer's own production of expansion joints.

Expansion joints containing reworked material shall comply with all of the applicable requirements of this Standard.

4.2.2 ABS

4.2.2.1 Compounds

ABS compounds used for manufacturing expansion joints shall comply with cell classification 32222 for DWV fittings, as specified in ASTM D3965.

4.2.2.2 Dimensions

ABS expansion joints shall comply with the applicable dimensional requirements of ASTM D2661.

4.2.3 PVC

4.2.3.1 Compounds

PVC compounds used for manufacturing expansion joints and flexible expansion joints shall comply with cell classification 12454 or 14333, as specified in ASTM D1784.

4.2.3.2 Dimensions

PVC expansion joints and flexible expansion joints shall comply with the applicable dimensional requirements of ASTM D2665.

4.3 Metals

4.3.1 Cast Iron

Cast iron used for manufacturing expansion joints shall be Class 25 grey iron as specified in ASTM A48/A48M.

4.3.2 Ductile Iron

Ductile iron used for manufacturing expansion joints and flexible expansion joints shall be a 60-42-10 ductile iron as specified in ASTM A536 or have a minimum of 415 MPa (60,000 psi) Tensile strength, and 290 MPa (42,000 psi) Yield strength.

4.3.3 Copper Alloys

Brass used for manufacturing expansion joints shall be copper alloys with UNS designations C83600, C83800, or C84400 as specified in ASTM B584.

4.3.4 Workmanship

Castings shall

- (a) be sound, free of blow holes, cold shuts, fins, and other imperfections;
- (b) have uniform wall thickness; and
- (c) be true to pattern.

4.4 Elastomeric Expansion Joints

4.4.1 General

Elastomeric components shall be free from pitting, cracks, air marks, porosity, and other imperfections that could affect its performance in service.

4.4.2 Materials

Elastomeric materials used for manufacturing expansion joints shall comply with the properties specified in Table 1.

4.5 Sealing Elements and Lubricants

4.5.1 Gaskets and parts used to effect sealing between moving parts shall not loosen or detach during handling and operation of the expansion joints.

4.5.2 When used, lubricants shall be suitable for the intended application.

4.6 Fasteners and Bolts

Metallic mechanical fasteners shall be made of 300 series stainless steel.

4.7 Travel Distance

4.7.1 Expansion joints and flexible expansion joints shall be capable expanding and contracting (i.e., travel distance) in accordance with the manufacturer's specifications.

4.7.2 Flexible expansion joints shall be capable of deflecting (in order to provide offset from one extreme to another) in accordance with the manufacturer's specifications.

4.8 Dimensions**4.8.1 Mechanically Fastened Expansion Joints**

Mechanically fastened expansion

- (a) joints shall fit properly over the pipe on which it is intended to be used; and
- (b) joint ends shall comply with the socket end dimensions specified in Table 2.

4.8.2 Expansion joint outlets shall not be smaller than the expansion joint inlets (i.e., expansion joints shall not reduce the size of the drainage system).

5 Testing Requirements

5.1 Tests for Plastic Piston Expansion Joints and Flexible Expansion Joints

5.1.1 General

The tests specified in Sections 5.1.2 to 5.1.4 shall be conducted only on plastic piston expansion joints that use rubber ring seals or similar devices to affect sealing.

5.1.2 Cycling Test for Plastic Piston Expansion Joints and Flexible Expansion Joints

5.1.2.1 Cold Cycling Test for Expansion Joints

The test specimen shall be subjected to 100 cycles from one extreme of the expansion range to the other at a test ambient temperature of $0 \pm 2^\circ\text{C}$ ($32 \pm 4^\circ\text{F}$). The cross head speed shall be approximately 508 mm/min (20 in/min).

5.1.2.2 Cold Cycling Test for Ball Joints

The test specimen with ball joints for offset shall have the ball joints deflected 100 cycles from one extreme of deflection to the other extreme of at a test ambient temperature of $0 \pm 2^\circ\text{C}$ ($32 \pm 4^\circ\text{F}$).

5.1.2.3 Hot Cycling Test for Expansion Joints

The test specified in Section 5.1.2.1 shall be conducted except that the test ambient temperature shall be $50 \pm 3^\circ\text{C}$ ($122 \pm 6^\circ\text{F}$).

5.1.2.4 Hot Cycling Test for Ball Joints

The test specified in Section 5.1.2.2 shall be conducted except that the test ambient temperature shall be $50 \pm 3^\circ\text{C}$ ($122 \pm 6^\circ\text{F}$).

5.1.3 Hydrostatic Pressure Test for Plastic Piston Expansion Joints and Flexible Expansion Joints

5.1.3.1 Test Procedure

The hydrostatic pressure test for plastic piston expansion joints and flexible expansion joints shall be conducted following completion of the cycling test specified in Section 5.1.2, as follows:

- (a) Assemble an expansion joint or flexible expansion joint and two pipe stubs approximately 150 mm (6 in) long jointed in accordance with the manufacturer's installation instructions.
- (b) Fit axial restraints to the test assembly.
- (c) Extend the expansion joint or flexible expansion joint to approximately the middle of its full expansion length.
- (d) Subject the test specimen to hydrostatic pressure of 100 kPa (15 psi) with water at $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$).
- (e) Maintain the pressure and temperature for at least 1 h.

5.1.3.2 Performance Requirement

There shall be no leakage.

5.1.4 Breakaway Force Test for Plastic Piston Expansion Joints and Flexible Expansion Joints

5.1.4.1 Test Procedure

The breakaway force test for plastic piston expansion joints and flexible expansion joints shall be conducted as follows:

- (a) Store, for at least 30 d and at ambient laboratory conditions, two expansion joints or flexible expansion joints, as follows:
 - (i) one untested expansion joint or flexible expansion joint; and
 - (ii) one expansion joint or flexible expansion joint that has successfully complied with the test in Section 5.1.3.
- (b) Position each expansion joint or flexible expansion joint at approximately the middle of the expansion range during the storage period. Where ball joints exist as a part of the flexible expansion joint the ball joints shall be at the neutral or non-deflected position
- (c) At the end of the storage period, apply a force to move each test specimen from one extreme of the expansion range to the other (i.e., the breakaway force). Ensure that the force is applied along the longitudinal axis of the expansion joint. For ball joints apply a bending moment to force the ball joint to move from the neutral position to the extreme deflected position in one direction to the other (i.e. the deflection moment).

5.1.4.2 Performance Requirement

The force required to move the expansion joint from one extreme of the expansion range to the other shall not exceed the forces specified in Table 3. The deflection moment required to deflect the ball joints shall not exceed the moments specified in Table 6.

5.2 Tests for Elastomeric Mechanically Fastened Expansion Joints

5.2.1 General

The tests specified in Sections 5.2.2 and 5.2.3 shall be conducted on elastomeric mechanically restrained expansion joints using pipe stubs that comply with the applicable nationally recognized standards.

5.2.2 Expansion Test for Elastomeric Expansion Joints

5.2.2.1 Test Procedure

The expansion test for elastomeric expansion joints shall be conducted as follows:

- (a) Assemble an elastomeric expansion joint and two pipe stubs (see Section 5.2.1) approximately 150 mm (6 in) long jointed in accordance with the manufacturer's installation instructions.
- (b) Fit axial restraints to the test assembly.
- (c) Measure the length of the expansion joint while in its relaxed length.
- (d) Place the assembly in a vertical position on a tensile machine in its relaxed length.
- (e) Compress it from its relaxed length in accordance with Table 4.
- (f) Return the expansion joint to its relaxed length.
- (g) Extend it from its relaxed length in accordance with Table 4.

5.2.2.2 Performance Requirements

There shall be no slipping, tearing, cracking, or any other failure.