



Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) IPS Dimensioned Pressure Pipe¹

This standard is issued under the fixed designation F2969; 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.

1. Scope

1.1 This specification covers acrylonitrile-butadiene-styrene (ABS) IPS dimensioned pressure pipe produced by single extrusion in standard thermoplastic pipe dimension ratios and pressure rated for water (see [Appendix X1](#)). Included are criteria for classifying ABS plastic pipe materials and ABS plastic pipe, a system of nomenclature for ABS plastic pipe, and requirements and test methods for materials, workmanship, dimensions, sustained pressure, burst pressure, and extrusion quality. Methods of marking are also given.

1.2 The products covered by this specification are intended for use with the distribution of pressurized liquids, which are chemically compatible with the piping materials. Consult with the manufacturer and local building codes before use in other applications. Due to inherent hazards associated with testing components and systems with compressed air or other compressed gases some manufacturers do not allow pneumatic testing of their products. Consult with specific product/component manufacturers for their specific testing procedures prior to pneumatic testing.

NOTE 1—Pressurized (compressed) air or other compressed gases contain large amounts of stored energy which present serious safety hazards should a system fail for any reason.

NOTE 2—Exposure to ultraviolet radiation over a long period of time may affect the physical properties of ABS pipe. Consult the manufacturer for recommendations for handling, storage, and installations that are not protected by insulation.

1.3 Pipe meeting the requirements of this standard is not compatible with DWV fittings. The ABS pipe covered in this standard is intended for pressure service and it shall be joined to pressure fittings. Non-pressure fittings, such as DWV fittings from any material (ABS, PVC, CPVC, etc.) are not acceptable for pressure applications.

1.4 The text of this specification references notes, footnotes, and appendixes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.61 on Water. Current edition approved Aug. 1, 2012. Published September 2012. DOI: 10.1520/F2969-12

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.6 *The following safety hazards caveat pertains only to the test method portion, Section 7, of this specification: 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.*

2. Referenced Documents

2.1 ASTM Standards:²

- D618 Practice for Conditioning Plastics for Testing
- D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
- D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
- D3965 Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings
- F412 Terminology Relating to Plastic Piping Systems

2.2 Federal Standard:³

- Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.3 Military Standard:³

- MIL-STD-129 Marking for Shipment and Storage

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.

³ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS

2.4 *NSF International Standards:*⁴

NSF/ANSI Standard No. 14 for Plastic Piping Components and Related Materials

NSF/ANSI Standard No. 61 for Drinking Water System Components—Health Effects

3. Terminology

3.1 *General*—Definitions are in accordance with Terminology **F412**. Abbreviations are in accordance with Terminology **D1600**, unless otherwise indicated. The abbreviation for acrylonitrile-butadiene-styrene plastic is ABS.

4. Materials

4.1 *General*—Acrylonitrile-butadiene-styrene plastics used to make pipe meeting the requirements of this specification are categorized by means of two criteria: basic short-term properties, and long-term hydrostatic strength. Sections **4.2** and **4.3** respectively define these categories.

4.2 *Basic Materials – Short-term Properties*—This specification covers ABS pipe made from ABS plastic materials meeting or exceeding requirements for ABS 42222 as defined in Specification **D3965**.

4.3 *Long-Term Hydrostatic Strength*—This specification covers ABS pipe made from ABS plastic material having an established 73°F (23°C) hydrostatic design basis of 2500 psi (17.24 MPa) or greater in accordance with Test Method **D2837**.

4.4 *Rework Material*—The manufacturers shall use only their own clean rework pipe material and the pipe produced shall meet all the requirements of this specification.

4.5 *Potable Water Requirement*—Products intended for contact with potable water shall be evaluated, tested and certified for conformance with NSF/ANSI Standard No. 61 or the health effects portion of NSF/ANSI Standard No. 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

5. Pipe Classification

5.1 *General*—This specification covers ABS pipe produced by single extrusion.

5.2 *Standard Pipe Dimension Ratios (SDR)*—This specification covers ABS pipe in six standard dimension ratios, namely, 9, 11, 13.5, 17, 21, and 26. These are referred to as SDR9, SDR11, SDR13.5, SDR17, SDR21, and SDR26, respectively. The pressure rating is uniform for all nominal pipe sizes for a given ABS pipe material and SDR (see **Table XI.1**, Appendix).

6. Requirements

6.1 *Workmanship*—The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

6.2 Dimensions and Tolerances:

6.2.1 *Outside Diameters*—The outside diameters and tolerances shall be as shown in **Table 1** when measured in accordance with Test Method **D2122**. The tolerances for out-of-roundness shall apply only on pipe prior to shipment.

6.2.2 *Wall Thickness*—The wall thicknesses and tolerances shall be as shown in **Table 2** when measured in accordance with Test Method **D2122**.

6.3 *Sustained Pressure*—The pipe shall not fail, balloon, burst, or weep as defined in Test Method **D1598** at the test pressures given in **Table 3** when tested in accordance with **7.5**.

6.4 *Burst Pressure*—The minimum burst pressures for ABS plastic pipe shall be as given in **Table 4**, when determined in accordance with **7.6**.

7. Test Methods

7.1 *Conditioning*—Condition the test specimens at 73 ± 3.6°F (23 ± 2°C) and 50 ± 10 % relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice **D618** for those tests where conditioning is required.

7.2 *Test Conditions*—Conduct the tests in the Standard Laboratory Atmosphere of 23 ± 2°C and 50 ± 10 % relative humidity, unless otherwise specified in the test methods or in this specification.

7.3 *Sampling*—The selection of the sample or samples of pipe shall be as agreed upon by the purchaser and the seller. In case of no prior agreement, any sample selected by the testing laboratory shall be deemed adequate.

7.3.1 *Test Specimens*—Not less than 50 % of the test specimens required for any pressure test shall have at least a part of the marking in their central sections. The central section is that portion of pipe which is at least one pipe diameter away from an end closure.

7.4 *Dimensions and Tolerances*—Use any length of pipe to determine the dimensions. Measure in accordance with Test Method **D2122**.

TABLE 1 Outside Diameters and Tolerances for ABS IPS Dimensioned Pressure Pipe, in.

Nominal Pipe Size	Outside Diameter	Tolerances	
		Maximum Out-of-Roundness	
		Average	(Maximum – Minimum Diameter)
1/8	0.405	±0.004	0.015
1/4	0.540	±0.004	0.015
3/8	0.675	±0.004	0.030
1/2	0.840	±0.004	0.030
3/4	1.050	±0.004	0.030
1	1.315	±0.005	0.030
1-1/4	1.660	±0.005	0.030
1-1/2	1.900	±0.006	0.060
2	2.375	±0.006	0.060
3	3.500	±0.008	0.060
4	4.500	±0.009	0.100
6	6.625	±0.011	0.100
8	8.625	±0.015	0.150
10	10.750	±0.015	0.150
12	12.750	±0.015	0.150

⁴ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, <http://www.nsf.org>.

TABLE 2 Wall Thicknesses and Tolerances for ABS IPS Dimensioned Pressure Pipe

Nominal Pipe Size, in.	Wall Thickness ^{A,B} , in.							
	SDR26		SDR21		SDR17		SDR13.5	
	Min	Tolerance	Min	Tolerance	Min	Tolerance	Min	Tolerance
1/8	...	...	...	...	...	...	0.060	+0.020
1/4	...	...	...	...	...	...	0.060	+0.020
3/8	...	...	...	...	...	...	0.060	+0.020
1/2	...	...	...	...	0.060	+0.020	0.062	+0.020
3/4	...	...	0.060	+0.020	0.062	+0.020	0.078	+0.020
1	0.060	+0.020	0.063	+0.020	0.077	+0.020	0.097	+0.020
1-1/4	0.064	+0.020	0.079	+0.020	0.098	+0.020	0.123	+0.020
1-1/2	0.073	+0.020	0.090	+0.020	0.112	+0.020	0.141	+0.020
2	0.091	+0.020	0.113	+0.020	0.140	+0.020	0.176	+0.021
3	0.135	+0.020	0.167	+0.020	0.206	+0.025	0.259	+0.031
4	0.173	+0.021	0.214	+0.026	0.265	+0.032	0.333	+0.040
6	0.255	+0.031	0.316	+0.038	0.390	+0.047	0.491	+0.059
8	0.332	+0.040	0.410	+0.049	...	...	...	...
10	0.413	+0.050	0.511	+0.061	...	...	...	...
12	0.490	+0.059	0.606	+0.073	...	...	...	...

Nominal Pipe Size, in.	Wall Thickness ^{A,B} , in.			
	SDR11		SDR9	
	Min	Tolerance	Min	Tolerance
1/8	0.060	+0.020	0.045	+0.020
1/4	0.060	+0.020	0.060	+0.020
3/8	0.061	+0.020	0.075	+0.025
1/2	0.076	+0.020	0.093	+0.024
3/4	0.095	+0.020	0.117	+0.025
1	0.120	+0.020	0.146	+0.024
1-1/4	0.151	+0.020	0.184	+0.024
1-1/2	0.173	+0.021	0.211	+0.026
2	0.216	+0.026	0.264	+0.032
3	0.318	+0.039	0.389	+0.048
4	0.409	+0.049	0.500	+0.060
6	0.602	+0.073	0.736	+0.089
8	...	...	...	...
10	...	...	...	...
12	...	...	...	...

^AThe minimum is the lowest wall thickness of the pipe at any cross section. The maximum permitted wall thickness, at any cross section, is the minimum wall thickness plus the stated tolerance. All tolerances are on the plus side of the minimum requirement.

^BThe minimum wall thickness has been arbitrarily increased to 0.060 in. (1.52 mm) when the wall thickness calculated according to the definition for standard dimension ratio in **F412** is less than 0.060 in. (1.52 mm).

TABLE 3 Sustained Pressure Test Conditions for Water at 73°F (23°C) for ABS IPS Dimensioned Pressure Pipe

Standard Dimension Ratio	Pressure ^A Required for Test	
	psi	MPa
9	675	4.65
11	540	3.72
13.5	430	2.96
17	340	2.34
21	270	1.86
26	215	1.48

^AA fiber stress of 2700 psi (18.6 MPa) is used to derive these test pressures.

TABLE 4 Burst Pressure Requirements for Water at 73°F (23°C) for ABS IPS Dimensioned Pressure Pipe

Standard Dimension Ratio	Min Burst Pressure ^A	
	psi	MPa
9	1500	10.34
11	1200	8.27
13.5	960	6.62
17	750	5.17
21	600	4.14
26	480	3.31

^AA fiber stress of 6000 psi (41.4 MPa) is used to derive these test pressures.

7.5 Sustained Pressure Test—Select the test specimens at random. Test individually with water at the internal pressures given in **Table 3**, six specimens of pipe, each specimen at least ten times the nominal diameter in length, but not less than 10 in. (250 mm) or more than 3 ft (920 mm) between end closures and bearing the permanent marking on the pipe. Maintain the specimens at the pressure indicated for a period of 1000 h. Hold the pressure as closely as possible, but within ± 10 psi (± 70 kPa). Condition the specimens at the test temperature of 73°F (23°C) to within ± 3.6 °F (± 2 °C). Maintain the test temperature at 73 ± 3.6 °F (23 ± 2 °C). Test in accordance with Test Method **D1598**, except maintain the

pressure at the values given in **Table 3** for 1000 h. Failure of two of the six specimens tested shall constitute failure in the test. Failure of one of the six specimens tested is cause for retest of six additional specimens. Failure of one of the six specimens tested in retest shall constitute failure in the test. Evidence of failure of the pipe shall be as defined in Test Method **D1598**.

7.6 Burst Pressure—Determine the minimum burst pressure with at least five specimens in accordance with Test Method **D1599**. The time of testing each specimen shall be between 60 and 70 s.

8. Retest and Rejection

8.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) shall be conducted again only by agreement between the purchaser and the seller. Under such agreement, minimum requirements shall not be lowered, changed, or modified, nor shall specification limits be changed. If upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

9. Marking

9.1 *Quality of Marking*—The marking shall be applied to the pipe in such a manner that it remains legible (easily read) after installation and inspection.

9.2 Marking on the pipe shall include the following, spaced at intervals of not more than 5 ft:

9.2.1 Nominal pipe size (for example, 2 in.).

9.2.2 The ABS material designation and cell classification (for example ABS 42222).

9.2.3 Standard pipe dimension ratio in accordance with 5.2 (for example, SDR17).

9.2.4 The pressure rating in pounds per square inch for water at 73°F (23°C) shown as the number followed by psi (for example, 125 psi at 73°F).

9.2.5 This designation “ASTM F2969,” with which the pipe complies.

9.2.6 Manufacturer’s name (or trade mark) and code.

9.2.7 Pipe intended for the transport of potable water shall also include the seal or mark of the laboratory making the evaluation for this purpose, spaced at intervals specified by the laboratory.

10. Quality Assurance

10.1 When the product is marked with this designation, F2969, the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

11. Keywords

11.1 ABS; HDB; plastic pipe; pressure piping; SDR

SUPPLEMENTARY REQUIREMENTS

GOVERNMENT / MILITARY PROCUREMENT

These requirements apply *only* to Federal/Military procurement, not domestic sales or transfers.

S1. Responsibility for Inspection

S1.1 Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1—In U.S. Federal contracts, the contractor is responsible for inspection.

S2. Packaging and Marking for U.S. Government Procurement

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier’s standard practice in a manner ensuring arrival at destina-

tion in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

NOTE S2—The inclusion of U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this document.

APPENDIX

(Nonmandatory Information)

X1. PRESSURE RATING

X1.1 The hydrostatic design basis obtained in accordance with Test Method **D2837** is used to pressure rate ABS plastic pipe.

X1.2 Typical pressure ratings for ABS water pipe with various SDR values meeting the requirements of this standard

are shown in **Table X1.1**. These pressure ratings are obtained using **Eq X1.1**, shown below.

$$PR = 2(HDB)(DF)/(SDR - 1) \quad (X1.1)$$

where:

HDB = basis at 73°F (23°C) per Test Method **D2837**, defined as 2500 psi in this standard,

PR = pressure rating at 73°F (23°C), psig,

SDR = standard dimension ratio, and

DF = design factor, recommended as 0.5 in this standard.

NOTE X1.1—Under some conditions, such as pressure cycling, higher temperature, more aggressive environment, or handling and installation quality, all of which may significantly reduce pipe durability, a more conservative design factor or design coefficient should be chosen.

TABLE X1.1 Pressure Ratings for ABS Water Pipe (HDB of 2500 psi @ 73°F ABS IPS Dimensioned Pressure Pipe^A)

SDR	9	11	13.5	17	21	26
PR, psi	315	250	200	160	125	100
(MPa)	(2.17)	(1.72)	(1.38)	(1.10)	(0.86)	(0.69)

^AThese pressure ratings do not apply to threaded pipe.

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