



NSF Standard
American National Standard

NSF/ANSI 14-2024

Plastics Piping System Components and Related Materials



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NSF/ANSI 14-2024

**NSF Standard
American National Standard
for Water –**

Plastics Piping System Components and Related Materials

Standard Developer
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Abbreviations

The following table is provided as a reference for unit abbreviations for common forms of measurement used within NSF documents.

Time	second	s
	minute	min
	hour	h
	day	d
	week	wk
	month	mo
	year	yr
Length	inch	in.
	foot	ft
	yard	yd
	micrometer	µm
	nanometer	nm
	millimeter	mm
	centimeter	cm
	meter	m
	kilometer	km
Liquid measure	milliliter	mL
	liter	L
	liters per day	LPD
	liters per minute	LPM
	ounce	oz
	pint	pt
	quart	qt
	gallon	gal
	gallons per minute	GPM
	gallons per day	GPD
Weight	microgram	µg
	picogram	pg
	nanogram	ng
	milligram	mg
	centigram	cg
	gram	g
	kilogram	kg
	pound	lb
	ton	t
	metric ton	mt

Miscellaneous	pounds per square inch	psi
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Table of contents

1	General	1
1.1	Purpose	1
1.2	Scope	1
1.3	Materials, design, and construction	1
2	Normative references	1
2.1	Normative references for plastic pipe and related components	2
2.2	Normative references for compounds and other materials	9
2.3	International and other normative references	10
3	Definitions	11
4	Requirements for plastic piping system components and related materials	16
4.1	Materials	16
4.2	Physical and performance requirements	16
4.3	Potable water requirements	17
4.4	Special engineered products	17
4.5	Marking requirements	17
4.6	Quality assurance	17
5	Physical and performance requirements	17
5.1	General	17
5.2	Long-term strength of plastic pipe	17
5.3	Requirements for PVC resins	18
5.4	Critical dimensions	18
5.5	PVC ingredients	18
5.6	Monitoring	18
5.7	Chlorine resistance – Oxidative equivalency requirements	18
5.8	Chlorine resistance – Equivalency for polyethylene compound modifications	19
5.9	Fittings and valves	20
6	Special engineered product requirements	21
6.1	General	21
6.2	Special engineered specifications	21
7	Requirements for potable water plastic piping system components and related materials	22
7.1	General	22
7.2	Requirements for lead	22
7.3	Phthalates and phthalate plasticizers	22
7.4	Requirements for PVC generic ingredients	22
7.5	Requirements for other PVC ingredients	23
7.6	Monitoring	23

8	Marking requirements	24
8.1	General	24
8.2	Pipe	24
8.3	Fittings and appurtenances	24
8.4	Thread compounds, sealants, gasket lubricants, solvent cement, and adhesives	24
8.5	Special engineered products	25
8.6	Ingredients	25
9	Quality assurance	25
9.1	General	25
9.2	Start-up and qualification	25
9.3	Generic ingredients	26
9.4	Verification of the calibration of equipment	26
9.5	Quality assurance records	26
9.6	Production code identification	26
9.7	Number of test specimens	27
9.8	Formulation verification for solvent cements and primers	27
9.9	Marking verification requirements	27
9.10	Product-specific quality assurance requirements	28
	Informative Annex 1 References	58
	Informative Annex 2 Abbreviations	61

Foreword²

The purpose of this standard is to establish minimum physical, performance, and health effects requirements for plastics piping system components and related materials.

This edition of the standard contains the following revisions:

- **Issue 140**

This revision adds the verification frequency for packaging label content to Table [9.1](#).

- **Issue 141**

This revision updates the wall thickness testing frequency in Table [9.18](#) from 24 h to weekly in order to harmonize with similar tables.

- **Issue 142**

This revision updates normative references in Section [2](#) and Table [9.38](#).

- **Issue 143**

This revision changes the locations and order of footnotes in Table [9.13](#) to clarify that the impact test at 22.8 °C (73 °F) does not apply solely to products certified to ASTM D2241.

- **Issue 144**

This revision adds a reference for ASTM F3497 to Section [2.1](#) and associated text in Section [5.7](#). It also clarifies the source of the EFT calculation for metallic composite pipe in Section [5.7.3](#).

- **Issue 145**

This revision updates Table [9.11a](#) to reflect changes to CSA B137.1:23.

- **Issue 146**

This revision updates Tables [9.30a](#), [9.30b](#), and [9.31](#) to allow burst pressure testing to be substituted by ring tensile testing in order to harmonize with AWWA C900 and UL 1285.

- **Issue 147**

This revision updates Table [9.11a](#) to allow substitutions for ring tensile testing in order to harmonize with AWWA C906 and ASTM F714.

² The information contained in this foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.

- **Issue 148**

This revision removes a normative reference in Section [2.1](#), adds a definition for [specimen](#) to Section [3](#), corrects language to conform to ANSI publishing guidelines in Section [4.1](#), adds a footnote to Table [9.20](#), and updates product standards in Tables [9.13](#), [9.14](#), [9.39](#), and [9.40](#).

- **Issue 149**

This revision updates footnotes in Table [9.31](#) to align the in-plant QC burst pressure requirements with AWWA C900.

- **Issue 150**

This revision adds a footnote to the heat reversion test in Table [9.21](#) to harmonize with ISO 15874 Part 7, *Conformity Assessment* and DIN 8078.

This standard was developed by the NSF Joint Committee on Plastics and RV Plumbing Components using the consensus process described by the American National Standards Institute.

This standard and the accompanying text are intended for voluntary use by certifying organizations, utilities, regulatory agencies, and/or manufacturers as a basis of providing assurances that adequate health protection exists for covered products. Product certification issues, including frequency of testing and requirements for follow-up testing, evaluation, enforcement, and other policy issues, are not addressed by this standard.

Suggestions for improvement of this standard are welcome. This standard is maintained on a continuous maintenance schedule and can be opened for comment at any time. Comments should be sent to: Chair, Joint Committee on Plastics and RV Plumbing Components at standards@nsf.org, or c/o NSF, Standards Department, PO Box 130140, Ann Arbor, Michigan 48113-0140, USA.

NSF/ANSI Standard for Water –

Plastics Piping System Components and Related Materials

1 General

1.1 Purpose

This standard establishes minimum physical, performance, and health effects requirements for plastic piping system components and related materials. These criteria were established for the protection of public health and the environment.

1.2 Scope

The physical, performance, and health effects requirements in this standard apply to thermoplastic and thermoset plastic piping system components including, but not limited to, pipes, fittings, valves, joining materials, gaskets, and appurtenances. The established physical, performance, and health effects requirements also apply to materials (resin or blended compounds) and ingredients used to manufacture plastic piping system components. This standard provides definitions and requirements for materials, ingredients, products, quality assurance (QA), marking, and recordkeeping. Plastic piping system components which are manufactured to one of the normative references in Section 2 and do not have integral connections specifically intended for plastic piping systems are not covered by this standard.

1.3 Materials, design, and construction

For plastic piping system components and materials cited by the references in Section 2, the materials, design, and construction requirements of this standard and the applicable product standard(s) in Section 2 shall apply. When materials, designs, or constructions are utilized that are not cited in Section 2, the plastic piping system components and related materials shall comply with the applicable requirements of this standard. Plastic piping system components and related materials that incorporate materials, designs, or constructions not cited in Section 2 shall be acceptable, provided that such plastic piping system components and related materials can be demonstrated to be at least equivalent in terms of strength, quality, effectiveness, durability, and safety to those that are cited in this standard.

2 Normative references

The following documents contain requirements, which by reference in this text, constitute requirements of this standard. At the time this standard was balloted, the editions listed below were valid. All documents are subject to revision, and parties are encouraged to investigate the possibility of applying the recent editions of the documents indicated below. The most recent published edition of the document shall be used for undated references.

2.1 Normative references for plastic pipe and related components

ASME A112.4.4-2017, *Plastic Push-Fit Drain, Waste, and Vent (DWV) Fittings*³

ASME A112.4.14-2022/CSA B125.14-22, *Manually Operated Shutoff Valves for Use in Plumbing Systems*³

ASME A112.14.1-2003 (R2022), *Backwater Valves*³

ASME A112.18.6-2017/CSA B125.6-17 (R2021), *Flexible Water Connectors*³

ASSE (Plumbing) 1049-2021, *Performance Requirements for Individual and Branch Type Air Admittance Valves for Chemical Waste Systems*⁴

ASSE (Plumbing) 1050-2021, *Performance Requirements for Stack Air Admittance Valves for Sanitary Drainage Systems*⁴

ASSE (Plumbing) 1051-2021, *Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems*⁴

ASSE (Plumbing) 1061-2020, *Performance Requirements for Push-Fit Fittings*⁴

ASTM B858-06 (2018), *Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys*⁵

ASTM D1785-21a, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120*⁵

ASTM D2235-22, *Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings*⁵

ASTM D2239-22, *Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter*⁵

ASTM D2241-24, *Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)*⁵

ASTM D2464-23, *Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80*⁵

ASTM D2466-23, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40*⁵

ASTM D2467-20, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80*⁵

ASTM D2513-20, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*⁵

ASTM D2564-20, *Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems*⁵

ASTM D2609-24, *Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe*⁵

ASTM D2661-21, *Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings*⁵

³ The American Society of Mechanical Engineers. Two Park Avenue, New York, NY 10016. <[asme.org](https://www.asme.org)>

⁴ ASSE International. 18927 Hickory Creek Drive, Suite 220, Mokena, IL 60448. <[asse-plumbing.org](https://www.asse-plumbing.org)>

⁵ ASTM International. 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959. <[astm.org](https://www.astm.org)>

ASTM D2665-24, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings*⁵

ASTM D2672-20e1, *Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement*⁵

ASTM D2683-20, *Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing*⁵

ASTM D2729-21, *Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings*⁵

ASTM D2737-22, *Standard Specification for Polyethylene (PE) Plastic Tubing*⁵

ASTM D2846/D2846M-24, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems*⁵

ASTM D2949-22, *Standard Specification for 3.25-in Outside Diameter Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings*⁵

ASTM D2996-23, *Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe*⁵

ASTM D2997-21, *Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe*⁵

ASTM D3034-24, *Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings*⁵

ASTM D3035-22, *Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter*⁵

ASTM D3138-21, *Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components*⁵

ASTM D3261-16, *Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing*⁵

ASTM D3350-21, *Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*⁵

ASTM D3517-24, *Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe*⁵

ASTM D5927-17, *Standard Classification System for and Basis for Specifications for Thermoplastic Polyester (TPES) Injection and Extrusion Materials Based on ISO Test Methods*⁵

ASTM F409-22, *Standard Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings*⁵

ASTM F437-24, *Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80*⁵

ASTM F438-23, *Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40*⁵

ASTM F439-24, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80*⁵

ASTM F441/F441M-23, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80*⁵

ASTM F442/F442M-23, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)*⁵

ASTM F477-14 (2021), *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe*⁵

ASTM F480-14 (2022), *Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR) SCH 40 and SCH 80*⁵

ASTM F493-22, *Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings*⁵

ASTM F628-23, *Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core*⁵

ASTM F656-21, *Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride)(PVC) Plastic Pipe and Fittings*⁵

ASTM F667/F667M-16 (2021), *Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings*⁵

ASTM F714-24, *Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter*⁵

ASTM F794-21, *Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter*⁵

ASTM F876-24, *Standard Specification for Crosslinked Polyethylene (PEX) Tubing*⁵

ASTM F877-24, *Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems*⁵

ASTM F891-24, *Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core*⁵

ASTM F894-24, *Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe*⁵

ASTM F949-20, *Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings*⁵

ASTM F1055-16a (2022), *Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing*⁵

ASTM F1281-24, *Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe*⁵

ASTM F1282-23a, *Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe*⁵

ASTM F1336-20, *Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings*⁵

ASTM F1412-22, *Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems*⁵

ASTM F1483-23, *Standard Specification for Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe*⁵

- ASTM F1488-14 (2019), *Standard Specification for Coextruded Composite Pipe*⁵
- ASTM F1498-08 (2020), *Standard Specification for Taper Pipe Threads 60° for Thermoplastic Pipe Fitting*⁵
- ASTM F1499-22, *Standard Specification for Coextruded Composite Drain, Waste, and Vent Pipe (DWV)*⁵
- ASTM F1504-21e1, *Standard Specification for Folded Poly(Vinyl Chloride) (PVC) Pipe for Existing Sewer and Conduit Rehabilitation*⁵
- ASTM F1673-10 (2021)e1, *Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems*⁵
- ASTM F1732-24, *Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer and Drain Pipe Containing Recycled PVC Material*⁵
- ASTM F1760-16 (2020), *Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content*⁵
- ASTM F1807-23, *Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring, or Alternate Stainless Steel Clamps, for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing*⁵
- ASTM F1866-23, *Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings*⁵
- ASTM F1924-19, *Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing*⁵
- ASTM F1960-23b, *Standard Specifications for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing*⁵
- ASTM F1970-23, *Standard Specification for Special Engineered Fittings, Appurtenances or Valves for Use in Poly(Vinyl Chloride) (PVC) or Chlorinated Poly(Vinyl Chloride)(CPVC) Systems*⁵
- ASTM F1974-23 (2020), *Standard Specification for Metal Insert Fittings for Polyethylene/Aluminum/Polyethylene and Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe*⁵
- ASTM F2080-23, *Standard Specification for Cold-Expansion Fittings with Metal Compression Sleeves for Crosslinked Polyethylene (PEX) Pipe and SDR9 Polyethylene Raised Temperature (PE-RT) Pipe*⁵
- ASTM F2098-18, *Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) to Metal Insert Fittings and Plastic Insert Fittings*⁵
- ASTM F2158-08 (2016), *Standard Specification for Residential Central-Vacuum Tube and Fittings*⁵
- ASTM F2159-23a, *Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring, or Alternate Stainless Steel Clamps for SDR9 Cross-Linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing*⁵
- ASTM F2263-14 (2019), *Standard Test Method for Evaluating the Oxidative Resistance of Polyethylene (PE) Pipe to Chlorinated Water*⁵
- ASTM F2306/F2306M-21, *Standard Specification for 300 mm to 1500 mm [12 in. to 60 in.] Annular Corrugated*

*Profile-Wall Polyethylene (PE) Pipe and Fittings for Non-Pressure Gravity-Flow Storm Sewer and Subsurface Drainage Applications*⁵

*ASTM F2389-23, Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems*⁵

*ASTM F2390-21, Standard Specifications for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent (DWV) Pipe and Fittings Having Post-Industrial Recycle Content*⁵

*ASTM F2434-19, Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Tubing*⁵

*ASTM F2599-22, Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner*⁵

*ASTM F2561-20, Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner*⁵

*ASTM F2618-21, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems*⁵

*ASTM F2619-20/F2619M-20, Standard Specification for High-Density Polyethylene (PE) Line Pipe*⁵

*ASTM F2623-24e1, Standard Specification for Polyethylene of Raised Temperature (PE-RT) Systems for Non-Potable Water Applications*⁵

*ASTM F2648/F2648M-23, Standard Specification for 50 mm to 1500 mm [2 in. to 60 in.] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications*⁵

*ASTM F2764/F2764M-23, Standard Specification for 6 to 60 in [150 to 1500 mm] Polypropylene (PP) Corrugated Double and Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications*⁵

*ASTM F2769-24, Standard Specification for Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems*⁵

*ASTM F2788/F2788M-21, Standard Specification for Metric and Inch-sized Crosslinked Polyethylene (PEX) Pipe*⁵

*ASTM F2806-23, Standard Specification for Acrylonitrile Butadiene Styrene (ABS) Plastic Pipe (Metric SDR PR)*⁵

*ASTM F2855-19 (2024), Standard Specification for Chlorinated Poly(Vinyl Chloride)/Aluminum Chlorinated Poly(Vinyl Chloride) (CPVC-AL-CPVC) Composite Pressure Tubing*⁵

*ASTM F2881/F2881M-21e1, Standard Specification for 12 to 60 in [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications*⁵

*ASTM F2929-17 (2021), Standard Specification for Crosslinked Polyethylene (PEX) Tubing of 0.070 in. Wall and Fittings for Radiant Heating Systems up to 75 psig*⁵

*ASTM F2969-12 (2020), Standard Specification for Acrylonitrile Butadiene Styrene (ABS) IPS Dimensioned Pressure Pipe*⁵

*ASTM F3128-23, Standard Specification for Poly(Vinyl Chloride) (PVC) Schedule 40 Drain, Waste, and Vent Pipe with a Cellular Core*⁵

ASTM F3240-19 (2023), *Standard Practice for Installation of Seamless Molded Hydrophilic Gaskets (SMHG) for Long-Term Watertightness of Cure-in-Place Rehabilitation of Main and Lateral Pipelines*⁵

ASTM F3253-24, *Standard Specification for Crosslinked Polyethylene (PEX) Tubing with Oxygen Barrier for Hot- and Cold-Water Hydronic Distribution Systems*⁵

ASTM F3347-23, *Standard Specification for Metal Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing*⁵

ASTM F3348-23a, *Standard Specification for Plastic Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing*⁵

ASTM F3371-22, *Standard Specification for Polyolefin Pipe and Fittings for Drainage, Waste, and Vent Applications*⁵

ASTM F3497-21, *Standard Test Method for Evaluating the Oxidative Resistance of Polypropylene (PP) Piping Systems to Hot Chlorinated Water*⁵

ASTM F3541-22, *Standard Practice for Sectional Repair of Existing Gravity Flow, Non-Pressure Pipelines and Conduits by Pushed or Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)*⁵

AWWA C900-22, *Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 in. Through 60 in. (100 mm Through 1500 mm)*⁶

AWWA C901-20, *Polyethylene (PE) Pressure Pipe and Tubing, 3/4 in. (19 mm) Through 3 in. (76 mm), for Water Service*⁶

AWWA C904-22, *Cross-Linked Polyethylene (PEX) Pressure Tubing, 1/2 in. (13 mm) Through 3 in. (76 mm), for Water Service*⁶

AWWA C906-21, *Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 65 in. [100 mm Through 1650 mm], for Waterworks*⁶

AWWA C907-23, *Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 in. Through 12 in. (100 mm Through 300 mm)*⁶

AWWA C909-22, *Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in. (100 mm) and Larger*⁶

AWWA C950-20, *Fiberglass Pressure Pipe*⁶

CSA B125.3:22, *Plumbing Fittings*⁷

CSA B137.1:23, *Polyethylene (PE) Pipe, Tubing, and Fittings for Cold Water Pressure Services*⁷

CSA B137.3:23, *Rigid Polyvinyl Chloride (PVC) Pipe and Fittings for Pressure Applications*⁷

CSA B137.4:23, *Polyethylene (PE) Piping Systems for Gas Services*⁷

CSA B137.5:23, *Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications*⁷

⁶ American Water Works Association. 6666 W Quincy Avenue, Denver, CO 80235. <awwa.org>

⁷ CSA Group. 178 Rexdale Boulevard, Toronto, ON M9W 1R3, Canada. <csagroup.org>

CSA B137.6:23, *Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot and Cold Water Distribution Systems*⁷

CSA B137.9:23, *Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe Systems*⁷

CSA B137.10:23, *Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Composite Pressure Pipe Systems*⁷

CSA B137.11:23, *Polypropylene (PP-R and PP-RCT) Pipe and Fittings for Pressure Applications*⁷

CSA B137.18:23, *Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications*⁷

CSA B137.19:23, *Crosslinked Polyethylene (PEX) Piping Systems for Gas Services*⁷

CSA B181.0-21, *Definitions, general requirements, and methods of testing for thermoplastic nonpressure piping*⁷

CSA B181.1:21, *Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste, and Vent Pipe and Pipe Fittings*⁷

CSA B181.2:21, *Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings*⁷

CSA B181.3:21, *Polyolefin and Polyvinylidene Fluoride (PVDF) Laboratory Drainage Systems*⁷

CSA B181.5:21, *Coextruded Acrylonitrile-Butadienestyrene/PolyvinylChloride (ABS/PVC) Drain Waste and Vent Pipe*⁷

CSA B182.1:21, *Plastic Drain and Sewer Pipe and Pipe Fittings*⁷

CSA B182.2:21, *PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings (PSM Type)*⁷

CSA B182.4:21, *Profile Polyvinylchloride (PVC) Sewer Pipe and Fittings*⁷

CSA B182.6:21, *Profile polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications*⁷

CSA B182.8:21, *Profile polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings*⁷

CSA B182.11:21, *Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings*⁷

CSA B182.13:21, *Profile Polypropylene (PP) Sewer Pipe and Fittings for Leak-Proof Sewer Applications*⁷

CSA B182.14:21, *Profile Steel Reinforced Polyethylene (SRPE) Storm Sewer Pipe and Fittings*⁷

CSA B182.15:21, *Profile Steel Reinforced Polyethylene (SRPE) Sewer Pipe and Fittings*⁷

ANSI/CSA/IGSHPA C448 Series-16 (R2021), *Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings*⁷

FM 1612-2022, *Examination Standard for Polyvinyl Chloride (PVC) Pipe and Fittings for Underground Fire Protection Service*⁸

FM 1613-2022, *Examination Standard for Polyethylene (PE) Pipe and Fittings for Underground Fire Protection Service*⁸

⁸ FM Approvals. 270 Central Avenue, Johnston, Rhode Island, 02919. <[fmapprovals.com](https://www.fmapprovals.com)>

IAPMO Z1157-2014e1, *Ball Valves*⁹

NSF/ANSI 358-1, *Polyethylene Pipe and Fittings for Water-Based Ground-Source "Geothermal" Heat Pump Systems*

NSF/ANSI 358-2, *Polypropylene Pipe and Fittings for Water-Based Ground-Source "Geothermal" Heat Pump Systems*

NSF/ANSI 358-3, *Cross-linked Polyethylene (PEX) Pipe and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems*

NSF/ANSI 358-4, *Polyethylene of Raised Temperature (PE-RT) Tubing and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems*

NSF/ANSI 359, *Valves for Crosslinked Polyethylene (PEX) Water Distribution Tubing Systems*

PPI TR-2 2023, *PPI PVC Range Composition Listing of Qualified Ingredients*¹⁰

ANSI/CAN/UL/ULC 1285:2022, *Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service*¹¹

ANSI/CAN/UL 1821:2019, *Thermoplastic Sprinkler Pipe and Fittings for Fire Protection Service*¹¹

2.2 Normative references for compounds and other materials

ASTM D1784-20, *Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds*⁵

ASTM D3222-21, *Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials*⁵

ASTM D3350-21, *Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*⁵

ASTM D3965-21, *Standard Classification System for and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings*⁵

ASTM D4066-13 (2019), *Standard Classification System for Nylon Injection and Extrusion Materials (PA)*⁵

ASTM D4067-23, *Standard Classification System and Basis for Specification for Reinforced and Filled Poly(Phenylene Sulfide) (PPS) Injection Molding and Extrusion Materials Using ASTM Methods*⁵

ASTM D4101-24, *Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials*⁵

ASTM D4396-22, *Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications*⁵

ASTM D5990-20a, *Standard Classification System and Basis for Polyketone Injection Molding and Extrusion Materials (PK)*⁵

ASTM D6394-21a, *Standard Classification System and Basis for Specification for Sulfone Plastics (SP)*⁵

⁹ International Association of Plumbing and Mechanical Officials. 4755 E Philadelphia St., Ontario, CA 91761. <iapmo.org>

¹⁰ Plastic Pipe Institute. 105 Decker Court, Suite 825, Irving, TX 75062. <plasticpipe.org>

¹¹ UL Solutions. 333 Pfingsten Road, Northbrook, IL 60062. <ul.com>

ASTM D6778-20, *Standard Classification System and Basis for Specification for Polyoxymethylene Molding and Extrusion Materials (POM)*⁵

IAPMO PS 36-2014e1, *Lead-Free Sealing Compounds for Threaded Joints*⁹

IAPMO PS 51-2021, *Expansion Joints and Flexible Expansion Joints for DWV Piping Systems*⁹

UL 157-96, *Standard for Gaskets and Seals*¹¹

2.3 International and other normative references

21 CFR Parts 1-99, *Food and Drugs* (Rev 6/24)¹²

21 CFR Parts 100-169, *Food and Drugs* (Rev 6/24)¹²

21 CFR Parts 170-199, *Food and Drugs* (Rev 6/24)¹²

ASTM D543-21, *Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents*⁵

ASTM D638-22, *Standard Test Method for Tensile Properties of Plastics*⁵

ASTM D1243-22e1, *Standard Test Method for Dilute Solution Viscosity of Vinyl Chloride Polymers*⁵

ASTM D2837-22, *Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products*⁵

ASTM D2855-20, *Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly(Vinyl Chloride) (PVC) or Chlorinated Poly(Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets*⁵

ASTM D2992-24, *Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings*⁵

ASTM D3139-19, *Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals*⁵

ASTM D3212-21, *Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals*⁵

ASTM D6284-17 (2023), *Standard Test Method for Rubber Property – Effect of Aqueous Solutions with Available Chlorine and Chloramine*⁵

ASTM F1216-22, *Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube*⁵

ASTM F2023-21, *Standard Test Method for Evaluating the Oxidative Resistance of Cross-linked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water*⁵

ASTM F3497-21, *Standard Test Method for Evaluating the Oxidative Resistance of Polypropylene (PP) Piping Systems to Hot Chlorinated Water*⁵

DIN 8074:2011, *Polyethylene (PE) – Pipes PE 80, PE 100 – Dimensions*¹³

¹² Code of Federal Regulations, Office of the Federal Register, National Archives and Records Administration. 7 G Street NW, Suite A-734, Washington, DC 20401. <[ecfr.gov](https://www.ecfr.gov)>

¹³ European Standards s.r.o. Krimická 134, 318 00 Pilsen, Czech Republic. <en-standard.eu>

DIN 8075:2018, *Polyethylene (PE) Pipes – PE 80, PE 100 – General Quality Requirements, Testing*¹³

DIN 8077:2008, *Polypropylene (PP) Pipes – PP-H, PP-B, PP-R, PP-RCT – Dimensions*¹³

DIN 8078:2008, *Polypropylene (PP) Pipes – PP-H, PP-B, PP-R, PP-RCT – General Quality Requirements and Testing*¹³

ISO 6509-1:2014, *Corrosion Of Metal And Alloys – Determination Of Dezincification Resistance Of Copper Alloys With Zinc – Part 1: Test Method*¹⁴

ISO 6957:1988, *Copper Alloys – Ammonia Test For Stress Corrosion Resistance*¹⁴

ISO 9080:2012, *Plastics Piping And Ducting Systems – Determination Of The Long-Term Hydrostatic Strength Of Thermoplastics Materials In Pipe Form By Extrapolation*¹⁴

ISO 12162:2009, *Thermoplastics Materials For Pipes And Fittings For Pressure Applications – Classification, Designation And Design Coefficient*¹⁴

National Institute of Standards and Technology (NIST)¹⁵

NSF/ANSI/CAN 60, *Drinking Water Treatment Chemicals – Health Effects*

NSF/ANSI/CAN 61, *Drinking Water System Components – Health Effects*

NSF/ANSI/CAN 600, *Health Effects Evaluation and Criteria for Chemicals in Drinking Water*

PPI TR-3 2023, *Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings, and Categorized Required Strength (CRS) for Thermoplastic Piping Materials or Pipe*¹⁰

PPI TR-4 2021, *PPI HSB Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe*¹⁰

Title XIV of The Public Health Service Act: *Safety of Public Water Systems (Safe Drinking Water Act)*¹⁶

3 Definitions

Terms used in this standard that have a specific technical meaning are defined here.

appurtenances: Accessories of a [plastic piping](#) system designed for special applications or end uses. Appurtenances include, but are not limited to, pipes, [fittings](#), [valves](#), storage tanks, tank liners, special coatings, faucet parts, and riser assemblies.

bond: The union of surfaces through heat, chemical action, or adhesion that produces a joint strong enough to function as a unit (e.g. heat fusion or solvent fusion).

building drain: The part of the lowest horizontal piping of a [drainage system](#) that receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer

¹⁴ International Organization for Standardization. Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland. [iso.org](https://www.iso.org)

¹⁵ National Institute of Standards and Technology, U.S. Department of Commerce. 100 Bureau Drive, Gaithersburg, MD 20899-8930. [nist.gov](https://www.nist.gov)

¹⁶ US Environmental Protection Agency. 1200 Pennsylvania Avenue NW, Washington, DC 20004. [epa.gov/sdwa](https://www.epa.gov/sdwa)

beyond the foundation walls of the building or structure.

Note. The building sewer generally begins 2 to 5 ft beyond the foundation walls.

building sanitary sewer: The part of the horizontal piping of a sanitary [drainage system](#) that extends from the building sanitary drain, receives the discharge from the building sanitary drain, and conveys it to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

building storm sewer: The part of the horizontal piping of a storm [drainage system](#) that extends from the building storm drain, receives the discharge of the building storm drain, and conveys it to a public storm sewer, private storm sewer, or other point of disposal.

calcium carbonate: An ingredient obtained by crushing or grinding limestone or precipitating calcium carbonate by means of chemical processes. Some calcium carbonates are modified by the application of [calcium stearate](#) or stearic acid to improve dispersion characteristics.

calcium stearate: An ingredient consisting of calcium with a mixture of solid organic acids obtained from fats and oils.

calibration: A comparison of two measurement devices or systems, one of known uncertainty and better accuracy, and one of unknown uncertainty (the unit to be calibrated).

Note. The term *calibration*, as used in this standard, also involves the process of adjustment – the operation of bringing a measuring instrument into a state of performance/accuracy suitable for use.

composite pipe: Pipe consisting of two or more different materials arranged with specific functional purpose to serve as pipe.

Note. *Composite pipe* is a term used by ASTM. It is also known as *multi-layered pipe* by PPI and ISO.

compound: A mixture of polymers with other ingredients such as fillers, stabilizers, catalysts, processing aids, lubricants, modifiers, pigments, or curing agents.

Note. Compounds are considered materials; however, not all materials are considered compounds.

compounder: A corporation, company, or individual that blends, mixes, or otherwise combines ingredients to produce [compounds](#).

contamination: The presence of a substance not intentionally incorporated in a product.

continuous waste piping: Components used in a [drainage system](#) to connect two or more plumbing fixtures or plumbing fixture components to a common [trap](#).

corrosive waste: Industrial, chemical, or processed liquids that limit the useful service life of a piping system by chemical or mechanical corrosion.

critical dimensions: Dimensions of a product (e.g. pipes and [fittings](#)) that directly affect the fit and function, or the capacity of making a sound joint, or both.

dependent formulation: A [compound](#) formulation being used with the consent of the owner of the [independent formulation](#).

drainage system: All of the piping within a building that conveys sewage, rainwater, or other liquid waste to a point of disposal. A drainage system does not include the mains of public [sewer systems](#) or a sewage treatment or disposal plant.

drain, waste, and vent system (DWV): A combined sanitary drainage and venting system within a building [drainage system](#). It includes all piping within a building that conveys sewage or other liquid waste and provides air flow to or from a drainage system or air circulation within the system to protect [trap](#) seals from siphonage and back pressure.

elastomer: A macromolecular material that returns rapidly to approximately its initial dimensions and shape after substantial deformation by a weak stress and release of the stress.

elastomeric seal: A product or device that uses an [elastomer](#) to affect a seal between separable piping components.

expected failure time (EFT): Predicted failure time calculated using the regression equation developed in ASTM Test Method F2023⁵ for the PEX material or ASTM Test Method F2263⁵ for the PE material.

exposure water: Water having defined characteristics, prior to contact with a system or component(s) in extraction procedures.

extractant water: [Exposure water](#) that has been in contact with a system or component(s) for a specified duration.

fitting: A piping component used to join, terminate, or provide changes of direction in a piping system.

gasket lubricant: A product used to reduce friction between two mating surfaces being joined by sliding-contact action, such as pushing a pipe end into a gasketed, belled-end pipe.

generic ingredients: Ingredients that are physically and chemically similar, but vary in composition because of manufacturing process, source of ingredients, or trace components.

hydrocarbon wax: A wax composed of branched or linear hydrocarbons (essentially alkane in chemical character).

hydrostatic design basis (HDB): One of a series of established stress values specified in ASTM D2837⁵ for a [plastic compound](#), obtained by categorizing the long-term hydrostatic strength determined in accordance with ASTM D2837.⁵

hydrostatic design stress (HDS): The estimated maximum tensile stress a material is capable of withstanding continuously with a high degree of certainty that failure of the pipe does not occur. This stress is circumferential when internal hydrostatic water pressure is applied.

independent formulation: An original formulation of a [compound](#) that meets all of the applicable requirements of this standard.

in-plant compound: A [compound](#) that is produced by a corporation, company, or individual, and used exclusively in the production of that entity's own final plumbing system products.

integral: A [plastic pipe](#) connection point which is not removable from the [plastic piping](#) system component by the end user or installer without affecting the intended function of the product.

joining material: A substance used to produce a fluid-tight joint ([solvent cement](#), adhesive, [sealant](#), etc.) between two or more components.

material supplier: A company that produces [plastic resin](#) or blended [compounds](#), or both, for other companies that make a final product.