



Standard Guide for Design and Installation of Plastic Siphonic Roof Drainage Systems¹

This standard is issued under the fixed designation F2021; 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 guide covers design and installation considerations for plastic siphonic roof drain systems for industrial, commercial, public, and residential buildings. Requirements for materials, pipe, and fittings are included.

1.2 The interchangeability of pipe and fittings made by different manufacturers is not addressed in this guide. Transition fittings for joining pipe and fittings of different manufacturers is provided for in the referenced pipe and fitting specification.

1.3 In referee decisions, the SI units shall be used for metric-sized pipe and inch-pound units for pipe sized in the IPS system (ANSI B36.10). In all cases, the values given in parentheses are for information only.

1.4 *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

- D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D1785 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- D2661 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings

- D2665 Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
 - D2949 Specification for 3.25-in. Outside Diameter Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
 - D3034 Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
 - E84 Test Method for Surface Burning Characteristics of Building Materials
 - E814 Test Method for Fire Tests of Penetration Firestop Systems
 - E1966 Test Method for Fire-Resistive Joint Systems
 - E2393 Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
 - F412 Terminology Relating to Plastic Piping Systems
 - F628 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core (Withdrawn 2021)³
 - F714 Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
 - F891 Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core
 - F1901 Specification for Polyethylene (PE) Pipe and Fittings for Roof Drain Systems
- ### 2.2 ANSI/ASME Standards:⁴
- A112.20.2 Qualification of Installers of Firestop Systems and Devices for Piping Systems
 - A112.6.4 Roof, Deck and Balcony Drains
 - A112.6.9 Siphonic Roof Drains
 - B36.10 Standard Dimensions of Steel Pipe (IPS)
- ### 2.3 ANSI/UL Standard:
- UL-1479 (see Test Method E814)⁴
- ### 2.4 Other References:
- International Building Code (IBC)⁵
 - International Plumbing Code (IPC)⁵

¹ This guide is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.63 on DWV.

Current edition approved Feb. 1, 2022. Published March 2022. Originally approved in 2000. Last previous edition approved in 2017 as F2021 – 17. DOI: 10.1520/F2021-17R22.

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 The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ Available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001, <http://www.iccsafe.org>.

*A Summary of Changes section appears at the end of this standard

Uniform Plumbing Code (UPC)⁶
NFPA 5000 Building Code⁷

3. Terminology

3.1 *Definitions*—Terms and abbreviations as described in Terminologies F412 and D1600, respectively, shall apply in this guide. General terminology pertaining to roof drains as described in ANSI/ASME A112.6.4 and ASME A112.6.9 shall also apply in this guide.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *crow*, *n*—the elevation of the top of a pipe inner wall.

3.2.2 *drain*, *n*—any pipe which carries rain water, waste water or waterborne wastes in a building drainage system.

3.2.3 *drainage system*, *n*—includes all the piping within public or private premises, which conveys sewage, rain water, or other liquid wastes to a legal point of disposal. It does not include the mains of public sewer treatment or disposal plants.

3.2.4 *siphonic roof drain*, *n*—a roof drain with a fixed device allowing water to enter without the ingress of air that sustains a negative differential fluid head within the pipe system thereby inducing flow without pipe gradient (pitch).

4. Significance and Use

4.1 The information provided in this standard guide is intended for use by designers and specifiers of siphonic roof drainage systems and their related components. Specifically, this guide addresses the use and limitations of plastic pipe and fittings in siphonic roof drainage systems where internal operating pressures are typically sub-atmospheric.

5. Procedure

5.1 *General*—Refer to the governing plumbing code (for example, IPC, UPC) to determine if plastic pipe and fittings are permitted for building roof drainage systems in the project jurisdiction. When permitted, select the appropriate material as listed in the plumbing code that is approved for roof drainage applications. Use of plastic pipe materials not approved by the governing code must be approved by the local authority having jurisdiction. Regardless of material approval, use plastic pipe materials only when not prohibited by fire resistance requirements of the governing building code (that is, NFPA 5000, IBC, UPC). Pipe materials must also meet the fire resistive requirements as specified in the building code and as determined by Test Method E84.

5.1.1 Specific types of PVC pipe appropriate for siphonic roof drainage systems include, but are not limited to: Specifications D2665, D2949, and D3034. When pipe diameters of 2½-in. (64-mm) must be specified, Specification D1785 plain end pressure pipe shall be used as it shares the same manufacturing standards as Specification D2665.

5.1.2 Specific types of ABS pipe include but are not limited to: D2661.

5.1.3 Specific types of PE pipe include but are not limited to: D3350, F714, and F1901.

5.2 *Pipe Wall Thickness and Composition*—Refer to the governing plumbing code for the pipe wall thicknesses specified for approved pipe materials. Cellular-core plastic pipe (for example, Specifications F628 and F891) shall be *avoided* unless the respective pipe product manufacturer can certify by testing that the pipe product can withstand full vacuum internally without collapse. Solid wall plastic pipe of wall thickness of Schedule 40 or greater (including the equivalent SDR thickness) is adequate for siphonic roof drain system sub-atmospheric pressure regimes. Pipe wall thicknesses less than Schedule 40 shall not be specified.

5.3 *Hangers, Supports and Bracing*—Refer to the governing plumbing code for pipe support requirements. If local codes do not address pipe support, support plastic pipe every four feet on center and at every change in direction. Brace plastic pipe with lateral restraints every thirty feet on center and at every change in direction for hanger rods longer than 18 in.

5.4 *Thermal Displacement and Expansion Fittings:*

5.4.1 The normal mode of thermal transition in siphonic roof drainage systems is from room temperature to a 40 °F (4.4 °C) minimum resulting in an overall contraction of plastic piping in siphonic roof drainage systems. This occurs when the warm pipe in a heated building is filled with a cold rain. Therefore, a total temperature difference of 50 °F (10 °C) shall be assumed in calculating overall changes in pipe length due to thermal contraction.

5.4.2 Obtain the rate of thermal expansion from pipe manufacturer data as determined by Test Method D696. In the absence of manufacturer data, use the following rates as expressed in ft/ft/°F (cm/cm/°C). ABS: 5.7×10^{-5} (10.3×10^{-5}); PVC: 3.0×10^{-5} (5.2×10^{-5}); HDPE: 10.0×10^{-5} (18.0×10^{-5}).

5.4.3 Specify appropriate telescopic expansion fittings to account for pipe thermal displacement. This is particularly important for pipe sections that pass through fire rated walls where movement can pull apart fire stopping assemblies. Such telescoping expansion joints must be able to withstand negative internal pressure without air infiltration. Expansion joints used in pump suction applications are recommended

5.5 *Fire Stopping:*

5.5.1 Plastic piping passing through fire rated walls and floors must be fire stopped with appropriate and approved fire stopping assemblies as tested and certified under Test Method E814 (ANSI/UL 1479). Other fire resistive joint systems must be installed and inspected in accordance with Test Method E1966 and Practice E2393. Fire stop assemblies should be installed by qualified personnel as specified in ANSI/ASME A112.20.2.

5.5.2 Penetrations at fire rated penetrations should be treated as anchor points for the pipe system when determining the placement of expansion joints to prevent thermal displacement at these locations.

5.6 *Connection to Roof Drains*—Refer to ANSI/ASME A112.6.9 for information related to the method(s) of connection of piping to siphonic roof drain outlets. A threaded

⁶ Available from International Association of Plumbing and Mechanical Officials, 4755 E. Philadelphia St., Ontario, CA 91761, <http://www.iapmo.org>.

⁷ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.