



UL 1285

STANDARD FOR SAFETY

Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service

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UL Standard for Safety for Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service, UL 1285

Seventh Edition, Dated November 13, 2020

SUMMARY OF TOPICS:

This revision of UL 1285 dated August 31, 2021 is being issued to include updates to the Tensile Set Method and Hydrostatic integrity and pressure test; [12.1](#), [14.5.3](#), Section [14.6](#), [19.2](#) and [28.1](#).

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated June 18, 2021.

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NOVEMBER 13, 2020
(Title Page Reprinted: August 31, 2021)

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UL 1285

**Standard for Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented
Polyvinyl Chloride (PVCO) for Underground Fire Service**

First Edition – January, 1982
Second Edition – March, 1991
Third Edition – April, 1995
Fourth Edition – April, 2001
Fifth Edition – July, 2008
Sixth Edition – March, 2016

Seventh Edition

November 13, 2020

This UL Standard for Safety consists of the Seventh Edition including revisions through August 31, 2021.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover polyvinyl chloride (PVC) pressure pipe, machined couplings, fabricated fittings and gaskets and oriented polyvinyl chloride (PVCO) pressure pipe and gaskets for use in underground fire protection systems and connections to such systems.

1.2 These requirements do not cover fittings that consist of mechanical joint retainer devices even when intended for use with polyvinyl chloride (PVC) pressure pipe.

1.3 PVC pipe and couplings covered by these requirements shall be designated according to the Nominal Size, Pressure Class (PC), and Dimension Ratio (DR), as specified in ANSI/AWWA C900 for use with cast iron outside diameter (CIOD) or steel (IPS) pipe as applicable.

1.4 PVCO pipe covered by these requirements shall be designated according to the Nominal Size, Pressure Class (PC), Expansion Ratio (ER) and Wall-Thickness-Ratio (WTR), as specified in ANSI/AWWA C909 for use with ductile-iron equivalent OD (DIOD) pipe.

1.5 Requirements for the installation and use of PVC pressure pipe and couplings for fire protection service are specified in the Standard for the Installation of Private Fire Service Mains and their Appurtenances, NFPA 24 or the Standard for the Installation of Sprinkler Systems, NFPA 13.

2 Units of Measurement

2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

3 Components

3.1 Except as indicated in [3.2](#), a component of a product covered by this standard shall comply with the requirements for that component.

3.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

3.3 A component shall be used in accordance with its rating established for the intended conditions of use.

3.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

4 Reference Standards

4.1 The following standards are referenced in this standard, and portions of these referenced standards and codes identified in this standard may be essential for compliance.

American Society for Testing and Materials (ASTM) Standards

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

ANSI/ASTM D1598, *Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure*

ANSI/ASTM D1599, *Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings*

ASTM D1784, *Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds*

ANSI/ASTM D2564, *Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems*

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

ANSI/ASTM D3139, *Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals*

ASTM E145, *Standard Practice for Evaluating Flat-Faced Gasketed Joint Assemblies*

ANSI/ASTM F477, *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe*

ANSI/ASTM F1674, *Standard Test Method for Joint Restraint Products for Use with PVC Pipe*

American Water Works Association (AWWA) Standards

ANSI/AWWA C605, *Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings*

ANSI/AWWA C900, *Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)*

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

AWWA M23, *PVC Pipe- Design and Installation*

CSA Group

CSA B137.3-17, *Thermoplastic pressure piping compendium, Rigid polyvinylchloride (PVC) pipe and fittings for pressure applications*

5 Glossary

5.1 For the purposes of this Standard, the following definitions apply in addition to those definitions provided in ANSI/AWWA C900 and ANSI/AWWA C909.

5.2 FUSION JOINT – A PVC joint where two sections of pipe or pipe fittings are joined by heating and melting the mating surfaces and pressing them together.

5.3 GASKET SEATING AREA – The section of pipe or coupling that is, or has the potential to be, in contact with the sealing surfaces of the gasket in intended assemblies.

5.4 PIPE SIZE – The nominal outside diameter of pipe that is compatible with cast or ductile iron (CIOD or DIOD) pipe, or steel pipe (IPS) of the same nominal size.

5.5 RESTRAINED JOINT – A PVC or PVCO joint which is constructed to resist separation mechanically through the use of integral joint features. The integral mechanical restraint may be designed to prevent separation due to hydrostatic thrust forces, or due to installation tensile forces, or both, as defined by the manufacturer.

CONSTRUCTION

6 Materials

6.1 PVC pipe and fitting materials and PVCO pipe materials shall:

- a) Be made with virgin PVC resin;
- b) Meet or exceed the physical and chemical properties of Cell Class 12454 virgin compounds, as defined in ASTM D1784 except as allowed by [6.3](#); and
- c) Have an established hydrostatic-design-basis (HDB) rating of 4000 psig (27.6 MPa) for water at 73.4°F (23.0°C) as defined in ASTM D2837.

The manufacturer shall provide data demonstrating compliance with the HDB rating requirements. Materials which have been evaluated on behalf of the manufacturer in accordance with ASTM D2837 or listed on an equivalent basis, for example listing in PPI Technical Report TR-4 for PVC 1120, shall be considered to have met the intent of these requirements.

6.2 Finished PVCO pipe shall have an established hydrostatic-design-basis (HDB) rating of 7100 psig (49.0 MPa) as determined by testing in accordance with test method ANSI/ASTM D1598, with data evaluation as defined in ASTM D2837.

6.3 Noncontaminated PVC and PVCO pipe from the manufacturer's production that is reground, or pelletized, and dry blended by the manufacturer with the same grade and Cell Class of PVC virgin compound, is not prohibited from being used provided that the blended compound is the same Cell Class and the finished product complies with the requirements of this standard.

6.4 Qualification of alternate PVC pipe and fitting materials shall be evaluated on the basis of:

- a) Sustained Pressure, [14.4](#) or [15.4](#);
- b) Burst Pressure, [14.5](#) or [15.5](#);
- c) Flattening, Section [18](#);
- d) Apparent Hoop Tensile Strength (Ring-Tensile), Section [19](#); and
- e) Extrusion Quality, Section [20](#).

7 Gasketed Joints

7.1 Gasketed PVC pipe joints, couplings and fittings shall be supplied with gaskets as specified in ANSI/AWWA C900.

7.2 If couplings are used to join the pipe, couplings and gaskets shall be supplied according to the quantities specified in ANSI/AWWA C900. Each coupling shall be of the same composition, nominal size, and Pressure Class as the pipe.

7.3 Gasketed PVCO pipe joints shall be supplied with gaskets as specified in ANSI/AWWA C909.

8 Dimensions and Pressure Class

8.1 For PVC pipe, couplings and fittings, the dimensions for each size and Pressure Class shall be as specified in ANSI/ANSI/AWWA C900, with a minimum required PC of 150.

8.2 For PVCO pipe, the dimensions for each size and Pressure Class shall be as specified in ANSI/ANSI/AWWA C909, with a minimum required PC of 165.

9 Imperfections

9.1 PVC Pipe shall meet the workmanship requirements of ANSI/AWWA C900.

9.2 PVC Fittings shall meet the workmanship requirements of ANSI/AWWA C900.

9.3 PVCO Pipe shall meet the quality requirements of ANSI/AWWA C909.

10 Sealing Gaskets

10.1 A sealing gasket shall be made of a vulcanized natural rubber or a synthetic rubber compound and shall have uniform dimensions and sufficient thickness to provide a compression-like seal. Elastomeric gaskets for PVC pipe and fittings shall meet the requirements of ANSI/AWWA C900. Elastomeric gaskets for PVCO pipe shall meet the requirements of ANSI/AWWA C909. Physical properties of the sealing material shall be in compliance with the criteria in ANSI/ASTM F477 for High-Head Applications (150 kPa or 50 ft of head and above). See Elastomeric Parts, Section [12](#).

PERFORMANCE

11 General

11.1 Representative samples of each Pressure Class and nominal size of PVC pipe and couplings or PVCO pipe shall be subjected to the tests described in Sections [12 – 22](#).

12 Elastomeric Parts

12.1 An elastomeric part used to provide a seal shall have the following properties when representative samples are tested as specified in the Standard for Gaskets and Seals, UL 157:

a) Single material and sealing (soft) portion of dual material gaskets:

1) For EPDM and nitrile – Minimum tensile strength of 1500 psi (10.3 MPa), and minimum ultimate elongation of 300 percent.

- 2) For all other materials – Minimum tensile strength of 2000 psi (13.8 MPa), and minimum ultimate elongation of 300 percent.
 - 3) Maximum set of 25 percent.
 - 4) After accelerated aging for 96 hours at 70°C:
 - i) Maximum decrease in tensile strength – 15% of original.
 - ii) Maximum decrease in elongation – 20% of original.
 - iii) Maximum increase in hardness (Shore A) – 8 points.
 - 5) The compression set of samples of rubber seals shall not exceed 20 percent of the original thickness after being compressed to three-fourths of the original thickness.
- b) Retaining (hard) portion of dual material gaskets:
- 1) Minimum tensile strength – 1200 psi (8.3 MPa), and minimum ultimate elongation – 125 percent [1 to 2.25 inches (25.4 to 57.2 mm)].
 - 2) Those properties relating to minimum tensile strength and elongation after oven aging as specified in UL 157. The maximum service temperature used to determine the oven time and temperature for oven aging is 60°C (140°F).

13 Sealing Gaskets and Plastic Components

13.1 Sealing gaskets containing plastic components that are not fully encapsulated and are intended to function as an active component for the sealing gasket shall meet the requirements of this section.

13.2 Following air-oven aging for 180 days at 121°C (250°F), there shall be no warping, creeping, or other signs of deterioration of a plastic component that may preclude the intended operation of the joint seal. There shall be no cracking of any plastic component. A joint with aged plastic components shall demonstrate acceptable performance when subjected to Leakage, [14.2](#) or [15.2](#) and Assembly, [14.3](#) or [15.3](#), as applicable.

13.3 A complete sealing gasket, including the plastic components to be aged are to be supported in a full-draft, circulating-air oven that has been preheated at full draft, to $121 \pm 1^\circ\text{C}$ ($250 \pm 8^\circ\text{F}$). The manufacturer may exclude the elastomeric portion of the sealing gasket from aging. The manner of support is to be such that the samples are prevented from touching one another or the sides of the oven. The samples are to be aged for 180 days at full draft and then allowed to cool in air at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) for at least 24 hours before conducting any test or dimensional check. Prior to any tests, elastomeric components of the sealing gasket shall be added to the sealing gasket if not included in the aging test. As used in this test, the term "full draft" refers to the air flow over the samples in the oven with the air inlet and outlets fully open. The oven used for accelerated aging is to be Type IIA as specified in the Standard Specification for Gravity-Convection and Forced-Ventilation Ovens, ASTM E145.

13.4 If a plastic material cannot withstand the temperature indicated without softening, distortion, or deterioration, an air-oven aging test at a lower temperature for a longer period of time may be used. If a material is capable of withstanding a higher temperature than that specified in [13.3](#) without excessive softening, distortion, or deterioration, an air-oven aging test at a higher temperature for a shorter period of time, but not less than 30 days, shall be permitted. The duration of exposure is to be calculated from the following equation:

$$D = (790000)e^{-0.0693t}$$

in which:

D is the test duration in days, and

t is the test temperature in °C

13.5 Following immersion in tap water at $87 \pm 2^\circ\text{C}$ ($189 \pm 3.6^\circ\text{F}$) for 180 days, there shall be no warping, creeping, or other signs of deterioration of a plastic component that may preclude the intended operation of the joint seal. There shall be no cracking of any plastic component. A joint with aged plastic components shall demonstrate acceptable performance when subjected to leakage and assembly. If a material cannot withstand the temperature specified in [13.3](#) without excessive softening, distortion, or deterioration, a water aging test at a lower temperature for a longer period of time shall be applied. The duration of exposure is to be calculated from the following formula:

$$D = (74800)e^{-0.0693t}$$

in which:

D is the test duration in days, and

t is the test temperature in °C

14 Tests for Pipe, Couplings, and Fittings with Unrestrained Joints

14.1 General

14.1.1 The requirements in this section apply to pipe, couplings and fittings with unrestrained joints. They also apply to pipe, couplings and fittings that are designed with a restrained joint intended only to resist tensile forces during installation. For pipe, couplings and fittings that are designed with a restrained joint intended to resist separation due to hydrostatic thrust forces under pressure, see Section [15](#).

14.1.2 All test pressures shall be in accordance with [Table 14.1](#) for the applicable test. Joints may be restrained to prevent longitudinal separation at the joints during testing.

Table 14.1
Pressure Test Requirements

DR	Pressure Class/Rating	Test pressure, psig					
		Leakage (50% / 2-1/2 times / burst)	Sustained	Hydrostatic	Burst	Peak	Base
27.5	150	75 / 375 / 475	320	300	475	122	61
26	160	80 / 400 / 500	340	320	500	127	63
25	165	85 / 415 / 535	350	330	535	132	66
21	200	100 / 500 / 630	420	400	630	159	79
18	235	120 / 590 / 755	500	470	755	188	94
17	250	125 / 625 / 800	530	500	800	198	99
14	305	155 / 765 / 985	650	610	985	244	122

14.2 Leakage

14.2.1 All joints shall be designed to be leak-free and shall not leak when subjected to the Internal Pressure Testing using the methods in ANSI/ASTM D3139 as specified in ANSI/AWWA C900 or

ANSI/AWWA C909 as applicable. All samples are to be assembled in accordance with the manufacturer's installation instructions.

14.3 Assembly

14.3.1 Pipe joints made with minimum clearances between the pipe spigot and bell or coupling, determined in accordance with the manufacturer's tolerances, shall, when assembled as specified in [14.3.2](#), exhibit no damage to gaskets, pipe, or coupling sections. Cut or torn gasket materials and chipped or broken pipe or coupling sections do not comply with the requirement.

14.3.2 Representative samples of each Pressure Class and size of pipe and couplings shall be machined or otherwise modified as required to the minimum clearance specified on the manufacturer's drawings for each size. Where the minimum clearances for a joint are identical across multiple pressure classes, testing of a single pressure class is representative of other pressure class. Two pipe sections shall be joined together in accordance with the manufacturer's assembly instructions, using the manufacturer's recommended lubricant.

14.4 Sustained pressure

14.4.1 PVC pipe specimens shall not fail, balloon, burst or weep when tested in accordance with the sustained pressure tests in ANSI/AWWA C909.

14.4.2 PVCO pipe specimens shall not fail, balloon, burst or weep when tested in accordance with the sustained pressure tests in ANSI/AWWA C909.

14.5 Burst pressure

14.5.1 PVC pipe, including any integral bell end, shall not fail when tested in accordance with the burst pressure tests in ANSI/AWWA C909.

14.5.2 PVC couplings (if provided) shall not fail when tested in accordance with the burst pressure tests for machined couplings in ANSI/AWWA C900 for the pipe with which the couplings are designed to be used.

14.5.3 PVCO pipe, including any integral bell end, shall not fail when tested in accordance with the burst pressure tests in ANSI/AWWA C909.

14.6 Pressure integrity, fittings

14.6.1 Fabricated PVC fittings shall not fail, balloon, burst, or weep when tested in accordance with the pressure tests for fabricated fittings in ANSI/AWWA C900.

14.6.2 *Deleted*

14.6.3 *Deleted*

14.6.4 *Deleted*

15 Tests for Pipe, Couplings and Fittings with Restrained Joints for Hydrostatic Thrust Forces (PVC only)

15.1 General

15.1.1 The requirements in this section apply to pipe, couplings and fittings that are designed with a restrained joint intended to resist separation due to hydrostatic thrust forces under pressure.

15.1.2 All test pressures shall be in accordance with [Table 14.1](#) for the applicable test.

Exception: When specified in the individual test methods, the joint may be rated for a pressure lower than the pipe pressure class. In those cases, the test pressures may be reduced according to other available pressure ratings in [Table 14.1](#). Only the indicated pressure ratings may be used, no interpolation or extrapolation is permitted. See also Marking, [25.2](#), and Installation Instructions, Section [28](#).

15.1.3 After assembling in accordance with the manufacturer's installation instructions, no adjustments are to be made. No external restraint is to be used during testing.

15.2 Leakage

15.2.1 In addition to the requirements in [14.2.1](#), restrained joint test specimens shall not separate during testing.

15.2.2 Testing at a pressure lower than the pipe pressure class is permitted. See [15.1.1](#).

15.3 Assembly

15.3.1 Restrained joint test specimens shall comply with the requirements in [14.3.1](#).

15.4 Sustained pressure

15.4.1 Restrained joint test specimens shall not fail, balloon, burst or weep when tested in accordance with the sustained pressure tests in ANSI/ASTM F1674.

15.4.2 Testing at a pressure lower than the pipe pressure class is permitted only when the pipe has been separately evaluated at the pressure indicated in [Table 14.1](#) using a suitable joint configuration. See [14.4](#) and [15.1.1](#).

15.5 Burst pressure

15.5.1 Restrained joint test specimens shall not fail when tested in accordance with the burst pressure tests in ANSI/ASTM F1674.

15.5.2 Testing at a pressure lower than the pipe pressure class is permitted only when the pipe has been separately evaluated at the pressure indicated in [Table 14.1](#) using a suitable joint configuration. See [14.5](#) and [15.1.1](#).

15.6 Cyclic surge pressure

15.6.1 Restrained joint test specimens shall reach 1,000,000 pressure cycles when tested in accordance with ANSI/ASTM F1674. Samples representative of size range, and maximum pipe pressure class for each joint design specified in the manufacturer's installation instructions shall be tested.

15.6.2 Testing at peak and base pressures lower than the pipe pressure class is permitted. See [15.1.1](#).

16 Tests for Fusion Joints

16.1 The highest pressure class of every nominal diameter of pipe manufactured for fusion shall meet the axial strength qualification test requirement using full wall thickness coupon samples in accordance with ANSI/AWWA C900.

17 Tests for Fittings

17.1 General

17.1.1 Unless otherwise specified in the individual methods, all test pressures shall be in accordance with [Table 14.1](#) for the applicable test.

17.2 Hydrostatic integrity

17.2.1 Fabricated PVC fittings with butt-fusion or thermal weld segment joints shall not fail when tested in accordance with the burst pressure tests in ANSI/AWWA C900. Test specimens shall be prepared in accordance with the requirements of ANSI/AWWA C900 and with the manufacturer's recommended procedures and parameters. Test sample segments joined by thermal weld other than butt-fusion shall be tested only after the first 20 percent or less of the weld thickness is applied. All test sample segments shall be checked for discontinuity prior to testing.

17.2.2 Solvent-cemented PVC joints shall not fail when tested in accordance with the burst pressure tests in ANSI/AWWA C900. Test specimens shall be prepared in accordance with the requirements of ANSI/ASTM D2564, ANSI/AWWA C900 and with the manufacturer's recommended procedures and parameters. All test sample segments shall be checked for quality prior to testing.

18 Flattening Test

18.1 PVC pipe specimens shall exhibit no evidence of splitting, cracking, or breaking, when tested as specified in ANSI/AWWA C900.

18.2 PVCO pipe specimens shall exhibit no evidence of splitting, cracking, or breaking, when tested as specified in ANSI/AWWA C909.

19 Apparent Hoop Tensile Strength (Ring-Tensile) Test

19.1 The apparent tensile strength of PVC pipe ring specimens at yield shall not be less than 6,300 psi when tested in accordance with ANSI/AWWA C900.

19.2 The apparent tensile strength of PVCO pipe ring specimens at yield shall not be less than 160 percent of cell class 12454 pipe material in accordance with ANSI/AWWA C909.

20 Extrusion Quality Test

20.1 PVC pipe specimens shall not fail when tested in accordance with ANSI/AWWA C900.

20.2 Unexpanded PVCO pipe specimens shall not fail when tested in accordance with ANSI/AWWA C909.