



Designation: **F1735—09 (Reapproved 2015) F1735 – 21**

Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Strip for PVC Liners for Rehabilitation of Existing Man-Entry Sewers and Conduits¹

This standard is issued under the fixed designation F1735; 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 requirements and test methods for materials, dimensions, workmanship, extrusion quality, and a form of marking for extruded poly (vinyl chloride) (PVC) profile strips used for field fabrication of PVC liners for existing man-entry (36 in. to 144 in. (900 mm to 3650 mm) in vertical dimension) sewer and conduit rehabilitation.

1.2 Profile strip produced to this specification is for use in field fabrication of PVC liners in non-pressure pipe and conduit rehabilitation where the liner is installed into the existing sewer or conduit and the annular space between the liner and the existing sewer or conduit is grouted with cementitious grout.

NOTE 1—The practice for the installation of PVC liner covered by this specification is Practice F1698.

1.3 This specification includes extruded profile strips made only from materials specified in 6.1.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *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

D618 Practice for Conditioning Plastics for Testing

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.67 on Trenchless Plastic Pipeline Technology.

Current edition approved March 1, 2015; Feb. 15, 2021. Published April 2015; March 2021. Originally approved in 1996. Last previous edition approved in 2009 as F1735—09; F1735 - 09(2015). DOI: 10.1520/F1735-09R15; 10.1520/F1735-21.

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.

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

[D1784 Classification System and Basis for Specification for Rigid Poly\(Vinyl Chloride\) \(PVC\) Compounds and Chlorinated Poly\(Vinyl Chloride\) \(CPVC\) Compounds](#)

[D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings](#)

[D2152 Test Method for Adequacy of Fusion of Extruded Poly\(Vinyl Chloride\) \(PVC\) Pipe and Molded Fittings by Acetone Immersion](#)

[D2240 Test Method for Rubber Property—Durometer Hardness](#)

[D4226 Test Methods for Impact Resistance of Rigid Poly\(Vinyl Chloride\) \(PVC\) Building Products](#)

[F412 Terminology Relating to Plastic Piping Systems](#)

[F1057 Practice for Estimating the Quality of Extruded Poly \(Vinyl Chloride\) \(PVC\) Pipe by the Heat Reversion Technique](#)

[F1698 Practice for Installation of Poly\(Vinyl Chloride\)\(PVC\) Profile Strip Liner and Cementitious Grout for Rehabilitation of Existing Man-Entry Sewers and Conduits](#)

2.2 *Federal Standard:*

[Federal Standard No. 123 Marking For Shipment \(Civil Agencies\)](#)³

2.3 *Military Standard:*

[MIL-STD-129 Marking for Shipment and Storage](#)³

3. Terminology

3.1 *General*—Definitions are in accordance with Terminology [D883](#) and Terminology [F412](#). Abbreviations are in accordance with Terminology [D1600](#), unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 See [Fig. 1](#) to clarify terminology.

3.2.2 *coextruded elastomer seal, n*—a elastomer coextruded in the joiner strip to provide compression sealing of the mechanical joint made when the joiner strip locks adjacent edges of former strip.

3.2.3 *extruded PVC joiner strip, n*—a companion product to the profile former strip of such configuration as to provide the locking mechanism at the edges of the former strips.

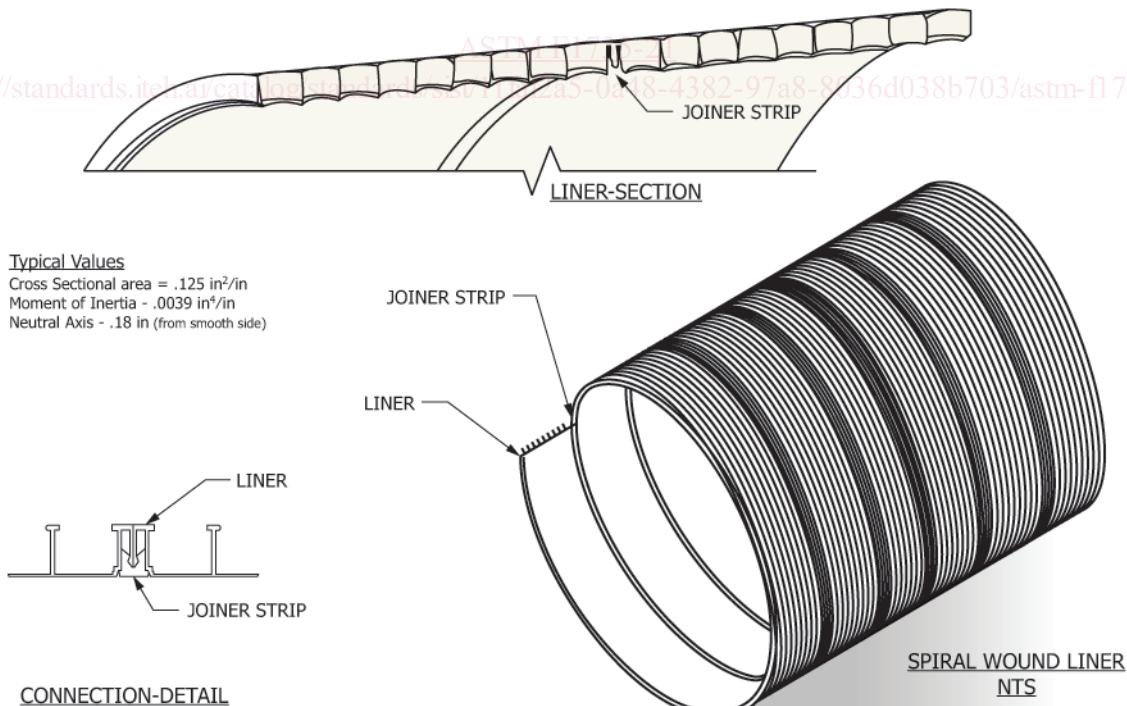


FIG. 1 An Example of A Profile PVC Strip

³ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

3.2.4 *extruded PVC profile former strip, n*—a product, available in various sizes, consisting of a smooth inner surface and a ribbed outer surface (profile) with edge configurations to allow mechanical locking of adjacent strips.

3.2.5 *production run, n*—a continuous extrusion of a given profile type.

3.2.6 *PVC liner, n*—a product field fabricated from extruded PVC profile strip into a shape which substantially conforms to the shape of the inner surface of the existing pipe or conduit over some portion or all of its inner circumference.

4. Significance and Use

4.1 The requirements of this specification are intended to provide extruded PVC profile suitable for the field fabrication of PVC liner for the rehabilitation of existing pipelines and conduits conveying sewage, process flow and storm water under gravity flow conditions.

NOTE 2—Industrial waste disposal lines shall be installed only with the specific approval of the cognizant code authority since chemicals not commonly found in drains and sewers and temperatures in excess of 140°F (60°C) may be encountered.

5. Application of Materials

5.1 The profile strip specified herein can be used for a range of existing sewer and conduit diameters. The selection of the annulus between the PVC liner and the host structure shall be determined based on analysis of installation conditions.

6. Materials and Manufacture

6.1 The extruded profile former and joiner strips shall be made from PVC compound meeting all the minimum requirements for cell classification 12344 or higher as defined in Specification **D1784**.

6.2 The elastomer seal shall be made from extrusion grade elastomer with Shore A durometer of 65 (+5 to -5), when measured in accordance with Test Method **D2240**.

6.3 *Rework Material*—Clean rework material generated from the manufacturer's own extruded PVC strip production may be used by the same manufacturer provided extruded profile strip produced meets all the requirements of this specification.

7. Other Requirements

7.1 *Acetone Immersion*—The profile strip shall not flake or disintegrate when tested in accordance with **11.3**.

NOTE 3—This is intended only for use as a quality control test and not for use as a simulated service test.

7.2 *Heat Reversion*—The profile strip shall not show any visual signs of incomplete processing (fishscaling, wall separation, or blisters) in the profile.

7.3 *Impact*—The profile strip shall be impacted in accordance with **11.5** at a minimum of two (2) test locations. The impact results shall be non-failure, or if a failure occurs it shall be ductile; brittle failures are not allowed.

7.4 *Flexural (Bending) Properties*—The flexural rigidity (stiffness factor) shall be determined in accordance with Test Methods **D790**, Section on Tangent Modulus of Elasticity, Procedure B, where the equation for E_B is replaced by $EI = L^3m/48h$. Procedure B of Test Methods **D790** shall be used in these tests. This is a qualification test that shall be performed on each distinct profile product; separate tests shall be performed for each PVC compound used in each distinct profile product. The test specimens shall be made from a flat sample profile former strip at least 12 in. (300 mm) long, split as near the middle of its width as possible without cutting through a rib and the outer edges joined in a joint (approximately in the center of the width of the specimen and running lengthwise) with the joiner strip installed in the joint. The load shall be applied to the profiled (ribbed) side of the specimens. See **Fig. 2**. The minimum flexural rigidity (stiffness factor) shall be 1600; higher values are available by special order from the manufacturer of the product. If required by the buyer or designated in the contract documents or purchase order, or combination thereof, this test shall be run as a quality control test on each production run supplying materials to the order.

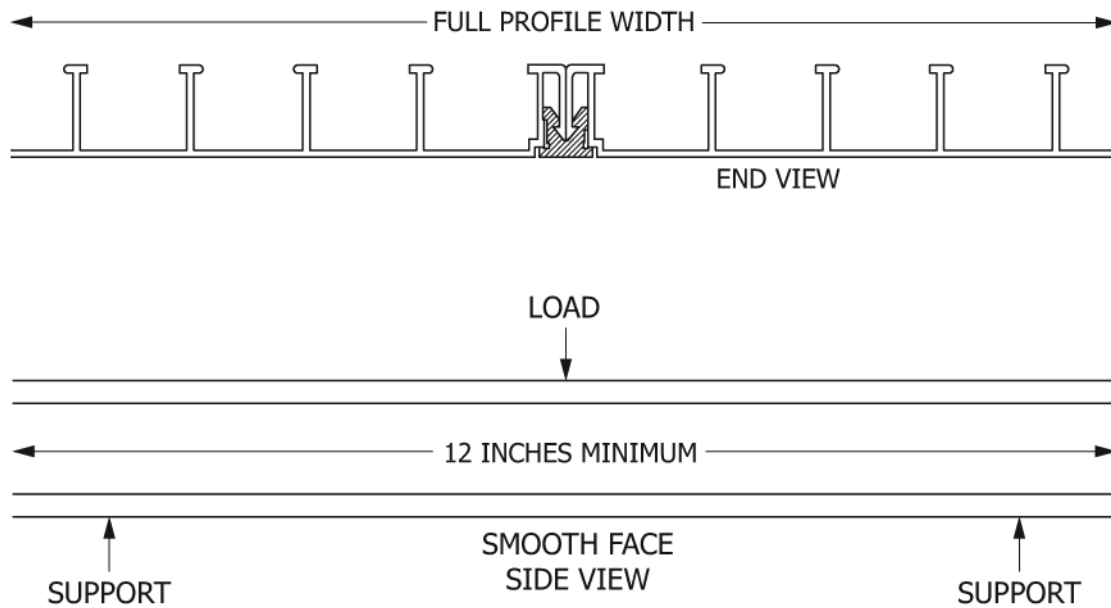


FIG. 2 Stiffness Factor (EI) Test Specimen

7.5 *Joint Leakage*—A 10 in. (250 mm) sample joint (consisting of a joiner strip joining two full width panels of former strip) shall be pressure tested with water at 15 psig (103.5 kPa) for a maximum 25-h period to simulated ground water leakage into the lined pipe. The maximum leakage through the joint shall be 0.00125 gal (4.7 mL) measured over a ± 1 h period. The test shall be terminated at the end of any 1-h period during which this requirement is satisfied. This test shall be conducted on each production run of extruded PVC joiner strip with samples from the extruded PVC former strip intended for use with that production run of joiner strip. If higher hydrostatic testing pressures are required by the buyer, additional testing, as agreed between the buyer and seller shall be performed. The test fixture used for this test shall provide for the pressurized water to interface with the joint on the ribbed side of the PVC panels such that the leakage flow is from the ribbed side to the smooth (inner) side of the PVC panels, that is, simulates ground water into liner. Means shall be provided to continuously measure and regulate the water pressure to within 1 psig (6.9 kPa) of the specified 15 psig (103.5 kPa) during the test period.

8. Dimensions, Mass, and Permissible Variation

8.1 *Height of Profile Former Strip*—The minimum height of the former strip shall be 0.488 in. (12.4 mm) when measured in accordance with 11.2.1

8.2 *Wall Thickness of Profile Former Strip*—The minimum average (arithmetic mean) wall thickness (between ribs) of each extruded former strip sample shall be 0.060 in. (1.5 mm) and no individual measurement being less than 0.055 in. (1.4 mm) when measured in accordance with 11.2.2.

8.3 *Width Tolerance of Former Strip*—The former strips may be produced in various widths as distinct products, for example, produced in nominal 8 in. (200 mm) and nominal 12 in. (300 mm) widths, which are not intended for mixed use in the same application. Tolerances on the nominal width shall be ± 2.5 % when measured in accordance with 11.2.3.

8.4 *Thickness of Coextruded Elastomer Seal*—The thickness of the coextruded seal, when measured in accordance with 11.2.4, shall be 0.040 in. \pm 0.015 in. (1.02 mm \pm 0.38 mm).

9. Workmanship, Finish, and Appearance

9.1 The extruded profile strips shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The extruded profile strips shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

10. Sampling

10.1 Samples of extruded profile strip of sufficient length to conduct the necessary quality control tests shall be cut from each extrusion production run of a given profile designation.

10.2 The frequency of sampling shall be as agreed upon by the purchaser and the seller.

10.3 Initial and retest samples shall be drawn from the same production run.

11. Test Methods

11.1 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of $73.473.4\text{ }^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$ ($23.3.6\text{ }^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and $50 \pm 5\%$ relative humidity, with test specimens conditioned in accordance with Procedure A of Practice **D618**, unless otherwise specified in the test methods or in this specification.

11.2 *Extruded Profile Dimensions:*

11.2.1 *Height of Profile Former Strip*—Measure the height of the profile strip in accordance with Section 6 of Test Method **D2122** for determining wall thickness. Measurements shall be made from the smooth surface to the outer surface of the ribs.

11.2.2 *Wall Thickness of Profile Former Strip*—Measure the average wall thickness of the cross section in the gaps between ribs in accordance with Section 6 of Test Method **D2122**.

11.2.3 *Width of Profile Former Strip*—Measure the width of the profile former strip (or panel) in accordance with Section 11 of Test Method **D2122**.

11.2.4 *Thickness of Coextruded Elastomer Seal*—Measure the thickness of the coextruded elastomer seal with a good quality micrometer using standard machine shop practice.

NOTE 4—Any micrometer of equivalent accuracy to the tubing micrometer specified may be used in these measurements.

11.3 *Acetone Immersion*—Test shall be run in accordance with Test Method **D2152** on full width profile strip samples (both former and joiner strips). This procedure is used for determining the extrusion quality of extruded PVC profile strip as indicated by reaction to immersion in anhydrous acetone. It is applicable only for distinguishing between unfused and properly fused PVC.

11.4 *Heat Reversion*—Test shall be run in accordance with Practice **F1057** on a full width profile strip sample with a minimum length of 6 in. This procedure is used for estimating the quality of extruded PVC profile samples as indicated by reaction to hot air.

11.5 *Impact Resistance*—Test shall be run in accordance with Test Methods **D4226** on flat sections within a profile strip sample. The C.125 Impactor Head Configuration shall be used, with a drop height chosen from **Table 1** or calculated using the following equation, or both:

TABLE 1 Drop Height versus Profile Strip Thickness

Profile Strip Thickness		Drop Height
in.	mm	
0.059	1.50	103
0.060	1.52	104
0.061	1.55	105
0.063	1.60	108
0.065	1.65	111
0.067	1.70	114
0.069	1.75	116
0.071	1.80	119
0.073	1.85	122
0.075	1.90	125