DEPARTMENT OF COMMERCE
NATIONAL INSTITURE OF STANDARDS AND TECHNOLOGY
OFFICE OF STANDARDS SERVICES

VOLUNTARY PRODUCT STANDARD PS34-70
FLUORINATED ETHYLENE-PROPYLENE (FEP)
PLASTIC LINED STEEL PIPE AND FITTINGS

Product Standard PS34-70, Fluorinated Ethylene-Propylene (FEP) Plastic Lined Steel Pipe and Fittings was withdrawn on January 20, 1982

This product standard was replaced by American Society for Testing and Materials (ASTM) Standard Specification F%46-77, Perflouro (Ethylene-Propylene) Copolymer (FEP) Plastic-Lined Ferrous Metal Pipe and Fittings. This specification is under the jurisdiction of Committee F17 on Plastic Piping Systems, and is the direct responsibility of Subcommittee F17.11 on Composite.

The Staff Manager can provide assistance and information on additional ASTM standards and subcommittee contacts.

Contacts:

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PS34-70 File

National Bureau of Standards

Status Report on Voluntary Product Standards

AGENCY: National Bureau of Standards; Commerce.

ACTION: Maintenance, retention, replacement, and withdrawal of certain voluntary product standards

On August 19, 1980, the Department of Commerce (Department) announced in the Federal Register (45 FR 55250-2) the status of 60 documents classified as Voluntary Product Standards. The announcement was made in accordance with the revised Procedures for the Development of Voluntary Product Standards (15 CFR Part 10). Section 10.0(b) of the Procedures specifies six criteria that must be met for the Department to sponsor the development or maintenance of a Voluntary Product Standard.

Numerous requests to retain or maintain various standards were received in response to the August 19, 1980, notice. A number of the requests specified retention of standards for fixed periods of time that have now elapsed. The current status of all such standards is indicated below.

Based on proposals from the proponent organizations identified after the following titles, the following product standards will continue to be sponsored by the Department:

PS 1-74, Construction and Industrial Plywood; American Plywood Association
PS 20-70, American Softwood Lumber Standard; American Lumber Standards Committee
PS 72-76, Toy Safety; Toy Manufacturers of America
PS 73-77, Carbonated Soft Drink Bottles; Glass Packaging Institute
TS 231, Proposed Voluntary Product Standard, Production of Carbonated Soft Drinks In Glass Bottles; National Soft Drink Association

Based on documented activity within a private standards-writing organization, the following standards will be retained by the National Bureau of Standards for the periods of time stated below to permit the orderly transfer of sponsorship of such standards from the Department to the identified organizations. The periods of time stated below shall commence from the date this notice is published in the Federal Register and supersede the periods of time stated for those standards in the August 19, 1980 notice.

PS 30-70, School Chalk; the Crayon, Water Color and Craft Institute, Inc.; 6 months
PS 36-70, Body Measurements for the Sizing of Boys' Apparel; Mail Order Association of America; 12 months
PS 42-70, Body Measurements for the Sizing of Women's Patterns and Apparel; Mail Order Association of America; 12 months
PS 45-71, Body Measurements for the Sizing of Apparel for Young Men (Students); Mail Order Association of America; 12 months
PS 46-71, Flame-Resistant Paper and Paperboard; American Society for Testing and Materials; 6 months
PS 51-71, Hardwood and Decorative Plywood; Hardwood Plywood Manufacturers Association; 12 months
PS 54-72, Body Measurements for the Sizing of Girls' Apparel; Mail Order Association of America; 12 months
PS 63-75, Latex Foam Mattresses for Hospitals; American Society for Testing and Materials; 12 months
PS 64-75, School Paste; The Crayon Water Color and Craft Institute, Inc.; 6 months
PS 65-75, Paints and Inks for Art Education in Schools; The Crayon, Water Color and Craft Institute, Inc.; 6 months
PS 67-76, Marking of Gold Filled and Rolled Gold Plate Articles Other Than Watchcases; Jewelers Vigilance Committee; 24 months
PS 68-76, Marking of Articles Made of Silver in Combination with Gold; Jewelers Vigilance Committee; 24 months
PS 69-76, Marking of Articles Made Wholly or in Part of Platinum; Jewelers Vigilance Committee; 2 months
PS 70-76, Marking of Articles Made of Karat Gold; Jewelers Vigilance Committee; 24 months
PS 71-76, Marking of Jewelry and Novelties of Silver; Jewelers Vigilance Committee; 24 months
CS 98-62, Artists Oil Paints; Artists Equity Association, Inc.; 6 months
CS 130-60, Color Materials for Art Education in Schools; the Crayon, Water Color and Craft Institute, Inc.; 6 months
CS 151-50, Body Measurements for the Sizing of Apparel for Infants, Babies, Toddlers and Children (for the Knit Underwear Industry); Mail Order Association of America; 12 months
R 192-63, Crayons and Related Art Materials for School Use (Types, Sizes, Packages and Colors); The Crayon, Water Color and Craft Institute, Inc.; 6 months

The following standard has been replaced by a standard being developed or published by a private standards-writing organization and, therefore, Department of Commerce sponsorship is no longer need for it:

PS 17-69, Polyethylene-sheeting (construction, industrial and agricultural applications); Society of the Plastics Industry

In the absence of any request for retention or maintenance, the following standards are withdrawn:

PS 13-69, Uncorded Slab Urethane Foam for Bedding and Furniture Cushioning
PS 15-69, Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment
PS 23-70, Horticultural Grade Perlite
PS 24-70, Melamine Dinnerware (Alpha-Cellulose Filled) for Household Use
PS 25-70, Heavy-Duty Alpha-Cellulose-Filled Melamine Tableware
PS 27-70, Mosaic-Parquet Hardwood Slat Flooring
PS 29-70, Plastic Heat-Shrinkable Film
PS 31-70, Polystyrene Plastic Sheet
* PS 34-70, Fluorinated Ethylene-Propylene (FEP) Plastic-Lined Steel Pipe and Fittings
PS 52-71, Polytetrafluorethylene (PTFE)
PS 53-72, Glass-Fiber Reinforced Polyester Structural Plastic Panels
PS 56-73, Structural Glued Laminated Timber
PS 57-73, Cellulosic Fiber Insulation Board
PS 58-73, Basic Hardboard
PS 59-73, Prefinished Hardboard Paneling
PS 60-73, Hardboard Siding
PS 62-74, Grading of Diamond Powder in Sub-Sieve Sizes
CS 138-55, Insect Wire Screening
CS 192-53, General Purpose Vinyl Plastic Film
CS 201-55, Rigid Polyvinyl Chloride Sheets
CS 227-59, Polyethylene Film
CS 245-62, Vinyl-Metal Laminates
CS 257-63, TFE-Fluorocarbon (Polytetrafluorethylene) Resin Molded Basic Shapes
CS 268-65, Hide-Trim Pattern for Domestic Cattlehides
CS 274-66, TFE-Fluorocarbon Resin Sintered Thin Coatings for Dry Film Lubrication
R2-62, Bedding Products and Components

In accordance with § 10.1(e) of the revised Procedures for the Development of Voluntary Product Standards and by agreement with the Consumer Product Safety Commission, the Department will retain sponsorship of the following Voluntary Product Standard for the period of time stated below to allow for arrangements to be made for its sponsorship by a private standards writing organization.

PS 66-75, Safety Requirements for Home Playground Equipment; 12 months

For further information contact Eric A. Vadelund, Office of Engineering Standards, National Bureau of Standards, Washington, D.C. 20234. Telephone: (301) 921-3272.

Dated: January 13, 1982.

Ernest Ambler,

Director.

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A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

NBS Voluntary Product Standard

PS 34-70

U.S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Voluntary Product Standard

(PS 34–70)

Fluorinated Ethylene-Propylene (FEP) Plastic Lined Steel Pipe and Fittings

Technical Standards Coordinator: L. H. Breden

Abstract

This Voluntary Product Standard covers requirements and methods of test for the material, dimensions, construction, and performance of commercially available steel pipe and fittings lined with fluorinated ethylene-propylene (FEP) plastic intended to be used for conveying acids, gases, solvents, and other corrosive materials.

Key words: FEP lined pipe; fluorinated ethylene-propylene plastic lined pipe; pipe and fittings, steel, plastic lined; plastic lined steel pipe; steel pipe and fittings, plastic lined.

Nat. Bur. Stand. (U.S.), Prod. Stand. 34–70, 12 pages (Mar. 1971)
CODEN: XNPSA

CONTENTS

VOLUNTARY PRODUCT STANDARDS

Voluntary Product Standards are standards developed under procedures established by the Department of Commerce (15 CFR Part 10, as amended, May 28, 1970). The standards may include (1) dimensional requirements for standard sizes and types of various products, (2) technical requirements, and (3) methods of testing, grading, and marking. The objective of a *Voluntary Product Standard* is to establish requirements which are in accordance with the principal demands of the industry and, at the same time, are not contrary to the public interest.

Development of a VOLUNTARY PRODUCT STANDARD

The Office of Engineering Standards Services of the National Bureau of Standards has been assigned by the Department of Commerce the responsibility to work closely with scientific and trade associations and organizations, business firms, testing laboratories, and other appropriate groups to develop *Voluntary Product Standards*. The Bureau has the following role in the development process: It (1) provides editorial assistance in the preparation of the standard; (2) supplies such assistance and review as is required to assure the technical soundness of the standard; (3) acts as an unbiased coordinator in the development of the standard; (4) sees that the standard is representative of the views of producers, distributors, and users or consumers; (5) seeks satisfactory adjustment of valid points of disagreement; (6) determines the compliance with the criteria established in the Department's procedures cited above; and (7) publishes the standard.

Industry customarily (1) initiates and participates in the development of a standard; (2) provides technical counsel on a standard; and (3) promotes the use of, and support for, the standard. (A group interested in developing a *Voluntary Product Standard* may submit a written request to the Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234.)

A draft of a proposed standard is developed in consultation with interested trade groups. Subsequently, a Standard Review Committee is established to review the proposed standard. The committee, appropriately balanced, includes qualified representatives of producers, distributors, and users or consumers of the product being standardized. When the committee approves a proposal, copies are distributed for industry consideration and acceptance. When the acceptances show general industry agreement, and when there is no substantive objection deemed valid by the Bureau, the Bureau announces approval of the *Voluntary Product Standard* and proceeds with its publication.

Use of a VOLUNTARY PRODUCT STANDARD

The adoption and use of a *Voluntary Product Standard* is completely voluntary. *Voluntary Product Standards* have been used most effectively in conjunction with legal documents such as sales contracts, purchase orders, and building codes. When a standard is made part of such a document, compliance with the standard is enforceable by the purchaser or the seller along with other provisions of the document.

Voluntary Product Standards are useful and helpful to purchasers, manufacturers, and distributors. Purchasers may order products that comply with *Voluntary Product Standards* and determine for themselves that their requirements are met. Manufacturers and distributors may refer to the standards in sales catalogs, advertising, invoices, and labels on their product. Commercial inspection and testing programs may also be employed, together with grade labels and certificates assuring compliance, to promote even greater public confidence. Such assurance of compliance promotes better understanding between purchasers and sellers.

Fluorinated Ethylene-Propylene (FEP) Plastic Lined Steel Pipe and Fittings

Effective September 1, 1970 (See section 7.)

(This voluntary Standard, initiated by The Society of the Plastics Industry, Inc., has been developed under the *Procedures for the Development of Voluntary Product Standards*, published by the U.S. Department of Commerce. See Section 8, *History of Project*, for further information.)

1. PURPOSE

The purpose of this Voluntary Product Standard is to establish nationally recognized dimensions and quality and performance requirements for commercially available integrally flanged pipe and fittings lined with fluorinated ethylene-propylene (FEP) plastic. This Standard is intended to provide producers, distributors, and users with a basis for common understanding of the characteristics of this product.

2. SCOPE AND CLASSIFICATION

2.1. Scope—This Voluntary Product Standard covers requirements and methods of test for the material, dimensions, construction, and performance of commercially available steel pipe and fittings lined with FEP plastic intended to be used for conveying acids, gases, solvents, and other corrosive materials. Methods of marking to indicate compliance with this Standard are included.

2.2. Classification

2.2.1. Pressure-temperature rating—This Standard covers pipe and fittings produced in two series: one based on the rated working pressure of 150 psi and one based on the rated working pressure of 300 psi. The FEP resin used in the liner has a maximum heat stability temperature of 204 °C (400 °F); however, the maximum operational range of the liner may be less than this temperature and is dependent on the type of material in contact with the inner surface of the liner, mechanical considerations, the pressure, and the temperature. Therefore, the manufacturer shall be consulted regarding chemical, pressure, temperature, and vacuum ratings.

2.2.2. Size—This Standard covers pipe and fittings in the following sizes:

Nominal inside diameter

½ inch	2 inches	5 inches
¾ inch	2½ inches	6 inches
1 inch	3 inches	8 inches
1½ inches	4 inches	10 inches
		12 inches

3. REQUIREMENTS

3.1. General—All products represented as complying with this

Voluntary Product Standard shall meet all of the requirements listed herein and shall be marked as specified in section 5.

3.2. Linings

3.2.1. Material—The linings shall be made from fluorinated ethylene-propylene resins conforming to the requirements of the American Society for Testing and Materials (ASTM) D 2116–66, *Standard Specification for FEP-Fluorocarbon Molding and Extrusion Materials,*[1] except that a maximum of 1 percent by weight of additives is permissible for identification or other purposes. Organic additives, if used, shall be identified in the manufacturer's specifications.

3.2.2. Tensile and elongation—The lining shall have a minimum tensile strength of 2700 psi and a minimum elongation of 240 percent when tested in accordance with the requirements of ASTM D 638–68, *Standard Method of Test for Tensile Properties of Plastics.*[1] The minimum values for tensile strength and elongation shall apply to both the longitudinal and the circumferential directions. When the size of the liner does not permit the selection of test specimens conforming to the sizes required in ASTM D 638–68, both the longitudinal and the transverse test specimens shall be prepared in accordance with ASTM D 1708–66, *Standard Method of Test for Tensile Properties of Plastics by Use of Microtensile Specimens.*[1]

3.2.3. Specific gravity—The linings shall have a minimum specific gravity of 2.14 when tested in accordance with the requirements of ASTM D 792–66, *Standard Methods of Test for Specific Gravity and Density of Plastics by Displacement.*[1]

3.2.4. Wall thickness—The linings shall have a minimum wall thickness of 0.050 inch, and the flared gasket faces shall be not less than 0.040 inch in thickness when tested in accordance with the requirements of ASTM D 2122–70, *Standard Method of Determining Dimensions of Thermoplastic Pipe.*[1]

TABLE 1. *Specifications for steel pipe and fittings*

Nominal pipe size	Minimum flare diameter
inches	*inches*
½	1¼
¾	1 9/16
1	1⅞
1½	2 11/16
2	3 7/16
2½	3 15/16
3	4⅝
4	5 15/16
5	7 1/16
6	8
8	10 1/16
10	12¼
12	14½

[1] Later issues of all ASTM publications referenced in this Standard may be used providing the requirements are applicable and consistent with the issue designated. Copies of ASTM publications are obtainable from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

TABLE 2. *Specifications for steel pipe and fittings*

Pipe section	Material	Specifications[a]	
Piping	Carbon steel	ASTM A53–69a	Welded and seamless steel pipe (Types E and S)
		ASTM A160–68	Seamless carbon steel pipe for high-temperature service
		ASTM A135–69	Electric-resistance-welded steel pipe
		ASTM A587–68	Electric-welded low-carbon steel pipe for the chemical industry
	Stainless steel	ASTM A312–70	Seamless and welded austenitic stainless steel pipe
		ANSI B36.19–65	Stainless steel pipe
Flanges	Ductile iron	ASTM A395–70	Ductile iron for pressure containing castings for use at elevated temperatures (60–45–15)
		ASTM A445–70	Ferritic ductile iron castings for valves, flanges, pipe fittings, and other piping components (60–40–18)
		ASTM A536–70	Ductile iron castings (60–45–12)
	Forged steel	ASTM A181–68	Forged or rolled steel pipe flanges, forged fittings, and valves and parts for general service
	Stainless steel	ASTM A182–69	Forged or rolled alloy-steel pipe flanges, forged fittings, and valves and parts for high-temperature service
	Ductile iron	ASTM A395–70	Ductile iron for pressure containing castings for use at elevated temperatures (60–45–15)
		ASTM A445–70	Ferritic ductile iron castings for valves, flanges, pipe fittings, and other piping components (60–40–18)
	Stainless steel	ASTM A351–69	Ferritic and austenitic steel castings for high-temperature service
		ASTM A389–68	Alloy steel castings specially heat treated for pressure containing parts suitable for high-temperature service
Fittings	Forged steel	ASTM A181–68	Forged or rolled steel pipe flanges, forged fittings, and valves and parts for general service
	Cast steel	ASTM A216–70	Carbon-steel castings suitable for fusion welding for high-temperature service (Grade WCB)
		ANSI B16.5–68	Steel pipe flanges and flanged fittings

[a] Later issues of all ASTM or ANSI publications in this table may be used providing the requirements are applicable and consistent with the issue designated. Copies of ASTM publications are obtainable from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103. Copies of ANSI publications are obtainable from the American National Standards Institute, 1430 Broadway, New York, New York 10018.

3.2.5. Flare (lap face) outside diameter—The outside diameter of the flare covering the gasket face portion of the flange or the full face of the lap-joint stub end shall not be less than the diameter specified in table 1. The flared portion of the lining shall be concentric with the flared portion of the pipe.

3.3. Pipe and fittings

3.3.1. Material—Prior to the installation of a venting system, the pipe and fittings, including flanges, fitting housings, and spacers, shall conform to the requirements of the appropriate specifications listed in table 2. The pipe shall be of welded or seamless steel, Schedule 40 or 80, except that Schedule 30 may be used for pipe with 8-inch and larger nominal size diameter. All sharp corners shall be removed by grinding or reaming to give a minimum radius of 1/8 inch.

3.3.2. Finish—The outside surface of all finished pipe and fittings, other than stainless steel, shall be coated with a corrosion resistant primer of an epoxy or zinc phosphate chemical coating. Precaution shall be taken to avoid plugging vent holes. In addition, if cleaning of the vent holes is required, care must be taken to prevent damage to the liner. The interior surfaces of all pipe and fittings shall be clean and free of casting-mold burrs, rust, scale, or other protrusions which may affect the integrity or performance of the liner component.

3.3.3. Tolerances—Tolerances shall be as specified in table 3. Centerline-to-face dimensions may be taken from the metal flange face or from the gasket face as indicated in the manufacturer's specifications.

TABLE 3. *Tolerances for pipe, flanges, and fittings*

Pipe section		Tolerances
		inches
Pipe	Length	±1/8
	Bolt-hole alinement	±1/16
	Flange alinement (with theoretical pipe centerline)	±3/64 for 6-inch-diameter pipe and over or ±1/32 for pipe under 6 inches in diameter
Flanges	All dimensions	as specified in ANSI B16.5–1968
Fittings	All dimensions	as specified in ANSI B16.5–1968
	Flange perpendicularity (with theoretical pipe centerline at the flange outside diameter)	±3/64 for 6-inch-diameter pipe and over or ±1/32 for pipe under 6 inches in diameter

3.3.4. Flange construction

3.3.4.1. Screw-type flanges shall be tack-welded to the pipe housing, or locked in position by other suitable means, before the pipe is lined to prevent inadvertent turning of the flange.

3.3.4.2. Slip-on and socket-type flanges shall be fully back-welded to the pipe housing before the pipe is lined. The inside surface of socket flanges shall be welded and ground smooth.

3.3.4.3. Lap-joint and Van Stone types of flanged ends may be manufactured by standard forming techniques or by using fully-welded stub ends or collars. Lap joints shall not contain any cracks or buckles.

Note: Use of one Van Stone flange in each straight run of pipe in a piping system simplifies alinement.

3.3.5. Venting—Each pipe or fitting shall be provided with a venting system which will release any gases that may be entrapped between the liner and the housing, and which will indicate any leakage through the liner. A vent hole system which provides adequate venting is described in 3.3.5.1, 3.3.5.2, and 3.3.5.3. Other systems which are safe and provide equal venting performance shall be acceptable under this Standard.

3.3.5.1. Lined pipe—Each lined pipe is provided with vent holes of not less than $\frac{1}{16}$ inch and not more than $\frac{1}{8}$ inch in diameter in the pipe wall location as follows:

a. Lined pipe over 72 inches long shall have two holes, 180° apart, located in back of each flange within 6 inches of the flange, and one hole located every 36 inches along the length of the pipe, rotated approximately 90° from the preceding hole.
b. Lined pipe 36 to 72 inches long, inclusive, shall have two holes, 180° apart, located in back of each flange within 6 inches of the flange, and one vent hole in the approximate center of the assembly.
c. Lined pipe between 18 and 36 inches in length shall have two holes, 180° apart, located in back of each flange within 6 inches of the flange.
d. Lined pipe 18 inches or less in length shall have two vent holes, 180° apart, located between flanges.

3.3.5.2. Fittings—All fittings shall have two vent holes, 180° apart, located between the flanges; however, fittings employing split-type housings need not incorporate vent holes.

3.3.5.3. Reducing flanges and reducers—A minimum of one vent hole is provided for reducing flanges. Standard and short tapered reducers shall have two vent holes, 180° apart, between the two flanges.

3.3.6. Gaskets—A $\frac{1}{16}$-inch-thick asbestos (or equal) backup gasket conforming to the requirements for Type 1, No. P 1161 A, of ASTM D 1170–62T, *Tentative Specifications for Nonmetallic Gasket Materials for General Automotive and Aeronautical Purposes*,[2] shall cover the pipe and gasket face of the threaded flanges. Back-up gaskets are not required when the flanged metal face has an uninterrupted surface and a minimum internal bore radius of $\frac{1}{8}$ inch.

3.4. Lined pipe and fittings

3.4.1. Continuity—All lined pipe and fittings shall show no evidence of pinholes, porosity, or cracks when tested in accordance with 4.3.1.

[2] See footnote 1, page 4.

3.4.2. Temperature and pressure—The lined pipe or fittings shall show no longitudinal or radial cracks or distortion which would impair the function of the liner component when tested in accordance with 4.3.2. On the completion of this test, each of the tested specimens shall meet the requirements of 3.4.1.

3.4.3. Steam and cold water—The lined pipe or fittings shall show no evidence of leakage through vent holes or other venting systems when tested in accordance with Procedure A or B of 4.3.3. The liners shall show no evidence of buckling, cracking, or crazing during the test. Formation of surface water blisters shall not be cause for rejection. On the completion of this test, each of the tested specimens shall then meet the requirements of 3.4.1.

3.4.4. Workmanship—The linings shall fit snugly inside the pipe and fitting housings. Scratches, dents, nicks, or tool marks on the surfaces of the lining shall not represent more than a 20 percent reduction in effective liner thickness or result in a minimum wall thickness of less than 0.050 inch. The gasket face portion of the lining shall be free of surface defects that would impair its effectiveness as a seal.

4. INSPECTION AND TEST RROCEDURES

4.1. General—The inspection and test procedures contained in this section are to be used to determine the conformance of products to the requirements of this Voluntary Product Standard. Each producer or distributor who represents his products as conforming to this Standard may utilize statistically based sampling plans which are appropriate for each particular manufacturing process but shall keep such essential records as are necessary to document with a high degree of assurance his claim that all of the requirements of this Standard have been met. Additional sampling and testing of the product, as may be agreed upon between purchaser and seller, is not precluded by this section.

4.2. Inspection—The lined pipe and fittings shall be visually inspected to determine their conformance to the finish, design, and dimensional requirements of this Standard. End plates shall be replaced immediately after inspection is completed and should not be removed until installation.

4.3. Tests

4.3.1. Electrostatic or hydrostatic testing—The lined pipe and fittings shall be subjected to an electrostatic or hydrostatic test as described in 4.3.1.1 or 4.3.1.2. The test to be used shall be at the option of the manufacturer, unless otherwise specified by the purchaser.

4.3.1.1. Electrostatic test—The test shall be performed with a nondestructive electrical coating-defect-tester. The output voltage shall be adjusted to 10,000 volts dc. A bronze scanning brush at this potential voltage, relative to the grounded lined pipe or fitting assembly, is moved through the interior of the component. Any leakage to ground is noted by the lighting of the neon indicator in the handle of the probe. A visible and audible spark, which occurs at the probe section when contact is made because of a defect in the liner, shall be cause for rejection. The surface of the component being tested must be clean and dry for effective results.

4.3.1.2. Hydrostatic pressure test—The internal test pressure shall be 400 psi minimum, and the test shall be conducted in a temperature range of 20 °C to 30 °C (68 °F to 86 °F). The pipe and fittings shall be completely filled with clean water, and the system shall be bled free of all air prior to the application of pressure. Full test pressure shall be reached within 1 minute and maintained for an additional 3 minutes; the pressure shall then be reduced to zero, and the pipe and fittings shall then be subjected immediately to a second pressure cycle. The venting system in the pipe and fitting housings shall be observed throughout the pressure test for evidence of leakage, which shall be cause for rejection.

4.3.2. Temperature and pressure test—Specimens of the lined pipe or fittings shall be assembled with suitable blind flanges having provisions for the introduction of compressed air. The specimens shall be subjected to internal air pressure equal to the pressure rating of the pipe, but not less than 150 psi, while being subjected to continuous heating in an oven for a minimum of 2 hours at 204 °C (400 °F). The specimens under internal pressure shall then be cooled to room temperature, vented, examined for distortion and cracks in their linings, and subjected to the electrostatic or hydrostatic test described in 4.3.1.1 or 4.3.1.2.

4.3.3. Steam and cold water cycling test—The pipe or fittings shall be subjected to steam and cold water cycling tests in accordance with either Procedure A or B described below.

4.3.3.1. Procedure A—Specimens of the lined pipe or fittings shall be assembled with suitable blind flanges having fittings for the introduction of steam, air, and cold water and for drainage. Each specimen shall be subjected to 500 steam-cold water cycling tests. Each cycling test shall be conducted as follows:

(1) introduce steam into the specimen, attaining an internal pressure of 125 to 150 psi within 3 minutes, and maintain this pressure for a minimum of 3 minutes; (2) close off steam; (3) introduce air to get rid of the steam; (4) vent; (5) fill with water, at a maximum temperature of 26.6 °C (80 °F), and allow to remain for a minimum of 3 minutes; and (6) drain completely. After completion of the 500 cycles, the specimens shall be cooled to room temperature, and the liners shall be examined for evidence of buckling, cracking, crazing, or other characteristics indicative of malfunctioning. The dried lined pipe or fittings shall be subjected to the electrostatic or hydrostatic test described in 4.3.1.1 or 4.3.1.2.

4.3.3.2. Procedure B—Specimens prepared in accordance with Procedure A, shall be subjected to 100 steam-cold water cycling tests. Each cycling test shall be conducted as follows:

(1) introduce steam into the specimen, attaining an internal pressure of 125 to 150 psi within 3 minutes, and maintain this pressure for a minimum of 165 minutes; (2) close off steam; (3) introduce air to get rid of the steam; (4) vent; (5) drain for ½ minute; (6) fill with water, at a maximum temperature of 26.6 °C (80 °F), and allow to remain for a minimum of 14 minutes; and (7) drain completely. After completion of the 100 cycles, the specimens shall be cooled to room temperature, and the liners shall be examined for evidence of buckling, cracking,

crazing, or other characteristics indicative of malfunctioning. Formation of surface water blisters shall not be cause for rejection. The dried lined pipe or fittings shall be subjected to the electrostatic or hydrostatic test described in 4.3.1.1 or 4.3.1.2.

5. MARKING

Marking on the pipe and fittings shall include the following:

(1) The nominal pipe or fitting size
(2) The type of plastic liner (FEP)
(3) This Voluntary Product Standard designation, PS 34–70
(4) Manufacturer's name (or trademark)

6. IDENTIFICATION

In order that purchasers may identify products conforming to all requirements of this Voluntary Product Standard, producers and distributors may include a statement of compliance in conjunction with their name and address on product labels, invoices, sales literature, and the like. The following statement is suggested when sufficient space is available.

> This fluorinated ethylene-propylene (or FEP) lined pipe and these fittings conform to all of the requirements established in Voluntary Product Standard PS 34–70, developed cooperatively with the industry and published by the National Bureau of Standards under the *Procedures for the Development of Voluntary Product Standards* of the U. S. Department of Commerce. Full responsibility for the conformance of this product to the standard is assumed by (name and address of producer or distributor).

The following abbreviated statement is suggested when available space on labels is insufficient for the full statement:

> Conforms to PS 34–70, (name and address of producer or distributor).

7. EFFECTIVE DATE

The effective date of this Voluntary Product Standard is the date upon which reference to the Standard may be made by producers, distributors, users and consumers, and other interested parties. Compliance by producers with all of the requirements of this Voluntary Product Standard may not actually occur until some time after its effective date. Products shall not be represented as conforming to this Voluntary Product Standard until such time as all requirements established in the Standard are met. The effective date of this Standard is September 1, 1970.

8. HISTORY OF PROJECT

In May 1966, The Society of the Plastics Industry, Inc., requested the assistance of the Department of Commerce in estab-

lishing a Voluntary Product Standard for fluorinated ethylene-propylene plastic lined steel pipe and fittings. A proposed draft of the Standard was developed, and in November 1969, the proposed Voluntary Product Standard was approved by the Standard Review Committee. In February 1970, public announcement was made, and the recommended Voluntary Product Standard was widely circulated to the industry for acceptance. The response to this circulation indicated a consensus of acceptability within the industry as defined in the *Procedures for the Development of Voluntary Product Standards.* Accordingly, the Standard, designated as PS 34–70, *Fluorinated Ethylene-Propylene (FEP) Plastic Lined Steel Pipe and Fttings,* was approved for publication by the National Bureau of Standards to be effective September 1, 1970.

Technical Standards Coordinator:

Leslie H. Breden, Product Standards Section
Office of Engineering Standards Services
National Bureau of Standards, Washington, D.C. 20234

9. STANDING COMMITTEE

The individuals whose names are listed below constitute the membership of the Standing Committee for this Standard. The function of the committee is to review all proposed revisions and amendments in order to keep this Standard up to date. Comments concerning this Standard and suggestions for its revision may be addressed to any member of the committee or to the Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234, which acts as secretary for the committee.

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