U.S. DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
(formerly National Bureau of Standards-NBS)
OFFICE OF STANDARDS SERVICES

PRODUCT STANDARD PS21-70
POLY (VINYL CHLORIDE) (PVC) PLASTIC PIPE
(SCHEDULES 40, 80, AND 120)

Product Standard PS21-70, Poly (Vinyl Chloride) (PVC) Plastic Pipe (Schedules 40, 80, and 120), was withdrawn by the U.S. Department of Commerce on September 9, 1974.

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The following standard was used to replace PS 21-70: ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

For assistance and additional information on this standard and other related standards and sources, please contact:

American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive
West Conshohocken, Pennsylvania 19428-2959 USA
Telephone: (610) 832-9500/-9585; Fax: (610) 832-9555
Internet: http://www.astm.org
(click on ASTM Store, Technical Committees/Memberships, etc.)

ASTM Committee F17 Plastic Piping Systems
(Subcommittee F17.25 Vinyl Based Pipe)
Telephone: (610) 832-9726; Fax: (610) 832-9666

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The following organization may provide assistance and additional information, contact:

Society of the Plastics Industry, Inc. (SPI)
1801 K Street, NW, Suite 600K
Washington, DC 20006, USA
Telephone: (202) 974-5200
Fax: (202) 296-7005

The Plastics Pipe Institute was formerly the Thermoplastic Pipe Division of the Society of the Plastics Industry.

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DEPARTMENT OF COMMERCE

National Bureau of Standards

VOLUNTARY PRODUCT STANDARDS

Notice of Intent To Withdraw

In accordance with § 10.12 of the Department's "Procedures for the Development of Voluntary Product Standards" (15 CFR Part 10, as revised; 35 FR 8349 dated May 28, 1970), notice is hereby given of the Department's intent to withdraw the following listed Voluntary Product Standards. This withdrawal action is being taken for the reason that the products are covered by the ASTM standards identified parenthetically and the continued duplication of standards is inappropriate.

PS 10-69, "Polyethylene (PE) Plastic Pipe (Schedule 40—Inside Diameter Dimensions)" (ASTM D 2104-73, "Specification for Polyethylene (PE) Plastic Pipe, Schedule 40")

PS 11-69, "Polyethylene (PE) Plastic Pipe (SDR)" (ASTM D 2239-73, "Specification for Polyethylene (PE) Plastic Pipe (SDR-PR)")

PS 12-69, "Polyethylene (PE) Plastic Pipe (Schedules 40 and 80—Outside Diameter Dimensions)" (ASTM D 2447-73, "Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80 Based on Outside Diameter")

PS 18-69, "Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (Schedules 40 and 80)" (ASTM D 1527-73, "Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80")

PS 19-69, "Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (Standard Dimension Ratio)" (ASTM D 2282-73, "Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)")

PS 21-70, "Poly(Vinyl Chloride) (PVC) Plastic Pipe (Schedules 40, 80, and 120)" (ASTM D 1785-73, "Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, (Schedules 40, 80, and 120")

PS 22-70, "Poly (Vinyl Chloride) (PVC) Plastic Pipe (Standard Dimension Ratio)" (ASTM D 2241-73, "Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)")

Any comments or objections concerning the intended withdrawal of these standards should be made in writing and directed to the Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234, by May 20, 1974. The effective date of withdrawal, if appropriate, will be not less than 60 days after the final notice of withdrawal. Withdrawal action will terminate the authority to refer to these standards as voluntary standards developed under the Department of Commerce procedures from the effective date of the withdrawal.

Dated: April 12, 1974.

RICHARD W. ROBERTS,
Director.

[FR Doc.74-8883 Filed 4-17-74;8:45 am]

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DEPARTMENT OF COMMERCE

National Bureau of Standards

VOLUNTARY PRODUCT STANDARDS

Action on Proposed Withdrawal

In accordance with § 10.12 of the Department's "Procedures for the Development of Voluntary Product Standards" (15 CFR Part 10, as revised; 35 FR 8349 dated May 28, 1970), notice is hereby given of the withdrawal of the following Voluntary Product Standards:

PS 10-69, "Polyethylene (PE) Plastic Pipe (Schedule 40—Inside Diameter Dimensions)".

PS 11-69, "Polyethylene (PE) Plastic Pipe (SDR)".

PS 12-69, "Polyethylene (PE) Plastic Pipe (Schedules 40 and 80—Outside Diameter Dimensions)".

PS 18-69, "Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (Schedules 40 and 80)".

PS 19-69, "Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (Standard Dimension Ratio)".

PS 21-70, "Poly(Vinyl Chloride) (PV) Plastic Pipe (Schedules 40, 80, and 120)".

PS 22-70, "Poly(Vinyl Chloride) (PVC) Plastic Pipe (Standard Dimension Ratio)".

This action is taken in furtherance of the Department's announced intentions as set forth in the public notice appearing in the FEDERAL REGISTER of April 18, 1974 (39 FR 13908), to withdraw these standards.

The effective date for the withdrawal of these standards will be Sept. 9, 1974. This withdrawal action terminates the authority to refer to these standards as voluntary standards developed under the Department of Commerce procedures.

ERNEST AMBLER,
Acting Director.

JULY 3, 1974.

[FR Doc.74-15609 Filed 7-8-74;8:45 am]

A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

NBS Voluntary Product Standard

PS 21-70

WITHDRAWN

Poly (Vinyl Chloride) (PVC) Plastic Pipe (Schedules 40, 80, and 120)

A Voluntary Standard Developed by Producers, Distributors, and Users With the Cooperation of the National Bureau of Standards

U.S. DEPARTMENT OF COMMERCE

National Bureau of Standards

PRODUCT STANDARDS

Product Standards are published voluntary standards that establish (1) dimensional requirements for standard sizes and types of various products, (2) technical requirements for the product, and (3) methods of testing, grading, and marking these products. The objective is to define requirements for these products in accordance with the principal demands of the trade. *Product Standards* are published by the National Bureau of Standards of the U. S. Department of Commerce.

Development of a PRODUCT STANDARD

The Bureau's Office of Engineering Standards Services works closely with business firms, trade organizations, testing laboratories, and other appropriate groups to develop such standards. (A group interested in developing a *Product Standard* may submit a written request to the Office of Engineering Standards Services, National Bureau of Standards.) After determining that the desired standard would be technically feasible and in the public interest, a specific proposal is developed in consultation with interested trade groups and circulated for industry consideration and comment.

Subsequently, a Standard Review Committee is established to review the proposed standard for conformance with the Department of Commerce procedures. The committee includes qualified representatives of producers, distributors, and users or consumers of the product. When approved by the committee, copies of the recommended standard are distributed for consideration and acceptance. When the acceptances show general agreement by all segments of the industry, and when there is no substantive objection deemed valid by the National Bureau of Standards, the Bureau announces approval of the *Product Standard* and proceeds with its publication.

Use of a PRODUCT STANDARD

Product Standards are developed for the maximum use of industry by ensuring that producers, distributors, and users or consumers cooperate in the development of a voluntary *Product Standard*. The adoption and use of a *Product Standard* is *voluntary*. *Product Standards* are used most effectively in conjunction with legal instrumentalities such as building codes, purchase orders, and sales contracts. When a standard is made part of such a contract, compliance with the standard is enforceable by the buyer or the seller along with other provisions of the contract. There is *no* governmental regulation or control involved.

Purchasers may order products that comply with Product Standards and determine for themselves that their requirements are met. More often, manufacturers refer to the standards in sales catalogs, advertising, invoices, and labels on the product. Commercial inspection and testing programs are also employed for greater effectiveness together with grade labels, hallmarks and certificates. Such assurance of compliance promotes confidence and understanding between buyers and sellers.

EFFECTIVE DATE

Having been passed through the regular procedures of the Office of Engineering Standards Services, National Bureau of Standards, and approved by the acceptors hereinafter listed in part, this Product Standard is issued by the National Bureau of Standards, effective:

February 15, 1970
(See Section 8)

Lewis M. Branscomb
Director

Nat. Bur. Stand. (U.S.), Prod. Stand. 21-70, 16 pages (June 1970)
CODEN: XNPSA

Product Standard PS 21-70
Supersedes Commercial Standard CS 207-60

Poly(Vinyl Chloride) (PVC) Plastic Pipe (Schedules 40, 80, and 120)

(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 Department of Commerce. See Section 9, *History of the Project*, for further information.)

1. PURPOSE

The purpose of this Product Standard is to establish nationally recognized dimensions and significant quality requirements for poly(vinyl chloride) (PVC) plastic pipe when it is made in Schedule 40, 80, and 120 sizes, with the outside diameter controlled. This Standard is also intended to provide producers, distributors, and users with a basis for common understanding of the material and dimensional characteristics of this product.

2. SCOPE AND CLASSIFICATION

2.1. Scope—This Product Standard covers the principal types, grades, sizes, and pressure ratings for commercially available PVC plastic pipe made in Schedule 40, 80, and 120 sizes, with the outside diameter controlled. Included are requirements and methods of test for materials, workmanship, dimensions, sustained pressure, burst pressure, flattening, and extrusion quality. Methods of marking and labeling to indicate compliance with this Standard are also provided.

2.2. Classification—The PVC plastic pipe material and pipe covered by this Product Standard are classified as follows:

2.2.1. Material—PVC plastics used to make pipe meeting the requirements of this Standard are categorized by means of two criteria, namely, short-term strength tests and long-term strength tests.

2.2.1.1. Basic materials—This Standard covers pipe made from four PVC plastics as defined in the American Society for Testing and Materials (ASTM)[1] D 1784–68, *Standard Specification for Rigid Poly(Vinyl Chloride) Compounds and Chlorinated Poly(Vinyl Chloride) Compounds*,[2] in which the requirements are based on short-term tests. These plastics are PVC Type I, Grade 1; Type I, Grade 2; Type II, Grade 1; and chlorinated poly (vinyl chloride) (CPVC) Type IV, Grade 1.

2.2.1.2. Hydrostatic design stresses—This Standard covers pipe made from PVC plastics as defined by four hydrostatic design stresses developed on the basis of long-term tests.[3] These hydrostatic design stresses are 1000, 1250, 1600, and 2000 psi for water at 23 °C (73.4 °F), and apply only to pipe meeting all of the requirements of this Standard.

[1] Copies of ASTM publications are obtainable from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.
[2] Later issues of all publications referenced or specified in this Product Standard may be used providing the requirements are applicable and consistent with the issues designated.
[3] Information regarding the method of test and other criteria used in assigning these hydrostatic design stresses may be obtained from the Plastics Pipe Institute (PPI), a division of The Society of the Plastics Industry, Inc., 250 Park Avenue, New York, N. Y. 10017.

2.2.1.3. Pipe materials—This Standard covers pipe made from six PVC plastic pipe materials and two CPVC plastic pipe materials coded as follows:

(1) PVC Type I, Grade 1, with a hydrostatic design stress of 2,000 psi for water at 23 °C (73.4 °F), designated as PVC1120.
(2) PVC Type I, Grade 2, with a hydrostatic design stress of 2,000 psi for water at 23 °C (73.4 °F), designated as PVC1220.
(3) PVC Type II, Grade 1, with a hydrostatic design stress of 1,000 psi for water at 23 °C (73.4 °F), designated as PVC2110.
(4) PVC Type II, Grade 1, with a hydrostatic design stress of 1,250 psi for water at 23 °C (73.4 °F), designated as PVC2112.
(5) PVC Type II, Grade 1, with a hydrostatic design stress of 1,600 psi for water at 23 °C (73.4 °F), designated as PVC2116.
(6) PVC Type II, Grade 1, with a hydrostatic design stress of 2,000 psi for water at 23 °C (73.4 °F), designated as PVC2120.
(7) CPVC Type IV, Grade 1, with a hydrostatic design stress of 1,600 psi for water at 23 °C (73.4 °F), designated as CPVC4116.
(8) CPVC Type IV, Grade 1, with a hydrostatic design stress of 2,000 psi for water at 23 °C (73.4 °F), designated as CPVC4120.

2.2.2. Pipe pressure rating—Pipe meeting the requirements of this Standard is rated for use with water at 23 °C (73.4 °F) at the maximum internal pressures shown in table 1, 2, or 3. These ratings have been calculated in accordance with the International Standards Organization (ISO)[4] equation as defined in 5.1.3. Lower ratings may be recommended at the option of the pipe manufacturer. The pressure ratings for Schedules 80 and 120 threaded pipe are one-half those for nonthreaded pipe in the same material and size. Schedule 40 pipe should not be threaded.

[4] Address: 1430 Broadway, New York, N. Y. 10018, c/o American National Standards Institute, Inc.

TABLE 1. *Pressure ratings*[a] *for water at 23 °C (73.4 °F), Schedule 40 pipe*

Nominal pipe size	PVC1120[b] PVC1220[b] PVC2120[b] CPVC4120[b]	PVC2110[b]	PVC2112[b]	PVC2116[b] CPVC4116[b]
inch	*psi*	*psi*	*psi*	*psi*
⅛	810	400	500	650
¼	780	390	490	620
⅜	620	310	390	500
½	600	300	370	480
¾	480	240	300	390
1	450	220	280	360
1¼	370	180	230	290
1½	330	170	210	260
2	280	140	170	220
2½	300	150	190	240
3	260	130	160	210
3½	240	120	150	190
4	220	110	140	180
5	190	100	120	160
6	180	90	110	140
8	160	80	100	120
10	140	70	90	110
12	130	70	80	110

[a] These pressure ratings apply only to unthreaded pipe. The industry does not recommend threading PVC plastic pipe in Schedule 40 dimensions.
Some minor changes have been made to keep the pressures uniform to simplify testing.
[b] See 2.2.1.3 and 5.1.4 for code designations.

TABLE 2. *Pressure ratings*[a] *for water at 23 °C (73.4 °F), Schedule 80 pipe*

Nominal pipe size	PVC1120[b], PVC2120[b], CPVC4120[b]		PVC2110[b]		PVC2112[b]		PVC2116[b], CPVC4116[b]	
	Unthreaded	Threaded	Unthreaded	Threaded	Unthreaded	Threaded	Unthreaded	Threaded
inch	*psi*	*psi*	*psi*	*psi*	*psi*	*psi*	*psi*	*psi*
¼	1230	610	610	310	770	380	980	490
⅜	1130	570	570	280	710	350	900	450
½	920	460	460	230	570	290	730	370
¾	850	420	420	210	530	260	680	340
1	680	340	340	170	430	210	550	280
1¼	650	320	320	160	390	200	500	250
1½	520	260	260	130	320	160	420	210
2	470	240	240	120	290	150	380	190
2½	400	200	200	100	250	130	320	160
3	420	210	210	110	260	130	340	170
3½	370	190	190	90	230	120	300	150
4	350	170	170	90	220	110	280	140
5	320	160	160	80	200	100	260	130
6	280	140	140	70	180	90	230	120
8	250	120	120	60	150	80	200	100
10	230	120	120	60	150	70	190	90
12	230	110	110	60	140	70	180	90

[a] Some minor adjustments have been made to keep the pressures uniform to simplify testing.
[b] See 2.2.1.3 and 5.1.4 for code designations.

TABLE 3. *Pressure ratings*[a] *for water at 23 °C (73.4 °F), Schedule 120 pipe*

Nominal pipe size	PVC1120[b], PVC2120[b], CPVC4120[b]		PVC2110[b]		PVC2112[b]		PVC2116[b], CPVC4116[b]	
	Unthreaded	Threaded	Unthreaded	Threaded	Unthreaded	Threaded	Unthreaded	Threaded
inch	*psi*	*psi*	*psi*	*psi*	*psi*	*psi*	*psi*	*psi*
½	1010	510	510	250	630	320	810	410
¾	770	390	390	190	480	240	620	310
1	720	360	360	180	450	220	570	290
1¼	600	300	300	150	370	190	480	240
1½	540	270	270	130	340	170	430	210
2	470	240	240	120	290	150	380	190
2½	470	230	230	120	290	150	370	190
3	440	220	220	110	280	140	360	180
3½	380	190	190	100	240	120	310	150
4	430	220	220	110	270	130	340	170
5	400	200	200	100	250	120	320	160
6	370	190	190	90	230	120	300	150
8	360	180	180	90	230	110	290	140
10	340	170	170	80	210	100	270	140
12	340	170	170	80	210	100	270	140

[a] Some minor adjustments have been made to keep the pressures uniform to simplify testing.
[b] See 2.2.1.3 and 5.1.4 for code designations.

3. REQUIREMENTS

3.1. General—All pipe represented as complying with this Standard shall meet all of the requirements listed herein, and shall be marked as specified in section 6.

3.2. Materials—The plastic extrusion compound shall meet the requirements of either PVC Type I, Grade 1; Type I, Grade 2; Type II, Grade 1; or CPVC Type IV, Grade 1, as described in ASTM D 1784–68.

3.2.1. Rework material—Clean rework material generated from the manufacturer's own pipe production may be used by the same manufacturer provided that the types of material specified in 3.2 are not mixed with one another and that the pipe produced meets all the requirements of this Standard.

3.3. Pipe dimensions and tolerances

3.3.1. Outside diameters—The average outside diameter of the pipe shall be as shown in table 4 when measured in accordance with 4.3 and 4.3.1. The tolerance for out-of-roundness applies only prior to shipment.

3.3.2. Wall thickness—The wall thickness of the pipe shall be as shown in table 5 when measured in accordance with 4.3 and 4.3.2.

3.3.3. Wall thickness range—The wall thickness range (eccentricity of the inside and outside circumference) of the pipe shall not exceed 12 percent when measured in accordance with 4.3 and 4.3.3.

TABLE 4. *Outside diameters and tolerances, Schedules 40, 80, and 120 pipe*

Nominal pipe size	Average outside diameter	Tolerances			
		For average outside diameter	For maximum and minimum (out-of-roundness)		
			Schedule 40	Schedule 80	Schedule 120
inch	*inch*	*inch*	*inch*	*inch*	*inch*
⅛	0.405	±0.004	±0.008	±0.008	± —
¼	.540	± .004	± .008	± .008	± —
⅜	.675	± .004	± .008	± .008	± —
½	.840	± .004	± .008	± .008	±0.008
¾	1.050	± .004	± .010	± .010	± .010
1	1.315	± .005	± .010	± .010	± .010
1¼	1.660	± .005	± .012	± .012	± .012
1½	1.900	± .006	± .012	± .012	± .012
2	2.375	± .006	± .012	± .012	± .012
2½	2.875	± .007	± .015	± .015	± .015
3	3.500	± .008	± .015	± .015	± .015
3½	4.000	± .008	± .050	± .015	± .015
4	4.500	± .009	± .050	± .015	± .015
5	5.563	± .010	± .050	± .030	± .030
6	6.625	± .011	± .050	± .035	± .035
8	8.625	± .015	± .075	± .075	± .045
10	10.750	± .015	± .075	± .075	± .050
12	12.750	± .015	± .075	± .075	± .060

TABLE 5. *Wall thicknesses, Schedules 40, 80, and 120 pipe*

Nominal pipe size	Schedule 40		Schedule 80		Schedule 120	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
inch	*inch*	*inch*	*inch*	*inch*	*inch*	*inch*
⅛	0.068	0.088	0.095	0.115	—	—
¼	.088	.108	.119	.139	—	—
⅜	.091	.111	.126	.146	—	—
½	.109	.129	.147	.167	0.170	0.190
¾	.113	.133	.154	.174	.170	.190
1	.133	.153	.179	.200	.200	.224
1¼	.140	.160	.191	.214	.215	.241
1½	.145	.165	.200	.224	.225	.252
2	.154	.174	.218	.244	.250	.280
2½	.203	.227	.276	.309	.300	.336
3	.216	.242	.300	.336	.350	.392
3½	.226	.253	.318	.356	.350	.392
4	.237	.265	.337	.377	.437	.489
5	.258	.289	.375	.420	.500	.560
6	.280	.314	.432	.484	.562	.629
8	.322	.361	.500	.560	.718	.804
10	.365	.409	.593	.664	.843	.944
12	.406	.455	.687	.769	1.000	1.120

3.4. Extrusion quality—The pipe shall not flake or disintegrate when tested in accordance with 4.4. This requirement is not applicable to CPVC4116 and CPVC4120.

3.5. Sustained pressure—The pipe shall not fail, balloon, burst, or weep as defined in section 4 of ASTM D 1598–67, *Standard Method of Test for Time-to-Failure of Plastic Pipe Under Long-Term Hydrostatic Pressure*,[5] at the test pressures given in table 6, 7, or 8 when tested in accordance with 4.5.

3.6. Burst pressure—The minimum burst pressure of the pipe shall be as given in table 9, when determined in accordance with 4.6.

3.7. Flattening—There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 4.7.

3.8. Workmanship—The pipe shall be homogeneous throughout and free from visible cracks, holes, or foreign inclusions. The pipe shall be uniform in color, opacity, and density.

3.9. Approval for potable water—All pipe intended for use with potable water shall meet the requirements for that purpose specified by the National Sanitation Foundation Testing Laboratory, Inc.,[6] or specified by other organizations accredited by Federal or State Public Health agencies as having requirements for that purpose which are less stringent than those of the National Sanitation Foundation Testing Laboratory, Inc.

[5] See footnotes 1 and 2, page 1.
[6] Address: The National Sanitation Foundation Testing Laboratory, Inc., 2355 West Stadium Boulevard, Ann Arbor, Mich. 48106.

TABLE 6. *Sustained test pressures*[a] *for water at 23 °C (73.4 °F), Schedule 40 pipe*

Nominal pipe size	PVC1120[b] PVC1220[b] PVC2120[b] CPVC4120[b]	PVC2110[b]	PVC2112[b]	PVC2116[b]	CPVC4116[b]
inch	*psi*	*psi*	*psi*	*psi*	*psi*
⅛	1690	930	1130	1360	1480
¼	1640	900	1090	1310	1430
⅜	1310	720	870	1050	1150
½	1250	690	840	1000	1100
¾	1010	550	680	810	890
1	950	520	630	760	830
1¼	770	420	520	620	680
1½	690	380	460	560	610
2	580	320	390	470	510
2½	640	350	430	510	560
3	550	300	370	440	480
3½	500	280	340	400	440
4	470	260	310	370	410
5	410	220	270	330	360
6	370	200	250	300	320
8	330	180	220	260	290
10	300	160	200	240	260
12	280	150	180	220	240

[a] The hoop stresses used to derive these test pressures are as follows:
PVC1120 — 4200 psi PVC2112 — 2800 psi
PVC1220 — 4200 psi PVC2116 — 3360 psi
PVC2120 — 4200 psi CPVC4116 — 3680 psi
PVC2110 — 2300 psi CPVC4120 — 4200 psi
Some minor adjustments have been made to keep the pressures uniform to simplify testing.
[b] See 2.2.1.3 and 5.1.4 for code designations.

TABLE 7. *Sustained test pressures*[a] *for water at 23 °C (73.4 °F), Schedule 80 pipe*

Nominal pipe size	PVC1120[b] PVC1220[b] PVC2120[b] CPVC4120[b]	PVC2110[b]	PVC2112[b]	PVC2116[b]	CPVC4116[b]
inch	*psi*	*psi*	*psi*	*psi*	*psi*
⅛	2570	1410	1720	2060	2260
¼	2370	1300	1580	1900	2080
⅜	1930	1060	1290	1540	1690
½	1780	980	1190	1430	1560
¾	1440	790	960	1160	1270
1	1320	720	880	1060	1160
1¼	1090	600	730	870	960
1½	990	540	660	790	870
2	850	460	570	680	740
2½	890	490	590	710	780
3	790	430	520	630	690
3½	730	400	480	580	640
4	680	370	450	540	600
5	610	330	400	490	530
6	590	320	390	470	510
8	520	280	340	410	450
10	490	270	330	390	430
12	480	260	320	380	420

[a] The hoop stresses used to derive these test pressures are as follows:
PVC1120 — 4200 psi PVC2112 — 2800 psi
PVC1220 — 4200 psi PVC2116 — 3360 psi
PVC2120 — 4200 psi CPVC4116 — 3680 psi
PVC2110 — 2300 psi CPVC4120 — 4200 psi
Some minor adjustments have been made to keep the pressures uniform to simplify testing.
[b] See 2.2.1.3 and 5.1.4 for code designations.

TABLE 8. *Sustained test pressures*[a] *for water at 23 °C (73.4 °F), Schedule 120 pipe*

Nominal pipe size	PVC1120[b] PVC1220[b] PVC2120[b] CPVC4120[b]	PVC2110[b]	PVC2112[b]	PVC2116[b]	CPVC4116[b]
inch	*psi*	*psi*	*psi*	*psi*	*psi*
½	2130	1170	1420	1710	1870
¾	1620	890	1080	1300	1420
1	1510	830	1000	1200	1320
1¼	1250	680	830	1000	1100
1½	1130	620	750	900	990
2	990	540	660	790	870
2½	980	540	650	780	860
3	930	510	620	750	820
3½	810	440	540	640	710
4	900	490	600	720	790
5	830	450	550	660	730
6	780	430	520	620	680
8	760	420	510	610	670
10	720	390	480	570	630
12	710	390	480	570	630

[a] The hoop stresses used to derive these test pressures are as follows:
PVC1120 — 4200 psi PVC2112 — 2800 psi
PVC1220 — 4200 psi PVC2116 — 3360 psi
PVC2120 — 4200 psi CPVC4116 — 3680 psi
PVC2110 — 2300 psi CPVC4120 — 4200 psi
Some minor adjustments have been made to keep the pressures uniform to simplify testing.
[b] See 2.2.1.3 and 5.1.4 for code designations.

TABLE 9. *Minimum burst pressures*[a] *for water at 23 °C (73.4 °F), Schedules 40, 80, and 120 pipe*

Nominal pipe size	Schedule 40		Schedule 80		Schedule 120	
	PVC1120[b] PVC1220[b] PVC2120[b] CPVC4116[b] CPVC4120[b]	PVC2110[b] PVC2112[b] PVC2116[b]	PVC1120[b] PVC1220[b] PVC2120[b] CPVC4116[b] CPVC4120[b]	PVC2110[b] PVC2112[b] PVC2116[b]	PVC1120[b] PVC1220[b] PVC2120[b] CPVC4116[b] CPVC4120[b]	PVC2110[b] PVC2112[b] PVC2116[b]
inch	*psi*	*psi*	*psi*	*psi*	*psi*	*psi*
⅛	2580	2020	3920	3060	—	—
¼	2490	1950	3620	2830	—	—
⅜	1990	1560	2940	2300	—	—
½	1910	1490	2720	2120	3250	2540
¾	1540	1210	2200	1720	2470	1930
1	1440	1130	2020	1580	2300	1790
1¼	1180	920	1660	1300	1900	1490
1½	1060	830	1510	1180	1720	1340
2	890	690	1290	1010	1510	1180
2½	970	760	1360	1060	1490	1170
3	840	660	1200	940	1420	1110
3½	770	600	1110	860	1230	960
4	710	560	1040	810	1380	1080
5	620	490	930	720	1260	990
6	560	440	890	700	1190	930
8	500	390	790	620	1160	910
10	450	350	750	580	1090	850
12	420	330	730	570	1090	850

[a] The hoop stresses used to derive these test pressures are as follows:
PVC1120 — 6400 psi PVC2110 — 5000 psi
PVC1220 — 6400 psi PVC2112 — 5000 psi
PVC2120 — 6400 psi PVC2116 — 5000 psi
CPVC4116 — 6400 psi CPVC4120 — 6400 psi
Some minor adjustments have been made to keep the pressures uniform to simplify testing.
[b] See 2.2.1.3 and 5.1.4 for code designations.

4. INSPECTION AND TEST PROCEDURES

4.1. Test conditions—Tests shall be conducted in the standard laboratory atmosphere of 23 ± 2 °C (73.4 ± 3.6 °F) and 50 ± 5 percent relative humidity.

4.2. Conditioning test specimens—The test specimens shall be conditioned at 23 ± 2 °C (73.4 ± 3.6 °F) and 50 ± 5 percent relative humidity for not less than 40 hours prior to test in accordance with Procedure A in ASTM D 618-61, *Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing.*[7]

4.3. Dimensions—Measurements shall be made in accordance with ASTM D 2122-67, *Standard Method of Determining Dimensions of Thermoplastic Pipe.*[7]

4.3.1. Outside diameter—The outside diameter of the pipe shall be measured in accordance with section 7 of ASTM D 2122-67. The average outside diameter at any cross section on the length of the pipe is the arithmetic average of the maximum and minimum diameters at that section. The average outside diameter of the pipe is the arithmetic mean of the average diameters at all measured cross sections.

4.3.2. Wall thickness—Micrometer measurements of the wall thickness shall be made in accordance with section 4 of ASTM D 2122-67, to determine the maximum and minimum values. The wall thickness shall be measured at both ends of the pipe to the nearest 0.001 inch.

4.3.3. Wall thickness range—The wall thickness range, E, shall be calculated for each cross section as follows:

$$E, \%, = \frac{A - B}{A} \times 100$$

where A and B are the maximum and minimum wall thicknesses, respectively, for each cross section. The wall thickness range shall not exceed 12 percent for any cross section measured.

4.4. Extrusion quality—The extrusion quality of the pipe shall be determined by immersion in anhydrous acetone in accordance with ASTM D 2152-67, *Standard Method of Test for Quality of Extruded Poly(Vinyl Chloride) Pipe by Acetone Immersion.*[7]

4.5. Sustained pressure test—Six specimens of pipe shall be tested with water at the internal pressures given in table 6, 7, or 8. Each specimen shall be at least 10 times the nominal diameter in length, but not less than 10 inches or greater than 3 feet between end closures, and shall bear the permanent marking specified in section 6. The test shall be in accordance with ASTM D 1598-67, except that the pressure shall be maintained within ± 10 psi of the values given in tables 6, 7, and 8 for 1,000 hours. Failure of two of the six specimens constitutes failure of the test. Failure of one of the six specimens is cause for retest of six additional specimens. Failure of one of these six specimens constitutes failure of the test. Evidence of failure of the pipe shall be as defined in section 4 of ASTM D 1598-67 as follows.

4.5.1. Failure—Any continuous loss of pressure resulting from the transmission of the test liquid through the body of the specimen under test.

[7] See footnotes 1 and 2, page 1.

4.5.2. Ballooning—Any abnormal localized expansion of a pipe specimen while under internal hydraulic pressure.

4.5.3. Bursting—A break in the pipe with immediate loss of test liquid and continued loss at essentially no pressure.

4.5.4. Seepage or weeping—Failure that occurs through microscopic breaks in the pipe wall, frequently only at or near the test pressure. At lower pressures the pipe may carry liquids without evidence of loss of the liquids.

4.6. Burst pressure—The minimum burst pressure shall be determined with at least five specimens in accordance with ASTM D 1599-62T, *Tentative Method of Test for Short-Time Rupture Strength of Plastic Pipe, Tubing, and Fittings.*[8] The time of testing to failure for each specimen shall be between 60 and 70 seconds.

4.7. Flattening—Three specimens of the pipe, 2 inches long, shall be flattened between parallel plates in a suitable press until the distance between the plates is 40 percent of the average outside diameter of the pipe or the walls of the pipe touch, whichever occurs first. The rate of loading shall be uniform and such that the compression is completed within 2 to 5 minutes. On removal of the load, the specimens shall be examined for evidence of splitting, cracking, or breaking.

5. DEFINITIONS

5.1. General—Definitions and abbreviations are in accordance with ASTM D 833-69, *Standard Nomenclature Relating to Plastics,*[8] ASTM D 1600-69, *Standard Abbreviations of Terms Relating to Plastics;*[8] and Plastics Pipe Institute[9] Technical Report PPI-TR 1-Nov, 1968, *Glossary of Plastic Piping Terms.*[10]

5.1.1. Hydrostatic design stress—The estimated maximum tensile stress in the wall of the pipe in the circumferential orientation due to internal hydrostatic water pressure that can be applied continuously with a high degree of certainty that failure of the pipe shall not occur.

5.1.2. Pressure rating—The estimated maximum pressure that water in the pipe can exert continuously with a high degree of certainty that failure of the pipe shall not occur.

5.1.3. Relation between dimensions, design stress, and pressure rating—The following expression, commonly known as the ISO equation (see ISO R161-1960, *Pipes of Plastic Materials for the Transport of Fluids*[11]), is used in this Stansard to relate dimensions, design stress, and pressure rating:

$$\frac{2S}{P} = \frac{OD}{t} - 1$$

Where S=design stress, psi
P=pressure rating, psi
OD=average outside diameter, inches
t=minimum wall thickness, inches

[8] See footnotes 1 and 2, page 1.
[9] A division of The Society of the Plastics Industry, Inc., 250 Park Avenue, New York, N. Y. 10017.
[10] See footnote 2, page 1.
[11] See footnote 4, page 2.

5.1.4. Standard thermoplastic pipe materials designation code—The pipe materials designation code consists of the abbreviation PVC or CPVC, for the type of plastic, followed by the ASTM type and grade in Arabic numerals and the design stress in units of 100 psi with any decimal figures dropped. When the design stress code contains less than two figures, a zero is used before the number. Thus a complete material code consists of three or four letters and four figures. (See 2.2.1.3.)

6. MANDATORY MARKING

Marking on the pipe shall include the following, spaced at intervals of not more than 5 feet:

(1) The nominal pipe size (e.g., 2″).

(2) The type of plastic material in accordance with the designation code (e.g., PVC1120).

(3) The schedule size (40, 80, or 120, whichever is applicable).

(4) The pressure rating in psi (e.g., 200 psi). For threaded pipe the pressure rating shall be identified with a "T" after the value (e.g., 100T psi). When the indicated pressure rating is lower than that calculated in accordance with 5.1.3. (see 2.2.2) this shall be indicated by placing a star after the pressure rating.

(5) This Product Standard designation, PS 21-70.

(6) The manufacturer's name or trademark and code.

(7) Pipe intended for transporting potable water shall include the seal of approval (or "nSf" mark) of the National Sanitation Foundation Testing Laboratory, Inc., or of some other testing laboratory accredited by Federal or State Public Health agencies. The marking shall be spaced at intervals required by the organization establishing the specifications.[12]

7. IDENTIFICATION

In order that purchasers may identify products complying with all requirements of this voluntary Product Standard, producers choosing to produce such products in conformance with this voluntary Standard may include a statement in conjunction with their name and address on labels, invoices, sales literature, and the like. The following statement is suggested when sufficient space is available:

> This PVC plastic pipe conforms to the requirements established in Product Standard PS 21-70, developed cooperatively with the industry and published by the National Bureau of Standards under the voluntary Product Standards procedures of the U.S. Department of Commerce. Full responsibility for the conformance of this product with 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 21-70, (name and address of producer or distributor).

[12] Manufacturers using the seal of approval of an accredited testing laboratory must obtain authorization from the laboratory concerned.

8. EFFECTIVE DATE

The effective date of a 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 the requirements of a Product Standard may not actually occur until some time after the effective date. Products shall not be labeled or otherwise described as conforming to a Product Standard until such time as all applicable requirements established in the Standard are met. The effective date of this Standard is February 15, 1970.

9. HISTORY

9.1. First edition—On January 17, 1956, The Society of the Plastics Industry, Inc., requested the assistance of the Department of Commerce in establishing a Commercial Standard for rigid poly (vinyl chloride) plastic pipe when made in Schedules 40, 80, and 120. With the assistance and cooperation of the industry, Commercial Standard CS 207-57 was developed and became effective on January 10, 1957.

9.2. First revision—On May 5, 1958, The Society of the Plastics Industry, Inc. requested the Department's assistance in the development of a revision of CS 207-57. After approval of the Standing Committee and circulation to the industry, the revision was published and became effective on February 15, 1960.

9.3. Current revision—On July 11, 1967, approval was granted to process a revision of CS 207-60 in accordance with the *Procedures for the Development of Voluntary Product Standards* as published by the Department of Commerce on December 10, 1965. This revision was submitted to the National Bureau of Standards by the Plastics Pipe Institute of The Society of the Plastics Industry, Inc., to bring the Standard up to date through the incorporation of advanced technical knowledge regarding poly (vinyl chloride) plastic pipe.

With the approval of the reconstituted Standing Committee, public announcement was made and the recommended Product Standard was widely circulated on November 28, 1969, for consideration and acceptance. The response to this circulation provided sufficient acceptances from producers, distributors, and users of PVC plastic pipe to meet the procedural requirements and to reflect the success of the project.

Accordingly, on February 9, 1970, PS 21-70, *Poly (Vinyl Chloride) (PVC) Plastic Pipe (Schedules 40, 80, and 120)* was announced to become effective on February 15, 1970.

Technical Standards Coordinator:
Karl G. Newell, Product Standards Section, Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234.

10. STANDING COMMITTEE

The following individuals constitute the membership of the Standing Committee which is to review all revisions proposed to keep this Standard abreast of progress. Comments concerning the Standard and suggestions for revision may be addressed to any member of the committee or to the Office of Engineering Standards Services, Na-