ASME B16.40-2013
(Revision of ASME B16.40-2008)

Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems

AN AMERICAN NATIONAL STANDARD

The American Society of
Mechanical Engineers

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AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers
Two Park Avenue • New York, NY • 10016 USA

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ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Periodically certain actions of the ASME B16 Committee may be published as Cases. Cases and interpretations are published on the ASME Web site under the Committee Pages at http://cstools.asme.org/ as they are issued.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

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The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

CONTENTS

FOREWORD

The B16 Standards Committee was organized in the spring of 1920 and held its organizational meeting on November 21 of that year. The group operated as a Sectional Committee (later redesignated as a Standards Committee) under the authorization of the American Engineering Standards Committee [subsequently named American Standards Association, United States of America Standards Institute, and now American National Standards Institute (ANSI)]. Sponsors for the group were the American Society of Mechanical Engineers, Manufacturers Standardization Society of the Valve and Fittings Industry, and the Heating and Piping Contractors National Association (later the Mechanical Contractors Association of America).

The American Gas Association determined that standardization of gas valves used in distribution systems was desirable and needed. The A.G.A. Task Committee on Standards for Valves and Shutoffs was formed, and development work commenced in 1958. In 1968, it was determined that a more acceptable document would result if approval were gained from ANSI, and to facilitate such action, the A.G.A. Committee became Subcommittee No. 13 of the B16 activity. This B16 group was later renamed Subcommittee L, which is its current designation.

The first standard developed by Subcommittee L was B16.33. The B16.38 standard was subsequently developed to cover larger sizes of gas valves and shutoffs. Since about 1965, the increased use of plastic piping in gas distribution systems brought with it the need for valves and shutoffs of compatible material. To fill this need, the present standard was developed and initially appeared as ANSI B16.40-1977. Subcommittee L began review of this document in 1982.

In ANSI/ASME B16.40-1985, editorial changes were made throughout the text to bring the format in line with the rest of the B16 series of standards and to clarify the intent of this Standard. Revisions included the addition of rules for allowable pressure at temperatures above 74°F for valves of certain materials, updating of reference standards, and editorial changes to text and tables.

In 2001, after several years and iterations, B16 Subcommittee L produced a fully revised document. Among the many revisions were a new Definitions section, a new Impact Resistance section, and a nonmandatory Quality Systems Program Annex.

Following approval by the B16 Standards Committee and the ASME Supervisory Board, the last version of this Standard was approved as an American National Standard by ANSI on March 18, 2008.

The 2013 Edition of B16.40 has updated certain material specifications and includes other editorial revisions to the text.

This edition of the Standard was approved as an American National Standard by ANSI on August 6, 2013.

All requests for interpretations or suggestions for revisions should be sent to the Secretary, B16 Committee, The American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME B16 COMMITTEE
Standardization of Valves, Flanges, Fittings, and Gaskets

CORRESPONDENCE WITH THE B16 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B16 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

As an alternative, inquiries may be submitted via e-mail to: SecretaryB16@asme.org.

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Interpretations. Upon request, the B16 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B16 Standards Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings, which are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B16 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B16 Standards Committee.

MANUALLY OPERATED THERMOPLASTIC GAS SHUTOFFS AND VALVES IN GAS DISTRIBUTION SYSTEMS

1 SCOPE

1.1 General

(a) This Standard covers manually operated thermoplastic valves in nominal valve sizes ½ through 12. These valves are intended for use below ground in thermoplastic fuel gas distribution mains and service lines. The maximum operating pressure (MOP) at which such distribution piping systems may be operated is in accordance with the Code of Federal Regulations (CFR) Title 49, Part 192, Transportation of Natural and Other Gas by Pipeline; Minimum Safety Standards, for temperature ranges of −20°F to 140°F (−29°C to 60°C).

(b) This Standard sets qualification requirements for each basic valve design as a necessary condition for demonstrating conformance to this Standard.

(c) This Standard sets requirements for newly manufactured valves for use in below-ground piping systems for fuel gas [includes synthetic natural gas (SNG)] and liquefied petroleum (LP) gases (distributed as a vapor, with or without the admixture of air) or mixtures thereof.

1.2 References

Standards and specifications referenced under this Standard are shown in Mandatory Appendix II.

1.3 Conversion

For the purpose of determining conformance with this Standard, the convention for fixing significant digits, where limits maximum or minimum values are specified, shall be "rounded off" as defined in ASTM Practice E29. This requires that an observed or calculated value shall be rounded off to the nearest unit in the last right-hand digit used for expressing the limit. Decimal values and tolerances do not imply a particular method of measurement.

1.4 Relevant Units

The values stated in either inch or metric units are to be regarded separately as standard. Within the text, the values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the Standard.

1.5 Definitions

basic valve design: for a given valve design, each variation in material, size, or configuration of molded pressure-containing parts shall constitute a different basic valve design, except where minor design variations are produced by differences in machining of the same molded piece(s) to produce different end sizes or dimensional ratios (DRs).

DR: the dimensional ratio defined as the pipe outside diameter (O.D.) divided by the pipe wall thickness, t. DR = O.D./t.

DRv: the valve DR equivalent is the designated valve DR based on the lowest DR of the ASTM D2513 pipe ends used in long-term hydrostatic testing under this Standard.

fasteners: nuts, bolts, washers, clip rings, and other devices used in the assembly of valves.

lubricated valves: valves that require pressure lubrication to effect a leak-tight seal (by the insertion through fittings of lubricant to the sealing surfaces of the valve).

NVS: nominal valve size.

pressure: unless otherwise stated, pressure is gage pressure.

production pressure tests: pressure tests that include seat and closure-member and shell tests.

seat and closure-member test: an internal pressure test of closure-sealing elements (seats, seals, and closure members, such as gate, disc, ball, or plug).

shell test: an internal pressure test of the pressure-containing envelope.

valve design pressure: the pressure calculated by the method described in Mandatory Appendix I using the valve shell material's Hydrostatic Design Basis (HDB) at 73°F (23°C).

1.6 Quality Systems

Nonmandatory requirements relating to the product manufacturer's Quality System Program are described in Nonmandatory Appendix A.

2 CONSTRUCTION

2.1 General

(a) The workmanship used in the manufacture and assembly of each valve shall provide gas tightness, safety and reliability of performance, and freedom from injurious imperfections and defects.

(b) Design details not addressed in this Standard are the responsibility of the manufacturer.

2.2 Materials

2.2.1 Valve Shell. The pressure-containing valve shell shall be made from either polyethylene (PE) or polyamide 11 (PA-11) materials specified in and qualified to the requirements for pipe and fittings as listed in ASTM D2513.

2.2.2 Parts Other Than the Valve Shell. Parts other than the valve shell, which contribute to pressure containment or retaining differential pressure across the closure element, shall be resistant to the gases in para. 1.1(c). Such parts shall be designed to withstand normal valve-operating loads and, in addition, shall provide long-term pressure-containment integrity consistent with the valve shell. The sustained pressure tests of para. 6.3.3 shall qualify the design and material selected for these parts, which include, but are not limited to, the closure member, stems or shafts (if they are designed to retain pressure), and fasteners retaining shell sections.

2.2.3 Lubricants and Sealants. Lubricants and sealants shall be resistant to the action of gases referred to in para. 1.1(c). Lubricated valves, as defined in para. 1.5, are not within the scope of this Standard.

2.2.4 Responsibility. When service conditions, such as gases having high hydrogen content or compounds likely to form condensate, dictate special materials considerations, it is the users' responsibility to specify this information to the manufacturer.

3 CONFIGURATION

3.1 Operating Indication

(a) Valves designed for one-quarter turn operation shall be designed to visually show the open and closed position of the valve. A rectangular stem head with an arrow thereon or a separate position indicator shall indicate the closed position of the valve port when the longitudinal axis of the stem head or indicator is perpendicular to the axis of the connecting pipe. If a separate indicator is used, it shall be designed such that it cannot be assembled to incorrectly indicate the position of the valve.

(b) Valves designed for more than one-quarter turn operation shall close by clockwise stem rotation, unless otherwise specified by the user. The direction for closing the valve shall be indicated.

3.2 Valve End Design

Valve ends shall be designed to one or more of the following, unless otherwise specified by the user:

(a) PE or PA-11 valve stub-ends that conform to the applicable dimensions of ASTM D3261, F1733, or D2513

(b) polyethylene socket ends that conform to the applicable dimensions listed in Tables 1 and 2 of ASTM D2683

(c) integral mechanical joints that meet the requirements of the applicable paragraphs under CFR, Title 49, Part 192, Subpart F, Joining of Material Other Than by Welding

4 PRESSURE RATING

4.1 Maximum Pressure Rating

The maximum pressure rating of each valve is the valve design pressure as defined in para. 1.5 for service from −20°F to 140°F (−29°C to 60°C).

4.2 Design Pressure

The design pressure of the valve shall be limited to the maximum service pressure permitted for plastic pipe as specified in 49 CFR, Part 192.123.

5 MARKING

Each valve shall be clearly marked to show the following:

(a) the manufacturer's name or trademark.

(b) the designation B16.40.

(c) the NVS.

(d) the pressure shell material designation code as specified in ASTM D 2513.

(e) DRv.

(f) each molded pressure shell part shall be marked with the date it was molded. Valve shells that are not molded shall be stamped with the date of manufacture using low-stress stamping.

The markings specified in paras. 5(a) and (f) shall be permanently affixed to or be incorporated as part of the permanent valve identification.

Other markings may be affixed to the valve by any means, provided they do not impair the structural integrity or the operation of the valve.

6 PRODUCTION AND QUALIFICATION TESTING

6.1 General

(a) Gas tightness of production valves shall be demonstrated by subjecting each valve to shell and seat tests in accordance with para. 6.2.

(b) Each basic valve design shall be qualified by testing randomly selected production valves in accordance with para. 6.3.

Table 1 Duration of Test

Nominal Valve Size	Minimum Time Duration, sec
2 and smaller	15
Over 2 to 6	30
Over 6	60

(c) Leak test fluid shall be air or other gas. During leakage testing, there shall be no visible leakage (breaking away or buildup of bubbles) as measured by the immersion or leak detection solution methods. If immersion is used, the depth from the water surface shall be no more than 12 in. (300 mm). Other means of leak detection may be used, provided they can be shown to be equivalent in leak detection sensitivity.

6.2 Production Testing

6.2.1 Shell Test. Each valve shall be tested at 4 psi ± 2 psi (0.28 bar ± 0.14 bar) and at a minimum of 1.5 times the design pressure. The test pressure shall be applied to all pressure-containing areas of the valve (including stem seals and valve ends). This may require that the valve be in the partially open position. The shell test shall be conducted at a temperature of 73°F ± 15°F (23°C ± 8°C). The test fixturing shall not restrain the valve against any mode of failure or leakage. The minimum duration of each of the two shell tests shall be as shown in Table 1.

6.2.2 Seat Test. Each valve shall be seat closure tested at 4 psi ± 2 psi (0.28 bar ± 0.14 bar) and at a minimum of 1.5 times the valve design pressure. These pressures shall be applied successively on each side of the valve seat(s) to check the valve-sealing performance in both directions. The seat test shall be conducted at a temperature of 73°F ± 15°F (23°C ± 8°C). The seat test's fixturing shall not restrain the valve against any mode of failure or leakage. The minimum duration of each portion of the test shall be as shown in Table 1.

6.3 Qualification Testing

6.3.1 Operational Test. It shall be demonstrated that each nominal size of each basic valve design is capable of successfully passing the seat leakage tests of para. 6.2.2, after having completed ten fully opened/closed cycles at 73°F ± 15°F (23°C ± 8°C). The valve shall be pressurized with air or other gas to the design pressure at one port with the other port open to atmosphere before opening on each cycle. At the start of each cycle, the operating torque shall be measured and not exceed those in Table 2 for −20°F (−29°C).

6.3.2 Temperature Resistance. It shall be demonstrated that each nominal size of each basic valve design is capable of being operated at temperatures of −20°F ± 5°F (−29°C ± 3°C) and 140°F ± 5°F (60°C ± 3°C) without visible leakage to atmosphere and without affecting the internal seat-sealing performance of the valve. The method of test is as follows. A closed valve shall be cooled to a temperature of −20°F ± 5°F (−29°C ± 3°C) and held there for an 18-hr minimum. The valve shall then be pressurized with air or gas to a differential pressure across the seat equal to the valve design pressure.

The valve shall then be opened against the applied-differential pressure, using a torque less than or equal to that of Table 2 at the −20°F (−29°C) values and then closed (no differential pressure across the seat required). The valve shall then be tested to meet the requirements of para. 6.2 while at −20°F (−29°C), except nonfreezing leak-detection agents shall be used. The valve shall then be heated to a temperature of 140°F ± 5°F (60°C ± 3°C) and held there for an 18-hr minimum. The closed valve shall then be pressurized with air or other gas to a differential pressure across the seat equal to the valve's design pressure at 140°F (60°C). The valve shall then be opened against the applied-differential pressure using a torque less than or equal to that of Table 2 [140°F (60°C)] values and then closed (no differential pressure across the seat required). The valve shall then be tested to and meet the requirements of para. 6.2, while at 140°F (60°C).

6.3.3 Sustained-Pressure Test. Each basic valve design shall be subjected to the sustained-pressure tests described herein to evaluate the long-term pressure integrity of the valve shell and closure elements. All valves shall be in the open position for the Pressure-Boundary Test [see para. 6.3.3(a)] and in the closed position for the Valve Closure Test [see para. 6.3.3(b)].

For both PE and PA-11, Table 3 offers two choices of pressures and duration times for the sustained pressure test. The valve manufacturer may choose to test for 1,000 hr at the lower listed pressures, depending on valve DR, or for 170 hr at the higher listed pressures. Either choice is valid. The valve manufacturer is not required to perform both tests.

The valves shall not fail, as defined in ASTM D1598, when subjected to the sustained pressure test.

(a) Pressure-Boundary Test. Six samples of each basic valve design shall be connected at both ends to thermoplastic pipe of appropriate wall thickness of a length of at least five times its outside diameter or 20 in. (510 mm), whichever is less. These assemblies shall be subjected to a sustained-pressure test as chosen from the sustained test pressures and minimum durations as listed in Table 3. The DRv for the valve shall be used in determining the test pressure. Failure of two of the six samples tested shall constitute failure in the test. Failure of one of the six samples tested is cause for a retest of six additional samples. Failure of one of the six samples in retest shall constitute failure in the test. Failure of a test sample shall be as defined in ASTM D1598.

Table 2 Maximum Operating Torque Values

Nominal Valve Size [Note (1)]	Maximum Operating Torque at 140°F (60°C)		Maximum Operating Torque at −20°F (−29°C)	
	lbf-in.	N·m	lbf-in.	N·m
½	130	15	390	45
¾	160	18	480	54
1	300	34	600	68
1¼	400	45	800	90
1½	500	56	1,000	112
2	600	68	1,200	136
3	900	102	1,350	153
4	1,200	136	1,800	204
5	1,350	153	2,025	229
6	1,500	169	2,250	253
8	2,600	293	3,900	440
10	4,000	451	6,000	677
12	6,000	677	9,000	1016

NOTE:
(1) For valves having different sized inlets and outlets, the smaller size shall determine the maximum operating torque.

Table 3 Sustained Test Pressures and Minimum Durations

	PE 2708, PE 4710				PA-11			
	176°F (80°C), 1,000 hr		176°F (80°C), 170 hr		73°F (23°C), 1,000 hr		176°F (80°C), 170 hr	
DR	psig	bar	psig	bar	psig	bar	psig	bar
6	232	16.0	268	18.5	1,120	77.2	580	40.0
9.3	140	9.6	161	11.1	675	46.5	349	24.1
10	129	8.9	149	10.3	622	42.9	322	22.2
11	116	8.0	134	9.2	560	38.6	290	20.0
13.5	93	6.4	107	7.4	448	30.9	232	16.0
17	73	5.0	84	5.8	350	24.1	181	12.5
21	58	4.0	67	4.6	280	19.3	145	10.0
26	46	3.2	54	3.7	224	15.4	116	8.0

GENERAL NOTES:
(a) PE 170 hr fiber stress, $S = 670$ psi (4.5 MPa)
(b) PE 1,000 hr fiber stress, $S = 580$ psi (4.0 MPa)
(c) PA-11 170 hr fiber stress, $S = 1{,}450$ psi (10.0 MPa)
(d) PA-11 1,000 hr fiber stress, $S = 2{,}800$ psi (19.3 MPa)
(e) P, psig $= 2 \times S$ / (DR − 1)
(f) Table 3 has two options for each material, and the valve manufacturer may choose to perform long-term tests at the pressure–temperature conditions specified for 1,000 hr or alternative pressure–temperature conditions for 170 hr.

(b) *Valve Closure Test.* One of each variation in design or material of the closure element and/or seat seals of each nominal valve size shall be tested in the closed position. One port shall be pressurized to 1.1 times the valve design pressure and the opposite port open to atmosphere. The pressure shall be maintained for a minimum of 170 hr at 176°F (80°C) or for 1,000 hr at 100°F (38°C). There shall be no evidence of leakage (breaking away of bubbles) past the closure element for the duration of the test.

At the conclusion of this test, the valve must be operable at both 0 psi (0 bar) and with a differential pressure equal to its design pressure. The valve must operate with torque less than that shown in Table 2, 100°F (38°C) values, and there must be no leakage through a closure part.

6.3.4 Flow Capacity. The shape, size, and configuration of the valve when in the fully opened position shall be designed to provide flow- and head-loss coefficients specified in Table 4. A valve of each NVS and type shall be tested to verify the coefficient when installed in a straight run of pipe of the size and wall thickness for which the valve is designed to be conducted, following a procedure such as ANSI/ISA S75.02.

The test fluid and type of test facility and instrumentation are the responsibility of the manufacturer. Flow test reports shall be available for purchaser's review at the manufacturer's facility.

6.3.5 Impact Resistance. This test shall be performed on each NVS and type.

A valve shall not develop leakage or otherwise exhibit impairment of operation when subjected to impacts according to the following test procedure.

The valve shall be firmly supported with stem vertical, while in the upright position, resting on $\frac{3}{4}$ in. (19 mm) plywood. The valve shall be conditioned for a minimum of 18 hr at a temperature of 0°F ± 5°F (−18°C ± 3°C).

An impact shall be applied to the valve stem or operating nut perpendicular to the top of the valve operating nut, using a type "B" 20 lb tup as described in ASTM D2444 dropped from a height of 3 ft (914 mm). The valve shall be impacted five consecutive times within 2 min of removing the valve from the conditioning environmental chamber. The ambient test conditions shall not exceed 88°F (31°C). Following the impacts, the valve shall be operable and subjected to the testing required by para. 6.3.2.

The entire test shall be repeated with the impacts applied at a temperature of 100°F ± 5°F (38°C ± 3°C) on a second valve that has been conditioned at that temperature for a minimum of 18 hr.

Table 4 Flow and Head Loss Coefficients

Nominal Valve Size [Note (1)]	Coefficients: Minimum Gas Flow at Reference Condition [Note (2)]		Minimum Flow Coefficient, C_v [Note (3)]	Maximum Head Loss in Velocity Heads, K [Note (4)]	Maximum Equivalent Length of SDR 11 Pipe	
	ft^3/hr	m^3/h			ft	m
$\frac{1}{2}$	190	5.4	6	5.0	10	3.0
$\frac{3}{4}$	290	8.2	10	5.0	15	4.6
1	600	17.0	20	3.0	12	3.7
$1\frac{1}{4}$	1,200	34.0	39	2.0	11	3.4
$1\frac{1}{2}$	1,500	42.5	51	2.0	13	4.0
2	2,400	68.0	80	2.0	17	5.2
3	6,000	170.0	200	1.5	21	6.4
4	9,900	280.0	330	1.5	28	8.5
5	15,000	425.0	440	1.5	37	11.3
6	19,000	538.0	650	1.9	57	17.4
8	36,000	1 020.0	1,200	1.5	61	18.4
10	60,000	1 700.0	2,000	1.3	69	20.8
12	90,000	2 550.0	3,000	1.1	74	22.5

NOTES:

(1) For valves having different sized inlets and outlets, the smaller size shall determine the coefficient.

(2) Minimum gas flow in standard cubic feet per hour (cubic meters per hour) with the valve in the fully opened position at an inlet pressure of 0.5 psi (0.035 bar), 70°F (21.1°C), 0.64 specific gravity, and 0.3 in. (7.6 mm) water column net valve pressure drop, assuming valve in SDR 11 pipe.

(3) C_v = flow of water at 60°F (16°C) in U.S. gallons per minute that a valve will pass at a pressure drop of 1.0 psi (0.07 bar).

(4) K = head loss coefficient consistent with the following formula:

$$h_L = K\,(V^2/2g_c);\ K = (29.9d^2/C_v)^2$$

where

d = pipe inside diameter for which the value of fluid velocity, V, is associated, in.
g_c = 32.2 ft/sec^2 (9.81 m/s^2)
h_L = head loss produced by valve, ft (m)
V = fluid velocity in pipe, ft/sec (m/s)

MANDATORY APPENDIX I
VALVE DESIGN PRESSURE

The valve design pressure, p, for the various materials and DR equivalents is to be calculated as follows:

$$p = 2SF/(DRv - 1) \text{ [psi (bar)]}$$

where

DRv = valve's dimensional ratio (DR) equivalent

F = a service (design) derating factor (see example below)

S = Hydrostatic Design Basis (HDB) at the maximum expected application use temperature, as listed by the PPI Hydrostatic Stress Board and as published in PPI TR4. Methods of determining HDBs are described in ASTM D2837.

EXAMPLE: If the material is PE 2708, the expected maximum use temperature is 73°F (23°C), and the valve's DR equivalent is 11; from the PPI TR 4, the material's HDB, S, at 73°F (23°C) is 1,250 psi (8.6 MPa). (The design factor 0.32, F, used for this example is taken from 49 CFR, Part 192.121.) Then

$$p = 2 \times 1{,}250 \times 0.32/(11 - 1) = 80 \text{ psig}$$

NOTE: 80 psig is equivalent to 5.5 bar.

MANDATORY APPENDIX II
REFERENCES

The following is a list of publications referenced in this Standard.

ANSI/ISA S75.02-1996, Control Valve Capacity Test Procedures[1]

Publisher: International Society of Automation (ISA), 67 T. W. Alexander Drive, P.O. Box 12277, Research Triangle Park, NC 27709 (www.isa.org)

ASTM D1598-02, Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

ASTM D2444-05, Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

ASTM D2513-05, Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D2683-04, Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

ASTM D2837-04, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

ASTM D3261-03, Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM E29-03, Standard Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications

ASTM F1733, Standard Specification for Butt Heat Fusion Polyamide (PA) Plastic Fitting for Polyamide (PA) Plastic Pipe and Tubing

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

CFR, Title 49, Part 192-2000, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Standards

Publisher: U.S. Government Printing Office (GPO), 732 N. Capitol Street NW, Washington, DC 20401 (www.gpoaccess.gov/index.html)

ISO 9000: 2000, Quality management systems — Fundamentals and vocabulary[1]

ISO 9001: 2000, Quality management systems — Requirements[1]

ISO 9004: 2000, Quality management systems — Guidelines for performance improvements[1]

Publisher: International Organization for Standardization (ISO) Central Secretariat, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Genève 20, Switzerland/Suisse (www.iso.org)

PPI TR4-2000b, HDB/PDB/MRS Listed Materials

Publisher: Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062 (www.plasticpipe.org)

[1] May also be obtained from American National Standards Institute, 25 West 43rd Street, New York, NY 10036.

NONMANDATORY APPENDIX A
QUALITY SYSTEM PROGRAM

The products manufactured in accordance with this Standard shall be produced under a quality system program following the principles of an appropriate standard from the ISO 9000 series.[1] A determination of the need for registration and/or certification of the product manufacturer's quality system by an independent organization shall be the responsibility of the manufacturer. The detailed documentation demonstrating program compliance shall be available to the purchaser at the manufacturer's facility. A written summary description of the program utilized by the product manufacturer shall be available to the purchaser upon request. The product manufacturer is defined as the entity whose name or trademark appears on the product in accordance with the marking or identification requirements of this Standard.

[1] The series is also available from the American National Standards Institute (ANSI) and the American Society for Quality Control (ASQC) as American National Standards that are identified by a prefix "Q" replacing the prefix "ISO." Each standard of the series is listed under Mandatory Appendix II, References.

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