ASME B16.38-2023

[Revision of ASME B16.38-2012 (R2017)]

Large Metallic Valves for Gas Distribution

Manually Operated, NPS 2½ (DN 65) to NPS 12 (DN 300), 125 psig (8.6 bar) Maximum

AN AMERICAN NATIONAL STANDARD

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Two Park Avenue • New York, NY • 10016 USA

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The endnotes and preamble in this document (if any) are part of this American National Standard.

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The American Society of Mechanical Engineers
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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). In 1982, the B16 Committee was reorganized as an ASME Committee operating under procedures accredited by ANSI.

The American Gas Association (AGA) determined that standardization of gas valves used in distribution systems was desirable and needed. The AGA 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 was gained from ANSI, and to facilitate such action, the A.G.A. Committee became Subcommittee 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 ANSI B16.33, which was published in 1973. As a follow-up, ANSI B16.38 was subsequently developed to cover larger sizes of gas valves and shutoffs and was first published in 1978.

ANSI/ASME B16.38-1985 offered more performance requirements than had been customary in many B16 standards. It was expected that this would permit both manufacturers and users greater latitude in producing and using products made to that standard.

Editorial changes were made throughout the text and tables to bring the format in line with the rest of the B16 series of standards and to clarify the intent of that standard. Revisions included changes to the qualification requirements and to requirements for construction and valve ends, updating of reference standards, and editorial changes to the text and tables. The cover, headings, and designation of the standard had also been revised to reflect reorganization of the B16 Committee as an ASME Committee.

The 2007 edition of ASME B16.38 updated the 1985 edition. All requirements were metricated, and the references were updated to the current revision. The paragraph on minimum levels of performance was expanded to describe valve types and their relevant standards. The section on "Lubrication (Sealant)" was renamed "Injection Sealant," and the paragraph was edited for clarity. Paragraph 2.6, Pressure-Containing Materials; para. 2.7, Gas Resistance; para. 2.8, Temperature Resistance; and para. 2.9, Elastomer Components, were added. Paragraph 3.2, Number of Tests, was expanded to require that any material or design change that could affect qualification test results is reason to repeat all qualification tests. Wording throughout this edition was expanded for clarity.

The 2012 edition of B16.38 updated the referenced standards in Mandatory Appendix I. Following approval by the ASME B16 Standards Committee, B16.38-2012 was approved by ANSI as an American National Standard on August 21, 2012.

In ASME B16.38-2023, the figure and tables have been redesignated. Cross-references have been updated accordingly. Also, in this edition, the references in Mandatory Appendix I have been updated. Following approval by the ASME B16 Standards Committee, ASME B16.38-2023 was approved by ANSI on June 30, 2023.

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

(The following is the roster of the committee at the time of approval of this Standard.)

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General. ASME codes and standards are developed and maintained by committees with the intent to represent the consensus of concerned interests. Users of ASME codes and standards may correspond with the committees to propose revisions or cases, report errata, or request interpretations. Correspondence for this Standard should be sent to the staff secretary noted on the committee's web page, accessible at https://go.asme.org/B16committee.

Revisions and Errata. The committee processes revisions to this Standard on a continuous basis 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 in the next edition of the Standard.

In addition, the committee may post errata on the committee web page. Errata become effective on the date posted. Users can register on the committee web page to receive e-mail notifications of posted errata.

This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases

(a) The most common applications for cases are

(1) to permit early implementation of a revision based on an urgent need

(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Standard

(4) to permit the use of a new material or process

(b) Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or owners to choose any method of design or any form of construction that conforms to the Standard.

(c) A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Standard and the paragraph, figure, or table number

(4) the editions of the Standard to which the proposed case applies

(d) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Approved cases are posted on the committee web page.

Interpretations. Upon request, the committee will issue an interpretation of any requirement of this Standard. An interpretation can be issued only in response to a request submitted through the online Interpretation Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic e-mail confirming receipt.

ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers can track the status of their requests at https://go.asme.org/Interpretations.

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Committee Meetings. The B16 Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the committee. Information on future committee meetings can be found on the committee web page at https://go.asme.org/B16committee.

ASME B16.38-2023
SUMMARY OF CHANGES

Following approval by the ASME B16 Standards Committee and ASME, and after public review, ASME B16.38-2023 was approved by the American National Standards Institute on June 30, 2023.

In ASME B16.38-2023, figure and tables have been redesignated. Cross-references have been updated accordingly. In addition, this edition includes the following changes identified by a margin note, **(23)**. The Record Numbers listed below are explained in more detail in the "List of Changes in Record Number Order" following this Summary of Changes.

Page	*Location*	*Change (Record Number)*
1	2.1.2	Reference to MSS SP-84 deleted *(14-391)*
2	2.3.3	Reference to MSS SP-72 deleted *(14-391)*
7	Mandatory Appendix I	Updated *(21-2227)*

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
14-391	Revised the references in paras. 2.1.2 and 2.3.3.
21-2227	Updated references in Mandatory Appendix I.

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LARGE METALLIC VALVES FOR GAS DISTRIBUTION Manually Operated, NPS $2\frac{1}{2}$ (DN 65) to NPS 12 (DN 300), 125 psig (8.6 bar) Maximum

1 SCOPE

1.1 Valve Types

This Standard covers requirements for manually operated metallic valves in nominal sizes $2\frac{1}{2}$ (DN 65) through 12 (DN 300) having the inlet and outlet on a common centerline. These valves are intended for controlling the flow of gas from open to fully closed positions, for use in distribution and service lines where the maximum gage pressure does not exceed 125 psig (8.6 bar). Valve seats, seals, and stem packing may be nonmetallic.

1.2 Application

This Standard sets forth the minimum capabilities, characteristics, and properties that a newly manufactured metallic valve must possess in order to be considered suitable for use in the piping systems indicated above, carrying natural gas, manufactured gas [includes synthetic natural gas (SNG)], and liquefied petroleum gases (distributed as a vapor, with or without the admixture of air) or mixtures thereof.

1.3 Referenced Standards

Standards and specifications adopted by reference in this Standard and the names of the sponsoring organizations are shown in Mandatory Appendix I. It is not considered practical to refer to a specific edition of each of the standards and specifications in the individual references. Instead, the specific edition references are included in Mandatory Appendix I. A product made in conformance with a prior edition of referenced standards will be considered to be in conformance, even though the edition reference may be changed in a subsequent revision of the standard.

1.4 Quality Systems

Nonmandatory requirements relating to the product manufacturer's quality system program are described in Nonmandatory Appendix A.

1.5 Convention

For determining conformance with this Standard, the convention for fixing significant digits where limits (maximum or minimum values) are specified shall be as defined in ASTM E29. This requires that an observed or calculated value 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.

1.6 Codes and Regulations

A valve used under the jurisdiction of a Federal Regulation, such as CFR Title 49, Part 192; the ASME Code for Pressure Piping, such as ASME B31.8; or the National Fuel Gas Code, AGA Z223121/ANSI Z223.1/NFPA 54, is subject to any limitation of that code or regulation.

1.7 Definitions

NPS: nominal pipe size.

NVS: nominal valve size.

one bar: 100 kPa.

PTFE: materials that comply with ASTM D4894.

All pressures, unless otherwise stated, are gage pressures.

2 CONSTRUCTION

2.1 Conformance

2.1.1 Each completed and assembled valve at the time of manufacture and marked with the designation "B16.38" shall be capable of meeting the requirements set forth in this Standard.

2.1.2 Classes 125 and 150 valves (depending upon (23)
their design) shall meet the requirements of one of the following standards: MSS SP-67, MSS SP-70, MSS SP-72, MSS SP-78, MSS SP-80, ASME B16.34, and ASME B16.42 (see Mandatory Appendix I).

2.2 Tamperproof Features

Where valves are specified to be tamperproof, they shall be designed and constructed to minimize the possible removal of the core of the valve with other-than-specialized tools, e.g., tools other than common wrenches, pliers, etc.

2.3 Configuration

2.3.1 Closure Indication.

2.3.1.1 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 or a 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 employed, it shall be designed such that it cannot be assembled to incorrectly indicate the position of the valve.

2.3.1.2 Valves shall close by clockwise stem rotation unless otherwise specified by the purchaser or by the reference standard in para. 2.1.2. The direction for closing shall be indicated.

2.3.2 Valve Ends. Valve ends shall conform to the following standards where applicable:

(a) for threaded valve ends, ANSI/ASME B1.20.1
(b) for flanged gray cast iron valve ends, ASME B16.1
(c) for flanged ductile cast iron valve ends, ASME B16.42
(d) for flanged steel valve ends, ASME B16.5
(e) for flanged, butt-welding, and socket-welding valve ends, ASME B16.34

(23) **2.3.3 Dimensions.** Face-to-face and end-to-end dimensions of valves (other than ball, butterfly, or diaphragm valves) with flanged ends or butt-welding ends shall conform to the dimensions contained in ASME B16.10. Face-to-face dimensions for butterfly valves shall be in accordance with dimensions contained in MSS SP-67. End-to-end dimensions of threaded end valves shall be in accordance with the manufacturer's standard dimensions.

2.4 Marking

Each valve, in addition to the markings required by the applicable valve standard of para. 2.1.2, shall bear the marking "B16.38" or "B16.38T" if tamperproof features are included according to para. 2.2. Alternative to the latter, the marking "T" may be shown on the operating head or stem.

2.5 Injection Sealant

A valve that uses injection of sealant through a fitting that leads to the sealing surfaces shall be capable of having sealant injected in both the full-open and full-closed positions at an inlet pressure of 125 psig (8.6 bar).

2.6 Pressure-Containing Materials

Materials for valve bodies, plugs, bonnets, unions, and other pressure-containing parts shall be in accordance with the applicable standards of para. 2.1.2.

2.7 Gas Resistance

All materials, including lubricants and sealants, shall be resistant to deterioration when exposed to fuel gases such as listed in para. 1.2.

2.8 Temperature Resistance

The materials used for valve bodies, plugs, bonnets, unions, and other pressure-containing parts, excluding handles, shall have a solidus temperature in excess of 600°F (427°C).

2.9 Elastomer Components

2.9.1 Air Aging Tests. Elastomer parts that are exposed to fuel gas shall be made of materials that [following 70-hr air aging at 212°F (100°C) in accordance with ASTM D573] meet elongation, tensile, and hardness property requirements as specified in paras. 2.9.1.1 and 2.9.1.2.

2.9.1.1 Tensile tests shall be conducted in accordance with ASTM D412. Three dumbbells shall be air aged 70 hr at 212°F (100°C) in accordance with ASTM D573. The dumbbells shall have a thickness of 0.08 in. ± 0.008 in. (2 mm ± 0.2 mm). The average of the three individual tests for the aged dumbbells shall exceed 60% retention of ultimate elongation and 60% retention of tensile strength at break. The average of the three individual tests for the nonaged dumbbells shall be the basis for the percent calculation.

2.9.1.2 Hardness tests shall be conducted using specimens in accordance with ASTM D395, Type 2. Three specimens shall be air aged 70 hr at 212°F (100°C) in accordance with ASTM D573. The average of the three individual tests for the aged specimens shall not show a hardness change of more than ±10 Shore A hardness points relative to the average hardness of the nonaged specimens.

2.9.2 Swell Tests. Elastomer parts that are exposed to fuel gas shall be made from materials that after 70-hr exposure to *N*-hexane at 74°F (23°C), in accordance with ASTM D471, meet the volume change, elongation, and tensile property requirements as specified in paras. 2.9.2.1 and 2.9.2.2.

2.9.2.1 Volume change tests shall be conducted using six specimens in accordance with ASTM D471, Section 8. Three specimens shall be exposed for 70 hr at 74°F (23°C) in *N*-hexane in accordance with ASTM D471. The average of the three *N*-hexane tests shall not show an increase in volume of more than 1%. The average of the three tests for nonaged specimens shall be the basis for the percent retention calculation.

2.9.2.2 Tensile tests shall be conducted on six dumbbells in accordance with ASTM D412. Three of the tensile tests shall be conducted on dumbbells exposed in *N*-hexane for 70 hr at 74°F (23°C) in accordance with ASTM D471. The dumbbells shall have a thickness of 0.08 in. ± 0.008 in. (2 mm ± 0.02 mm). The average of the three individual *N*-hexane tests shall exceed 60% retention of tensile strength at break. The average of the three tests for the nonaged specimens shall be the basis for the percent retention calculation.

2.9.3 Compression Set Tests. Elastomer parts that may be exposed to fuel gas shall be made from materials having a compression set of not more than 25% after 22 hr at 212°F (100°C), in accordance with ASTM D395, Method B, using standard test specimens in accordance with ASTM D395.

3 QUALIFICATION REQUIREMENTS

3.1 Qualification Tests

In a range of sizes of valves that use the same materials and are proportionally designed, qualification tests consisting of tests for gas tightness, temperature resistance, bending, and flow capacity shall be conducted on at least one sample of the two largest sizes in the following ranges:

(a) range #1 — NPS 5 (DN 125) and smaller valves

(b) range #2 — NPS 6 (DN 150) to NPS 12 (DN 300) valves

If the sizes regularly manufactured do not span the ranges shown, then the largest size manufactured in each range shall be tested.

Valves that require pressure lubrication as described in para. 2.5 may not be relubricated during the qualification tests.

3.2 Number of Tests

Qualification tests shall be conducted on an initial basis, provided the valve was manufactured under a quality control system, which provides assurance that each item manufactured is of comparable quality and capable of performances equivalent to that of the tested unit. Material or design changes to the product that could affect qualification test results require that all qualification tests be repeated.

3.3 Method of Test for Gas Tightness

A valve shall provide a shutoff when in the closed position and shall not leak to atmosphere in the open, closed, or any intermediate position(s).

3.3.1 Shell Test. With the valve in the partially open position and the outlet capped, air or gas pressure of first 4 psig ± 2 psig (0.3 bar ± 0.13 bar) and then 200 psig (13.8 bar) shall be applied to the inlet of the valve with the valve immersed in a bath of water at a temperature of 74°F ± 15°F (23°C ± 8°C). Leakage (as evidenced by the breaking away of bubbles) shall not be permitted. The minimum duration of each portion of the test shall be as specified in Table 3.3.1-1.

3.3.2 Seat Test. Following the shell test, and after removing the outlet cap, with the valve in the full-closed position, air or gas pressure of first 4 psig ± 2 psig (0.3 bar ± 0.13 bar) and then 200 psig (13.8 bar) shall be applied to one end of the valve with the valve immersed in a bath of water at a temperature of 74°F ± 15°F (23°C ± 8°C). Leakage (as evidenced by the breaking away of bubbles) shall not be permitted over the time periods specified in Table 3.3.1-1.

The test pressures shall then be applied to the other valve end and under the same test conditions and acceptance criteria.

3.4 Operational Test

The test valve shall provide a shutoff as determined in para. 3.3 after having been operated for ten cycles between the limits of full-closed to full-open and back to full-closed when subjected to an internal air or gas pressure of 125 psig (8.6 bar) with the outlet capped.

3.5 Temperature Resistance

All test valves shall be operable at metal temperatures ranging from −20°F (−29°C) to 150°F (66°C) without affecting the capability of the valve to control the flow of gas and without leakage to atmosphere.

3.5.1 Method of Test.

3.5.1.1 The valve shall be maintained at a temperature of −20°F (−29°C) for a period long enough to allow all parts to come to an equilibrium temperature. With the valve subjected to an internal air or gas pressure of 125 psig (8.6 bar) and the outlet side sealed, the valve

Table 3.3.1-1
Duration of Test

Valve Size, NPS (DN)	Minimum Duration, min
$2\frac{1}{2}$–5 (65–125)	2
6–10 (150–250)	5
12 (300)	10

Table 3.6.1.1-1
Bending Moment Values

Nominal Pipe Size [Note (1)]	Test Bending Moment, lbf-in. (N·m)	Wall Thickness, in. (mm)
2½	31,000 (3 500)	0.188 (4.78)
3	44,000 (4 975)	0.188 (4.78)
3½	59,000 (6 675)	0.188 (4.78)
4	75,000 (8 475)	0.188 (4.78)
5	116,000 (13 100)	0.188 (4.78)
6	164,000 (18 525)	0.188 (4.78)
8	335,000 (37 850)	0.219 (5.56)
10	512,000 (57 850)	0.219 (5.56)
12	812,000 (91 750)	0.250 (6.35)

GENERAL NOTE: Values are calculated bending moments using 35,000 psig SMYS steel pipe with wall thicknesses shown in this table.

NOTE: (1) For valves having different size inlet and outlet, the smaller size shall determine the bending value.

shall be closed and opened 10 times to establish that it can be opened and closed in a normal manner, i.e., within 15% of the valve manufacturer's specified operating torque.

3.5.1.2 The test valve shall then be maintained at a temperature of 150°F (66°C) for a period long enough to allow all parts to come to equilibrium temperature. With the valve subjected to an internal air or gas pressure of 125 psig (8.6 bar) and the outlet sealed, the valve shall be closed and opened 10 times to establish that it can be opened and closed in a normal manner, i.e., within 15% of the manufacturer's specified operating torque.

3.5.1.3 The test valve shall then be allowed to return to a temperature of 74°F ± 15°F (23°C ± 8°C) and subjected to the tests outlined in paras. 3.3.1 and 3.3.2.

3.6 Structural Provisions: Bending

All test valves shall pass the bending test described herein.

3.6.1 Method of Test for Bending.

3.6.1.1 The test valve shall withstand the bending moment specified in Table 3.6.1.1-1 adjusted by the appropriate ratio in the following:

(a) for ductile materials

$$\frac{\text{actual yield strength of body material}}{\text{specified minimum yield strength of body material}}$$

(b) for nonductile materials

$$\frac{\text{actual tensile strength of body material}}{\text{specified minimum tensile strength of body material}}$$

Strength values shall be determined in accordance with the appropriate material specification.

3.6.1.2 Two bending tests shall be conducted, one with the test bending moments applied parallel to the valve stem and one with the load applied perpendicular to the valve stem. The valve shall be in the half-open position and pressurized internally to a pressure of 125 psig (8.6 bar) for the period of time specified in Table 3.3.1-1 with no visible leakage to atmosphere. The cover (from which protrudes the stem or equivalent) shall be placed in tension when loaded in the parallel-to-the-stem position. While subjected to the test bending moment, the valve shall operate through ten full closing and opening cycles. The test fixture shall apply essentially uniform bending load with zero shear load (neglecting fixture pipe and valve weight) throughout the valve length, as provided by the arrangement in Figure 3.6.1.2-1.

3.6.1.3 After the bending load is removed, there shall be no permanent deformation evidenced by binding, when the test valve is operated through one full closing and opening cycle. The valve shall then be tested as specified in paras. 3.3.1 and 3.3.2 and shall not leak.

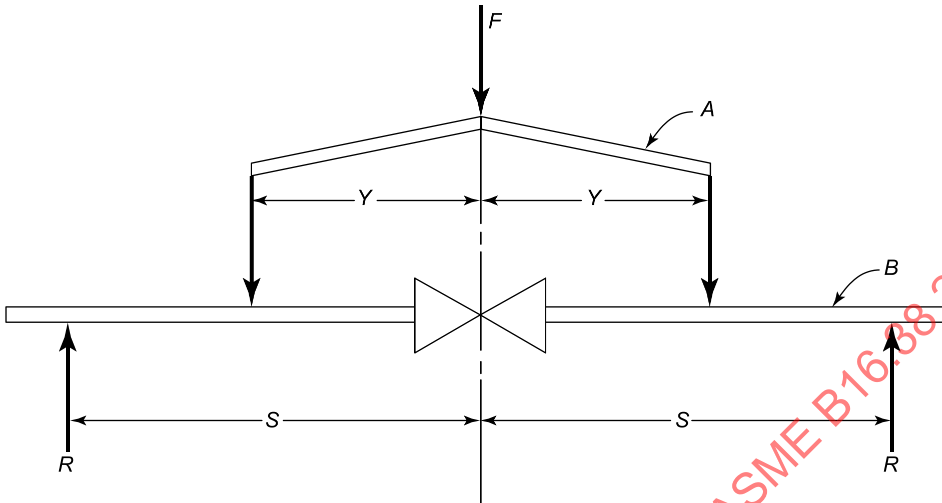
3.7 Flow Capacity

The shape, size, and configuration of the flow passage in fully open valves shall be designed to provide flow and head loss coefficients specified in Table 3.7-1. Qualification tests shall be conducted using technically competent procedures such as that contained in ANSI/ISA SP-75.02.01. The test fluid and type of test facility and instrumentation are at the discretion of the manufacturer and shall be fully described in his records.

4 PRODUCTION TESTING

Gas tightness of production valves shall be demonstrated by subjecting each valve first to a shell test and then a seat test using air or gas pressure of at least 200 psig (13.8 bar). Leakage (as evidenced by the breaking away of bubbles) shall not be permitted over a time period of at least 15 sec.

Figure 3.6.1.2-1
Bend Test Assembly



Legend:
- A = load application yoke
- B = connecting pipe, Schedule 80 of a size to match the valve nominal size
- F = applied load
- R = reaction force = $F/2$
- S = distance from valve centerline to reaction point
- Y = distance from valve centerline to the applied load

Equation for bending moment, M_b

$$M_b = \frac{F}{2}(S - Y)$$

Table 3.7-1
Flow and Head Loss Coefficients

Nominal Valve Size [Note (1)]	Minimum Gas Flow at Reference Conditions, ft^3/hr (m^3/h) [Note (2)]	Alternate Coefficients: Minimum Valve Coefficient, C_v [Note (3)]	Alternate Coefficients: Maximum Head Loss in Pipe Velocity Heads, K [Note (4)]	Alternate Coefficients: Maximum Equivalent Length of Standard Weight or Schedule 40 Pipe, ft (m)
2½	4,400 (125)	150	1.5	17 (5.2)
3	6,000 (170)	200	2.0	30 (9.1)
3½	8,000 (227)	270	2.0	35 (10.7)
4	9,900 (280)	330	2.1	43 (13.1)
5	15,000 (425)	490	2.4	65 (19.8)
6	19,000 (538)	630	3.0	100 (30.5)
8	30,000 (850)	990	3.7	180 (54.9)
10	47,000 (1 330)	1,560	3.7	230 (70.1)
12	66,000 (1 870)	2,200	3.7	280 (85.3)

NOTES:
(1) For valves having different size inlet and outlet, 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 open position at an inlet gage pressure of 0.5 psig (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 Schedule 40 pipe.
(3) C_v = flow of water at 60°F (16°C) in U.S. gallons per minute, which a valve will pass at a pressure drop of 1.0 psig (0.07 bar).
(4) K = head loss coefficient consistent with the following equation:

$$h_1 = K\left(\frac{V^2}{2g}\right)$$

where
g = acceleration due to gravity, ft/sec^2 (m/s^2)
h_1 = head loss produced by valve, ft (m)
V = fluid velocity in pipe, ft/sec (m/s)