ASME B31.8-2007
(Revision of ASME B31.8-2003)

Gas Transmission and Distribution Piping Systems

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Three Park Avenue • New York, NY 10016

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The next edition of this Code is scheduled for publication in 2009. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Code. The interpretations will be included with this edition. Interpretations are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued.

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

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FOREWORD

The need for a national code for pressure piping became increasingly evident from 1915 to 1925. To meet this need, the American Engineering Standards Committee (later changed to the American Standards Association, now the American National Standards Institute) initiated Project B31 in March 1926 at the request of the American Society of Mechanical Engineers and with that Society as sole sponsor. After several years of work by Sectional Committee B31 and its subcommittees, a first Edition was published in 1935 as an American Tentative Standard Code for Pressure Piping.

A revision of the original tentative standard began in 1937. Several more years of effort were given to securing uniformity among sections, eliminating divergent requirements and discrepancies, keeping the Code abreast of current developments in welding technique, calculating stress computations, and including reference to new dimensional and material standards. During this period, a new section added on refrigeration piping was prepared in cooperation with the American Society of Refrigeration Engineers and complemented the American Standard Code for Mechanical Refrigeration. This work culminated in the 1942 American Standard Code for Pressure Piping.

Supplements 1 and 2 of the 1942 Code, which appeared in 1944 and 1947, respectively, introduced new dimensional and material standards, a new formula for pipe wall thickness, and more comprehensive requirements for instrument and control piping. Shortly after the 1942 Code was issued, procedures were established for handling inquiries requiring explanation or interpretation of Code requirements and for publishing such inquiries and answers in *Mechanical Engineering* for the information of all concerned.

By 1948, continuing increases in the severity of service conditions combined with the development of new materials and designs to meet these higher requirements warranted more extensive changes in the Code than could be provided from supplements alone. The decision was reached by the American Standards Association and the sponsor to reorganize the sectional committee and its several subcommittees and to invite the various interested bodies to reaffirm their representatives or to designate new ones.

Because of the wide field involved, between 30 and 40 different engineering societies, government bureaus, trade associations, institutes, and similar organizations have had one or more representatives on the sectional committee, plus a few "members at large" to represent general interests. Code activities have been subdivided according to the scope of the several sections. General direction of Code activities rested with the Standards Committee officers and an executive committee, membership of which consisted principally of Standards Committee officers and section chairmen.

Following its reorganization in 1948, Standards Committee B31 made an intensive review of the 1942 Code that resulted in

(a) a general revision and extension of requirements to agree with present day practice

(b) the revision of references to existing dimensional standards and material specifications and the addition of references to the new ones

(c) the clarification of ambiguous or conflicting requirements

The revision was presented for letter ballot vote of Standards Committee B31. Following approval by this body, the project was approved by the sponsor organization and by the American Standards Association. It was finally designated as an American Standard in February 1951, with the designation B31.1-1951.

Standards Committee B31 at its annual meeting of November 29, 1951, authorized the separate publication of a section of the Code for Pressure Piping addressing gas transmission and distribution piping systems, to be complete with the applicable parts of Section 2, Gas and Air Piping Systems, Section 6, Fabrication Details, and Section 7, Materials — Their Specifications and Identification. The purpose was to provide an integrated document for gas transmission and distribution piping that would not require cross-referencing to other sections of the Code.

The first Edition of this integrated document, known as American Standard Code for Pressure Piping, Section 8, Gas Transmission and Distribution Piping Systems, was published in 1952 and consisted almost entirely of material taken from Sections 2, 6, and 7 of the 1951 Edition of the Pressure Piping Code.

A new section committee was organized in 1952 to update Section 8 as necessary to address modern materials and methods of construction and operation.

After a review by B31 Executive and Standards Committees in 1955, a decision was made to develop and publish industry sections as separate Code documents of the American Standard B31 Code for Pressure Piping. The 1955 Edition constituted a general revision of the 1952 Edition with a considerably expanded scope. Further experience in the application of the Code resulted in revisions in 1958, 1963, 1966, 1967, 1968, 1969, 1975, and 1982.

In December 1978, the American National Standards Committee B31 was reorganized as the ASME Code for Pressure Piping, B31 Committee. The code designation was also changed to ANSI/ASME B31.

The 1989 Edition of the Code was a compilation of the 1986 Edition and the subsequent addenda issued to the 1986 Edition.

The 1992 Edition of the Code was a compilation of the 1989 Edition, the subsequent three addenda, and the two special Errata issued to the 1989 Edition.

The 1995 Edition of the Code is a compilation of the 1992 Edition and the subsequent three addenda issued to the 1992 Edition.

The 1999 Edition of the Code is a compilation of the 1995 Edition and the revisions that have occurred since the issuance of the 1995 Edition.

The 2003 Edition of the Code is a compilation of the 1999 Edition and revisions that have occurred since the issuance of the 1999 Edition.

The 2007 Edition of the Code is a compilation of the 2003 Edition and revisions that have occurred since the issuance of the 2003 Edition. This Edition was approved by the American National Standards Institute on September 25, 2007.

ASME CODE FOR PRESSURE PIPING, B31

(The following is the roster of the Committee at the time of approval of this Code.)

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INTRODUCTION

The ASME Code for Pressure Piping consists of many individually published sections, each an American National Standard. Hereafter, in this Introduction and in the text of this Code Section, B31.8, when the word "Code" is used without specific identification, it means this Code Section.

The Code sets forth engineering requirements deemed necessary for the safe design and construction of pressure piping. Although safety is the basic consideration, this factor alone will not necessarily govern the final specifications of any piping system. The designer is cautioned that the Code is not a design handbook; it does not eliminate the need for the designer or for competent engineering judgment.

To the greatest possible extent, Code requirements for design are stated in terms of basic design principles and formulas. These are supplemented as necessary with specific requirements to ensure uniform application of principles and to guide selection and application of piping elements. The Code prohibits designs and practices known to be unsafe and contains warnings where caution, but not prohibition, is warranted.

This Code Section includes

(a) references to acceptable material specifications and component standards, including dimensional and mechanical property requirements

(b) requirements for designing components and assemblies

(c) requirements and data for evaluating and limiting stresses, reactions, and movements associated with pressure, temperature changes, and other forces

(d) guidance and limitations on selecting and applying materials, components, and joining methods

(e) requirements for fabricating, assembling, and installing piping

(f) requirements for examining, inspecting, and testing piping

(g) procedures for operation and maintenance that are essential to public safety

(h) provisions for protecting pipelines from external and internal corrosion

It is intended that this Edition of Code Section B31.8 and any subsequent addenda not be retroactive. The latest edition and addenda issued at least 6 months before the original contract date for the first phase of activity covering a piping system or systems shall be the governing document, unless agreement is specifically made between contracting parties to use another issue, or unless the regulatory body having jurisdiction imposes the use of another issue or different requirements.

Users of this Code are cautioned against making use of revisions without assurance that they are acceptable to any authorities of jurisdiction where the piping is to be installed.

The Code is under the direction of ASME Committee B31, Code for Pressure Piping, which is organized and operates under procedures of The American Society of Mechanical Engineers that have been accredited by the American National Standards Institute. The Committee is a continuing one and keeps all Code Sections current with new developments in materials, construction, and industrial practice. Addenda are issued periodically. New editions are published at intervals of 3 years to 5 years.

When no Section of the ASME Code for Pressure Piping specifically covers a piping system, the user has discretion to select any Section determined to be generally applicable; however, it is cautioned that supplementary requirements to the Section chosen may be necessary to provide for a safe piping system for the intended application. Technical limitations of the various Sections, legal requirements, and possible applicability of other Codes or Standards are some of the factors to be considered by the user in determining the applicability of any Section of this Code.

Interpretations and Revisions

The Committee has established an orderly procedure to consider requests for interpretation and revision of Code requirements. To receive consideration, inquiries must be in writing and must give full particulars. (See Appendix O covering preparation of technical inquiries.)

The approved reply to an inquiry will be sent directly to the inquirer. In addition, the question and reply will be published as part of an Interpretation Supplement to the Code Section, issued with Addenda.

Requests for interpretation and suggestions for revision should be addressed to the Secretary, ASME B31 Committee, c/o The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

Cases

A Case is the prescribed form of reply to an inquiry when study indicates that the Code wording needs clarification or when the reply modifies existing requirements of the Code or grants permission to use new

materials or alternative constructions. Proposed Cases are published in *Mechanical Engineering* for public review. In addition, the Case will be published as part of an Interpretation Supplement issued with Addenda to the applicable Code Section.

A Case is normally issued for a limited period, after which it may be renewed, incorporated in the Code, or allowed to expire if there is no indication of further need for the requirements covered by the Case. The provisions of a Case, however, may be used after its expiration or withdrawal, provided the Case was effective on the original contract date or was adopted before completion of the work, and the contracting parties agree to its use.

Materials are listed in the Stress Tables only when sufficient usage in piping within the scope of the Code has been shown. Materials may be covered by a case. Requests for listing shall include evidence of satisfactory usage and specific data to permit establishment of allowable stresses or pressure rating, maximum and minimum temperature limits, and other restrictions. Additional criteria can be found in the guidelines for addition of new materials in the ASME Boiler and Pressure Vessel Code, Section II and Section VIII, Division 1, Appendix B. (To develop usage and gain experience, unlisted materials may be used in accordance with para. 811.22.)

Effective Date

This Edition, when issued, contains new Code provisions. It is a compilation of the 2003 Edition and revisions to the 2003 Edition.

ASME B31.8-2007
SUMMARY OF CHANGES

Following approval by the B31 Committee and ASME, and after public review, ASME B31.8-2007 was approved by the American National Standards Institute on September 25, 2007.

ASME B31.8-2007 includes editorial changes, revisions, and corrections introduced in ASME B31.8-2003, as well as the following changes identified by a margin note, **(07)**, placed next to the affected area.

Page	*Location*	*Change*
1, 2	802.21	Second sentence revised
4	803.41	Revised
8	811.22	Revised
	811.24(a)	Revised
13	823.21	Revised
16	831.21(a)	Revised
18	831.31	(1) New subparagraph (c) added (2) Previous subparagraphs (c) through (f) redesignated as (d) through (g), respectively
21	831.42(e)	Revised
	831.42(f)	Revised
	831.42(j)	Revised
	Table 831.42	Revised
24	833.2(c)	Nomenclature for T_1 corrected by errata
	833.2(e)	Second equation revised to include equal sign
31	841.113(a)	Parentheses added to third sentence by errata
32	841.123	Title corrected by errata
34	841.129	Added
35	841.142	Parentheses added to last sentence by errata
36	841.231(f)	Revised
44	Table 842.32(c)	Fourth entry in second column corrected by errata
46	842.43(a)	Revised in its entirety
53	845.214(b)(2)	Revised
56	845.411	Heads for (a) and (b) corrected by errata
59	846.11	Revised in its entirety

Page	*Location*	*Change*
67	850.6(c)	Spelling of "water" corrected by errata
68	851.4	First sentence of first paragraph corrected by errata
69	851.42(c)(3)	Equation corrected by errata
70	851.43(c)	Corrected by errata
	851.43(f)	Added
93	A814.1	Second paragraph revised
95, 96	A841.1	Last paragraph added
	A841.32	Last paragraph added
97, 98	A842.11	Last paragraph added
	A842.12	Last paragraph added
	A842.13	Last paragraph added
	A842.18	Parenthetical sentence revised
	A842.221	(1) Second sentence added (2) Third equation added (3) Nomenclature for D_i added
	A842.222	Last paragraph added
	A842.223	Second nomenclature for S_t corrected by errata
99	A842.24	Last paragraph added
	A842.25	Last paragraph added
	A842.31	Last sentence revised
100	A844	Last paragraph added
101	A847.2	Caution added
113–115	Appendix A	References updated
117, 118	Appendix C	References updated
122–126	Table E-1	(1) Callout in sketch for Extruded outlet corrected by errata (2) Under Description, for Buttweld, last line corrected by errata (3) With Concentric reducer per ANSI B16.9, under Stress Intensification Factor, *i*, superscript corrected by errata (4) Notes revised
127	F-1	(1) Second nomenclature for L corrected by errata (2) With nomenclature for r_o, subpara. (b), first NPS value corrected by errata
138	Fig. I-3.1	Added
149	Appendix L	Second sentence added to first paragraph

Page	*Location*	*Change*
163	R-2(a)	Equation corrected by errata
	R-2(b)	Equation corrected by errata
	R-2(c)	Equation corrected by errata
165–173	Index	Updated

SPECIAL NOTE:

The interpretations to ASME B31.8 are included in this edition as a separate section for the user's convenience.

GAS TRANSMISSION AND DISTRIBUTION PIPING SYSTEMS

General Provisions and Definitions

801 GENERAL

801.1 Standards and Specifications

801.11 Standards and specifications approved for use under the Code and the names and addresses of the sponsoring organizations are shown in Appendix A. It is not considered practicable to refer to a specific edition of each of the standards and specifications in the individual Code paragraphs.

801.12 Use of Standards and Specifications Incorporated by Reference. Some standards and specifications cited in Appendix A are supplemented by specific requirements elsewhere in this Code. Users of this Code are advised against attempting direct application of any of these standards without carefully observing the Code's reference to that standard.

801.2 Standard Dimensions

Adherence to American National Standards Institute (ANSI) dimensions is strongly recommended wherever practicable. Paragraphs or notations specifying these and other dimensional standards in this Code, however, shall not be mandatory, provided that other designs of at least equal strength and tightness, capable of withstanding the same test requirements, are substituted.

801.3 SI (Metric) Conversion

For factors used in converting English units to SI units, see Appendix J.

802 SCOPE AND INTENT

802.1 Scope

802.11 This Code covers the design, fabrication, installation, inspection, and testing of pipeline facilities used for the transportation of gas. This Code also covers safety aspects of the operation and maintenance of those facilities.

802.12 This Code does not apply to

(a) design and manufacture of pressure vessels covered by the BPV Code[1]

(b) piping with metal temperatures above 450°F or below −20°F (For low temperature within the range covered by this Code, see para. 812.)

(c) piping beyond the outlet of the customer's meter set assembly (Refer to ANSI Z223.1 and NFPA 54.)

(d) piping in oil refineries or natural gasoline extraction plants, gas treating plant piping other than the main gas stream piping in dehydration, and all other processing plants installed as part of a gas transmission system, gas manufacturing plants, industrial plants, or mines (See other applicable sections of the ASME Code for Pressure Piping, B31.)

(e) vent piping to operate at substantially atmospheric pressures for waste gases of any kind

(f) wellhead assemblies, including control valves, flow lines between wellhead and trap or separator, offshore platform production facility piping, or casing and tubing in gas or oil wells. (For offshore platform production facility piping, see API RP 14E.)

(g) the design and manufacture of proprietary items of equipment, apparatus, or instruments

(h) the design and manufacture of heat exchangers (Refer to appropriate TEMA[2] Standard.)

(i) liquid petroleum transportation piping systems (Refer to ASME B31.4.)

(j) liquid slurry transportation piping systems (Refer to ASME B31.11.)

(k) carbon dioxide transportation piping systems

(l) liquefied natural gas piping systems (Refer to NFPA 59A and ASME B31.3.)

802.2 Intent

802.21 The requirements of this Code are adequate for safety under conditions usually encountered in the gas industry. Requirements for all unusual conditions (07)

[1] BPV Code references here and elsewhere in this Code are to the ASME Boiler and Pressure Vessel Code.

[2] Tubular Exchanger Manufacturers Association, 25 North Broadway, Tarrytown, NY 10591.

cannot be specifically provided for, nor are all details of engineering and construction prescribed; therefore, activities involving the design, construction, operation, or maintenance of gas transmission, gathering, or distribution pipelines should be undertaken using supervisory personnel having the experience or knowledge to make adequate provision for such unusual conditions and specific engineering and construction details. All work performed within the scope of this Code shall meet or exceed the safety standards expressed or implied herein.

802.22 This Code is concerned with

(a) Safety of the general public.

(b) Employee safety to the extent that it is affected by basic design, quality of materials and workmanship, and requirements for testing, operations, and maintenance of gas transmission and distribution facilities. Existing industrial safety procedures pertaining to work areas, safety devices, and safe work practices are not intended to be supplanted by this Code.

802.23 It is not intended that this Code be applied retroactively to such aspects of existing installations as design, fabrication, installation, and testing at the time of construction. Further, it is not intended that this Code be applied retroactively to established operating pressures of existing installations, except as provided for in Chapter V.

802.24 Provisions of this Code shall be applicable to operating and maintenance procedures of existing installations, and when existing installations are uprated.

802.25 Qualification of Those Performing Inspections. Individuals who perform inspections shall be qualified by training and/or experience to implement the applicable requirements and recommendations of this Code.

802.26 For further information concerning pipeline integrity, reference the nonmandatory supplement ASME B31.8S, Managing System Integrity of Gas Pipelines.

802.3 Offshore Gas Transmission

See Chapter VIII for additional requirements and definitions applicable to offshore gas transmission systems.

803 PIPING SYSTEMS DEFINITIONS

803.1 General Terms

803.11 *Gas,* as used in this Code, is any gas or mixture of gases suitable for domestic or industrial fuel and transmitted or distributed to the user through a piping system. The common types are natural gas, manufactured gas, and liquefied petroleum gas distributed as a vapor, with or without the admixture of air.

803.12 *Operating company,* as used herein, is the individual, partnership, corporation, public agency, or other entity that operates the gas transmission or distribution facilities.

803.13 *Private rights-of-way,* as used in this Code, are rights-of-way not located on roads, streets, or highways used by the public, or on railroad rights-of-way.

803.14 *Parallel encroachment,* as used in this Code, is the portion of the route of a pipeline or main that lies within, runs in a generally parallel direction to, and does not necessarily cross the rights-of-way of a road, street, highway, or railroad.

803.15 *Hot taps* are branch piping connections made to operating pipelines, mains, or other facilities while they are in operation. The branch piping is connected to the operating line, and the operating line is tapped while it is under gas pressure.

803.16 *Vault* is an underground structure that may be entered and that is designed to contain piping and piping components (such as valves or pressure regulators).

803.17 *Transportation of gas* is gathering, transmission, or distribution of gas by pipeline or the storage of gas.

803.18 *Pipeline* is all parts of physical facilities through which gas moves in transportation, including pipe, valves, fittings, flanges (including bolting and gaskets), regulators, pressure vessels, pulsation dampeners, relief valves, and other appurtenances attached to pipe, compressor units, metering stations, regulator stations, and fabricated assemblies. Included within this definition are gas transmission and gathering lines, including appurtenances, that are installed offshore for transporting gas from production facilities to onshore locations and gas storage equipment of the closed pipe type, that is fabricated or forged from pipe or fabricated from pipe and fittings.

803.2 Piping Systems

803.21 *Transmission system* is one or more segments of pipeline, usually interconnected to form a network, that transports gas from a gathering system, the outlet of a gas processing plant, or a storage field to a high- or low-pressure distribution system, a large-volume customer, or another storage field.

803.211 *Transmission line* is a segment of pipeline installed in a transmission system or between storage fields.

803.212 *Storage field* is a geographic field containing a well or wells that are completed for and dedicated to subsurface storage of large quantities of gas for later recovery, transmission, and end use.