ASME B31.8-2020
(Revision of ASME B31.8-2018)

Gas Transmission and Distribution Piping Systems

ASME Code for Pressure Piping, B31

AN INTERNATIONAL PIPING CODE®

The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

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The next edition of this Code is scheduled for publication in 2022. This Code will become effective 6 months after the Date of Issuance.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Code. Interpretations are published on the Committee web page and under http://go.asme.org/Interpretations. Periodically certain actions of the ASME B31 Committee may be published as Cases. Cases are published on the ASME website under the B31 Committee Page at http://go.asme.org/B31committee as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages of the associated codes and standards 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.

The B31 Committee Page can be found at http://go.asme.org/B31committee. The associated B31 Committee Pages for each code and standard can be accessed from this main page. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting “Errata” in the “Publication Information” section.

The American Society of Mechanical Engineers
Two 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 (ANSI)] initiated Project B31 in March 1926 at the request of the American Society of Mechanical Engineers (ASME) 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 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 had one or more representatives on the sectional committee, plus a few "members-at-large" to represent general interests. Code activities were 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

A 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, with the designation B31.1-1951, in February 1951.

At its annual meeting on November 29, 1951, Standards Committee B31 authorized the separate publication of a section of the Code for Pressure Piping addressing gas transmission and distribution piping systems, to be completed 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 was a compilation of the 1992 Edition and the subsequent three addenda issued to the 1992 Edition.

The 1999 Edition of the Code was a compilation of the 1995 Edition and the revisions that occurred following the issuance of the 1995 Edition.

The 2003 Edition of the Code was a compilation of the 1999 Edition and revisions that occurred following the issuance of the 1999 Edition.

The 2007 Edition of the Code was a compilation of the 2003 Edition and revisions that occurred following the issuance of the 2003 Edition.

The 2010 Edition of the Code was a compilation of the 2007 Edition and revisions that occurred following the issuance of the 2007 Edition.

The 2012 Edition of the Code was a compilation of the 2010 Edition and revisions that occurred following the issuance of the 2010 Edition.

The 2014 Edition of the Code was a compilation of the 2012 Edition and revisions that occurred following the issuance of the 2012 Edition.

The 2016 Edition of the Code was a compilation of the 2014 Edition and revisions that occurred following the issuance of the 2014 Edition.

The 2018 Edition of the Code is a compilation of the 2016 Edition and revisions that have occurred since the issuance of the 2016 Edition.

The 2020 Edition of the Code is a compilation of the 2018 Edition and revisions that have occurred since the issuance of the 2018 Edition. ASME B31.8-2020 was approved by ANSI on September 18, 2020.

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Code for Pressure Piping

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

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CORRESPONDENCE WITH THE B31 COMMITTEE

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

Secretary, B31 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

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

The Committee welcomes proposals for revisions to this Code. 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 to provide 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 Code and 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 Code to which the proposed Case applies.

Interpretations. Upon request, the B31 Standards Committee will render an interpretation of any requirement of the Code. Interpretations can only be rendered in response to a written request sent to the Secretary of the B31 Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the Secretary of the B31 Standards Committee at the above address. The request for an 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 in one or two words.
Edition:	Cite the applicable edition of the Code 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. Please provide a condensed and precise question, composed in such a way that a "yes" or "no" reply is acceptable.
Proposed Reply(ies):	Provide a proposed reply(ies) in the form of "Yes" or "No," with explanation as needed. If entering replies to more than one question, please number the questions and replies.
Background Information:	Provide the Committee with any background information that will assist the Committee in understanding the inquiry. The Inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

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

Moreover, ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Code requirements. If, based on the inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

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 B31 Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the B31 Standards Committee.

INTRODUCTION

(20) **1 General.** 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 specifies engineering requirements deemed necessary for the safe design and construction of pressure piping. While safety is the primary consideration, this factor alone will not necessarily govern the final specifications of any piping installation or operation. The Code is not a design handbook. Many decisions that must be made to produce a sound piping installation and maintain system integrity during operation are not specified in detail within this Code. The Code does not serve as a substitute for sound engineering judgement by the operating company and designer.

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 not be retroactive. The latest edition 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.

Either U.S. Customary (USC) units or International System (SI, also known as metric) units may be used with this Edition. Local customary units may also be used to demonstrate compliance with this Code. One system of units should be used consistently for requirements applying to a specific installation. The equations in this Code may be used with any consistent system of units. It is the responsibility of the organization performing calculations to ensure that a consistent system of units is used.

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.

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.

2 Appendices. This Code contains two kinds of appendices: mandatory and nonmandatory. Mandatory appendices contain materials the user needs to carry out a requirement or recommendation in the main text of the Code. Nonmandatory appendices, which are written in mandatory language, are offered for application at the user's discretion.

3 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 Nonmandatory 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 the revisions.

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

4 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. The Case will be published on the B31.8 Committee Page at http://cstools.asme.org/.

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. (To develop usage and gain experience, unlisted materials may be used in accordance with para. 811.2.2.)

5 Effective Date. This Edition, when issued, contains new Code provisions. It is a compilation of the 2018 Edition and revisions to the 2018 Edition.

ASME B31.8-2020
SUMMARY OF CHANGES

Following approval by the ASME B31 Committee and ASME, and after public review, ASME B31.8-2020 was approved by the American National Standards Institute on September 18, 2020.

ASME B31.8-2020 includes the following changes identified by a margin note, **(20)**.

Page	*Location*	*Change*
xiv	Correspondence With the B31 Committee	Added
xvi	Introduction	In General, paragraph on units of measure added
1	801.4	Revised
1	802.1	(1) Subparagraphs (b)(11) and (b)(13) revised (2) Subparagraph (b)(14) added
2	803.1	Definition of *gas* revised
4	803.7	Term *block* revised by errata to *block valve* and definition editorially revised
6	804.7.3	Revised in its entirety
8	805.1.4	(1) Definitions of *arc weld* and *seam weld* revised (2) Definition of *longitudinal weld joint quality factor, E* added
8	805.2.1	Term *stand-up pressure test* editorially revised
12	805.2.6	Definition of *design life* editorially revised
16	814.1.1	References updated
17	816	Second paragraph revised
18	817.1.3	Subparagraph (d) revised
22	825.2	Revised in its entirety
22	825.5	Subparagraphs (a) and (b) revised
23	826.3	Subparagraph (d) revised
26	831.3.1	In subpara. (c), second sentence added
29	831.4.2	Subparagraph (k) added
31	832.3	(1) Subparagraph (e) revised (2) Subparagraph (h) editorially revised
35	834.5	Subparagraph (a) added and subsequent subparagraphs redesignated
39	841.1.1	In subpara. (a) nomenclature, definition of *E* revised
39	841.1.2	(1) In subparas. (b) and (c), first sentence revised (2) In subpara. (c)(2), last two paragraphs revised
41	841.1.7	Revised
43	841.1.9	(1) In subpara. (b), "upported" corrected by errata to "supported" (2) Subparagraph (g)(1) revised
43	Table 841.1.7-1	(1) Title revised (2) Pipe class entries for API 5L revised
45	841.1.10	In subpara. (c), last sentence added

Page	*Location*	*Change*
48	841.2.4	Subparagraph (c)(3) revised
50	841.3.1	(1) Subparagraph (a) revised (2) Subparagraphs (h) and (i) added
51	841.3.2	Subparagraph (c)(3) revised
64	843.4.5	Revised in its entirety
64	843.4.6	Revised
71	846.1.1	First sentence editorially revised
75	849.1.6	Subparagraphs (e) and (f) added
84	851.4.3	(1) Subparagraphs (c) and (d) revised (2.) In subpara. (e), fifth sentence editorially revised
87	851.12.1	Subparagraph (b) editorially revised
96	856.1	First paragraph editorially revisd
109	A814.1.1	Revised
110	A825	Deleted
110	A826	Former paras. A826.2, A826.2.1, A826.2.2, and A-826.2.3 redesignated as A826.3, A826.3.1, A826.3.2, and A836.3.3, respectively
111	A840.2	Last sentence added
113	A842.2.2	In subparas. (c) and (d), equations revised in their entirety
117	A844.3	Last sentence added
118	A847.1	Revised
118	A847.4	Revised
125	B826.3	Former paragraph B826.2 redesignated
131	Mandatory Appendix A	References updated
137	Nonmandatory Appendix C	References updated
141	Table D-1	(1) Entries for Type and SMYS revised (2) ASTM A3333, ASTM A381, ASTM A671, ASTM A672, and ASTM A691 added to Specs (3) Note 1 revised in its entirety
144	Table E-1	(1) General Note added (2) Last column head editorially revised (3) Under description, ninth entry revised
149	F-2	(1) Paragraphs F-2.1, F-2.1M, F-2.2, and F-2.2M revised in their entirety (2) Titles added to Figures F-1, F-2, F-3, F-4, F-6, and F-7 (3) General Note deleted from Figure F-3
158	Mandatory Appendix I	Term *sketch* revised as *illustration* throughout
164	Figure I-5	Illustration (g) revised
190	Figure R-1	Illustration (b) caption revised by errata

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General Provisions and Definitions

801 GENERAL

801.1 Approved Standards and Specifications

Standards and specifications approved for use under this Code and the names and addresses of the sponsoring organizations are shown in Mandatory 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.

801.2 Use of Standards and Specifications Incorporated by Reference

Some standards and specifications cited in Mandatory 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.

801.3 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.

(20) 801.4 Units of Measure

This Code states values in both USC and SI units. Within the text, the SI units are shown in parentheses or in separate tables. The values stated in each system are not exact equivalents; therefore, each system of units should be used independently of the other. When separate equations are provided for USC and SI units, those equations shall be executed using variables in the units associated with the specific equation. The results obtained from execution of these equations may be converted to other units.

When necessary to convert from one system of units to another, conversion should be made by rounding the values to the number of significant digits of implied precision in the starting value, but to not less than four significant digits for use in calculations. For factors used in converting USC units to SI units, see Nonmandatory Appendix J.

802 SCOPE AND INTENT

802.1 Scope (20)

(a) 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. (See Mandatory Appendix Q for scope diagrams.)

This Code is concerned only with certain safety aspects of liquefied petroleum gases when they are vaporized and used as gaseous fuels. All of the requirements of NFPA 58 and NFPA 59 and of this Code concerning design, construction, and operation and maintenance of piping facilities shall apply to piping systems handling butane, propane, or mixtures of these gases.

(b) This Code does not apply to

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

(2) piping with metal temperatures above 450°F (232°C). (For low-temperature considerations, see section 812.)

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

(4) 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.)

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

(6) 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.)

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

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

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

[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.