ASME B31.4-2025
(Revision of ASME B31.4-2022)

Pipeline Transportation Systems for Liquids and Slurries

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

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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 (ASA)] 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' 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 was begun in 1937. Several more years' effort was given to securing uniformity between sections and to eliminating divergent requirements and discrepancies, as well as to keeping the code abreast of current developments in welding technique, stress computations, and references to new dimensional and material standards. During this period, a new section was added on refrigeration piping, prepared in cooperation with The American Society of Refrigeration Engineers (ASRE) and complementing 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 that require explanation or interpretation of code requirements, and for publishing such inquiries and answers in *Mechanical Engineering* for the information of all concerned.

Continuing increases in the severity of service conditions, with concurrent developments of new materials and designs equal to meeting these higher requirements, had pointed to the need by 1948 for more extensive changes in the code than could be provided by supplements alone. The decision was reached by ASA and ASME 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. Following its reorganization, Sectional Committee B31 made an intensive review of the 1942 code, and a revised code was approved and published in February 1951 with the designation ASA B31.1-1951, which included

(a) a general revision and extension of requirements to agree with practices current at the time

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

(c) clarification of ambiguous or conflicting requirements

Supplement No. 1 to ASA B31.1 was approved and published in 1953 as ASA B31.1a-1953. This Supplement and other approved revisions were included in a new edition published in 1955 with the designation ASA B31.1-1955.

A review by B31 Executive and Sectional Committees in 1955 resulted in a decision to develop and publish industry sections as separate code documents of the American Standard B31 Code for Pressure Piping. ASA B31.4-1959 was the first separate code document for Oil Transportation Piping Systems and superseded that part of Section 3 of ASA B31.1-1955 covering oil transportation piping systems. In 1966, B31.4 was revised to expand coverage on welding, inspection, and testing, and to add new chapters covering construction requirements and operation and maintenance procedures affecting the safety of the piping systems. This revision was published with the designation USAS B31.4-1966, Liquid Petroleum Transportation Piping Systems, since ASA was reconstituted as the United States of America Standards Institute (USASI) in 1966.

USASI changed its name, effective October 6, 1969, to the American National Standards Institute, Inc. (ANSI), and USAS B31.4-1966 was redesignated as ANSI B31.4-1966. The B31 Sectional Committee was redesignated as American National Standards Committee B31 Code for Pressure Piping, and, because of the wide field involved, more than 40 different engineering societies, government bureaus, trade associations, institutes, and the like had one or more representatives on Standards Committee B31, plus a few "Individual Members" to represent general interests. Code activities were subdivided according to the scope of the several sections, and general direction of Code activities rested with Standards Committee B31 officers and an Executive Committee whose membership consisted principally of Standards Committee officers and chairmen of the Section and Technical Specialists Committees.

The ANSI B31.4-1966 Code was revised and published in 1971 with the designation ANSI B31.4-1971.

The ANSI B31.4-1971 Code was revised and published in 1974 with the designation ANSI B31.4-1974.

In December 1978, American National Standards Committee B31 was converted to an ASME Committee with procedures accredited by ANSI. The 1979 revision was approved by ASME and subsequently by ANSI on November 1, 1979, with the designation ANSI/ASME B31.4-1979.

Following publication of the 1979 edition, the B31.4 Section Committee began work on expanding the scope of the Code to cover requirements for the transportation of liquid alcohols. References to existing dimensional standards and material specifications were revised, and new references were added. Other clarifying and editorial revisions were made to improve the text. These revisions led to the publication of two addenda to ANSI/ASME B31.4. Addenda "b" was approved and published in 1981 as ANSI/ASME B31.4b-1981. Addenda "c" was approved and published in 1986 as ANSI/ASME B31.4c-1986.

The 1986 edition of ANSI/ASME B31.4 included the two previously published addenda to the 1979 edition.

Following publication of the 1986 edition, clarifying and editorial revisions were made to improve the text. Additionally, references to existing standards and material specifications were revised, and new references were added. These revisions led to the publication of an addenda that was approved and published in 1987 as ASME/ANSI B31.4a-1987.

The 1989 edition of ASME/ANSI B31.4 included the previously published addenda to the 1986 edition.

Following publication of the 1989 edition, clarifying revisions were made to improve the text. Additionally, references to existing standards and material specifications were revised and updated. These revisions led to the publication of an addenda that was approved and published in 1991 as ASME B31.4a-1991.

The 1992 edition of ASME B31.4 included the previously published addenda to the 1989 edition and a revision to valve maintenance. The 1992 edition was approved by ANSI on December 15, 1992, and designated as ASME B31.4-1992 edition.

The 1998 edition of ASME B31.4 included the previously published addenda to the 1992 edition. Also included in the 1998 edition were other revisions and the addition of Chapter IX, Offshore Liquid Pipeline Systems. The 1998 edition was approved by ANSI on November 11, 1998, and designated as ASME B31.4-1998 edition.

The 2002 edition of ASME B31.4 included the previously published addenda to the 1998 edition along with revisions to the maintenance section and updated references. The 2002 edition was approved by ANSI on August 5, 2002, and designated as ASME B31.4-2002.

The 2006 edition of ASME B31.4 contained a new repair section, along with revisions to the definitions section, expansion of material standards Table 423.1 and dimensional standards Table 426.1, and updated references. The 2006 edition was approved by ANSI on January 5, 2006, and designated as ASME B31.4-2006.

The 2009 edition of ASME B31.4 contained major revisions to the definitions section; Chapter II, Design; and Chapter VIII, Corrosion Control. The materials standards Table 423.1 and references were revised and updated. The 2009 edition was approved by ANSI on September 14, 2009, and designated as ASME B31.4-2009.

The 2012 edition of ASME B31.4 contained a revised scope and a new chapter to incorporate the requirements from ASME B31.11, Slurry Transportation Piping Systems. There was also a new chapter for carbon dioxide piping, extracting all of the previous carbon dioxide information into a stand-alone chapter. The definitions section was also revised with new entries. The 2012 edition was approved by ANSI on September 14, 2012, and designated as ASME B31.4-2012.

The 2016 edition of ASME B31.4 contained a revised scope and updates to the stress section in Chapter II. A new paragraph was added in Chapter III for material requirements in low-temperature applications. In addition, changes were included throughout to reference minimum wall thickness requirements as permitted by manufacturing specifications. The 2016 edition was approved by ANSI on February 22, 2016, and designated as ASME B31.4-2016.

The 2019 edition of ASME B31.4 contained a rework of Chapter IX to align with standardized numbering of other chapters. A new standard was referenced in Chapter II to improve the accuracy of calculations that use stress intensification and flexibility factors. Updates to the text and table in Chapter VI on allowable repairs were completed. The 2019 edition was approved by ANSI on July 18, 2019, and designated as ASME B31.4-2019.

ASME B31.4-2022 was approved by ANSI on September 6, 2022.

This 2025 edition revises all equations for use with any consistent system of units. It replaces the term "and/or" with clearer language and adds a paragraph on suspension of operation to Chapter VII. This edition also revises para. 402.6.2 with new formulae for unrestrained longitudinal stress, and para. 461.1.5 as well as the definitions of sustained in-plane moment index, I_i, and sustained out-of-plane moment index, I_o, and updates the references. ASME B31.4-2025 was approved by ANSI on October 27, 2025.

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

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 email notifications of posted errata.

This Code 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 Code

(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 Code.

(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 Code and the paragraph, figure, or table number

(4) the editions of the Code 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 Code. An interpretation can be issued only in response to a request submitted through the online Inquiry Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic email confirming receipt.

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 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.

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.

Interpretations are published in the ASME Interpretations Database at https://go.asme.org/Interpretations as they are issued.

Committee Meetings. The B31 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/B31committee.

(25)

INTRODUCTION

The ASME B31 Code for Pressure Piping consists of a number of individually published Sections, each an American National Standard. Rules for each Section reflect the kinds of piping installations considered during its development, as follows:

B31.1 Power Piping: piping typically found in electric power-generating stations, industrial and institutional plants, geothermal heating systems, and central and district heating and cooling systems

B31.3 Process Piping: piping typically found in petroleum refineries; onshore and offshore petroleum and natural gas production facilities; chemical, pharmaceutical, textile, paper, ore processing, semiconductor, and cryogenic plants; food and beverage processing facilities; and related processing plants and terminals

B31.4 Pipeline Transportation Systems for Liquids and Slurries: piping transporting hazardous products that are predominately liquid between facilities, production and storage fields, plants, and terminals, and within terminals and pumping, regulating, and metering stations associated with liquid pipeline systems

B31.5 Refrigeration Piping and Heat Transfer Components: piping for refrigerants and secondary coolants

B31.8 Gas Transmission and Distribution Piping Systems: piping transporting products that are predominately gas between sources and terminals, including compressor, regulating, and metering stations, and gas gathering pipelines

B31.9 Building Services Piping: piping typically found in industrial, institutional, commercial, and public buildings, and in multi-unit residences, that does not require the range of sizes, pressures, and temperatures covered in B31.1

B31.12 Hydrogen Piping and Pipelines: piping in gaseous and liquid hydrogen service and pipelines in gaseous hydrogen service

This is Code Section B31.4, Pipeline Transportation Systems for Liquids and Slurries. Hereafter, in this Introduction and in the text of this Code Section B31.4, where the word "Code" is used without specific identification, it means this Code Section.

The user has the responsibility of selecting the Code Section that most nearly applies to a proposed piping installation. Factors to be considered include limitations of the Code Section, jurisdictional requirements, and the applicability of other codes and standards. All applicable requirements of the selected Code Section shall be met. For some installations, more than one Code Section may apply to different parts of the installation. Certain piping within a facility may be subject to other national or industry codes and standards. The user is also responsible for imposing requirements, if necessary, that are supplementary to the Code to ensure safe piping for the proposed installation.

The Code specifies engineering requirements deemed necessary for safe design, construction, operation, and maintenance of pressure piping. While safety is the primary consideration, this factor alone will not necessarily govern the final specifications for 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 to maintain system integrity during operation are not specified in detail within this Code. The Code does not serve as a substitute for sound engineering judgments by the operating company and the 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 requirements and pressure–temperature ratings

(b) requirements for design of components and assemblies, including pipe supports

(c) requirements and data for evaluation and limitation of stresses, reactions, and movements associated with pressure, temperature changes, and other forces

(d) guidance and limitations on the selection and application of materials, components, and joining methods