ASME B31.9-2014
(Revision of ASME B31.9-2011)

Building Services Piping

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

INTENTIONALLY LEFT BLANK

ASME B31.9-2014
(Revision of ASME B31.9-2011)

Building Services Piping

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD

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

Date of Issuance: April 28, 2014

The next edition of this Code is scheduled for publication in 2017. 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, Code Cases, and errata are published on the ASME Web site under the Committee Pages at http://cstools.asme.org/ as they are issued.

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

The Committee Pages can be found at http://cstools.asme.org/. 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

CONTENTS

FOREWORD

The need for a national code for pressure piping became increasingly evident from 1915 to 1925. The American Standards Association (ASA) initiated the B31 Project in March 1926 to meet that need. The American Society of Mechanical Engineers (ASME) proposed the work and has served as sponsor since its inception.

The first edition was published in 1935 as the American Tentative Standard Code for Pressure Piping. To keep the Code abreast of developments in design, welding, and of new standards and specifications, as well as of developments in service conditions, new or supplementary editions were issued as follows:

B31.1-1942 American Standard Code for Pressure Piping
B31.1a-1944 Supplement 1
B31.1b-1947 Supplement 2
B31.1-1951 American Standard Code for Pressure Piping
B31.1a-1953 Supplement 1 to B31.1-1951
B31.1-1955 American Standard Code for Pressure Piping

In 1955, a decision was made to develop and publish separate Code Sections for various industries. The current Sections are

B31.1 Power Piping
B31.3 Process Piping
B31.4 Pipeline Transportation Systems for Liquids and Slurries
B31.5 Refrigeration Piping and Heat Transfer Components
B31.8 Gas Transmission and Distribution Piping Systems
B31.9 Building Services Piping
B31.12 Hydrogen Piping and Pipelines

In 1969, ASA, renamed the United States of America Standards Institute (USASI), became the American National Standards Institute (ANSI), and the B31 Sectional Committee became the B31 Standards Committee. In 1978, ASME was granted accreditation by ANSI to organize the B31 Committee as the ASME Code for Pressure Piping, with Code Sections designated as ANSI/ASME B31.

Need for a separate Building Services Section of the Code for Pressure Piping was recognized for several years. This new Code Section, ASME B31.9 Building Services Piping, first issued in 1982, was developed to fill that need.

The Code has intentionally been written on a conservative basis in order to avoid the necessity for complex design, fabrication, and inspection criteria. For this reason, application of this Code is expected to be simple and straightforward.

Metric (SI) units have been added in parentheses after U.S. Customary units. This Code is based on U.S. Customary units. The 2008 edition was approved by ANSI on April 1, 2008, and designated as ASME B31.9-2008.

The 2011 edition of B31.9 contained revisions to the definitions and materials section of the Standard. Additionally, the allowable stress values were updated to the 3.5 design margin.

The 2014 edition of B31.9 includes revisions to materials and the standards for material specifications, and other errata found in the Code.

Following approval by the B31 Main Committee and the ASME Board on Pressure Technology Codes and Standards, and after public review, this Code Section was approved by ANSI on March 18, 2014.

ASME B31 COMMITTEE
Code for Pressure Piping

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

STANDARDS COMMITTEE OFFICERS

M. L. Nayyar, *Chair*
J. E. Meyer, *Vice Chair*
N. Lobo, *Secretary*

STANDARDS COMMITTEE PERSONNEL

R. J. Appleby, ExxonMobil Development Co.
C. Becht IV, Becht Engineering Co., Inc.
A. E. Beyer, Fluor Enterprises
K. C. Bodenhamer, EPCO, Inc.
R. Bojarczuk, ExxonMobil Research & Engineering Co.
C. J. Campbell, Air Liquide
J. S. Chin, TransCanada Pipeline U.S.
D. D. Christian, Victaulic Co.
R. P. Deubler, Fronek Power Systems, LLC
W. H. Eskridge, Jr., Jacobs Engineering
D. J. Fetzner, BP Exploration Alaska, Inc.
P. D. Flenner, Flenner Engineering Services
J. W. Frey, Stress Engineering Services, Inc.
D. R. Frikken, Becht Engineering Co., Inc.
R. A. Grichuk, Fluor Enterprises, Inc.
R. W. Haupt, Consultant
B. P. Holbrook, Babcock Power, Inc.
G. A. Jolly, Vogt Valves Flowserve Corp.
N. Lobo, The American Society of Mechanical Engineers
W. J. Mauro, American Electric Power
J. E. Meyer, Louis Perry & Associates, Inc.
T. Monday, Team Industries, Inc.
M. L. Nayyar, NICE
G. R. Petru, EPCO, Inc.
E. H. Rinaca, Dominion Resources, Inc.
M. J. Rosenfeld, Kiefner & Associates, Inc.
S. K. Sinha, Lummus Pitkin, Inc.
W. J. Sperko, Sperko Engineering Services, Inc.
F. W. Tatar, FM Global
K. A. Vilmont, Black & Veatch
R. A. Appleton, *Contributing Member,* Refrigeration Systems Co.
G. A. Antaki, *Ex-Officio Member,* Becht Engineering Co., Inc.
L. E. Hayden, Jr., *Ex-Officio Member,* Consultant
A. J. Livingston, *Ex-Officio Member,* Kinder Morgan

B31.9 BUILDING SERVICES PIPING SECTION COMMITTEE

D. D. Christian, *Chair,* Victaulic Co.
J. W. Willis, *Vice Chair,* Page Southerland Page, LLP
F. Huang, *Secretary,* The American Society of Mechanical Engineers
M. H. Barnes, Scantec, Inc.
R. D. Gilligan, Consultant
L. E. Hayden, Jr., Consultant
L. A. Loziuk, Consultant
T. Q. McCawley, TQM Engineering
J. R. Paschal, Paschal Engineering & Forensics Consulting, Inc.
K. J. Simko, Victaulic Co.
W. J. Sperko, Sperko Engineering Services, Inc.
F. R. Volgstadt, Consultant

B31 FABRICATION AND EXAMINATION COMMITTEE

A. P. Ranger, *Chair,* Bechtel Corp.
F. Huang, *Secretary,* The American Society of Mechanical Engineers
R. Campbell, Bechtel National, Inc.
D. Chauch, Electric Power Research Institute
J. P. Ellenberger, Consultant
R. J. Ferguson, Metallurgist
D. J. Fetzner, BP Exploration Alaska, Inc.
P. D. Flenner, Flenner Engineering Services
J. W. Frey, Stress Engineering Services, Inc.
S. Gingrich, URS Corp.
J. Hainsworth, Consultant
W. W. Lewis, E. I. Du Pont
S. P. Licud, Consultant
T. Monday, Team Industries, Inc.
A. D. Nalbandian, Thielsch Engineering, Inc.
R. J. Silvia, Process Engineering & Constructors, Inc.
W. J. Sperko, Sperko Engineering Services, Inc.
E. F. Summers, Jr., Babcock & Wilcox Construction Co.
J. Swezy, Jr., Boiler Code Tech, LLC
P. L. Vaughan, Oneok Partners
K. Wu, Stellar Energy Systems

B31 MATERIALS TECHNICAL COMMITTEE

R. A. Grichuk, *Chair,* Fluor Enterprises, Inc.
N. Lobo, *Secretary,* The American Society of Mechanical Engineers
R. P. Deubler, Fronek Power Systems, LLC
W. H. Eskridge, Jr., Jacobs Engineering
G. A. Jolly, Vogt Valves Flowserve Corp.
C. Melo, S & B Engineers and Constructors, Ltd.
M. L. Nayyar, NICE
M. B. Pickell, Willbros Engineers, Inc.
D. W. Rahoi, CCM 2000
R. A. Schmidt, Canadoil
H. R. Simpson, Stantec
J. L. Smith, Jacobs Engineering Group
Z. Djilali, *Contributing Member,* BEREP

B31 MECHANICAL DESIGN TECHNICAL COMMITTEE

G. A. Antaki, *Chair,* Becht Engineering Co., Inc.
J. C. Minichiello, *Vice Chair,* Bechtel National, Inc.
R. Lucas, *Secretary,* The American Society of Mechanical Engineers
D. Arnett, Fluor Enterprises, Inc.
C. Becht IV, Becht Engineering Co., Inc.
R. Bethea, Huntington Ingalls Industries — Newport News Shipbuilding
J. P. Breen, Becht Engineering Co., Inc.
P. Cakir-Kavcar, Bechtel Corp.
N. F. Consumo, Sr., GE Energy (IGCC) NPI
J. P. Ellenberger, Consultant
D. J. Fetzner, BP Exploration Alaska, Inc.
D. Fraser, NASA Ames Research Center
J. A. Graziano, Consultant
R. W. Haupt, Consultant
B. P. Holbrook, Babcock Power, Inc.
W. J. Koves, Pi Engineering Software, Inc.
R. A. Leishear, Savannah River National Laboratory
G. D. Mayers, Alton Science & Technology
J. F. McCabe, General Dynamics Electric Boat
T. Q. McCawley, TQM Engineering
A. W. Paulin, Paulin Research Group
R. A. Robleto, KBR
M. J. Rosenfeld, Kiefner & Associates, Inc.
T. Sato, Japan Power Engineering and Inspection Corp.
G. Stevick, Berkeley Engineering & Research, Inc.
H. Kosasayama, *Delegate,* JGC Corp.
E. C. Rodabough, *Honorary Member,* Consultant

B31 CONFERENCE GROUP

T. A. Bell, Bonneville Power Administration
R. A. Coomes, State of Kentucky, Department of Housing/Boiler Section
D. H. Hanrath, Consultant
C. J. Harvey, Alabama Public Service Commission
D. T. Jagger, Ohio Department of Commerce
K. T. Lau, Alberta Boilers Safety Association
R. G. Marini, New Hampshire Public Utilities Commission
I. W. Mault, Manitoba Department of Labour
A. W. Meiring, State of Indiana, Fire and Building Boiler and Pressure Vessel Division
R. F. Sullivan, Boiler and Pressure Vessel Safety Branch
P. Sher, State of Connecticut
J. E. Skarda, State of Arkansas, Department of Labor
D. A. Starr, Nebraska Department of Labor
D. J. Stursma, Iowa Utilities Board
R. P. Sullivan, The National Board of Boiler and Pressure Vessel Inspectors
J. E. Troppman, Division of Labor/State of Colorado Boiler Inspections
W. A. West, Lighthouse Assistance, Inc.
T. F. Wickham, Rhode Island Department of Labor

B31 NATIONAL INTEREST REVIEW GROUP

American Pipe Fitting Association — J. Thielsch
American Society of Heating, Refrigerating and Air-Conditioning Engineers — H. R. Kornblum
Chemical Manufacturers Association — D. R. Frikken
Copper Development Association — A. Cohen
Ductile Iron Pipe Research Association — T. F. Stroud
Edison Electric Institute — R. L. Williams
International District Heating Association — G. M. Von Bargen
Manufacturers Standardization Society of the Valve and Fittings Industry — R. A. Schmidt
National Association of Plumbing-Heating-Cooling Contractors — R. E. White
National Certified Pipe Welding Bureau — D. Nikpourfard
National Fire Protection Association — T. C. Lemoff
National Fluid Power Association — H. G. Anderson
Valve Manufacturers Association — R. A. Handschumacher

(14)

INTRODUCTION

The ASME B31 Code for Pressure Piping consists of a number of individually published Sections, each an American National Standard. Hereafter, in this Introduction and in the text of this Code Section B31.9, where the word *Code* is used without specific identification, it means this Code Section.

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

(a) This Code Section includes

(1) references to acceptable material specifications and component standards, including dimensional requirements and pressure–temperature ratings

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

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

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

(5) requirements for the fabrication, assembly, and erection of piping

(6) requirements for examination, inspection, and testing of piping

It is intended that this Edition of Code Section B31.9 not be retroactive. Unless agreement is specifically made between contracting parties to use another issue, or the regulatory body having jurisdiction imposes the use of another issue, the latest edition issued at least 6 months prior to the original contract date for the first phase of activity covering a piping system or systems shall be the governing document for all design, materials, fabrication, erection, examination, and testing for the piping until the completion of the work and initial operation.

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

Code users will note that clauses in the Code are not necessarily numbered consecutively. Such discontinuities result from following a common outline, insofar as practicable, for all Code Sections. In this way, corresponding material is correspondingly numbered in most Code Sections, thus facilitating reference by those who have occasion to use more than one Section.

The Code is under the direction of ASME Committee B31, Code for Pressure Piping, which is organized and operates under ASME procedures 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. New editions are published at intervals of 3 to 5 years.

It is the owner's responsibility to select the Code Section that most nearly applies to a proposed piping installation. Different Code Sections may apply to different parts of an installation. Factors to be considered by the owner 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, and the owner should impose additional requirements supplementing those of the Code in order to ensure safe piping for the proposed installation.

(b) Rules for each Code Section have been developed considering the need for application specific requirements for the pressure piping involved. Applications considered for each Code Section include

(1) 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

(2) B31.3, Process Piping — piping typically found in petroleum refineries; chemical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals

(3) B31.4, Pipeline Transportation Systems for Liquids and Slurries — piping for transporting predominantly liquid products between plants and terminals and within terminals, and for pumping, regulating, and metering stations

(4) B31.5, Refrigeration Piping and Heat Transfer Components — piping for refrigerants and secondary coolants

(5) B31.8, Gas Transportation and Distribution Piping Systems — piping for transporting predominantly gas products between sources and terminals, including compressor, regulating, and metering stations; and gas gathering pipelines

(6) B31.9, Building Services Piping — piping for industrial, institutional, commercial, and public buildings, and multi-unit residences, which does not require the range of sizes, pressures, and temperatures covered in B31.1

(7) B31.12, Hydrogen Piping and Pipelines — piping in gaseous and liquid hydrogen service, and pipelines in gaseous hydrogen service

(c) Certain piping within a facility may be subject to other codes and standards, including but not limited to

(1) ASME Boiler and Pressure Vessel Code, Section III — nuclear power piping

(2) ANSI Z223.1, National Fuel Gas Code — fuel gas piping from the point of delivery to the connections of each gas utilization device

(3) NFPA Fire Protection Standards — fire protection systems using water and other materials such as carbon dioxide, halon, foam, dry chemicals, and wet chemicals

(4) NFPA 85, Boiler and Combustion Systems Hazards Code

(5) NFPA 99, Health Care Facilities — medical and laboratory gas systems

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 Mandatory Appendix IV, 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 issued to the applicable Code Section.

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 a Case Supplement issued 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. However, the provisions of a Case 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, maximum and minimum temperature limits, and other restrictions. (To develop usage and gain experience, unlisted materials may be used in accordance with para. 923.1.2.)

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

ASME B31.9-2014
SUMMARY OF CHANGES

Following approval by the B31 Committee and ASME, and after public review, ASME B31.9-2014 was approved by the American National Standards Institute on March 18, 2014.

ASME B31.9-2014 includes editorial changes, revisions, and corrections identified by a margin note, **(14)**, placed next to the affected area.

Page	*Location*	*Change*
viii	Introduction	(1) References to "addenda" deleted (2) ASME B31 Code Section list updated
2	Figure 900.1.2	Under "Administrative Jurisdiction and Technical Responsibility," in the "Boiler Proper" callout, cross reference to ASME BPVC Section I updated
14	904.5.1	Cross reference to ASME BPVC Section VIII-1 updated
	904.7.2	Cross reference to ASME BPVC Section VIII-2 updated
18, 19	Table 919.3.1	New materials added
25	922.1.1	Last sentence revised
	922.1.2	Last sentence of subpara. (a) revised
29, 31	Table 926.1	(1) ASME PCC-1 added (2) ASTM standard titles revised
33	Table 926.2	(1) Title of ASTM F2014 revised (2) ASTM F2389 added
41	935.1	Revised
53	Table I-2	ASTM F2389 added
58–60	Mandatory Appendix III	Revised

BUILDING SERVICES PIPING

Chapter I
Scope and Definitions

900 GENERAL

This Building Services Piping Code is a Section of The American Society of Mechanical Engineers Code for Pressure Piping, B31. This Section, herein called the Code, is published as a separate document for convenience.

Standards and specifications incorporated by reference in this Code are shown in Table 926.1, Mandatory Appendix I, and elsewhere. It is not considered practical to refer to a dated edition of each standard or specification where referenced. Instead, the dated edition references are included in Mandatory Appendix III.

The user is cautioned that the local building code must be observed and adhered to when its requirements are more stringent than those of this Code.

Components of piping systems shall conform to the specifications and standards listed in this Code. Piping elements neither specifically approved nor specifically prohibited by this Code may be used provided they are qualified for use as set forth in applicable chapters of this Code.

Engineering requirements of this Code, while considered necessary and adequate for safe design, generally employ a simplified approach. An engineer capable of applying a more rigorous analysis shall have the latitude to do so. He must be able to demonstrate the validity of his approach.

900.1 Scope

900.1.1 Coverage and Application. This Code Section has rules for the piping in industrial, institutional, commercial, and public buildings, and multi-unit residences, which does not require the range of sizes, pressures, and temperatures covered in B31.1. This Code prescribes requirements for the design, materials, fabrication, installation, inspection, examination, and testing of piping systems for building services. It includes piping systems in the building or within the property limits.

900.1.2 Services and Limits

(a) Services. This Code applies to the following building services, except as excluded in para. 900.1.3:

(1) water and antifreeze solutions for heating and cooling
(2) condensing water
(3) steam or other condensate
(4) other nontoxic liquids
(5) steam
(6) vacuum
(7) compressed air
(8) other nontoxic, nonflammable gases
(9) combustible liquids including fuel oil

(b) Boiler External Piping. The scope of this Code includes boiler external piping within the following limits:

(1) for steam boilers, 15 psig (103 kPa gage) max.
(2) for water heating units, 160 psig (1 103 kPa gage) max. and 250°F (121°C) max.

Boiler external piping above these pressure or temperature limits is within the scope of ASME B31.1. Boiler external piping is the piping connected to the boiler and extending to the points identified in Fig. 900.1.2.

(c) Material and Size Limits. Piping systems of the following materials are within the scope of this Code, through the indicated maximum size (and wall thickness if noted):

(1) carbon steel: NPS 48 (DN 1 200) and 0.50 in. (12.7 mm) wall
(2) stainless steel: NPS 24 (DN 600) and 0.50 in. (12.7 mm) wall
(3) aluminum: NPS 12 (DN 300)
(4) brass and copper: NPS 12 (DN 300) and 12.125 in. (308 mm) O.D. for copper tubing
(5) thermoplastics: NPS 24 (DN 600)
(6) ductile iron: NPS 48 (DN 1 200)
(7) reinforced thermosetting resin: 24 in. (600 mm) nominal

Other materials may be used as noted in Chapter III.

(d) Pressure Limits. Piping systems with working pressures not in excess of the following limits are within the scope of this Code:

(1) steam and condensate: 150 psig (1 034 kPa g)
(2) liquids: 350 psig (2 413 kPa g)
(3) vacuum: 1 atm external pressure