ASME B31.5-2013
(Revision of ASME B31.5-2010)

Refrigeration Piping and Heat Transfer Components

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

INTENTIONALLY LEFT BLANK

ASME B31.5-2013
(Revision of ASME B31.5-2010)

Refrigeration Piping and Heat Transfer Components

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: May 31, 2013

The next edition of this Code is scheduled for publication in 2016.

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

Figures

Tables

Nonmandatory Appendices

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 American Standards Association, then changed to United States of America Standards Institute, and now known as 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 the sole administrative sponsor. Because of the wide field involved, Sectional Committee B31, later changed to Standards Committee, was composed of representatives of some 40 different engineering societies, industries, government bureaus, institutes, and trade associations. After several years' work, the first edition was published in 1935 as an American Tentative Standard Code for Pressure Piping.

In order to keep the Code abreast of current developments in piping design, welding, stress computations, new dimensional and material standards and specifications, and increases in the severity of service conditions, revisions, supplements, and new editions of the Code were published 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 1952, a new section of the Code was published to cover Gas Transmission and Distribution Piping Systems. In 1955, after a review by B31 Executive and Sectional Committees, a decision was made to develop and publish other industry sections as separate code documents of the American Standard Code for Pressure Piping.

The first edition of Refrigeration Piping was published as ASA B31.5-1962, superseding Section 5 of B31.1-1955. This Section was revised in 1966. Following approval by the Sectional Committee and the sponsor, this revision was approved by the United States of America Standards Institute on September 8, 1966, and designated USAS B31.5-1966. Revision of this Section was approved on April 18, 1974 by the American National Standards Institute and designated ANSI B31.5-1974.

In December 1978, the American National Standards Committee B31 was reorganized as the ASME Code for Pressure Piping, B31 Committee under procedures developed by the American Society of Mechanical Engineers and accredited by the American National Standards Institute. The Code designation was also changed to ANSI/ASME B31.

Previous editions of this Code include those of 1983, 1987, 1989, 1992, 2001, 2006, and 2010. In this, the 2013 Edition, new additions and revisions have been made to the text, shown in the Summary of Changes page.

This Code was approved as an American National Standard on February 19, 2013.

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*
K. C. Bodenhamer, *Vice Chair*
N. Lobo, *Secretary*

STANDARDS COMMITTEE PERSONNEL

R. J. T. Appleby, ExxonMobil Development Co.
C. Becht IV, Becht Engineering Co.
A. E. Beyer, Fluor Enterprises
K. C. Bodenhamer, Enterprise Products Co.
R. M. Bojarczuk, ExxonMobil Research & Engineering Co.
C. J. Campbell, Air Liquide
J. S. Chin, TransCanada Pipeline U.S.
D. D. Christian, Victaulic
D. L. Coym, Intertek Moody
R. P. Deubler, Fronek Power Systems, LLC
C. Eskridge Jr., Jacobs Engineering
D. J. Fetzner, BP Exploration Alaska, Inc.
P. D. Flenner, Flenner Engineering Services
J. W. Frey, Stress Engineering Service, Inc.
D. R. Frikken, Becht Engineering Co.
R. A. Grichuk, Fluor Enterprises
R. W. Haupt, Pressure Piping Engineering Associates, Inc.
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, Bechtel Power Corp.
G. R. Petru, EPCO Inc.
E. H. Rinaca, Dominion Resources, Inc.
M. J. Rosenfeld, Kiefner/Applus — RID
S. K. Sinha, Lucius Pitkin, Inc.
W. J. Sperko, Sperko Engineering Services, Inc.
F. W. Tatar, FM Global
K. A. Vilminot, Black and Veatch
G. A. Antaki, *Ex-Officio Member,* Becht Engineering Co., Inc.
L. E. Hayden Jr., *Ex-Officio Member,* Consultant
A. J. Livingston, *Ex-Officio Member,* El Paso Pipeline Group
R. A. Appleton, *Contributing Member,* Refrigeration Systems Co.

B31.5 REFRIGERATION PIPING SECTION COMMITTEE

R. A. Appleton, *Chair,* Refrigeration Systems, Co.
H. Kutz, *Vice Chair,* Johnson Controls Corp./York Process Systems
F. Huang, *Secretary,* The American Society of Mechanical Engineers
M. R. Braz, MRBraz & Associates, PLLC
G. S. Derosier, Evapco, Inc.
A. A. Kailasam, Baltimore Aircoil Co.
G. W. Prie, Johnson Controls
S. A. Walter, Vilter Manufacturing Corp.
D. F. Witte, Speer Mechanical
K. Wu, Stellar Energy Systems
R. J. Ferguson, *Contributing Member,* Metallurgist
P. Papavizas, *Contributing Member,* Baltimore Aircoil Co.
J. A. Gruber, *Honorary Member,* J A Gruber & Associates, LLC
F. T. Morrison, *Honorary Member,* Baltimore Aircoil Co.
R. C. Schmidt, *Honorary Member,* Johnson Controls

B31 EXECUTIVE COMMITTEE

J. E. Meyer, *Chair,* Louis Perry & Associates, Inc.
N. Lobo, *Secretary,* The American Society of Mechanical Engineers
G. A. Antaki, Becht Engineering Co., Inc.
R. J. T. Appleby, ExxonMobil Development Co.
D. A. Christian, Victaulic Middle East
J. W. Frey, Stress Engineering Services
D. R. Frikken, Becht Engineering Co.
R. A. Grichuk, Fluor Enterprises, Inc.
L. E. Hayden, Jr., Consultant
G. A. Jolly, Vogt Valves/Flowserve Corp.
A. J. Livingston, El Paso Pipeline Group
M. L. Nayyar, Consultant
G. R. Petru, EPCO, Inc.
R. A. Appleton, *Contributing Member,* Refrigeration Systems Co.

B31 FABRICATION AND EXAMINATION COMMITTEE

A. P. Rangus, *Chair,* Bechtel
J. Swezy, Jr., *Vice Chair,* Boiler Code Technology, LLC
F. Huang, *Secretary,* The American Society of Mechanical Engineers
R. Campbell, Bechtel Fellow
D. Couch, EPRI
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 Service, Inc.
S. Gingrich, URS Corp.
J. Hainsworth, WR Metallurgical
W. W. Lewis, E. I. DuPont
S. P. Licud, Consultant
T. Monday, Team Industries, Inc.
A. D. Nalbandian, Thielsch Engineering, Inc.
R. J. Silvia, Process Engineers & Constructors, Inc.
W. J. Sperko, Sperko Engineering Services, Inc.
E. F. Summers, Jr., Babcock & Wilcox Construction Co.
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
Z. Djilali, BEREP
W. H. Eskridge, Jr., Jacobs Engineering
G. A. Jolly, Vogt Valves Flowserve Corp.
C. J. Melo, S&B Engineers and Constructors, Ltd.
M. L. Nayyar, Consultant
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

B31 MECHANICAL DESIGN TECHNICAL COMMITTEE

G. A. Antaki, *Chair,* Becht Engineering Co., Inc.
J. C. Minichello *Vice Chair,* Becht National, Inc.
R. Lucas, *Secretary,* The American Society of Mechanical Engineers
D. Arnett, Fluor Enterprises, Inc.
C. Becht IV, Becht Engineering Co.
R. Bethea, HII - Newport News Shipbuilding
J. P. Breen, Becht Engineering Co.
P. Cakir-Kavcar, Bechtel Corp. Oil — Oil, Gas and Chemicals
N. F. Consumo, GE Energy (IGCC) NPI
J. P. Ellenberger, Consultant
D. J. Fetzner, BP Exploration Alaska, Inc.
D. R. Fraser, NASA Ames Research Center
J. A. Graziano, Tennessee Valley Authority
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 PC
A. W. Paulin, Paulin Research Group
R. A. Robleto, KBR
M. J. Rosenfeld, Kiefner/Applus — RID
T. Sato, Japan Power Engineering and Inspection Corp
G. Stevick, Berkeley Engineering & Research, Inc.
H. Kosasayama, *Delegate,* JGC Corp.
E. C. Rodabaugh, *Honorary Member,* Consultant

B31 CONFERENCE GROUP

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
M. Kotb, Regie du Batiment du Quebec
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, Fire and Building Boiler and Pressure Vessel Division
R. F. Mullaney, Boiler and Pressure Vessel Safety Branch
P. Sher, State of Connecticut
M. E. Skarda, 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. Miller West, Lighthouse Assistance, Inc.
T. F. Wickham, Rhode Island Department of Labor

B31 NATIONAL INTEREST REVIEW GROUP

American Pipe Fitting Association — H. Thielsch
American Society of Heating, Refrigeration 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

INTRODUCTION

The ASME B31 Code for Pressure Piping consists of a number of individually published Sections, each an American National Standard, under the direction of ASME Committee B31, Code for Pressure Piping. Rules for each Section reflect the kinds of piping installations considered during its development. This is the B31.5 Refrigeration Piping and Heat Transfer Components Code Section. Hereafter, in this Introduction and in the text of this Code Section B31.5, when the word "Code" is used without specific identification, it means this Code Section. This Section also includes nonmandatory appendices containing referenced standards (Nonmandatory Appendix A), information instructing users on the preparation of technical inquiries (Nonmandatory Appendix B) and the selection of appropriate piping codes (Nonmandatory Appendix C), and nomenclature (Nonmandatory Appendix D).

It is the owner's responsibility to select the Code Section that most nearly applies to a proposed piping 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. For some installations more than one Code Section may apply to different parts of the installation. The owner is also responsible for imposing requirements supplementary to those of the Code if necessary to assure safe piping for the proposed installation. (See Nonmandatory Appendix C.)

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

The Code contains basic reference data and formulas necessary for design. It is intended to state these requirements in terms of basic design principles to the fullest possible extent, supplemented with specific requirements, where necessary, to obtain uniform interpretation of principle. It contains prohibitions in areas where practices or designs are known to be unsafe. In other areas the Code contains warnings or "flags" where caution is known to be necessary, but where it is considered that a direct prohibition would be unwarranted.

The Code includes the following:

(a) references to material specifications and component standards that are acceptable for Code usage

(b) references to acceptable dimensional standards for the elements comprising piping systems

(c) requirements for the pressure design of component parts and assembled units

(d) requirements for the evaluation and limitation of stresses, reactions, and movements associated with pressure, temperature, and external forces, and for the design of pipe supports

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

(f) requirements for examination, inspection, and testing of piping systems

It is the intent of the Code that this not be retroactive and that, unless agreement is specifically made between contracting parties to use other issues, or the regulatory body having jurisdiction imposes the use of other issues, the latest Code, issued 6 months prior to the original contract date for the first phase of activity covering a piping system(s), be the governing document for all design, materials, fabrication, erection, examination, and testing activities for the piping system(s) until the completion of the work and initial operation.

Manufacturers and users of piping are cautioned against making use of revisions less restrictive than former requirements without having assurance that they have been accepted by the proper authorities in the jurisdiction where the piping is to be installed.

Users of this Code are advised that in some locations legislation may establish jurisdiction over the subject matter of this Code.

Attention of Code users is directed to the fact that the numbering of the Divisions and the text therein may not be consecutive. This is not the result of editorial or printing errors. An attempt has been made to follow a uniform outline of the various Sections. Therefore, the same subject, in general, appears under the same number and subnumber in all Sections.

The Committee is a continuing one and is organized to keep the Code current with new developments in materials, construction, and usage. New Editions are published at 3-yr to 5-yr intervals.

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 B 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 issued to the applicable Code Section.

A Case is the prescribed form of reply 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 as part of a Case supplement issued to the applicable Code Section.

Requests for interpretations or suggestions for revisions should be addressed to the Secretary, ASME B31 Committee, Two Park Avenue, New York, NY 10016-5990.

ASME B31.5-2013
SUMMARY OF CHANGES

Following approval by the B31 Committee and ASME, and after public review, ASME B31.5-2013 was approved by the American National Standards Institute on February 19, 2013.

ASME B31.5-2013 consists of editorial changes, revisions, and corrections identified by a margin note, **(13)**, placed next to the affected area.

Page	*Location*	*Change*
49	523.2.2	First paragraph and subparas. (a) and (e) revised
53	Fig. 523.2.2	Revised in its entirety
56	Table 526.1	Updated
64	528.2.2	Revised
65	528.4.2	Revised
71, 72	536.6.3	Subparagraph (c) revised
	536.6.4	Added
	536.6.5	Added
75–77	Nonmandatory Appendix A	Updated

INTENTIONALLY LEFT BLANK

REFRIGERATION PIPING AND HEAT TRANSFER COMPONENTS

Chapter I
Scope and Definitions

500 GENERAL STATEMENTS

This Refrigeration Piping and Heat Transfer Components Code is a Section of the American Society of Mechanical Engineers Code for Pressure Piping, B31. This Section is published as a separate document for simplicity and for convenience of Code users. The users of this Code are advised that in some areas legislation may establish governmental jurisdiction over the subject matter covered by the Code. The owner of a piping installation shall choose which piping code(s) are applicable to the installation and shall have the overall responsibility for compliance with this Code. (See Nonmandatory Appendix C.) The owner of a complete piping installation shall have the overall responsibility for compliance with this Code.

It is required that the engineering design specify any special requirements pertinent to the particular service involved. For example, the engineering design shall not for any service specify a weld quality lower than that stipulated in para. 527.3.2(d) for the Code-required visual examination quality and for the types of welds involved; but where service requirements necessitate added quality and more extensive nondestructive examination, these are to be specified in the engineering design and any revision thereto, and when so specified, the Code requires that they be accomplished.

500.1 Scope

Rules for this Code Section have been developed considering the needs for applications that include piping and heat transfer components for refrigerants and secondary coolants.

500.1.1 This Code prescribes requirements for the materials, design, fabrication, assembly, erection, test, and inspection of refrigerant, heat transfer components, and secondary coolant piping for temperatures as low as –320°F (–196°C), whether erected on the premises or factory assembled, except as specifically excluded in the following paragraphs.

500.1.3 This Code shall not apply to any of the following:

(a) any self-contained or unit systems subject to the requirements of Underwriters Laboratories or other nationally recognized testing laboratory

(b) water piping, other than where water is used as a secondary coolant or refrigerant

(c) piping designed for external or internal gage pressure not exceeding 15 psi (105 kPa) regardless of size

(d) pressure vessels, compressors, or pumps, but does include all connecting refrigerant and secondary coolant piping starting at the first joint adjacent to such apparatus

500.2 Definitions

For convenience in reference, some of the more common terms relating to piping are defined in this subdivision.

Most welding definitions were taken from the AWS Welding Handbook, Volume 1, 7th Edition. Heat treatment terms were taken from ASM Metals Handbook Properties and Selection of Materials, Volume 1, 8th Edition.

arc welding: a group of welding processes wherein coalescence is produced by heating with an electric arc(s), with or without the application of pressure and with or without the use of filler metal.

automatic welding: welding with equipment that performs the entire welding operation without constant observation and adjustment of the controls by an operator. The equipment may or may not perform the loading and unloading of the work.

backing ring: backing in the form of a ring generally used in the welding of piping.

base metal: the metal to be welded, soldered, brazed, or cut.

brazing: a joining process that produces coalescence of materials by heating them in the presence of a filler metal having a liquidus above 840°F (450°C) but below the solidus of the base metals. Heating may be provided by a variety of processes. The filler metal distributes itself between the closely fitted surfaces of the joint by capillary action. Brazing differs from soldering in that