

ASME B31.12-2011
(Revision of ASME B31.12-2008)

Hydrogen Piping and Pipelines

ASME Code for Pressure Piping, B31

AN AMERICAN NATIONAL STANDARD



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FOREWORD

Responding to an evident need and at the request of The American Society of Mechanical Engineers, the American Standards Association initiated Project B31 in March 1926, with ASME as sole administrative sponsor. The breadth of the field involved required that membership of the Sectional Committee be drawn from some 40 engineering societies, industries, government bureaus, institutes, and trade associations.

The initial publication in 1935 was the American Tentative Standard Code for Pressure Piping. Revisions from 1942 through 1955 were published as the American Standard Code for Pressure Piping, ASA B31.1. Then it was decided that the various industry sections, beginning with ASA B31.8-1955, Gas Transmission and Distribution Piping Systems, be published as separate documents. The first Petroleum Refinery Piping Code Section was designated ASA B31.3-1959. ASA B31.3 revisions were published in 1962 and 1966. In 1967–1969, the American Standards Association became first the United States of America Standards Institute, then the American National Standards Institute. The Sectional Committee became American National Standards Committee B31, and the Code was renamed the American National Standard Code for Pressure Piping. The next B31.3 revision was designated ANSI B31.3-1973. Addenda were published through 1975. The Standards Committee was reorganized in 1978 as a Committee operating under ASME procedures with ANSI accreditation. It is now the ASME Code for Pressure Piping, B31 Committee. The Section committee structure remains essentially unchanged.

As a result of preliminary studies, it was concluded that gaps exist between existing piping and pipeline codes and standards, and hydrogen infrastructure applications. A Project Team was formed under the B31 Standards Committee to develop a new B31.12 Code for hydrogen piping and pipelines. The Project Team was subsequently restructured under the B31 Standards Committee as a Section Committee.

The first edition of the B31.12 Code applies to design, construction, operation, and maintenance requirements for piping, pipelines, and distribution systems in hydrogen service. Typical applications are power generation, process plants, refining, transportation, distribution, and automotive filling stations. This Code is composed of Part GR, General Requirements, including common requirements referenced by all other parts; Part IP, Industrial Piping; and Part PL, Pipelines, including distribution systems. These Parts incorporate information specific to hydrogen service and either reference or incorporate applicable parts of ASME B31.3, Process Piping; ASME B31.1, Power Piping; ASME B31.8, Gas Transmission and Distribution Piping Systems; ASME B31.8S, Managing System Integrity of Gas Pipelines; and Section VIII, Division 3 of the ASME Boiler and Pressure Vessel Code, where appropriate.

Material performance factors have been included to account for the adverse effects of hydrogen gas on the mechanical properties of carbon and low alloy steels operating within the hydrogen embrittlement range. Many materials included in B31.3 have been omitted from B31.12's tables due to their unsuitability for hydrogen service. Rules have been added for conversion or retrofit of existing pipeline and distribution systems from natural gas or petroleum to hydrogen service. Parts covering commercial, residential, and nonmetallic systems will be added in future editions. Material performance factors will be reevaluated as materials research data is developed and understanding of hydrogen embrittlement of carbon and low alloy steels increases.

ASME B31.12-2008 was approved by the American National Standards Institute on December 3, 2008.

ASME B31.12-2011 was approved by the American National Standards Institute on June 7, 2011.



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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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R. J. Medvick, Swagelok
A. W. Paulin, Paulin Research Group
M. J. Rosenfeld, Kiefner & Associates, Inc.
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, Commonwealth 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, Régie du Bâtiment du Québec
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/Indiana
- R. F. Mullaney**, Boiler and Pressure Vessel Safety Branch/Vancouver
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. M. West, Lighthouse Assistance, Inc.
T. F. Wickham, Rhode Island Department of Labor

B31 QUALIFICATION OF PIPELINE PERSONNEL TECHNICAL COMMITTEE

- J. T. Schmitz**, *Chair*, Southwest Gas Corp.
A. J. Livingston, *Vice Chair*, El Paso Pipeline Group
P. D. Stumpf, *Secretary*, The American Society of Mechanical Engineers
L. B. Ables, Enterprise Products Co.
M. Burkhardt, Nicor Gas
G. E. Carter, State of California/Public Utilities Commission
J. S. Chin, TransCanada Pipeline U.S.
R. L. Cooper, T. D. Williamson, Inc.
G. M. Cowden, Equitable Resources
K. Denny, Spectra Energy Transmission
- R. Evans**, U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration
M. A. Gruenberg, Southwest Gas Corp.
S. C. Gupta, Bharat Petroleum Corp. Ltd.
D. Haifleigh, Flint Hills Resources L.P.
C. Hanson, Arizona Corporation Commission
B. A. Heck, Miller Pipeline Corp.
L. L. Hughes, Laborers–Employers Cooperation and Education Trust
T. J. Kasprzyk, TECO Peoples Gas
D. D. Lykken, Washington Utilities and Transportation Commission



W. B. McGaughey, U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration
T. Meek, El Paso Pipeline Group
W. Miller, U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration
D. K. Moore, El Paso Pipeline Group
L. P. Murray, Midwest Energy Association
K. Riddle, Magellan Midstream Partners, L.P.
D. Ristig, Center Point Energy Gas Transmission
E. W. Scott, Ameren
R. C. Smith, AGL Resources

R. L. Stump, Consumers Energy
D. E. Thacker, Kinder Morgan, Inc.
A. N. Welker, Infrasource Underground
M. R. Comstock, *Contributing Member*, City of Mesa/Gas Division
G. W. Isbell, *Contributing Member*, ENERGY Worldnet, Inc.
T. M. Lael, *Contributing Member*, ConocoPhillips Pipe Line Co.
R. E. Sanders, *Contributing Member*, U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration
B. J. Selig, *Contributing Member*, Process Performance Improvement Consultants
K. Wester-Hayes, *Contributing Member*, Explorer Pipeline Co.



ASME B31.12-2011 SUMMARY OF CHANGES

Following approval by the B31 Committee and ASME, and after public review, ASME B31.12-2011 was approved by the American National Standards Institute on June 7, 2011.

Changes given below are identified on the pages by a margin note, **(11)**, placed next to the affected area. In addition, nearly all figures and tables have been redesignated, and cross-references to them have been revised accordingly.

<i>Page</i>	<i>Location</i>	<i>Change</i>
2–11	GR-1.5	(1) Definition of <i>cyclic service conditions</i> deleted (2) Definitions of <i>elevated temperature fluid service</i> and <i>ventilated location</i> added (3) Definition of <i>miter</i> revised
13, 18	GR-2.1.2	In subpara. (b)(6)(b)(1), cross-reference revised
32	GR-3.4.3	Subparagraph (b)(1) revised
51–54	Chapter GR-4	(1) In paras. GR-4.1 and GR-4.3.2, cross-reference revised (2) Paragraphs GR-4.10 through GR-4.12 redesignated as GR-4.11 through GR-4.13, respectively (3) New para. GR-4.10 added
59	GR-5.6	In subpara. (a), sixth line corrected by errata to read Appendix D
69–71	Chapter GR-6	Revised in its entirety
72	IP-1.1.2	(1) Subparagraph (b) redesignated as (c) and its last sentence deleted (2) New subpara. (b) added
73	IP-2.1.1	Subparagraphs (a) and (c) revised
	IP-2.1.3	Subparagraph (a) revised
74	IP-2.1.8	Subparagraphs (b) and (c) revised
79	IP-2.2.10	(1) Subparagraph (c) revised (2) Subparagraph (e) deleted
81	IP-3.2	In subpara. (b), nomenclature for <i>W</i> deleted
	IP-3.2.1	In subpara. (a), equations (3a) and (3b) revised
82, 83	IP-3.3.1	Equation (3c) revised
	IP-3.3.3	(1) Equations (4a) and (4b) revised (2) In subpara. (b)(2), eq. (4c) revised (3) In subpara. (d), nomenclature for <i>W</i> deleted



<i>Page</i>	<i>Location</i>	<i>Change</i>
89, 90	IP-3.6.1	In subpara. (b), nomenclature for S_f revised
	IP-3.6.2	In subpara. (b), nomenclature for S_f revised
	IP-3.6.3	(1) Equation (15) revised (2) Nomenclature for W deleted
91	IP-3.8.2	Subparagraphs (b) and (d) revised
92	Chapter IP-4	(1) Paragraph IP-4.1 revised (2) Paragraph IP-4.2 moved to Nonmandatory Appendix A, para. A-7 (3) Paragraph IP-4.3 redesignated as IP-4.2
95, 96	IP-5.5.3	Revised in its entirety
	IP-5.7.2	(1) Subparagraphs (a) and (b) redesignated as (b) and (c), respectively (2) New subpara. (a) added
99	IP-6.1.5	Former footnote 7 revised and moved to subpara. (a)(3)
104	IP-6.2.7	Subparagraph (b) revised
105	IP-7.2.3	Revised in its entirety
107	Table IP-8.1.1-1	(1) ASME B1.20.3 deleted (2) Note (1) redesignated as (2) and new Note (1) added
108–111	Chapter IP-9	(1) Paragraph IP-9.6.3 added (2) Paragraphs IP-9.19 through IP-9.21 deleted
112–120	Chapter IP-10	Revised in its entirety
132	PL-3.3.2	Revised
138	Table PL-3.7.1-5	Under Facility, last entry revised
152, 153	PL-3.19.8	Subparagraph (c)(3)(a) revised
159, 160	Mandatory Appendix II	(1) Under ASME Standards, B31E added (2) Under PFI Standards, ES-21-2004 added
163	III-1	In third paragraph, cross-reference corrected by errata to read Mandatory Appendix III
165, 168	Mandatory Appendix IV	Symbol W deleted
188, 190	Table IX-1A	Under Stainless Steel, Min. Temp. reduced for all entries except A 451 CPF8, A 249 TP304N, and A 479 304
222	A-3.7	Added
223, 224	A-7	Revised in its entirety



<i>Page</i>	<i>Location</i>	<i>Change</i>
226, 227	Nonmandatory Appendix B	(1) Paragraph B-2 deleted (2) Paragraphs B-3 through B-8 redesignated as B-2 through B-7, respectively
235	E-6	Revised

NOTE: A separate supplement containing Case 186 follows this edition.



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PART GR

GENERAL REQUIREMENTS

Chapter GR-1

Scope and Definitions

GR-1.1 SCOPE

This Code is applicable to piping in gaseous and liquid hydrogen service and to pipelines in gaseous hydrogen service. This Code is applicable up to and including the joint connecting the piping to associated pressure vessels and equipment but not to the vessels and equipment themselves. It is applicable to the location and type of support elements but not to the structure to which the support elements are attached. The design for pressure and temperature shall be in accordance with the requirements of Part IP for industrial piping and Part PL for pipelines. This Code is presented in the following parts and appendices:

(a) *Part GR — General Requirements.* Part GR contains requirements applicable to and referenced by other parts. It contains definitions and requirements for materials, welding, brazing, heat treating, forming, testing, inspection, examination, operation, and maintenance. It also contains quality system topics common to the other parts.

(b) *Part IP — Industrial Piping.* Part IP includes requirements for components, design, fabrication, assembly, erection, inspection, examination, and testing of piping.

(c) *Part PL — Pipelines.* Part PL sets forth requirements for components, design, installation, and testing of hydrogen pipelines.

(d) Mandatory Appendices I through IX

(e) Nonmandatory Appendices A through F

Each part defines requirements for piping or pipelines, as applicable, within its scope. The requirements are different for different aspects of components, design, fabrication, installation, assembly, erection, inspection, examination, and testing. It is required that each part be used in conjunction with the General Requirements section but independent of the other parts. The joint connecting piping governed by two different parts shall

be subject exclusively to the requirements of one of the two parts. It is not intended that this edition of this Code be applied retroactively to existing hydrogen systems.

GR-1.2 RESPONSIBILITIES

GR-1.2.1 Owner

The owner shall have overall responsibility for compliance with this Code and for establishing the requirements for design, construction, examination, inspection, testing, operation, and maintenance of the hydrogen piping or pipeline system.

GR-1.2.2 Designer

The designer is responsible to the owner for assurance that the engineering design of piping or the pipeline system complies with the requirements of this Code and with any additional requirements established by the owner.

GR-1.2.3 Construction Organization

The construction organization of piping and pipeline systems is responsible for providing materials, components, and workmanship in compliance with the requirements of this Code and the engineering design.

GR-1.2.4 Owner's Inspector

The owner's Inspector is responsible to the owner to verify that all required examinations, inspections, and testing are complete. The owner's Inspector verifies that all required certifications and records have been completed. Also, the owner's Inspector is responsible for verification of the construction organization's quality systems program implementation.

