ASME B31G-2023
[Revision of ASME B31G-2012 (R2017)]

Manual for Determining the Remaining Strength of Corroded Pipelines

Supplement to ASME B31 Code for Pressure Piping

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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This Manual was developed under procedures accredited as meeting the criteria for American National Standards. The standards committee that approved the Manual was balanced to ensure that individuals from competent and concerned interests had an opportunity to participate. The Manual was made available for public review and comment, which provided an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

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FOREWORD

It has been recognized within the pipeline industry that some sections of high-pressure pipelines, particularly those with long service histories, may experience corrosion. It has also been recognized, through theoretical analysis, scientific research and testing, and industry operating experience, that some amount of metal loss due to corrosion can be tolerated without impairing the ability of the pipeline to operate safely. In 1984, the American Society of Mechanical Engineers (ASME) published the first edition of the ASME B31G Manual for Determining the Remaining Strength of Corroded Pipelines. ASME B31G provided pipeline operators with a simplified evaluation method based on the results of analysis and tests. The application of ASME B31G has enabled pipeline operators to reliably determine safe operating pressure levels for pipe affected by corrosion, and to determine whether repairs are necessary in order to continue operating safely.

ASME B31G continued to be reissued by ASME with only minor revisions over time, although other corrosion evaluation methods had evolved since ASME B31G's initial publication. A majority of these other methods are based on the same theoretical model from which the original ASME B31G method was derived, but may offer some refinement in accuracy. Subsequently, an effort was undertaken to update the ASME B31G document to recognize certain other corrosion evaluation methods that have proven sound and that have seen successful use in the pipeline industry. Incorporation of these other methods into a recognized Code document provides the pipeline operator or other user with a formalized framework within which to use such methodologies, as well as a wider range of codified technical options with which to make an evaluation. The 2009 revision of ASME B31G reflected those objectives.

The 2012 edition of ASME B31G was approved by the American National Standards Institute (ANSI) on September 20, 2012.

In ASME B31G-2023, the nomenclature (see para. 1.5) has been revised and Nonmandatory Appendix A has been added. Following approval by the ASME B31 Standards Committee, ASME B31G-2023 was approved by ANSI as an American National Standard on August 3, 2023.

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Code for Pressure Piping

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Revisions and Errata. The committee processes revisions to this Manual on a continuous basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Manual. Approved revisions will be published in the next edition of the Manual.

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 e-mail notifications of posted errata.

This Manual is always open for comment, and the committee welcomes proposals for revisions. 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 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 Manual

(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 Manual.

(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 Manual and the paragraph, figure, or table number(s)

(4) the edition(s) of the Manual 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 Manual. An interpretation can be issued only in response to a request submitted through the online Interpretation Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic e-mail confirming receipt.

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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.

ASME B31G-2023
SUMMARY OF CHANGES

Following approval by the ASME B31G Committee and ASME, and after public review, ASME B31G-2023 was approved by the American National Standards Institute on August 3, 2023.

ASME B31G-2023 includes the following changes identified by a margin note, **(23)**.

Page	*Location*	*Change*
1	1.4	Subparagraph (a) editorially revised
2	1.5	(1) Nomenclature for L_e and Z_e deleted (2) Nomenclature for g added
4	1.10	In second paragraph, references added
7	2.2	References editorially revised
7	2.3	Second paragraph and subpara. (b) revised
64	Nonmandatory Appendix A	Added

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MANUAL FOR DETERMINING THE REMAINING STRENGTH OF CORRODED PIPELINES

1 INTRODUCTION

1.1 Scope

This document is intended solely for the purpose of providing guidance in the evaluation of metal loss in pressurized pipelines and piping systems. It is applicable to all pipelines and piping systems within the scope of the transportation pipeline codes that are part of ASME B31 Code for Pressure Piping, namely: ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids; ASME B31.8, Gas Transmission and Distribution Piping Systems; ASME B31.11, Slurry Transportation Piping Systems; and ASME B31.12, Hydrogen Piping and Pipelines, Part PL. Where the term "pipeline" is used, it may also be read to apply to piping or pipe conforming to the acceptable applications and within the technical limitations discussed below.

1.2 Acceptable Applications

The application of this document is limited to the evaluation of wall loss in metal pipe within the following limitations:

(a) metal loss in pipelines located belowground, aboveground, or offshore

(b) metal loss due to external or internal corrosion

(c) metal loss produced by grinding where used to completely remove mechanical damage, cracks, arc burns, manufacturing defects, or other defects from the pipe surface

(d) metal loss in field bends, induction bends, and elbows

(e) metal loss that incidentally affects longitudinal or helical electric seam welds or circumferential electric welds of sound quality and having ductile characteristics, provided workmanship flaws are not present in sufficiently close proximity to interact with the metal loss

(f) metal loss of any depth with respect to the pipe wall, except that due consideration shall be given to the accuracy of measurements and effective corrosion rates when the depth of metal loss exceeds 80% of the actual pipe wall dimension

(g) metal loss in new pipe where allowed by the applicable code of construction

(h) metal loss in pipe material having ductile fracture initiation characteristics [see paras. 1.7(e) and 1.7(f)] unless using a Level 3 assessment in accordance with paras. 2.2(b) and 2.4

(i) metal loss in pipe operating at temperatures above ambient within the range of operating temperature recognized by the governing standard, and provided material strength properties at temperature are considered

(j) metal loss in pipe operating at any level of allowable design hoop stress [see paras. 1.4(a) and 1.4(b) for additional considerations]

(k) metal loss in pipe where internal pressure is the primary loading [see paras. 1.4(c) and 1.4(d) for additional considerations]

1.3 Exclusions

This document does not apply to the following:

(a) crack-like defects or mechanical surface damage not completely removed to a smooth contour by grinding

(b) metal loss in indentations or buckles resulting in radial distortion of the pipe wall larger than 6% of the pipe outside diameter, unless a Level 3 assessment is performed in accordance with para. 2.4

(c) grooving corrosion, selective corrosion, or preferential corrosion affecting pipe seams or girth welds

(d) metal loss in fittings other than bends or elbows

(e) metal loss affecting material having brittle fracture initiation characteristics [see paras. 1.7(e) and 1.7(f)] unless a Level 3 assessment is performed in accordance with para. 2.4

(f) pipe operating at temperatures outside the range of operating temperature recognized by the governing standard or operating at temperatures in the creep range

1.4 Additional Considerations (23)

The user is cautioned that additional considerations may apply in certain situations, described below.

(a) Pipe operating at low hoop stress levels due to internal pressure [e.g., less than 25% of specified minimum yield strength (SMYS)] may be perforated by corrosion without inducing structural material failure. The methods and criteria provided herein do not address failure by perforation.

(b) Pipe affected by general corrosion of the pipe wall (i.e., corrosion-caused wall loss over the entire pipe surface) effectively operates at a greater hoop stress