

**ASME B31G-2009**  
(Revision of ASME B31G-1991)

# 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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## 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, ASME published the first edition of the B31G Manual for Determining the Remaining Strength of Corroded Pipelines. The B31G document provided pipeline operators with a simplified evaluation method based on the results of analysis and tests. The application of 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.

B31G continued to be reissued by ASME with only minor revisions over time, although other corrosion evaluation methods had evolved since B31G's initial publication. A majority of these other methods are based on the same theoretical model from which the original B31G method was derived, but may offer some refinement in accuracy. Subsequently, an effort was undertaken to update the 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. This 2009 revision of B31G reflects those objectives. ASME B31G-2009 was approved by the American National Standards Institute (ANSI) on July 10, 2009.



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## Code for Pressure Piping

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**General.** ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to

Secretary, B31 Committee  
The American Society of Mechanical Engineers  
Three Park Avenue  
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**Proposing Revisions.** Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. 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 documentation.

**Interpretations.** Upon request, the B31 Mechanical Design Technical Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B31 Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject: Cite the applicable paragraph number(s) and the topic of the inquiry.  
Edition: Cite the applicable edition of the Standard for which the interpretation is being requested.  
Question: Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

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.

**Attending Committee Meetings.** The B31 Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B31 Committee.



# 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 below ground, above ground, 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 (f)] unless using a Level 3 assessment in accordance with paras. 2.2(b) and 2.3

(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 (b) for additional consideration]

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

### 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. 2.3
- (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 (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

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 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 than

