ASME PCC-3–2022
(Revision of ASME PCC-3–2017)

# Inspection Planning Using Risk-Based Methods

AN AMERICAN NATIONAL STANDARD

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# FOREWORD

ASME formed an Ad Hoc Task Group on Post Construction in 1993 in response to an identified need for recognized and generally accepted engineering standards for the inspection and maintenance of pressure equipment after it has been placed in service. At the recommendation of this Task Group, the Board on Pressure Technology Codes and Standards (BPTCS) formed the Post Construction Committee (PCC) in 1995. The scope of this Committee was to develop and maintain standards addressing common issues and technologies related to post-construction activities, and to work with other consensus committees in the development of separate, product-specific codes and standards addressing issues encountered after initial construction for equipment and piping covered by Pressure Technology Codes and Standards. The BPTCS covers non-nuclear boilers, pressure vessels (including heat exchangers), piping and piping components, pipelines, and storage tanks.

The PCC selects standards to be developed based on identified needs and the availability of volunteers. The PCC formed the Subcommittee on Inspection Planning and the Subcommittee on Flaw Evaluations in 1995. In 1998, a Task Group under the PCC began preparation of Guidelines for Pressure Boundary Bolted Flange Joint Assembly, and in 1999 the Subcommittee on Repair and Testing was formed. Other topics are under consideration and may possibly be developed into future guideline documents. The subcommittees were charged with preparing standards dealing with several aspects of the in-service inspection and maintenance of pressure equipment and piping.

This Standard provides guidance on the preparation and implementation of a risk-based inspection plan. Flaws that are identified during inspection plan implementation are then evaluated, when appropriate, using the procedures provided in API 579-1/ASME FFS-1, Fitness for Service. If it is determined that repairs are required, guidance on repair procedures is provided in ASME PCC-2, Repair of Pressure Equipment and Piping.

This Standard is based on API 580, Risk-Based Inspection. By agreement with the American Petroleum Institute (API), this Standard is closely aligned with the risk-based inspection (RBI) process in API 580, which is oriented toward the hydrocarbon and chemical process industries. In the standards development process that led to the publication of this Standard, numerous changes, additions, and improvements to the text of API 580 were made, many of which are intended to generalize the RBI process to enhance applicability to a broader spectrum of industries.

This Standard provides recognized and generally accepted good engineering practices (RAGAGEP) that may be used in conjunction with other post construction codes (e.g., API 510, API 570, and NB-23).

This Standard uses the words "shall," "should," and "may" as follows:

*(a)* “Shall” is used to denote a requirement.

*(b)* “Should” is used to denote a recommendation.

*(c)* “May” is used to denote a permission, neither a requirement nor a recommendation.

ASME PCC-3–2007 was approved by the American National Standards Institute (ANSI) on October 4, 2007. ASME PCC-3–2017 was approved by ANSI on May 11, 2017.

ASME PCC-3–2022 was approved by ANSI on June 21, 2022.

# ASME PRESSURE TECHNOLOGY POST CONSTRUCTION COMMITTEE

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

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# CORRESPONDENCE WITH THE POST CONSTRUCTION COMMITTEE

**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 or a case, and attending Committee meetings. Correspondence should be addressed to:

Secretary, PCC Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

**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.

**Proposing a Case.** Cases may be issued to provide alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard and the paragraph, figure, or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

**Interpretations.** Upon request, the PCC Standards 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 PCC Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the Secretary of the PCC Standards Committee at the above address. The request for an 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 in one or two words. |
| 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. Please provide a condensed and precise question, composed in such a way that a “yes” or “no” reply is acceptable. |
| Proposed Reply(ies): | Provide a proposed reply(ies) in the form of “Yes” or “No,” with explanation as needed. If entering replies to more than one question, please number the questions and replies. |
| Background Information: | Provide the Committee with any background information that will assist the Committee in understanding the inquiry. 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 the format described above may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

Moreover, ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

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 PCC Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the PCC Standards Committee.

# ASME PCC-3–2022
# SUMMARY OF CHANGES

Following approval by the ASME PCC Committee and ASME, and after public review, ASME PCC-3–2022 was approved by the American National Standards Institute on June 21, 2022.

In ASME PCC-3-2022, figure and table designators have been updated throughout to follow ASME style. In addition, this edition includes the following changes identified by a margin note, **(22)**.

| *Page* | *Location* | *Change* |
|---|---|---|
| 13 | 4.4.2.2 | Restructured and revised |
| 18 | 7.2.1 | In subpara. (b), cross-reference to API publication updated |
| 30 | Figure 9.2.1-1 | Revised in its entirety |
| 33 | 10.4.3 | Subparagraph title revised |
| 34 | 10.4.3.1 | Title and first sentence revised |
| 40 | 15.1 | Definition of *NDE personnel* added |
| 41 | 15.2 | Defintion of NACE updated |
| 42 | Table 16-1 | Updated |
| 45 | Table 16-2 | Updated |
| 61 | Table B-1 | Column heads reformatted |
| 68 | Table C-1 | Revised in its entirety |
| 77 | D-7.4.8 | Text editorially reformatted |
| 77 | D-7.5.2 | Text editorially reformatted |
| 80 | F-1 | In first paragraph and subpara. (e), cross-reference to API publication updated |
| 81 | F-3 | (1) In subpara. (a), first sentence revised<br>(2) In subpara. (b), first, second, and fourth sentences revised<br>(3) Former subparas. (c) through (f) revised in their entirety and redesignated as (c) through (e) |

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# INSPECTION PLANNING USING RISK-BASED METHODS

## 1 SCOPE, INTRODUCTION, AND PURPOSE

### 1.1 Scope

The risk analysis principles, guidance, and implementation strategies presented in this Standard are broadly applicable; however, this Standard has been specifically developed for applications involving fixed pressure-containing equipment and components. This Standard is not intended to be used for nuclear power plant components; see ASME BPVC, Section XI. It provides guidance to owners, operators, and designers of pressure-containing equipment for developing and implementing an inspection program. These guidelines include means for assessing an inspection program and its plan. The approach emphasizes safe and reliable operation through cost-effective inspection. A spectrum of complementary risk analysis approaches (qualitative through fully quantitative) should be considered as part of the inspection planning process.

### 1.2 Introduction

This Standard provides information on using risk analysis to develop and plan an effective inspection strategy. Inspection planning is a systematic process that begins with identification of facilities or equipment and culminates in an inspection plan. Both the probability[1] of failure and the consequence of failure should be evaluated by considering all credible damage mechanisms that could be expected to affect the facilities or equipment. In addition, failure scenarios based on each credible damage mechanism should be developed and considered.

The output of the inspection planning process conducted according to these guidelines should be an inspection plan for each equipment item analyzed that includes

*(a)* inspection methods that should be used

*(b)* extent of inspection (percent of total area to be examined or specific locations)

*(c)* inspection interval (timing)

*(d)* other risk mitigation activities

*(e)* the residual level of risk after inspection and other mitigation actions have been implemented

[1] "Likelihood" is sometimes used as a synonym for "probability"; however, "probability" is used throughout this Standard for consistency.

### 1.3 Purpose

This Standard presents the concepts and principles used to develop and implement a risk-based inspection (RBI) program. Items covered are

*(a)* an introduction to the concepts and principles of RBI

1 Scope, Introduction, and Purpose
2 Basic Concepts
3 Introduction to Risk-Based Inspection

*(b)* description of the steps in applying these principles within the framework of the RBI process

4 Planning the Risk Analysis
5 Data and Information Collection
6 Damage Mechanisms and Failure Modes
7 Determining Probability of Failure
8 Determining Consequence of Failure
9 Risk Determination, Analysis, and Management
10 Risk Management With Inspection Activities
11 Other Risk Mitigation Activities
12 Reanalysis
13 Roles, Responsibilities, Training, and Qualifications
14 Documentation and Record Keeping

### 1.4 Relationship to Regulatory and Jurisdictional Requirements

This Standard does not replace or supersede laws, regulations, or jurisdictional requirements.

## 2 BASIC CONCEPTS

### 2.1 Risk

Everyone lives with risk and, knowingly or unknowingly, people are constantly making decisions based on risk. Simple decisions such as whether to drive to work or walk across a busy street involve risk. Bigger decisions such as buying a house, investing money, and getting married all imply an acceptance of risk. Life is not risk free and even the most cautious, risk-averse individuals inherently take risks.