ASME PCC-1–2026
(Revision of ASME PCC-1–2022)

Pressure Boundary Bolted Flange Joint Assembly

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ASME PCC-1–2026
(Revision of ASME PCC-1–2022)

Pressure Boundary Bolted Flange Joint Assembly

AN AMERICAN NATIONAL STANDARD



The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: September 18, 2026

The next edition of this Standard is scheduled for publication in 2030. This Standard will become effective 6 months after the Date of Issuance.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The standards committee that approved the code or standard was balanced to ensure that individuals from competent and concerned interests had an opportunity to participate. The proposed code or standard 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.

ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity. ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor does ASME assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representatives or persons affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

The endnotes and preamble in this document (if any) are part of this American National Standard.



ASME Collective Membership Mark

All rights reserved. "ASME" and the above ASME symbol are registered trademarks of The American Society of Mechanical Engineers. No part of this document may be copied, modified, distributed, published, displayed, or otherwise reproduced in any form or by any means, electronic, digital, or mechanical, now known or hereafter invented, without the express written permission of ASME. No works derived from this document or any content therein may be created without the express written permission of ASME. Using this document or any content therein to train, create, or improve any artificial intelligence and/or machine learning platform, system, application, model, or algorithm is strictly prohibited.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

Copyright © 2026 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Printed in U.S.A.

CONTENTS

Foreword vii
Committee Roster ix
Correspondence With the PCC Committee x
Summary of Changes xii

1 Scope 1
2 Introduction 1
3 Training And Qualification of Bolted Joint Assembly Personnel 2
4 Cleaning of Gasket Seating Surfaces of Flanges 2
5 Examination of Flange and Fastener Contact Surfaces 2
6 Alignment of Flange Joints 3
7 Installation of Gasket 3
8 Lubrication 4
9 Installation of Bolts 4
10 Tightening Procedure 4
11 Optional Practices 5
12 Joint Pressure and Tightness Testing 6
13 Records 6
14 Joint Disassembly 6
15 References 7

Mandatory Appendix

I Definitions 10

Nonmandatory Appendices

A Training and Qualification of Bolted Joint Assembly Personnel 15
B Description of Common Terms 24
C Recommended Gasket Seating Surface Finish for Various Gasket Types 25
D Guidelines for Allowable Gasket Seating Surface Flatness and Defect Depth 26
E Flange Joint Alignment Guidelines 31
F Joint-Tightening Practices and Patterns 34
G Single-Stud Replacement 48
H Bolt Root and Tensile Stress Areas 68
J Optional Practices for Flange Joint Assembly 70
K Nut Factor Calculation of Target Torque 79
L ASME B16.5 Flange Bolting Information 81
M Washer Usage Guidance and Purchase Specifications for Through-Hardened Washers 82

N Definitions, Commentary, and Guidelines on the Reuse of Bolts 87
O Assembly Bolt Stress Determination 89
P Troubleshooting Flange Joint Leakage 105
R Assembly Records Management 123

Figures

8-1 Examples of Lubrication Application 5
D-2-1 Flange Circumferential Variation Tolerance, *T*1 27
D-2-2 Flange Radial Variation Tolerance, *T*2 28
D-3-1 Flange Surface Damage Assessment: Pits and Dents 29
D-3-2 Flange Surface Damage Assessment: Scratches and Gouges 29
D-4-1 RTJ Gasket Seating Surface Assessment 30
E-2-1 Centerline High/Low 32
E-2-2 Excessive Spacing Gap 32
E-2-3 Parallelism 32
E-2-4 Rotational Two-Hole 33
F-6.1.1.2.1-1 Pattern #1 (Star Pattern): 24-Bolt Basic Example 38
F-6.1.1.2.2-1 Pattern #1 (Star Pattern): 24-Bolt Modified Star Example 39
F-6.1.1.2.2-2 Modified Star Pattern With Multiple Tools 40
F-6.1.2.1-1 Pattern #2 (Quadrant Pattern): 24-Bolt Examples 41
F-6.1.2.2-1 Pattern #2 (Quadrant Pattern): 24-Bolt Accelerated Cross Example . . 44
F-6.1.3.1-1 Pattern #3 (Circular Pattern): 24-Bolt Example 45
F-6.1.3.2-1 Pattern #3 (Circular Pattern): 24-Bolt Step-by-Step Example 46
F-6.1.3.3-1 Pattern #3 (Simultaneous Multibolt Circular Pattern): 24-Bolt Step-by-Step Example (Two Tools) 47
G-5-1 Procedure to Assess Risk Associated With SSR 51
J-5-1 Example of Bolt Grouping for a 48-Bolt Flange 73
J-7.3-1 Nut Flat Turns in Commonly Applied Increments 75
P-4.6.1-1 Tapered-Hub-Type Flange 110
P-4.6.2-1 Slip-On-Type Flange 111
P-4.6.3-1 Lap Joint Flange 112
Q-4.5-1 24-Bolt, 24-Tool Example 120
Q-4.5-2 24-Bolt, 50% (12-Tool) Example 121
R-2.2-1 Controlled Torque Assembly Sheet for Critical/Intermediate Joints (Sample) 124
R-2.2-2 Hydraulic Tension Assembly Sheet for Critical/Intermediate Joints (Sample) 125
R-2.2-3 Example Short Assembly Record 126
R-2.2-4 Example Medium-Length Assembly Record 126
R-2.2-5 Example Multipart Tear-Off Tag 127

Tables

A-1.4-1 Training and Examination Matrix 16
A-2.1-1 Skill Level — Training Curriculum 19
A-2.2-1 Powered-Equipment Endorsement Curriculum 22
A-2.5-1 Heat Exchanger Endorsement — Training Curriculum 23

C-1	Recommended Gasket Seating Surface Finish for Various Gasket Types	25
D-2-1M	Flange Seating Face Flatness Tolerances (Metric)	27
D-2-1	Flange Seating Face Flatness Tolerances (U.S. Customary)	27
D-3-1M	Allowable Defect Depth vs. Width Across Face (Metric)	28
D-3-1	Allowable Defect Depth vs. Width Across Face (U.S. Customary)	28
E-2-1	Common Alignment Tolerances	33
F-4-1	Example Tightening Practices Based on Service Application	35
F-6.1.1.1-1	Star and Modified Star Pattern Sequence	36
F-6.1.2.1.1-1	Quadrant Pattern Cross Sequence	42
F-6.1.2.1.2-1	Quadrant Pattern Circular Sequence	43
G-6-1	Critical Factors That Prevent Performing SSR	54
G-6-2	Stud Diameter Corrosion Limit for SSR	55
G-6-3	Bolt Stress Increase Factor	56
G-6-4	Remaining Gasket Stress Factor	57
G-6-5	Baseline Likelihood of Leakage Categories at the Flange Rated Pressure	58
G-6-6	Likelihood of Leakage SSR Factor	59
G-6-7	Likelihood of Leakage Pressure Factor	60
G-6-8	Equivalent Hole Size for Gasket Leakage Prior to SSR	61
G-6-9	Equivalent Hole Size for Gasket Blowout Prior to SSR	62
G-6-10	Equivalent Hole Size for Gasket Blowout During SSR	63
G-6-11	Qualitative Factors Affecting the Likelihood of Leakage Prior to SSR	64
G-6-12	Qualitative Factors Affecting the Likelihood of Leakage During SSR	65
G-6-13	Considerations When Performing the Baseline Risk Assessment	66
H-1M	Bolt Root and Tensile Stress Areas (Metric Threads)	68
H-1	Bolt Root and Tensile Stress Areas (Inch Series)	69
J-6-1	Legacy Cross-Pattern Tightening Sequence and Bolt-Numbering System When Using a Single Tool	74
J-7.3-1	Nut Flat Turns to Decrease Bolt Stress by 10 ksi (69 MPa) for Standard ASME B16.5 and ASME B16.47 Series A Flanges	75
L-1	ASME B16.5 Flange Bolting Information	81
M-1.3-1	Recommended Washer Temperature Limits	82
M-2.4-1	Chemical Requirements	84
M-2.6.1-1	Dimensional Requirements for Metric Washers	85
M-2.6.1-2	Dimensional Requirements for U.S. Customary Washers	85
M-2.6.1-3	Dimensional Tolerances for Metric Washers	86
M-2.6.1-4	Dimensional Tolerances for U.S. Customary Washers	86
M-2.8.2-1	Sampling	86
O-3.2-1M	Reference Values (Target Torque Index) for Calculating Target Torque Values for Low-Alloy Steel Bolting Based on Unit Prestress of 1 MPa (Root Area) (Metric Series Threads)	94
O-3.2-1	Reference Values (Target Torque Index) for Calculating Target Torque Values for Low-Alloy Steel Bolting Based on Unit Prestress of 1 ksi (Root Area) (Inch Series Threads)	95
O-4.1-1M	Pipe Wall Thickness Used for Following Tables (mm)	96
O-4.1-1	Pipe Wall Thickness Used for Following Tables (in.)	96
O-4.1-2M	Bolt Stress Limit for SA-105 Steel Flanges Using Elastic–Plastic FEA (MPa)	97

O-4.1-2 Bolt Stress Limit for SA-105 Steel Flanges Using Elastic–Plastic FEA (ksi) 97
O-4.1-3 Flange Rotation for SA-105 Steel Flanges Loaded to Table O-4.1-2M/ Table O-4.1-2 Bolt Stress Using Elastic–Plastic FEA (deg) 98
O-4.1-4M Bolt Stress Limit for SA-105 Steel Flanges Using Elastic Closed Form Analysis (MPa) 99
O-4.1-4 Bolt Stress Limit for SA-105 Steel Flanges Using Elastic Closed Form Analysis (ksi) 99
O-4.1-5 Flange Rotation for SA-105 Steel Flanges Loaded to Table O-4.1-4M/ Table O-4.1-4 Bolt Stress Using Elastic Closed Form Analysis (deg) 100
O-4.1-6M Bolt Stress Limit for SA-182 F304 Steel Flanges Using Elastic–Plastic FEA (MPa) 101
O-4.1-6 Bolt Stress Limit for SA-182 F304 Steel Flanges Using Elastic–Plastic FEA (ksi) 101
O-4.1-7 Flange Rotation for SA-182 F304 Steel Flanges Loaded to Table O-4.1-6M/Table O-4.1-6 Bolt Stress Using Elastic–Plastic FEA (deg) 102
O-4.2-1 Example Bolt Stress for SA-105 Steel Weld-Neck Flanges, SA-193 B7 Steel Bolts, and Spiral-Wound Gasket With Inner Ring (ksi) ASME B16.5 and ASME B16.47 Series A — Weld Neck 103
O-4.2-2 Example Assembly Bolt Torque for SA-105 Steel Weld-Neck Flanges, SA-193 B7 Steel Bolts, and Spiral-Wound Gasket With Inner Ring (ft-lb) 104
P-5-1 Leak During Pressure Test 113
P-5-2 Leak During Heat-Up or Initial Operation 114
P-5-3 Leak Corresponding to Thermal or Pressure Upset 115
P-5-4 Leak After Long-Term Operation 115
P-5-5 Leak During Shutdown 116

Form

P-3-1 Sample Flange Joint Leak Report 106

FOREWORD

ASME formed an Ad Hoc Task Group on Post Construction in 1993 in response to an increased 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 nonnuclear 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 Evaluation 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 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. ASME PCC-1, Pressure Boundary Bolted Flange Joint Assembly, is the standard for bolted flange joint assemblies. ASME PCC-3, Inspection Planning Using Risk-Based Methods, provides guidance on the preparation of a risk-based inspection plan. Imperfections found at any stage of assembly, installation, inspection, operation, or maintenance are then evaluated, when appropriate, using the procedures provided in API 579-1/ASME FFS-1, Fitness-for-Service. Guidance on repair procedures is provided in the appropriate portion of ASME PCC-2, Repair of Pressure Equipment and Piping. To provide all stakeholders involved in pressure equipment with a guide to identify publications related to pressure equipment integrity, ASME PTB-2, Guide to Life Cycle Management of Pressure Equipment Integrity, has been prepared.

None of these documents are Codes. They provide recognized and generally accepted good practices that may be used in conjunction with post-construction codes, such as API 510, API 570, and NBBI NB-23, and with jurisdictional requirements.

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 permission, which is neither a requirement nor a recommendation.

The first edition of ASME PCC-1 was approved for publication in 2000. The 2010 edition was approved by the American National Standards Institute (ANSI) as an American National Standard on January 14, 2010. The 2013 edition included many updates and a major new Appendix A titled “Training and Qualification of Bolted Joint Assembly Personnel” and was approved by ANSI as an American National Standard on August 12, 2013. The 2019 edition contained a number of updates. The most notable of these updates were the removal of the reference torque tables (Tables 1M and 1) for similar tables in Appendix O introducing the Target Torque Index and the insertion of a new Appendix Q titled “Considerations for the Use of Powered Equipment.” ASME PCC-1–2019 was approved by ANSI as an American National Standard on January 17, 2019.

The 2022 edition was a major revision of ASME PCC-1. Requirements and recommendations replaced the guidelines of previous editions. “Guidelines for” was deleted from the title. The main text and many of the appendices were revised in their entirety. ASME PCC-1–2022 was approved by ANSI as an American National Standard on August 18, 2022.

ASME PCC-1–2026 contains a number of updates. The most notable of these updates are the revisions to the Nonmandatory Appendix A skill level definition and requalification and the insertion of a new Nonmandatory Appendix G for single-stud replacement. In August 2025, PCC Case 103 was approved to make major revisions to Nonmandatory Appendix A. The additional changes to Nonmandatory Appendix A are incremental to the previously approved changes from PCC Case 103. Other improvements have been made to Nonmandatory Appendix J for relaxation pass guidance and prevention of self-loosening, Nonmandatory Appendix M for disassembly turn-of-nut, Nonmandatory Appendix O for additional considerations, Nonmandatory Appendix P for differential thermal expansion and conical spring washer considerations,

and Nonmandatory Appendix R for records. The main body and many definitions from Mandatory Appendix I have also been improved. ASME PCC-1–2026 was approved by ANSI as an American National Standard on March 19, 2026.

ASME PRESSURE TECHNOLOGY POST-CONSTRUCTION COMMITTEE

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

STANDARDS COMMITTEE OFFICERS

C. D. Rodery, *Chair*
B. D. Ray, *Vice Chair*
S. J. Rossi, *Secretary*

STANDARDS COMMITTEE PERSONNEL

M. Boring, DNV GL
W. Brown, Integrity Engineering Solutions
S. Hamilton, Hex Technology
B. F. Hantz, Valero Energy Corp.
D. T. Peters, Structural Integrity Associates
B. D. Ray, Marathon Petroleum Corp.
J. T. Reynolds, Intertek/Moody
S. C. Roberts, Shell Global Solutions U.S., Inc.
C. D. Rodery, C&S Technology, LLC
S. J. Rossi, The American Society of Mechanical Engineers
I. Roux, Roux Engineering
C. W. Rowley, The Wesley Corp.
K. Schupp, The Equity Engineering Group, Inc.
J. Taagepera, Chevron Technical Center
G. M. Tanner, M&M Engineering Associates, Inc.
A. Thistlethwaite, TEAM, Inc.
K. Oyamada, *Delegate,* High Pressure Gas Safety Institute of Japan
D. E. Lay, *Contributing Member,* D&S Lay, Inc.
J. R. Sims, *Contributing Member,* Becht Engineering Co., Inc.

SUBCOMMITTEE ON FLANGE JOINT ASSEMBLY

B. F. Hantz, *Chair,* Valero Energy Corp.
B. A. Thibodeaux, *Vice Chair,* Citgo Petroleum Corp.
C. Cary, *Secretary,* Consultant
B. Baird, TEAM, Inc. & Fastened.app
J. Barnard, Hydratight, Ltd.
W. Brown, Integrity Engineering Solutions
M. Bush, Marathon Petroleum Corp.
M. F. Dolan, HYTORC
S. Hamilton, Hex Technology
S. Hom, Dow Chemical
M. Johnson, Integra Services Technologies, Inc.
C. Lilley, Chevron Corp.
K. J. LoCascio, Equity Engineering Group, Inc.
G. Milne, 3t Energy Group
M. Ruffin, TEADIT Group
K. Schupp, The Equity Engineering Group, Inc.
A. Seijas, Phillips 66 Co.
D. Arnett, *Contributing Member,* Enterprise Products
B. Barron, *Contributing Member,* Consultant
L. Carpenter, *Contributing Member,* Consultant
C. D. Rodery, *Contributing Member,* C&S Technology, LLC
J. E. Batey, *Honorary Member,* Consultant

CORRESPONDENCE WITH THE PCC COMMITTEE

General. ASME codes and standards are developed and maintained by committees with the intent to represent the consensus of concerned interests. Users of ASME codes and standards may correspond with the committees to propose revisions or cases, report errata, or request interpretations. Correspondence for this Standard should be sent to the staff secretary noted on the committee's web page, accessible at https://go.asme.org/PCCcommittee.

Revisions and Errata. The committee processes revisions to this Standard on a continuous basis 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 in the next edition of the Standard.

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 email notifications of posted errata.

This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, 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 Standard

(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 Standard.

(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 Standard and the paragraph, figure, or table number

(4) the editions of the Standard 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 Standard. An interpretation can be issued only in response to a request submitted through the online Inquiry Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic email confirming receipt.

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 information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers can track the status of their requests at https://go.asme.org/Interpretations.

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.

Interpretations are published in the ASME Interpretations Database at https://go.asme.org/Interpretations as they are issued.

Committee Meetings. The PCC 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/PCCcommittee.

ASME PCC-1–2026
SUMMARY OF CHANGES

Following approval by the ASME PCC Standards Committee and ASME, and after public review, ASME PCC-1–2026 was approved by the American National Standards Institute on March 19, 2026.

ASME PCC-1–2026 includes the following changes identified by a margin note, **(26)**.

Page	*Location*	*Change*
1	1	Footnote 1 revised
1	2	Subparagraphs (d)(1) and (d)(2) revised
2	3	(1) Second and third paragraphs revised (2) Fourth paragraph added
5	11	Subparagraph (c) revised
6	13	Revised in its entirety
7	15	Updated
10	Mandatory Appendix I	(1) Definitions of *assistant bolting assembler*, *bolting inspector*, *bolting subject matter expert*, *bolting supervisor*, *bolting trainer*, *pre-pass torque*, *retighten*, *skill*, *skill level 1*, *skill level 2*, *skill level 3*, and *skill level 4* deleted (2) Definitions of *axial backlash*, *cold relaxation pass*, *double nutting*, *hot bolting*, *jam-nutting*, *joint record*, *joint assembly record*, *joint historical record*, *pre-SSR tightening*, *pre-start-up retorque*, *relaxation pass*, *slack*, *target torque*, and *thermal cycle* added (3) Definitions of *bolting assembler*, *gasket seating surface*, *half-bolting*, *live tightening*, *single-stud replacement*, *start-up retorque*, *torquing*, and *turn-of-nut* revised
15	Nonmandatory Appendix A	Revised in its entirety
34	F-2	Revised
34	F-3	Third paragraph revised
35	F-6.1.1.1	First and second paragraphs revised
36	Table F-6.1.1.1-1	Title revised
37	F-6.1.1.2.1	Subparagraph (a) revised
37	F-6.1.1.2.2	Subparagraph (a) revised
38	F-7	Subparagraph (a) revised
48	Nonmandatory Appendix G	Added
70	J-3	Revised in its entirety
71	J-4	Revised in its entirety
73	Figure J-5-1	Description of the treatment of groups revised
73	J-7	Revised in its entirety
75	Table J-7.3-1	Added
75	Figure J-7.3-1	Added
76	J-8	Added

Page	*Location*	*Change*
78	J-9	Added
82	M-1.4	Revised in its entirety
82	M-1.5	Deleted and subsequent paragraphs redesignated
91	O-4.1	Footnote 2 revised
91	O-4.2	Footnotes 3 and 4 revised
92	O-4.3	Steps 4 through 8 revised
92	O-4.4	Added
93	O-5.1	Revised
93	O-6	Added
108	P-4.1.2	Revised in its entirety
109	P-4.2	First paragraph revised in its entirety
109	P-4.2.2	Revised in its entirety
109	P-4.2.3	Revised
110	P-4.4	Subparagraph (b) revised
111	P-4.6.3	Subparagraph (b)(4) revised
112	P-6	Updated
113	Table P-5-1	In first row, “Potential Solutions” entry revised
114	Table P-5-2	(1) In first row, “Potential Solutions” entries (a) through (c) revised (2) In second row, “Potential Solutions” entry (c) revised
115	Table P-5-3	In first row, “Potential Solutions” entry (c) revised
115	Table P-5-4	In third row, “Potential Solutions” entries (a) through (c) revised
116	Table P-5-5	In first row, “Potential Solutions” entry (b) revised
119	Q-4.5	Second paragraph added
123	R-1	Revised in its entirety
123	R-2	Revised
124	Figure R-2.2-1	Revised in its entirety
125	Figure R-2.2-2	Added and subsequent figures redesignated

INTENTIONALLY LEFT BLANK

PRESSURE BOUNDARY BOLTED FLANGE JOINT ASSEMBLY

(26) 1 SCOPE

This Standard covering bolted flange joint assemblies (BFJAs) applies to pressure-boundary flange joints with ring-type gaskets that are entirely within the circle enclosed by the bolt holes and with no contact outside this circle.[1] The principles of this Standard may be selectively applied to other joint geometries. By selecting those features suitable to the specific service or need, this Standard may be used to develop effective joint assembly procedures for the broad range of sizes and service conditions normally encountered in industry.

Users [see para. 2(b)] of this Standard are cautioned that the content contained in ASME PCC-1 has been developed generically and may not necessarily be suitable for all applications. Precautionary considerations are provided in some cases but should not be considered as all-inclusive. Sound engineering judgment and practices should be used to determine the applicability of a specific method or part of a method to a specific application. Each joint assembly procedure should be subject to an appropriate review by qualified personnel. While this Standard covers joint assembly within the scope of ASME Pressure Technology Codes and Standards, it may be used on equipment constructed in accordance with other codes and standards.

Guidance on troubleshooting BFJAs not providing leak-tight performance is also provided in this Standard (see Nonmandatory Appendix P).

(26) 2 INTRODUCTION

(a) Intent. A BFJA is a complex mechanical device; therefore, BFJAs that provide leak-free service result from many selections and activities having been made and performed within a relatively narrow band of acceptable limits. One of the activities essential to leak-free performance is the joint assembly process. The content outlined in this Standard covers the assembly elements essential for a high level of leak-tightness integrity of otherwise properly designed and constructed BFJAs. Users should develop written assembly procedures based on the owner's requirements, incorporating the features contained herein that are deemed suitable to the specific application under consideration. Alternative features and methods for specific applications may be used subject to endorsement by the owner.

(b) User. The user is defined as any entity that applies the provisions of this Standard. The user could be the owner, owner's representative, manufacturer, fabricator, erector, or other contract personnel. The specific assignment of responsibilities among these entities is outside the scope of this Standard. As a result, this Standard is silent when assigning specific provisions to a single entity.

(c) Owner and Representative. Within the context of this Standard, "owner" and "representative" are defined as follows:

owner: the person, partnership, organization, or business responsible for the leak tightness of BFJAs on their pressure equipment.

representative: a person, partnership, organization, or business designated by the owner to carry out selected responsibilities on the owner's behalf.

(d) Responsibilities

(1) Owner. The owner is responsible for establishing the requirements for assembly, training, qualification, requalification, examination, inspection, and testing of BFJAs on their pressure equipment. The owner may designate a representative to carry out selected responsibilities in establishing such requirements; however, the owner retains ultimate responsibility for the actions of the representative.

NOTE: Within the context of this Standard, the term "owner" includes the owner and the owner's representative, as recorded in either the contract documents or the written assembly procedures [see para. 13(a)].

(2) Assembler. The assembler of piping, pipelines, or equipment containing BFJAs is responsible for providing workmanship in conformance to the requirements of the assembly procedure.

(e) Organization of This Standard. The main body of this Standard covers the following topic areas associated with the BFJA assembly process:

(1) scope and introduction

(2) training and qualification of bolted joint assembly personnel

(3) cleaning of gasket seating surfaces of flanges

[1] Rules for the design of bolted flanges with ring-type gaskets are covered in ASME Boiler and Pressure Vessel Code (ASME BPVC), Section VIII, Division 1, Mandatory Appendix 2 and Section VIII, Division 2, Part 4.16. See also ASME BPVC, Section VIII, Division 1, Nonmandatory Appendix S for supplementary considerations for bolted flanges that are helpful to the designer of flanged joints.