

**SECTION IV**

2023

ASME Boiler and  
Pressure Vessel Code  
An International Code

**Rules for Construction  
of Heating Boilers**

Currently in preview, click buy full version

Markings such as “ASME,” “ASME Standard,” or any other marking including “ASME,” ASME logos, or the ASME Single Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code or Standard. Use of the ASME Single Certification Mark requires formal ASME certification; if no certification program is available, such ASME markings may not be used. (For Certification and Accreditation Programs, see <https://www.asme.org/certification-accreditation>.)

Items produced by parties not formally possessing an ASME Certificate may not be described either explicitly or implicitly, as ASME certified or approved in any code forms or other document.

AN INTERNATIONAL CODE

# 2023 ASME Boiler & Pressure Vessel Code

2023 Edition

July 1, 2023

## **IV** **RULES FOR CONSTRUCTION OF HEATING BOILERS**

ASME Boiler and Pressure Vessel Committee  
on Heating Boilers



The American Society of  
Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2023

This international code or standard was developed under procedures accredited as meeting the criteria for American National Standards and it is an American National Standard. 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



ASME Single Certification Mark

“ASME” and the above ASME symbols are registered trademarks of The American Society of Mechanical Engineers.

No part of this document may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Library of Congress Catalog Card Number: 56-3934

Adopted by the Council of The American Society of Mechanical Engineers, 1914; latest edition 2023.

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

Copyright © 2023 by  
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS  
All rights reserved  
Printed in U.S.A.

# TABLE OF CONTENTS

List of Sections .....		xii
Foreword .....		iv
Statement of Policy on the Use of the ASME Single Certification Mark and Code Authorization in Advertising .....		xvi
Statement of Policy on the Use of ASME Marking to Identify Manufactured Items .....		xvi
Personnel .....		xvii
Correspondence With the Committee .....		xxxix
Preamble .....		xli
Summary of Changes .....		xlii
Cross-Referencing in the ASME BPVC .....		xlv
<b>PART HG</b>	<b>GENERAL REQUIREMENTS FOR ALL MATERIALS OF CONSTRUCTION</b>	<b>1</b>
<b>Article 1</b>	<b>Scope and Service Restrictions</b>	<b>1</b>
HG-100	Scope .....	1
HG-101	Service Restrictions .....	1
HG-102	Units .....	1
HG-103	Tolerances .....	2
<b>Article 2</b>	<b>Material Requirements</b>	<b>3</b>
HG-200	General Material Requirements .....	3
HG-201	Specific Material Requirements .....	3
<b>Article 3</b>	<b>Design</b>	<b>4</b>
HG-300	Design Pressure .....	4
HG-301	Cylindrical Parts Under Internal Pressure .....	4
HG-305	Formed Heads, Pressure on Concave Side .....	4
HG-306	Formed Heads, Pressure on Convex Side .....	5
HG-307	Flat Heads .....	5
HG-309	Spherically Dished Covers (Bolted Heads) .....	9
HG-312	Cylindrical Parts Under External Pressure .....	11
HG-320	Openings in Boilers, General Requirements .....	14
HG-321	Reinforcement Required for Openings in Shells and Formed Heads .....	15
HG-323	Flanged-In Openings in Formed Heads .....	16
HG-325	Reinforcement Required for Openings in Flat Heads .....	16
HG-326	Limits of Metal Available for Reinforcement .....	17
HG-327	Strength of Reinforcement .....	19
HG-328	Reinforcement for Multiple Openings .....	19
HG-330	Inspection and Access Openings .....	19
HG-340	Stayed Surfaces .....	21
HG-341	Staybolts .....	23
HG-342	Dimensions of Stays .....	23

HG-343	Dimensions of Diagonal Stays . . . . .	25
HG-345	Staying of Heads . . . . .	25
HG-346	Tubesheets With Firetubes Used As Stays . . . . .	26
HG-350	Ligaments . . . . .	29
HG-360	Requirements for Tube Holes and Tube Attachments . . . . .	29
HG-370	External Piping Connections . . . . .	32
<b>Article 4</b>	<b>Pressure-Relieving Devices . . . . .</b>	<b>33</b>
<b>Article 4A</b>	<b>Overpressure Protection . . . . .</b>	<b>34</b>
HG-400A	General Requirements . . . . .	34
HG-401A	Responsibility . . . . .	34
HG-402A	Pressure Relief Valve Requirements . . . . .	34
HG-403A	Heating Surface . . . . .	36
<b>Article 5</b>	<b>Tests, Inspection, and Marking . . . . .</b>	<b>37</b>
HG-500	Proof Tests to Establish Design Pressure . . . . .	37
<b>Article 6</b>	<b>Instruments, Fittings, and Controls . . . . .</b>	<b>51</b>
HG-600	General . . . . .	51
HG-601	For Steam Heating Boilers . . . . .	51
HG-610	For Hot Water Heating or Hot Water Supply Boilers . . . . .	53
HG-620	For All Boilers . . . . .	54
HG-630	Electric Wiring . . . . .	54
HG-640	Controls and Heat Generating Apparatus . . . . .	54
<b>Article 7</b>	<b>Installation Requirements . . . . .</b>	<b>56</b>
HG-700	Installation Requirements, All Boilers . . . . .	56
<b>Article 8</b>	<b>Modular Boilers . . . . .</b>	<b>65</b>
HG-800	Inspection and Access Openings . . . . .	65
HG-801	Marking and Certification of Modular Boilers and Use of Manufacturer's Modular Master List Reports . . . . .	65
HG-802	Instruments, Fittings, and Controls . . . . .	65
HG-803	Installation Requirements . . . . .	66
<b>PART HF</b>	<b>REQUIREMENTS FOR BOILERS CONSTRUCTED OF WROUGHT MATERIALS . . . . .</b>	<b>68</b>
<b>Article 1</b>	<b>General . . . . .</b>	<b>68</b>
HF-100	Scope . . . . .	68
<b>Article 2</b>	<b>Material Requirements . . . . .</b>	<b>69</b>
HF-200	General Material Requirements . . . . .	69
HF-201	Plate . . . . .	69
HF-202	Rods, Bars, and Shapes . . . . .	69
HF-203	Prefabricated or Preformed Pressure Parts . . . . .	69
HF-204	Pipe and Tubes . . . . .	70
HF-205	Material Not Fully Identified . . . . .	71
HF-206	Recertification of Material Produced to a Specification Not Permitted by This Section . . . . .	72
HF-207	Austenitic Stainless Steel . . . . .	72
HF-210	Maintaining Material Identification . . . . .	72
<b>Article 3</b>	<b>Design Stresses and Minimum Thicknesses . . . . .</b>	<b>73</b>
HF-300	Maximum Allowable Stress Values . . . . .	73

HF-301	Minimum Thicknesses . . . . .	73
HF-302	Basis for Establishing Stress Values in Section II, Part D, Table 6A or Table 6B . . . . .	73
<b>PART HF — SUBPART HW</b>	<b>REQUIREMENTS FOR BOILERS FABRICATED BY WELDING . . . . .</b>	<b>74</b>
<b>Article 4</b>	<b>General Requirements . . . . .</b>	<b>74</b>
HW-400	Scope . . . . .	74
HW-401	Responsibility of Manufacturer or Contractor . . . . .	74
<b>Article 5</b>	<b>Material Requirements . . . . .</b>	<b>75</b>
HW-500	Permissible Materials . . . . .	75
HW-501	Materials of Different Specifications . . . . .	75
HW-502	Materials for Small Parts . . . . .	75
<b>Article 6</b>	<b>Welding Processes and Qualifications . . . . .</b>	<b>76</b>
HW-600	Welding Processes . . . . .	76
HW-610	Welding Qualifications . . . . .	76
HW-611	No Production Work Without Qualifications . . . . .	76
HW-612	Interchange of Qualifying Tests Among Manufacturers Permitted . . . . .	76
HW-613	Maintenance of Records of Qualifications and Identifying Marks . . . . .	76
<b>Article 7</b>	<b>Design of Weldments . . . . .</b>	<b>77</b>
HW-700	Design of Welded Joints . . . . .	77
<b>Article 8</b>	<b>Fabrication Requirements . . . . .</b>	<b>92</b>
HW-800	Forming Plates . . . . .	92
HW-801	Base Metal Preparation . . . . .	92
HW-810	Assembly . . . . .	92
HW-812	Alignment Tolerance . . . . .	92
HW-813	Distortion . . . . .	92
HW-820	Specific Welding Requirements . . . . .	93
HW-830	Repair of Weld Defects . . . . .	94
HW-840	Posthydrotest Welding of Nonpressure Parts to Pressure Parts . . . . .	94
<b>Article 9</b>	<b>Inspection . . . . .</b>	<b>95</b>
HW-900	Inspection During Fabrication . . . . .	95
HW-910	Check of Welding Procedure Qualifications . . . . .	95
HW-911	Check of Welder and Welding Operator Performance Qualifications . . . . .	95
<b>PART HF — SUBPART HB</b>	<b>REQUIREMENTS FOR BOILERS FABRICATED BY BRAZING . . . . .</b>	<b>96</b>
<b>Article 10</b>	<b>General Requirements . . . . .</b>	<b>96</b>
HB-1000	Scope . . . . .	96
HB-1001	Responsibility of Manufacturer or Contractor . . . . .	96
<b>Article 11</b>	<b>Material Requirements . . . . .</b>	<b>97</b>
HB-1100	General . . . . .	97
HB-1101	Combinations of Dissimilar Materials . . . . .	97
HB-1102	Brazing Filler Metals . . . . .	97
HB-1103	Fluxes and Atmospheres . . . . .	97
<b>Article 12</b>	<b>Brazing Processes, Procedures, and Qualifications . . . . .</b>	<b>98</b>
HB-1200	Brazing Processes . . . . .	98
HB-1201	Joint Brazing Procedures . . . . .	98
HB-1202	Brazing Qualifications and Records . . . . .	98
<b>Article 13</b>	<b>Design . . . . .</b>	<b>99</b>

HB-1300	Strength of Brazed Joints . . . . .	99
HB-1301	Brazed Joint Efficiency Factors . . . . .	99
HB-1302	Minimum Thickness . . . . .	99
HB-1303	Permissible Service Temperature . . . . .	99
HB-1304	Application of Brazing Filler Metal . . . . .	99
HB-1305	Joint Clearance . . . . .	99
HB-1306	Openings . . . . .	100
HB-1307	Brazed Connections . . . . .	100
<b>Article 14</b>	<b>Fabrication Requirements</b> . . . . .	<b>101</b>
HB-1400	Cleaning of Surfaces to Be Brazed . . . . .	101
HB-1401	Postbrazing Operations . . . . .	101
HB-1402	Repair of Defective Brazing . . . . .	101
<b>Article 15</b>	<b>Inspection and Marking</b> . . . . .	<b>102</b>
HB-1500	Inspection . . . . .	102
<b>PART HC</b>	<b>REQUIREMENTS FOR BOILERS CONSTRUCTED OF CAST IRON</b> . . . . .	<b>103</b>
<b>Article 1</b>	<b>General</b> . . . . .	<b>103</b>
HC-100	Scope . . . . .	103
<b>Article 2</b>	<b>Material Requirements</b> . . . . .	<b>104</b>
HC-200	General Material Requirements . . . . .	104
HC-201	Manufacture . . . . .	104
HC-202	Chemical Composition . . . . .	104
HC-203	Tensile Strength Classification . . . . .	104
HC-204	Test Bars . . . . .	104
HC-205	Selection of Test Bar Size . . . . .	104
HC-206	Molding and Pouring Test Bars . . . . .	104
HC-207	Number of Tests . . . . .	104
HC-208	Tension Test . . . . .	105
HC-209	Tension Test Procedure . . . . .	105
HC-210	Tension Retests . . . . .	105
HC-211	Transverse Test . . . . .	106
HC-212	Transverse Test Procedure . . . . .	106
HC-213	Transverse Retests . . . . .	106
HC-214	Workmanship, Finish, and Repair . . . . .	107
HC-215	Examinations and Tests . . . . .	107
HC-216	Test Records . . . . .	107
<b>Article 3</b>	<b>Design</b> . . . . .	<b>109</b>
HC-300	Maximum Allowable Stress Values . . . . .	109
HC-301	Basis for Establishing Stress Values in Table HC-300 . . . . .	109
HC-310	Heads . . . . .	109
HC-311	Spherically Shaped Covers . . . . .	109
HC-312	Openings and Reinforcements . . . . .	111
HC-313	Corners and Fillets . . . . .	111
HC-320	Washout Openings . . . . .	111
HC-325	Assembly Method . . . . .	112
HC-330	Assembly Method . . . . .	112
<b>Article 4</b>	<b>Tests</b> . . . . .	<b>113</b>

HC-400	Tests to Establish Design Pressure . . . . .	113
<b>Article 5</b>	<b>Quality Control and Inspection . . . . .</b>	<b>115</b>
HC-501	General . . . . .	115
HC-502	Outline of Features to Be Included in the Written Description of the Quality Control System . . . . .	115
HC-510	Examination . . . . .	116
HC-520	Certificates of Conformance . . . . .	117
<b>Part HA</b>	<b>REQUIREMENTS FOR BOILERS CONSTRUCTED OF CAST ALUMINUM . . . . .</b>	<b>118</b>
<b>Article 1</b>	<b>General . . . . .</b>	<b>118</b>
HA-100	Scope . . . . .	118
<b>Article 2</b>	<b>Material Requirements . . . . .</b>	<b>119</b>
HA-200	General Material Requirements . . . . .	119
HA-201	Workmanship, Finish, and Repair . . . . .	119
HA-202	Examinations and Tests . . . . .	119
HA-203	Test Records . . . . .	120
<b>Article 3</b>	<b>Design . . . . .</b>	<b>121</b>
HA-300	Maximum Allowable Stress Values . . . . .	121
HA-301	Heads and Spherically Shaped Covers . . . . .	121
HA-302	Openings and Reinforcements . . . . .	121
HA-303	Corners and Fillets . . . . .	121
HA-304	Washout Openings . . . . .	121
HA-305	Assembly Method . . . . .	121
<b>Article 4</b>	<b>Tests . . . . .</b>	<b>122</b>
HA-400	Tests to Establish Design Pressure . . . . .	122
<b>Article 5</b>	<b>Quality Control and Inspection . . . . .</b>	<b>125</b>
HA-501	General . . . . .	125
HA-502	Outline of Features to Be Included in the Written Description of the Quality Control System . . . . .	125
HA-503	Examination . . . . .	126
HA-504	Certificates of Conformance . . . . .	127
<b>Part HLW</b>	<b>REQUIREMENTS FOR POTABLE-WATER HEATERS . . . . .</b>	<b>128</b>
	<b>Introduction . . . . .</b>	<b>128</b>
<b>Article 1</b>	<b>General . . . . .</b>	<b>130</b>
HLW-100	Scope . . . . .	130
HLW-101	Service Limits . . . . .	130
HLW-102	Permissible Marking . . . . .	130
HLW-103	Units . . . . .	130
<b>Article 2</b>	<b>Material Requirements . . . . .</b>	<b>132</b>
HLW-200	Lining . . . . .	132
HLW-201	Primary Pressure Parts Material . . . . .	133
HLW-202	Acceptance of Unidentified or Small Quantities of Material . . . . .	133
HLW-203	Miscellaneous Pressure Parts Material . . . . .	134
HLW-204	Flanges and Pipe Fittings . . . . .	134
HLW-205	Nonpressure Part Material . . . . .	134
<b>Article 3</b>	<b>Design . . . . .</b>	<b>135</b>
HLW-300	Design . . . . .	135

HLW-301	Basis for Establishing Stress Values in Section II, Part D, Tables 6C and 6D	135
HLW-302	Minimum Thicknesses	135
HLW-303	Shells Under Internal Pressure	135
HLW-305	Blank Unstayed Dished Heads, Pressure on Concave Side	136
HLW-306	Blank Unstayed Dished Heads, Pressure on Convex Side	136
HLW-307	Tubes	136
HLW-308	Openings	136
HLW-309	Tubes Attached by Expanding	137
HLW-310	Storage Tanks	137
<b>Article 4</b>	<b>Design of Weldments</b>	138
HLW-400	Design of Welded Joints	138
<b>Article 5</b>	<b>Tests</b>	153
HLW-500	Tests to Establish Maximum Allowable Working Pressure and Production Line Tests	153
<b>Article 6</b>	<b>Inspection and Marking</b>	156
HLW-600	Inspection and Certification	156
HLW-601	Manufacturer's Data and Partial Data Reports	156
HLW-602	Marking of Water Heaters and Storage Tanks	157
<b>Article 7</b>	<b>Controls</b>	160
HLW-700	Controls	160
<b>Article 8</b>	<b>Installation Requirements</b>	161
HLW-800	Pressure Relief Valves	161
HLW-801	Mounting Pressure Relief Valve	161
HLW-805	Water Supply	162
HLW-809	Provisions for Thermal Expansion in Hot Water Systems	162
HLW-810	Bottom Drain Valve	162
HLW-820	Thermometer	163
<b>Article 9</b>	<b>Modular Water Heater Requirements</b>	165
HLW-900	General	165
HLW-901	Marking	165
HLW-902	Installments, Fittings, and Controls	165
HLW-903	Installation Requirements	165
<b>Mandatory Appendix 2</b>	<b>Codes, Standards, and Specifications Referenced in Text</b>	167
2-100	Reference Standards	167
2-200	Organizations	167
<b>Mandatory Appendix 3</b>	<b>Adhesive Attachment of Nameplates to Casing</b>	169
3-100	Scope	169
3-101	Nameplate Application Procedure Qualification	169
<b>Mandatory Appendix 4</b>	<b>Guide to Manufacturer's Data Report Forms</b>	170
4-100	Introduction	170
4-200	Manufacturer's Data Report Forms	170
4-300	Certificate of Conformance Forms	170
<b>Mandatory Appendix 5</b>	<b>Vacuum Boilers</b>	198
5-100	Scope	198
5-200	Maximum Pressure and Temperature	198

5-300	Design Parameters . . . . .	198
5-400	Welding . . . . .	198
5-500	Alternative to Hydrotest . . . . .	198
5-600	Instruments, Fittings, and Controls . . . . .	199
5-700	Inspection Openings . . . . .	199
<b>Mandatory Appendix 6</b>	<b>Standard Units for Use in Equations . . . . .</b>	<b>200</b>
<b>Mandatory Appendix 7</b>	<b>Rules for Mass-Production of Heating Boilers . . . . .</b>	<b>201</b>
7-100	Introduction . . . . .	201
7-200	Scope . . . . .	201
7-300	General . . . . .	201
7-400	Quality Control Procedures . . . . .	201
7-500	Manufacturer's Data Reports . . . . .	202
<b>Mandatory Appendix 8</b>	<b>Criteria for Reapplication of a Certification Mark . . . . .</b>	<b>204</b>
<b>Mandatory Appendix 9</b>	<b>Establishing Governing Code Editions, Addenda, and Cases for Heating Boilers and Replacement Parts . . . . .</b>	<b>205</b>
9-100	General . . . . .	205
9-200	Design . . . . .	205
9-300	Materials . . . . .	205
9-400	Fabrication . . . . .	205
9-500	Examination . . . . .	205
9-600	Inspection . . . . .	205
9-700	Testing . . . . .	206
9-800	Overpressure Protection . . . . .	206
9-900	Field Assembly . . . . .	206
9-1000	Certification . . . . .	206
<b>Mandatory Appendix 10</b>	<b>Requirements for Feedwater Economizers . . . . .</b>	<b>207</b>
10-100	General . . . . .	207
10-200	Design . . . . .	207
10-300	Pressure Relief . . . . .	207
<b>Nonmandatory Appendix A</b>	<b>Estimating Pressure Relief Valve Capacity Requirements . . . . .</b>	<b>208</b>
A-100	Guide for Estimating Pressure Relief Valve Capacity Based on Heating Surface . . . . .	208
<b>Nonmandatory Appendix B</b>	<b>Method of Checking Pressure Relief Valve Capacity by Measuring Maximum Amount of Fuel That Can Be Burned . . . . .</b>	<b>209</b>
B-100	Procedure . . . . .	209
B-101	Examples . . . . .	209
B-102	Heats of Combustion of Fuels . . . . .	210
<b>Nonmandatory Appendix C</b>	<b>Examples of Method of Calculating a Welded Ring Reinforced Furnace . . . . .</b>	<b>211</b>
C-100	For a Steam or Hot Water Boiler . . . . .	211
C-101	For a Hot Water Boiler . . . . .	212
<b>Nonmandatory Appendix D</b>	<b>Examples of Methods of Computation of Openings in Boiler Shells . . . . .</b>	<b>213</b>
D-100	Pad Reinforced Opening . . . . .	213
D-101	Nozzle Reinforced Opening . . . . .	213
<b>Nonmandatory Appendix E</b>	<b>Terminology . . . . .</b>	<b>216</b>
E-100	Terms Relating to Certification . . . . .	216
E-101	Terms Relating to Design . . . . .	216
E-102	Terms Relating to Welding . . . . .	218

<b>Nonmandatory Appendix F</b>	<b>Quality Control System</b> . . . . .	221
F-100	General . . . . .	221
F-202	Outline of Features to Be Included in the Written Description of the Quality Control System . . . . .	221
<b>Nonmandatory Appendix H</b>	<b>List of Abbreviations and Addresses</b> . . . . .	223
<b>Nonmandatory Appendix K</b>	<b>Guide to Information Appearing on Certificate of Authorization</b> . . . .	224
<b>Nonmandatory Appendix M</b>	<b>Guidance for the Use of U.S. Customary and SI Units in the ASME Boiler and Pressure Vessel Code</b> . . . . .	227
M-100	Use of Units in Equations . . . . .	227
M-200	Guidelines Used to Develop SI Equivalentents . . . . .	227
M-300	Soft Conversion Factors . . . . .	229
<b>Nonmandatory Appendix N</b>	<b>Guide to Manufacturer's Certificate of Conformance for Pressure Relief Valves</b> . . . . .	230
<b>Nonmandatory Appendix P</b>	<b>Guide to the Relocation of Overpressure Protection Requirements</b> . .	231
<b>Figures</b>		
HG-307	Some Acceptable Types of Unstayed Flat Heads and Covers . . . . .	6
HG-309	Spherically Dished Steel Plate Covers With Bolting Flanges . . . . .	10
HG-312.4	Acceptable Type of Ring-Reinforced Furnace . . . . .	12
HG-312.7	Connection Between Plain and Corrugated Furnace . . . . .	13
HG-312.8	Acceptable Type of Semicircular Furnace Reinforcement . . . . .	14
HG-321	Chart for Determining Values of $F$ . . . . .	16
HG-326.1	Some Representative Configurations Describing the Reinforcement Dimension, $t_e$ , and the Finished Opening Dimension, $d$ . . . . .	18
HG-326.2	Nomenclature and Formulas for Reinforced Openings . . . . .	20
HG-340.1	Pitch of Staybolts Adjacent to Upper Corners of Fireboxes . . . . .	22
HG-340.2	Acceptable Proportions for Ends of Through-Stays . . . . .	22
HG-340.3	Examples of Acceptable Corner Welds for Pressures Not Over 30 psi . . .	23
HG-343	Details of Installation of Diagonal Stays . . . . .	26
HG-345.1(a)	Sketch Showing Application of HG-345.1 to the Staying of Boilers . . . . .	27
HG-345.1(b)	Sketch Showing Application of HG-345.1 to the Staying of Boilers . . . . .	28
HG-350.1	Example of Tube Spacing With Pitch of Holes Equal in Every Row . . . . .	29
HG-350.2	Example of Tube Spacing With Pitch of Holes Unequal in Every Second Row	30
HG-350.3	Example of Tube Spacing With Pitch of Holes Varying in Every Second and Third Row . . . . .	31
HG-350.4	Example of Tube Spacing With Tube Holes on Diagonal Lines . . . . .	31
HG-530.1	Official Certification Mark to Denote the American Society of Mechanical Engineers' Standard . . . . .	44
HG-530.2	Steam and Water Boilers Form of Marking on Completed Boilers or Their Nameplates (Not Applicable for Boilers Constructed Primarily of Cast Iron)	45
HG-530.3	Boilers Suitable for Water Only Form of Marking on Completed Boilers or Their Nameplates (Not Applicable for Boilers Constructed Primarily of Cast Iron) . . . . .	45
HG-530.4	Steam and Water Boilers Form of Data Cast or Marked on Cast Iron Boiler Sections . . . . .	46
HG-530.5	Boilers Suitable for Water Only Form of Data Cast or Marked on Cast Iron Boiler Sections . . . . .	46

HG-530.6	Boilers Suitable for Water Only Form of Data Cast or Marked on Cast Aluminum Boiler Sections . . . . .	47
HG-530.7	Steam and Water Boilers Form of Marking on Completed Cast Iron Boilers or Their Nameplates . . . . .	47
HG-530.8	Boilers Suitable for Water Only Form of Marking on Completed Cast Iron or Cast Aluminum Boilers or Their Nameplates . . . . .	47
HG-531.1	Form of Marking on Part or Accessory — H Designator . . . . .	48
HG-531.2	Form of Marking on Part or Accessory — PRT IV Designator . . . . .	49
HG-703.1(a)	Steam Boilers in Battery — Pumped Return — Acceptable Piping Installation	58
HG-703.1(b)	Steam Boilers in Battery — Gravity Return — Acceptable Piping Installation	59
HG-703.2	Hot Water Boilers in Battery — Acceptable Piping Installation . . . . .	60
HG-725(a)	Spacing and Weld Details for Supporting Lugs in Pairs on Horizontal-Return Tubular Boiler . . . . .	63
HG-725(b)	Welded Bracket Connection for Horizontal-Return Tubular Boiler . . . . .	63
HW-701.1	Butt Welding of Plates of Unequal Thickness . . . . .	78
HW-701.3	Some Forms of Attachments of Pressure Parts to Flat Plates to Form a Corner Joint (Tee Joint) . . . . .	79
HW-710.4(a)	Some Acceptable Types of Diagonal Stays for Installation by Welding . . .	80
HW-710.4(b)	Unacceptable Types of Diagonal Stays for Installation by Welding . . . . .	80
HW-715.1	Heads Attached to Shells . . . . .	83
HW-731	Some Acceptable Types of Welds for Fittings, Nozzles, and Other Connections to Shells, Drums, and Headers . . . . .	85
HW-740	Three-Ply Joint Assemblies . . . . .	87
HW-745	Two-Ply Joint Assemblies . . . . .	90
HC-204.1	Dimensions of Tensile Test Specimen . . . . .	105
HC-205.1	Cast Test Bars . . . . .	106
HC-311	Spherically Shaped Covers With Bolting Flanges . . . . .	110
HLW-401.1	Butt Welding of Plates of Unequal Thickness . . . . .	138
HLW-401.2	Typical Corner Joints . . . . .	139
HLW-411	Typical Water Heater Welded Joints . . . . .	141
HLW-413	Tubes Attached by Welding . . . . .	143
HLW-415	Heads Attached to Shells . . . . .	144
HLW-431.1	Some Acceptable Types of Welds for Fittings, Nozzles, and Other Connections to Shells and Head . . . . .	146
HLW-431.5	Some Acceptable Types of Welds for Fittings, Nozzles, and Other Connections to Shells and Head . . . . .	147
HLW-432.1	Some Acceptable Types of Brazed Fittings, Nozzles, and Other Connections to Copper-Lined Shells and Heads . . . . .	150
HLW-602.1	Official Symbol to Denote The American Society of Mechanical Engineers' Standard . . . . .	158
HLW-602.2	Form of Marking on Completed Water Heaters . . . . .	158
HLW-809.1	A Typical Acceptable Piping Installation for Storage Water Heaters in Battery	163
HLW-809.2	A Typical Acceptable Piping Installation for Flow Through Water Heater With Provisions for Piping Expansion . . . . .	164
D-100	Computation of Typical Pad Reinforcement . . . . .	213
D-101	Computation of a Typical Nozzle Fitting . . . . .	214
K-1	Sample Certificate of Authorization . . . . .	226

**Tables**

HG-321	Values of Spherical Radius Factor $K_1$ . . . . .	16
HG-340	Allowable Pitch of Stays, in. (mm) (Limited by HG-340.3) . . . . .	24
HG-360	Permitted O-Ring Materials . . . . .	31
HG-370	Minimum Thickness of Material for Threaded Connections to Boilers . . . . .	32
HG-709.2	Expansion Tank Capacities for Forced Hot Water Systems . . . . .	61
HG-715	Size of Bottom Blowoff Piping, Valves, and Cocks . . . . .	62
HW-713	Firetube Extension Through Tubesheets for Welded Construction . . . . .	82
HB-1305	Recommended Joint Clearances at Brazing Temperature . . . . .	100
HC-212	Correction Factors for Transverse Test Bars . . . . .	107
HC-214	Pipe Plug Size for Minimum Wall Thickness . . . . .	108
HC-300	Maximum Allowable Stress Values in Tension for Cast Iron, ksi (MPa) . . . . .	109
HLW-401.3-1	Alignment Tolerance . . . . .	139
HLW-809.1	Expansion Tank Capacities for a Water Heater . . . . .	164
2-100	Codes, Standards, and Specifications Referenced in Text . . . . .	168
4-1	Guide for the Preparation of Section IV Manufacturer’s Data Report Forms . . . . .	171
6-1	Standard Units for Use in Equations . . . . .	200
A-100	Guide for Estimating Steaming Capacity Based on Heating Surface . . . . .	208

**Forms**

H-1	Manufacturer’s Modular Master Data Report for Modular Boilers or Modular Water Heaters . . . . .	174
H-2	Manufacturer’s Data Report for All Types of Boilers Except Watertube and Those Made of Cast Iron or Cast Aluminum . . . . .	176
H-3	Manufacturer’s Data Report for Watertube Boilers and Economizers . . . . .	178
H-4	Manufacturer’s Partial Data Report . . . . .	180
H-5	Manufacturer’s Master Data Report for Boilers Constructed From Cast Iron . . . . .	182
H-5A	Manufacturer’s Master Data Report for Boilers Constructed From Cast Aluminum . . . . .	184
H-6	Manufacturer’s Data Report Supplementary Sheet . . . . .	186
HC-1	Manufacturer’s Material Certificate of Conformance for Cast Iron Boiler Sections . . . . .	187
HC-2	Manufacturer’s Material Certificate of Conformance for Hydrostatic Testing of Cast Iron Boiler Sections . . . . .	188
HC-3	Manufacturer’s Report for the Application of Nameplates on Cast Iron Boilers . . . . .	189
HA-1	Manufacturer’s Material Certificate of Conformance for Cast Aluminum Boiler Sections . . . . .	190
HA-2	Manufacturer’s Material Certificate of Conformance for Hydrostatic and Pneumatic Testing of Cast Aluminum Boiler Sections . . . . .	191
HA-3	Manufacturer’s Report for the Application of Nameplates on Cast Aluminum Boilers . . . . .	192
HLW-6	Manufacturer’s Data Report for Water Heaters or Storage Tanks . . . . .	193
HLW-7	Manufacturer’s Partial Data Report for Water Heaters and Storage Tanks . . . . .	195
HLW-8	Manufacturer’s Master Data Proof Test Report for Water Heaters or Storage Tanks . . . . .	197

**Endnotes**

. . . . .	232
-----------	-----

# LIST OF SECTIONS

(23)

## SECTIONS

- I Rules for Construction of Power Boilers
- II Materials
  - Part A — Ferrous Material Specifications
  - Part B — Nonferrous Material Specifications
  - Part C — Specifications for Welding Rods, Electrodes, and Filler Metals
  - Part D — Properties (Customary)
  - Part D — Properties (Metric)
- III Rules for Construction of Nuclear Facility Components
  - Subsection NCA — General Requirements for Division 1 and Division 2
  - Appendices
  - Division 1
    - Subsection NB — Class 1 Components
    - Subsection NCD — Class 2 and Class 3 Components
    - Subsection NE — Class MC Components
    - Subsection NF — Supports
    - Subsection NG — Core Support Structures
  - Division 2 — Code for Concrete Containments
  - Division 3 — Containment Systems for Transportation and Storage of Spent Nuclear Fuel and High-Level Radioactive Material
  - Division 4 — Fusion Energy Devices
  - Division 5 — High Temperature Reactors
- IV Rules for Construction of Heating Boilers
- V Nondestructive Examination
- VI Recommended Rules for the Care and Operation of Heating Boilers
- VII Recommended Guidelines for the Care of Power Boilers
- VIII Rules for Construction of Pressure Vessels
  - Division 1
  - Division 2 — Alternative Rules
  - Division 3 — Alternative Rules for Construction of High Pressure Vessels
- IX Welding, Brazing, and Fusing Qualifications
- X Fiber-Reinforced Plastic Pressure Vessels
- XI Rules for Inservice Inspection of Nuclear Reactor Facility Components
  - Division 1 — Rules for Inspection and Testing of Components of Light-Water-Cooled Plants
  - Division 2 — Requirements for Reliability and Integrity Management (RIM) Programs for Nuclear Reactor Facilities
- XII Rules for Construction and Continued Service of Transport Tanks
- XIII Rules for Overpressure Protection

# FOREWORD\*

In 1911, The American Society of Mechanical Engineers established the Boiler and Pressure Vessel Committee to formulate standard rules for the construction of steam boilers and other pressure vessels. In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees:

- (a) Committee on Power Boilers (I)
- (b) Committee on Materials (II)
- (c) Committee on Construction of Nuclear Facility Components (III)
- (d) Committee on Heating Boilers (IV)
- (e) Committee on Nondestructive Examination (V)
- (f) Committee on Pressure Vessels (VIII)
- (g) Committee on Welding, Brazing, and Fusing (IX)
- (h) Committee on Fiber-Reinforced Plastic Pressure Vessels (X)
- (i) Committee on Nuclear Inservice Inspection (XI)
- (j) Committee on Transport Tanks (XII)
- (k) Committee on Overpressure Protection (XIII)
- (l) Technical Oversight Management Committee (TOMC)

Where reference is made to “the Committee” in this Foreword, each of these committees is included individually and collectively.

The Committee’s function is to establish rules of safety relating to pressure integrity, which govern the construction\*\* of boilers, pressure vessels, transport tanks, and nuclear components, and the inservice inspection of nuclear components and transport tanks. The Committee also interprets these rules when questions arise regarding their intent. The technical consistency of the Sections of the Code and coordination of standards development activities of the Committees is supported and guided by the Technical Oversight Management Committee. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks, or nuclear components, or the inservice inspection of nuclear components or transport tanks. Users of the Code should refer to the pertinent codes, standards, laws, regulations, or other relevant documents for safety issues other than those relating to pressure integrity. Except for Sections XI and XII, and with a few other exceptions, the rules do not, of practical necessity, reflect the likelihood and consequences of deterioration in service related to specific service fluids or external operating environments. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of pressure vessels. The objective of the rules is to afford reasonably certain protection of life and property, and to provide a margin for deterioration in service to give a reasonably long, safe period of usefulness. Advancements in design and materials and evidence of experience have been recognized.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities and inservice inspection and testing activities. The Code does not address all aspects of these activities and those aspects that are not specifically addressed should not be considered prohibited. The Code is not a handbook and cannot replace education, experience, and the use of engineering judgment. The phrase *engineering judgment* refers to technical judgments made by knowledgeable engineers experienced in the application of the Code. Engineering judgments must be consistent with Code philosophy, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of the Code.

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code neither requires nor prohibits the use of computers for the design or analysis of components constructed to the requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and the application of these programs to their design.

---

\* The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI’s requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Code.

\*\* *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and overpressure protection.

The rules established by the Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design, or as limiting in any way the manufacturer's freedom to choose any method of design or any form of construction that conforms to the Code rules.

The Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Committee has the authority to provide official interpretations of this Code. Requests for revisions, new rules, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action (see Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees). Proposed revisions to the Code resulting from inquiries will be presented to the Committee for appropriate action. The action of the Committee becomes effective only after confirmation by ballot of the Committee and approval by ASME. Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute (ANSI) and published at <http://go.asme.org/BPVCPublicReview> to invite comments from all interested persons. After public review and final approval by ASME, revisions are published at regular intervals in Editions of the Code.

The Committee does not rule on whether a component shall or shall not be constructed to the provisions of the Code. The scope of each Section has been established to identify the components and parameters considered by the Committee in formulating the Code rules.

Questions or issues regarding compliance of a specific component with the Code rules are to be directed to the ASME Certificate Holder (Manufacturer). Inquiries concerning the interpretation of the Code are to be directed to the Committee. ASME is to be notified should questions arise concerning improper use of the ASME Single Certification Mark.

When required by context in this Section, the singular shall be interpreted as the plural, and vice versa, and the feminine, masculine, or neuter gender shall be treated as such other gender as appropriate.

The words "shall," "should," and "may" are used in this Standard as follows:

- *Shall* is used to denote a requirement.
- *Should* is used to denote a recommendation.
- *May* is used to denote permission, neither a requirement nor a recommendation.

# **STATEMENT OF POLICY ON THE USE OF THE ASME SINGLE CERTIFICATION MARK AND CODE AUTHORIZATION IN ADVERTISING**

ASME has established procedures to authorize qualified organizations to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. It is the aim of the Society to provide recognition of organizations so authorized. An organization holding authorization to perform various activities in accordance with the requirements of the Code may state this capability in its advertising literature.

Organizations that are authorized to use the ASME Single Certification Mark for marking items or constructions that have been constructed and inspected in compliance with the ASME Boiler and Pressure Vessel Code are issued Certificates of Authorization. It is the aim of the Society to maintain the standing of the ASME Single Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the ASME Single Certification Mark who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the ASME Single Certification Mark, Certificates of Authorization, and reference to Code construction. The American Society of Mechanical Engineers does not “approve,” “certify,” “rate,” or “endorse” any item, construction, or activity and there shall be no statements or implications that might so indicate. An organization holding the ASME Single Certification Mark and/or a Certificate of Authorization may state in advertising literature that items, constructions, or activities “are built (produced or performed) or activities conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code,” or “meet the requirements of the ASME Boiler and Pressure Vessel Code.” An ASME corporate logo shall not be used by any organization other than ASME.

The ASME Single Certification Mark shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of the ASME Single Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the ASME Single Certification Mark.

# **STATEMENT OF POLICY ON THE USE OF ASME MARKING TO IDENTIFY MANUFACTURED ITEMS**

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. This includes requirements for materials, design, fabrication, examination, inspection, and stamping. Items constructed in accordance with all of the applicable rules of the Code are identified with the ASME Single Certification Mark described in the governing Section of the Code.

Markings such as “ASME,” “ASME Standard,” or any other marking including “ASME” or the ASME Single Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code.

Items shall not be described on ASME Data Report Forms nor on similar forms referring to ASME that tend to imply that all Code requirements have been met when, in fact, they have not been. Data Report Forms covering items not fully complying with ASME requirements should not refer to ASME or they should clearly identify all exceptions to the ASME requirements.

# PERSONNEL

## ASME Boiler and Pressure Vessel Standards Committees, Subgroups, and Working Groups

(23)

January 1, 2023

### TECHNICAL OVERSIGHT MANAGEMENT COMMITTEE (TOMC)

R. E. McLaughlin, <i>Chair</i>	W. M. Lundy
N. A. Finney, <i>Vice Chair</i>	D. I. Morris
S. J. Rossi, <i>Staff Secretary</i>	T. P. Pastor
G. Aurioles, Sr.	M. D. Rana
R. W. Barnes	S. C. Roberts
T. L. Bedeaux	F. J. Schaaf, Jr.
C. Brown	G. Scribner
D. B. DeMichael	W. J. Sperko
R. P. Deubler	D. Srnica
J. G. Feldstein	R. W. Swayne
G. W. Galanes	J. Vattappilly
J. A. Hall	M. Wadkinson
T. E. Hansen	B. K. Nutter, <i>Ex-Officio Member</i>
G. W. Hembree	M. J. Pischke, <i>Ex-Officio Member</i>
R. B. Keating	J. F. Henry, <i>Honorary Member</i>
B. Linnemann	

### Subgroup on Research and Development (TOMC)

S. C. Roberts, <i>Chair</i>	R. B. Keating
S. J. Rossi, <i>Staff Secretary</i>	R. E. McLaughlin
R. W. Barnes	T. P. Pastor
N. A. Finney	D. Andrei, <i>Contributing Member</i>
W. Hoffelner	

### Subgroup on Strategic Initiatives (TOMC)

N. A. Finney, <i>Chair</i>	M. H. Jawad
S. J. Rossi, <i>Staff Secretary</i>	R. B. Keating
R. W. Barnes	R. E. McLaughlin
T. L. Bedeaux	T. P. Pastor
G. W. Hembree	S. C. Roberts

### Task Group on Remote Inspection and Examination (SI-TOMC)

S. C. Roberts, <i>Chair</i>	M. Tannenbaum
P. J. Coco	J. Cameron, <i>Alternate</i>
N. A. Finney	A. Byk, <i>Contributing Member</i>
S. A. Marks	J. Pang, <i>Contributing Member</i>
R. Rockwood	S. J. Rossi, <i>Contributing Member</i>
C. Stevens	C. A. Sanna, <i>Contributing Member</i>

### Special Working Group on High Temperature Technology (TOMC)

D. Dewees, <i>Chair</i>	B. F. Hantz
F. W. Brust	R. I. Jetter
T. D. Burchell	P. Smith
P. R. Donavin	

### ADMINISTRATIVE COMMITTEE

R. E. McLaughlin, <i>Chair</i>	M. J. Pischke
N. A. Finney, <i>Vice Chair</i>	M. D. Rana
S. J. Rossi, <i>Staff Secretary</i>	S. C. Roberts
J. Cameron	R. R. Stevenson
R. B. Keating	R. W. Swayne
B. Linnemann	M. Wadkinson
B. K. Nutter	

### MARINE CONFERENCE GROUP

J. Oh, <i>Staff Secretary</i>	H. N. Patel
J. G. Hungerbuhler, Jr.	N. Prokopuk
G. Nair	J. D. Reynolds

### CONFERENCE COMMITTEE

R. D. Troutt — Texas, <i>Chair</i>	J. LeSage, Jr. — Louisiana
J. T. Amato — Ohio, <i>Secretary</i>	A. M. Lorimor — South Dakota
W. Anderson — Mississippi	M. Mailman — Northwest Territories, Canada
R. Becker — Colorado	W. McGivney — City of New York, New York
T. D. Boggs — Missouri	S. F. Noonan — Maryland
R. A. Boillard — Indiana	C. L. O'Guin — Tennessee
D. P. Brockerville — Newfoundland and Labrador, Canada	B. S. Oliver — New Hampshire
R. J. Bunte — Iowa	J. L. Oliver — Nevada
J. H. Burpee — Maine	P. B. Polick — Illinois
M. Carlson — Washington	J. F. Porcella — West Virginia
T. G. Clark — Oregon	B. Ricks — Montana
B. J. Crawford — Georgia	W. J. Ross — Pennsylvania
E. L. Creaser — New Brunswick, Canada	M. H. Sansone — New York
J. J. Dacanay — Hawaii	T. S. Seime — North Dakota
R. DeLury — Manitoba, Canada	C. S. Selinger — Saskatchewan, Canada
A. Denham — Michigan	J. E. Sharier — Ohio
C. Dinic — Ontario, Canada	R. Spiker — North Carolina
D. A. Ehler — Nova Scotia, Canada	D. Srnica — Alberta, Canada
S. D. Frazier — Washington	D. J. Stenrose — Michigan
T. J. Granneman II — Oklahoma	R. J. Stimson II — Kansas
S. Harder — Arizona	R. K. Sturm — Utah
M. L. Jordan — Kentucky	D. K. Sullivan — Arkansas
R. Kamboj — British Columbia, Canada	J. Taveras — Rhode Island
E. Kawa — Massachusetts	G. Teel — California
A. Khssassi — Quebec, Canada	D. M. Warburton — Florida
D. Kinney — North Carolina	M. Washington — New Jersey
K. S. Lane — Alaska	E. Wiggins — Alabama

**INTERNATIONAL INTEREST REVIEW GROUP**

V. Felix  
 Y.-G. Kim  
 S. H. Leong  
 W. Lin  
 O. F. Manafa

C. Minu  
 Y.-W. Park  
 A. R. Reynaga Nogales  
 P. Williamson

**COMMITTEE ON POWER BOILERS (BPV I)**

R. E. McLaughlin, *Chair*  
 E. M. Ortman, *Vice Chair*  
 U. D'Urso, *Staff Secretary*  
 D. I. Anderson  
 J. L. Arnold  
 K. K. Coleman  
 J. G. Feldstein  
 S. Fincher  
 G. W. Galanes  
 T. E. Hansen  
 J. S. Hunter  
 M. Ishikawa  
 M. Lemmons  
 L. Moedinger  
 Y. Oishi  
 M. Ortolani  
 A. Spangenberg  
 D. E. Tompkins  
 D. E. Tuttle

J. Vattappilly  
 M. Wadkinson  
 R. V. Wielgoszinski  
 F. Zeller  
 H. Michael, *Delegate*  
 D. L. Berger, *Honorary Member*  
 P. D. Edwards, *Honorary Member*  
 D. N. French, *Honorary Member*  
 J. Hainsworth, *Honorary Member*  
 J. F. Henry, *Honorary Member*  
 W. L. Lowry, *Honorary Member*  
 J. R. MacKay, *Honorary Member*  
 P. A. Molvie, *Honorary Member*  
 J. T. Pillow, *Honorary Member*  
 B. W. Roberts, *Honorary Member*  
 R. D. Schueler, Jr., *Honorary Member*  
 J. M. Tanzosh, *Honorary Member*  
 R. L. Williams, *Honorary Member*  
 L. W. Yoder, *Honorary Member*

**Executive Committee (BPV I)**

E. M. Ortman, *Chair*  
 R. E. McLaughlin, *Vice Chair*  
 D. I. Anderson  
 J. L. Arnold  
 J. R. Braun  
 K. K. Coleman  
 H. Dalal  
 T. Dhanraj

U. D'Urso  
 P. F. Gilston  
 K. Hayes  
 P. Jennings  
 A. Spangenberg  
 D. E. Tompkins  
 M. Wadkinson

**Subgroup on Design (BPV I)**

D. I. Anderson, *Chair*  
 L. S. Tsai, *Secretary*  
 P. Becker  
 L. Krupp  
 C. T. McDaris

N. S. Ranck  
 J. Vattappilly  
 M. Wadkinson  
 D. Dewees, *Contributing Member*  
 J. P. Glaspie, *Contributing Member*

**Subgroup on Fabrication and Examination (BPV I)**

J. L. Arnold, *Chair*  
 P. F. Gilston, *Vice Chair*  
 P. Becker, *Secretary*  
 K. K. Coleman  
 S. Fincher  
 G. W. Galanes  
 T. E. Hansen

P. Jennings  
 M. Lewis  
 C. T. McDaris  
 R. E. McLaughlin  
 R. J. Newell  
 Y. Oishi  
 R. V. Wielgoszinski

**Subgroup on General Requirements and Piping (BPV I)**

D. E. Tompkins, *Chair*  
 M. Wadkinson, *Vice Chair*  
 M. Lemmons, *Secretary*  
 R. Antoniuk  
 T. E. Hansen  
 M. Ishikawa  
 R. E. McLaughlin  
 L. Moedinger

B. J. Mollitor  
 Y. Oishi  
 E. M. Ortman  
 D. E. Tuttle  
 J. Vattappilly  
 R. V. Wielgoszinski  
 W. L. Lowry, *Contributing Member*

**Subgroup on Locomotive Boilers (BPV I)**

J. R. Braun, *Chair*  
 S. M. Butler, *Secretary*  
 G. W. Galanes  
 D. W. Griner  
 M. A. Janssen

S. A. Lee  
 L. Moedinger  
 G. M. Ray  
 M. W. Westland

**Subgroup on Materials (BPV I)**

K. K. Coleman, *Chair*  
 K. Hayes, *Vice Chair*  
 M. Lewis, *Secretary*  
 S. H. Bowes  
 G. W. Galanes  
 P. F. Gilston  
 J. S. Hunter  
 E. Liebl

F. Masuyama  
 L. S. Nicol  
 M. Ortolani  
 D. W. Raho  
 F. Zeller  
 B. W. Roberts, *Contributing Member*  
 J. M. Tanzosh, *Contributing Member*

**Subgroup on Solar Boilers (BPV I)**

P. Jennings, *Chair*  
 R. E. Hearne, *Secretary*  
 S. Fincher

J. S. Hunter  
 P. Swarnkar

**Task Group on Modernization (BPV I)**

D. I. Anderson, *Chair*  
 U. D'Urso, *Staff Secretary*  
 J. L. Arnold  
 D. Dewees  
 G. W. Galanes  
 J. P. Glaspie

T. E. Hansen  
 R. E. McLaughlin  
 E. M. Ortman  
 D. E. Tuttle  
 J. Vattappilly

**Germany International Working Group (BPV I)**

A. Spangenberg, *Chair*  
 P. Chavdarov, *Secretary*  
 B. Daume  
 J. Fleischfresser  
 C. Jaekel  
 R. Kauer  
 D. Koelbl  
 S. Krebs  
 T. Ludwig

R. A. Meyers  
 H. Michael  
 F. Miunske  
 M. Sykora  
 R. Helmholdt, *Contributing Member*  
 J. Henrichsmeyer, *Contributing Member*  
 B. Müller, *Contributing Member*

**India International Working Group (BPV I)**

H. Dalal, <i>Chair</i>	S. Purkait
T. Dhanraj, <i>Vice Chair</i>	M. G. Rao
K. Thanupillai, <i>Secretary</i>	G. U. Shanker
P. Brahma	D. K. Shrivastava
S. Chakrabarti	K. Singha
A. Hantodkar	R. Sundararaj
A. J. Patil	S. Venkataramana

**Subgroup on International Material Specifications (BPV II)**

M. Ishikawa, <i>Chair</i>	F. Zeller
P. Chavdarov, <i>Vice Chair</i>	C. Zhou
A. Chaudouet	O. Oldani, <i>Delegate</i>
H. Chen	H. Lorenz, <i>Contributing Member</i>
A. F. Garbolevsky	T. F. Miskell, <i>Contributing Member</i>
D. O. Henry	E. Upitis, <i>Contributing Member</i>
W. M. Lundy	

**COMMITTEE ON MATERIALS (BPV II)**

J. Cameron, <i>Chair</i>	L. S. Nicol
G. W. Galanes, <i>Vice Chair</i>	M. Ortolani
C. E. Rodrigues, <i>Staff Secretary</i>	D. W. Raho
A. Appleton	W. Ren
P. Chavdarov	E. Shapiro
K. K. Coleman	R. C. Sutherlin
D. W. Gandy	F. Zeller
J. F. Grubb	O. Oldani, <i>Delegate</i>
J. A. Hall	A. Chaudouet, <i>Contributing Member</i>
D. O. Henry	J. D. Fritz, <i>Contributing Member</i>
K. M. Hottle	W. Hoffelner, <i>Contributing Member</i>
M. Ishikawa	K. E. Orié, <i>Contributing Member</i>
K. Kimura	D. T. Peters, <i>Contributing Member</i>
M. Kowalczyk	B. W. Roberts, <i>Contributing Member</i>
D. L. Kurle	J. M. Tanzosh, <i>Contributing Member</i>
F. Masuyama	E. Upitis, <i>Contributing Member</i>
S. Neilsen	R. G. Young, <i>Contributing Member</i>

**Subgroup on Nonferrous Alloys (BPV II)**

E. Shapiro, <i>Chair</i>	J. A. McMaster
W. MacDonald, <i>Vice Chair</i>	D. W. Raho
J. Robertson, <i>Secretary</i>	W. Ren
R. M. Beldyk	R. C. Sutherlin
J. M. Downs	R. Wright
J. F. Grubb	S. Yem
J. A. Hall	D. B. Denis, <i>Contributing Member</i>
D. Maitra	D. T. Peters, <i>Contributing Member</i>

**Subgroup on Physical Properties (BPV II)**

P. K. Rai, <i>Chair</i>	R. D. Jones
S. Neilsen, <i>Vice Chair</i>	P. K. Lam
G. Aurioles, Sr.	D. W. Raho
D. Chandiramani	E. Shapiro
P. Chavdarov	D. K. Verma
H. Eshraghi	S. Yem
J. F. Grubb	D. B. Denis, <i>Contributing Member</i>
B. F. Hantz	

**Executive Committee (BPV II)**

J. Cameron, <i>Chair</i>	W. Hoffelner
C. E. Rodrigues, <i>Staff Secretary</i>	M. Ishikawa
A. Appleton	M. Ortolani
K. K. Coleman	P. K. Rai
G. W. Galanes	J. Robertson
J. F. Grubb	E. Shapiro
S. Guzey	

**Subgroup on Strength, Ferrous Alloys (BPV II)**

M. Ortolani, <i>Chair</i>	M. Osterfoss
L. S. Nicol, <i>Secretary</i>	D. W. Raho
G. W. Galanes	S. Rosinski
J. A. Hall	M. Ueyama
M. Ishikawa	F. Zeller
S. W. Knowles	F. Abe, <i>Contributing Member</i>
F. Masuyama	R. G. Young, <i>Contributing Member</i>

**Subgroup on External Pressure (BPV II)**

S. Guzey, <i>Chair</i>	M. H. Jawad
E. Alexis, <i>Vice Chair</i>	S. Krishnamurthy
J. A. A. Morrow, <i>Secretary</i>	D. L. Kurle
L. F. Campbell	R. W. Mikitka
H. Chen	P. K. Rai
D. S. Griffin	M. Wadkinson
J. F. Grubb	

**Subgroup on Strength of Weldments (BPV II & BPV IX)**

K. K. Coleman, <i>Chair</i>	J. Penso
K. L. Hayes, <i>Vice Chair</i>	D. W. Raho
S. H. Bowes, <i>Secretary</i>	W. J. Sperko
M. Denault	J. P. Swezy, Jr.
G. W. Galanes	M. Ueyama
D. W. Gandy	P. D. Flenner, <i>Contributing Member</i>
M. Ghahremani	B. W. Roberts, <i>Contributing Member</i>
W. F. Newell, Jr.	

**Subgroup on Ferrous Specifications (BPV II)**

A. Appleton, <i>Chair</i>	S. G. Lee
K. M. Hottle, <i>Vice Chair</i>	W. C. Mack
C. Hyde, <i>Secretary</i>	J. Nickel
D. Amire-Brahimi	K. E. Orié
G. Cuccio	D. Poweleit
O. Elkadim	E. Upitis
D. Fialkowski	L. Watzke
J. F. Grubb	J. D. Fritz, <i>Contributing Member</i>
D. S. Janikowski	C. Meloy, <i>Contributing Member</i>
Y.-J. Kim	

**Working Group on Materials Database (BPV II)**

W. Hoffelner, <i>Chair</i>	J. Cameron, <i>Contributing Member</i>
C. E. Rodrigues, <i>Staff Secretary</i>	J. F. Grubb, <i>Contributing Member</i>
F. Abe	D. T. Peters, <i>Contributing Member</i>
W. MacDonald	W. Ren, <i>Contributing Member</i>
R. C. Sutherlin	B. W. Roberts, <i>Contributing Member</i>
D. Andrei, <i>Contributing Member</i>	E. Shapiro, <i>Contributing Member</i>
J. L. Arnold, <i>Contributing Member</i>	

**Working Group on Creep Strength Enhanced Ferritic Steels (BPV II)**

M. Ortolani, <i>Chair</i>	T. Melfi
G. W. Galanes, <i>Vice Chair</i>	W. F. Newell, Jr.
P. Becker, <i>Secretary</i>	J. J. Sanchez-Hanton
S. H. Bowes	J. A. Siefert
K. K. Coleman	W. J. Sperko
K. Kimura	F. Zeller
M. Lang	F. Abe, <i>Contributing Member</i>
S. Luke	P. D. Flenner, <i>Contributing Member</i>
F. Masuyama	J. M. Tanzosh, <i>Contributing Member</i>

**Working Group on Data Analysis (BPV II)**

J. F. Grubb, <i>Chair</i>	M. J. Swindeman
W. Ren, <i>Vice Chair</i>	F. Abe, <i>Contributing Member</i>
K. Kimura	W. Hoffelner, <i>Contributing Member</i>
F. Masuyama	W. C. Mack, <i>Contributing Member</i>
S. Neilsen	D. T. Peters, <i>Contributing Member</i>
M. Ortolani	B. W. Roberts, <i>Contributing Member</i>

**China International Working Group (BPV II)**

T. Xu, <i>Secretary</i>	S. Tan
W. Cai	C. Wang
W. Fang	Jinguang Wang
Q. C. Feng	Jiongxian Wang
S. Huo	Q.-J. Wang
F. Kong	X. Wang
H. Leng	H.-C. Yang
Hli Li	J. Yang
Hongbin Li	L. Yin
J. Li	H. Zhang
S. Liu	X.-H. Zhang
Z. Rongcan	Y. Zhang

**COMMITTEE ON CONSTRUCTION OF NUCLEAR FACILITY COMPONENTS (BPV III)**

R. B. Keating, <i>Chair</i>	K. Matsunaga
T. M. Adams, <i>Vice Chair</i>	B. McGlone
D. E. Matthews, <i>Vice Chair</i>	S. McKillop
A. Maslowski, <i>Staff Secretary</i>	J. McLean
A. Appleton	J. C. Minichiello
S. Asada	M. N. Mitchell
R. W. Barnes	T. Nagata
W. H. Borter	J. B. Ossmann
M. E. Cohen	S. Pellet
R. P. Deubler	E. L. Pleins
P. R. Donavin	T.-L. Sham
A. C. Eberhardt	W. J. Sperko
J. V. Gardiner	W. Windes
J. Grimm	C. Basavaraju, <i>Alternate</i>
S. Hunter	C. T. Smith, <i>Contributing Member</i>
R. M. Jessee	W. K. Sowder, Jr., <i>Contributing Member</i>
R. I. Jetter	M. Zhou, <i>Contributing Member</i>
C. C. Kim	E. B. Branch, <i>Honorary Member</i>
G. H. Koo	G. D. Cooper, <i>Honorary Member</i>
D. W. Lewis	D. F. Landers, <i>Honorary Member</i>
M. A. Lockwood	C. Pieper, <i>Honorary Member</i>
K. A. Manoly	

**Executive Committee (BPV III)**

R. B. Keating, <i>Chair</i>	K. A. Manoly
A. Maslowski, <i>Secretary</i>	D. E. Matthews
T. M. Adams	S. McKillop
P. R. Donavin	J. McLean
J. V. Gardiner	T.-L. Sham
J. Grimm	W. K. Sowder, Jr.
D. W. Lewis	K. A. Kavanagh, <i>Alternate</i>

**Argentina International Working Group (BPV III)**

M. F. Liendo, <i>Chair</i>	A. J. Dall'Osto
J. Fernández, <i>Vice Chair</i>	J. I. Duo
O. Martinez, <i>Staff Secretary</i>	M. M. Gamizo
O. A. Verastegui, <i>Secretary</i>	I. M. Guerreiro
E. H. Aldaz	I. A. Knorr
G. O. Anteri	D. E. Matthews
A. P. Antipasti	A. E. Pastor
D. O. Bordato	M. Rivero
G. Bourguigne	M. D. Vigliano
M. Brusa	P. Yamamoto
A. Claus	M. Zunino
R. G. Cocco	

**China International Working Group (BPV III)**

Y. Wang, <i>Chair</i>	C. Peiyin
H. Yu, <i>Secretary</i>	Z. Sun
L. Feng	G. Tang
J. Gu	L. Ting
L. Guo	F. Wu
C. Jiang	C. Yang
D. Kang	P. Yang
Y. Li	W. Yang
H. Lin	H. Yin
S. Liu	D. Yuangang
W. Liu	G. Zhang
J. Ma	D. Zhao
K. Mao	Z. Zhong
D. E. Matthews	Q. Zhou
J. Ming	H. Zhu
W. Pei	

**Germany International Working Group (BPV III)**

J. Wendt, <i>Chair</i>	C. Kuschke
D. Koelbl, <i>Vice Chair</i>	H.-W. Lange
R. Gersinska, <i>Secretary</i>	T. Ludwig
P. R. Donavin	X. Pitoiset
R. Döring	M. Reichert
C. G. Frantescu	G. Roos
A. Huber	J. Rudolph
R. E. Hueggenberg	L. Sybertz
C. Huttner	I. Tewes
E. Iacopetta	R. Tiete
M. H. Koeppen	F. Wille

**India International Working Group (BPV III)**

R. N. Sen, <i>Chair</i>	R. Kumar
S. B. Parkash, <i>Vice Chair</i>	S. Kumar
A. D. Bagdare, <i>Secretary</i>	M. Lakshminarasimhan
S. Aithal	T. Mukherjee
S. Benhur	D. Narain
N. M. Borwankar	A. D. Paranjpe
M. Brijlani	J. R. Patel
H. Dalal	E. L. Pleins
S. K. Goyal	T. J. P. Rao
A. Johori	V. Sehgal
A. P. Kishore	S. Singh
D. Kulkarni	B. K. Sreedhar

**Korea International Working Group (BPV III)**

G. H. Koo, <i>Chair</i>	Y.-S. Kim
O.-S. Kim, <i>Secretary</i>	D. Kwon
H. Ahn	B. Lee
S. Cho	D. Lee
G.-S. Choi	S. Lee
M.-J. Choi	S.-G. Lee
S. Choi	H. Lim
J. Y. Hong	I.-K. Nam
N.-S. Huh	C.-K. Oh
J.-K. Hwang	C.-Y. Oh
S. S. Hwang	E.-J. Oh
C. Jang	C. Park
I. I. Jeong	H. Park
S. H. Kang	Y. S. Pyun
J.-I. Kim	T. Shin
J.-S. Kim	S. Song
M.-W. Kim	W. J. Sperko
S.-S. Kim	J. S. Yang
Y.-B. Kim	O. Yoo

**Seismic Design Steering Committee (BPV III)**

T. M. Adams, <i>Chair</i>	G. H. Koo
F. G. Abatt, <i>Secretary</i>	A. Maekawa
G. A. Antaki	K. Matsunaga
C. Basavaraju	J. McLean
D. Chowdhury	R. M. Pace
R. Döring	D. Watkins

**Task Group on Alternate Requirements (BPV III)**

J. Wen, <i>Chair</i>	D. E. Matthews
R. R. Romano, <i>Secretary</i>	S. McKillop
P. J. Coco	B. P. Nolan
P. R. Donavin	J. B. Ossmann
J. V. Gardiner	E. C. Renaud
J. Grimm	M. A. Richter
R. S. Hill III	I. H. Tseng
M. Kris	Y. Wang
M. A. Lockwood	

**United Kingdom International Working Group (BPV III)**

C. D. Bell, <i>Chair</i>	G. Innes
P. M. James, <i>Vice Chair</i>	S. A. Jones
C. B. Carpenter, <i>Secretary</i>	B. Pellereau
T. M. Adams	C. R. Schneider
T. Bann	J. W. Stairmand
M. J. Chevalier	J. Sulley
A. J. Cole-Baker	J. Talamantes-Silva
M. Consonni	A. J. Holt, <i>Contributing Member</i>
M. J. Crathorne	

**Special Working Group on New Plant Construction Issues (BPV III)**

J. B. Ossmann, <i>Chair</i>	R. E. McLaughlin
A. Maslowski, <i>Staff Secretary</i>	E. L. Pleins
M. C. Buckley, <i>Secretary</i>	D. W. Sandusky
M. Arcaro	M. C. Scott
A. Cardillo	R. R. Stevenson
P. J. Coco	H. Xu
K. Harris	J. Yan
J. Honcharik	J. C. Minichiello, <i>Contributing Member</i>
M. Kris	

**Special Working Group on Editing and Review (BPV III)**

D. E. Matthews, <i>Chair</i>	S. Hunter
R. P. Deubler	J. C. Minichiello
A. C. Eberhardt	J. F. Strunk
J. V. Gardiner	C. Wilson

**Special Working Group on HDPE Stakeholders (BPV III)**

S. Patterson, <i>Secretary</i>	D. P. Munson
S. Choi	T. M. Musto
C. M. Faidy	J. E. O'Sullivan
M. Golliet	V. Rohatgi
R. M. Jessee	F. J. Schaaf, Jr.
J. Johnston, Jr.	R. Stakenborghs
M. Kuntz	M. Troughton
M. Lashley	B. Lin, <i>Alternate</i>
K. A. Manoly	

**Special Working Group on Honors and Awards (BPV III)**

J. C. Minichiello, <i>Chair</i>	R. M. Jessee
A. Appleton	D. E. Matthews
R. W. Barnes	

**Special Working Group on International Meetings and IWG Liaisons (BPV III)**

D. E. Matthews, <i>Chair</i>	P. R. Donavin
A. Maslowski, <i>Staff Secretary</i>	E. L. Pleins
T. M. Adams	W. J. Sperko
R. W. Barnes	

**Joint ACI-ASME Committee on Concrete Components for Nuclear Service (BPV III)**

J. McLean, *Chair*  
L. J. Colarusso, *Vice Chair*  
J. Cassamassino, *Staff Secretary*  
A. Dinizulu, *Staff Secretary*  
C. J. Bang  
A. C. Eberhardt  
B. D. Hovis  
T. C. Inman  
C. Jones  
T. Kang  
N.-H. Lee  
J. A. Munshi  
T. Muraki  
J. S. Saini

J. F. Strunk  
G. Thomas  
A. Varma  
S. Wang  
A. Istar, *Alternate*  
A. Adediran, *Contributing Member*  
S. Bae, *Contributing Member*  
J.-B. Domage, *Contributing Member*  
P. S. Ghosal, *Contributing Member*  
B. B. Scott, *Contributing Member*  
M. R. Senecal, *Contributing Member*  
Z. Shang, *Contributing Member*  
M. Sircar, *Contributing Member*  
C. T. Smith, *Contributing Member*

**Special Working Group on Modernization (BPV III-2)**

S. Wang, *Chair*  
J. McLean, *Vice Chair*  
A. Adediran  
S. Malushte  
J. S. Saini

A. Varma  
F. Lin, *Contributing Member*  
J. A. Pires, *Contributing Member*  
I. Zivanovic, *Contributing Member*

**Task Group on Steel-Concrete Composite Containments (BPV III-2)**

A. Varma, *Chair*  
S. Malushte  
J. McLean

J. A. Pires  
J. S. Saini

**Working Group on Design (BPV III-2)**

N.-H. Lee, *Chair*  
S. Wang, *Vice Chair*  
M. Allam  
S. Bae  
L. J. Colarusso  
A. C. Eberhardt  
B. D. Hovis  
T. C. Inman  
C. Jones  
J. A. Munshi  
T. Muraki  
J. S. Saini

G. Thomas  
A. Istar, *Alternate*  
P. S. Ghosal, *Contributing Member*  
S.-Y. Kim, *Contributing Member*  
J. Kwon, *Contributing Member*  
S. E. Ohler-Schmitz, *Contributing Member*  
B. B. Scott, *Contributing Member*  
Z. Shang, *Contributing Member*  
M. Shin, *Contributing Member*  
M. Sircar, *Contributing Member*

**Working Group on Materials, Fabrication, and Examination (BPV III-2)**

C. Jones, *Chair*  
A. Eberhardt, *Vice Chair*  
C. J. Bang  
B. Birch  
J.-B. Domage  
T. Kang  
N.-H. Lee

Z. Shang  
J. F. Strunk  
A. A. Aboelmagd, *Contributing Member*  
P. S. Ghosal, *Contributing Member*  
B. B. Scott, *Contributing Member*  
I. Zivanovic, *Contributing Member*

**Subcommittee on Design (BPV III)**

P. R. Donavin, *Chair*  
S. McKillop, *Vice Chair*  
R. P. Deubler  
M. A. Gray  
R. I. Jetter  
R. B. Keating  
J.-I. Kim  
K. A. Manoly  
D. E. Matthews  
M. N. Mitchell

B. Pellereau  
T.-L. Sham  
W. F. Weitzel  
C. Basavaraju, *Alternate*  
G. L. Hollinger, *Contributing Member*  
M. H. Jawad, *Contributing Member*  
W. J. O'Donnell, Sr., *Contributing Member*  
K. Wright, *Contributing Member*

**Subgroup on Component Design (SC-D) (BPV III)**

D. E. Matthews, *Chair*  
P. Vock, *Vice Chair*  
S. Pellet, *Secretary*  
T. M. Adams  
D. J. Ammerman  
G. A. Antaki  
J. J. Arthur  
S. Asada  
J. F. Ball  
C. Basavaraju  
D. Chowdhury  
N. A. Costanzo  
R. P. Deubler  
M. Kassar  
D. Keck  
T. R. Liszkai  
K. A. Manoly  
J. C. Minichiello

T. Mitsushashi  
D. Murphy  
T. M. Musto  
T. Nagata  
G. Z. Tokarski  
S. Willoughby-Braun  
C. Wilson  
A. A. Dermenjian, *Contributing Member*  
P. Hirschberg, *Contributing Member*  
R. B. Keating, *Contributing Member*  
O.-S. Kim, *Contributing Member*  
R. J. Masterson, *Contributing Member*  
H. S. Mehta, *Contributing Member*  
I. Saito, *Contributing Member*  
J. P. Tucker, *Contributing Member*

**Task Group to Improve Section III/XI Interface (SG-CD) (BPV III)**

P. Vock, *Chair*  
E. Henry, *Secretary*  
G. A. Antaki  
A. Cardillo  
D. Chowdhury  
J. Honcharik  
J. Hurst  
J. Lambin

C. A. Nove  
T. Nuoffer  
J. B. Ossmann  
A. T. Roberts III  
J. Sculli  
A. Udyawar  
S. Willoughby-Braun

**Working Group on Core Support Structures (SG-CD) (BPV III)**

D. Keck, *Chair*  
R. Z. Ziegler, *Vice Chair*  
R. Martin, *Secretary*  
G. W. Delpont  
L. C. Hartless  
T. R. Liszkai  
M. Nakajima

M. D. Snyder  
R. Vollmer  
T. M. Wiger  
C. Wilson  
Y. Wong  
H. S. Mehta, *Contributing Member*

**Working Group on Design of Division 3 Containment Systems (SG-CD) (BPV III)**

D. J. Ammerman, *Chair*  
S. Klein, *Secretary*  
G. Bjorkman  
V. Broz  
D. W. Lewis  
J. M. Piotter  
A. Rigato  
P. Sakalaukus, Jr.

D. Siromani  
R. Sypulski  
X. Zhai  
X. Zhang  
C. R. Sydnor, *Alternate*  
J. C. Minichiello, *Contributing Member*

**Working Group on HDPE Design of Components (SG-CD) (BPV III)**

T. M. Musto, <i>Chair</i>	K. A. Manoly
J. B. Ossmann, <i>Secretary</i>	D. P. Munson
M. Brandes	F. J. Schaaf, Jr.
S. Choi	R. Stakenborghs
J. R. Hebeisen	M. T. Audrain, <i>Alternate</i>
P. Krishnaswamy	J. C. Minichiello, <i>Contributing Member</i>
M. Kuntz	

**Working Group on Valves (SG-CD) (BPV III)**

P. Vock, <i>Chair</i>	H. O'Brien
S. Jones, <i>Secretary</i>	J. O'Callaghan
M. C. Buckley	M. Rain
A. Cardillo	K. E. Reid II
G. A. Jolly	J. Sulley
J. Lambin	I. H. Tseng
T. Lippucci	J. P. Tucker
C. A. Mizer	Y. Wong, <i>Alternate</i>

**Working Group on Piping (SG-CD) (BPV III)**

G. A. Antaki, <i>Chair</i>	J. O'Callaghan
G. Z. Tokarski, <i>Secretary</i>	K. E. Reid II
C. Basavaraju	D. Vlaicu
J. Catalano	S. Weindorf
F. Claeys	T. M. Adams, <i>Contributing Member</i>
C. M. Faidy	R. B. Keating, <i>Contributing Member</i>
R. G. Gilada	T. B. Littleton, <i>Contributing Member</i>
N. M. Graham	Y. Liu, <i>Contributing Member</i>
M. A. Gray	J. F. McCabe, <i>Contributing Member</i>
R. J. Gurdal	J. C. Minichiello, <i>Contributing Member</i>
R. W. Haupt	
A. Hirano	A. N. Nguyen, <i>Contributing Member</i>
P. Hirschberg	M. S. Sills, <i>Contributing Member</i>
M. Kassab	N. C. Sutherland, <i>Contributing Member</i>
J. Kawahata	
D. Lieb	E. A. Wais, <i>Contributing Member</i>
I.-K. Nam	C.-I. Wu, <i>Contributing Member</i>

**Working Group on Vessels (SG-CD) (BPV III)**

D. Murphy, <i>Chair</i>	T. J. Schriefer
S. Willoughby-Braun, <i>Secretary</i>	M. C. Scott
J. J. Arthur	P. K. Shah
C. Basavaraju	D. Vlaicu
M. Brijlani	C. Wilson
L. Constantinescu	R. Z. Ziegler
J. I. Kim	R. J. Huang, <i>Alternate</i>
O.-S. Kim	B. Basu, <i>Contributing Member</i>
D. E. Matthews	R. B. Keating, <i>Contributing Member</i>
T. Mitsuhashi	W. F. Weitze, <i>Contributing Member</i>

**Working Group on Pressure Relief (SG-CD) (BPV III)**

K. R. May, <i>Chair</i>	K. Shores
R. Krithivasan, <i>Secretary</i>	I. H. Tseng
M. Brown	B. J. Yonsky
J. W. Dickson	Y. Wong, <i>Alternate</i>
S. Jones	J. Yu, <i>Alternate</i>
R. Lack	S. T. French, <i>Contributing Member</i>
D. Miller	D. B. Ross, <i>Contributing Member</i>
T. Patel	S. Ruesenberg, <i>Contributing Member</i>

**Subgroup on Design Methods (SC-D) (BPV III)**

S. McKillop, <i>Chair</i>	W. D. Reinhardt
P. R. Donavin, <i>Vice Chair</i>	P. Smith
J. Wen, <i>Secretary</i>	R. Vollmer
K. Avrithi	W. F. Weitze
L. Davies	T. M. Adams, <i>Contributing Member</i>
M. A. Gray	C. W. Bruny, <i>Contributing Member</i>
J. V. Gregg, Jr.	S. R. Gosselin, <i>Contributing Member</i>
K. Hsu	H. T. Harrison III, <i>Contributing Member</i>
R. Kalnas	W. J. O'Donnell, Sr., <i>Contributing Member</i>
D. Keck	
J. I. Kim	K. Wright, <i>Contributing Member</i>
B. Pellereau	

**Working Group on Pumps (SG-CD) (BPV III)**

D. Chowdhury, <i>Chair</i>	K. B. Wilson
J. V. Gregg, Jr., <i>Secretary</i>	Y. Wong
B. Busse	I. H. Tseng, <i>Alternate</i>
M. D. Eftychiou	X. Di, <i>Contributing Member</i>
R. A. Fleming	C. Gabhart, <i>Contributing Member</i>
K. J. Noel	R. Ladefian, <i>Contributing Member</i>
J. Sulley	

**Working Group on Supports (SG-CD) (BPV III)**

N. A. Costanzo, <i>Chair</i>	G. Thomas
U. S. Bandyopadhyay, <i>Secretary</i>	G. Z. Tokarski
K. Avrithi	L. Vandersip
N. M. Bisceglia	P. Wiseman
R. P. Deubler	R. J. Masterson, <i>Contributing Member</i>
N. M. Graham	
Y. Matsubara	J. R. Stinson, <i>Contributing Member</i>
S. Pellet	

**Special Working Group on Computational Modeling for Explicit Dynamics (SG-DM) (BPV III)**

G. Bjorkman, <i>Chair</i>	D. Siromani
D. J. Ammerman, <i>Vice Chair</i>	C.-F. Tso
V. Broz, <i>Secretary</i>	M. C. Yaksh
S. Kuehner	U. Zencker
D. Molitoris	X. Zhang
W. D. Reinhardt	Y. Wong, <i>Contributing Member</i>

**Working Group on Design Methodology (SG-DM) (BPV III)**

B. Pellereau, *Chair*  
 R. Vollmer, *Secretary*  
 K. Avrithi  
 C. Basavaraju  
 F. Berkepille  
 C. M. Faidy  
 Y. Gao  
 M. Kassar  
 J. I. Kim  
 T. R. Liszkai  
 D. Lytle  
 K. Matsunaga  
 S. McKillop  
 S. Ranganath  
 W. D. Reinhardt  
 P. K. Shah  
 S. Wang  
 W. F. Weitze

J. Wen  
 T. M. Wiger  
 K. Hsu, *Alternate*  
 G. Banyay, *Contributing Member*  
 D. S. Bartran, *Contributing Member*  
 R. D. Blevins, *Contributing Member*  
 M. R. Breach, *Contributing Member*  
 C. W. Bruny, *Contributing Member*  
 D. L. Caldwell, *Contributing Member*  
 H. T. Harrison III, *Contributing Member*  
 C. F. Heberling II, *Contributing Member*  
 P. Hirschberg, *Contributing Member*  
 R. B. Keating, *Contributing Member*  
 A. Walker, *Contributing Member*  
 K. Wright, *Contributing Member*

**Working Group on Environmental Fatigue Evaluation Methods (SG-DM) (BPV III)**

M. A. Gray, *Chair*  
 W. F. Weitze, *Secretary*  
 S. Asada  
 K. Avrithi  
 R. C. Cipolla  
 T. M. Damiani  
 C. M. Faidy  
 A. Hirano  
 P. Hirschberg  
 K. Hsu  
 J.-S. Park

B. Pellereau  
 D. Vlaicu  
 K. Wang  
 R. Z. Ziegler  
 S. Cuvilliez, *Contributing Member*  
 T. D. Gilman, *Contributing Member*  
 S. R. Gosselin, *Contributing Member*  
 Y. He, *Contributing Member*  
 H. S. Mehta, *Contributing Member*  
 K. Wright, *Contributing Member*

**Working Group on Fatigue Strength (SG-DM) (BPV III)**

P. R. Donavin, *Chair*  
 M. S. Shelton, *Secretary*  
 R. S. Bass  
 T. M. Damiani  
 D. W. DeJohn  
 C. M. Faidy  
 P. Gill  
 S. R. Gosselin  
 R. J. Gurdal  
 C. F. Heberling II  
 C. E. Hinnant  
 P. Hirschberg  
 K. Hsu

J. I. Kim  
 S. H. Kleinsmith  
 B. Pellereau  
 S. Ranganath  
 Y. Wang  
 W. F. Weitze  
 Y. Zou  
 S. Majumdar, *Contributing Member*  
 H. S. Mehta, *Contributing Member*  
 W. J. O'Donnell, Sr., *Contributing Member*  
 K. Wright, *Contributing Member*

**Working Group on Probabilistic Methods in Design (SG-DM) (BPV III)**

M. Golliet, *Chair*  
 R. Kalnas, *Vice Chair*  
 K. Avrithi  
 G. Brouette  
 J. Hakii  
 D. O. Henry

A. Hirano  
 K. A. Manoly  
 P. J. O'Regan  
 B. Pellereau  
 M. Yagodich  
 R. S. Hill III, *Contributing Member*

**Subgroup on Containment Systems for Spent Nuclear Fuel and High-Level Radioactive Material (BPV III)**

D. W. Lewis, *Chair*  
 D. J. Ammerman, *Vice Chair*  
 S. Klein, *Secretary*  
 G. Bjorkman  
 V. Broz  
 A. Rigato  
 P. Sakalaukus, Jr.  
 D. Siromani  
 D. B. Spencer

R. Sypulski  
 J. Wellwood  
 X. J. Zhai  
 X. Zhang  
 D. Dunn, *Alternate*  
 W. H. Borter, *Contributing Member*  
 E. L. Pleins, *Contributing Member*  
 N. M. Simpson, *Contributing Member*

**Subgroup on Fusion Energy Devices (BPV III)**

W. K. Sowder, Jr., *Chair*  
 A. Maslowski, *Staff Secretary*  
 M. Ellis, *Secretary*  
 M. Bashir  
 J. P. Blanchard  
 T. P. Davis  
 B. R. Doshi  
 L. El-Guebaly  
 G. Holtmeier  
 D. Johnson  
 I. Kimihiro

C. J. Lammi  
 S. Lawler  
 P. Mokaria  
 D. J. Roszman  
 F. J. Schaaf, Jr.  
 P. Smith  
 Y. Song  
 C. Vangaasbeek  
 I. J. Zatz  
 R. W. Barnes, *Contributing Member*

**Special Working Group on Fusion Stakeholders (BPV III-4)**

T. P. Davis, *Chair*  
 R. W. Barnes  
 V. Chugh  
 S. S. Desai  
 F. Deschamps  
 M. Hua  
 S. Lawler

S. C. Middleburgh  
 R. J. Pearson  
 W. K. Sowder, Jr.  
 D. A. Sutherland  
 N. Young  
 J. Zimmermann

**Working Group on General Requirements (BPV III-4)**

D. J. Roszman, *Chair*  
 M. Ellis

P. Mokaria  
 W. K. Sowder, Jr.

**Working Group on In-Vessel Components (BPV III-4)**

M. Bashir, *Chair*  
 Y. Carin  
 T. P. Davis

M. Kalsey  
 S. T. Madabusi

**Working Group on Magnets (BPV III-4)**

W. K. Sowder, Jr., *Chair*

D. S. Bartran

**Working Group on Materials (BPV III-4)**

M. Porton, *Chair*  
 T. P. Davis

P. Mummery

**Working Group on Vacuum Vessels (BPV III-4)**

I. Kimihiro, *Chair*  
 L. C. Cadwallader  
 B. R. Doshi

D. Johnson  
 Q. Shijun  
 Y. Song

**Subgroup on General Requirements (BPV III)**

J. V. Gardiner, <i>Chair</i>	E. C. Renaud
N. DeSantis, <i>Secretary</i>	T. N. Rezk
V. Apostolescu	J. Rogers
A. Appleton	R. Spuhl
S. Bell	D. M. Vickery
J. R. Berry	J. DeKleine, <i>Contributing Member</i>
G. Brouette	H. Michael, <i>Contributing Member</i>
G. C. Deleanu	D. J. Roszman, <i>Contributing Member</i>
J. W. Highlands	C. T. Smith, <i>Contributing Member</i>
E. V. Imbro	W. K. Sowder, Jr., <i>Contributing Member</i>
K. A. Kavanagh	G. E. Szabatura, <i>Contributing Member</i>
Y.-S. Kim	
B. McGlone	

**Subgroup on High Temperature Reactors (BPV III)**

T.-L. Sham, <i>Chair</i>	A. Mann
Y. Wang, <i>Secretary</i>	M. C. Messner
M. Ando	X. Wei
N. Broom	W. Windes
F. W. Brust	R. Wright
P. Carter	G. L. Zeng
M. E. Cohen	D. S. Griffin, <i>Contributing Member</i>
W. J. Geringer	X. Li, <i>Contributing Member</i>
B. F. Hantz	W. O'Donnell, Sr., <i>Contributing Member</i>
M. H. Jawad	L. Shi, <i>Contributing Member</i>
W. T. Jessup	R. W. Swindeman, <i>Contributing Member</i>
R. I. Jetter	
K. Kimura	
G. H. Koo	

**Special Working Group on General Requirements Consolidation (SG-GR) (BPV III)**

J. V. Gardiner, <i>Chair</i>	E. C. Renaud
J. Grimm, <i>Vice Chair</i>	J. L. Williams
G. C. Deleanu	C. T. Smith, <i>Contributing Member</i>
A. C. Eberhardt	

**Special Working Group on High Temperature Reactor Stakeholders (SG-HTR) (BPV III)**

M. E. Cohen, <i>Chair</i>	G. H. Koo
M. C. Albert	N. J. McTiernan
M. Arcaro	T. Nguyen
R. W. Barnes	K. J. Noel
N. Broom	T.-L. Sham
R. Christensen	B. Song
V. Chugh	X. Wei
W. Corwin	G. L. Zeng
G. C. Deleanu	T. Asayama, <i>Contributing Member</i>
R. A. Fleming	X. Li, <i>Contributing Member</i>
K. Harris	L. Shi, <i>Contributing Member</i>
R. I. Jetter	G. Wu, <i>Contributing Member</i>
Y. W. Kim	

**Working Group on General Requirements (SG-GR) (BPV III)**

B. McGlone, <i>Chair</i>	Y. K. Law
J. Grimm, <i>Secretary</i>	D. T. Meisch
V. Apostolescu	E. C. Renaud
A. Appleton	T. N. Rezk
S. Bell	J. Rogers
J. R. Berry	B. S. Sandhu
G. Brouette	R. Spuhl
P. J. Coco	J. F. Strunk
N. DeSantis	D. M. Vickery
Y. Diaz-Castillo	J. L. Williams
O. Elkadim	J. DeKleine, <i>Contributing Member</i>
J. Harris	S. F. Harrison, Jr., <i>Contributing Member</i>
J. W. Highlands	D. J. Roszman, <i>Contributing Member</i>
E. V. Imbro	G. E. Szabatura, <i>Contributing Member</i>
K. A. Kavanagh	
Y.-S. Kim	

**Task Group on Division 5 AM Components (SG-HTR) (BPV III)**

R. Wright, <i>Chair</i>	M. McMurtrey
R. Bass, <i>Secretary</i>	M. C. Messner
M. C. Albert	T. Patterson
R. W. Barnes	E. C. Renaud
F. W. Brust	D. Rudland
Z. Feng	T.-L. Sham
S. Lawler	I. J. Van Rooyen
X. Lou	X. Wei

**Working Group on General Requirements for Graphite and Ceramic Composite Core Components and Assemblies (SG-GR) (BPV III)**

W. J. Geringer, <i>Chair</i>	M. N. Mitchell
A. Appleton	J. Potgieter
J. R. Berry	E. C. Renaud
C. Cruz	R. Spuhl
Y. Diaz-Castillo	W. Windes
J. Lang	B. Lin, <i>Alternate</i>

**Working Group on Allowable Stress Criteria (SG-HTR) (BPV III)**

R. Wright, <i>Chair</i>	W. Ren
M. McMurtrey, <i>Secretary</i>	T.-L. Sham
R. Bass	Y. Wang
K. Kimura	X. Wei
D. Maitra	M. Yoo, <i>Alternate</i>
R. J. McReynolds	R. W. Swindeman, <i>Contributing Member</i>
M. C. Messner	
J. C. Poehler	

**Working Group on Analysis Methods (SG-HTR) (BPV III)**

M. C. Messner, <i>Chair</i>	T.-L. Sham
H. Mahajan, <i>Secretary</i>	X. Wei
R. W. Barnes	S. X. Xu
J. A. Blanco	J. Young
P. Carter	M. R. Breach, <i>Contributing Member</i>
W. T. Jessup	T. Hassan, <i>Contributing Member</i>
R. I. Jetter	S. Krishnamurthy, <i>Contributing Member</i>
G. H. Koo	M. J. Swindeman, <i>Contributing Member</i>
H. Qian	
T. Riordan	

**Working Group on Creep-Fatigue and Negligible Creep (SG-HTR) (BPV III)**

Y. Wang, <i>Chair</i>	M. C. Messner
M. Ando	T. Nguyen
P. Carter	J. C. Poehler
M. E. Cohen	H. Qian
J. I. Duo	R. Rajasekaran
R. I. Jetter	T.-L. Sham
G. H. Koo	X. Wei
H. Mahajan	J. Young
M. McMurtrey	M. Yoo, <i>Alternate</i>

**Working Group on High Temperature Flaw Evaluation (SG-HTR) (BPV III)**

C. J. Sallaberry, <i>Chair</i>	H. Qian
F. W. Brust	D. A. Scarth
P. Carter	D. J. Shim
S. Kalyanam	A. Udyawar
B.-L. Lyow	X. Wei
M. C. Messner	S. X. Xu
J. C. Poehler	M. Yoo, <i>Alternate</i>

**Working Group on Nonmetallic Design and Materials (SG-HTR) (BPV III)**

W. Windes, <i>Chair</i>	M. N. Mitchell
W. J. Geringer, <i>Vice Chair</i>	J. Parks
J. Potgieter, <i>Secretary</i>	T.-L. Sham
G. Beirnaert	A. Tzelepi
C. Chen	G. L. Zeng
A. N. Chereskin	M. Yoo, <i>Alternate</i>
V. Chugh	A. Appleton, <i>Contributing Member</i>
C. Contescu	R. W. Barnes, <i>Contributing Member</i>
N. Gallego	A. A. Campbell, <i>Contributing Member</i>
S. T. Gonczy	S.-H. Chi, <i>Contributing Member</i>
K. Harris	Y. Katoh, <i>Contributing Member</i>
M. G. Jenkins	A. Mack, <i>Contributing Member</i>
J. Lang	J. B. Ossmann, <i>Contributing Member</i>
M. P. Metcalfe	

**Subgroup on Materials, Fabrication, and Examination (BPV III)**

J. Grimm, <i>Chair</i>	M. Kris
S. Hunter, <i>Secretary</i>	D. W. Mann
W. H. Borter	T. Melfi
M. Brijlani	I.-K. Nam
G. R. Cannell	J. B. Ossmann
A. Cardillo	J. E. O'Sullivan
S. Cho	M. C. Scott
P. J. Coco	W. J. Sperko
R. H. Davis	J. R. Stinson
D. B. Denis	J. F. Strunk
B. D. Frew	W. Windes
D. W. Gandy	R. Wright
S. E. Gingrich	S. Yee
M. Golliet	H. Michael, <i>Delegate</i>
L. S. Harbison	A. L. Hiser, Jr., <i>Alternate</i>
R. M. Jessee	R. W. Barnes, <i>Contributing Member</i>
C. C. Kim	

**Task Group on Advanced Manufacturing (BPV III)**

D. W. Mann, <i>Chair</i>	T. Melfi
D. W. Gandy, <i>Secretary</i>	E. C. Renaud
R. Bass	W. J. Sperko
D. Chowdhury	J. F. Strunk
P. J. Coco	J. Sulley
B. D. Frew	S. Tate
J. Grimm	S. Wolbert
A. L. Hiser, Jr.	H. Xu
J. Lambin	D. W. Pratt, <i>Alternate</i>
T. Lippucci	S. Malik, <i>Contributing Member</i>
K. Matsunaga	

**Joint Working Group on HDPE (SG-MFE) (BPV III)**

M. Brandes, <i>Chair</i>	K. Manoly
T. M. Musto, <i>Chair</i>	D. P. Munson
J. B. Ossmann, <i>Secretary</i>	J. O'Sullivan
G. Brouette	V. Rohatgi
M. C. Buckley	F. Schaaf, Jr.
S. Choi	S. Schuessler
M. Golliet	R. Stakenborghs
J. Hebeisen	M. Troughton
J. Johnston, Jr.	P. Vibien
P. Krishnaswamy	J. Wright
M. Kuntz	T. Adams, <i>Contributing Member</i>
B. Lin	

**COMMITTEE ON HEATING BOILERS (BPV IV)**

M. Wadkinson, <i>Chair</i>	C. Dinic
J. L. Kleiss, <i>Vice Chair</i>	J. M. Downs
C. R. Ramcharran, <i>Staff Secretary</i>	J. A. Hall
B. Ahee	M. Mengon
L. Badziagowski	D. Nelson
T. L. Bedeaux	H. Michael, <i>Delegate</i>
B. Calderon	D. Picart, <i>Delegate</i>
J. P. Chicoine	P. A. Molvie, <i>Contributing Member</i>

**Executive Committee (BPV IV)**

M. Wadkinson, <i>Chair</i>	J. P. Chicoine
C. R. Ramcharran, <i>Staff Secretary</i>	J. A. Hall
L. Badziagowski	J. L. Kleiss
T. L. Bedeaux	

**Subgroup on Cast Boilers (BPV IV)**

J. P. Chicoine, *Chair*                      J. A. Hall  
J. M. Downs, *Vice Chair*                  J. L. Kleiss  
C. R. Ramcharran, *Staff Secretary*      M. Mengon  
T. L. Bedeaux

**Subgroup on Materials (BPV IV)**

J. A. Hall, *Chair*                              T. L. Bedeaux  
J. M. Downs, *Vice Chair*                  Y. Teng  
C. R. Ramcharran, *Staff Secretary*      M. Wadkinson  
L. Badziagowski

**Subgroup on Water Heaters (BPV IV)**

J. L. Kleiss, *Chair*                            B. J. Iske  
L. Badziagowski, *Vice Chair*              M. Mengon  
C. R. Ramcharran, *Staff Secretary*      Y. Teng  
B. Ahee    T. E. Trant  
J. P. Chicoine                                  P. A. Molvie, *Contributing Member*  
C. Dinic

**Subgroup on Welded Boilers (BPV IV)**

T. L. Bedeaux, *Chair*                         J. L. Kleiss  
C. R. Ramcharran, *Staff Secretary*      M. Mengon  
B. Ahee    M. Wadkinson  
L. Badziagowski                              M. J. Melita, *Alternate*  
B. Calderon                                    D. Nelson, *Alternate*  
J. P. Chicoine                                  P. A. Molvie, *Contributing Member*  
C. Dinic

**Europe International Working Group (BPV IV)**

L. Badziagowski, *Chair*                      E. Van Bruggen  
D. Picart, *Vice Chair*                        G. Vicchi  
R. Lozny    A. Alessandrini, *Alternate*

**COMMITTEE ON NONDESTRUCTIVE EXAMINATION (BPV V)**

N. A. Finney, *Chair*                            B. D. Laite  
C. May, *Vice Chair*                            P. B. Shaw  
C. R. Ramcharran, *Staff Secretary*      C. Vorwald  
D. Bajula                                        S. J. Akryn, *Contributing Member*  
P. L. Brown                                    J. E. Batey, *Contributing Member*  
M. A. Burns                                    A. S. Birks, *Contributing Member*  
N. Carter                                        N. Y. Faransso, *Contributing Member*  
T. Clausing                                    J. F. Halley, *Contributing Member*  
C. Emslander                                  R. W. Kruzic, *Contributing Member*  
A. F. Garbolevsky                            L. E. Mullins, *Contributing Member*  
P. T. Hayes                                    F. J. Sattler, *Contributing Member*  
G. W. Hembree                                H. C. Graber, *Honorary Member*  
F. B. Kovacs                                  T. G. McCarty, *Honorary Member*  
K. Krueger

**Executive Committee (BPV V)**

C. May, *Chair*                                    G. W. Hembree  
N. A. Finney, *Vice Chair*                    F. B. Kovacs  
C. R. Ramcharran, *Staff Secretary*      K. Krueger  
N. Carter                                        E. Peloquin  
V. F. Godinez-Azcuaga                      C. Vorwald  
P. T. Hayes

**Subgroup on General Requirements/Personnel Qualifications and Inquiries (BPV V)**

C. Vorwald, *Chair*                            F. B. Kovacs  
D. Bajula                                        K. Krueger  
N. Carter                                        C. May  
P. Chavdarov                                 S. J. Akryn, *Contributing Member*  
T. Clausing                                    N. Y. Faransso, *Contributing Member*  
C. Emslander                                 J. F. Halley, *Contributing Member*  
N. A. Finney                                  D. I. Morris, *Contributing Member*  
G. W. Hembree                                J. P. Swezy, Jr., *Contributing Member*

**Project Team on Assisted Analysis (BPV V)**

K. Hayes, *Chair*                                C. Hansen  
J. Aldrin                                         G. W. Hembree  
J. Chen    R. S. F. Orozco  
N. A. Finney                                    E. Peloquin  
V. F. Godinez-Azcuaga                      T. Thulien

**Subgroup on Volumetric Methods (BPV V)**

C. May, *Chair*                                    K. Krueger  
P. T. Hayes, *Vice Chair*                      E. Peloquin  
D. Adkins                                        C. Vorwald  
P. L. Brown                                    S. J. Akryn, *Contributing Member*  
N. A. Finney                                    N. Y. Faransso, *Contributing Member*  
A. F. Garbolevsky                            J. F. Halley, *Contributing Member*  
R. W. Hardy                                    R. W. Kruzic, *Contributing Member*  
G. W. Hembree                                L. E. Mullins, *Contributing Member*  
F. B. Kovacs                                  F. J. Sattler, *Contributing Member*

**Working Group on Radiography (SG-VM) (BPV V)**

C. Vorwald, *Chair*                            T. R. Lerohl  
D. M. Woodward, *Vice Chair*              C. May  
J. Anderson                                    R. J. Mills  
P. L. Brown                                    J. F. Molinaro  
C. Emslander                                  T. Vidimos  
A. F. Garbolevsky                            B. White  
R. W. Hardy                                    S. J. Akryn, *Contributing Member*  
G. W. Hembree                                T. L. Clifford, *Contributing Member*  
F. B. Kovacs                                  N. Y. Faransso, *Contributing Member*  
B. D. Laite                                    R. W. Kruzic, *Contributing Member*

**Working Group on Ultrasonics (SG-VM) (BPV V)**

K. Krueger, *Chair*                              D. Tompkins  
D. Bajula, *Vice Chair*                        D. Van Allen  
D. Adkins                                        J. Vinyard  
C. Brown                                        C. Vorwald  
C. Emslander                                  C. Wassink  
N. A. Finney                                    N. Y. Faransso, *Contributing Member*  
P. T. Hayes                                    J. F. Halley, *Contributing Member*  
G. W. Hembree                                R. W. Kruzic, *Contributing Member*  
B. D. Laite                                    P. Mudge, *Contributing Member*  
T. R. Lerohl                                    L. E. Mullins, *Contributing Member*  
C. May    M. J. Quarry, *Contributing Member*  
E. Peloquin                                    F. J. Sattler, *Contributing Member*  
J. Schoneweis                                J. Vanvelsor, *Contributing Member*

**Working Group on Acoustic Emissions (SG-VM) (BPV V)**

V. F. Godinez-Azcuaga, *Chair*  
 J. Catty, *Vice Chair*  
 S. R. Doctor

N. F. Douglas, Jr.  
 R. K. Miller  
 N. Y. Faransso, *Contributing Member*

**Working Group on Full Matrix Capture (SG-VM) (BPV V)**

E. Peloquin, *Chair*  
 C. Wassink, *Vice Chair*  
 D. Bajula  
 D. Bellistri  
 J. Catty  
 N. A. Finney  
 J. L. Garner  
 R. T. Grotenhuis  
 P. T. Hayes

G. W. Hembree  
 K. Krueger  
 M. Lozev  
 R. Nogueira  
 D. Richard  
 M. Sens  
 D. Tompkins  
 J. F. Halley, *Contributing Member*  
 L. E. Mullins, *Contributing Member*

**Subgroup on Inservice Examination Methods and Techniques (BPV V)**

P. T. Hayes, *Chair*  
 E. Peloquin, *Vice Chair*  
 M. A. Burns  
 M. Carlson  
 N. A. Finney  
 V. F. Godinez-Azcuaga

G. W. Hembree  
 K. Krueger  
 C. May  
 D. D. Raimander  
 C. Vorwald

**Subgroup on Surface Examination Methods (BPV V)**

N. Carter, *Chair*  
 B. D. Laite, *Vice Chair*  
 R. M. Beldyk  
 P. L. Brown  
 T. Clausing  
 C. Emslander  
 N. Farenbaugh  
 N. A. Finney  
 A. F. Garbolevsky  
 K. Hayes  
 G. W. Hembree  
 C. May

P. B. Shaw  
 R. Tedder  
 C. Vorwald  
 C. Wassink  
 D. M. Woodward  
 S. J. Akryn, *Contributing Member*  
 N. Y. Faransso, *Contributing Member*  
 J. F. Halley, *Contributing Member*  
 R. W. Kruzic, *Contributing Member*  
 L. E. Mullins, *Contributing Member*  
 F. J. Sattler, *Contributing Member*

**Germany International Working Group (BPV V)**

P. Chavdarov, *Chair*  
 C. Kringe, *Vice Chair*  
 H.-P. Schmitz, *Secretary*  
 K.-H. Gischler

D. Kaiser  
 S. Mann  
 V. Reusch

**India International Working Group (BPV V)**

P. Kumar, *Chair*  
 A. V. Bhagwat  
 J. Chahwala  
 S. Jobanputra  
 D. Joshi

G. R. Joshi  
 A. Relekar  
 V. J. Sonawane  
 D. B. Tanpure

**Italy International Working Group (BPV V)**

D. D. Raimander, *Chair*  
 O. Oldani, *Vice Chair*  
 C. R. Ramcharan, *Staff Secretary*  
 P. Campli, *Secretary*  
 M. Agostini  
 T. Aldo  
 F. Bresciani  
 N. Caputo  
 M. Colombo  
 P. L. Dinelli  
 F. Ferrarese

E. Ferrari  
 M. A. Grimoldi  
 G. Luoni  
 U. Pappionetti  
 P. Pedersoli  
 A. Veroni  
 M. Zambon  
 V. Calo, *Contributing Member*  
 G. Gobbi, *Contributing Member*  
 A. Gusmaroli, *Contributing Member*  
 G. Pontiggia, *Contributing Member*

**COMMITTEE ON PRESSURE VESSELS (BPV VIII)**

S. C. Roberts, *Chair*  
 M. D. Lower, *Vice Chair*  
 S. J. Rossi, *Staff Secretary*  
 G. Auriolos, Sr.  
 S. R. Babka  
 R. J. Basile  
 P. Chavdarov  
 D. B. DeMichael  
 J. F. Grubb  
 B. F. Hantz  
 M. Kowalczyk  
 D. L. Kurle  
 R. Mahadeen  
 S. A. Marks  
 P. Matkovics  
 R. W. Mikitka  
 B. R. Morelock  
 T. P. Pastor  
 D. T. Peters  
 M. J. Pischke  
 M. D. Rana  
 G. B. Rawls, Jr.  
 F. L. Richter

C. D. Rodery  
 J. C. Sowinski  
 D. Srnic  
 D. B. Stewart  
 P. L. Sturgill  
 K. Subramanian  
 D. A. Swanson  
 J. P. Swezy, Jr.  
 S. Terada  
 E. Uptis  
 A. Viet  
 K. Xu  
 P. A. McGowan, *Delegate*  
 H. Michael, *Delegate*  
 K. Oyamada, *Delegate*  
 M. E. Pappionetti, *Delegate*  
 A. Chaudouet, *Contributing Member*  
 J. P. Glaspie, *Contributing Member*  
 K. T. Lau, *Contributing Member*  
 U. R. Miller, *Contributing Member*  
 K. Mokhtarian, *Contributing Member*  
 G. G. Karcher, *Honorary Member*  
 K. K. Tam, *Honorary Member*

**Executive Committee (BPV VIII)**

M. D. Lower, *Chair*  
 S. J. Rossi, *Staff Secretary*  
 G. Auriolos, Sr.  
 C. W. Cary  
 J. Hoskinson  
 M. Kowalczyk

S. A. Marks  
 P. Matkovics  
 S. C. Roberts  
 J. C. Sowinski  
 K. Subramanian  
 K. Xu

**Subgroup on Design (BPV VIII)**

J. C. Sowinski, *Chair*  
 C. S. Hinson, *Vice Chair*  
 G. Aurioles, Sr.  
 S. R. Babka  
 O. A. Barsky  
 R. J. Basile  
 D. Chandiramani  
 M. D. Clark  
 M. Faulkner  
 B. F. Hantz  
 C. E. Hinnant  
 M. H. Jawad  
 S. Krishnamurthy  
 D. L. Kurle  
 K. Kusc  
 M. D. Lower  
 R. W. Mikitka  
 B. Millet

M. D. Rana  
 G. B. Rawls, Jr.  
 S. C. Roberts  
 C. D. Rodery  
 T. G. Seipp  
 D. Srnic  
 D. A. Swanson  
 S. Terada  
 J. Vattappilly  
 K. Xu  
 K. Oyamada, *Delegate*  
 M. E. Papponetti, *Delegate*  
 P. K. Lam, *Contributing Member*  
 K. Mokhtarian, *Contributing Member*  
 T. P. Pastor, *Contributing Member*  
 S. C. Shah, *Contributing Member*  
 K. K. Tam, *Contributing Member*  
 E. Uptis, *Contributing Member*

**Subgroup on General Requirements (BPV VIII)**

J. Hoskinson, *Chair*  
 M. Faulkner, *Vice Chair*  
 N. Barkley  
 R. J. Basile  
 T. P. Beirne  
 D. B. DeMichael  
 M. D. Lower  
 T. P. Pastor  
 I. Powell  
 G. B. Rawls, Jr.

F. L. Richter  
 S. C. Roberts  
 J. Rust  
 J. C. Sowinski  
 P. Speranza  
 D. Srnic  
 D. B. Stewart  
 D. A. Swanson  
 J. P. Glaspie, *Contributing Member*  
 Y. Yang, *Contributing Member*

**Task Group on Fired Heater Pressure Vessels (BPV VIII)**

J. Hoskinson, *Chair*  
 W. Kim  
 S. Kirk  
 D. Nelson  
 T. P. Pastor

R. Robles  
 J. Rust  
 P. Shanks  
 E. Smith  
 D. Srnic

**Working Group on Design-by-Analysis (BPV VIII)**

B. F. Hantz, *Chair*  
 T. W. Norton, *Secretary*  
 D. A. Arnett  
 J. Bedoya  
 S. Guzey  
 C. F. Heberling II  
 C. E. Hinnant  
 M. H. Jawad  
 S. Kataoka  
 S. Kilambi  
 K. D. Kirkpatrick

S. Krishnamurthy  
 A. Mann  
 C. Nadarajah  
 P. Prueter  
 T. G. Seipp  
 M. A. Shah  
 S. Terada  
 R. G. Brown, *Contributing Member*  
 D. Dewees, *Contributing Member*  
 K. Saboda, *Contributing Member*

**Task Group on Subsea Applications (BPV VIII)**

M. Sarzynski, *Chair*  
 A. J. Grohmann, *Vice Chair*  
 L. P. Antalffy  
 R. C. Biel  
 J. Ellens  
 J. Hademenos  
 J. Kaculi  
 K. Karpanan  
 F. Kirkemo

C. Lan  
 P. Lutkiewicz  
 N. McKie  
 S. K. Parimi  
 R. H. Patil  
 M. P. Vaclavik  
 R. Cordes, *Contributing Member*  
 D. T. Peters, *Contributing Member*  
 J. R. Sims, *Contributing Member*

**Working Group on Elevated Temperature Design (BPV I and VIII)**

A. Mann, *Chair*  
 C. Nadarajah, *Secretary*  
 D. Anderson  
 D. Dewees  
 B. F. Hantz  
 M. H. Jawad  
 R. I. Jetter  
 S. Krishnamurthy

T. Le  
 M. C. Messner  
 M. N. Mitchell  
 P. Prueter  
 M. J. Swindeman  
 J. P. Glaspie, *Contributing Member*  
 N. McMurray, *Contributing Member*  
 B. J. Mollitor, *Contributing Member*

**Subgroup on Heat Transfer Equipment (BPV VIII)**

P. Matkovic, *Chair*  
 M. D. Clark, *Vice Chair*  
 L. Bower, *Secretary*  
 G. Aurioles, Sr.  
 S. R. Babka  
 J. H. Barbee  
 O. A. Barsky  
 T. Bunyarattaphantu  
 A. Chaudouet  
 D. L. Kurle

R. Mahadeen  
 S. Mayeux  
 S. Neilsen  
 E. Smith  
 A. M. Voytko  
 R. P. Wiberg  
 J. Pasek, *Contributing Member*  
 D. Srnic, *Contributing Member*  
 Z. Tong, *Contributing Member*

**Subgroup on Fabrication and Examination (BPV VIII)**

S. A. Marks, *Chair*  
 D. I. Morris, *Vice Chair*  
 T. Halligan, *Secretary*  
 N. Carter  
 J. Lu  
 B. R. Morelock  
 O. Mulet  
 M. J. Pischke  
 M. J. Rice  
 J. Roberts  
 C. D. Rodery

B. F. Shelley  
 D. Smith  
 P. L. Sturgill  
 J. P. Swezy, Jr.  
 E. Uptis  
 C. Violand  
 K. Oyamada, *Delegate*  
 W. J. Bees, *Contributing Member*  
 L. F. Campbell, *Contributing Member*  
 R. Uebel, *Contributing Member*

**Working Group on Plate Heat Exchangers (BPV VIII)**

D. I. Morris, *Chair*  
 S. R. Babka  
 J. F. Grubb  
 V. Gudge  
 R. Mahadeen  
 S. A. Marks

P. Matkovic  
 M. J. Pischke  
 P. Shanks  
 E. Smith  
 D. Srnic  
 S. Sullivan

**Subgroup on High Pressure Vessels (BPV VIII)**

K. Subramanian, *Chair*  
M. Sarzynski, *Vice Chair*  
A. Dinizulu, *Staff Secretary*  
L. P. Antalffy  
J. Barlow  
R. C. Biel  
P. N. Chaku  
L. Fridlund  
D. Fuenmayor  
J. Gibson  
R. T. Hallman  
K. Karpanan  
J. Keltjens  
A. K. Khare  
G. T. Nelson  
D. T. Peters  
E. D. Roll  
J. R. Sims  
E. Smith  
F. W. Tatar

S. Terada  
Y. Xu  
A. M. Clayton, *Contributing Member*  
R. Cordes, *Contributing Member*  
R. D. Dixon, *Contributing Member*  
Q. Dong, *Contributing Member*  
T. A. Duffey, *Contributing Member*  
R. M. Hoshman, *Contributing Member*  
F. Kirkemo, *Contributing Member*  
R. A. Leishear, *Contributing Member*  
G. M. Mital, *Contributing Member*  
M. Parr, *Contributing Member*  
M. D. Rana, *Contributing Member*  
C. Romero, *Contributing Member*  
C. Tipple, *Contributing Member*  
K.-J. Young, *Contributing Member*  
D. J. Burns, *Honorary Member*  
G. J. Mraz, *Honorary Member*

**Subgroup on Materials (BPV VIII)**

M. Kowalczyk, *Chair*  
P. Chavdarov, *Vice Chair*  
S. Kilambi, *Secretary*  
J. Cameron  
J. F. Grubb  
D. Maitra  
D. W. Rahoi  
J. Robertson  
R. C. Sutherlin

E. Uptis  
K. Xu  
S. Yem  
A. Di Rienzo, *Contributing Member*  
J. D. Fritz, *Contributing Member*  
M. Katcher, *Contributing Member*  
W. M. Lundy, *Contributing Member*  
J. Penso, *Contributing Member*

**Subgroup on Toughness (BPV VIII)**

K. Xu, *Chair*  
T. Halligan, *Vice Chair*  
T. Finn  
C. S. Hinson  
S. Kilambi  
D. L. Kurle  
T. Newman  
J. Qu  
M. D. Rana  
F. L. Richter  
K. Subramanian

D. A. Swanson  
J. P. Swezy, Jr.  
S. Terada  
E. Uptis  
J. Vattappilly  
K. Oyamada, *Delegate*  
L. Dong, *Contributing Member*  
S. Krishnamurthy, *Contributing Member*  
K. Mokhtarian, *Contributing Member*

**Subgroup on Graphite Pressure Equipment (BPV VIII)**

C. W. Cary, *Chair*  
A. Viet, *Vice Chair*  
G. C. Becherer  
F. L. Brown  
R. J. Bulgin

J. D. Clements  
H. Lee, Jr.  
S. Mehrez  
T. Rudy  
A. A. Stupica

**Argentina International Working Group (BPV VIII)**

A. Dominguez, *Chair*  
R. Robles, *Vice Chair*  
G. Glissenti, *Secretary*  
M. M. Acosta  
R. A. Barey  
C. Alderetes  
F. A. Andres  
A. Antipasti  
D. A. Bardelli  
L. F. Bocanera  
O. S. Bretones  
A. Burgueno  
G. Casanas  
D. H. Da Rold  
D. A. Del Teglia  
J. I. Duo

M. Favareto  
M. D. Kuhn  
F. P. Larrosa  
L. M. Leccese  
C. Meinl  
M. A. Mendez  
J. J. Monaco  
C. Parente  
M. A. A. Pipponzi  
L. C. Rigoli  
A. Rivas  
D. Rizzo  
J. C. Rubeo  
S. Schamun  
G. Telleria  
M. M. C. Tocco

**China International Working Group (BPV VIII)**

X. Chen, *Chair*  
B. Shou, *Vice Chair*  
Z. Fan, *Secretary*  
Y. Chen  
J. Cui  
R. Duan  
J.-G. Gong  
B. Han  
J. Hu  
Q. Hu  
H. Hui  
K. Li  
D. Luo  
Y. Luo

C. Miao  
L. Sun  
C. Wu  
J. Xiaobin  
F. Xu  
G. Xu  
F. Yang  
Y. Yang  
Y. Yuan  
Yanfeng Zhang  
Yijun Zhang  
S. Zhao  
J. Zheng  
G. Zhu

**Germany International Working Group (BPV VIII)**

R. Kauer, *Chair*  
M. Sykora, *Vice Chair*  
A. Aloui  
P. Chavdarov  
A. Emrich  
J. Fleischfresser  
C. Jaekel  
D. Koelbl

S. Krebs  
T. Ludwig  
R. A. Meyers  
H. Michael  
S. Reich  
A. Spangenberg  
C. Stobbe  
G. Naumann, *Contributing Member*

**India International Working Group (BPV VIII)**

D. Chandiramani, *Chair*  
D. Kulkarni, *Vice Chair*  
A. D. Dalal, *Secretary*  
P. Arulkumar  
B. Basu  
P. Gandhi  
U. Ganesan  
S. K. Goyal  
V. Jayabalan  
V. K. Joshi

A. Kakumanu  
V. V. P. Kumar  
T. Mukherjee  
P. C. Pathak  
D. Prabhu  
A. Sadasivam  
M. P. Shah  
R. Tiru  
V. T. Valavan  
M. Sharma, *Contributing Member*

**Italy International Working Group (BPV VIII)**

A. Teli, <i>Chair</i>	M. Guglielmetti
M. Millefanti, <i>Vice Chair</i>	A. F. Magri
P. Campli, <i>Secretary</i>	P. Mantovani
B. G. Alborali	L. Moracchioli
P. Aliprandi	P. Pacor
A. Avogadri	S. Sarti
A. Camanni	V. Calo, <i>Contributing Member</i>
N. Caputo	G. Gobbi, <i>Contributing Member</i>
M. Colombo	A. Gusmaroli, <i>Contributing Member</i>
P. Conti	G. Pontiggia, <i>Contributing Member</i>
D. Cortassa	D. D. Raimander, <i>Contributing Member</i>
P. L. Dinelli	
F. Finco	

**Special Working Group on Bolted Flanged Joints (BPV VIII)**

W. Brown, <i>Chair</i>	W. McDaniel
M. Osterfoss, <i>Vice Chair</i>	R. W. Mikitka
G. Aurioles, Sr.	D. Nash
D. Bankston, Jr.	M. Ruffin
H. Bouzid	R. Wacker
A. Chaudouet	E. Jamalyaria, <i>Contributing Member</i>
H. Chen	J. R. Payne, <i>Contributing Member</i>
D. Francis	G. Van Zyl, <i>Contributing Member</i>
H. Lejeune	J. Veiga, <i>Contributing Member</i>
A. Mann	

**Subgroup on Interpretations (BPV VIII)**

G. Aurioles, Sr., <i>Chair</i>	J. C. Sowinski
J. Oh, <i>Staff Secretary</i>	D. B. Stewart
S. R. Babka	K. Subramanian
J. Cameron	D. A. Swanson
C. W. Cary	J. P. Swezy, Jr.
B. F. Hantz	J. Vattappilly
M. Kowalczyk	A. Viet
D. L. Kurle	K. Xu
M. D. Lower	R. J. Basile, <i>Contributing Member</i>
S. A. Marks	D. B. DeMichael, <i>Contributing Member</i>
P. Matkovic	
D. I. Morris	R. D. Dixon, <i>Contributing Member</i>
D. T. Peters	S. Kilambi, <i>Contributing Member</i>
F. L. Richter	R. Mahadeen, <i>Contributing Member</i>
S. C. Roberts	T. P. Pastor, <i>Contributing Member</i>
C. D. Rodery	P. L. Sturgill, <i>Contributing Member</i>
T. G. Seipp	

**COMMITTEE ON WELDING, BRAZING, AND FUSING (BPV IX)**

M. J. Pischke, <i>Chair</i>	M. B. Sims
P. L. Sturgill, <i>Vice Chair</i>	W. J. Sperko
R. Rahaman, <i>Staff Secretary</i>	J. P. Swezy, Jr.
M. Bernasek	A. D. Wilson
M. A. Boring	E. W. Woelfel
D. A. Bowers	D. Pojatar, <i>Delegate</i>
N. Carter	A. Roza, <i>Delegate</i>
J. G. Feldstein	M. Consonni, <i>Contributing Member</i>
P. Gilston	P. D. Fenner, <i>Contributing Member</i>
S. E. Gingrich	S. A. Jones, <i>Contributing Member</i>
K. L. Hayes	D. K. Peetz, <i>Contributing Member</i>
R. M. Jessee	S. Raghunathan, <i>Contributing Member</i>
J. S. Lee	
W. M. Lundy	M. J. Stanko, <i>Contributing Member</i>
D. W. Mann	P. L. Van Fosson, <i>Contributing Member</i>
S. A. Marks	
T. Melfi	R. K. Brown, Jr., <i>Honorary Member</i>
W. F. Newell, Jr.	M. L. Carpenter, <i>Honorary Member</i>
E. G. Reichelt	B. R. Newmark, <i>Honorary Member</i>
M. J. Rice	S. D. Reynolds, Jr., <i>Honorary Member</i>

**Subgroup on Brazing (BPV IX)**

S. A. Marks, <i>Chair</i>	M. J. Pischke
E. W. Beckman	P. L. Sturgill
A. F. Garbolevsky	J. P. Swezy, Jr.
N. Mohr	

**Subgroup on General Requirements (BPV IX)**

N. Carter, <i>Chair</i>	P. L. Sturgill
P. Gilston, <i>Vice Chair</i>	J. P. Swezy, Jr.
J. P. Bell	E. W. Woelfel
D. A. Bowers	E. W. Beckman, <i>Contributing Member</i>
M. Heinrichs	
A. Howard	A. Davis, <i>Contributing Member</i>
R. M. Jessee	D. K. Peetz, <i>Contributing Member</i>
S. A. Marks	B. R. Newmark, <i>Honorary Member</i>
H. B. Porter	

**Subgroup on Materials (BPV IX)**

M. Bernasek, <i>Chair</i>	M. J. Pischke
T. Anderson	A. Roza
L. Constantinescu	C. E. Sainz
E. Cutlip	P. L. Sturgill
M. Denault	C. Zanfir
S. E. Gingrich	V. G. V. Giunto, <i>Delegate</i>
L. S. Harbison	D. J. Kotecki, <i>Contributing Member</i>
M. James	B. Krueger, <i>Contributing Member</i>
R. M. Jessee	W. J. Sperko, <i>Contributing Member</i>
T. Melfi	M. J. Stanko, <i>Contributing Member</i>
S. D. Nelson	

**Subgroup on Plastic Fusing (BPV IX)**

K. L. Hayes, <i>Chair</i>	S. Schuessler
R. M. Jessee	M. Troughton
J. Johnston, Jr.	C. Violand
J. E. O'Sullivan	E. W. Woelfel
E. G. Reichelt	J. Wright
M. J. Rice	

**Subgroup on Welding Qualifications (BPV IX)**

T. Melfi, <i>Chair</i>	E. G. Reichelt
A. D. Wilson, <i>Vice Chair</i>	M. J. Rice
K. L. Hayes, <i>Secretary</i>	M. B. Sims
M. Bernasek	W. J. Sperko
M. A. Boring	P. L. Sturgill
D. A. Bowers	J. P. Swezy, Jr.
R. Campbell	C. Violand
R. B. Corbit	D. Chandiramani, <i>Contributing Member</i>
L. S. Harbison	M. Consonni, <i>Contributing Member</i>
M. Heinrichs	M. Dehghan, <i>Contributing Member</i>
J. S. Lee	P. D. Flenner, <i>Contributing Member</i>
W. M. Lundy	T. C. Wiesner, <i>Contributing Member</i>
D. W. Mann	
W. F. Newell, Jr.	

**Argentina International Working Group (BPV IX)**

A. Burgueno, <i>Chair</i>	M. Favareto
A. R. G. Frinchaboy, <i>Vice Chair</i>	J. A. Gandola
R. Rahaman, <i>Staff Secretary</i>	C. A. Garibotti
M. D. Kuhn, <i>Secretary</i>	J. A. Herrera
B. Bardott	M. A. Mendez
L. F. Boccanera	A. E. Pastor
P. J. Cabot	G. Telleria
J. Caprarulo	M. M. C. Tocco

**Germany International Working Group (BPV IX)**

A. Roza, <i>Chair</i>	T. Ludwig
A. Spangenberg, <i>Vice Chair</i>	S. Wegener
R. Rahaman, <i>Staff Secretary</i>	F. Wodke
P. Chavadarov	J. Daldrup, <i>Contributing Member</i>
B. Daume	E. Floer, <i>Contributing Member</i>
J. Fleischfresser	R. Helmholdt, <i>Contributing Member</i>
P. Khwaja	G. Naumann, <i>Contributing Member</i>
S. Krebs	K.-G. Toelle, <i>Contributing Member</i>

**Italy International Working Group (BPV IX)**

D. D. Raimander, <i>Chair</i>	L. Moracchioli
F. Ferrarese, <i>Vice Chair</i>	P. Pacor
R. Rahaman, <i>Staff Secretary</i>	P. Siboni
M. Bernasek	V. Calo, <i>Contributing Member</i>
A. Camanni	G. Gobbi, <i>Contributing Member</i>
P. L. Dinelli	A. Gusmaroli, <i>Contributing Member</i>
M. Mandina	G. Pontiggia, <i>Contributing Member</i>
A. S. Monastra	

**Spain International Working Group (BPV IX)**

F. J. Q. Pandelo, <i>Chair</i>	F. Manas
F. L. Villabrille, <i>Vice Chair</i>	B. B. Miguel
R. Rahaman, <i>Staff Secretary</i>	A. D. G. Munoz
F. R. Hermida, <i>Secretary</i>	A. B. Pascual
C. A. Celimendiz	S. Sevil
M. A. F. Garcia	G. Gobbi, <i>Contributing Member</i>
R. G. Garcia	

**COMMITTEE ON FIBER-REINFORCED PLASTIC PRESSURE VESSELS (BPV X)**

B. Linnemann, <i>Chair</i>	D. H. McCauley
D. Eisberg, <i>Vice Chair</i>	N. L. Newhouse
P. D. Stumpf, <i>Staff Secretary</i>	G. Ramirez
A. L. Beckwith	J. R. Richter
F. L. Brown	B. F. Shelley
J. L. Bustillos	G. A. Van Beek
B. R. Colley	S. L. Wagner
T. W. Cowley	D. O. Yancey, Jr.
I. L. Dinovo	P. H. Ziehl
J. Eihusen	D. H. Hodgkinson, <i>Contributing Member</i>
M. R. Gorman	D. L. Keeler, <i>Contributing Member</i>
B. Hebb	
L. E. Hunt	

**COMMITTEE ON NUCLEAR INSERVICE INSPECTION (BPV XI)**

R. W. Swayne, <i>Chair</i>	T. Nuoffer
D. W. Lamond, <i>Vice Chair</i>	J. Nygaard
A. T. Roberts III, <i>Vice Chair</i>	J. E. O'Sullivan
D. Miro-Quesada, <i>Staff Secretary</i>	N. A. Palm
J. F. Ball	G. C. Park
W. H. Bamford	D. A. Scarth
M. L. Benson	F. J. Schaaf, Jr.
J. M. Boughman	S. Takaya
C. Brown	D. Vetter
S. B. Brown	T. V. Vo
T. L. Chan	J. G. Weicks
R. C. Cipolla	M. Weis
D. R. Cordes	Y.-K. Chung, <i>Delegate</i>
H. Do	C. Ye, <i>Delegate</i>
E. V. Farrell, Jr.	B. Lin, <i>Alternate</i>
M. J. Ferlisi	R. O. McGill, <i>Alternate</i>
T. J. Griesbach	L. A. Melder, <i>Alternate</i>
J. Hakii	A. Udyawar, <i>Alternate</i>
M. L. Hall	E. B. Gerlach, <i>Contributing Member</i>
P. J. Hennessey	C. D. Cowfer, <i>Honorary Member</i>
D. O. Henry	R. E. Gimple, <i>Honorary Member</i>
K. Hojo	F. E. Gregor, <i>Honorary Member</i>
S. D. Kulat	R. D. Kerr, <i>Honorary Member</i>
C. Latiolais	P. C. Riccardella, <i>Honorary Member</i>
J. T. Lindberg	R. A. West, <i>Honorary Member</i>
H. Malikowski	C. J. Wirtz, <i>Honorary Member</i>
S. L. McCracken	R. A. Yonekawa, <i>Honorary Member</i>
S. A. Norman	

**Executive Committee (BPV XI)**

D. W. Lamond, <i>Chair</i>	S. L. McCracken
R. W. Swayne, <i>Vice Chair</i>	T. Nuoffer
D. Miro-Quesada, <i>Staff Secretary</i>	N. A. Palm
M. L. Benson	G. C. Park
M. J. Ferlisi	A. T. Roberts III
S. D. Kulat	B. L. Lin, <i>Alternate</i>
J. T. Lindberg	

**Argentina International Working Group (BPV XI)**

O. Martinez, <i>Staff Secretary</i>	F. J. Schaaf, Jr.
A. Claus	F. M. Schroeter
I. M. Guerreiro	P. Yamamoto
L. R. Miño	

**China International Working Group (BPV XI)**

J. H. Liu, <i>Chair</i>	S. Shuo
J. F. Cai, <i>Vice Chair</i>	Y. Sixin
C. Ye, <i>Vice Chair</i>	Y. X. Sun
M. W. Zhou, <i>Secretary</i>	G. X. Tang
H. Chen	Q. Wang
H. D. Chen	Q. W. Wang
Y. Cheng	Z. S. Wang
Y. B. Guo	L. Xing
Y. Hongqi	F. Xu
D. R. Horn	S. X. Xu
Y. Hou	Q. Yin
S. X. Lin	K. Zhang
Y. Nie	Y. Zhe
W. N. Pei	Z. M. Zhong
L. Shiwei	

**Germany International Working Group (BPV XI)**

R. Döring, <i>Chair</i>	N. Legl
M. Hagenbruch, <i>Vice Chair</i>	T. Ludwig
R. Piel, <i>Secretary</i>	X. Pitoiset
A. Casse	M. Reichert
C. G. Frantescu	L. Sybertz
E. Iacopetta	I. Tewes
S. D. Kulat	R. Tiete
H.-W. Lange	J. Wendt

**India International Working Group (BPV XI)**

S. B. Parkash, <i>Chair</i>	N. Palm
D. Narain, <i>Vice Chair</i>	D. Rawal
K. K. Rai, <i>Secretary</i>	R. Sahai
Z. M. Mansuri	R. K. Sharma
M. R. Nadgouda	

**Special Working Group on Editing and Review (BPV XI)**

R. W. Swayne, <i>Chair</i>	M. Orihuela
R. C. Cipolla	D. A. Scarth
D. O. Henry	

**Task Group on Inspectability (BPV XI)**

J. T. Lindberg, <i>Chair</i>	J. Honcharik
E. Henry, <i>Secretary</i>	C. Latiolais
A. Bushmire	G. A. Lofthus
A. Cardillo	S. Matsumoto
K. Caver	D. E. Matthews
D. R. Cordes	P. J. O'Regan
P. Gionta	J. B. Ossmann
D. O. Henry	C. Thomas

**Working Group on Spent Nuclear Fuel Storage and Transportation Containment Systems (BPV XI)**

K. Hunter, <i>Chair</i>	K. Mauskar
M. Orihuela, <i>Secretary</i>	R. M. Meyer
D. J. Ammerman	R. M. Pace
W. H. Bortner	E. L. Pleins
J. Broussard	M. A. Richter
C. R. Bryan	B. Sarno
T. Carraher	R. Sindelar
S. Corcoran	M. Staley
D. Dunn	J. Wellwood
N. Fales	K. A. Whitney
R. C. Folley	X. J. Zhai
G. Grant	P.-S. Lam, <i>Alternate</i>
B. Gutherman	G. White, <i>Alternate</i>
M. W. Joseph	J. Wise, <i>Alternate</i>
M. Keene	H. Smith, <i>Contributing Member</i>
M. Liu	

**Task Group on Mitigation and Repair of Spent Nuclear Fuel Canisters (WG-SNFS & TCS) (BPV XI)**

J. Tatman, <i>Chair</i>	M. Kris
D. J. Ammerman	M. Liu
J. Broussard	K. Mauskar
C. R. Bryan	S. L. McCracken
G. R. Cannell	M. Orihuela
K. Dietrich	M. Richter
D. Dunn	K. E. Ross
N. Fales	B. Sarno
R. C. Folley	R. Sindelar
D. Jacobs	J. Wellwood
N. Klymyshyn	A. Williams

**Subgroup on Evaluation Standards (SG-ES) (BPV XI)**

N. A. Palm, <i>Chair</i>	Y. S. Li
S. X. Xu, <i>Secretary</i>	R. O. McGill
W. H. Bamford	K. Miyazaki
M. Brumovsky	R. M. Pace
H. D. Chung	J. C. Poehler
R. C. Cipolla	S. Ranganath
C. M. Faidy	D. A. Scarth
M. M. Farooq	D. J. Shim
B. R. Ganta	A. Udyawar
T. J. Griesbach	T. V. Vo
K. Hasegawa	G. M. Wilkowski
K. Hojo	M. L. Benson, <i>Alternate</i>
D. N. Hopkins	H. S. Mehta, <i>Contributing Member</i>
D. R. Lee	

**Task Group on Evaluation of Beyond Design Basis Events (SG-ES) (BPV XI)**

R. M. Pace, <i>Chair</i>	K. Hojo
S. X. Xu, <i>Secretary</i>	S. A. Kleinsmith
F. G. Abatt	S. M. Moenssens
G. A. Antaki	T. V. Vo
P. R. Donavin	G. M. Wilkowski
R. G. Gilada	H. S. Mehta, <i>Contributing Member</i>
T. J. Griesbach	T. Weaver, <i>Contributing Member</i>
M. Hayashi	

**Working Group on Flaw Evaluation  
(SG-ES) (BPV XI)**

R. C. Cipolla, <i>Chair</i>	Y. S. Li
S. X. Xu, <i>Secretary</i>	C. Liu
W. H. Bamford	M. Liu
M. L. Benson	G. A. Miessi
M. Brumovsky	K. Miyazaki
H. D. Chung	S. Noronha
N. G. Cofie	R. K. Qashu
M. A. Erickson	S. Ranganath
C. M. Faidy	D. A. Scarth
M. M. Farooq	W. L. Server
B. R. Ganta	D. J. Shim
R. G. Gilada	S. Smith
C. Guzman-Leong	M. Uddin
P. H. Hoang	A. Udyawar
K. Hojo	T. V. Vo
D. N. Hopkins	K. Wang
S. Kalyanam	B. Wasiluk
Y. Kim	G. M. Wilkowski
V. Lacroix	H. S. Mehta, <i>Contributing Member</i>
D. R. Lee	

**Working Group on Flaw Evaluation Reference Curves  
(SG-ES) (BPV XI)**

A. Udyawar, <i>Chair</i>	V. Lacroix
D. A. Scarth, <i>Secretary</i>	K. Miyazaki
W. H. Bamford	B. Pellereau
M. L. Benson	S. Ranganath
F. W. Brust	D. J. Shim
R. C. Cipolla	S. Smith
M. M. Farooq	M. Uddin
A. E. Freed	T. V. Vo
P. Gill	G. White
K. Hasegawa	S. X. Xu
K. Hojo	H. S. Mehta, <i>Contributing Member</i>

**Working Group on Operating Plant Criteria (SG-ES) (BPV XI)**

N. A. Palm, <i>Chair</i>	A. D. Odell
A. E. Freed, <i>Secretary</i>	R. M. Pace
W. H. Bamford	J. C. Poehler
M. Brumovsky	S. Ranganath
M. A. Erickson	W. L. Server
T. J. Griesbach	C. A. Tomes
M. Hayashi	A. Udyawar
R. Janowiak	T. V. Vo
M. Kirk	H. Q. Xu
S. A. Kleinsmith	H. S. Mehta, <i>Contributing Member</i>
H. Kobayashi	

**Task Group on Appendix L (WG-OPC) (BPV XI)**

N. Glunt, <i>Chair</i>	C.-S. Oh
R. M. Pace, <i>Secretary</i>	H. Park
J. I. Duo	S. Ranganath
A. E. Freed	A. Scott
M. A. Gray	D. J. Shim
T. J. Griesbach	S. Smith
H. Nam	A. Udyawar
A. Nana	T. V. Vo
A. D. Odell	

**Working Group on Pipe Flaw Evaluation (SG-ES) (BPV XI)**

D. A. Scarth, <i>Chair</i>	Y. Kim
S. Kalyanam, <i>Secretary</i>	V. Lacroix
K. Azuma	Y. S. Li
W. H. Bamford	R. O. McGill
M. L. Benson	G. A. Miessi
M. Brumovsky	K. Miyazaki
F. W. Brust	S. M. Parker
H. D. Chung	S. H. Pellet
R. C. Cipolla	C. J. Sallaberry
N. G. Cofie	W. L. Server
C. M. Faidy	D. J. Shim
M. M. Farooq	S. Smith
B. R. Ganta	M. F. Uddin
R. G. Gilada	A. Udyawar
S. R. Gosselin	T. V. Vo
C. E. Guzman-Leong	K. Wang
K. Hasegawa	B. Wasiluk
P. H. Hoang	G. M. Wilkowski
K. Hojo	S. X. Xu
D. N. Hopkins	Y. Zou
E. J. Houston	K. Gresh, <i>Alternate</i>
R. Janowiak	H. S. Mehta, <i>Contributing Member</i>
K. Kashima	

**Task Group on Code Case N-513 (WG-PFE) (BPV XI)**

R. O. McGill, <i>Chair</i>	E. J. Houston
S. M. Parker, <i>Secretary</i>	R. Janowiak
G. A. Antaki	S. H. Pellet
R. C. Cipolla	D. Rudland
M. M. Farooq	D. A. Scarth
K. Gresh	S. X. Xu

**Task Group on Evaluation Procedures for Degraded Buried Pipe  
(WG-PFE) (BPV XI)**

R. O. McGill, <i>Chair</i>	R. Janowiak
S. X. Xu, <i>Secretary</i>	M. Kassar
F. G. Abatt	M. Moenssens
G. A. Antaki	D. P. Munson
R. C. Cipolla	R. M. Pace
R. G. Gilada	S. H. Pellet
K. Hasegawa	D. Rudland
K. M. Hoffman	D. A. Scarth

**Task Group on Flaw Evaluation for HDPE Pipe (WG-PFE) (BPV XI)**

S. Kalyanam, <i>Chair</i>	D. J. Shim
P. Krishnaswamy	M. Troughton
M. Moenssens	J. Wright
D. P. Munson	S. X. Xu
D. A. Scarth	

**Subgroup on Nondestructive Examination (SG-NDE) (BPV XI)**

J. T. Lindberg, <i>Chair</i>	S. E. Cumblidge
D. O. Henry, <i>Vice Chair</i>	K. J. Hacker
T. Cinson, <i>Secretary</i>	J. Harrison
M. Briley	D. A. Kull
C. Brown	C. Latiolais
A. Bushmire	F. J. Schaaf, Jr.
T. L. Chan	R. V. Swain
D. R. Cordes	C. A. Nove, <i>Alternate</i>

**Working Group on Personnel Qualification and Surface Visual and Eddy Current Examination (SG-NDE) (BPV XI)**

C. Brown, *Chair*  
M. Orihuela, *Secretary*  
J. Bennett  
T. Cinson  
S. E. Cumblidge  
A. Diaz  
N. Farenbaugh

D. O. Henry  
J. T. Lindberg  
C. Shinsky  
R. Tedder  
T. Thulien  
J. T. Timm

**Working Group on Procedure Qualification and Volumetric Examination (SG-NDE) (BPV XI)**

J. Harrison, *Chair*  
D. A. Kull, *Secretary*  
M. Briley  
A. Bushmire  
D. R. Cordes  
K. J. Hacker  
R. E. Jacob  
W. A. Jensen

C. Latiolais  
C. A. Nove  
D. R. Slivon  
R. V. Swain  
D. Van Allen  
J. Williams  
B. Lin, *Alternate*

**Subgroup on Reliability and Integrity Management Program (SG-RIM) (BPV XI)**

A. T. Roberts III, *Chair*  
D. Vetter, *Secretary*  
T. Anselmi  
M. T. Audrain  
N. Broom  
F. W. Brust  
V. Chugh  
S. R. Doctor  
J. D. Fletcher  
J. T. Fong  
R. Grantom  
K. Harris

P. J. Hennessey  
S. Kalyanam  
D. R. Lee  
R. J. McReynolds  
R. Meyer  
M. Orihuela  
C. J. Sallaberry  
F. J. Schaaf, Jr.  
H. M. Stephens, Jr.  
R. W. Swayne  
S. Takaya  
R. Vayda

**Working Group on MANDE (SG-RIM) (BPV XI)**

H. M. Stephens, Jr., *Chair*  
S. R. Doctor, *Vice Chair*  
M. Turnbow, *Secretary*  
T. Anselmi  
M. T. Audrain  
N. A. Finney

J. T. Fong  
D. O. Henry  
R. J. McReynolds  
R. Meyer  
M. Orihuela  
K. Yamada

**Task Group on Nonmetallic Component Degradation and Failure Monitoring (SG-RIM) (BPV XI)**

M. P. Metcalfe, *Chair*  
A. Tzelepi, *Secretary*  
M. T. Audrain  
G. Beirnaert  
C. Chen

W. J. Geringer  
K. Harris  
J. Lang  
J. Potgieter

**ASME/JSME Joint Working Group on RIM Processes and System-Based Code (SG-RIM) (BPV XI)**

S. Takaya, *Chair*  
R. J. McReynolds, *Vice Chair*  
M. T. Audrain  
K. Dozaki  
J. T. Fong  
J. Hakii  
K. Harris  
M. Hayashi  
S. Kalyanam  
D. R. Lee  
H. Machida

R. Meyer  
T. Muraki  
S. Okajima  
A. T. Roberts III  
C. J. Sallaberry  
F. J. Schaaf, Jr.  
R. Vayda  
D. Watanabe  
H. Yada  
K. Yamada  
T. Asayama, *Contributing Member*

**Subgroup on Repair/Replacement Activities (SG-RRA) (BPV XI)**

S. L. McCracken, *Chair*  
E. V. Farrell, Jr., *Secretary*  
J. F. Ball  
M. Brandes  
S. B. Brown  
R. Clow  
S. J. Findlan  
M. L. Hall  
J. Honcharik  
A. B. Meichler

L. A. Melder  
S. A. Norman  
G. T. Olson  
J. E. O'Sullivan  
G. C. Park  
R. R. Stevenson  
R. W. Swayne  
D. J. Tilly  
J. G. Weicks  
B. Lin, *Alternate*

**Working Group on Design and Programs (SG-RRA) (BPV XI)**

S. B. Brown, *Chair*  
R. A. Patel, *Secretary*  
O. Bhatti  
R. Clow  
R. R. Croft  
E. V. Farrell, Jr.  
K. Harris  
B. Lin

H. Malikowski  
A. B. Meichler  
G. C. Park  
M. A. Pyne  
R. R. Stevenson  
K. Sullivan  
R. W. Swayne

**Task Group on Repair and Replacement Optimization (WG-D&P) (BPV XI)**

S. L. McCracken, *Chair*  
S. J. Findlan, *Secretary*  
T. Basso  
R. Clow  
K. Dietrich  
E. V. Farrell, Jr.  
M. J. Ferlisi  
R. C. Folley

M. L. Hall  
D. Jacobs  
H. Malikowski  
T. Nuoffer  
G. C. Park  
A. Patel  
R. R. Stevenson  
J. G. Weicks

**Working Group on Nonmetals Repair/Replacement Activities (SG-RRA) (BPV XI)**

J. E. O'Sullivan, *Chair*  
S. Schuessler, *Secretary*  
M. Brandes  
D. R. Dechene  
M. Golliet  
J. Johnston, Jr.  
B. Lin

T. M. Musto  
A. Pridmore  
F. J. Schaaf, Jr.  
R. Stakenborghs  
P. Vibien  
M. P. Marohl, *Contributing Member*

**Task Group on HDPE Piping for Low Safety Significance Systems  
(WG-NMRRRA) (BPV XI)**

M. Brandes, *Chair*  
J. E. O'Sullivan, *Secretary*  
M. Golliet  
B. Lin

T. M. Musto  
F. J. Schaaf, Jr.  
S. Schuessler  
R. Stakenborghs

**Task Group on Repair by Carbon Fiber Composites  
(WG-NMRRRA) (BPV XI)**

J. E. O'Sullivan, *Chair*  
S. F. Arnold  
S. W. Choi  
D. R. Dechene  
M. Golliet  
L. S. Gordon  
P. Krishnaswamy  
M. Kuntz  
H. Lu  
M. P. Marohl  
L. Nadeau

C. A. Nove  
R. P. Ojdrovic  
A. Pridmore  
S. Rios  
C. W. Rowley  
J. Sealey  
R. Stakenborghs  
N. Stoeva  
M. F. Uddin  
J. Wen  
B. Davenport, *Alternate*

**Working Group on Welding and Special Repair Processes  
(SG-RRRA) (BPV XI)**

J. G. Weicks, *Chair*  
G. T. Olson, *Secretary*  
D. Barborak  
S. J. Findlan  
R. C. Folley  
M. L. Hall  
J. Honcharik

D. Jacobs  
M. Kris  
S. E. Marlette  
S. L. McCracken  
L. A. Melder  
J. E. O'Sullivan  
D. J. Tilly

**Task Group on Temper Bead Welding (WG-W&SRP) (BPV XI)**

S. J. Findlan, *Chair*  
D. Barborak  
R. C. Folley  
J. Graham  
M. L. Hall  
D. Jacobs  
H. Kobayashi

S. L. McCracken  
N. Mohr  
G. T. Olson  
J. E. O'Sullivan  
A. Patel  
J. Tatman  
J. G. Weicks

**Task Group on Weld Overlay (WG-W&SRP)(BPV XI)**

S. L. McCracken, *Chair*  
S. Hunter, *Secretary*  
D. Barborak  
S. J. Findlan  
J. Graham  
M. L. Hall  
D. Jacobs

C. Lohse  
S. E. Marlette  
G. T. Olson  
A. Patel  
D. W. Sandusky  
D. E. Waskey  
J. G. Weicks

**Subgroup on Water-Cooled Systems (SG-WCS) (BPV XI)**

M. J. Ferlisi, *Chair*  
J. Nygaard, *Secretary*  
J. M. Boughman  
S. T. Chesworth  
J. Collins  
H. Q. Do  
K. W. Hall  
P. J. Hennessey  
A. E. Keyser

S. D. Kulat  
D. W. Lamond  
T. Nomura  
T. Nuoffer  
M. A. Pyne  
H. M. Stephens, Jr.  
R. Thames  
M. Weis  
I. A. Anchondo-Lopez, *Alternate*

**Task Group on High Strength Nickel Alloys Issues (SG-WCS) (BPV XI)**

H. Malikowski, *Chair*  
C. Waskey, *Secretary*  
E. Blackard  
T. Cinson  
J. Collins  
K. Dietrich  
P. R. Donavin

H. Kobayashi  
S. E. Marlette  
G. C. Park  
C. Wax  
G. White  
K. A. Whitney

**Working Group on Containment (SG-WCS) (BPV XI)**

M. J. Ferlisi, *Chair*  
R. Thames, *Secretary*  
P. S. Ghosal  
H. T. Hill  
S. Johnson  
A. E. Keyser  
B. Lehman

P. Leininger  
J. A. Munshi  
M. Sircar  
P. C. Smith  
S. Walden  
M. Weis  
S. G. Brown, *Alternate*

**Working Group on Inspection of Systems and Components  
(SG-WCS) (BPV XI)**

H. Q. Do, *Chair*  
M. Weis, *Secretary*  
I. A. Anchondo-Lopez  
R. W. Blyde  
K. Caver  
C. Cueto-Felgueroso  
M. J. Ferlisi  
M. L. Garcia Heras  
K. W. Hall

J. Howard  
A. Keller  
S. D. Kulat  
E. Lantz  
A. Maekawa  
T. Nomura  
J. C. Nygaard  
S. Orita  
A. W. Wilkens

**Working Group on Pressure Testing (SG-WCS) (BPV XI)**

J. M. Boughman, *Chair*  
S. A. Norman, *Secretary*  
T. Anselmi  
M. J. Homiack  
A. E. Keyser

D. W. Lamond  
M. Moenssens  
R. A. Nettles  
C. Thomas  
K. Whitney

**Working Group on Risk-Informed Activities (SG-WCS) (BPV XI)**

M. A. Pyne, *Chair*  
S. T. Chesworth, *Secretary*  
G. Brouette  
C. Cueto-Felgueroso  
R. Haessler  
J. Hakii  
K. W. Hall

M. J. Homiack  
S. D. Kulat  
D. W. Lamond  
E. Lantz  
P. J. O'Regan  
N. A. Palm  
D. Vetter

**Working Group on General Requirements (BPV XI)**

T. Nuoffer, *Chair*  
J. Mayo, *Secretary*  
J. F. Ball  
T. L. Chan  
P. J. Hennessey  
K. A. Kavanagh  
G. Ramaraj

T. N. Rezk  
A. T. Roberts III  
S. R. Scott  
D. Vetter  
S. E. Woolf  
B. Harris, *Alternate*  
R. S. Spencer, *Alternate*

**COMMITTEE ON TRANSPORT TANKS (BPV XII)**

N. J. Paulick, <i>Chair</i>	M. Pitts
M. D. Rana, <i>Vice Chair</i>	J. Roberts
J. Oh, <i>Staff Secretary</i>	T. A. Rogers
A. N. Antoniou	R. C. Sallash
K. W. A. Cheng	M. Shah
P. Chilukuri	S. Staniszewski
W. L. Garfield	A. P. Varghese
P. Miller	R. Meyers, <i>Contributing Member</i>

**Executive Committee (BPV XII)**

M. D. Rana, <i>Chair</i>	T. A. Rogers
N. J. Paulick, <i>Vice Chair</i>	R. C. Sallash
J. Oh, <i>Staff Secretary</i>	S. Staniszewski
M. Pitts	A. P. Varghese

**Subgroup on Design and Materials (BPV XII)**

R. C. Sallash, <i>Chair</i>	S. Staniszewski
D. K. Chandiramani	A. P. Varghese
K. W. A. Cheng	K. Xu
P. Chilukuri	Y. Doron, <i>Contributing Member</i>
S. L. McWilliams	A. T. Duggleby, <i>Contributing Member</i>
N. J. Paulick	R. D. Hayworth, <i>Contributing Member</i>
M. D. Rana	B. E. Spencer, <i>Contributing Member</i>
T. J. Rishel	J. Zheng, <i>Contributing Member</i>
T. A. Rogers	
M. Shah	

**Subgroup on Fabrication, Inspection, and Continued Service (BPV XII)**

M. Pitts, <i>Chair</i>	T. A. Rogers
K. W. A. Cheng	R. C. Sallash
P. Chilukuri	S. Staniszewski
M. Koprivnak	Y. Doron, <i>Contributing Member</i>
P. Miller	R. D. Hayworth, <i>Contributing Member</i>
O. Mulet	G. McRae, <i>Contributing Member</i>
T. J. Rishel	
J. Roberts	

**Subgroup on General Requirements (BPV XII)**

S. Staniszewski, <i>Chair</i>	M. Pitts
A. N. Antoniou	R. C. Sallash
P. Chilukuri	Y. Doron, <i>Contributing Member</i>
H. Ebben III	T. J. Hitchcock, <i>Contributing Member</i>
J. L. Freiler	S. L. McWilliams, <i>Contributing Member</i>
W. L. Garfield	T. A. Rogers, <i>Contributing Member</i>
O. Mulet	D. G. Shelton, <i>Contributing Member</i>
B. F. Pittel	

**Subgroup on Nonmandatory Appendices (BPV XII)**

T. A. Rogers, <i>Chair</i>	R. C. Sallash
S. Staniszewski, <i>Secretary</i>	D. G. Shelton
P. Chilukuri	D. D. Brusewitz, <i>Contributing Member</i>
N. J. Paulick	Y. Doron, <i>Contributing Member</i>
M. Pitts	
T. J. Rishel	

**COMMITTEE ON OVERPRESSURE PROTECTION (BPV XIII)**

B. K. Nutter, <i>Chair</i>	R. W. Barnes, <i>Contributing Member</i>
A. Donaldson, <i>Vice Chair</i>	R. D. Danzy, <i>Contributing Member</i>
C. E. Rodrigues, <i>Staff Secretary</i>	A. Frigerio, <i>Contributing Member</i>
J. F. Ball	J. P. Gaspie, <i>Contributing Member</i>
J. Burgess	S. F. Harrison, Jr., <i>Contributing Member</i>
B. Calderon	A. Hassan, <i>Contributing Member</i>
D. B. DeMichael	P. K. Lam, <i>Contributing Member</i>
J. W. Dickson	M. Mengon, <i>Contributing Member</i>
J. M. Levy	J. Mize, <i>Contributing Member</i>
D. Miller	M. Mullavey, <i>Contributing Member</i>
T. Patel	S. K. Parimi, <i>Contributing Member</i>
B. F. Pittel	J. Phillips, <i>Contributing Member</i>
T. R. Tarbay	M. Reddy, <i>Contributing Member</i>
D. E. Tompkins	S. Ruesenberg, <i>Contributing Member</i>
Z. Wang	K. Shores, <i>Contributing Member</i>
J. A. West	D. E. Tezzo, <i>Contributing Member</i>
B. Engman, <i>Alternate</i>	A. Wilson, <i>Contributing Member</i>
H. Aguilar, <i>Contributing Member</i>	

**Executive Committee (BPV XIII)**

A. Donaldson, <i>Chair</i>	D. B. DeMichael
B. K. Nutter, <i>Vice Chair</i>	K. R. May
C. E. Rodrigues, <i>Staff Secretary</i>	D. Miller
J. F. Ball	

**Subgroup on Design and Materials (BPV XIII)**

D. Miller, <i>Chair</i>	J. A. West
T. Patel, <i>Vice Chair</i>	A. Williams
T. K. Acharya	D. J. Azukas, <i>Contributing Member</i>
C. E. Beair	R. D. Danzy, <i>Contributing Member</i>
W. E. Chapin	A. Hassan, <i>Contributing Member</i>
J. L. Freiler	R. Miyata, <i>Contributing Member</i>
B. Joergensen	M. Mullavey, <i>Contributing Member</i>
V. Kalyanasundaram	S. K. Parimi, <i>Contributing Member</i>
R. Krithivasan	G. Ramirez, <i>Contributing Member</i>
B. J. Mollitor	K. Shores, <i>Contributing Member</i>
T. R. Tarbay	

**Subgroup on General Requirements (BPV XIII)**

A. Donaldson, *Chair*  
 B. F. Pittel, *Vice Chair*  
 J. M. Levy, *Secretary*  
 R. Antoniuk  
 D. J. Azukas  
 J. F. Ball  
 J. Burgess  
 D. B. DeMichael  
 S. T. French  
 J. Grace  
 C. Haldiman  
 J. Horne  
 R. Klimas, Jr.  
 Z. E. Kumana  
 P. K. Lam  
 D. Mainiero-Cessna  
 K. R. May  
 J. Mize  
 L. Moedinger  
 M. Mullavey  
 K. Shores

D. E. Tezzo  
 D. E. Tompkins  
 J. F. White  
 B. Calderon, *Contributing Member*  
 P. Chavdarov, *Contributing Member*  
 T. M. Fabiani, *Contributing Member*  
 J. L. Freiler, *Contributing Member*  
 J. P. Glaspie, *Contributing Member*  
 G. D. Goodson, *Contributing Member*  
 B. Joergensen, *Contributing Member*  
 C. Lasarte, *Contributing Member*  
 M. Mengon, *Contributing Member*  
 D. E. Miller, *Contributing Member*  
 R. Miyata, *Contributing Member*  
 B. Mruk, *Contributing Member*  
 J. Phillips, *Contributing Member*  
 M. Reddy, *Contributing Member*  
 S. Ruesenberg, *Contributing Member*  
 R. Sadowski, *Contributing Member*  
 A. Swearingin, *Contributing Member*  
 A. P. Varghese, *Contributing Member*

**Subgroup on Nuclear (BPV XIII)**

K. R. May, *Chair*  
 J. F. Ball, *Vice Chair*  
 R. Krithivasan, *Secretary*  
 M. Brown  
 J. W. Dickson  
 S. Jones  
 R. Lack  
 D. Miller  
 T. Patel

K. Shores  
 I. H. Tseng  
 B. J. Yonsky  
 J. M. Levy, *Alternate*  
 Y. Wong, *Alternate*  
 J. Yu, *Alternate*  
 S. T. French, *Contributing Member*  
 D. B. Ross, *Contributing Member*

**Subgroup on Testing (BPV XIII)**

B. K. Nutter, *Chair*  
 J. W. Dickson, *Vice Chair*  
 R. Houk, *Secretary*  
 T. P. Beirne  
 M. Brown  
 B. Calderon  
 V. Chicola III  
 B. Engman  
 R. J. Garnett  
 R. Lack  
 M. Mengon

C. Sharpe  
 J. R. Thomas, Jr.  
 Z. Wang  
 D. Nelson, *Alternate*  
 J. Mize, *Contributing Member*  
 M. Mullavey, *Contributing Member*  
 S. Ruesenberg, *Contributing Member*  
 K. Shores, *Contributing Member*  
 A. Streckler, *Contributing Member*  
 A. Wilson, *Contributing Member*

**US TAG to ISO TC 185 Safety Devices for Protection Against Excessive Pressure (BPV XIII)**

D. Miller, *Chair*  
 C. E. Rodrigues, *Staff Secretary*  
 J. F. Ball  
 T. J. Bevilacqua  
 D. B. DeMichael  
 J. W. Dickson

B. K. Nutter  
 T. Patel  
 J. R. Thomas, Jr.  
 D. Tuttle  
 J. A. West  
 J. F. White

**COMMITTEE ON BOILER AND PRESSURE VESSEL CONFORMITY ASSESSMENT (CBPVCA)**

R. V. Wielgoszinski, *Chair*  
 G. Scribner, *Vice Chair*  
 G. Moino, *Staff Secretary*  
 M. Blankinship  
 J. P. Chicoine  
 T. E. Hansen  
 W. Hibdon  
 B. L. Krasiun  
 L. E. McDonald  
 N. Murugappan  
 I. Powell  
 D. E. Tuttle  
 E. A. Whittle  
 P. Williams

T. P. Beirne, *Alternate*  
 N. Caputo, *Alternate*  
 P. Chavdarov, *Alternate*  
 J. M. Downs, *Alternate*  
 P. D. Edwards, *Alternate*  
 Y.-S. Kim, *Alternate*  
 B. Morelock, *Alternate*  
 M. Prefumo, *Alternate*  
 R. Rockwood, *Alternate*  
 K. Roewe, *Alternate*  
 B. C. Turczynski, *Alternate*  
 J. Yu, *Alternate*  
 D. Cheetham, *Contributing Member*  
 A. J. Spencer, *Honorary Member*

**COMMITTEE ON NUCLEAR CERTIFICATION (CNC)**

R. R. Stevenson, *Chair*  
 M. A. Lockwood, *Vice Chair*  
 S. Khan, *Staff Secretary*  
 A. Appleton  
 J. F. Ball  
 G. Claffey  
 N. DeSantis  
 C. Dinic  
 G. Gobbi  
 J. W. Highlands  
 K. A. Kavanagh  
 J. C. Krane  
 T. McGee  
 E. L. Pleins  
 T. E. Quaka  
 T. N. Rezk  
 D. M. Vickery  
 E. A. Whittle

T. Aldo, *Alternate*  
 M. Blankinship, *Alternate*  
 G. Brouette, *Alternate*  
 M. Burke, *Alternate*  
 P. J. Coco, *Alternate*  
 Y. Diaz-Castillo, *Alternate*  
 P. D. Edwards, *Alternate*  
 J. Grimm, *Alternate*  
 K. M. Hottle, *Alternate*  
 P. Krane, *Alternate*  
 S. J. Montano, *Alternate*  
 I. Olson, *Alternate*  
 L. Ponce, *Alternate*  
 M. Wilson, *Alternate*  
 S. Yang, *Alternate*  
 S. F. Harrison, Jr., *Contributing Member*

# CORRESPONDENCE WITH THE COMMITTEE

(23)

## 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 Section of the ASME Boiler and Pressure Vessel Code (BPVC) should be sent to the staff secretary noted on the Section's committee web page, accessible at <https://go.asme.org/CSCcommittees>.

NOTE: See ASME BPVC Section II, Part D for guidelines on requesting approval of new materials. See Section II, Part C for guidelines on requesting approval of new welding and brazing materials ("consumables").

## Revisions and Errata

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

In addition, the committee may post errata and Special Notices at <http://go.asme.org/BPVCerrata>. Errata and Special Notices become effective on the date posted. Users can register on the committee web page to receive e-mail notifications of posted errata and Special Notices.

This Code 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 Code
  - (4) to permit 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 Code.
- (c) The committee will consider proposed cases concerning the following topics only:
  - (1) equipment to be marked with the ASME Single Certification Mark, or
  - (2) equipment to be constructed as a repair/replacement activity under the requirements of Section XI
- (d) 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 Code Section and the paragraph, figure, or table number(s) to which the proposed case applies
  - (4) the edition(s) of the Code to which the proposed case applies
- (e) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Cases that have been approved will appear in the next edition or supplement of the Code Cases books, "Boilers and Pressure Vessels" or "Nuclear Components." Each Code Cases book is updated with seven Supplements.

Supplements will be sent or made available automatically to the purchasers of the Code Cases books until the next edition of the Code. Annulments of Code Cases become effective six months after the first announcement of the annulment in a Code Case Supplement or Edition of the appropriate Code Case book. The status of any case is available at <http://go.asme.org/BPVCCDatabase>. An index of the complete list of Boiler and Pressure Vessel Code Cases and Nuclear Code Cases is available at <http://go.asme.org/BPVCC>.

## **Interpretations**

*(a)* Interpretations clarify existing Code requirements and are written as a question and reply. Interpretations do not introduce new requirements. If a revision to resolve conflicting or incorrect wording is required to support the interpretation, the committee will issue an intent interpretation in parallel with a revision to the Code.

*(b)* Upon request, the committee will render an interpretation of any requirement of the Code. An interpretation can be rendered only in response to a request submitted through the online Interpretation Submittal Form at <http://go.asme.org/InterpretationRequest>. Upon submitting the form, the inquirer will receive an automatic e-mail confirming receipt.

*(c)* ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Code 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 may track the status of their requests at <http://go.asme.org/Interpretations>.

*(d)* 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.

*(e)* Interpretations are published in the ASME Interpretations Database at <http://go.asme.org/Interpretations> as they are issued.

## **Committee Meetings**

The ASME BPVC committees regularly hold meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the applicable committee. Information on future committee meetings can be found at <http://go.asme.org/BCW>.

# PREAMBLE

The rules of this Section of the Code cover minimum construction requirements for the design, fabrication, installation, and inspection of steam heating, hot water heating, and hot water supply boilers that are directly fired with oil, gas, electricity, coal, or other solid or liquid fuels, and for operation at or below the pressure and temperature limits set forth in this document. Similar rules for potable water heaters are also included.

For Section IV application, the boiler proper or other vessels terminate at the supply and return connections to the system or the supply and feedwater connections of a hot water supply boiler. These connections may be any of the following:

- (a) the first circumferential joint for welding end connections
- (b) the face of the first flange in bolted flanged connections
- (c) the first threaded joint in that type of connection

Included within the scope of the boiler are pressure-retaining covers for inspection openings, such as manhole covers, handhold covers, and plugs; and headers required to connect individual coils, tubes, or cast sections within a boiler.

The rules are divided into four major Parts: Part HG, applying to all materials of construction except as provided for in Part HLW; Part HF, applying to assemblies fabricated of wrought material, except as provided for in Part HLW; Part HC, applying to cast iron assemblies; Part HA, applying to boilers constructed of cast aluminum; and Part HLW, applying to potable water heaters. Part HF is further subdivided into Subpart HW, containing rules for welded construction, and Subpart HB, containing rules for brazed construction.

The Parts and Subparts of this Section are divided into Articles. Each Article is given a number and a title, as for example, Part HG, Article 3, Design. Articles are divided into paragraphs that are given a three-digit number, the first of which corresponds to the Article number. Thus, under Article 3 of Part HG, paragraph HG-307 will be found. Paragraphs are further subdivided into subparagraphs. Major subdivisions of paragraphs are designated by three- or four-digit numbers followed by a decimal point and a digit or digits. Where necessary, further subdivisions are represented by letters and then by numbers in parentheses. Minor subdivisions of the paragraphs are also represented by letters. A reference to one of these paragraphs in the text of the Section includes all of the applicable rules in that paragraph. Thus, reference to HG-307 includes all the rules in HG-307.1 through HG-307.4.

This Section does not contain rules to cover all possible details of design and construction. Where complete details are not given, it is intended that the manufacturer, subject to the acceptance of the Authorized Inspector, shall provide details of design and construction that will be as safe as otherwise required by these rules.

When the strength of any part cannot be computed with a satisfactory assurance of safety, these rules provide procedures for establishing its maximum allowable working pressure.

## SUMMARY OF CHANGES

Changes listed below are identified on the pages by a margin note, **(23)**, placed next to the affected area.

<i>Page</i>	<i>Location</i>	<i>Change</i>
xiii	List of Sections	(1) Under Section III, Division 4 added (2) Title of Section XI and subtitle of Section XI, Division 2 revised (3) Information on interpretations and Code cases moved to “Correspondence With the Committee”
xvii	Personnel	Updated
xxxix	Correspondence With the Committee	Added (replaces “Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees”)
xlv	Cross-Referencing in the ASME BPVC	Updated
4	HG-301.2	Subparagraph (d) revised
6	Figure HG-307	Cross-references in sketches (j) and (k) revised
9	HG-307.5	Subparagraph (b) revised
29	HG-360.1	Subparagraph (b) revised
33	Article 4	Deleted
34	HG-401A	Subparagraph (a) revised
34	HG-402A.2	Revised
38	HG-502.2	Subparagraph (d)(2)(-b) revised
39	HG-502.4	Subparagraph (d)(2)(-b) revised
41	HG-511	(1) Former subpara. (c) deleted and subsequent subparagraphs redesignated (2) Subparagraph (e) [formerly (f)] revised
41	HG-515.2	(1) Subparagraphs (d), (n), (o), and (p) revised (2) Subparagraph (q) added
42	HG-515.3	Subparagraph (b)(14) revised
43	HG-520	Revised in its entirety
44	HG-530.1	Subparagraph (g) revised
45	HG-530.2	Subparagraph (g) revised
48	HG-531	Revised in its entirety
49	Figure HG-531.2	In title and figure, “PRT” revised to “PRT IV”
48	HG-532	Revised in its entirety
49	HG-533.1	First sentence revised
49	HG-533.2	Revised
49	HG-533.3	Last sentence revised
49	HG-533.6	Revised
49	HG-533.7	Second sentence revised
50	HG-540.1	First sentence revised
50	HG-540.5	First sentence revised
61	HG-710.2	Subparagraph (b) revised
62	HG-710.4	(1) Former HG-710.5 redesignated as HG-710.4 (2) Subparagraph (d) revised
62	HG-715	Subparagraphs (c) and (d) revised
63	HG-725.6	Second sentence revised
65	HG-801	Revised in its entirety
66	HG-803	Revised in its entirety
69	HF-201	Subparagraph (b)(1) revised
69	HF-203	Revised
69	HF-203.1	First sentence of subpara. (a) revised
70	HF-203.3	Endnote 20 and subpara. (a) revised

<b>Page</b>	<b>Location</b>	<b>Change</b>
73	HF-301.1	Subparagraphs (c) and (d) revised
73	HF-301.2	Subparagraph (b) revised
83	Figure HW-715.1	Revised
90	Figure HW-745	In illustration (f), Step 1 revised
93	HW-820.1	Editorially reformatted
93	HW-820.8	(1) Editorially reformatted (2) Subparagraph (e) [formerly (a)(5)] revised
106	HC-211	In-text table editorially revised
114	HC-403	Revised
116	HC-502.10.1	Revised
116	HC-502.12.2	Subparagraph (b) revised
123	HA-404	Revised
126	HA-502.10.1	Revised
126	HA-502.12.2	Subparagraph (b) revised
132	HLW-200	Subparagraph (k) added
133	HLW-201	Subparagraph (d) added
137	HLW-309	Title and subparas. (a)(1) and (b) revised
137	HLW-310.2	Revised
140	HLW-413	Subparagraph (c) added and subsequent subparagraphs redesignated
149	HLW-451	Subparagraph (b)(5)
154	HLW-504	Second paragraph revised
154	HLW-505.1	Revised
154	HLW-505.2	Added and subsequent paragraph redesignated
156	HLW-601	Revised in its entirety
157	HLW-602	Revised in its entirety
161	HLW-800.1	Subparagraph (c) revised
161	HLW-801.3	Subparagraph (b) added and subsequent paragraph redesignated
162	HLW-801.7	Subparagraph (b) revised
162	HLW-810	Subparagraph (a) revised
165	Article 9	Revised in its entirety
168	Table 2-100	ASME B16.14 deleted by errata
170	Mandatory Appendix 4	Revised
171	Table 4-1	(1) Column for Form H-1 added (2) Instructions for Reference Numbers (4), (23), (28), (29), (30), (40), (54), (55), and (74) revised
174	Form H-1	Added
176	Form H-2	Title and line 4 revised
178	Form H-3	Title and line 4 revised
180	Form H-4	Under "Certificate of Shop Compliance," "PRT" revised to "PRT IV"
182	Form H-5	On back page, Note deleted
184	Form H-5A	On back page, Note deleted
193	Form HLW-6	Title and line 9 revised
195	Form HLW-7	(1) Title editorially revised (2) Under "Certificate of Shop Compliance," "PRT" revised to "PRT IV"
202	7-500	Revised
204	Mandatory Appendix 8	(1) Revised in its entirety (2) Form 8-1 and Table 8-200-1 deleted
207	10-100	Last sentence revised
216	E-100	Added and subsequent paragraphs redesignated
216	E-101	(1) Definition of <i>feedwater</i> revised (2) Definition of <i>valve, pressure relief</i> deleted (3) Definition of <i>valve, relief</i> added
223	Nonmandatory Appendix H	Updated

<i>Page</i>	<i>Location</i>	<i>Change</i>
224	Nonmandatory Appendix K	Under “Description,” “Certification Mark With PRT Designator” revised to “Certification Mark With PRT IV Designator”
231	Nonmandatory Appendix P	Deleted

## CROSS-REFERENCING IN THE ASME BPVC

(23)

Paragraphs within the ASME BPVC may include subparagraph breakdowns, i.e., nested lists. The following is a guide to the designation and cross-referencing of subparagraph breakdowns:

*(a) Hierarchy of Subparagraph Breakdowns*

- (1) First-level breakdowns are designated as (a), (b), (c), etc.
- (2) Second-level breakdowns are designated as (1), (2), (3), etc.
- (3) Third-level breakdowns are designated as (-a), (-b), (-c), etc.
- (4) Fourth-level breakdowns are designated as (-1), (-2), (-3), etc.
- (5) Fifth-level breakdowns are designated as (+a), (+b), (+c), etc.
- (6) Sixth-level breakdowns are designated as (+1), (+2), etc.

*(b) Cross-References to Subparagraph Breakdowns.* Cross-references within an alphanumerically designated paragraph (e.g., PG-1, UIG-56.1, NCD-3223) do not include the alphanumeric designator of that paragraph. The crossreferences to subparagraph breakdowns follow the hierarchy of the designators under which the breakdown appears. The following examples show the format:

- (1) If X.1(c)(1)(-a) is referenced in X.1(c)(1), it will be referenced as (-a).
- (2) If X.1(c)(1)(-a) is referenced in X.1(c)(2), it will be referenced as (1)(-a).
- (3) If X.1(c)(1)(-a) is referenced in X.1(e)(1), it will be referenced as (c)(1)(-a).
- (4) If X.1(c)(1)(-a) is referenced in X.2(c)(2), it will be referenced as X.1(c)(1)(-a).

# PART HG

## GENERAL REQUIREMENTS FOR ALL MATERIALS OF CONSTRUCTION

---

### ARTICLE 1

#### SCOPE AND SERVICE RESTRICTIONS

##### HG-100 SCOPE

(a) The rules of [Part HG](#) apply to steam heating boilers, hot water heating boilers, hot water supply boilers, and to appurtenances thereto. They shall be used in conjunction with the specific requirements in [Part HF](#) (boilers of wrought materials), [Part HC](#) (cast iron boilers), and [Part HA](#) (cast aluminum boilers), as applicable. The Foreword provides the basis for these rules. [Part HG](#) is not intended to apply to potable water heaters except as provided for in [Part HLW](#). Boilers with economizers shall follow the rules of Mandatory [Appendix 10](#).

(b) This Part contains mandatory requirements, specific prohibitions, and nonmandatory guidance for materials, designs, fabrication, examination, inspection, testing, certification, and overpressure protection. When detailed rules are not given in Section IV, the Manufacturer, subject to the acceptance of the Authorized Inspector, shall provide details of design that will be as safe as those provided by the rules of Section IV. This may be done by appropriate analytical methods, the appropriate use of rules from other design Codes or, as permitted in [HG-500](#), by proof test.

(c) The Manufacturer shall establish the effective Code edition, addenda, and cases in accordance with [Mandatory Appendix 9](#). Laws or regulations issued by a municipality, state, provincial, federal, or other enforcement or regulatory body having jurisdiction at the location of an installation, establish the mandatory applicability of these rules, in whole or in part.

##### HG-101 SERVICE RESTRICTIONS

**HG-101.1 Service Restrictions.** The rules of this Section are restricted to the following services:

(a) steam boilers for operation at pressures not exceeding 15 psi (100 kPa)

(b) hot water heating boilers and hot water supply boilers for operation at pressures not exceeding 160 psi (1 100 kPa)

(c) hot water heating boilers and hot water supply boilers for operation at temperatures not exceeding 250°F (120°C), at or near the boiler outlet, except that when some of the wrought materials permitted by [Part HF](#) are used, a lower temperature is specified

**HG-101.2 Services in Excess of Those Covered by This Section.** For services exceeding the limits specified in [HG-101.1](#), the rules of Section I shall apply.

##### HG-102 UNITS

Either U.S. Customary, SI, or any local customary units may be used to demonstrate compliance with all requirements of this edition (e.g., materials, design, fabrication, examination, inspection, testing, certification, and overpressure protection).

In general, it is expected that a single system of units shall be used for all aspects of design except where unfeasible or impractical. When components are manufactured at different locations where local customary units are different than those used for the general design, the local units may be used for the design and documentation of that component. Similarly, for proprietary components or those uniquely associated with a system of units different than that used for the general design, the alternate units may be used for the design and documentation of that component.

For any single equation, all variables shall be expressed in a single system of units. When separate equations are provided for U.S. Customary and SI units, those equations must be executed using variables in the units associated with the specific equation. Data expressed in other units shall be converted to U.S. Customary or SI units for use in these equations. The result obtained from execution of these equations may be converted to other units.