

ASME BPVC.II.B-2023

**SECTION II**  
MATERIALS

2023

ASME Boiler and  
Pressure Vessel Code  
An International Code

**Part B**  
Nonferrous Material  
Specifications

  
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AN INTERNATIONAL CODE

# 2023 ASME Boiler & Pressure Vessel Code

2023 Edition

July 1, 2023

## II MATERIALS

### Part B

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## Nonferrous Material Specifications

ASME Boiler and Pressure Vessel Committee  
on Materials



The American Society of  
Mechanical Engineers

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# TABLE OF CONTENTS

List of Sections .....		ix
Foreword .....		x
Statement of Policy on the Use of the ASME Single Certification Mark and Code Authorization in Advertising .....		xii
Statement of Policy on the Use of ASME Marking to Identify Manufactured Items .....		xii
Personnel .....		xiii
ASTM Personnel .....		xxxv
Correspondence With the Committee .....		xxxvi
Preface .....		xxxviii
Specifications Listed by Materials .....		xxxix
Specification Removal .....		xliv
Summary of Changes .....		xlv
Cross-Referencing in the ASME BPVC .....		xlvii
Statement of Policy on the Use of ASME Material Specifications .....		1
SB-26/SB-26M	Specification for Aluminum-Alloy Sand Castings .....	3
SB-42	Specification for Seamless Copper Pipe, Standard Sizes .....	17
SB-43	Specification for Seamless Red Brass Pipe, Standard Sizes .....	25
SB-61	Specification for Steam or Valve Bronze Castings .....	33
SB-62	Specification for Composition Bronze or Ounce Metal Castings .....	37
SB-75/SB-75M	Specification for Seamless Copper Tube .....	41
SB-96/SB-96M	Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels .....	51
SB-98/SB-98M	Specification for Copper-Silicon Alloy Rod, Bar and Shapes .....	57
SB-108/SB-108M	Specification for Aluminum-Alloy Permanent Mold Castings .....	63
SB-111/SB-111M	Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock .....	81
SB-127	Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip .....	95
SB-135/SB-135M	Specification for Seamless Brass Tube .....	105
SB-148	Specification for Aluminum-Bronze Sand Castings .....	115
SB-150/SB-150M	Specification for Aluminum Bronze Rod, Bar, and Shapes .....	123
SB-151/SB-151M	Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar .....	131
SB-152/SB-152M	Specification for Copper Sheet, Strip, Plate, and Rolled Bar .....	137
SB-160	Specification for Nickel Rod and Bar .....	145
SB-161	Specification for Nickel Seamless Pipe and Tube .....	155
SB-162	Specification for Nickel Plate, Sheet, and Strip .....	161
SB-163	Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes .....	177
SB-164	Specification for Nickel-Copper Alloy Rod, Bar, and Wire .....	191
SB-165	Specification for Nickel-Copper Alloy Seamless Pipe and Tube .....	205
SB-166	Specification for Nickel-Chromium-Aluminum Alloy, Nickel-Chromium-Iron Alloys, Nickel-Chromium-Cobalt-Molybdenum Alloy, Nickel-Iron- Chromium-Tungsten Alloy, and Nickel-Chromium-Molybdenum-Copper Alloy, Rod, Bar, and Wire .....	213
SB-167	Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), and Nickel- Chromium-Cobalt-Molybdenum Alloy (UNS N06617), Nickel-Iron- Chromium-Tungsten Alloy (UNS N06674), and Nickel-Chromium- Molybdenum-Copper Alloy (UNS N06235) Seamless Pipe and Tube .....	223

SB-168	Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674), and Nickel-Chromium-Molybdenum-Copper Alloy (UNS N06235) Plate, Sheet, and Strip . . . . .	233
SB-169/SB-169M	Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar . . . . .	247
SB-171/SB-171M	Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers . . . . .	253
SB-187/SB-187M	Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes . . . . .	261
SB-209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate . . . . .	271
SB-210	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes . . . . .	297
SB-211/SB-211M	Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire . . . . .	309
SB-221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes . . . . .	323
SB-234	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Condensers and Heat Exchangers . . . . .	339
SB-241/SB-241M	Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube . . . . .	347
SB-247	Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings . . . . .	367
SB-248	Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar . . . . .	385
SB-249/SB-249M	Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings . . . . .	399
SB-251/SB-251M	Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube . . . . .	413
SB-265	Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate . . . . .	423
SB-271/SB-271M	Specification for Copper-Base Alloy Centrifugal Castings . . . . .	437
SB-283/SB-283M	Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed) . . . . .	445
SB-308/SB-308M	Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles . . . . .	461
SB-315	Specification for Seamless Copper Alloy Pipe and Tube . . . . .	467
SB-333	Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip . . . . .	479
SB-335	Specification for Nickel-Molybdenum Alloy Rod . . . . .	483
SB-338	Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers . . . . .	489
SB-348/SB-348M	Specification for Titanium and Titanium Alloy Bars and Billets . . . . .	499
SB-359/SB-359M	Specification for Copper and Copper-Alloy Seamless Condenser and Heat Exchanger Tubes with Integral Fins . . . . .	509
SB-363	Specification for Seamless and Welded Unalloyed Titanium and Titanium Alloy Welding Fittings . . . . .	521
SB-366/SB-366M	Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings . . . . .	527
SB-367	Specification for Titanium and Titanium Alloy Castings . . . . .	537
SB-369	Specification for Copper-Nickel Alloy Castings . . . . .	545
SB-381	Specification for Titanium and Titanium Alloy Forgings . . . . .	551
SB-395/SB-395M	Specification for U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes . . . . .	561
SB-407	Specification for Nickel-Iron-Chromium Alloy Seamless Pipe and Tube . . . . .	573
SB-408	Specification for Nickel-Iron-Chromium Alloy Rod and Bar . . . . .	579
SB-409	Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip . . . . .	585
SB-423	Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825 and N08221) Seamless Pipe and Tube . . . . .	591
SB-424	Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825, UNS N08221, and UNS N06845) Plate, Sheet, and Strip . . . . .	597

SB-425	Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Rod and Bar .....	603
SB-434	Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, UNS N10242) Plate, Sheet, and Strip .....	611
SB-435	Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Plate, Sheet, and Strip .....	615
SB-443	Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip .....	619
SB-444	Specification for Nickel-Chromium-Molybdenum-Columbium Alloys (UNS N06625 and UNS N06852) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Pipe and Tube .....	631
SB-446	Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar .....	635
SB-462	Specification for Forged or Rolled Nickel Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service .....	641
SB-463	Specification for UNS N08020 Alloy Plate, Sheet, and Strip .....	647
SB-464	Specification for Welded UNS N08020, N08024, and N08026 Alloy Pipe ..	651
SB-466/SB-466M	Specification for Seamless Copper-Nickel Pipe and Tube .....	655
SB-467	Specification for Welded Copper-Nickel Pipe .....	663
SB-468	Specification for Welded UNS N08020, N08024, and N08026 Alloy Tubes .	671
SB-473	Specification for UNS N08020, UNS N08024, and UNS N08026 Nickel Alloy Bar and Wire .....	675
SB-493/SB-493M	Specification for Zirconium and Zirconium Alloy Forgings .....	685
SA-494/SA-494M	Specification for Castings, Nickel and Nickel Alloy .....	689
SB-505/SB-505M	Specification for Copper Alloy Continuous Castings .....	697
SB-511	Specification for Nickel-Iron-Chromium-Silicon Alloy Bars and Shapes ....	707
SB-514	Specification for Welded Nickel-Iron-Chromium Alloy Pipe .....	717
SB-515	Specification for Welded UNS N08120, UNS N08800, UNS N08810, and UNS N08811 Alloy Tubes .....	721
SB-516	Specification for Welded Nickel-Chromium-Aluminum Alloy (UNS N06699) and Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06601, UNS N06603, UNS N06025, UNS N06045, UNS N06690, AND UNS N06693) Tubes .....	725
SB-517	Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Pipe .....	729
SB-523/SB-523M	Specification for Seamless and Welded Zirconium and Zirconium Alloy Tubes .....	733
SB-535	Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Seamless Pipe and Tube .....	739
SB-536	Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Plate, Sheet, and Strip .....	743
SB-543/SB-543M	Specification for Welded Copper and Copper-Alloy Heat Exchanger Tube .	755
SB-548	Test Method for Ultrasonic Inspection of Aluminum-Alloy Plate for Pressure Vessels .....	769
SB-550/SB-550M	Specification for Zirconium and Zirconium Alloy Bar and Wire .....	775
SB-551/SB-551M	Specification for Zirconium and Zirconium Alloy Strip, Sheet, and Plate ...	781
SB-564	Specification for Nickel Alloy Forgings .....	793
SB-572	Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Rod .....	805
SB-573	Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, N10242) Rod .....	811

SB-574	Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod .....	815
SB-575	Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Tungsten, and Low-Carbon Nickel-Molybdenum-Chromium Alloy Plate, Sheet, and Strip .....	821
SB-581	Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Rod ..	827
SB-582	Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip .....	833
SB-584	Specification for Copper Alloy Sand Castings for General Applications ....	837
SB-599	Specification for Nickel-Iron-Chromium-Molybdenum-Columbium Stabilized Alloy (UNS N08700) Plate, Sheet, and Strip .....	847
SB-619/SB-619M	Specification for Welded Nickel and Nickel-Cobalt Alloy Pipe .....	861
SB-620	Specification for Nickel-Iron-Chromium-Molybdenum Alloy (UNS N08320) Plate, Sheet, and Strip .....	869
SB-621	Specification for Nickel-Iron-Chromium-Molybdenum Alloy (UNS N08320) Rod .....	873
SB-622	Specification for Seamless Nickel and Nickel-Cobalt Alloy Pipe and Tube ..	877
SB-625	Specification for UNS N08925, UNS N08031, UNS N08034, UNS N08932, UNS N08926, UNS N08354, UNS N08830, and UNS R20033 Plate, Sheet, and Strip .....	885
SB-626	Specification for Welded Nickel and Nickel-Cobalt Alloy Tube .....	889
SB-637	Specification for Precipitation-Hardening and Cold Worked Nickel Alloy Bars, Forgings, and Forging Stock for Moderate or High-Temperature Service .....	895
SB-649	Specification for Ni-Fe-Cr-Mo-Cu-N Low-Carbon Alloys (UNS N08925, UNS N08031, UNS N08034, UNS N08354, and UNS N08926), and Cr-Ni-Fe-N Low-Carbon Alloy (UNS R20033) Bar and Wire, and Ni-Cr-Fe-Mo-N Alloy (UNS N08936) Wire .....	903
SB-653/SB-653M	Specification for Seamless and Welded Zirconium and Zirconium Alloy Welding Fittings .....	911
SB-658/SB-658M	Specification for Seamless and Welded Zirconium and Zirconium Alloy Pipe .....	915
SB-666/SB-666M	Practice for Identification Marking of Aluminum and Magnesium Products .....	921
SB-668	Specification for UNS N08028 Seamless Tubes .....	929
SB-672	Specification for Nickel-Iron-Chromium-Molybdenum-Columbium Stabilized Alloy (UNS N08700) Bar and Wire .....	933
SB-673	Specification for UNS N08925, UNS N08354, and UNS N08926 Welded Pipe .....	941
SB-674	Specification for UNS N08925, UNS N08354, and UNS N08926 Welded Tube .....	945
SB-675	Specification for UNS N08367 Welded Pipe .....	949
SB-676	Standard Specification for UNS N08367 Welded Tube .....	953
SB-677	Specification for Nickel-Iron-Chromium-Molybdenum and Iron-Nickel-Chromium-Molybdenum-Copper Seamless Pipe and Tube .....	957
SB-688	Specification for Chromium-Nickel-Molybdenum-Iron (UNS N08366 and UNS N08367) Plate, Sheet, and Strip .....	961
SB-690	Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Seamless Pipe and Tube .....	971
SB-691	Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Rod, Bar, and Wire .....	979
SB-704	Specification for Welded UNS N06625, UNS N06219, and UNS N08825 Alloy Tubes .....	987
SB-705	Specification for Nickel-Alloy (UNS N06625, N06219 and N08825) Welded Pipe .....	991
SB-706	Specification for Seamless Copper Alloy (UNS NO. C69100) Pipe and Tube .....	995



SB-709	Specification for Iron-Nickel-Chromium-Molybdenum Alloy (UNS N08028) Plate, Sheet, and Strip .....	1003
SB-710	Specification for Nickel-Iron-Chromium-Silicon Alloy Welded Pipe .....	1009
SB-729	Specification for Seamless Nickel-Iron-Chromium-Molybdenum-Copper Nickel Alloy Pipe and Tube .....	1013
SB-751	Specification for General Requirements for Nickel and Nickel-Alloy Welded Tube .....	1017
SB-752/SB-752M	Specification for Castings, Zirconium-Base, Corrosion Resistant, for General Application .....	1025
SB-775	Specification for General Requirements for Nickel and Nickel-Alloy Welded Pipe .....	1031
SB-804	Specification for UNS N08367 and UNS N08926 Welded Pipe .....	1037
SB-815	Specification for Cobalt-Chromium-Nickel-Molybdenum-Tungsten Alloy (UNS R31233) Rod .....	1045
SB-818	Specification for Cobalt-Chromium-Nickel-Molybdenum-Tungsten Alloy (UNS R31233) Plate, Sheet, and Strip .....	1049
SB-824	Specification for General Requirements for Copper Alloy Castings .....	1053
SB-829	Specification for General Requirements for Nickel and Nickel Alloys Seamless Pipe and Tube .....	1061
SB-834	Specification for Pressure Consolidated Powder Metallurgy Iron-Nickel-Chromium-Molybdenum (UNS N08367), Nickel-Chromium-Molybdenum-Columbium (Nb) (UNS N06625), Nickel-Chromium-Iron Alloys (UNS N06600 and N06690), and Nickel-Chromium-Iron-Columbium-Molybdenum (UNS N07718) Alloy Pipe Flanges, Fittings, Valves, and Parts .....	1069
SB-861	Specification for Titanium and Titanium Alloy Seamless Pipe .....	1075
SB-862	Specification for Titanium and Titanium Alloy Welded Pipe .....	1085
SB-906	Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip .....	1097
SB-928/SB-928M	Specification for High Magnesium Aluminum-Alloy Sheet and Plate for Marine Service and Similar Environments .....	1115
SB-956	Specification for Welded Copper and Copper-Alloy Condenser and Heat Exchanger Tubes with Integral Fins .....	1129
SF-467	Specification for Nonferrous Nuts for General Use .....	1141
SF-467M	Specification for Nonferrous Nuts for General Use [Metric] .....	1151
SF-468	Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use .....	1161
SF-468M	Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use [Metric] .....	1177
SB/EN 1706	Aluminum and Aluminum Alloys — Castings — Chemical Composition and Mechanical Properties .....	1189
<b>Mandatory Appendix I</b>	<b>Standard Units for Use in Equations</b> .....	1191
<b>Mandatory Appendix II</b>	<b>Framework of ASME Material Specifications</b> .....	1192
II-100	General .....	1192
II-200	Source Standards .....	1192
II-300	Permissibility of Superseded Editions for ASME Construction .....	1192
II-400	Structure of ASME Material Specifications .....	1192
<b>Mandatory Appendix III</b>	<b>Guidelines on Multiple Marking of Materials</b> .....	1202
III-100	Background .....	1202
III-200	Guidelines .....	1202
<b>Mandatory Appendix IV</b>	<b>Guidelines on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code</b> .....	1204
IV-100	Code Policy .....	1204
IV-200	Application .....	1204
IV-300	Chemical Composition .....	1206

IV-400	Metallurgical Structure and Heat Treatment .....	1206
IV-500	Mechanical Properties .....	1206
IV-600	Definitions for Data Collection Purposes .....	1206
IV-700	Required Sampling .....	1206
IV-800	Time-Independent Properties .....	1207
IV-900	Time-Dependent Properties .....	1207
IV-1000	Low-Temperature Properties .....	1209
IV-1100	Toughness Data .....	1209
IV-1200	Stress-Strain Curves .....	1209
IV-1300	Fatigue Data .....	1209
IV-1400	Physical Properties .....	1209
IV-1500	Data Requirements for Welds, Weldments, and Weldability .....	1210
IV-1600	Long-Term Properties Stability .....	1210
IV-1700	Requests for Additional Data .....	1212
IV-1800	New Materials Checklist .....	1212
IV-1900	Requirements for Recognized National or International Specifications ....	1212
IV-2000	Publication of Recognized National or International Specifications .....	1212
IV-2100	CEN Specifications .....	1212
<b>Nonmandatory Appendix A</b>	<b>Sources of Standards .....</b>	<b>1214</b>

**FIGURE**

II-400-1	Illustrative Table of ASME Material Specifications (for II-400 Explanation Purposes Only) .....	1201
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**TABLES**

I-1	Standard Units for Use in Equations .....	1191
II-200-1	Material Specifications Acceptable for ASME Construction .....	1194
II-200-2	Material Specifications Acceptable for ASME Construction .....	1201
IV-100-1	Hot Isostatically Pressed Component Requirements for Austenitic Stainless Steels, Austenitic-Ferritic (Duplex) Stainless Steels, Martensitic Stainless Steels, Ferritic Steels, and Nickel Alloys .....	1205
IV-800-1	ASTM Test Methods and Units for Reporting .....	1208
IV-1500-1	Example of a Comparison of Allowable Stresses of Base Metals With Compositions Similar to Those of Selected Welding Consumables and the Proposed New Base Metal .....	1211

# 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 only 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

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\* 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.

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 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.



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January 1, 2023

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(23)

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## CORRESPONDENCE WITH THE COMMITTEE

### General

ASME codes and standards are developed and maintained by committees with the intent to represent the consensus of concerned interests. Users of ASME codes and standards may correspond with the committees to propose revisions or cases, report errata, or request interpretations. Correspondence for this 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>.

# PREFACE

The American Society of Mechanical Engineers (ASME) and the American Society for Testing and Materials (ASTM) have cooperated for more than fifty years in the preparation of material specifications adequate for safety in the field of pressure equipment for ferrous and nonferrous materials, contained in Section II (Part A — Ferrous and Part B — Nonferrous) of the ASME Boiler and Pressure Vessel Code.

The evolution of this cooperative effort is contained in Professor A. M. Greene's "History of the ASME Boiler Code," which was published as a series of articles in *Mechanical Engineering* from July 1952 through August 1953 and is now available from ASME in a special bound edition. The following quotations from this history, which was based upon the minutes of the ASME Boiler and Pressure Vessel Committee, will help focus on the cooperative nature of the specifications found in Section II, Material Specifications.

*"General discussion of material specifications comprising Paragraphs 1 to 112 of Part 2 and the advisability of having them agree with ASTM specifications," (1914).*

*"ASME Subcommittee appointed to confer with ASTM," (1916).*

*"Because of this cooperation the specifications of the 1918 Edition of the ASME Boiler Code were more nearly in agreement with ASTM specifications. In the 1924 Edition of the Code, 10 specifications were in complete agreement with ASTM specifications, 4 in substantial agreement and 2 covered materials for which ASTM had no corresponding specifications."*

*"In Section II, Material Specifications, the paragraphs were given new numbers beginning with S-1 and extending to S-213," (1925).*

*"Section II was brought into agreement with changes made in the latest ASTM specifications since 1921," (1932).*

*"The Subcommittee on Material Specifications arranged for the introduction of the revisions of many of the specifications so that they would agree with the latest form of the earlier ASTM specifications...," (1935).*

From the preceding, it is evident that many of the material specifications were prepared by the Boiler and Pressure Vessel Code Committees, then subsequently, by cooperative action, modified and identified as ASTM specifications. Section II, Parts A and B, currently contain many material specifications that are identical with the corresponding ASTM specifications and some that have been modified for Code usage. Many of these specifications are published in dual format. That is, they contain both U.S. Customary units and SI units. The metrication protocols followed in the specifications are those adopted by ASTM, and are usually to the rules of IEEE/ASTM SI 10-1997, Standard for the Use of the International System of Units (SI): The Modern Metric System.

In 1969, the American Welding Society began publication of specifications for welding rods, electrodes, and filler metals, hitherto issued by ASTM. The Boiler and Pressure Vessel Committee has recognized this new arrangement, and is now working with AWS on these specifications. Section II, Part C, contains the welding material specifications approved for Code use.

In 1992, the ASME Board of Pressure Technology Codes and Standards endorsed the use of non-ASTM material for Boiler and Pressure Vessel Code applications. It is the intent to follow the procedures and practices currently in use to implement the adoption of non-ASTM materials.

All identical specifications are indicated by the ASME/originating organization symbols. The specifications prepared and copyrighted by ASTM, AWS, and other originating organizations are reproduced in the Code with the permission of the respective Society. The ASME Boiler and Pressure Vessel Committee has given careful consideration to each new and revised specification, and has made such changes as they deemed necessary to make the specification adaptable for Code usage. In addition, ASME has furnished ASTM with the basic requirements that should govern many proposed new specifications. Joint action will continue an effort to make the ASTM, AWS, and ASME specifications identical.

To assure that there will be a clear understanding on the part of the users of Section II, ASME publishes both the identical specifications and those amended for Code usage every 2 years.

The ASME Boiler and Pressure Vessel Code has been adopted into law by 50 states and many municipalities in the United States and by all of the Canadian provinces.



# SPECIFICATIONS LISTED BY MATERIALS

## Aluminum and Aluminum Alloys

SB-26/SB-26M	Specification for Aluminum-Alloy Sand Castings .....	3
SB-108/SB-108M	Specification for Aluminum-Alloy Permanent Mold Castings .....	63
SB-209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate .....	271
SB-210	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes .....	297
SB-211/SB-211M	Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire .....	309
SB-221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes .....	323
SB-234	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Condensers and Heat Exchangers .....	339
SB-241/SB-241M	Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube .....	347
SB-247	Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings .....	367
SB-308/SB-308M	Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles .....	461
SB-548	Test Method for Ultrasonic Inspection of Aluminum-Alloy Plate for Pressure Vessels ....	769
SB-666/SB-666M	Practice for Identification Marking of Aluminum and Magnesium Products .....	921
SB-928/SB-928M	Specification for High Magnesium Aluminum-Alloy Sheet and Plate for Marine Service and Similar Environments .....	1115
SB/EN 1706	Aluminum and Aluminum Alloys — Castings — Chemical Composition and Mechanical Properties .....	1189

## Cobalt Alloys

SB-815	Specification for Cobalt-Chromium-Nickel-Molybdenum-Tungsten Alloy (UNS R31233) Rod	1045
SB-818	Specification for Cobalt-Chromium-Nickel-Molybdenum-Tungsten Alloy (UNS R31233) Plate, Sheet, and Strip .....	1049

## Copper Alloy Castings

SB-61	Specification for Steam or Valve Bronze Castings .....	33
SB-62	Specification for Composition Bronze or Ounce Metal Castings .....	37
SB-148	Specification for Aluminum-Bronze Sand Castings .....	115
SB-271/SB-271M	Specification for Copper-Base Alloy Centrifugal Castings .....	437
SB-369	Specification for Copper-Nickel Alloy Castings .....	545
SB-505/SB-505M	Specification for Copper Alloy Continuous Castings .....	697
SB-584	Specification for Copper Alloy Sand Castings for General Applications .....	837
SB-824	Specification for General Requirements for Copper Alloy Castings .....	1053

## Copper and Copper Alloy Pipe and Tubes

SB-42	Specification for Seamless Copper Pipe, Standard Sizes .....	17
SB-43	Specification for Seamless Red Brass Pipe, Standard Sizes .....	25
SB-75/SB-75M	Specification for Seamless Copper Tube .....	41
SB-111/SB-111M	Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock .	81
SB-135/SB-135M	Specification for Seamless Brass Tube .....	105
SB-251/SB-251M	Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube .....	413
SB-315	Specification for Seamless Copper Alloy Pipe and Tube .....	467

SB-359/SB-359M	Specification for Copper and Copper-Alloy Seamless Condenser and Heat Exchanger Tubes with Integral Fins .....	509
SB-395/SB-395M	Specification for U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes .....	561
SB-466/SB-466M	Specification for Seamless Copper-Nickel Pipe and Tube .....	655
SB-467	Specification for Welded Copper-Nickel Pipe .....	663
SB-543/SB-543M	Specification for Welded Copper and Copper-Alloy Heat Exchanger Tube .....	755
SB-706	Specification for Seamless Copper Alloy (UNS NO. C69100) Pipe and Tube .....	995
SB-956	Specification for Welded Copper and Copper-Alloy Condenser and Heat Exchanger Tubes with Integral Fins .....	1129

### **Copper and Copper Alloy Plate, Sheet, Strip, and Rolled Bar**

SB-96/SB-96M	Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels .....	51
SB-152/SB-152M	Specification for Copper Sheet, Strip, Plate, and Rolled Bar .....	137
SB-169/SB-169M	Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar .....	247
SB-171/SB-171M	Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers .....	253
SB-248	Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar .....	385
SB-283/SB-283M	Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed) .....	445

### **Copper and Copper Alloy Rod, Bar, and Shapes**

SB-98/SB-98M	Specification for Copper-Silicon Alloy Rod, Bar and Shapes .....	57
SB-150/SB-150M	Specification for Aluminum Bronze Rod, Bar, and Shapes .....	123
SB-151/SB-151M	Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar .....	131
SB-187/SB-187M	Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes .....	261
SB-249/SB-249M	Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings .....	399

### **Nickel Alloy Castings**

SA-494/SA-494M	Specification for Castings, Nickel and Nickel Alloy .....	689
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### **Nickel and Nickel Alloy Fittings**

SB-366/SB-366M	Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings .....	527
SB-834	Specification for Pressure Consolidated Powder Metallurgy Iron-Nickel- Chromium-Molybdenum (UNS N08367), Nickel-Chromium- Molybdenum-Columbium (Nb) (UNS N06625), Nickel- Chromium-Iron Alloys (UNS N06600 and N06690), and Nickel-Chromium-Iron-Columbium-Molybdenum (UNS N07718) Alloy Pipe Flanges, Fittings, Valves, and Parts .....	1069

### **Nickel and Nickel Alloy Pipe and Tubes**

SB-161	Specification for Nickel Seamless Pipe and Tube .....	155
SB-163	Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes .....	177
SB-165	Specification for Nickel-Copper Alloy Seamless Pipe and Tube .....	205
SB-167	Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), and Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674), and Nickel-Chromium-Molybdenum-Copper Alloy (UNS N06235) Seamless Pipe and Tube .....	223
SB-407	Specification for Nickel-Iron-Chromium Alloy Seamless Pipe and Tube .....	573
SB-423	Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825 and N08221) Seamless Pipe and Tube .....	591

SB-444	Specification for Nickel-Chromium-Molybdenum-Columbium Alloys (UNS N06625 and UNS N06852) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Pipe and Tube	631
SB-462	Specification for Forged or Rolled Nickel Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service	641
SB-464	Specification for Welded UNS N08020, N08024, and N08026 Alloy Pipe	651
SB-468	Specification for Welded UNS N08020, N08024, and N08026 Alloy Tubes	671
SB-514	Specification for Welded Nickel-Iron-Chromium Alloy Pipe	717
SB-515	Specification for Welded UNS N08120, UNS N08800, UNS N08810, and UNS N08811 Alloy Tubes	721
SB-516	Specification for Welded Nickel-Chromium-Aluminum Alloy (UNS N06699) and Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06601, UNS N06603, UNS N06025, UNS N06045, UNS N06690, AND UNS N06693) Tubes	725
SB-517	Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Pipe	729
SB-535	Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Seamless Pipe and Tube	739
SB-619/SB-619M	Specification for Welded Nickel and Nickel-Cobalt Alloy Pipe	861
SB-622	Specification for Seamless Nickel and Nickel-Cobalt Alloy Pipe and Tube	877
SB-626	Specification for Welded Nickel and Nickel-Cobalt Alloy Tube	889
SB-668	Specification for UNS N08028 Seamless Tubes	929
SB-673	Specification for UNS N08925, UNS N08354, and UNS N08926 Welded Pipe	941
SB-674	Specification for UNS N08925, UNS N08354, and UNS N08926 Welded Tube	945
SB-675	Specification for UNS N08367 Welded Pipe	949
SB-676	Standard Specification for UNS N08367 Welded Tube	953
SB-677	Specification for Nickel-Iron-Chromium-Molybdenum and Iron-Nickel-Chromium-Molybdenum-Copper Seamless Pipe and Tube	957
SB-690	Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Seamless Pipe and Tube	971
SB-704	Specification for Welded UNS N06625, UNS N06219, and UNS N08825 Alloy Tubes	987
SB-705	Specification for Nickel-Alloy (UNS N06625, N06219 and N08825) Welded Pipe	991
SB-710	Specification for Nickel-Iron-Chromium-Silicon Alloy Welded Pipe	1009
SB-729	Specification for Seamless Nickel-Iron-Chromium-Molybdenum-Copper Nickel Alloy Pipe and Tube	1013
SB-751	Specification for General Requirements for Nickel and Nickel-Alloy Welded Tube	1017
SB-775	Specification for General Requirements for Nickel and Nickel-Alloy Welded Pipe	1031
SB-804	Specification for UNS N08367 and UNS N08926 Welded Pipe	1037
SB-829	Specification for General Requirements for Nickel and Nickel Alloys Seamless Pipe and Tube	1061

**Nickel and Nickel Alloy Plate, Sheet, and Strip**

SB-127	Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip	95
SB-162	Specification for Nickel Plate, Sheet, and Strip	161
SB-168	Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674), and Nickel-Chromium-Molybdenum-Copper Alloy (UNS N06235) Plate, Sheet, and Strip	233
SB-333	Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip	479
SB-409	Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip	585
SB-424	Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825, UNS N08221, and UNS N06845) Plate, Sheet, and Strip	597
SB-434	Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, UNS N10242) Plate, Sheet, and Strip	611
SB-435	Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Plate, Sheet, and Strip	615
SB-443	Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip	619

SB-463	Specification for UNS N08020 Alloy Plate, Sheet, and Strip .....	647
SB-536	Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Plate, Sheet, and Strip .....	743
SB-575	Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Tungsten, and Low-Carbon Nickel-Molybdenum-Chromium Alloy Plate, Sheet, and Strip .....	821
SB-582	Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip .....	833
SB-599	Specification for Nickel-Iron-Chromium-Molybdenum-Columbium Stabilized Alloy (UNS N08700) Plate, Sheet, and Strip .....	847
SB-620	Specification for Nickel-Iron-Chromium-Molybdenum Alloy (UNS N08320) Plate, Sheet, and Strip .....	869
SB-625	Specification for UNS N08925, UNS N08031, UNS N08034, UNS N08932, UNS N08926, UNS N08354, UNS N08830, and UNS R20033 Plate, Sheet, and Strip .....	885
SB-688	Specification for Chromium-Nickel-Molybdenum-Iron (UNS N08366 and UNS N08367) Plate, Sheet, and Strip .....	961
SB-709	Specification for Iron-Nickel-Chromium-Molybdenum Alloy (UNS N08028) Plate, Sheet, and Strip .....	1003
SB-906	Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip .....	1097

**Nickel and Nickel Alloy Rod, Bar, and Wire**

SB-160	Specification for Nickel Rod and Bar .....	145
SB-164	Specification for Nickel-Copper Alloy Rod, Bar, and Wire .....	191
SB-166	Specification for Nickel-Chromium-Aluminum Alloy, Nickel-Chromium-Iron Alloys, Nickel-Chromium-Cobalt-Molybdenum Alloy, Nickel-Iron-Chromium-Tungsten Alloy, and Nickel-Chromium-Molybdenum-Copper Alloy, Rod, Bar, and Wire .....	213
SB-335	Specification for Nickel-Molybdenum Alloy Rod .....	483
SB-408	Specification for Nickel-Iron-Chromium Alloy Rod and Bar .....	579
SB-425	Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Rod and Bar .....	603
SB-446	Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar .....	635
SB-473	Specification for UNS N08020, UNS N08024, and UNS N08026 Nickel Alloy Bar and Wire .....	675
SB-511	Specification for Nickel-Iron-Chromium-Silicon Alloy Bars and Shapes .....	707
SB-564	Specification for Nickel Alloy Forgings .....	793
SB-572	Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Rod .....	805
SB-573	Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, N10242) Rod .....	811
SB-574	Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod .....	815
SB-581	Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Rod .....	827
SB-621	Specification for Nickel-Iron-Chromium-Molybdenum Alloy (UNS N08320) Rod .....	873
SB-637	Specification for Precipitation-Hardening and Cold Worked Nickel Alloy Bars, Forgings, and Forging Stock for Moderate or High-Temperature Service .....	895
SB-649	Specification for Ni-Fe-Cr-Mo-Cu-N Low-Carbon Alloys (UNS N08925, UNS N08031, UNS N08034, UNS N08354, and UNS N08926), and Cr-Ni-Fe-N Low-Carbon Alloy (UNS R20033) Bar and Wire, and Ni-Cr-Fe-Mo-N Alloy (UNS N08936) Wire .....	903
SB-672	Specification for Nickel-Iron-Chromium-Molybdenum-Columbium Stabilized Alloy (UNS N08700) Bar and Wire .....	933
SB-691	Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Rod, Bar, and Wire .....	979

**Other**

SF-467	Specification for Nonferrous Nuts for General Use .....	1141
SF-467M	Specification for Nonferrous Nuts for General Use [Metric] .....	1151
SF-468	Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use .....	1161
SF-468M	Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use [Metric] ..	1177

**Titanium and Titanium Alloys**

SB-265	Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate .....	423
SB-338	Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers .....	489
SB-348/SB-348M	Specification for Titanium and Titanium Alloy Bars and Billets .....	499
SB-363	Specification for Seamless and Welded Unalloyed Titanium and Titanium Alloy Welding Fittings .....	521
SB-367	Specification for Titanium and Titanium Alloy Castings .....	537
SB-381	Specification for Titanium and Titanium Alloy Forgings .....	551
SB-861	Specification for Titanium and Titanium Alloy Seamless Pipe .....	1075
SB-862	Specification for Titanium and Titanium Alloy Welded Pipe .....	1085

**Zirconium and Zirconium Alloys**

SB-493/SB-493M	Specification for Zirconium and Zirconium Alloy Forgings .....	685
SB-523/SB-523M	Specification for Seamless and Welded Zirconium and Zirconium Alloy Tubes .....	733
SB-550/SB-550M	Specification for Zirconium and Zirconium Alloy Bar and Wire .....	775
SB-551/SB-551M	Specification for Zirconium and Zirconium Alloy Strip, Sheet, and Plate .....	781
SB-653/SB-653M	Specification for Seamless and Welded Zirconium and Zirconium Alloy Welding Fittings ..	911
SB-658/SB-658M	Specification for Seamless and Welded Zirconium and Zirconium Alloy Pipe .....	915
SB-752/SB-752M	Specification for Castings, Zirconium-Base, Corrosion Resistant, for General Application ..	1025

## SPECIFICATION REMOVAL

From time to time, it becomes necessary to remove specifications from this Part of Section II. This occurs because the sponsoring society (e.g., ASTM, AWS, CEN) has notified ASME that the specification has either been replaced with another specification, or that there is no known use and production of a material. Removal of a specification from this Section also results in concurrent removal of the same specification from Section IX and from all of the ASME Boiler and Pressure Vessel Construction Codes that reference the material. This action effectively prohibits further use of the material in ASME Boiler and Pressure Vessel construction.

The following specifications will be dropped from this Section in the next Edition, unless information concerning current production and use of the material is received before December 1 of this year:

None

If you are currently using and purchasing new material to this specification for ASME Boiler and Pressure Vessel Code construction, and if discontinuance of this specification would present a hardship, please notify the Secretary of the ASME Boiler and Pressure Vessel Committee, at the address shown below:

Secretary  
ASME Boiler and Pressure Vessel Committee  
Two Park Avenue  
New York, NY 10016-5990

## 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>
ix	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”
xiii	Personnel	Updated
xxxv	ASTM Personnel	Updated
xxxvi	Correspondence With the Committee	Added (replaces “Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees”)
xliv	Specification Removal	Updated
xlvii	Cross-Referencing in the ASME BPVC	Updated
1	Statement of Policy on the Use of ASME Material Specifications	Added
17	SB-42	Revised in its entirety
25	SB-43	Revised in its entirety
51	SB-96/SB-96M	Revised in its entirety
115	SB-148	Revised in its entirety
131	SB-151/SB-151M	Revised in its entirety
205	SB-165	Revised in its entirety
213	SB-166	Revised in its entirety
223	SB-167	Revised in its entirety
233	SB-168	Revised in its entirety
247	SB-169/SB-169M	Revised in its entirety
261	SB-187/SB-187M	Revised in its entirety
309	SB-211/SB-211M	Revised in its entirety
399	SB-249/SB-249M	Revised in its entirety
413	SB-251/SB-251M	Revised in its entirety
445	SB-283/SB-283M	Revised in its entirety
461	SB-308/SB-308M	Revised in its entirety
641	SB-462	Revised in its entirety
725	SB-516	Revised in its entirety
775	SB-550/SB-550M	Revised in its entirety
811	SB-573	Revised in its entirety

<i>Page</i>	<i>Location</i>	<i>Change</i>
885	SB-625	Revised in its entirety
903	SB-649	Revised in its entirety
911	SB-653/SB-653M	Revised in its entirety
915	SB-658/SB-658M	Revised in its entirety
957	SB-677	Revised in its entirety
1009	SB-710	Revised in its entirety
1013	SB-729	Revised in its entirety
1017	SB-751	Revised in its entirety
1025	SB-752/SB-752M	Revised in its entirety
1189	SB/EN 1706	Revised
1192	Mandatory Appendix II	Revised in its entirety
1194	Table II-200-1	Updated
1201	Table II-200-2	Updated



## 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 cross-references 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).

# STATEMENT OF POLICY ON THE USE OF ASME MATERIAL SPECIFICATIONS

(23)

The material specifications in Section II, Part A or Section II, Part B shall be used when ordering, producing, and certifying materials for ASME BPV Code construction. The use of a specification not in Section II, Part A or Section II, Part B is acceptable only when it is referenced in an approved Code Case.

A complete list of ASME material specifications can be found in Mandatory Appendix II, Tables II-200-1 and II-200-2. Since the framework of ASME material specifications does not originate with the Section II committee (see Mandatory Appendix II, II-100 for more information), the following information is provided to assist the user in understanding and applying the specifications:

*(a) Scope.* Some specifications contain a statement in the Scope about the uses or service temperatures for alloys within. Such statements are to be viewed as guidance in the corresponding ASME material specification. Alloys approved for ASME BPV Code construction are restricted by maximum design temperatures stipulated in Section II, Part D, and any stipulations of the individual construction Codes.

*(b) Units.* Specifications often designate one unit (SI or Customary) as the standard for the specification with conversions of the other being cited as for information only. Compliance and acceptance for the purposes of Code usage is not governed by this. Section II, Part D has a U.S. Customary volume and an SI volume for mechanical and physical properties of all materials approved for Code construction.

*(c) References.* References to other material specifications within the text often carry the original title given to it by the parent organization. The following are two examples:

*(1) From 2021 Edition of Section II, Part A, SA-203*

*4.1 Steelmaking Practice — The steel shall be killed and shall conform to the fine grain size requirement of Specification A20/A20M.*

*(2) From 2021 Edition of Section II, Part B, SB-98/SB-98M*

*9.1 Refer to the appropriate paragraphs in Specification B249/B249M with particular reference to the following tables.*

Such references shall be interpreted as referring to the corresponding ASME material specification. If no corresponding ASME specification exists, then the user is bound to the latest revision of the cited specification.

*(d) Ordering Information.* The Ordering Information section of some specifications state that furnishing test reports and certification is optional. This is not valid for ASME BPVC. When alloys are purchased for use in ASME construction, test reports and certifications shall be furnished to the purchaser.

*(e) Individual Alloys.* To be used for Code construction, any alloy listed in an ASME material specification shall also have either allowable stress values or mechanical properties listed in either a Section II, Part D table or a Code Case.

Material produced to an acceptable material specification is not limited to country of origin. Before the material is ordered, it is the responsibility of the user to ensure that the intended construction Code permits materials certified to the desired specification.

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