<table>
<thead>
<tr>
<th><strong>Record No:</strong> 20-502</th>
<th><strong>Adoption of:</strong> ASTM B752/B752M-18</th>
<th><strong>As:</strong> ASME SB-752/SB-752M</th>
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<tbody>
<tr>
<td><strong>Recommended Subtitle for ASME Specification:</strong></td>
<td>Identical with ASTM B752/B752M-18 except that hot isostatic pressing and tension testing are made mandatory, and repair by welding requirements are revised.</td>
<td></td>
</tr>
<tr>
<td><strong>Previous ASTM Version adopted by ASME:</strong></td>
<td>None</td>
<td><strong>ASTM Version(s) reviewed:</strong> 18</td>
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</table>

**Review Checklist**

### Part I – Material Addition/Deletion

| Has a new grade, type, or class of material(s) been added or deleted to the specification since the last ASME adoption? | YES ☐ | NO ☒ |
| If a new grade, type, or class of material(s) has been added or deleted, then will the specification adoption result in the need for a revision to either an ASME BPV Code Volume or an ASME Code Case? | YES ☐ | NO ☒ | NA ☐ |

Reason for answer:

### Part II – Property Change to Existing Material

Have any of the following items changed for a material(s) that, as of the last ASME adoption, was already in the ASTM specification:

| A mechanical property? | YES ☐ | NO ☒ |
| A scope or thickness range? | YES ☐ | NO ☒ |
| A chemical composition and/or physical property? | YES ☐ | NO ☒ |
| A heat treatment temperature or range? | YES ☒ | NO ☐ |

If ANY of the above answers is YES, then does the material(s) with the changed property appear in either an ASME BPV Code Volume or an ASME Code Case? | YES ☐ | NO ☒ | NA ☐ |

If the material(s) with the changed property appears in an ASME BPV Code Volume(s)/Code Case(s), then will the adoption of this specification result in the need for the Volume/Code Case to be revised? | YES ☐ | NO ☒ | NA ☒ |

Reason for answer:

### Part III – Other Changes

Has any other significant change(s) been made to the ASTM specification that was not identified in Parts I-II and of which BPV II needs to be aware? | YES ☐ | NO ☒ |

Were any changes in the ASTM specification made as a result of an ASME request? | YES ☐ | NO ☒ |

Has any change(s) been made to the ASTM specification that was not already identified in Parts I-II | YES | NO |

*(If NO is checked, state why:)*
# Review Checklist

<table>
<thead>
<tr>
<th>and which is objectionable to ASME?</th>
<th>☐</th>
<th>☒</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will any of the proposed changes make any grade, type, or class of material(s) obsolete?</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

List any editorial changes to the ASTM Specification (since the last ASME Spec Adoption) of which BVP II needs to be aware:

None, this is a new material specification for ASME.

## Part IV – Necessary Revisions for ASME Adoption

List any additional revisions necessary for adoption into ASME Code Volume BPV IIB:

Addition of para. 6. Mechanical Properties and para 8 and revision of para. 11.1 and 11.2.

NOTE: ASME editors will remove ASTM proprietary footnotes and logo; and then add the ASME logo.

## Part V – BPV IIB Mandatory Appendix II, Table II-200

Will this adoption result in Table II-200-1 restricting the usage of certain versions of this ASTM specification? *(If yes, state why:)*

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
</table>

Respectfully submitted: __Richard Sutherlin_________________________ Tuesday, July 28, 2020, 8:43 AM

Phone __541-990-6814_________________________ email: rsuther223@comcast.net ________________
Standard Specification for
Castings, Zirconium-Base, Corrosion Resistant, for General Application

Identical with ASTM B752/B752M-18 except that hot isostatic pressing and tension testing are made mandatory, and repair by welding requirements are revised.

1. Scope

1.1 This specification covers zirconium and zirconium-alloy castings for general corrosion-resistant and industrial applications.

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of each other. Combining values from the two systems may result in nonconformance with this specification.

1.3 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:

A802/A802M Practice for Steel Castings, Surface Acceptance Standards, Visual Examination
E8/ERM Test Methods for Tension Testing of Metallic Materials
E10 Test Method for Brinell Hardness of Metallic Materials
E18 Test Methods for Rockwell Hardness of Metallic Materials
E23 Test Methods for Notched Bar Impact Testing of Metallic Materials
E94 Guide for Radiographic Examination Using Industrial Radiographic Film
E165 Practice for Liquid Penetrant Examination for General Industry

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 pour, n—shall consist of all material melted and cast at one time.

3.2 Lot Definitions:

3.2.1 castings, n—a lot shall consist of all castings produced from the same pour.

4. Ordering Information

4.1 Orders for castings to this specification shall include the following, as required to describe the requirements adequately.

4.1.1 Description of the castings by pattern number or drawing (dimensional tolerances shall be included on the casting drawing),

4.1.2 Quantity,

4.1.3 Grade Designation (see Table 1),

4.1.4 Options in the specification, and

4.1.5 Supplementary requirements desired, including the standards of acceptance.

5. Materials and Manufacture

5.1 Material for this specification shall be melted by conventional processes used for reactive metals. Typical methods include the consumable electrode and inductoslag melting processes.

6. Chemical Composition

6.1 Pour Analysis—An analysis of each pour shall be made by the producer from a sample such as a casting or test bar that is representative of the pour. The chemical composition determined shall conform to the requirements specified for the relevant grade in Table 1.

6.1.1 The elements listed in Table 1 are intentional alloying additions of elements which are inherent to the manufacture of primary zirconium, zirconium sponge, mill product or castings.

6.1.2 Elements other than those listed in Table 1 are deemed to be capable of occurring in the grades listed in Table 1 by and only by way of unregulated or unanalyzed scrap.

6. Mechanical Properties

6.1 Mechanical Testing - Supplementary Requirement S6 is mandatory.
7. Heat Treatment

7.1 Unless otherwise specified in the contract, all castings shall be supplied in the as-cast condition except when post-weld heat treatment is required.

7.2 If post-weld heat treatment is required, it shall consist of a stress relief performed at 1050 ± 50°F [565 ± 25°C] for a minimum of ½ h at temperature plus an additional ½ h at temperature per inch of thickness for section sizes greater than 1 in. [25 mm]. After heat treatment, the castings should be cooled in air or in the furnace to ambient temperature unless otherwise agreed upon between the purchaser and producer.

8. Workmanship, Finish, and Appearance

8.1 All castings shall be made in a workmanlike manner and shall conform to the dimensions in drawings furnished by the purchaser before manufacturing is started. If the pattern is supplied by the purchaser, the dimensions of the casting shall be as predicted by the pattern.

8.2 The surface of the casting shall be free of adhering mold material, scale, cracks, and hot tears as determined by visual examination. Other surface discontinuities shall meet the visual acceptance standards specified in the order. Practice A802/ A802M or other visual standards may be used to define acceptable surface discontinuities and finish. Unacceptable surface discontinuities shall be removed, and their removal verified by visual examination of the resultant cavities.

9. Repair by Welding

9.1 If repairs are required, these shall be made using a welding procedure and operators certified to quality requirements established by the producer. The procedures developed shall be consistent with standard practices recommended for reactive metal alloys. The producer shall maintain documentation on procedure and welder qualifications. Procedure modifications or special arrangements shall be as agreed upon between the producer and purchaser.

9.2 Weld repairs shall be considered major in the case of a casting that has leaked on a hydrostatic test or when the depth of the cavity after preparation for repair exceeds 20 % of the actual wall thickness or 1 in. [25 mm], whichever is smaller, or when the surface area of the cavity exceeds approximately 10 in.² [6500 mm²]. All other weld repairs shall be considered minor. Major and minor repairs shall be subject to the same quality standards as are used to inspect the castings.

9.3 The composition of the deposited weld metal shall be within the chemical requirements for each grade established in Table 1.

9.4 All castings with major weld repairs shall be stress relieved after repair in accordance with 7.2. Stress relief after minor repairs is not required for grades 702C and 704C except by agreement between the producer and the purchaser. Grade 705C must be stress relieved after any weld repair.

10. Inspection

10.1 The producer shall afford the purchaser’s inspector all reasonable facilities necessary to satisfy him that the material
11. Repair by Welding

11.1 All welding, including repairs, shall be made using welders, welding operators, and welding procedures qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code and certified to the quality requirements established by the producer. The procedures developed shall be consistent with standard practices recommended for reactive metal alloys. The producer shall maintain documentation on procedure and welder qualifications. Procedure modifications or special arrangements shall be as agreed upon between the producer and purchaser.

11.2 The composition of the deposited weld metal shall be within the chemical requirements for each grade established in Table 1. Filler metals, if used for weld repair, must conform to those filler metal compositions as shown in ASME SFA-5.24/SFA-5.24M (Specification for Zirconium and Zirconium - Alloy Welding Electrodes and Rods).
is being produced and furnished in accordance with this specification. Foundry inspection by the purchaser shall not interfere unnecessarily with the producer’s operations. All tests and inspections, with the exception of product analysis (6.3), shall be made at the place of manufacture, testing, or inspection unless otherwise agreed upon.

11. Rejection

11.1 Any rejection based on test reports shall be reported to the producer within 60 days from the receipt of the test reports by the purchaser.

11.2 Material that shows unacceptable discontinuities as determined by the acceptance standards specified on the order, subsequent to acceptance at the producer’s works, will be rejected, and the producer shall be notified within 60 days, or as otherwise agreed upon.

12. Certification

12.1 A producer or supplier shall furnish the purchaser with a certificate that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. The certificate shall include a report of the test results.

13. Product Marking

13.1 Unless otherwise specified, the following shall apply:

13.1.1 Castings shall be marked for material identification with the ASTM specification number (B752) and grade symbol, that is, 702C, 704C, or 705C.

13.1.2 The producer’s name or identification mark and the pattern number shall be cast or stamped using low stress stamps on all castings. Small size castings may be such that marking must be limited consistent with the available area.

13.1.3 The marking of lot numbers on individual castings shall be agreed upon between the producer and the purchaser.

13.1.4 Marking shall be in such a position as not to injure the usefulness of the casting.

14. Keywords

14.1 castings; corrosion-resistant; zirconium; zirconium alloys

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall be applied only when specified by the purchaser. Details of the supplementary requirements shall be agreed upon between the producer and purchaser. The specified tests shall be performed by the producer prior to shipment of the castings.

S1. Radiographic Examination

S1.1 The castings shall be examined for internal defects by means of X rays or gamma rays. The procedure shall be in accordance with Guide E94 and types and degrees of discontinuities shall be judged by Reference Radiographs E446. The extent of examination and basis for acceptance shall be agreed upon between the producer and purchaser.

S2. Liquid Penetrant Examination

S2.1 The castings shall be examined for surface discontinuities by means of liquid penetrant examination. The examination shall be in accordance with Test Method E165. Areas to be tested, and methods and types of liquid penetrants to be used, developing procedure, and basis for acceptance shall be agreed upon between the producer and purchaser.

S3. Examination of Weld Preparation

S3.1 Cavities prepared for welding as a result of surface discontinuities, such as cracks, open porosity, and so forth shall be examined by means of liquid penetrant examination in order to verify removal of such discontinuities.

S3.2 Weld repairs that are made to eliminate discontinuities that are detected by radiography shall be re-radiographed to verify that unacceptable discontinuities have been removed.

S5. Prior Approval of Major Weld Repairs

S5.1 Major weld repairs as defined and agreed upon between the producer and purchaser shall be subject to the prior approval of the purchaser.

S6. Tension Test

S6.1 Tensile properties shall be determined on material representing each pour. Properties shall be determined in the as-cast condition unless the purchase order requires the properties be determined in the final condition after all heat treatments (including isostatic pressing) have been completed, or unless otherwise specified in the purchase order. The results shall conform to the requirements specified in Table S6.1.

S6.2 Test bars may be obtained from special test blocks cast for that purpose or cut from castings processed with a lot.

S6.3 Tensile tests shall be made in accordance with the requirements of Test Methods E8/E8M. Tensile properties shall be determined using a strain rate of 0.003 to 0.007 in./in./min (0.005 to 0.007 mm/mm/min) through the yield strength.

S6.4 If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted from the same pour.
S7. Hardness Test

S7.1 Hardness shall be determined on each lot. Hardness shall be determined in the as-cast condition unless the purchase order requires the hardness be determined in the final condition after all heat treatments (including isostatic pressing) have been completed or unless otherwise specified in the purchase order. The results shall conform to the requirements specified in Table S6.1.

S7.2 Hardness shall be determined on a sample cast for that purpose, or on a casting randomly selected from a lot. If a casting is used for a hardness sample, indentations shall be made in a surface that will not be subsequently machined. Hardness values reported shall be representative of the base metal of the castings and not of any surface contamination caused by mold-metal interactions.

S7.3 Hardness tests shall be made in accordance with the requirements of Test Methods E10 or E18.

S8. Hot Isostatic Pressing (HIP)

S8.1 Hot Isostatic Pressing (HIP) shall be used to improve as-cast properties or remove internal defects, or both. Temperature, time at temperature, and atmosphere shall be agreed upon between supplier and purchaser.

S8.2 HIP may be substituted for required thermal treatment provided all requirements for that treatment are met and temperatures detrimental to the material properties are not reached.

S9. Charpy Impact Test

S9.1 Charpy impact test properties shall be determined on material representing each lot. Three Charpy V-notch specimens shall be made from a test piece and tested in accordance with Test Methods E23. They shall be tested at room temperature unless otherwise agreed upon by the manufacturer and purchaser and reported as absorbed energy. The condition of the sample material and the acceptance limit shall be agreed to by both the purchaser and the supplier.

APPENDIX

(Nonmandatory Information)

X1. RATIONALE (COMMENTARY)

X1.1 This specification is intended for use by purchasers or producers, or both, of reactive metal castings for defining the requirements and ensuring the properties of castings for unique corrosion-resistant applications, that is, not for commodity items which must meet all potential purchasers’ requirements.

X1.1.1 Users are advised to use the specification as a basis for obtaining castings that will meet minimum acceptance requirements established and revised by consensus of the members of the committee.

X1.1.2 User requirements considered more stringent may be met by the addition to the purchase order of one or more supplementary requirements, which may include, but are not limited to, those listed in Sections S1 through S9.
## Table II-200-1
### Other Acceptable ASTM Editions (Cont’d)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Latest Adopted ASTM</th>
<th>Description</th>
<th>Other Acceptable ASTM Editions</th>
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<tr>
<td>SB-775</td>
<td>08</td>
<td>Identical except that certification and test reports have been made mandatory.</td>
<td>90 through 08</td>
</tr>
<tr>
<td>SB-804</td>
<td>02(R13)</td>
<td>Identical except that the following additional requirements apply, and certification is mandatory.</td>
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<tr>
<td>SB-815</td>
<td>02(R11)</td>
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<td>97 through 02(R11)</td>
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<tr>
<td>SB-818</td>
<td>03(R13)</td>
<td>Identical except for requiring a report of the test results.</td>
<td>98a through 03(R13)</td>
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<tr>
<td>SB-824</td>
<td>11</td>
<td>Identical except that tensile testing, certification, and reporting have been made mandatory.</td>
<td>93 through 11</td>
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<tr>
<td>SB-829</td>
<td>99</td>
<td>Identical except that certification has been made mandatory.</td>
<td>92 through 99</td>
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<td>SB-858</td>
<td>06(R12)</td>
<td>Identical.</td>
<td>95 through 06(R12)</td>
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<tr>
<td>SB-861</td>
<td>10</td>
<td>Identical for all grades, except for a revision to 22.1.2. For all prior editions, certification and reporting are mandatory.</td>
<td>05a through 10</td>
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<tr>
<td>SB-862</td>
<td>13a</td>
<td>Identical except that Supplementary Requirement S2 shall be mandatory. For editions prior to 08a, certification and reporting are mandatory.</td>
<td>95 through 13a</td>
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<tr>
<td>SB-906</td>
<td>02(R12)</td>
<td>Identical except that certification has been made mandatory.</td>
<td>00 through 02(R12)</td>
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<tr>
<td>SB-928/SB-928M</td>
<td>13</td>
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<td>04a through 13</td>
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<tr>
<td>SB-956/SB-956M</td>
<td>10e1</td>
<td>Identical except that certification and test report have been made mandatory.</td>
<td>07 through 10e1</td>
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<tr>
<td>SF-467</td>
<td>03a</td>
<td>Identical except that certification has been made mandatory.</td>
<td>...</td>
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<tr>
<td>SF-467M</td>
<td>03a</td>
<td>Identical except that certification has been made mandatory.</td>
<td>...</td>
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<tr>
<td>SF-468</td>
<td>06</td>
<td>Identical except that certification has been made mandatory.</td>
<td>...</td>
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<tr>
<td>SF-468M</td>
<td>06</td>
<td>Identical except that certification has been made mandatory.</td>
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## Table II-200-2
### Other Acceptable Non-ASTM Specifications

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<th>Description</th>
<th>Other Acceptable Editions [Note (1)]</th>
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<tr>
<td>SB/EN 1706</td>
<td>2010</td>
<td>Identical except for scope, marking, impregnation, welding, heat treatment, mechanical properties, and test reports as shown in the specification</td>
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**GENERAL NOTE:** The date of publication of the European Standards considered in this Guideline is the year of approval of the standard by CEN. This date appears in the body of the standard on the page starting with EN; dates appearing on the front page of an XX EN standard (e.g. XX = BS or NF or DIN or...) correspond only to the date of adoption by each member country.

**NOTE:** (1) “Other Acceptable Editions” refers exclusively to non-ASTM and non-ASME specifications listed.