

## AIBeCast® Prototype Material Specification

Effective: June 5, 2018

Revision A

### 1.0 SCOPE

#### 1.1 Form

This specification defines material requirements for **AIBeCast® 910**, **AIBeCast® 920** investment castings, Produced from rapid prototype manufacturing methods.

**1.1.1** Cast products produced to aerospace standards and commercial grade castings are not covered by this procedure. For aerospace compliant hardware, reference Materion Inc. document **AIBeCast®** Aerospace Material Specification. For commercial casting manufacturing, reference Materion Inc. document **AIBeCast®** Commercial Material Specification.

#### 1.2 Safety / Environmental

Handling Beryllium Containing Material in solid form poses no special health risk. Like many industrial materials, beryllium-containing materials may pose a health risk if recommended safe handling practices are not followed. Inhalation of airborne beryllium may cause a serious lung disorder in susceptible individuals. The Occupational Safety and Health Administration (OSHA) has set mandatory limits on occupational respiratory exposures. Read and follow the guidance in the Safety Data Sheet (SDS) before working with this material. For additional information on safe handling practices or technical data on Beryllium Containing Material, contact Materion Inc. EH&S Hotline @ USA: 800-862-4118, International: 216-383-4019.

### 2.0 APPLICABLE DOCUMENTS

The following documents form part of this specification to the extent specified herein. The applicable issue of these documents shall be the issue in effect on the date of the purchase order.

#### 2.1 Government

MIL-STD-129 Marking for Shipment and Storage

#### 2.2 ASTM Publications

ASTM E8 Standard Test Methods for Tension Testing of Metallic Materials  
ASTM E155 Standard Reference Radiographs for Inspection of Aluminum and Magnesium Castings  
ASTM E1417 Standard Practice for Liquid Penetrant Examination  
ASTM E1742 Standard Practice for Radiographic Examination

#### 2.3 SAE Publications

AMS 2175 Castings, Classification and Inspection of

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## 2.4 Materion Inc. Documents

Radiographic Specification for Al-Be Castings

BW-ELM-IN-3523 Method A for Liquid Penetrant Testing

BW-ELM-IN-0255 Method B for Liquid Penetrant Testing

BW-ELM-XR-3369 Computed Radiographic Testing

BW-ELM-IC-3439 Straightening and Weld Repair of Investment Castings

Safety Data Sheet (SDS) for the beryllium containing material being used or produced.

## 2.5 Definitions

Casting: The resulting metal hardware from a melt.

Melt: A single batch of molten metal on which all processing has been completed to yield a lot

Lot: All castings poured from a single melt.

Rapid Prototype: Any compatible hardware pattern from a customer or customer's file (e.g. CAD model, electronic file, electronic drawing, etc.) that may or may not have been produced from hard tooling, dimensional drawings, or complete features.

## 3.0 TECHNICAL REQUIREMENTS

### 3.1 Material Requirements

#### 3.1.1 Composition

Unless specifically indicated otherwise in the customer's purchase order (contract), rapid prototype castings shall conform to the percentages by weight, unless otherwise stated, shown in Table 1.

**TABLE 1**  
**Composition**

Element	Alloy 910		Alloy 920	
	Min.	Max.	Min.	Max.
Beryllium	56.0	68.0	58.0	70.0
Aluminum (3.1.1.1)	Bal.	Bal.	Bal.	Bal.
Nickel	2.4	3.5	N/A	2000 ppm
Silicon	N/A	2000 ppm	N/A	3000 ppm
Silver	N/A	2000 ppm	2.00	4.00
Cobalt	N/A	2000 ppm	0.65	1.50
Germanium	N/A	2000 ppm	0.40	1.20
Iron	N/A	4500 ppm	N/A	4500 ppm

#### 3.1.1.1 Aluminum content by balance

#### 3.1.2 Properties

Mechanical property testing will be performed if specifically required by the customer's purchase order (contract). If mechanical testing is required per the purchase order (contract), results will be for information only unless otherwise specified in the purchase order (contract). If required by the purchase order, (contract) **AlBeCast®** material shall conform to the mechanical properties shown in Table 2, determined by testing in accordance with ASTM E-8.

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**TABLE 2**  
**Minimum Ambient Temperature Tensile Properties of**  
**Integrally and Separately Cast Test Specimens**

<b>Alloy</b>	<b>910</b>	<b>920</b>
Ultimate Tensile Strength (ksi)	26.0	35.0
0.2% Offset Yield Strength (ksi)	18.0	28.0
% Elongation	2.0	2.5

**3.1.3** All test specimens, whether integrally cast or sacrificially machined, shall be from the same lot of material.

**3.2 Casting Requirements**

**3.2.1** Castings, as received by purchaser, as a minimum, shall meet the requirements of this specification.

**3.2.2** Delivery of hardware from customer furnished patterns and/or electronic files shall be based upon Materion Inc. receipt and acceptance of these patterns and/or files and successful translation of the data (if from electronic file) by Materion Inc.

**3.2.3** Contractual delivery dates shall only be established after customer furnished patterns and/or electronic files have been received and accepted through written documentation by Materion Inc. and/or the rapid prototype fabricator.

**3.2.4** Casting dimensions shall be the result of the supplied pattern or pattern electronic file.

**3.2.5** As appropriate, and if specifically indicated in the customer's purchase order (Contract), Materion Inc. will inspect and report a sample quantity of envelope dimensions as mutually agreed upon by both parties.

**3.2.6** Rapid prototype casting dimensions shall not be the basis of any acceptance criteria unless otherwise specifically indicated in the customers purchase order (Contract).

**3.2.7** The rapid prototype radiographic grade requirement shall be "for information only", unless stipulated otherwise by purchase order (Contract).

**3.2.8** Rapid prototype radiography shall be conducted in accordance with the Materion Inc. defined applicable requirements of ASTM E1742 and in process inspection as defined per Radiographic Specification for Al-Be Castings.

**3.2.9** Materion Inc. Engineering radiographic "defect maps" will be provided only if specifically required by the customer's purchase order (Contract).

**3.2.10** Hardware shall be visually inspected for general quality and linear surface indications only, such as, cracks, folds, laps, seams and tears.

**3.2.11** Visually detected linear or crack like surface indications will be verified or dismissed through Liquid Penetrant Testing (PT). Rough pattern artifacts shall not be cause for any PT rejection.

**3.2.12** As appropriate, and if specifically indicated in the customer's purchase order (Contract), Liquid Penetrant Inspection shall be conducted in accordance with the Materion Inc. defined applicable requirements of ASTM E1417 and in process inspection per BW-ELM-IN-3523 or BW-ELM-IN-0255.

**3.2.13** Castings may be repaired by welding in accordance with BW-ELM-IC-3439, when not restricted by the customer.

- 3.2.14 Castings may, unless specifically prohibited by the purchase order (contract), be cosmetically repaired using structural epoxies
- 3.2.15 Casting imperfections shall not be rejected if the discontinuity is determined to be removed in subsequent processing or finish machining operations.

**4.0 QUALITY ASSURANCE PROVISIONS**

- 4.1 Materion Inc. shall be responsible for coordinating all acceptance testing unless otherwise specified.
- 4.2 Acceptance Tests: Tests for composition, tensile properties, radiography, and liquid penetrant shall be performed in accordance with Table 3 on each casting, melt, or lot as requested by the procuring activity prior to purchase order (contract) acceptance.

**TABLE 3  
Test Specifications**

Test	Specification(s)
Tensile	ASTM E8
Radiography	Radiographic Testing, Reference Radiographs for AlBeCast Castings (ASTM E155, ASTM E1742, AMS 2175)
Fluorescent Penetrant	Liquid penetrant Testing (ASTM E1417, AMS 2175)
Chemical Composition	Table 1 of this document

Specifications contained within parentheses are referenced within the governing specification.

**4.3 Reports**

A certificate of conformance shall be supplied to document acceptance of each casting by serial number. These reports shall include the purchase order number, lot number, specification number, part number, and quantity.

**5.0 PREPARATION FOR DELIVERY**

- 5.1 Part Identification shall be in accordance with MIL-STD-129.
- 5.1.1 All parts from a casting shall be identified with a part number and a serial number.
- 5.2 Packaging: Castings shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the casting to ensure carrier acceptance and safe delivery.