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## Standard Specification for Titanium-6 Aluminum-4 Vanadium Alloy Castings for Surgical Implants (UNS R56406)<sup>1</sup>

This standard is issued under the fixed designation F 1108; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification provides material requirements for titanium-6 aluminum-4 vanadium alloy castings to be used in the manufacture of surgical implants.

1.2 The values stated in inch-pound units are to be regarded as the standard. The metric equivalents of inch-pound units may be approximate.

### 2. Referenced Documents

#### 2.1 *ASTM Standards:*

B 367 Specification for Titanium and Titanium Alloy Castings<sup>2</sup>

B 381 Specification for Titanium and Titanium Alloy Forgings<sup>2</sup>

B 600 Practice for Descaling and Cleaning Titanium and Titanium Alloy Surfaces<sup>2</sup>

E 8 Test Methods of Tension Testing of Metallic Materials<sup>3</sup>

E 120 Test Methods for Chemical Analysis of Titanium and Titanium Alloys<sup>4</sup>

E 1409 Test Method for Determination of Oxygen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique<sup>4</sup>

E 1447 Test Method for Determination Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity Method<sup>5</sup>

F 136 Specification for Wrought Titanium 6A1-4V ELI Alloy for Surgical Implant Applications<sup>6</sup>

F 601 Practice for Fluorescent Penetrant Inspection of Metallic Surgical Implants<sup>6</sup>

F 629 Practice for Radiography of Cast Metallic Surgical Implants<sup>6</sup>

#### 2.2 *ASQC Standard:*

C1 Specification of General Requirements for a Quality Control Program<sup>7</sup>

### 3. Materials and Manufacture

3.1 Parts conforming to this specification shall be produced by vacuum investment casting.

3.2 Parts covered by this specification shall be an annealed condition in the hot isostatically pressed condition.

NOTE 1—While hot isostatic processing (HIP) may enhance mechanical properties of Ti6Al4V castings, it has also been shown to reduce the scatter in mechanical properties and therefore increases the confidence in reliability of castings.

3.3 Surface defects may be repaired by welding.

3.3.1 Weld repair shall be carefully executed as per written procedures by individuals qualified to perform those procedures.

3.3.2 ELI weld rod conforming to Specification F 136 shall be used where filler metal is needed.

3.3.3 Weld repairs shall be performed prior to final thermal processing.

NOTE 2—Under certain circumstances, a weld repair will act as a stress riser. Therefore, care should be exercised in the location and extent of weld repair as it relates to regions of the implant where significant stresses might be incurred.

NOTE 3—While not covered by this specification, there are other thermal processes which meet specific needs of the implant manufacturer. These thermal treatments may be mutually agreed upon by the casting vendor and the implant manufacturer.

3.4 All alpha case shall be removed by suitable means such as chemical milling or machining prior to HIP processing.

3.5 Parts shall be furnished in the descaled and cleaned condition in accordance with B 600.

### 4. Chemical Composition

4.1 The analysis for chemical composition of the castings shall conform to the requirements prescribed in Table 1. Chemical analysis shall be performed on a representative specimen cast from each heat using the same general procedures used in casting implants.

4.1.1 Requirements for the major and minor elemental constituents are listed in Table 1. Also listed are important

<sup>7</sup> Available from American Society for Quality Control, 161 W. Wisconsin Ave., Milwaukee, WI 53203.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 02.04.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 03.05.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 03.06.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 13.01.