TC 150

INTERNATIONAL STANDARD

ISO 5832-3

Second edition
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Implants for surgery — Metallic materials —

Part 3:
Wrought titanium 6-aluminium 4-vanadium alloy

Implants chirurgicaux — Produits à base de métaux —

Partie 3: Alliage à forger à base de titane, d'aluminium 6 et de vanadium 4

Reference number
ISO 5832-3:1990(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5832-3 was prepared by Technical Committee ISO/TC 150, *Implants for surgery*.

This second edition cancels and replaces the first edition (ISO 5832-3:1978), of which it constitutes a technical revision: 4.1 is new, 5.1 is now based on an International Standard, and table 3 has been updated accordingly.

ISO 5832 consists of the following parts, under the general title *Implants for surgery — Metallic materials*:

— *Part 1: Wrought stainless steel*

— *Part 2: Unalloyed titanium*

— *Part 3: Wrought titanium 6-aluminium 4-vanadium alloy*

— *Part 4: Cobalt-chromium-molybdenum casting alloy*

— *Part 5: Wrought cobalt-chromium-tungsten- nickel alloy*

— *Part 6: Wrought cobalt-nickel-chromium- molybdenum alloy*

— *Part 7: Forgeable and cold-formed cobalt-chromium-nickel-molybdenum-iron alloy*

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— *Part 8: Wrought cobalt-nickel-chromium- molybdenum-tungsten-iron alloy*

— *Part 9: Wrought high nitrogen stainless steel*

Implants for surgery — Metallic materials —

Part 3:
Wrought titanium 6-aluminium 4-vanadium alloy

1 Scope

This part of ISO 5832 specifies the characteristics of, and corresponding test methods for, the wrought titanium alloy known as titanium 6-aluminium 4-vanadium alloy (Ti 6-Al 4-V alloy) for use in the manufacture of surgical implants.

NOTE 1 The mechanical properties of a sample obtained from a finished product made of this alloy may not necessarily comply with those specified in this part of ISO 5832.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 5832. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5832 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6892:1984, *Metallic materials — Tensile testing.*

Publication ETTC 2, *Microstructural standards for α + β titanium alloy bars,* 1979, the European Titanium Producers Technical Committee (ETTC).[1)]

3 Chemical composition

The heat analysis of the alloy when tested as specified in clause 6 shall comply with the chemical composition specified in table 1.

Table 1 — Chemical composition

Element	Composition limits % (*m*/*m*)
Aluminium	5,5 to 6,75
Vanadium	3,5 to 4,5
Iron	0,3 max.
Oxygen	0,2 max.
Carbon	0,08 max.
Nitrogen	0,05 max.
Hydrogen	0,015 max.[1)]
Titanium	Balance

1) Except for billets, for which the maximum hydrogen content shall be 0,01 % (*m*/*m*).

4 Microstructure

The microstructure, when examined as indicated in table 3, shall be alpha + beta globular, and shall correspond to photomicrographs A1 to A9 in Publication ETTC 2 for annealed material. The alloy shall be free of optically visible inclusions at magnification × 200.

5 Mechanical properties

5.1 Test pieces

Representative test pieces for the determination of mechanical properties shall be prepared in accordance with the provisions of ISO 6892.

1) Available from IMI Titanium Ltd., Technical Services Department, P.O. Box 704, Witton, Birmingham B6 7UR, United Kingdom. (This reference will be replaced by reference to an appropriate International Standard when available.)

5.2 Tensile test

The tensile properties of the alloy, determined as specified in clause 6, shall be in accordance with the requirements of table 2.

Should any of the test pieces not meet the specified requirements, or should they break outside the gauge limits, two further test pieces representative of the same batch shall be tested in the same manner. The alloy shall be deemed to comply only if both additional test pieces meet the specified requirements.

If any of the retests fails to meet the appropriate requirements, the product represented shall be deemed not to comply with this part of ISO 5832. However, the manufacturer may, if he so desires, re-heat-treat the material and resubmit it for testing in accordance with the requirements of this part of ISO 5832.

5.3 Bend test

Titanium alloy sheet or strip, when tested as specified in clause 6, shall not show any cracking on the outside surface of the test pieces.

6 Test methods

The test methods to be used in determining compliance with the requirements of this part of ISO 5832 shall be those given in table 3.

Table 2 — Mechanical properties of alloy in annealed condition

Form of alloy	Ultimate tensile strength min. MPa	Yield strength (0,2 % offset) min. MPa	Elongation[1] min. %	Reduction of area min. %	Mandrel diameter for bend test[2]
Sheet and strip	860	780	8	Not applicable	10 t
Bar[3]	860	780	10	25	Not applicable

1) Gauge length $= 5{,}65\sqrt{S_0}$ or 50 mm, where S_0 is the original cross-sectional area in square millimetres.
2) t = thickness of the sheet or strip.
3) Maximum diameter or thickness = 75 mm.

Table 3 — Test methods

Requirements	Relevant clause	Test method
Chemical composition	3	Recognized analytical procedures (ISO methods where these exist)
Microstructure	4	ETTC 2
Mechanical properties	5	
Ultimate tensile strength		ISO 6892
Yield strength		ISO 6892
Elongation		ISO 6892
Reduction of area		ISO 6892
Bend test		Bend the sheet or strip around a mandrel of the diameter specified in table 2.