BS EN 4685:2011

BSI Standards Publication

Aerospace series — Titanium Ti10V2Fe3Al — Bars — D < 110 mm — Rm ≥ 1 240 MPa

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 4685:2011.

The UK participation in its preparation was entrusted to Technical Committee ACE/61/-/49, Titanium and its Alloys for Aerospace Purposes.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 67358 0

ICS 49.025.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2011.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 4685

June 2011

ICS 49.025.30

English Version

Aerospace series - Titanium Ti10V2Fe3Al - Bars - D < 110 mm - Rm ≥ 1 240 MPa

Série aérospatiale - Titane Ti10V2Fe3Al - Barres - D < 110 mm - Rm ≥ 1 240 MPa

Luft- und Raumfahrt - Titan Ti10V2Fe3Al - Stangen - D < 110 mm - Rm ≥ 1 240 MPa

This European Standard was approved by CEN on 27 November 2010.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword

This document (EN 4685:2011) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard is part of the series of EN metallic material standards for aerospace applications. The general organization of this series is described in EN 4258.

This European Standard has been prepared in accordance with EN 4500-4.

1 Scope

This European Standard specifies the requirements relating to:

Titanium Ti-10V-2Fe-3Al
Bars
$D < 110$ mm
$R_m \geq 1\,240$ MPa

for aerospace applications.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2032-2, *Aerospace series — Metallic materials — Part 2: Coding of metallurgical condition in delivery condition*

EN 2954 (all parts), *Aerospace series — Macrostructure of titanium and titanium alloy wrought products*

EN 3684, *Aerospace series — Test methods — Titanium alloy wrought products — Determination of ß transus temperature — Metallographic method*

EN 4050-1, *Aerospace series —Test method for metallic materials — Part 1: General requirements*

EN 4258, *Aerospace series — Metallic materials — General organization of standardization — Links between types of EN standards and their use*

EN 4500-4, *Aerospace series — Metallic materials — Rules for drafting and presentation of material standards — Part 4: Specific rules for titanium and titanium alloys* [1)]

EN 4800-002, *Aerospace series — Titanium and titanium alloys — Technical specification — Part 002: Bar and section* [1)]

1) Published as ASD-STAN Prestandard at the date of publication of this standard.

1	Material designation		Titanium Ti-10V-2Fe-3Al									
2	Chemical composition %	Element	Al	V	Fe	O	C	N	Y	Other		Ti
										Each	Total	
		min.	2,60	9,00	1,60	–	–	–	–	–	–	Base
		max.	3,40	11,00	2,20	0,13	0,05	0,05	0,005	0,10	0,30	
3	Method of melting		Vacuum melted. Last melting by consumable electrode									
4.1	Form		Bars									
4.2	Method of production		Hot rolling									
4.3	Limit dimension(s)	mm	< 110									
5	Technical specification		EN 4800-002									
6.1	Delivery condition		Not heat treated									
	Heat treatment		–									
6.2	Delivery condition code		F according to EN 2032-2									
7	Use condition		Solution treated and aged									
	Heat treatment		[33-56] °C below the beta transus / ≥ 1 h / WQ + ≥ 480 °C / ≥ 8 h / AC									

Characteristics

8.1	Test sample(s)			–			
8.2	Test piece(s)			–			
8.3	Heat treatment			Solution treated and aged			
9	Dimensions concerned		mm	≤ 75		75 < *D* < 110	
10	Thickness of cladding on each face		%	–			
11	Direction of test piece			L		L	T [a]
12	T	Temperature	θ °C	Ambient			
13	T	Proof stress	$R_{p0,2}$ MPa	≥ 1 110		≥ 1 110	≥ 1 110
14	T	Strength	R_m MPa	≥ 1 240		≥ 1 240	≥ 1 240
15	T	Elongation	A %	≥ 4		≥ 4	≥ 4
16	T	Reduction of area	Z %	≥ 10		≥ 10	≥ 8
17	Hardness			–			
18	Shear strength	R_c	MPa	–			
19	Bending	k	–	–			
20	Impact strength			–			
21	C	Temperature	θ °C	–			
22	C	Time	h	–			
23	C	Stress	σ_a MPa	–			
24	C	Elongation	a %	–			
25	C	Rupture stress	σ_R MPa	–			
26	C	Elongation at rupture	A %	–			
27	Notes (see line 98)			a			

<table>
<tr><td rowspan="2">30</td><td rowspan="2">Microstructure</td><td>–</td><td>[33-56] °C below the beta transus / ≥ 1 h / WQ
+ ≥ 480 °C / ≥ 8 h / AC</td></tr>
<tr><td>7</td><td>Shall consist of primary alpha phase in a matrix of aged beta phase.
An unbroken continuous alpha phase network along prior beta phase grain boundaries is not acceptable.</td></tr>
<tr><td rowspan="2">44</td><td rowspan="2">External defects</td><td>–</td><td>See EN 4800-002.</td></tr>
<tr><td>6</td><td>Visual</td></tr>
<tr><td rowspan="2">51</td><td rowspan="2">Macrostructure</td><td>1</td><td>See EN 4800-002.</td></tr>
<tr><td>7</td><td>
<table>
<tr><td colspan="2">Delivery condition</td><td>Beta transus – 25 °C / 1 h / WQ</td></tr>
<tr><td>D
mm</td><td>Maximum acceptable macrostructure
EN 2954</td><td rowspan="4">No beta fleck. (No area without primary alpha phase greater than [0,76 × 0,76] mm).
Inspection from locations representing the top and the bottom end of each batch.</td></tr>
<tr><td>≤ 50</td><td>2MA2</td></tr>
<tr><td>50 < D ≤ 110</td><td>2MA3</td></tr>
</table>
</td></tr>
<tr><td rowspan="3">61</td><td rowspan="3">Internal defects</td><td>–</td><td>See EN 4800-002.</td></tr>
<tr><td>1</td><td>EN 4050-1</td></tr>
<tr><td>7</td><td>Class 5</td></tr>
<tr><td>86</td><td>β-transus temperature</td><td>–</td><td>See EN 3684.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>95</td><td>Marking inspection</td><td>–</td><td>–</td></tr>
<tr><td>96</td><td>Dimensional inspection</td><td>–</td><td>–</td></tr>
<tr><td>98</td><td>Notes</td><td>–</td><td>[a] Test sample over 55 mm thickness.</td></tr>
<tr><td>99</td><td>Typical use</td><td>–</td><td>–</td></tr>
</table>

100	–	Product qualification	–	–
				Qualification programme to be agreed between manufacturer and purchaser.

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™