BRITISH STANDARD

BS EN
3973:2006

Aerospace series — Steel FE-CM3801 (X5CrNiCuNb16-4) — Homogenized, solution treated and precipitation hardened — Investment casting — De ⩽ 50 mm — Rm ⩾ 1 030 MPa

The European Standard EN 3973:2006 has the status of a British Standard

ICS 49.025.10

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 3973:2006.

The UK participation in its preparation was entrusted by Technical Committee ACE/61, Metallic materials for aerospace purposes, to Panel ACE/61/-/15, Steels.

A list of organizations represented on ACE/61/-/15 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.

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 January 2007

ISBN 978 0 580 50084 8

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 3973

December 2006

ICS 49.025.10

English Version

Aerospace series - Steel FE-CM3801 (X5CrNiCuNb16-4) - Homogenized, solution treated and precipitation hardened - Investment casting - De ≤ 50 mm - Rm ≥ 1 030 MPa

Série aérospatiale - Acier FE-CM3801 (X5CrNiCuNb16-4) - Homogénéisé, mis en solution et durci par précipitation - Pièces moulées en cire perdue - De ≤ 50 mm - Rm ≥ 1 030 MPa

Luft- und Raumfahrt - Stahl FE-CM3801 (X5CrNiCuNb16-4) - Homogenisiet, lösungsgeglüht und ausgelagert - Feingußstücke durch Wachsausschmelzverfahren - De ≤ 50 mm - Rm ≥ 1 030 MPa

This European Standard was approved by CEN on 18 October 2006.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, 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: rue de Stassart, 36 B-1050 Brussels

Foreword

This document (EN 3973:2006) 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 June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

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, 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 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 standard has been prepared in accordance with EN 4500-5.

1 Scope

This standard specifies the requirements relating to:

Steel FE-CM3801 (X5CrNiCuNb16-4)
Homogenized, solution treated and precipitation hardened
Investment casting
$D_e \leq 50$ mm
$R_m \geq 1\,030$ 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 2103-3, *Aerospace series — Steel, nickel base and cobalt base alloy remelting stock and castings — Technical specification — Part 3 — Pre-production and production castings.*

EN 3484, *Aerospace series — Steel FE-CM61 — As cast — Reference heat treatment: homogenised, solution treated, precipitation hardened and sub zero — Remelting stock.* [1)]

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

EN 4436, *Aerospace series — Steel — Test methods — Determination of δ ferrite content.* [1)]

EN 4500-5, *Aerospace series — Metallic materials — Rules for drafting and presentation of material standards — Part 5: Specific rules for steels.* [1)]

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

1	Material designation		Steel FE-CM3801 (X5CrNiCuNb16-4)										
2	Chemical composition %	Element	C	Si	Mn	P	S	Cr	Ni	Cu	N_2	Nb+Ta	Fe
		min.	–	0,50	–	–	–	15,5	3,60	2,80	–	0,15	Base
		max.	0,06	1,00	0,70	0,04	0,03	16,7	4,60	3,50	0,05	0,40	
3	Method of melting		Air melted										
4.1	Form		Investment casting										
4.2	Method of production		Cast from remelting stock EN 3484										
4.3	Limit dimension(s)	mm	$D_e \leq 50$										
5	Technical specification		EN 2103-3										

6.1	Delivery condition	Homogenized, solution treated and precipitation hardened
	Heat treatment	1 150 °C / t = 1h 30 min / AC or OQ + 1 040 °C / t ≥ 30 min / AC or OQ / cool to $\theta \leq$ 20 °C + 540 °C / t = 1h 30 min / AC
6.2	Delivery condition code	U
7	Use condition	Delivery condition
	Heat treatment	–

Characteristics

8.1	Test sample(s)				Specimens cut from the casting	Separately cast
8.2	Test piece(s)				See EN 2103-3.	See EN 2103-3.
8.3	Heat treatment				Delivery condition	Delivery condition
9	Dimensions concerned			mm	Wall thickness ≤ 25 [a]	–
10	Thickness of cladding on each face			%	–	–
11	Direction of test piece				–	–
12	T	Temperature	θ	°C	Ambient	Ambient
13		Proof stress	$R_{p0,2}$	MPa	≥ 900	≥ 900
14		Strength	R_m	MPa	≥ 1 030	≥ 1 030
15		Elongation	A	%	≥ 4	≥ 6
16		Reduction of area	Z	%	≥ 12	≥ 12
17	Hardness				≥ 34 HRC	
18	Shear strength		R_c	MPa	–	
19	Bending		k	–	–	
20	Impact strength				–	
21	C	Temperature	θ	°C	–	
22		Time		h	–	
23		Stress	σ_a	MPa	–	
24		Elongation	a	%	–	
25		Rupture stress	σ_R	MPa	–	
26		Elongation at rupture	A	%	–	
27	Notes (see line 98)				[a]	

30	Microstructure	1	EN 4436
		2	One per batch
		3	Test piece appended to casting
		5	Delivery condition
		7	δ-ferrite content ≤ 15 %
35	Repair by welding	–	See EN 2103-3.
44	External defects	–	See EN 2103-3.
61	Internal defects	–	See EN 2103-3.
95	Marking inspection	–	See EN 2103-3.
96	Dimensional inspection	–	See EN 2103-3.
98	Notes	–	[a] For wall thickness > 25 mm, properties to be agreed between manufacturer and purchaser.
99	Typical use	–	–

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

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL