BS EN 4721:2014

BSI Standards Publication

Aerospace series — Steel X4CrNiMo16-5-1 (1.4418) — Air melted and electroslag remelted (ESR) — Hardened and tempered — Bar — De ≤ 200 mm — 900 MPa ≤ Rm ≤ 1 050 MPa

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 4721:2014.

The UK participation in its preparation was entrusted to Technical Committee ACE/61/-/15, Steels 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.

Published by BSI Standards Limited 2014

ISBN 978 0 580 84539 0
ICS 49.025.10

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 October 2014.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 4721

October 2014

ICS 49.025.10

English Version

Aerospace series - Steel X4CrNiMo16-5-1 (1.4418) - Air melted and electroslag remelted (ESR) - Hardened and tempered - Bar - De ≤ 200 mm - 900 MPa ≤ Rm ≤ 1 050 MPa

Série aérospatiale - Acier X4CrNiMo16-5-1 (1.4418) - Élaboré à l´air - Trempé et revenu - Barres - De ≤ 200 mm - 900 MPa ≤ Rm ≤ 1 050 MPa

Luft- und Raumfahrt - Stahl X4CrNiMo16-5-1 (1.4418) - Lufterschmolzen - Gehärtet- und angelassen - Stangen - De ≤ 200 mm -900 MPa ≤ Rm ≤ 1 050 MPa

This European Standard was approved by CEN on 4 January 2014.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 4721:2014 E

Contents

Foreword

This document (EN 4721:2014) 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 April 2015, and conflicting national standards shall be withdrawn at the latest by April 2015.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey 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 4500-005.

1 Scope

This European Standard specifies the requirements relating to:

Steel X4CrNiMo16-5-1 (1.4418)
Air melted and electroslag remelted (ESR)
Hardened and tempered
Bar
$D_e \leq 200$ mm
900 MPa $\leq R_m \leq$ 1 050 MPa

for aerospace applications.

NOTE Other common designation:
AIR: Z 8 CND 17-04.

2 Normative references

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

EN 2043, *Aerospace series — Metallic materials — General requirements for semi-finished product qualification (excluding forgings and castings)*

EN 2951, *Aerospace series — Metallic materials — Test method — Micrographic determination of content of non-metallic inclusions* [1)]

EN 4050-4, *Aerospace series — Test method for metallic materials — Ultrasonic inspection of bars, plates, forging stock and forgings — Part 4: Acceptance criteria*

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

EN 4500-005, *Aerospace series — Metallic materials — Rules for drafting and presentation of material standards — Part 005: Specific rules for steels*

EN 4700-002, *Aerospace series — Steel and heat resisting alloys — Wrought products — Technical specification — Part 002: Bar and section*

EN ISO 643, *Steels — Micrographic determination of the apparent grain size (ISO 643:2003)*

AMS 2315, *Determination of delta ferrite content* [2)]

---

1) Published as ASD-STAN Prestandard at the date of publication of this standard (www.asd-stan.org).

2) Published as SAE National (US) Society of Automotive Engineers (http://www.sae.org/).

1	Material designation		Steel X4CrNiMo16-5-1 (1.4418)									
2	Chemical composition %	Element	C	Si	Mn	P [a]	S [a]	N	Cr	Mo	Ni	Fe
		min.	–	–	–	–	–	0,020	15,00	0,80	4,00	Base
		max.	0,06	0,70	1,50	0,030	0,005	–	17,00	1,50	6,00	
3	Method of melting		Air melted and electroslag remelted (ESR)									
4.1	Form		Bar									
4.2	Method of production		–									
4.3	Limit dimension(s)	mm	$D_e \leq 200$ mm									
5	Technical specification		EN 4700-002									

6.1	Delivery condition	Annealed	Hardened and tempered
	Heat treatment	–	1 010 °C ≤ θ ≤ 1 060 °C / OQ or WQ [b] + Tempered 580 °C ≤ θ ≤ 610 °C
6.2	Delivery condition code	A	U
7	Use condition	Hardened and tempered	Delivery condition
	Heat treatment	1 010 °C ≤ θ ≤ 1 060 °C / OQ or WQ [b] + Tempered 580 °C ≤ θ ≤ 610 °C	–

Characteristics

8.1	Test sample(s)			–	–	
8.2	Test piece(s)			–	–	
8.3	Heat treatment			Delivery condition	Use condition	
9	Dimensions concerned		mm	$D_e \leq 200$	$D_e \leq 75$	$75 < D_e \leq 200$
10	Thickness of cladding on each face		%	–	–	–
11	Direction of test piece			–	L	LT
12	T	Temperature	θ °C	Ambient	Ambient	Ambient
13	T	Proof stress	$R_{p0,2}$ MPa	–	≥ 700	≥ 700
14	T	Strength	R_m MPa	–	$900 \leq R_m \leq 1\,050$	$900 \leq R_m \leq 1\,050$
15	T	Elongation	A %	–	≥ 16	≥ 12
16	T	Reduction of area	Z %	–	–	–
17	Hardness			HBW ≤ 293	269 ≤ HBW ≤ 331	269 ≤ HBW ≤ 331
18	Shear strength		R_c MPa	–	–	–
19	Bending		k –	–	–	–
20	Impact strength		KV J	–	≥ 120 J at 20 °C Notch direction T ≥ 70 J at – 40 °C Notch direction T	≥ 60 J at 20 °C Notch direction L ≥ 35 J at – 40°C Notch direction L
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, b		

30	Microstructure	–	EN 4700-002
		1	See AMS 2315.
		7	The δ ferrite content shall not exceed 5 %
34	Grain size	–	EN 4700-002
		1	See EN ISO 643.
		7	G ≥ 5 or finer
44	External defects	–	EN 4700-002
50	Cleanliness/inclusion content (micro cleanness)	–	EN 4700-002
		1	See EN 2951.
		7	Category 4
61	Internal defects	–	EN 4700-002
		1	See EN 4050-4.
		7	Class 5
95	Marking inspection	–	EN 4700-002
96	Dimensional inspection	–	EN 4700-002
98	Notes	–	[a] For specific welding applications (e.g. high power beam), and after agreement between manufacturer and purchaser, S+P should be equal or less than 0,023 %. [b] Air quenching may be used for $D_e \leq 20$ mm.
99	Typical use	–	–

100	–	Product qualification	–	EN 2043
				Qualification programme to be agreed between manufacturer and purchaser.

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.™