BS EN 4376:2016

BSI Standards Publication

Aerospace series — Heat resisting alloy NiCr19Fe19Nb5Mo3 (2.4668) solution treated and precipitation treated — Bar and section, De ≤ 200 mm

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National foreword

This British Standard is the UK implementation of EN 4376:2016.

The UK participation in its preparation was entrusted to Technical Committee ACE/61/-/48, Heat Resisting 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.

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

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English Version

Aerospace series - Heat resisting alloy NiCr19Fe19Nb5Mo3 (2.4668) solution treated and precipitation treated - Bar and section, De ≤ 200 mm

Série aérospatiale - Alliage résistant à chaud NiCr19Fe19Nb5Mo3 (2.4668) mis en solution et précipté - Barres et profilés, De ≤ 200 mm

Luft- und Raumfahrt - Hochwarmfeste Legierung NiCr19Fe19Nb5Mo3 (2.4668) lösungsgeglüht und ausgehärtet - Stangen und Profile, De ≤ 200 mm

This European Standard was approved by CEN on 28 June 2014.

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

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

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European Foreword

This document (EN 4376:2016) 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of an identical text or by endorsement, at the latest by September 2016, and conflicting national standards shall be withdrawn at the latest by September 2016.

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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 4500-3.

1 Scope

This European Standard specifies the requirements relating to:

Heat resisting alloy NiCr19Fe19Nb5Mo3 (2.4668)
Solution treated and precipitation treated
Bar and section
$D_e \leq 200$ mm

for aerospace applications.

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

EN 4500-003, *Aerospace series — Metallic materials — Rules for drafting and presentation of material standards — Part 003: Specific rules for heat resisting alloys*

EN 4700-2, *Aerospace series — Steel and heat resisting alloys — Wrought products — Technical specification — Part 002: Bar and section*

1	Material designation		Heat resisting alloy NiCr19Fe19Nb5Mo3 (2.4668)									
2	Chemical composition %	Element	C	Si	Mn	P	S	Al	B	Co	Cr	Cu
		min.	0,02	-	-	-	-	0,20	20*)	-	17,0	-
		max.	0,80	0,35	0,35	0,015	0,015	0,80	60*)	1,00	21,0	0,30
		Element	Fe	Mg	Mo	Nb + Ta	Ti	Ag	Bi	Ca	Pb	Ni
		min.	16,5	-	2,80	4,80	0,70	-	-	-	-	Base
		max.	20,5	0,010	3,30	5,50	1,15	5*)	1*)	0,010	5*)	
3	Method of melting		Consumable electrode remelted									
4.1	Form		Bar and section									
4.2	Method of production		Wrought									
4.3	Limit dimension(s)	mm	$D_e \leq 200$									
5	Technical specification		EN 4700-2									

6.1	Delivery condition	Solution treated	Solution treated and precipitation treated
	Heat treatment	940 °C ≤ θ ≤ 980 °C/t = 1 h/AC or faster	940 °C ≤ θ ≤ 980 °C/t = 1 h/AC or faster + θ = 720 °C ± 10 °C/t = 8 h/FC at 50 °C per h ≤ θ ≤ 60° C per h [1)] to θ = 620 °C ± 10 °C/t = 8 h/AC
6.2	Delivery condition code	W	U
7	Use condition	Solution treated and precipitation treated	Delivery condition
	Heat treatment	Delivery condition +θ = 720 °C ± 10 °C/t = 8 h/FC at 50 °C per h ≤ θ ≤ 60° C per h [1)] to θ = 620 °C ± 10 °C/t = 8 h/AC	–

Characteristics

8.1	Test sample(s)		See EN 4700-2
8.2	Test piece(s)		See EN 4700-2
8.3	Heat treatment		Use condition
9	Dimension concerned	mm	$D_e \leq 200$

10	Thickness of cladding on each face			%	–			
11	Direction of test piece				L[2)]		LT[2)]	
12	T	Temperature	θ	°C	Ambient	650	Ambient	650
13		Proof stress	$R_{p0,2}$	MPa	1 035	860	1 035	860
14		Strength	R_m	MPa	1 270	1 000	1 240	960
15		Elongation	A	%	≥ 10	≥ 9	≥ 10	≥ 9
16		Reduction of area	Z	%	≥ 15	≥ 15	≥ 8	≥ 8
17	Hardness				≥ 331 HB			
18	Shear strength		R_c	MPa	–			
19	Bending		k	–	–			
20	Impact strength				–			
21	C	Temperature	θ	°C	650[3)]			
22		Time		h	t_R ≥ 23			
23		Stress	σ_a	MPa	-			
24		Elongation	a	%	-			

25		Rupture stress	σ_R	MPa	690
26		Elongation at ruture	A	%	≥ 5
27	Notes (see line 98)				*) 1) 2) 3)
30	Microstructure			–	See EN 4700-2
				2	The “capability clause” applies
				7	Homogeneous structure - No pronounced segregation
34	Grain size			–	See EN 4700-2
				7	G ≥ 3, 1 ≤ G < 3 accepted up to 5 % max. area
44	External defects			–	See EN 4700-2
51	Macrostructure			–	See EN 4700-2

		7	No harmful defects
61	Internal defects	–	See EN 4700-2
		7	Class 3
95	Marking inspection	-	See EN 4700-2
96	Dimensional inspection	-	See EN 4700-2
98	Notes	-	*) p.p.m. 1) If the rate of furnace cooling is outside this range then the precipitation time at 620 °C ± 10 °C shall be increased to ≥ 18 h. 2) If test results in LT direction are successfull, L test direction is not requested. 3) Combined notched-unnotched test piece.The rupture shall occur in the unnotched section.
99	Typical use	–	–
100	– Product qualification	–	See EN 2043 Qualification programme to be agreed between manufacturer and purchaser.

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