



BSI Standards Publication

**Aerospace series —
Steel X4CrNiMo16-5-1
(1.4418) — Air melted —
Hardened and tempered
— Bar — $D_e \leq 200$ mm —
 $900 \text{ MPa} \leq R_m \leq 1\,050 \text{ MPa}$**

National foreword

This British Standard is the UK implementation of EN 4631:2013. It supersedes BS EN 4631:2007, which is withdrawn.

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.

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EUROPEAN STANDARD

EN 4631

NORME EUROPÉENNE

EUROPÄISCHE NORM

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Supersedes EN 4631:2007

English Version

**Aerospace series - Steel X4CrNiMo16-5-1 (1.4418) - Air melted
- Hardened and tempered - Bar - $D_e \leq 200$ mm - $900 \text{ MPa} \leq R_m$
 $\leq 1\,050 \text{ MPa}$**

Série aérospatiale - Acier X4CrNiMo16-5-1 (1.4418) -
Élaboré à l'air - Trempé et revenu - Barres - $D_e \leq 200$ mm -
 $900 \text{ MPa} \leq R_m \leq 1\,050 \text{ MPa}$

Luft- und Raumfahrt - Stahl X4CrNiMo16-5-1 (1.4418) -
Lufterschmolzen - Gehärtet- und angelassen - Stangen -
 $D_e \leq 200$ mm - $900 \text{ MPa} \leq R_m \leq 1\,050 \text{ MPa}$

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Foreword

This document (EN 4631:2013) 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of an identical text or by endorsement, at the latest by August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.

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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 4500-005.

1 Scope

This European Standard specifies the requirements relating to:

Steel X4CrNiMo16-5-1 (1.4418)
Air melted
Hardened and tempered
Bar
 $D_e \leq 200$ mm
 $900 \text{ MPa} \leq R_m \leq 1\,050 \text{ MPa}$

for aerospace applications.

NOTE Other designation: Z 8 CND 17-04.
Only the chemical composition of this standard must be considered.

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 2950, *Aerospace series — Test method — Wrought heat resisting alloys — Semi-finished products and parts — Conditions for macrographic and micrographic examination — Atlas of structures and defects*

prEN 2951, *Aerospace series — Metallic materials — Test method — Micrographic determination of content of non-metallic inclusions*

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 4629, *Aerospace series — Steel FE-PM 3504 (X4CrNiMo16-5-1) — Air melted — Hardened and tempered — Forging stock — $D_e \leq 300$ mm*¹⁾

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)*

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

1) Published as ASD-STAN Standard 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 ^a	P ^b	S ^b	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									
4.1	Form		Bar									
4.2	Method of production		–									
4.3	Limit dimension(s)	mm	$D_e \leq 200$									
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 ^c + 550 °C ≤ θ ≤ 620 °C				
6.2	Delivery condition code		A					U				
7	Use condition		Hardened and tempered					Delivery condition				
	Heat treatment		Delivery condition + 1 010 °C ≤ θ ≤ 1 060 °C / OQ or WQ ^c + 550 °C ≤ θ ≤ 620 °C					–				

Characteristics

8.1	Test sample(s)		See EN 4700-002.										
8.2	Test piece(s)		See EN 4700-002.										
8.3	Heat treatment		Annealed					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	Temperature	θ	°C	Ambient					Ambient		Ambient		
13	Proof stress	$R_{p0,2}$	MPa	–					≥ 700		≥ 700		
14	T Strength	R_m	MPa	–					900 ≤ R_m ≤ 1 050		900 ≤ R_m ≤ 1 050		
15	Elongation	A	%	–					≥ 16		≥ 12		
16	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	Temperature	θ	°C	–									
22	Time		h	–									
23	C	Stress	σ_a	MPa									
24		Elongation	a	%									
25		Rupture stress	σ_R	MPa									
26		Elongation at rupture	A	%									
27		Notes (see line 98)		a, b, c									

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	$G \geq 5$
44	External defects	–	EN 4700-002
		7	Visual
50	Cleanliness/inclusion content (micro cleanness)	–	EN 4700-002
		1	See EN 2951.
		7	Category 2
51	Macrostructure (grain flow)	–	EN 4700-002
		1	See EN 2950.
61	Internal defects	–	EN 4700-002
		1	See EN 4050-4.
		7	Class 4
95	Marking inspection	–	EN 4700-002
96	Dimensional inspection	–	EN 4700-002
98	Notes	–	<p>^a Where a higher impact strength is required, the maximum Mn content may be increased to 2 % subject to agreement between the customer and the supplier.</p> <p>^b 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 %.</p> <p>^c Air quenching may be used for $D_e \leq 20$ mm.</p>
99	Typical use	–	–

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

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