



BSI Standards Publication

**Aerospace series — Steel FE-
PM1504 (X1CrNiMoAlTi12-10-2)
— Vacuum induction melted
and consumable electrode
remelted — Softened —
Forging stock — a or D \leq
300 mm**

National foreword

This British Standard is the UK implementation of EN 4672:2011.

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 4672

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English Version

**Aerospace series - Steel FE-PM1504 (X1CrNiMoAlTi12-10-2) -
Vacuum induction melted and consumable electrode remelted -
Softened - Forging stock - a or D ≤ 300 mm**

Série aéronautique - Acier FE-PM1504 (X1CrNiMoAlTi12-10-2) - Elaboré sous vide par induction et refondu à l'électrode consommable - Adouci - Produits destinés à la forge - a ou D ≤ 300 mm

Luft- und Raumfahrt - Stahl FE-PM1504 (X1CrNiMoAlTi12-10-2) - Vakuuminduktionserschmolzen und mit selbstverzehrender Elektrode umgeschmolzen - Weichgeglüht - Schmiedevormaterial - a oder D ≤ 300 mm

This European Standard was approved by CEN on 9 July 2010.

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Foreword

This document (EN 4672:2011) 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of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

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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 standard has been prepared in accordance with EN 4500-3.

1 Scope

This European Standard specifies the requirements relating to:

Steel FE-PM1504 (X1CrNiMoAlTi12-10-2)
Vacuum induction melted and consumable electrode remelted
Softened
Forging stock
a or $D \leq 300$ mm

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 2043, *Aerospace series — Metallic materials — General requirements for semi-finished product qualification (excluding forgings and castings)* ¹⁾

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

EN 4500-3, *Aerospace series — Metallic materials — Rules for drafting and presentation of material standards — Part 3: Specific rules for heat resisting alloys* ¹⁾

EN 4700-005, *Aerospace series — Steel and heat resisting alloys — Wrought products — Technical specification — Part 005: Forging stock* ¹⁾

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

1	Material designation			FE-PM1504 (X1CrNiMoAlTi12-10-2)											
2	Chemical composition %	Element	C	Si	Mn	P	S	Cr	Ni	Mo	Al	Ti	N ₂	Fe	
		min.	–	–	–	–	–	11,5	9,2	1,85	0,80	0,28	–	base	
		max.	0,015	0,10	0,10	0,010	0,005	12,5	10,2	2,15	1,10	0,40	0,01		
3	Method of melting			Vacuum induction melted and consumable electrode remelted											
4.1	Form			Forging stock											
4.2	Method of production			–											
4.3	Limit dimension(s)	mm		a or D ≤ 300											
5	Technical specification			EN 4700-005											
Characteristics															
6.1	Delivery condition			Softened											
	Heat treatment			–											
6.2	Delivery condition code			U											
7	Use condition			Delivery condition											
	Heat treatment			–											
Characteristics															
8.1	Test sample(s)			See EN 4700-005.				Forged or machined							
8.2	Test piece(s)			See EN 4700-005.				See EN 4700-005.							
8.3	Heat treatment			Delivery condition				See line 29							
9	Dimensions concerned	mm		a or D ≤ 300				a or D ≤ 75 ^a				75 ≤ a or D ≤ 300 ^a			
10	Thickness of cladding on each face	%		–				–				–			
11	Direction of test piece			–				L				T			
12	T	Temperature	θ	°C	–				Ambient				Ambient		
13		Proof stress	R _{p0,2}	MPa	–				≥ 1 300				≥ 1 300		
14		Strength	R _m	MPa	–				≥ 1 400				≥ 1 400		
15		Elongation	A	%	–				≥ 9				≥ 8		
16		Reduction of area	Z	%	–				≥ 50				≥ 45		
17	Hardness			≤ 363 HB				≥ 400 HB				≥ 400 HB			
18	Shear strength	R _c	MPa	–				–				–			
19	Bending	k	–	–				–				–			
20	Impact strength			–				Notch direction T KV ≥ 50 J; ambient + KV ≥ 20 J; at – 40 °C				Notch direction L KV ≥ 15 J; ambient + KV ≥ 15 J; at – 40 °C			
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										

29	Reference heat treatment	–	Solution treated and precipitation treated 820 °C ≤ θ ≤ 860 °C / OQ, AQ or WQ + cooling to θ ≤ 20 °C + 530 °C ≤ θ ≤ 550 °C / t ≥ 4 h / AC		
30	Microstructure	1	EN 4700-005		
		2	One per cast		
		3	Corresponding to ingot top		
		7	The δ ferrite content shall not exceed 2 %.		
44	External defects	–	See EN 4700-005.		
		1	Visual		
50	Cleanliness / inclusion content (micro-cleanness)	–	See EN 4700-005.		
		7	Category 5		
51	Macrostructure	–	See EN 4700-005.		
		7	Class	Condition	Severity
			1	Freckles	A
			2	White spots	A
			3	Radial segregation	A
4	Ring pattern	B			
61	Internal defects	–	See EN 4700-005.		
		6	<i>a</i> or <i>D</i> ≤ 200 mm may be tested either on the product or at an earlier stage of manufacturing.		
		7	Class 5		
95	Marking inspection	–	See EN 4700-005.		
96	Dimensional inspection	–	See EN 4700-005.		
98	Notes	–	^a 75 mm ≤ <i>a</i> or <i>D</i> ≤ 100 mm may be tested in L or T direction.		
99	Typical use	–	–		

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

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