



BSI Standards Publication

**Aerospace series — Steel FE-  
PM1507 (X1CrNiMoAlTi12-11-2)  
— Vacuum induction melted  
and consumable electrode  
remelted — Solution treated  
and precipitation treated —  
Bars — a or D  $\leq$  200 mm —  
Rm  $\geq$  1520 MPa**

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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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**Amendments issued since publication**

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EUROPEAN STANDARD

**EN 4656**

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2010

ICS 49.025.10

English Version

**Aerospace series - Steel FE-PM1507 (X1CrNiMoAlTi12-11-2) -  
Vacuum induction melted and consumable electrode remelted -  
Solution treated and precipitation treated - Bars - a or D ≤ 200  
mm - Rm ≥ 1520 MPa**

Série aérospatiale - Acier FE-PM1507 (X1CrNiMoAlTi12-11-2) - Élaboré sous vide par induction et refondu à l'électrode consommable - Mis en solution et vieilli - Barres - a ou D < 200 mm - Rm > 1 520 MPa

Luft- und Raumfahrt - Stahl FE-PM1507 (X1CrNiMoAlTi12-11-2) - Vakuuminduktionserschmolzen und mit selbstverzehrender Elektrode umgeschmolzen - Lösungsgeglüht und ausgelagert - Stangen - a oder D < 200 mm - Rm > 1 520 MPa

This European Standard was approved by CEN on 2 July 2010.

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## Contents

Page

Foreword.....	3
Introduction .....	4
1 <b>Scope</b> .....	5
2 <b>Normative references</b> .....	5

## Foreword

This document (EN 4656:2010) 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of an identical text or by endorsement, at the latest by June 2011, and conflicting national standards shall be withdrawn at the latest by June 2011.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 4500-5.

## 1 Scope

This European Standard specifies the requirements relating to:

Steel FE-PM1507 (X1CrNiMoAlTi12-11-2)  
Vacuum induction melted and consumable electrode remelted  
Solution treated and precipitation treated  
Bars  
 $a$  or  $D \leq 200$  mm  
 $R_m \geq 1\,520$  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 2043, *Aerospace series — Metallic materials — General requirements for semi-finished product qualification (excluding forgings and castings)* <sup>1)</sup>

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

EN 4500-5, *Aerospace series — Metallic materials — Rules for drafting and presentation of material standards — Part 5: Specific rules for steels* <sup>1)</sup>

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

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

1	Material designation		FE-PM1507 (X1CrNiMoAlTi12-11-2)											
2	Chemical composition %	Element	C	Si	Mn	P	S	Cr	Ni	Mo	Al	Ti	N <sub>2</sub>	Fe
		min.	–	–	–	–	–	11,0	10,25	1,75	1,35	0,20	–	base
		max.	0,015	0,10	0,10	0,010	0,005	12,5	11,25	2,25	1,75	0,50	0,01	
3	Method of melting		Vacuum induction melted and consumable electrode remelted											
4.1	Form		Bar											
4.2	Method of production		–											
4.3	Limit dimension(s)	mm	a or D ≤ 200											
5	Technical specification		EN 4700-002											

6.1	Delivery condition		Solution treated					Solution treated and precipitation treated				
	Heat treatment		840 °C ≤ θ ≤ 860 °C / 2 h / WQ + Sub-zero to θ – 75 °C / 8 h					840 °C ≤ θ ≤ 860 °C / 2 h / WQ + Sub-zero to θ – 75 °C / 8 h + 525 °C ≤ θ ≤ 545 °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 + 525 °C ≤ θ ≤ 545 °C / t ≥ 8 h / AC					–				

Characteristics

8.1	Test sample(s)		See EN 4700-002.												
8.2	Test piece(s)		See EN 4700-002.												
8.3	Heat treatment		Delivery condition					Use condition							
9	Dimensions concerned	mm	a or D ≤ 200					a or D ≤ 200 <sup>a</sup>			75 ≤ a or D ≤ 200 <sup>a</sup>				
10	Thickness of cladding on each face	%	–					–			–				
11	Direction of test piece		–					L			T				
12	Temperature	θ	°C	–					Ambient			Ambient			
13	Proof stress	R <sub>p0,2</sub>	MPa	–					≥ 1 380			≥ 1 380			
14	T Strength	R <sub>m</sub>	MPa	–					≥ 1 520			≥ 1 520			
15	Elongation	A	%	–					≥ 10			≥ 10			
16	Reduction of area	Z	%	–					≥ 50			≥ 40			
17	Hardness		≤ 363 HB					≥ 426 HB			≥ 426 HB				
18	Shear strength	R <sub>c</sub>	MPa	–					–			–			
19	Bending	k	–	–					–			–			
20	Impact strength		–					Notch direction T KV ≥ 30 J; ambient			Notch direction L KV ≥ 25 J; ambient				
21	Temperature	θ	°C	–											
22	Time		h	–											
23	Stress	σ <sub>a</sub>	MPa	–											
24	Elongation	a	%	–											
25	Rupture stress	σ <sub>R</sub>	MPa	–											
26	Elongation at rupture	A	%	–											
27	Notes (see line 98)		a												



30	Microstructure	1	EN 4700-002		
		2	One per cast		
		3	Corresponding to ingot top		
		7	The $\delta$ ferrite content shall not exceed 2 %.		
34	Grain size	–	See EN 4700-002.		
		7	$G \geq 6$ , some 5 accepted		
44	External defects	–	See EN 4700-002.		
		1	Visual		
50	Cleanliness / inclusion content (micro-cleanness)	1	EN 4700-002		
		7	Category 5		
51	Macrostructure	–	See EN 4700-002.		
		7	Class	Condition	Severity
			1	Freckles	A
			2	White spots	A
			3	Radial segregation	A
			4	Ring pattern	B
61	Internal defects	–	See EN 4700-002.		
		6	$a$ or $D \leq 100$ mm may be tested either on the product or at an earlier stage of manufacturing		
		7	Class 5		
95	Marking inspection	–	See EN 4700-002.		
96	Dimensional inspection	–	See EN 4700-002.		
98	Notes	–	<sup>a</sup> $75$ mm $\leq a$ or $D \leq 200$ mm may be tested in L or T direction.		
99	Typical use	–	–		

100	-	Product qualification	-	See EN 2043.

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