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SIST EN 4465:2009

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EUROPEAN STANDARD

EN 4465

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2007

ICS 49.025.10

English Version

**Aerospace series - Steel FE-PM1506 (X5CrNiMoAl13-8-2) -  
Vacuum induction melted and consumable electrode remelted -  
Solution treated and precipitation treated - Forgings - a or D ≤  
150 mm - Rm ≥ 1 300 MPa**

Série aérospatiale - Acier FE-PM1506 (X5CrNiMoAl13-8-2)  
- Élaboré sous vide par induction et refondu à l'électrode  
consommable - Mis en solution et vieilli - Pièces forgées et  
pièces matricées - a ou D ≤ 150 mm - Rm ≥ 1 300 MPa

Luft- und Raumfahrt - Stahl FE-PM1506 (X5CrNiMoAl13-8-  
2) - Vakuuminduktionserschmolzen und mit  
selbstverzehrender Elektrode umgeschmolzen -  
Lösungsgeglüht und ausgelagert - Schmiedestücke - a  
oder D ≤ 150 mm - Rm ≥ 1 300 MPa

This European Standard was approved by CEN on 15 February 2007.

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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 Management Centre has the same status as the official versions.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

**EN 4465:2007 (E)****Foreword**

This document (EN 4465:2007) 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of an identical text or by endorsement, at the latest by January 2008, and conflicting national standards shall be withdrawn at the latest by January 2008.

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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 4500-5.

## 1 Scope

This standard specifies the requirements relating to:

Steel FE-PM1506 (X5CrNiMoAl13-8-2)  
Vacuum induction melted and consumable electrode remelted  
Solution treated and precipitation treated  
Forgings  
 $a$  or  $D \leq 150$  mm  
 $R_m \geq 1\,300$  MPa

for aerospace applications.

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

EN 4347, *Aerospace series — Steel FE-PM1506 (X3CrNiMoAl13-8-2) — Vacuum induction melted and consumable electrode remelted — Softened — Forging stock —  $a$  or  $D \leq 300$  mm.* <sup>1)</sup>

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 4700-6, *Aerospace series — Steel and heat resisting alloys — Wrought products — Technical specification — Part 6: Pre-production and production forgings.* <sup>2)</sup>

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

2) In preparation at the date of publication of this standard.

## EN 4465:2007 (E)

1	Material designation		Steel FE-PM1506 (X5CrNiMoAl13-8-2)											
2	Chemical composition %	Element	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Ti	N <sub>2</sub>	Fe
		min.	–	–	–	–	–	12,25	2,00	7,50	0,8	–	–	Base
		max.	0,05	0,10	0,10	0,010	0,005	13,25	2,50	8,50	1,10	0,50	0,010	
3	Method of melting		Vacuum induction melted and consumable electrode remelted											
4.1	Form		Forgings											
4.2	Method of production		Forged from forging stock EN 4347											
4.3	Limit dimension(s)	mm	$a$ or $D \leq 150$											
5	Technical specification		EN 4700-6											

6.1	Delivery condition		Solution treated				Solution treated and precipitation treated			
	Heat treatment		830 °C ≤ $\theta$ ≤ 930 °C / OQ, AQ or WQ + cooling to $\theta \leq 20$ °C				830 °C ≤ $\theta$ ≤ 930 °C / OQ, AQ or WQ + cooling to $\theta \leq 20$ °C + 530 °C ≤ $\theta$ ≤ 550 °C / t ≥ 4 h / AC			
6.2	Delivery condition code		W				U			
7	Use condition		Solution treated and precipitation treated				Delivery condition			
	Heat treatment		Solution treated + 530 °C ≤ $\theta$ ≤ 550 °C / t ≥ 4 h / AC				–			

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Characteristics

8.1	Test sample(s)		See EN 4700-6.												
8.2	Test piece(s)		See EN 4700-6.												
8.3	Heat treatment		Delivery condition				Use condition								
9	Dimensions concerned	mm	$a$ or $D \leq 150$				$a$ or $D \leq 150$ <sup>a</sup>				$75 \leq a$ or $D \leq 150$				
10	Thickness of cladding on each face	%	–				–				–				
11	Direction of test piece		–				L				T				
12	Temperature	$\theta$	°C	–				Ambient				Ambient			
13	Proof stress	R <sub>p0,2</sub>	MPa	–				≥ 1 200				≥ 1 200			
14	T Strength	R <sub>m</sub>	MPa	–				≥ 1 300				≥ 1 300			
15	Elongation	A	%	–				≥ 11				≥ 9			
16	Reduction of area	Z	%	–				≥ 50				≥ 45			
17	Hardness		≤ 363 HB				≥ 380 HB				≥ 380 HB				
18	Shear strength	R <sub>c</sub>	MPa	–				–				–			
19	Bending	k	–	–				–				–			
20	Impact strength		–				KV ≥ 50 J ; Notch direction T + KV ≥ 20 J, at – 40 °C ; Notch direction T				KV ≥ 40 J ; Notch direction L + KV ≥ 15 J, at – 40 °C ; Notch direction L				
21	Temperature	$\theta$	°C	–											
22	Time		h	–											
23	Stress	$\sigma_a$	MPa	–											
24	Elongation	a	%	–											
25	Rupture stress	$\sigma_R$	MPa	–											
26	Elongation at rupture	A	%	–											
27	Notes (see line 98)		a												

34	Grain size	–	See EN 4700-6.
		7	$G \geq 6$
44	External defects	–	See EN 4700-6.
61	Internal defects	–	See EN 4700-6.
		7	Class 5
82	Batch uniformity	–	See EN 4700-6.
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95	Marking inspection	–	See EN 4700-6.
96	Dimensional inspection	–	See EN 4700-6.
98	Notes	–	<sup>a</sup> $75 \text{ mm} \leq a \text{ or } D \leq 150 \text{ mm}$ may be tested in L or T direction.
99	Typical use	–	–

## EN 4465:2007 (E)

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