



SLOVENSKI STANDARD  
SIST EN 4461:2009

01-maj-2009

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Ta slovenski standard je istoveten z: EN 4461:2007

<b>ICS:</b>		
49.025.10	Jekla	Steels
<b>SIST EN 4461:2009</b>		<b>en,de</b>

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EUROPEAN STANDARD

EN 4461

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 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 - Bar - a or D ≤ 150  
mm - Rm ≥ 1 200 MPa

Série aérospatiale - Acier FE-PM1506 (X5CrNiMoAl13-8-2)  
- Elaboré sous vide par induction et refondu à l'électrode  
consommable - Mis en solution et vieilli - Barres - a ou D ≤  
150 mm - Rm ≥ 1 200 MPa

Luft- und Raumfahrt - Stahl FE-PM1506 (X5CrNiMoAl13-8-  
2) - Vakuuminduktionserschmolzen und mit  
selbstverzehrender Elektrode umgeschmolzen -  
Lösungsgeglüht und ausgelagert - Stangen - a oder D ≤  
150 mm - Rm ≥ 1 200 MPa

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

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

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 4461:2007 (E)****Foreword**

This document (EN 4461:2007) 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 December 2007 and conflicting national standards shall be withdrawn at the latest by December 2007

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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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  
Bar  
 $a$  or  $D \leq 150$  mm  
 $R_m \geq 1\,200$  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 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 4436, *Aerospace series — Steel — Test methods — Determination of  $\delta$  ferrite content*.<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 4700-2, *Aerospace series — Steel and heat resisting alloys — Wrought products — Technical specification — Part 2: Bar and section*.<sup>1)</sup>

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

## EN 4461:2007 (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		Bar											
4.2	Method of production		–											
4.3	Limit dimension(s)	mm	$a$ or $D \leq 150$											
5	Technical specification		EN 4700-2											

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 + 545 °C ≤ $\theta$ ≤ 565 °C / t ≥ 4 h / AC			
6.2	Delivery condition code		W				U			
7	Use condition		Solution treated and precipitation treated				Delivery condition			
	Heat treatment		Delivery condition + 545 °C ≤ $\theta$ ≤ 565 °C / t ≥ 4 h / AC				–			

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Characteristics

8.1	Test sample(s)		See EN 4700-2.												
8.2	Test piece(s)		See EN 4700-2.												
8.3	Heat treatment		Delivery condition				Use condition								
9	Dimensions concerned	mm	$a$ or $D \leq 150$ <sup>a</sup>				$a$ or $D \leq 150$ <sup>a</sup>				$75 \leq a$ or $D \leq 150$ <sup>a</sup>				
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	–				≥ 1 100				≥ 1 100			
14	T Strength	R <sub>m</sub>	MPa	–				≥ 1 200				≥ 1 200			
15	Elongation	A	%	–				≥ 12				≥ 10			
16	Reduction of area	Z	%	–				≥ 50				≥ 45			
17	Hardness		≤ 363 HB				≥ 360 HB				≥ 360 HB				
18	Shear strength	R <sub>c</sub>	MPa	–				–				–			
19	Bending	k	–	–				–				–			
20	Impact strength		–				KV ≥ 90 J ; Notch direction T + KV ≥ 30 J, at – 40 °C ; Notch direction T				KV ≥ 90 J ; Notch direction L + KV ≥ 30 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												

30	Microstructure	1	EN 4436		
		2	One per cast		
		3	Corresponding to ingot top		
		7	The $\delta$ -ferrite content shall not exceed 2 %		
34	Grain size	–	See EN 4700-2.		
		7	G $\geq$ 6		
44	External defects	–	See EN 4700-2.		
		1	Visual		
50	Cleanliness / inclusion content (micro-cleanness)	–	See EN 4700-2.		
		7	Category 5		
51	Macrostructure	–	See EN 4700-2.		
		7	Class	Condition	Severity
			1	Freckles	A
			2	White spots	A
			3	Radial segregation	A
	4	Ring pattern	B		
61	Internal defects	–	See EN 4700-2.		
		6	a or D $\leq$ 100 mm may be tested either on the product or at an earlier stage of manufacturing.		
		7	Class 5		
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95	Marking inspection	–	See EN 4700-2.		
96	Dimensional inspection	–	See EN 4700-2.		
98	Notes	–	<sup>a</sup> 75 mm $\leq$ a or D $\leq$ 150 mm may be tested in L or T direction.		
99	Typical use	–	–		

## EN 4461:2007 (E)

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