BRITISH STANDARD

BS EN
4346:2007

Aerospace series — Steel FE-PM1505 (X1CrNiMoAlTi12-9-2) — Vacuum induction melted and consumable electrode remelted, softened, forging stock a or D ⩽ 300 mm

ICS 49.025.10

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 4346:2007.

The UK participation in its preparation was entrusted by Technical Committee ACE/61, Metallic materials for aerospace purposes, to Panel ACE/61/-/15, Steels.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Aerospace series - Steel FE-PM1505 (X1CrNiMoAlTi12-9-2) - Vacuum induction melted and consumable electrode remelted, softended, forging stock a or D ≤ 300 mm

Série aérospatiale - Acier FE-PM1505 (X1CrNiMoAlTi12-9-2) - Élaboré 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-PM1505 (X1CrNiMoAlTi12-9-2) - Vakuuminduktionserschmolzen und mit selbstverzehrender Elektrode umgeschmolzen, weichgeglüht, Schmiedevormaterial a oder D ≤ 300 mm

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

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 4346:2007) 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of an identical text or by endorsement, at the latest by February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.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-PM1505 (X1CrNiMoAlTi12-9-2) — 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 2003-7, *Aerospace series — Steel, Test methods — Part 7: Macrographic test*[1)]

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

EN 2157-2, *Aerospace series — Steel — Forging stock and forgings — Technical specification — Part 2: Forging stock*

EN 4050-1, *Aerospace series — Test method for metallic materials — Ultrasonic inspection of bars, plates, forging stock and forgings — Part 1: General requirements*[1)]

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 δ ferrite content*[1)]

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

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

1	Material designation		Steel FE-PM1505 (X1CrNiMoAlTi12-9-2)											
2	Chemical composition %	Element	C	Si	Mn	P	S	Cr	Mo	Ni	Al	N_2	Ti	Fe
		min.	–	–	–	–	–	11,5	1,85	8,50	0,60	–	0,28	Base
		max.	0,015	0,10	0,10	0,010	0,005	12,5	2,15	9,50	0,80	0,010	0,37	
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 $D \leq 300$											
5	Technical specification		EN 2157-2											

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 2157-2	Forged or machined	
8.2	Test piece(s)			See EN 2157-2	See EN 2157-2	
8.3	Heat treatment			Delivery condition	See line 29	
9	Dimensions concerned		mm	*a* or $D \leq 300$	*a* or $D < 75$	$75 \leq a$ or $D \leq 300$
10	Thickness of cladding on each face		%	–	–	–
11	Direction of test piece			–	L	T
12	T	Temperature	θ °C	–	Ambient	Ambient
13	T	Proof stress	$R_{p0,2}$ MPa	–	≥ 1 300	≥ 1 300
14	T	Strength	R_m MPa	–	≥ 1 400	≥ 1 400
15	T	Elongation	A %	–	≥ 9	≥ 8
16	T	Reduction of area	Z %	–	≥ 50	≥ 40
17	Hardness			≤ 363 HB	≥ 400 HB	≥ 400 HB
18	Shear strength		R_c MPa	–	–	–
19	Bending		k –	–	–	–
20	Impact strength			–	KV ≥ 40 J; Notch direction T	KV ≥ 30 J; Notch direction L
21	C	Temperature	θ °C	–		
22	C	Time	h	–		
23	C	Stress	σ_a MPa	–		
24	C	Elongation	*a* %	–		
25	C	Rupture stress	σ_R MPa	–		
26	C	Elongation at rupture	A %	–		
27	Notes (see line 98)			–		

29	Reference heat treatment	–	Solution treated and precipitation treated 820 °C ≤ θ ≤ 860 °C / OQ, AQ or WQ + Cooling to θ ≤ 20 °C + 510 °C ≤ θ ≤ 530 °C / t ≥ 4 h / AC		
30	Microstructure	1	See EN 4436		
		2	One per cast		
		3	Corresponding to ingot top		
		5	See line 29		
		7	The δ-ferrite content shall not exceed 2 %		
44	External defects	–	See EN 2157-2		
50	Cleanliness/inclusion content (micro-cleanness)	–	See EN 2157-2		
		7	Category 5		
51	Macrostructure	1	EN 2003-7		
		7	Class	Condition	Severity
			1	Freckles	A
			2	White spots	A
			3	Radial segregation	A
			4	Ring pattern	B
61	Internal defects	–	See EN 2157-2		
		1	See EN 4050-1		
		7	Class 5		
95	Marking inspection	–	See EN 2157-2		
96	Dimensional inspection	–	See EN 2157-2		
98	Notes	–	–		
99	Typical use	–	–		

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

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