



BSI Standards Publication

AEROSPACE SERIES

Specification for nickel-chromium-cobalt-titanium-aluminium heat-resisting alloy billets, bars, forgings and parts (Nickel base, Cr 19.5, Co 18.0, Ti 2.5, Al 1.5)

Publishing and copyright information

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 January 2010. It was prepared by Panel ACE/61/-/48, *Heat resisting alloys*, under the authority of Technical Committee ACE/61, *Metallic materials for aerospace purposes*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

BS 3HR 2:2010+A2:2012 supersedes BS 3HR 2:2010+A1:2011, which is withdrawn.

Information about this document

The start and finish of text introduced or altered by Amendment No.2 is indicated in the text by tags $\boxed{A_2}$ $\triangleleft A_2$. Minor editorial changes are not tagged.

This is a full revision of BS HR 2. The principal change from the previous edition is that the requirements are stated in tabular format in accordance with EN 4500-1 and EN 4500-3.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

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.

1 Scope

This British Standard specifies requirements for nickel-chromium-cobalt-titanium-aluminium heat-resisting alloy supplied in the following forms, and as parts.

- a) Bars and extruded sections for machining: solution treated, designation HR 2A.
- b) Extruded sections for subsequent forming: softened, designation HR 2B.
- c) Billets and bars for forging: hot or cold worked and subsequently machined or ground, designation HR 2C.
- d) Forgings: solution treated, designation HR 2D.

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.

BS HR 100, *Procedure for inspection, testing and acceptance of wrought heat-resisting alloys*

3 Technical requirements

3.1 Material to this standard shall conform to Table 1, Table 2, Table 3 and Table 4.

NOTE The format and symbols used in Table 1, Table 2, Table 3 and Table 4 are derived from EN 4500-1 and EN 4500-3.

3.2 Parts finally heat-treated after machining shall conform to Section 1 and Section 8 of BS HR 100.

3.3 Parts shall be supplied in the solution treated and precipitation treated condition.

Table 1 Technical requirements for nickel-chromium-cobalt-titanium-aluminium heat-resisting alloy bars and extruded sections for machining

1	Material designation		BS HR 2							
2	Chemical composition %	Element	C	Si	Mn	S	Ag	Al	B	Bi
		Min.	—	—	—	—	—	1.0	—	—
		Max.	0.13	1.0	1.0	0.015	5 ppm	2.0	0.020	1 ppm
		Element	Co	Cr	Cu	Fe	Pb	Ti	Zr	Ni
		Min.	15.0	18.0	—	—	—	2.0	—	Base
		Max.	21.0	21.0	0.2	1.5	20 ppm	3.0	0.15	
3	Method of melting		Air melted; vacuum melted; air melted and vacuum refined; consumable electrode remelted							
4.1	Form		Bars and extruded sections for machining (HR 2A)							
4.2	Method of production		A ₂ Rolled, forged or extruded A ₂							
4.3	Limit dimension(s)	mm	—							
5	Technical specification		Sections 1 and 2 of BS HR 100							

6.1	Delivery condition		Solution treated							
	Heat treatment		$\theta = (1\,080 \pm 10)^\circ\text{C} / t = 8\text{ h} / \text{AC or OQ or WQ}^{1)}$							
6.2	Delivery condition code		W							
7	Use condition		Solution treated + precipitation treated							
	Heat treatment		Delivery condition + $\theta = (700 \pm 10)^\circ\text{C} / t = 16\text{ h} / \text{AC}$							

Characteristics

8.1	Test sample(s)			See Section 2 of BS HR 100		
8.2	Test piece(s)			See Section 2 of BS HR 100		
8.3	Heat treatment			Delivery condition		Use condition
9	Dimensions concerned		mm	—		
10	Thickness of cladding on each face		%	—		
11	Direction of test piece			—		L
12	T	Temperature	θ	°C	Ambient	Ambient
13		Proof stress	R _{p0.2}	MPa	—	≥ 695 ²⁾
14		Strength	R _m	MPa	—	≥ 1 080 ²⁾
15		Elongation	A	%	—	≥ 20 ²⁾
16		Reduction of area	Z	%	—	
17	Hardness			a or D ≤ 70 mm: HBW ≤ 277 or HV ≤ 295		HBW ≥ 293 or HV ≥ 310
18	Shear strength		R _c	MPa	—	
19	Bending		κ	—	—	
20	Impact strength			—		
21	C	Temperature	θ	°C	—	870
22		Time		h	—	t _R ≥ 30
23		Stress	σ _a	MPa	—	
24		Elongation	a	%	—	
25		Rupture stress	σ _R	MPa	—	140
26		Elongation at rupture	A	%	—	
27	Notes (see line 98)			1), 2)		