

BS 2HR 403:2011



BSI Standards Publication

## AEROSPACE SERIES

**Specification for nickel-  
chromium-titanium heat-  
resisting alloy seamless tubes  
(Nickel base, Cr 19.5, Ti 0.4)**

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The following BSI references relate to the work on this standard:

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 4, an inside back cover and a back cover.

## Foreword

### Publishing information

This British Standard is published by BSI and came into effect on 31 January 2011. It was prepared by Panel ACE/61/-/48, *Heat resisting alloys for aerospace purposes*, 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

This standard supersedes BS HR 403:1973, which is withdrawn.

### Information about this document

This is a full revision of BS HR 403 and introduces the following principal changes.

- a) Change in title.
- b) Requirements are stated in tabular format in accordance with EN 4500-1 and EN 4500-3.

### Hazard warnings

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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 methods are expressed either as a set of instructions or 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-titanium heat-resisting alloy seamless tubes.

## 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

Material to this standard shall conform to Table 1.

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

Table 1 Technical requirements for nickel-chromium-titanium heat-resisting alloy seamless tubes

1	Material designation		BS HR 403										
2	Chemical composition %	Element	C	Si	Mn	S	Co	Cr	Cu	Fe	Pb	Ti	Ni
		Min.	0.08	—	—	—	—	18.0	—	—	—	0.20	Base
		Max.	0.15	1.0	1.0	0.020	5.0	21.0	0.5	5.0	0.0050	0.60	
3	Method of melting		Electric process										
4.1	Form		Seamless tube										
4.2	Method of production		—										
4.3	Limit dimension(s)	mm	—										
5	Technical specification		Sections 1 and 6 of BS HR 100										

6.1	Delivery condition		Cold worked + softened										
	Heat treatment		1000 °C ≤ θ ≤ 1050 °C / AC or OQ or WQ <sup>1)</sup>										
6.2	Delivery condition code		U										
7	Use condition		Delivery condition										
	Heat treatment		—										

## Characteristics

8.1	Test sample(s)		See Section 6 of BS HR 100												
8.2	Test piece(s)		See Section 6 of BS HR 100												
8.3	Heat treatment		Use condition												
9	Dimensions concerned	mm	a < 0.5							a ≥ 0.5					
10	Thickness of cladding on each face	%	—												
11	Direction of test piece		L												
12	Temperature	θ	°C	Ambient											
13	T	Proof stress	R <sub>p0.2</sub>	MPa	—							≥ 300			
14		Strength	R <sub>m</sub>	MPa	690 ≤ R <sub>m</sub> ≤ 830							690 ≤ R <sub>m</sub> ≤ 830			
15		Elongation	A	%	—							≥ 30			
16		Reduction of area	Z	%	—										
17		Hardness		HV ≤ 230											
18	Shear strength	R <sub>c</sub>	MPa	—											
19	Bending	κ	—	—											
20	Impact strength		—												
21	C	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)		—												



## Bibliography

### Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 4500-1, *Metallic materials – Rules for the drafting and presentation of material standards – Part 1: General rules*<sup>1)</sup>

EN 4500-3, *Metallic materials – Rules for the drafting and presentation of material standards*

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





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