



DPC: 25 / 30398867 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: + 44 (0)20 8996 9000

Fax: + 44 (0)20 8996 7400

www.bsigroup.com

Date: 21 February 2025

Origin: National

Latest date for receipt of comments: 21 April 2025

Project No. 2019/02037

Responsible committee: ACE/12 Aerospace fasteners and fastening systems

Interested committees:

Title: Draft BS A 104 AEROSPACE SERIES Bolts, hexagonal heads with optional locking wire holes, unified threads, corrosion-resisting or heat-resisting steels, plain finish - Specification

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 21 April 2025**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: + 44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Responsible Editorial Project Manager: **Mary Groom**

Direct tel:

E-mail: mary.groom@bsigroup.com

Introduction

Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international and European standards, comments will be reviewed by the relevant UK national committee before submitting the consensus UK vote and comments. If the draft standard is approved, it is usual for the resulting published standard to be adopted as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

Annotated drafts are not acceptable and will be rejected.

All comments should be submitted online at <http://standardsdevelopment.bsigroup.com>. You will need to register in order to comment.

BS A 104:2025

AEROSPACE SERIES

Bolts, hexagonal heads with optional locking wire holes, unified threads, corrosion-resisting or heat-resisting steels, plain finish – Specification

Classification CR steel $R_m \geq 127\,600\text{ lbf/in}^2$ (880 MPa) at Ambient temperature | +515°C

Classification HR steel $R_m \geq 130\,500\text{ lbf/in}^2$ (900 MPa) at Ambient temperature | +515°C

Contents

Foreword	3
1	Scope 4
2	Normative references 4
3	Terms, definitions and abbreviated terms 5
3.1	Terms and definitions 5
3.2	Abbreviated terms 5
4	General requirements 5
5	Materials and manufacture 5
<i>Table 1 – Materials and material properties for manufacture of bolts</i> 6	
6	Dimensions and tolerances 6
7	Screw threads 6
8	Protective finish 7
9	Identification and marking 7
9.1	Identification 7
9.2	Marking 7
10	Quality assurance procedure 7
<i>Figure 1 – Outline dimensions of bolts (see Table 2a)</i> 8	
<i>Figure 2 – Outline dimensions of optional locking wire holes (see Table 2b)</i> 9	
<i>Table 2a – Outline dimensions of bolts</i> 10	
<i>Table 2b – Outline dimensions of locking wire holes</i> 12	
<i>Figure 3 – Bearing length L, clamping length M and overall length E (see Table 3)</i> 13	
<i>Table 3a – Bearing length L, clamping length M and overall length E</i> 14	
<i>Table 3b – Bearing length L, clamping length M and overall length E</i> 17	
<i>Table 3c – Bearing length L, clamping length M and overall length E</i> 21	
<i>Table 3d – Bearing length L, clamping length M and overall length E</i> 25	
<i>Table 3e – Bearing length L, clamping length M and overall length E</i> 28	
Bibliography	29

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 August 2025. It was prepared by Technical Committee ACE/12, *Aerospace fasteners and fastening*. A list of organizations represented on this committee can be obtained on request to the committee manager.

Supersession

This British Standard supersedes BS 4A 104:2002+A2:2012, which is withdrawn.

Information about this document

This is a full revision of the document.

NOTE Fasteners manufactured to previous editions of this specification may continue to be supplied until stocks are exhausted.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at knowledge.bsigroup.com, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Presentational conventions

The provisions of this document 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.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient’s own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute 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 materials and manufacture, dimensions, protective finish and quality assurance requirements for hexagon head bolts with unified threads for aerospace use.

It also caters for the bolts to have additional locking wire holes in the heads if so required.

It covers two material types:

- a) corrosion-resisting steel with a minimum tensile strength of 127 500 lbf/in² (880 MPa); and
- b) high-expansion heat-resisting steel with a minimum tensile strength of 130 500 lbf/in² (900 MPa).

Bolts made from this material are primarily intended for use for securing components made with aluminium, so to match its similar coefficient of thermal expansion (CTE).

NOTE The values in British units are to be regarded as the standard, with metric SI conversions in parentheses () as needs be.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application, of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4A 100:2003, *Specification for general requirements for bolts and free running nuts of tensile strength not exceeding 1 249 MPa*

BS S 80, *High chromium-nickel corrosion resisting steel forging stock, bars, forgings and parts (880 to 1 080 MPa: limiting ruling section 100 mm)*

BS S 143, *Specification for chromium-nickel-copper-molybdenum corrosion-resisting steel (precipitation hardening) billets, bars, forgings and parts (930-1080 MPa)*

BS HR 650, *Specification for high expansion heat-resisting steel bar and wire for the manufacture of bolts, studs, set screws and nuts (Ni 25.5, Cr 15, Ti 2, Mn 1.5, Mo 1.25, Si 0.7, V 0.3) (Limiting ruling section 50 mm)*

BS EN 2398, *Aerospace series – Heat resisting steel FE-PA2601 (X6NiCrTiMoV26-15) – $R_m \geq 900$ MPa – Bars for machined bolts – $D \leq 25$ mm*

BS EN 2399, *Aerospace series – Heat resisting steel FE-PA2601 (X4NiCrTi MoV26-15) – $R_m \geq 900$ MPa – Bars for forged bolts – $D \leq 25$ mm*

BS EN 2516, *Aerospace series – Passivation of corrosion resisting steels and decontamination of nickel or cobalt base alloys*

BS EN ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method*

BS EN ISO 6508-1, *Metallic materials – Rockwell hardness test – Part 1: Test method*

SAE AMS2700, *Passivation of corrosion resistant steels*²⁾

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

²⁾ Available from SAE International: www.sae.org/standards/content/ams2700/

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

No terms and definitions are listed in this document.

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

HT	heat treated
PS	proof stress
RA	reduction in area
UTS	ultimate tensile strength

4 General requirements

Except where otherwise stated, bolts shall conform to the latest edition of BS A 100.

5 Materials and manufacture

5.1 The bolts shall be manufactured by one of the following methods:

- a) machined from bright drawn bars which conform to one of the British Standards specified in Table 1;
- b) forged from material which conforms to one of the British Standards specified in Table 1.

5.2 The material used to manufacture the bolts shall be heat treated in accordance with the applicable material specification and meet the mechanical properties of Table 1. The hardness values of finished bolts shall be as follows in accordance with BS EN ISO 6507-1 (Vickers) or BS EN ISO 6508-1 (Rockwell):

- a) for machined bolts: 270 to 340 HV or 25.5 to 34.5 HRc; and
- b) for forged bolts: 260 to 360 HV or 24 to 36.5 HRc.

5.3 Locking wire holes shall not be drilled through any hexagon flat carrying a unified thread identification symbol.

5.4 All holes shall have their sharp edges removed.

Table 1 – Materials and material properties for manufacture of bolts

BS No.	Material	Application	UTS	0.2% PS	Elong- ation	RA	Izod impact ft·lbf (J)
			lbf/in ² (MPa)	lbf/in ² (MPa)			
BS S 80	2.5% nickel-chromium-molybdenum corrosion resisting steel	Manufacture of machined bolts from fully HT material	116 000 – 156 650 (800 – 1 080)	≥100 100 (690)	≥12%	N/A	25 (34)
BS S 143	Nickel-chromium-molybdenum corrosion resisting steel	Manufacture of machined bolts from fully HT material	134 900 – 156 650 (930 – 1 080)	≥113 100 (780)	≥15%	N/A	40 (55)
BS HR 650	High expansion heat resisting alloy	Manufacture of forged bolts ^{A)}	≥130 500 (900)	≥85 570 (590)	≥12%	≥20%	N/A
BS EN 2398	High expansion heat resisting alloy	Manufacture of machined bolts from fully HT material	≥130 500 (900)	≥85 570 (590)	≥13%	≥20%	N/A
BS EN 2399	High expansion heat resisting alloy	Manufacture of forged bolts ^{A)}	≥130 500 (900)	≥85 570 (590)	≥13%	≥20%	N/A

^{A)} Manufacturers shall verify that the high expansion material they select for a given size of forged bolt is compatible with that material's stated limited ruling section.

6 Dimensions and tolerances

6.1 All finished bolts shall conform to the dimensions and tolerances specified in Figure 1 and Table 2a and, if selected, also Table 2b.

6.2 The clamping length of the bolt shall conform to the dimensions and tolerances specified in Table 2a, and shall be such that when a standard nut (without countersink) or a ring gauge is screwed on as far as possible by hand, its leading face is within a distance M from the under side of the bolt head. The run-out of the thread shall not exceed twice the thread pitch.

6.3 The nominal length of the bolt shall be the minimum bearing length L, which is determined by the minimum clamping length M, less two thread pitches (see Figure 3 and Table 3).

NOTE The bearing lengths L specified in Table 3 are in .100 inch increments, but where a .050 length increment is required, this should be by agreement between the manufacturer and the customer and should be identified as follows: 805B, indicating a 6-32 UNC bolt of bearing length L .850 inches. M and E are required to be adjusted accordingly.

6.4 The optional holes for the use of safety locking wire can be found in Figure 2 and Table 2b.

7 Screw threads

The bolts shall have unified screw threads of the form and class of fit specified in the latest edition of BS A 100.

8 Protective finish

There shall be no protective finish applied.

The part's surfaces shall be cleaned of any process applied contamination by Nitric or Citric acid passivation, which shall be in accordance with BS EN 2516 or SAE AMS2700 with Process Class at the option of the manufacturer.

9 Identification and marking

9.1 Identification

For the purpose of ordering, the bolt's BS Part No. (written contiguously) shall be designated by the following three component parts in the order shown.

- a) The British Standard identification number, without any separation space nor any historic revision number (i.e. A104).
- b) For standard corrosion resisting steel bolts:
 - 1) without safety locking wire holes, add a separator hyphen (i.e. -); or
 - 2) if safety locking wire holes are required, substitute the hyphen with an H.For high-expansion, heat-resisting alloy bolts:
 - 3) substitute the hyphen with an X (X for expansion); or
 - 4) if both code H and X are required, the material code X shall proceed the hole code H in the Part No. code order (i.e. XH).
- c) The BS suffix code for bearing length L and thread size, e.g. for L = $\cdot 100$ inch and 4-40 UNC thread (see Table 3), the code is 1A.

NOTE 1 Examples of full BS Part Nos. made from any of the corrosion resisting steels (see Table 1):

- a) without safety locking wire holes, e.g. A104-1A; and
- b) with safety locking wire holes, e.g. A104H1A.

NOTE 2 Examples of full BS Part Nos. made from any of the high-expansion heat-resisting alloys (see Table 1):

- a) without safety locking wire holes, e.g. A104X1A; and
- b) with safety locking wire holes, e.g. A104XH1A.

9.2 Marking

Bolts shall be marked in accordance with BS 4A 100:2003, Clause 8.

Bolts of all thread sizes made from high-expansion heat-resisting alloy material shall also be marked with a capital "X".

10 Quality assurance procedure

The bolts shall conform to the quality requirements specified in BS A 100 (latest edition), as appropriate to the method of manufacture.

Figure 1 – Outline dimensions of bolts (see Table 2a)

