

British Standard : Aerospace Series

General requirements for Steel protruding-head bolts of tensile strength 1250 MPa (180 000 lbf/in²) or greater

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Foreword

This British Standard is intended for use in conjunction with those 'A' series British Standard Aerospace Specifications in which conformity to this standard is a specific requirement.

It may also be applicable to other aerospace threaded fasteners, if required by the relevant specification, drawing, contract or order and is a companion to British Standard A 100 'General requirements for bolts and nuts of tensile strength not exceeding 125 hbar (180 000 lbf/in²)'.

The standard makes reference to DTD 392, 'Anti Seize Compound, Aircraft, Graphite-Petrolatum' and to the following British Standards:

BS 308 Engineering drawing practice

BS 427 Method for Vickers hardness test
Part 1 Testing of metals

BS 891 Method for Rockwell hardness test
Part 1 Testing of metals

BS 1134 Centre-line-average height method for assessment of surface texture

BS 6000 Guide to the use of BS 6001, Sampling procedures and tables for inspection by attributes

BS 6001 Sampling procedures and tables for inspection by attributes

NOTE. 1 MPa = 1 N/mm² = 145.0 lbf/in².



Amendment Slip No.1, published 29 October 1976
to British Standard A 241 : 1973
(Aerospace Series)
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bolts of tensile strength 1250 MPa
(180 000 lbf/in²) or greater

Revised text

AMD 2143
October 1976

Clause 1.7.2
Delete 'A 241' and substitute 'A ...'

AMD 2143
October 1976

Clause 1.7.3
Delete 'A 241' and substitute 'A ...'

AMD 2143
October 1976

Clause 2.1.2 Qualification approval
This clause is suspended pending national and international discussions.

AMD 2143
October 1976

Clause 2.3 Control of dimensions
This clause contains 2.3.1, 2.3.3 and 2.3.3. The second of these has been wrongly numbered '2.3.3'; delete this number and substitute '2.3.2'.



Amendment Slip No. 2
published and effective from 28 September 1979
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(Aerospace Series)

General requirements for steel protruding-head
bolts of tensile strength 1250 MPa (180 000 lbf/in²)
or greater

Revised text

AMD 3067
September 1979

Clause 2.7.1 Hardness test

Insert the following after the second sentence:

'On bolt blanks of $\frac{5}{16}$ in and M10 diameter and below, 100 % hardness testing may be replaced by a sorting bridge examination, using a technique approved by the Inspecting Authority.'

AMD 3067
September 1979

Clause A.1 Tension and shear tests

In item (2) delete the formulae for S_1 and S_t and substitute the following:

$$S_1 = \sqrt{\frac{N_1 \sum X_1^2 - (\sum X_1)^2}{N_1 (N_1 - 1)}}$$

$$S_t = \sqrt{\frac{N_t \sum X_t^2 - (\sum X_t)^2}{N_t (N_t - 1)}}$$

Amendment Slip No. 3**published and effective from 28 November 1980
to British Standard A 241 : 1973****(Aerospace Series)****General requirements for steel protruding-head
bolts of tensile strength 1250 MPa (180 000 lbf/in²)
or greater****Revised text****AMD 3356
November 1980****Contents**

Against 2. delete 'Inspection procedure' and substitute 'Quality assurance and product qualification testing approvals'.

Against 2.2. delete 'Acceptance of production batches' and substitute 'Production acceptance tests'.

Under 'Appendices', insert the following:

'H. Product qualification approval and production acceptance tests'.

Under 'Tables', insert the following:

'27. Qualification approval testing requirements for bolt samples.

28. Summary of tests: Qualification and production acceptance'.

**AMD 3356
November 1980****Clause 2. Inspection procedure**

Delete the titles of clauses 2 and 2.1. Delete the headings and text of subclauses 2.1.1 to 2.1.5 inclusive. Substitute the following.

2. Quality assurance and product qualification testing approvals**2.1 General**

2.1.1 Quality assurance approval. The quality assurance requirements shall be as specified by the British Civil and Military Airworthiness Authorities as appropriate. Quality assurance approval shall be carried out by the Civil and Military Airworthiness Authorities as appropriate or by their delegated representative, who may be the prime contractor.

2.1.2 Product qualification testing approval. Product qualification testing shall be in accordance with appendix H of this specification. Product qualification test approval shall be carried out by the British Civil and Military Airworthiness Authorities as appropriate or by their delegated representative, who may be the prime contractor.

**AMD 3356
November 1980****Clause 2.2 Acceptance of production batches**

Delete the existing heading and substitute 'Production acceptance tests'.

Insert a new appendix H as follows:

Appendix H

Product qualification approval and production acceptance tests

H.1 The inspection and testing of bolts shall be classified as follows:

- (1) Product qualification approval tests;
- (2) Production acceptance tests.

H.2 Product qualification approval tests

H.2.1 The qualification approval tests shall consist of all the tests summarized in Tables 27 and 28.

H.2.2 The qualification approval test sample shall consist of 25 bolts for each diameter to be qualification tested as specified in Table 27. The number of sample bolts for each test is indicated in Table 27. Samples shall have a minimum grip length of 2 x shank diameter to enable all tests to be carried out. At the option of the Qualification Authority, qualification of one part number may be accepted as covering bolts of the adjacent diameter in the series and a range of lengths, provided that the manufacturing method is identical.

H.3 Production acceptance tests

H.3.1 Production acceptance tests shall be carried out for each production batch.

H.3.2 The acceptance tests shall consist of all the tests summarized in Table 28.

New tables 27 and 28

Insert the new tables 27 and 28 given on the following pages.

Table 27. Qualification approval testing requirements for bolt samples

Type of test	Defined in Clause	Bolt sample number																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		Uncoated			Coated																					
Non-destructive																										
Surface protection	1.6				X	X	X																			
Product identification	1.7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dimensions	2.3				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface texture	2.4	X	X	X																						
Head and shank discontinuities	2.6.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Thread discontinuities	2.6.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Destructive																										
Head/shank grain flow	2.6.2.1	X	X	X	X																					
Thread grain flow	2.6.2.2	X	X	X	X																					
Carburization decarburization and overheating	2.6.2.4	X	X	X	X																					
Hardness	2.7.1	X	X	X	X																					
Tensile strength	2.7.2					X	X	X	X	X																
Double shear strength	2.7.3.2			X	X						X	X	X													
Stress durability	2.7.3.4													X	X	X										
Tension fatigue strength	Appendix B																X	X	X	X	X	X	X	X	X	X

Table 28. Summary of tests. Qualification and production acceptance

Type of test	Qualification		Acceptance	
	Clause	Sample size	Clause	Sample size
Surface protection	1.6	3	1.6	Table 1 & BS 6001
Product identification	1.7	25	1.7	Table 1 & BS 6001
Dimensions	2.3	22	2.3	Table 1 & BS 6001
Surface texture	2.4	3	2.4	Table 1 & BS 6001
Thread discontinuities	2.6.1	25	2.6.1	Magnetic 100 % Micro Table 14
Head and shank discontinuities	2.6.1	25	2.6.1	Magnetic 100 % Micro Table 14
Head/shank grain flow	2.6.2.1	4	2.6.2.1	Table 14
Thread grain flow	2.6.2.2	4	2.6.2.2	Table 14
Carburization, decarburization and overheating	2.6.2.4	4	2.6.2.4	Table 14
Hardness (bolt blanks)	—	—	2.7.1	100 %
Hardness (finished bolts)	2.7.1	4	2.7.1	Table 14
Tensile strength	2.7.2	5	2.7.2	Table 5
Double shear strength	2.7.3.2	5	2.7.3.2	Table 14
Stress durability	2.7.3.4	3	2.7.3.4	Table 14
Tension fatigue strength	Appendix B	10	Appendix B	Table 5

Specification

1. General

1.1 Scope

This British Standard specifies the general requirements for metric and inch steel protruding-head aerospace bolts of tensile strength of 1250 MPa (180 000 lbf/in²) or greater.

The requirements related to nominal size are presented in individual tables for use as appropriate to the relevant bolt specification. The values quoted for metric and inch bolts have a proportional relationship and are not direct conversions.

1.2 Material

1.2.1 The bolts shall be manufactured from the material specified in the relevant bolt standard.

1.2.2 Bolts may be rejected at any time for faults in or revealed by manufacture, although they may have been made from material which previously complied with the relevant material standard.

1.3 Manufacture

1.3.1 The heads of bolts shall be formed by forging before heat treatment.

The lightening hole of the double hexagon design may be machined or forged.

The heating equipment for hot forging shall be approved by the Inspecting Authority and shall be of a type which ensures a consistent temperature throughout the batch of that part of the material being worked. This temperature shall be automatically controlled.

1.3.2 The forged blanks shall be heat treated in accordance with the requirements of the material standard to produce the properties required by the relevant bolt standard and this standard. No blank shall be submitted to the specified heat treatment more than three times.

1.3.3 The headed and heat treated blanks shall have the shank, and bearing surface of the head, machined or wet ground. The amount of metal removed shall be as little as is practicable, consistent with the production of a clean smooth surface and the maintenance of optimum grain flow around the underhead radii as specified in 2.6.2.1. After machining or grinding and before thread and fillet rolling, the bolts shall be stress relieved at a temperature from 0–25 °C below the original tempering temperature for not less than one hour.

1.3.4 Threads shall be formed by a single rolling process after final heat treatment.

1.3.5 The head to shank fillet shall be rolled after final heat treatment.

The fillet radius, after rolling, shall conform to the requirements of the relevant bolt standard. The fillet area may be distorted as shown in Appendix E. There shall be no machining of the fillet radius after rolling.

1.3.6 All processes of manufacture shall be to the satisfaction of the Inspecting Authority.

1.4 Dimensions

All bolts shall conform to the dimensions and tolerances specified in this standard and in the relevant bolt standard. The dimensions shall be controlled as specified in 2.3.

1.5 Run-out of screw threads

The bolts shall have a run-out conforming to the requirements of Appendix F.