
British Standard Aerospace Series : Specification for

Procurement of alloy steel bolts, metric, with a minimum tensile strength of 1 100 MPa

Série aérospatiale. Spécification relative à l'approvisionnement des boulons en acier spécial, métriques, avec une résistance à la traction minimale de 1100 MPa

Luft- und Raumfahrt-Reihe. Spezifikation für den Ankauf der Legierstahlschrauben, metrisch, mit einer Mindestzugfestigkeit von 1100 MPa

Index title: Bolts, metric, 1100 MPa alloy steel, procurement specification

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The following BSI references relate to the work on this standard: Committee reference ACE/12 Draft for comment 78/80581 DC

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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 metric threaded fasteners if required by the relevant specification, drawing, contract or order.

This standard invokes

- (a) quality assurance approval of the manufacturer, and
- (b) product qualification testing approval.

Appendix A is included in this standard to provide information on the minimum tensile and tension fatigue test loads for thread sizes M8 × 1.25, M10 × 1.5 and M12 × 1.5. When there is no further requirement for these sizes appendix A will be deleted by amendment.

1. Scope

This British Standard specifies the performance and manufacturing requirements for forged bolts made of alloy steel heat treated to produce a minimum tensile strength of 1100 MPa.

This standard invokes product qualification testing requirements and quality assurance approval procedures for the manufacture of aerospace standard parts, thus making it mandatory that bolts supplied in accordance with this standard are restricted to suppliers who can demonstrate conformance to these requirements.

It is mandatory that bolts produced in accordance with this British Standard have forged heads and threads rolled after heat treatment. Cold working of the underhead fillet radius is mandatory except as specified herein (see 5.3.4).

2. References

This standard makes reference to the following standards publications.

- BS 427 Method for Vickers hardness test
- BS 891 Method for Rockwell hardness test
- BS 1134 Method for the assessment of surface texture
Part 1 Method and instrumentation
- BS 6001 Sampling procedures and tables for inspection by attributes
- BS* Fasteners test method: metric
- BS M 35 Magnetic particle flaw detection of materials and components

3. Field of application

This British Standard is intended primarily to be used in conjunction with bolt standards of minimum tensile strength level 1100 MPa. It may however be used as the procurement document for special bolts of compatible configurations of this tensile strength level as long as this British Standard is specified on the bolt drawing or purchase order.

4. Definitions

For the purposes of this British Standard the following definitions apply.

4.1 production lot. Finished bolts fabricated by the same process from a single material cast and which have the same basic part number and diameter, heat treated together, to the same specified condition and produced as one continuous run.

4.2 inspection lot. Bolts from a single production lot, of the same part number which completely defines the bolt.

4.3 discontinuities

4.3.1 crack. A rupture in the material which may extend in any direction and which may be intercrystalline or transcrystalline in character.

*In course of preparation.

4.3.2 seam. A longitudinal surface defect in the form of an unwelded open fold in the material.

4.3.3 lap. A surface defect caused by folding over metal fins or sharp corners and then rolling or forging them into the surface.

4.4 inclusions. Non-metallic particles originating from the steel making process. They may exist as discrete particles or strings of particles extending in a longitudinal direction.

4.5 test temperature. Ambient temperature, unless specified otherwise.

4.6 random sample. A sample taken in such a manner that each unit in the inspection lot has the same chance of being the first unit in the random sample. After the first unit in the sample is taken, each of the remaining units in the inspection lot has the same chance of being the second unit in the sample.

4.7 acceptable quality level (AQL). The maximum percentage defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered acceptable as a process average.

4.8 limiting quality (LQ). A magnitude of percentage defective, greater than the AQL, which, in accordance with the operating characteristic of the sampling/inspection plan, the purchaser runs a specified risk of accepting. (In this document the LQ corresponds to a purchaser's risk of 10 %.)

4.9 finished bolt. A bolt ready for use inclusive of any surface treatment and/or coating specified in the product standard or drawing.

5. Technical requirements and test methods

The following technical requirements and test methods complement the requirements of the bolt standard or drawing but may supplement the requirements of the material specification.

Table 1 shows in tabular form the testing required for each element of the 25 bolt sample necessary for qualification approval. Table 2 summarizes the testing required for both qualification and production acceptance testing.

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tensile strength of 1 100 MPa

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Clause	Characteristic	Technical requirement	Inspection and test method	Q/A*	Sample size
5.1	Materials	The bolts shall be made from the alloy steel specified in the bolt standard or on the drawing.	As stated in the material specification.		
5.2	Dimensions	The dimensions of the finished bolts shall conform to the bolt standard or drawings.	All dimensions shall be controlled by an approved system of gauging. (See 6.1.)	Q A	22 Tables 7 and 8
5.3 5.3.1	Manufacturing Forging	The heads of the bolts shall be formed by a hot or cold forging process before heat treatment. The heating equipment for forging (if applicable) shall be of a type which ensures a consistent temperature throughout the lot.	Whichever method of processing is used it shall be by an approved method. (See 6.2.)		
5.3.2	Heat treatment	The forged blanks shall be heat treated to produce the properties required by the bolt standard or drawing. Blanks shall not be hardened more than three times.			
5.3.3	Removal of surface contamination	The amount of material removed from the bearing surface of the head and the shank of the heat treated blanks shall be as little as practicable consistent with the removal of surface contamination to meet the requirements of 5.5.3, production of a smooth surface and maintenance of optimum grain flow around the under-head fillet radius as shown in figure 1.	Removal of surface contamination shall be by an approved method. (See 5.5.3.)		

*Q = Qualification approval test requirements (6.3.1).
A = Production acceptance test requirements (6.3.2).

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Clause	Characteristic	Technical requirement	Inspection and test method	Q/A*	Sample size
5.3.4	Head to shank fillet	The head-to shank fillet radius shall be cold worked after completion of heat treatment and machining. Cold working of the head-to-shank fillet radius may cause distortion of the fillet area. Distortion shall not exceed a height <i>A</i> and depth <i>B</i> and shall not extend beyond <i>C</i> as shown in figure 2 and table 10, unless otherwise specified by the bolt standard. The fillet shall not show evidence of seams or inclusions. This requirement is not applicable to threaded-to-head bolts or bolts of diameter less than MJ5.	See 5.5.1		
5.3.5	Threads	Threads shall be formed only by a single rolling process after hardening and tempering.			
5.3.6	Surface texture	The surface texture shall be as specified in the bolt standard or on the drawing prior to protective treatment.	Surface texture of thread shall be determined by a visual comparison method. (See BS 1134.)	Q A	3 Tables 7 and 8
5.3.7	Surface protection	Where applicable all surfaces shall be coated as specified in the bolt standard or on the drawing.	See applicable coating specification.	Q A	3 Tables 7 and 8
5.4	Mechanical properties				
5.4.1	Tensile strength	The finished bolts shall develop the minimum tensile loads specified in table 4. Standard externally wrenched protruding head bolts shall not fail in the head-to-shank area when subjected to the tensile test.	The bolts shall be tested to destruction in tension between the head of the bolt and the threaded member in accordance with BS† Tensile tests are not applicable to the following. (a) Protruding head bolts of grip length less than $2D$. (b) Countersunk head bolts of grip length less than $2.5D$. (c) Threaded to head bolts of overall length less than $3D$ or bolts having an overall length less than 18 mm. In these cases acceptability shall be based on the results of the hardness tests.	Q A	5 Table 9, column B

*Q = Qualification approval test requirements (6.3.1).

A = Production acceptance test requirements (6.3.2).

†In course of preparation.