

Specification for

Design and performance requirements for turnlock, stud-type panel fasteners (metric series)

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Foreword

This British Standard has been prepared at the request of the British Aerospace Industry to specify the requirements for the design and performance of turnlock stud-type panel fasteners.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 21 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

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The following BSI references relate to the work on this standard:
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Section 1. General

1 Scope

This specification stipulates the design and performance requirements for stud-type, turnlock panel fasteners for use in aerospace applications where primary structural loads are not involved.

This specification embraces single unit assembly fasteners of the rigid and floating receptacle types and multi-fastener strip receptacle assemblies.

2 References

This standard makes reference to the following standards publication.

BS 3G 100, *General requirements for equipment for use in aircraft — Part 2: All equipment — Section 3: Environmental conditions — Subsection 3: Salt mist.*

3 Definitions

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

3.1

fastener

a device used to secure a panel by the operation of a stud of restricted rotation which engages a locking element in a receptacle. Such a fastener shall be designated “turnlock”

3.2

stud or stud assembly

that element of the fastener which is permanently fixed to the panel for operational purposes

3.3

receptacle

that element of the fastener which is permanently fixed to the panel support structure

3.4

grommet

a device used for one or more of the following purposes:

- a) to retain the stud in the panel;
- b) to protect the panel during operation of the stud;
- c) to increase the load-carrying capacity of the fastener.

3.5

float

the permitted amount of lateral movement, in any direction, of the relative positions of stud and receptacle

3.6

performance class

the relative performance requirements of the RQA and FQA fasteners (see clause 4) covered by this specification and which are designated class 1, class 2 and class 3. (See Table 2 for details)

3.7

failure

the point at which one or more of the fastener component parts fractures or breaks or where distortion and permanent set prevent the locking and unlocking of the fastener

4 Symbols for fasteners

For the purposes of this specification the following symbols are used:

Symbol	Fastener description
RQA	Panel fastener, turnlock, rigid receptacle, quick action stud type.
FQA	Panel fastener, turnlock, floating receptacle, quick action stud type.
MSQA	Panel fastener, turnlock, multi-fastener, strip receptacle, quick action stud type.

5 Stud head configurations

The stud head configuration and type of driving recess are optional.

Section 2. Design requirements

6 All turnlock fasteners

6.1 General. Fasteners shall comply with all the requirements defined on the approved fastener drawing or standard and comply with the requirements of this specification.

6.1.1 Fasteners shall be of uncomplicated construction and shall be capable of being fitted to both panel and support structure with simple hand tools that are recommended by the manufacturer.

6.1.2 The fastener shall provide for retention of the stud in the panel when unlocked.

6.1.3 The fasteners shall be so constructed that neither the stud assembly nor the receptacle assembly can be inadvertently disassembled during normal operation.

6.1.4 Where the stud is retained in the panel by means of a grommet, the grommet shall be capable of being removed without damage to the panel or stud.

6.1.5 Studs shall be so designed that the fasteners shall be capable of being operated without the use of special tools.

6.1.6 Fasteners shall be so designed that their operation is not impeded by the presence of small foreign particles (e.g. grit) and shall at all times be capable of operation without lubrication.

6.1.7 Fasteners shall be free from burrs, tool marks and other defects that may adversely affect serviceability or performance as defined in this specification.

6.2 Materials

6.2.1 Fasteners shall be manufactured from materials such that the fasteners shall be capable of meeting the performance and test requirements specified in this standard.

6.2.2 All materials used in the manufacture of the fasteners shall be compatible with high aromatic fuels, lubricants and other fluids (e.g. de-icing fluids, hydraulic fluids) normally encountered in aerospace vehicles.

6.3 Protective treatment

6.3.1 Protective treatment that is in accordance with specifications approved for use in the design of aerospace vehicles shall be applied, where appropriate, to all fastener parts.

6.3.2 Precautions shall be taken to guard against corrosion due to electrolytic action that may develop between contacting dissimilar materials, particularly in the presence of moisture or any of the fluids stated in **6.2.2**.

6.4 Interchangeability

6.4.1 All parts having a manufacturer's identical part number shall be directly and completely interchangeable with each other in respect of installation and performance.

6.4.2 For the purpose of interchangeability the parts of the fastener regarded as indivisible are the stud, the receptacle and the grommet.

6.5 Functional requirements

6.5.1 When mounted on the panel, studs shall not be free to become misaligned to an extent that will prevent each stud entering its receptacle when the panel is offered up to the support structure for attachment.

6.5.2 Not more than 180° clockwise rotation of each stud shall thereafter be required before it engages the locking element in the receptacle.

6.5.3 After the stud has made initial engagement with the locking element, it shall be positively locked with 85° to 135° of clockwise rotation, when viewed from the outside of the panel.

6.5.4 The centre line of a screwdriver slot driving recess shall lie along the centre line of the receptacle mounting attachment when the fastener is in the locked position.

6.5.5 The stud shall completely unlock within 85° to 135° of anti-clockwise rotation when viewed from the outside of the panel.

6.5.6 There shall be definite indication, either visual or tactile, that the fastener is in the fully locked position (see **6.5.4**) and there shall be a positive stop to prevent the stud from being turned past the fully locked position.

6.5.7 Fasteners shall be fully operable over the temperature range – 35 °C to + 70 °C and shall maintain efficient locking over the temperature range – 70 °C to + 90 °C.

6.5.8 Flushhead studs shall be so designed that, with the fastener assembled and fully locked in the panel, the head shall be flush with the outer surface of the panel within ± 0.4 mm.

6.6 Identification marking

6.6.1 The minimum head marking of the fastener in a position that is visible when the fastener is installed, shall be:

- a) the manufacturer's identification;
- b) the length coding.

Where space permits, the complete part number shall be added.

6.6.2 The precise position of the marking shall be as defined on the manufacturing drawing.

6.6.3 The size of characters shall be 0.5 mm minimum. Indented markings shall be not deeper than 0.25 mm. Embossed markings shall not protrude more than 0.25 mm.

7 RQA and FQA fasteners: special design requirements

7.1 RQA and FQA fasteners shall comply with the special design requirements specified in **7.2**.

7.2 Special requirements

7.2.1 The fasteners shall be either of the stud-receptacle type or of the stud-grommet-receptacle type.

7.2.2 FQA fasteners shall be capable of efficient operation with the centre line of the stud offset from the vertical centre line of the receptacle in any direction laterally, by the distance specified in Table 1 as the offset tolerance.

7.2.3 The fasteners shall have adequate bearing area beneath the stud head when in contact with the panel such that no failure of the fastener occurs when subjected to the tests specified in section 5.

The minimum difference between the maximum diameter of the hole in the panel and the minimum diameter of the stud underneath the head shall be as specified in Table 1.

Table 1 — Offset tolerance and diameter difference

Feature	Unit	Performance class		
		1	2	3
Offset tolerance (for FQA fasteners)	mm	1.65	1.14	0.75
Diameter difference		0.63	0.52	0.40

8 MSQA fasteners: special design requirements

8.1 MSQA fasteners shall comply with the special design requirements specified in **8.2**.

8.2 Special requirements

8.2.1 Fasteners shall be of the multi-fastener strip receptacle type.

8.2.2 The fasteners shall be capable of efficient operation with the centre line of the stud offset from the vertical centre line of the receptacle feature by 0.5 mm in any direction laterally.

Section 3. Performance requirements

9 All turnlock fasteners

9.1 General. The general performance requirements stated in **9.2** to **9.7** shall apply to all fasteners.

Type qualification tests are specified in section 5.

9.2 Operating torque

9.2.1 Maximum locking torque. The maximum locking torque under normal operating conditions shall be as stated in Table 2. With the panel and the structure separated by the addition of a 0.25 mm shim to simulate the intrusion of a foreign object, the maximum locking torque shall not exceed 133 % of the maximum locking torque permitted under normal operating conditions.

9.2.2 Minimum unlocking torque. The minimum unlocking torque under normal operating conditions shall be as stated in Table 2. With the combined panel and support thickness reduced by 0.25 mm to simulate wear, the minimum unlocking torque shall be not less than 67 % of the minimum unlocking torque permitted for normal operating conditions.

9.2.3 Locking stop. The locking stop shall withstand the required torque load as specified in Table 2.

9.3 Tensile load

9.3.1 Initial tension. The initial tension, which is the normal clamped tension developed by the assembly when locked, shall be as stated in Table 2.

9.3.2 Sheet separation. The sheet separation in the immediate area to the fastener shall not exceed 1.2 mm for the tensile proof load specified in Table 2.

9.3.3 Tensile proof load. The fastener shall be subjected to the application of the tensile proof load specified in Table 2. The fastener shall not thereafter develop a permanent set in excess of 0.2 mm for classes 1 and 2 and 0.15 mm for class 3.

After the release of the tensile proof load, no change in the maximum locking torque and the minimum locking torque, as stated in Table 2, shall be discernible.

9.3.4 Tensile ultimate load. The fastener shall withstand, without failure, the application of a load equal to 150 % of the tensile proof load.

9.4 Shear load

9.4.1 Shear proof load. The fastener shall be subjected to the shear proof load specified in Table 2 without signs of permanent deformation. After the release of the shear proof load, no change in the maximum locking torque and the minimum locking torque, as stated in Table 2, shall be discernible.

9.4.2 Shear ultimate load. The fastener shall withstand, without failure, the application of a shear load equal to 150 % of the shear proof load.

9.5 Operating endurance

9.5.1 The fastener shall withstand the required number of operating endurance cycles as specified in Table 2.

A cycle is one complete locking and unlocking operation.

9.6 Vibration

9.6.1 The fastener shall withstand the vibration requirements specified in Table 2 for 25 h without failure, with the fastener at an angle of 45° to the direction of vibration (see Figure 13).

9.6.2 The fastener shall withstand additional vibration at the frequency and amplitude specified in Table 2 at “no load”, for 5 h without failure, with the fastener at an angle of 45° to the direction of vibration.

NOTE “Amplitude” is defined as the extent of vibratory movement as measured between extremes.

9.7 Resistance to corrosion

9.7.1 Sample fasteners shall comply with the requirements of BS 3G 100-2.3.8:1972 for a period of 192 h. The tests shall reveal no signs of corrosion other than minor staining.

9.7.2 The samples used for this test shall not have been used for other tests.

10 MSQA fasteners: special performance requirements

10.1 Receptacle wire staking strength. When the receptacle design embodies a cross-wire locking device, the following requirements shall apply.

10.1.1 Axial slippage. The fastener wire in a 150 mm nominal length of receptacle strip shall not slip when a minimum load of 667 N is applied to the wire in the direction of the longitudinal axis of the wire.

10.1.2 Staking breakout. The fastener wire shall not be dislocated from its staked-in position, nor forced from the receptacle strip when a minimum load of 667 N is applied to the wire in the direction perpendicular to the longitudinal axis of the wire.

10.2 Receptacle alignment

10.2.1 Receptacle spacing tolerance. The fastener studs shall successfully engage and disengage the receptacle for any spacing of the receptacle within ± 0.5 mm of the nominal value with a skew between opposite hole centres of up to 0.25 mm and a difference between top surface levels of 1.6 mm.

10.2.2 The forces required to operate the fastener under the conditions stated in 10.2.1 shall not exceed 150 % of the maximum operating locking torque nor be less than 67 % of the minimum operating unlocking torque stated in Table 2.

Section 4. Quality assurance and product qualification testing requirements

11 Quality assurance

11.1 The procedures to be followed in respect of quality assurance approval are as detailed in the current national requirements defined by the relevant airworthiness authorities.

11.2 Sufficient inspection and testing shall be carried out by the fastener manufacturer (see sections 2 and 3) to ensure that the product conforms to all requirements defined on the appropriate fastener drawing or standard and in this specification. Certification to this effect shall be supplied by the manufacturer to the purchaser with each delivered fastener batch.

12 Product qualification testing

Prior to the supply of any components to this specification the manufacturer shall prove to the purchaser that satisfactory product qualification testing has been carried out in accordance with clause 13.

Section 5. Product qualification tests

13 General

13.1 Product qualification testing shall consist of all the tests specified in this section (as summarized in Appendix A). A fastener shall be deemed not to comply with the requirements of this British Standard if it fails any relevant test.

13.2 Product qualification test samples shall consist of 28 fasteners of each size, type and configuration. The sample fasteners shall be numbered as given in Appendix A for the purposes of allocating tests and recording results.

13.3 Unless otherwise stated, all tests shall be conducted at normal room temperature (15 °C to 20 °C) and with all fasteners loaded to initial tension (i.e. normal locked position).

13.4 The provision of suitable test rigs is the responsibility of the fastener manufacturer.

14 Initial tension and sheet separation

14.1 Initial tension. The initial tension shall be determined by establishing the tensile load which produces a separation of 0.08 mm over the area immediately around the fastener.

14.2 Sheet separation. The fastener shall be loaded to its tensile proof load as defined in Table 2. The sheet separation in the area immediately around the fastener shall be measured and shall not exceed 1.2 mm.

15 Operating torque loads

Figure 6 shows a typical test rig arranged for testing MSQA fasteners. The test rig for RQA and FQA fasteners shall be similar.

15.1 Operating torque tests. Fastener samples shall be tested to determine the operating locking torque and the operating unlocking torque in accordance with the requirements of 9.2, 9.3, 9.4 and 10.2.2. These tests shall be performed on unlubricated fasteners. The test results obtained shall be within the maxima and minima specified in Table 2 for the type and class of fastener under test.

15.2 Low temperature operating test. Fastener samples shall be subjected to an ambient temperature of -35 °C for a period of at least 30 min, immediately after which they shall be subjected to a test for satisfactory operation. The operating torque loads required shall be within the maxima and minima specified in Table 2 for the type and class of fastener undergoing test.