



## **Safety Belts**

### **1 Introduction**

- 1.1 Although this Specification was written originally for aeroplanes, a safety belt designed to this Specification is also acceptable to the CAA for use in a Rotorcraft.

### **2 Applicability**

- 2.1 Safety belts shall comply with this Specification or with such other Specifications as the CAA may approve. Alternative Specifications, submitted for approval, shall provide at least the same amount of protection. FAA TSO C.22(f) is considered to be an acceptable specification provided that compliance with paragraphs 3.8, 4.2, 5.3, 5.4, 5.5 and 5.6 of this Specification is also demonstrated.
- 2.2 FAA TSO-C22g or JTSO-C22g qualified safety belts are considered acceptable for installation with no further consideration of the requirements of this Specification.
- 2.3 The installation of safety belts shall be done in accordance with the certification requirements for the aircraft.

### **3 Form**

- 3.1 The belts shall be individual to a single occupant and shall be suitable in every respect for installation in an aeroplane for the purpose of restraining the wearer, without causing significant injury, against the ultimate inertia forces prescribed.
- 3.2 The correct method of using the belt shall be rapid and obvious.
- 3.3 Parts made of metal or similar unyielding material, which come into contact with the wearer, shall be well rounded where necessary.

**NOTE:** Consideration should be given to the fact that the wearer does not remain in the normal sitting position during the application of the higher accelerations.

- 3.4 No part of a safety belt shall pass between the wearer's legs or shall appreciably restrict the movement of the wearer's limbs.
- 3.5 The belt shall, when correctly adjusted to the wearer, remain in position irrespective of variation of load.
- 3.6 Those parts of the belt which under the prescribed accelerations restrain, and are in contact with the wearer, shall be not less than 50mm (2 in.) wide.

**NOTE:** However for belts not needing TSO approval an approved military belt 44mm (1.75 in) minimum width which is otherwise acceptable will not be rejected by the CAA.

---

The latest version of this document is available in electronic format at [www.caa.co.uk](http://www.caa.co.uk), where you may also register for e-mail notification of amendments.

Printed copy is available from: TSO, PO Box 29, Norwich NR3 1GN [www.tso.co.uk/bookshop](http://www.tso.co.uk/bookshop)  
Telephone: 0870 600 5522 e-mail: [book.orders@tso.co.uk](mailto:book.orders@tso.co.uk) Fax orders: 0870 600 5533

- 3.7 Those parts defined in paragraph 3.6 shall be such that the whole of the minimum width specified is effective in transmitting load from the parts to the wearer.
- 3.8 When correctly installed, the belt, when worn, shall lie across the groins of the wearer. The belt when so worn shall lie in a plane which is approximately at 45° to the plane of the longitudinal and lateral axes of the aeroplane.
- 3.9 Throughout this Specification, a belt is regarded as being divisible into various members (e.g. left strap, right strap, release mechanism, etc.) which are liable to be detached from each other for purposes of storage or replacement. It is further envisaged that more than one firm may be concerned in the manufacture of the completed belt; for example, a release box may be made by a different firm from that responsible for the webbing parts.

#### **4 Strength**

- 4.1 The certified strength of a belt is determined by the tests of paragraph 7.

- NOTES:**
- 1) The certified strength required of each member will depend upon the manner in which the belt is installed in the aeroplane and upon the emergency alighting accelerations appropriate to the particular aeroplane.
  - 2) The emergency alighting accelerations for a particular aeroplane type into which the belt is to be fitted may be determined in consultation with the aeroplane constructor. Alternatively the belt may be made sufficiently strong for it to be suitable in any aeroplane type. It is emphasised that greater strength will permit the belt to be certified as being capable of giving greater restraint, and this greater restraint may be of value in crash conditions.

- 4.2 The strength of belts with self-aligning end fittings, fitted in a normal forward-facing installation, however, may be designed for the loads prescribed in paragraph 4.3. The loads of paragraph 4.3 may not be used and the installation shall be conservatively represented in the tests as required by paragraph 7 if:
- a) When restraining an occupant, the vertical projection of the angle between any strap (at its attachment point) and the fore and aft axis of the aircraft exceeds 15°, or, if the end fittings are not self-aligning,
- or
- b) The installation is not a forward facing seat installation.

- 4.3 For unit value of forward g the basis of certified strength required of a member is 670 N/g (150 lbf/g), this load shall be multiplied by the prescribed forward g for the aeroplane type. Safety belt attachment fittings shall have an additional strength factor of 1.33.

#### **5 Means of Adjusting, Fastening and Releasing**

- 5.1 The belt adjustment shall be either in the buckle or adjacent to it. The adjustment provided in this way shall be such as to suit all persons likely to use the belt. A separate action shall not be necessary to lock the means of adjustment.

**NOTE:** The load required to vary the adjustment, i.e. tighten or loosen the belt, should not exceed 134 N (30 lbf) and the design should be such that it is easy to operate.

- 5.2 The means of fastening and releasing shall be rapid and obvious and shall be of the metal to metal positive latching type. The design shall be such that the possibility of the means of locking, releasing or adjustment being jammed by loose clothing or by twisting of the belt, is extremely remote. The fastening means shall be designed to preclude incorrect latching by the wearer.

**NOTE:** Instructions may be marked on the belt to facilitate its use. However, the action should not be such as to demand instructions.

5.3 The wearer, shall be able to release the belt with either hand, regardless of aircraft orientation in an otherwise survivable accident without undue difficulty.

5.4 The force required to effect release from the belt shall be assessed when, after the belt has been subjected to a load as near as practical to the ultimate load (see para. 7.2.2), it is under a residual load of 1112 N (250 lbf).

5.4.1 Where a conventional lever operated release mechanism is used (i.e. one which can be grasped with all the fingers of one hand) the load to effect release under the conditions defined in para. 5.4 shall not exceed 90 N (20 lbf).

**NOTE:** In addition to the requirements of 5.4.2 it is also recommended that the minimum release load should not be less than 22.5 N (5 lbf).

5.4.2 To avoid inadvertent release there shall be a free movement of the lever and the belt shall remain fastened until the lever attains an angle of not less than 70° or not more than 95° to its position at rest. The lever shall be spring loaded to the position it normally assumes when the belt is fastened.

**NOTE:** Release at a lever angle of less than 70° may be acceptable where the design is such that it can be demonstrated that the lever is unlikely to be caught and moved by clothing.

5.5 Where means of release other than by a conventional lever are employed the functional characteristics and release loads of such means shall be agreed with the CAA.

5.6 Where the positive locking action of the buckle is dependent upon a spring element, no single failure shall cause or permit the belt to release, unless an adequate fatigue life has been established.

**NOTES:** 1) A total of 100,000 cycles may be assumed as equal to 10 years of life.

2) It is recommended that the fastening and releasing mechanism should not embody parts which need to be manufactured and maintained to close tolerances for their satisfactory functioning.

5.7 The means of fastening shall be such that the responsible crew member will be able to see at a glance whether the belt is securely fastened or not.

5.8 Extension pieces shall be identified as to the type of belt with which they are to be used. Extension pieces shall be designed and tested to the same standards as are established for belts submitted in compliance with this Specification.

## 6 Materials and Processes

This paragraph 6 is applicable only to parts which contribute to strength, and to parts which are functionally important.

6.1 Only materials to a suitable approved specification<sup>1</sup>, or obtained from a source approved by the CAA, shall be used.

6.2 Fittings shall be made of metal or of materials that have been demonstrated to be equally satisfactory for their intended function.

---

1. British Standards Specifications issued by the British Standards Institution and D.T.D. Specifications obtainable from HMSO are approved. Other specifications will be approved by the CAA if, in its opinion, materials accepted as complying with these Specifications have the essential properties assumed in the technical investigation associated with the design approval.

- 6.3 Materials which may deteriorate in service or materials the properties of which may be significantly affected by ambient conditions (e.g. leather) shall not be used.
- 6.4 Where such processes as soldering, brazing, welding and casting are used, suitable factors and safeguards acceptable to the CAA shall be employed. Primary load carrying castings shall comply with the requirements for critical castings.
- 6.5 The choice of materials and of protective treatments for those parts which cannot readily be inspected shall be such as to minimise the risk of corrosion or deterioration.
- 6.6 Materials shall be flame resistant to the appropriate standard defined in the certification basis of the aircraft.

## 7 Tests

- 7.1 **General** Each member shall be tested in a manner which is agreed by the CAA to represent adequately the conditions of the installation. Accurate representation may be necessary for cases where unusual geometry or eccentricity of loading could affect the ultimate load or the functioning of the means of release. Tests shall be arranged so that the friction effects in the test apparatus do not significantly relieve the stress in any member under test. The load in a member shall be taken as the load applied to the end nearest to the point of attachment to the airframe or seat.

### 7.2 Prototype Belts

- 7.2.1 Each member shall be tested to the ultimate load: the member will be accepted if each part supports the load required of it without significant slipping of any adjusting mechanisms it may include.

**NOTE:** If, at the point during this test when one half of the certified strength is reached, an inspection is made of those members utilising webbing or similar material in a load-bearing capacity, it may be possible to obtain some confirmation whether or not it will be possible to carry out the production test of 7.3.2.1 without damage to otherwise satisfactory series belts.

- 7.2.1.1 The load to be applied shall be that of paragraph 4.3 multiplied by a factor of 1.2. where significantly new designs are being tested the CAA may require more than one specimen to be tested.

- 7.2.2 Compliance with the requirements of paragraph 5.4 shall be demonstrated by tests in which the release mechanism is first loaded by means of the members normally assembled to it, to as near as is practical to the ultimate load of the belt (in no case to less than its certified strength). The load shall then be reduced to not less than that prescribed in paragraph 5.4 and the release mechanism operated. The force required to operate it shall be assessed and shall be such that it can be applied without difficulty by a wearer of the belt. This test shall be made for each combination of loads liable to be critical.

### 7.3 Series Belts

- 7.3.1 **General** Series belts shall be checked for consistency with that of the prototype by means of the tests prescribed in paragraph 7.3.2.

**NOTE:** These tests may be modified, in consultation with the CAA, having regard to the particular design and to the results of tests made in accordance with paragraph 7.2. Where experience gained with the production of the particular design shows such test to be unnecessary, the CAA may agree to waive the test requirements of paragraphs 7.3.2.1 and 7.3.2.2 provided that an adequate sample of each production batch is tested in accordance with paragraph 7.3.2.3.

### 7.3.2 **Schedule of Tests**

- 7.3.2.1 Each member, in which webbing or similar material is used in a load-bearing capacity, shall be loaded to not less than one-half of its certified strength. Under these conditions no sign of incipient failure shall be exhibited.
- 7.3.2.2 Each member incorporating a release mechanism shall be loaded to not less than one-half of its certified strength. The load may then be reduced to not less than that appropriate to the item, as prescribed in paragraph 5.4 and the release shall be operated. Under these conditions the effort required for release shall be comparable to that agreed by the CAA, in the light of tests carried out in accordance with paragraph 7.2.2.
- 7.3.2.3 The ultimate strength as prescribed in paragraph 7.2.1.1 shall be verified by tests to destruction on samples taken at random by the manufacturer, the percentage of parts so tested being decided by the manufacturer, subject to any minimum which may be prescribed by the CAA.
- 7.4 **Reconditioned Belts** Reconditioned belts shall be subjected to tests similar to those prescribed in paragraphs 7.3.2.1 and 7.3.2.2, or, in agreement with the CAA, 7.3.2.3 on a sampling basis.

## 8 **Compass Safe Distance**

Where magnetic material is used the compass safe distance shall be not greater than 305mm (12 in.) (i.e. the belt when at a distance of 305mm (12 in.) from the compass shall not affect the compass readings by more than 1°). (See British Standard G.100 for further details.)

## 9 **Marking**

Each normally detachable member of a belt certified as complying with this Specification shall be indelibly marked with:

- the manufacturer's approved inspection mark;
- the part number and/or model number;
- the serial or batch number.