

# European Aviation Safety Agency

## European Technical Standard Order

**Subject:** AIRCRAFT TURNBUCKLE ASSEMBLIES AND/OR TURNBUCKLE SAFETYING DEVICES.

### 1 - Applicability

This ETSO gives the requirements which new models of aircraft turnbuckle assemblies and/or turnbuckle safetying devices that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

### 2 - Procedures

#### 2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

#### 2.2 - Specific

None.

### 3 - Technical Conditions

#### 3.1 - Basic

##### 3.1.1 - Minimum Performance Standard

Standards set forth in Sections 3 and 4 of Military Specifications MIL-T-5685A, dated April 6, 1950 with the additional tests, when applicable, listed below and as amended and supplemented by this ETSO:

Tests The following tests, when applicable, are required in addition to those set forth in MIL-T-5685A, and shall be conducted to substantiate the strength and reliability of special turnbuckle assemblies and/or safetying devices. A minimum of six samples each shall be used in conducting the tests for torsion, tension, fatigue (tensile), and fatigue (torsion).

- (i) Torsion. At least one sample of each size turnbuckle assembly and safetying device shall be tested in torsion to determine that the torque necessary to overcome the turnbuckle thread friction and break the safetying device is equal to or greater than that required when the conventional safety wire is used in accordance with the safetying procedure recommended in Civil Aeronautics Manual 4b.329-2.
- (ii) Tension. At least one sample of each size turnbuckle and safetying device assembly shall be tested to determine that the turnbuckle assembly (including safetying device) will not fail at any tensile load under the maximum (ultimate) tensile strength for which the comparable standard MIL or NAS turnbuckle is rated. For this test, the sample shall consist of the turnbuckle assembly (including safetying device) with a two (2) foot length of cable appropriately attached to each terminal (end) of the turnbuckle. In making the determination, the sample shall be tested for tensile strength in accordance with Federal Test Method Std. N° 151.3. If the sample does not fail under the specified maximum load, it need not be tested further to destruction.
- (iii) Vibration. At least one sample of each of 3 representative sizes of turnbuckle assemblies, i.e., the smallest, the largest, and an intermediate size, shall be vibrated to determine that the lock wire, or other safetying device which relies upon spring action or clamping to safety the turnbuckle, can be depended upon not to jump out of place or otherwise lose its safetying properties, under vibratory conditions apt to be encountered in aircraft service. It

is suggested that a cable tension load equal to 25 percent of rated ultimate cable strength and a frequency of 3600 cpm with an overall amplitude of 1/8 inch (parallel to the axis of the hole through the barrel) for 25 hours, be used for this determination.

- (iv) Fatigue (Tensile). At least one sample of each size turnbuckle assembly shall be given a repeated load test, in which a load equal to 2/3 the ultimate tensile strength requirement is applied repeatedly in tension for 300 applications of the load without failure of any component part. For this test, the sample shall consist of the turnbuckle assembly (including safetying device) with a two (2) foot length of cable appropriately attached to each terminal (end) of the turnbuckle.
- (v) Fatigue (Bending). The safety wire used in the conventional lock wire safetying procedure recommended in CAM 4b.329-2 is not considered to be re-usable. If the safety device used with the special aircraft turnbuckle assembly is to be considered re-usable, at least three (3) samples of the shortest formed non-standard safety wire (or other finished safetying device) shall be tested by alternate fastening and unfastening of the wire (or other safetying device), to determine that the device will not break after repeated applications of the bending loads involved. 200 on and off cycles, simulating rough treatment apt to be experienced during maintenance should substantiate a reasonable service life. It is felt that the shortest safety wire (or other safetying device) will be subjected to the greatest bending stresses. However, if the stresses may be greater in a longer wire (or other safetying device) intended for a larger size turnbuckle, the larger size turnbuckle and the longer wire (or other safetying device) shall be used for this test.
- (vi) Fatigue (Torsion). At least one sample of each size turnbuckle assembly and/or safetying device shall be given a repeated load test in which a load equal to 2/3 the torque (determined in test No 1 above) required to overcome the turnbuckle thread friction and break the conventional safety wire (CAM 4b.329-2) is applied in torsion first in one direction and then reversed for 3000 complete cycles of reversal without failure of any component part.

3.2 - Specific

None

#### **4 - Marking**

4.1 - General

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

None.

#### **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3.