SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS6554

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Superseding ARP6022

Cargo Stopper Devices

RATIONALE

This Aerospace Standard was prepared in order to replace former Aerospace Recommended Practice ARP6022, developed in order to specify basic design, performance and testing requirements for cargo tie-down accessories known as “Cargo Stoppers”, which are commonly used but were not defined in any applicable standard. Sub-committee AGE-2A determined that, because these devices were used as part of tie-down arrangements meeting airworthiness criteria, they should be covered by a standard rather than a recommendation. The only technical changes are added flammability requirements.

FOREWORD

In this document, the minimum essential criteria are identified by the use of the key word “shall”. Other recommended criteria are identified by the key word “should” and, while not mandatory, are considered to be of primary importance in providing reliable and effective Cargo Stopper devices.

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http://www.sae.org/technical/standards/AS6554

1. SCOPE

1.1 Purpose

1.1.1 The purpose of this SAE Aerospace Standard (AS) is to standardize the basic design, performance and testing requirements for “Cargo Stoppers” cargo tie-down accessories to be used in conjunction with approved tie-down straps meeting AS5385C (TSO C-172) requirements.

1.1.2 The lack of an agreed industry standard resulted in uncertainties about their operational capabilities, so that it was deemed advisable to specify the applicable design, minimum performance and testing requirements, since Cargo Stoppers are used as part of cargo tie-down arrangements that must meet regulatory airworthiness requirements.

1.2 Field of Application

1.2.1 The Cargo Stopper devices specified by this Aerospace Standard (AS) are intended to be used in either of the operational circumstances defined in 1.2.2, 1.2.3 and 1.2.4 hereafter.

1.2.2 A Cargo Stopper device should be used to ensure restraint / tie-down of a piece of cargo that does not lend itself to either direct hooking of tie-down straps or passing a strap around without risk of slippage. A common example is long cargo items with a narrow cross-section, whether or not overhanging from the pallet, individual or in bundles, e.g. pipes or beams. See 6.4 in ARP5595A, Cargo Restraint Straps – Utilization Guidelines.

1.2.3 A Cargo Stopper device shall be used to restrain cargo identified as “piercing”, presenting a hazard to the aircraft in the event of it being released during flight.

1.2.4 A Cargo Stopper device shall also be used whenever a crate containing cargo, even though its cross-section is large enough to be directly tied-down with the pallet net or straps, contains or may contain a heavy item, e.g. piece of machinery, shaft, or similar with a cross-section lower than the pallet net’s mesh size.

NOTE: such “hidden” items have been known to break free from insufficiently strong crates when subjected to in-flight accelerations, then pass due to their small size through the net mesh restraining the crate and be released into the cargo compartment.

1.2.5 In addition, a Cargo Stopper device may also be used to assist in tying-down odd shaped cargo pieces where it is difficult or not allowed to directly attach tie-down straps or pass them around the load in an effective manner.

2. REFERENCES

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 Applicable Documents

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org

AS5385C Cargo Restraint Straps – Design Criteria and Testing Methods

ARP5595 Cargo Restraint Straps – Utilization Guidelines

AS33601 Track and Stud Fitting for Cargo Transport Aircraft, Standard Dimensions for

2.1.3 IATA Publications

Available from International Air Transport Association, Publications Assistant, 800 Place Victoria, P.O. Box 113, Montréal, Québec H4Z 1M1, Canada, Tel: 1-514-874-0202, www.iata.org

Airport Handling Manual AHM 311 Securing of load

Unit Load Devices Technical Manual SS 60/2 Air cargo restraint straps

2.1.4 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

Federal Aviation Regulations Title 14 Code of Federal Regulations (14CFR) Part 25 Airworthiness Standards: Transport Category Airplanes, Amendment 25-72, Appendix F

FAA Technical Standard Order TSO C-172, Cargo Restraint Straps

2.1.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 7166 Aircraft – Rail and stud configuration for passenger equipment and cargo restraint

ISO 9788 Air cargo equipment – Cast component of double stud tie-down fittings having an omni-directional rated load capacity of 22 500 N (5 000 lbf) or above

ISO 12236 Geotextiles and geotextile-related products – Static puncture test (CBR test)

ISO 16049-1 Air cargo equipment – Restraint straps – Part 1: Design criteria and testing methods

ISO 16049-2 Air cargo equipment – Restraint straps – Part 2: Utilization guidelines and lashing calculations

2.2 Definitions

For the purposes of the present AS, the following definition applies :

PIERCING CARGO : any piece of cargo of a piercing or penetrating nature, such as rods, pipes, extrusions, beams, etc., that could become a projectile under flight operational loads.

3. REQUIREMENTS

3.1 Cargo Stopper devices (see typical examples in Figure 1 hereafter) shall be built from sewn lengths of cargo restraint straps grade webbing, performing two different roles:

a. tension straps connecting to the main restraint arrangement straps and able to withstand the same forces,

b. interlinking straps forming a weblike structure in order to prevent passage of small cross-section items, stitched together with supplemental continuous flexible material to fill the gaps between webbing straps.

3.2 The tension straps shall consist of a single uninterrupted piece of webbing with a rated tension load of at least 22 500 N (5 000 lbf), consistent with that mostly used to manufacture cargo restraint straps. They shall meet the AS5385C requirements applicable to the webbing and stitching.

3.3 The tension straps shall be equipped at each end with fittings allowing their attachement to standard cargo restraint straps as per AS5385C, and to pallet net rope as appropriate. The fittings may be hooks, rings or D rings, tie-down fittings or pieces of tie-down track, or a combination thereof. No tension device is required.

3.3.1 Hooks shall be equipped with a retainer and strong enough to withstand the rated load without deformation.

3.3.2 Rings or D rings shall be strong enough to withstand the rated load without deformation. Open rings or D rings are not permitted. Any gaps in bent wire shall be welded to provide an uninterrupted circumference.

3.3.3 Tie-down fttings where used shall be of the double stud type and conform with ISO 9788 strength requirements.

3.3.4 Tie-down track where used shall conform with AS33601 (ISO 7166) requirements.

3.4 The interlinking straps may be of lesser grade webbing for flexibility, but their assembly shall ensure the total rated tension load of at least 22 500 N (5000 lbf). Their geometric arrangement shall form a web ensuring the largest empty space between straps does not exceed a 100 mm (4.0 in) diameter circle. They shall be stitched together and with the tension straps at intersections. Webbing and stitching shall meet applicable AS5385C requirements.

3.5 The total area covered by the web of restraining straps shall be at least more than a typical pallet net's mesh size, i.e. 300 x 300 mm (12 x 12 in) diamond [400 x 400 mm (16 x 16 in) square], thus a minimum of 1600 cm² (250 sq.in). It is recommended to consider total areas up to 4 800 cm² (750 sq.in), usually limited by the desired unit's weight and flexibility to adapt to various shapes of cargo.

3.6 In addition, the area covered by the restraining straps web shall also be covered by a strong tarpaulin section, or other equivalent continuous flexible filling material as puncture-proof as possible, stitched to the straps, in order to prevent passage of smaller items.

3.7 All materials used in the Cargo Stopper assembly, including sewing and any treatment, shall meet the flammability test criteria of FAR Part 25 Appendix F, Part I, paragraph (a)(1)(v), as amended by Amendment 25-72: it may not have a burn rate greater than 100 mm (4.0 in) per minute when tested horizontally with the apparatus and test procedures required in Appendix F, Part I, paragraph (b)(5).

3.8 All hardware, e.g. rings, hooks, etc… used in the Cargo Stopper assembly shall be corrosion resistant.

4. TESTING

4.1 Load Test

4.1.1 Cargo Stopper devices shall be load tested prior to delivery. Three test specimens randomly selected from the same production batch shall be used for each test, and the test results recorded for each specimen. The rated ultimate load (UL) shall not exceed the lowest recorded breaking force (BF).

4.1.2 The test shall consist in applying steps 1, 3, 4 and 5 of the load test defined for straps in paragraph 5 of AS5385C between both ends of one of the assembled tension straps. Testing is deemed successful if rupture occurred at a load higher than the rated ultimate load (UL), and any damage observed under the ultimate load did not exceed the allowances.

4.2 Puncture Test

4.2.1 The filling tarpaulin material shall be tested for puncture resistance. Five wetted specimens shall be tested using the apparatus, plunger and methodology of ISO 12236, at a pushing rate of 50 ± 10 mm/min (2 ± 3/8 inch/min).

4.2.2 The mean push-through force in kN (lbf) measured at full puncture through the material shall be recorded.