
**Air cargo — Cargo stopper devices —
Design and testing**

Fret aérien — Dispositifs stop charge — Conception et essais

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 21894:2020](https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020)

<https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020>



iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 21894:2020

<https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Requirements	2
5 Testing	4
5.1 Load test	4
5.2 Puncture test	5
5.3 Flammability test	5
5.4 Other tests	5
5.5 Test report	5
6 Markings	5
7 Quality control	6
7.1 Design and production	6
7.2 Operation	6
Bibliography	8

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 21894:2020](https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020)

<https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020>

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies the design, performance and testing requirements for “cargo stopper” devices intended to be used in conjunction with restraint straps for cargo restraint on board civil transport aircraft.

The civil aviation requirements referred to in this document are those relating to operation of transport aircraft. They constitute the set of operation requirements internationally agreed in application of International Civil Aviation Organization (ICAO) Annex 6, *Operation of aircraft*, to the Convention on International Civil Aviation.

Throughout this document, the minimum essential criteria are identified by use of the key word “shall”. Recommended criteria are identified by use of the key word “should” and, while not mandatory, are considered to be of primary importance in providing safe restraint arrangements on board aircraft. Deviation from recommended criteria should only occur after careful consideration and thorough service evaluation have shown alternate methods to provide an equivalent level of safety.

Dimensions are expressed in millimetres, and forces in newtons. Equivalent inch-pound system units are given between brackets for information.

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 21894:2020

<https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 21894:2020

<https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020>

Air cargo — Cargo stopper devices — Design and testing

1 Scope

This document specifies the design, performance and testing requirements for “Cargo Stopper” air cargo restraint accessories with a 22 250 N (5 000 lbf) rated load capacity, to be used in conjunction with air cargo restraint straps meeting ISO 16049-1 (TSO/ETSO – C172), or air cargo restraint slings meeting ISO 20291-1, with the same rated load.

Cargo stopper devices designed to this document are intended to be used in either of the following typical instances:

- a) 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 shaped cargo items with a narrow cross-section, whether or not overhanging from the pallet, individual or in bundles, e.g. pipes or beams; see ISO 16049-2:2020, 7.4;
- b) to restrain cargo smaller than the pallet net’s mesh, or identified as “piercing” cargo, presenting a hazard to the aircraft in the event of it being released during flight;
- c) when a crate containing cargo, even though its cross-section is large enough to be directly tied-down with the pallet net or restraint straps, contains or can contain a heavy item, e.g. a 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.

- d) 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 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7166, *Aircraft — Rail and stud configuration for passenger equipment and cargo restraint*

ISO 9788, *Air cargo — Double stud tie-down fittings — Design and testing requirements*

ISO 10254, *Air cargo and ground equipment — Vocabulary*

ISO 12236, *Geosynthetics — 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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10254 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 breaking force

BF

lowest load at which a unit under tensile test exhibits part or complete failure

Note 1 to entry: Deformations are not accounted as a failure.

3.2 interlinking straps

cargo stopper straps sewn at an angle with the *tension straps* (3.4), forming a web to adapt the shape of the piece of cargo but which do not transmit the in-flight loads, to which they are perpendicular

3.3 "piercing" cargo

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

3.4 tension straps

cargo stopper straps which attach to the pallet through other straps or slings, and transmit in-flight loads, with which they form a low angle

iteh STANDARD PREVIEW
(standards.iteh.ai)

4 Requirements

ISO 21894:2020

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

- tension straps connecting to the main restraint arrangement straps and able to withstand the same forces;
- interlinking straps forming a web like structure in order to prevent passage of small cross-section items, stitched together with supplemental continuous flexible material to fill the gaps between tension straps.

4.2 The tension straps shall consist of a single uninterrupted piece of webbing with a rated tension load of at least 22 250 N (5 000 lbf), consistent with that mostly used to manufacture cargo restraint straps. They shall meet the ISO 16049-1 design requirements applicable to the webbing and stitching.

4.3 The tension straps shall be equipped at each end with fittings allowing their attachment to standard cargo restraint straps per ISO 16049-1, or 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.

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

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

4.3.3 Tie-down fittings where used shall be of the double stud type and conform to the requirements of ISO 9788.

4.3.4 Tie-down track where used shall conform to the requirements of ISO 7166.

4.4 The interlinking straps may be of lesser grade webbing for flexibility, but their assembly shall ensure the total rated tension load of at least 22 250 N (5 000 lbf) between two opposite end fittings. 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 of tension straps and interlinking straps shall meet the applicable ISO 16049-1 design requirements.

4.5 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 × 300 mm (12 × 12 in) diamond [400 × 400 mm (16 × 16 in) square], thus a minimum of 1 600 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. See [Figure 1](#) for examples.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 21894:2020](#)

<https://standards.iteh.ai/catalog/standards/sist/efab9a73-a816-46ce-bec5-081309627dc9/iso-21894-2020>