
**Air cargo equipment — Restraint
straps —**

**Part 2:
Utilization guidelines and lashing
calculations**

Équipement de fret aérien — Sangles d'arrimage —

Partie 2: Directives pour l'utilisation et calculs d'arrimage



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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. 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. 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.

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

This second edition cancels and replaces the first edition (ISO 16049-2:2005), which has been technically revised. It was technically revised to fully meet the requirements of Technical Standard Order (TSO/ETSO) C-172.

ISO 16049 consists of the following parts, under the general title *Air cargo equipment — Restraint straps*:

- *Part 1: Design criteria and testing methods*
- *Part 2: Utilization guidelines and lashing calculations*

Introduction

This part of ISO 16049 specifies utilization guidelines and the principles to be used in tie-down/lashing strength calculations for the use of air cargo restraint straps on board civil transport aircraft.

Throughout this part of ISO 16049, 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 lashing arrangements. Deviation from recommended criteria should only occur after careful consideration and thorough service evaluation have shown alternate methods to be satisfactory.

Air cargo equipment — Restraint straps —

Part 2:

Utilization guidelines and lashing calculations

1 Scope

1.1 This part of ISO 16049 aims to provide general utilization guidelines and calculation methods adequate to guarantee the effectiveness and ultimate load strength of tie-down/lashing arrangements performed to restrain cargo on board civil transport aircraft during flight:

- a) cargo loaded and tied down onto airworthiness approved air cargo pallets, themselves restrained into aircraft lower deck or main deck or upper deck cargo systems meeting the restraint requirements of air cargo pallets approved in accordance with ISO 8097, (NAS3610) or ISO/PAS 21100, or
- b) additional tie-down on aircraft structure when necessitated by pallet maximum gross mass or centre of gravity limits, or
- c) non-unitized individual pieces of cargo, or pieces of cargo placed onto an unrestrained (“floating”) pallet into either lower deck, main deck or upper deck containerized cargo compartments of an aircraft, or
- d) individual pieces of load loaded in non-containerized (bulk loaded) baggage or cargo compartments.

1.2 This part of ISO 16049 applies to cargo tie-down/lashing arrangements using exclusively air cargo restraint straps conforming to ISO 16049-1. Its general recommendations may also be used for tie-down arrangements using other means (e.g. steel cables, rope, other types of straps), but under the user’s responsibility as to their adequacy and the strength calculations required.

NOTE 1 Where tie-down is performed onto aircraft structure as per 1.1 b) or c), additional restrictions can be stated in the aircraft’s Authority approved Weight and Balance Manual.

NOTE 2 The use of chains or other rigid devices for tie-down onto civil transport aircraft floor tracks is not part of the scope of this part of ISO 16049, since it is not recommended due to the possibility of generating excessive stresses in the aircraft structure, except where explicitly approved in the manufacturer’s Authority approved Weight and Balance Manual.

1.3 This part of ISO 16049 aims to provide industry recognized means of complying with Airworthiness Authorities general regulations applicable to load securing on board civil transport aircraft (see 14 CFR Part 25 and EASA CS-25), and aircraft manufacturers Authority approved Weight and Balance Manuals for each aircraft type as specified therein. It is not the intent of this part of ISO 16049 to specify when restraint straps should be used, but how they should be used. It does not, under any circumstance, supersede the requirements of any of the above documents that take precedence at all times.

2 Normative references

The following referenced documents are indispensable for the application 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 8097:2001, *Aircraft — Minimum airworthiness requirements and test conditions for certified air cargo unit load devices*¹⁾

1) Endorsement of NAS 3610 revision 10, TSO/ETSO/CTSO/JTSO C-90c.