

AEROSPACE RECOMMENDED PRACTICE

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Superseding ARP4049

Cargo Restraint on Aircraft Passenger Seats – Main Passenger Cabin

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature

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1. SCOPE:

This SAE Aerospace Recommended Practice (ARP) establishes the basic recommendations for the following two types of configuration for securing cargo to aircraft passenger seats on transport category aircraft:

- a. Type 1: Seat bags
- b. Type 2: Restraint straps are examples of their type and may be adapted to suit the individual needs of the user.

It is emphasized that the two types of restraint shown are merely examples of methods currently used and does not imply that alternative methods are not acceptable.

For the purposes of this document, the minimum essential criteria are identified by the use of the key word "shall." Recommended criteria are identified by the use of the key word "should," and while not mandatory, are considered to be of significant importance in providing safe, economical, and practical means of cargo restraint. Deviation from recommended criteria should occur only after careful consideration, extensive testing, and thorough service evaluation have shown alternative methods to be satisfactory.

1.1 Field of Application:

Of concern to airlines in recent years has been the demands of their marketing organizations to carry cargo in excess of the volumetric limitations of their aircraft's cargo compartments or of a security nature, such as diplomatic or messenger mail and newspapers in the passenger compartment.

Cargo in excess of volumetric cargo compartment limitations generally arises from seasonal demands and consists mainly of mail, flowers, etc., whereas newspapers, messenger, and diplomatic mail occur at regular intervals throughout the year. The latter is of a special nature requiring observance until delivered and is usually deemed unacceptable to be loaded into cargo holds even though lockable stowages may be provided there.

1.1 (Continued):

A further concern arises in that the cargo is mostly "one-way" traffic. That is, it is carried on, say, the outward sector but not on the return sector. Equally, the passenger load demands on the return sector often demand that full use is made of the cabin seating, and that space cannot be released for the placement of cabin bins unless passenger load factors are reduced or there is insufficient time to effect the configuration change necessary.

1.2 Discussion:

In many cases, cargo of a rigid sizeable nature can safely be restrained in or under passenger seats or between seats by conventional methods using rope, straps, and seat track tie-down fittings. However, there is a range of loads which are of multisizes or of a nonrigid nature, which cannot be restrained safely by such conventional methods or require an excessive amount of time to produce a satisfactory restraint condition. A general category of this type of load would be mailbags. Moreover, conventional methods of restraint, particularly using ropes, cause damage to seating, which results in unnecessary maintenance and presents an unacceptable appearance to passengers. A number of methods have been used by airlines to deal with restraint problems which require the carriage of dead load in passenger cabins and where it is unacceptable to remove passenger seats.

2. REFERENCES:

2.1 Applicable Documents:

- 2.1.1 AIR1490, Environmental Degradation of Textiles Used in Air Cargo Restraint Equipment.
- 2.1.2 MS 33601A, Track and Stud Fitting for Cargo Transport Aircraft, Standard Dimensions for.
- 2.1.3 Federal Aviation Regulation Part 25, Airworthiness Standards: Transport Category Airplanes. United States Department of Transportation.
- 2.1.4 TSO C39b, Aircraft Seats and Berths.
- 2.1.5 NAS 809, Specification - Aircraft Seats and Berths.

3. TECHNICAL REQUIREMENTS:

3.1 Type 1: Seat Bags (Flexible Cargo Containers for Seats):

- 3.1.1 Seat bags may be designed to be installed in single, or multiple seat assemblies, as shown in Figure 1.
- 3.1.2 The maximum load limit of the seat bag shall not exceed the limits defined in 4.1.1 per seat position.

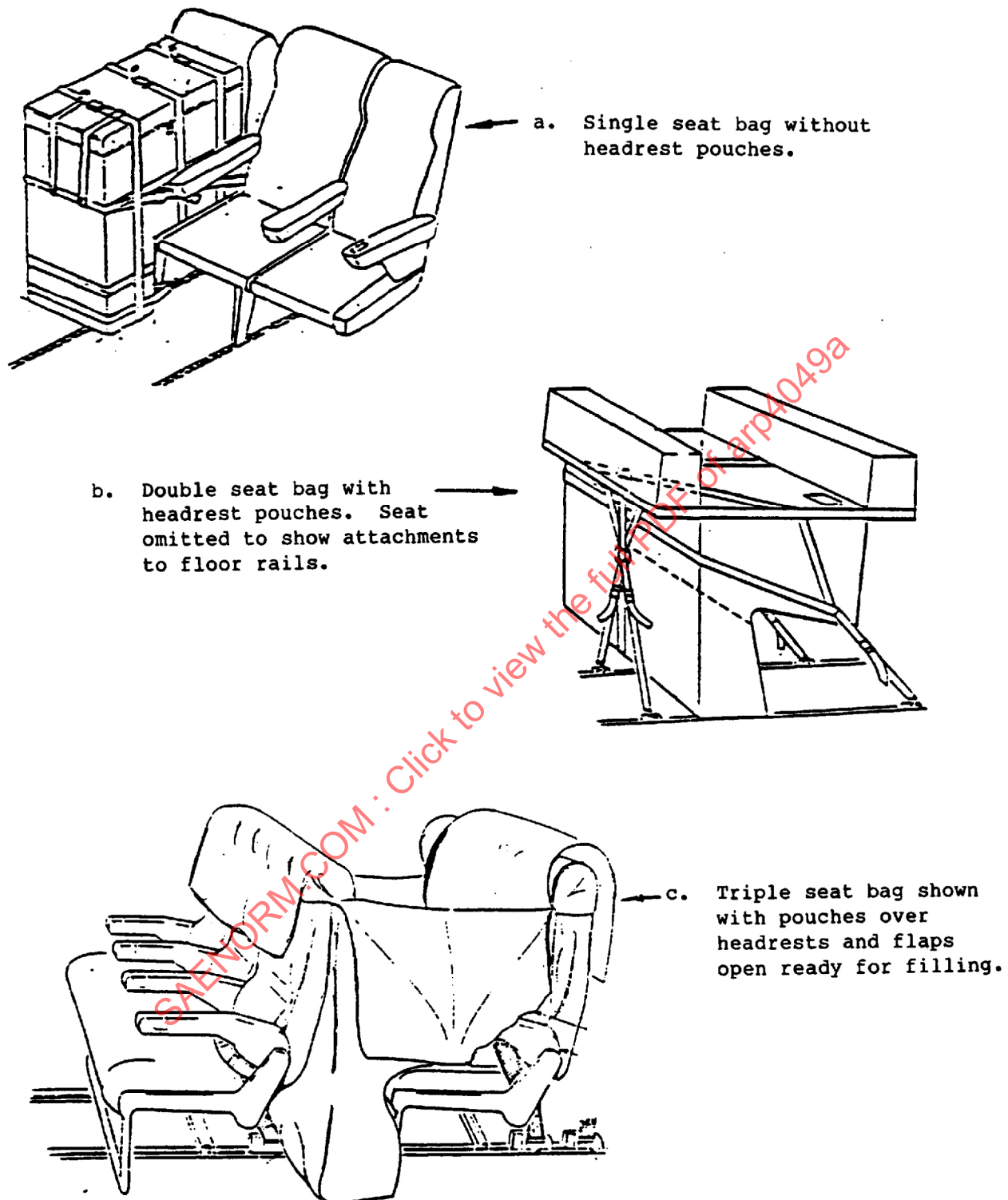


FIGURE 1 - Seat Bags

- 3.1.3 The bag shall be designed to conform to the shape of the passenger seats and to locate between seat arms in the case of a single seat bag. For multiple seat bags the intermediate armrests shall be raised. The seat bag shall be secured by means of body straps attaching to the seat tracks forward and aft of the seat. The straps shall be adjustable in length to accommodate variation in the volume of the contents and seat sizes.
- 3.1.4 Pouches shall be provided at the upper part of the bag to fit over the tops of the seat headrests. These headrest pouches will be slipped over the headrests of the seats and hold the container in position while it is loaded or unloaded as well as during the flight. By installing one container behind the other, the front headrest pocket is always slipped over the rear pocket of the preceding container.
- 3.1.5 The bag shall have a zippered lid in the upper face for loading/unloading purposes, or other provisions to ensure a safe closure.
- 3.1.6 Straps having quick release buckles and tensioning devices shall be attached to the body of the bag and pass over the zippered lid. These shall provide safe restraint of load in the event of damage to the zipper.
- Sufficient adjustment shall be provided to accommodate variations in volumetric fill.
- 3.1.7 The base of the main body of the bag should have a semirigid base to permit distribution of load over the contact area with the seat cushion.
- 3.1.8 The seat bag shall be certified to show compliance with the design loads specified in Section 4.
- 3.1.9 Materials used shall satisfy the flammability requirements of FAR 25.853(b-2).
- 3.1.10 The materials used shall satisfy the colors specified by the purchaser to be compatible with internal liveries.
- 3.1.11 All hardware shall be securely sewn into the webbing or otherwise attached to prevent loss. Loose webbing ends that pass through adjusting buckles shall be sewn back to form a stop.
- 3.1.12 All webbing ends shall be treated and material used in the construction of the bag seamed in such a way as to prevent fraying.

3.2 Type 2: Cargo Restraint Straps:

- 3.2.1 Seat restraint straps shall be designed to be installed to restrain loads in single or multiple seat assemblies. A typical example is shown in Figures 2 and 3. The straps shall be designed to be used in combination and in conjunction with rope having a minimum breaking strength defined in 4.2.2, which, when laced to the strap hooks, will form a net type arrangement overload placed in and under the seat assembly.
- 3.2.2 The maximum load limit of the strap installation shall not exceed the limits defined in 4.1.1 per seat position.

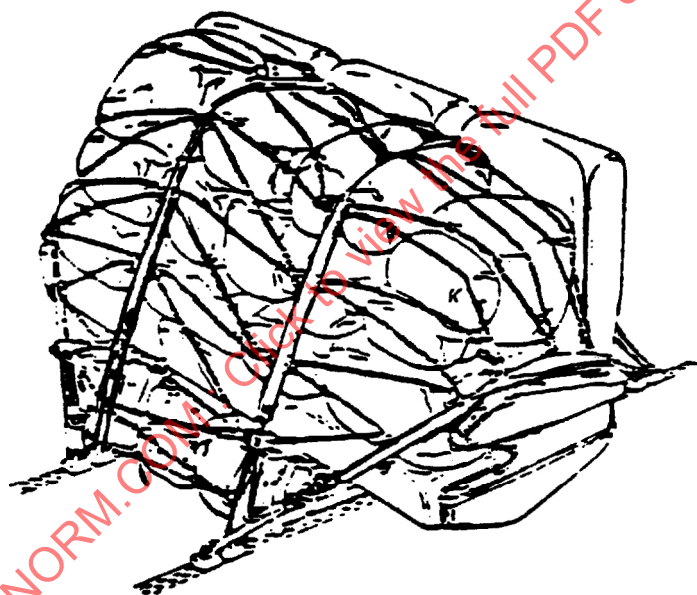
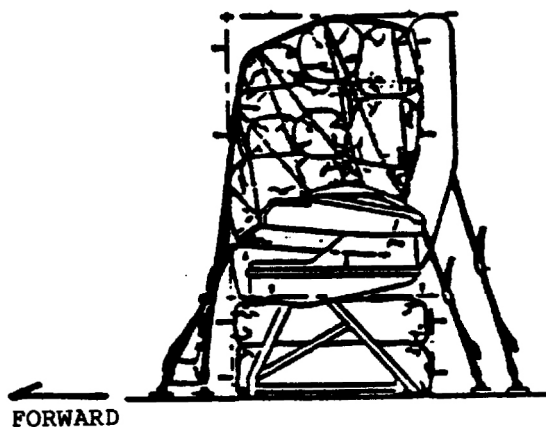


FIGURE 2 - Cargo Restraint Strap Installation



FIGURE 3 – Seat Restraint Strap

- 3.2.3 The general arrangement of the straps is illustrated in Figure 3.
- 3.2.4 The straps shall be designed to locate in seat tracks forward and aft of the seat. Straps attaching to the seat tracks shall incorporate double stud fittings per MS 33601A. The straps shall be adjustable. Where seat pitches are minimal it may not be possible to accommodate four adjacent double stud fittings in the same section of track. In this case, single stud fittings shall be incorporated at the forward end of the installed strap. The straps shall be attached via fittings in all of the available seat tracks at the seat location.
- 3.2.5 The straps shall incorporate pairs of hooks at intervals along their length for quick engagement of the rope lacing. The hooks shall be designed to be of a nontangle type. The opening of the hooks shall be on the same side of the strap as the tension buckle adjustment strap end. The distance between individual paired hooks shall be kept to a minimum to prevent entanglement.
- 3.2.6 Rings shall be incorporated at the first and last paired hook location nearest to the seat restraint fitting to provide additional tensioning if required.
- 3.2.7 The straps and installation shall be certified to show compliance with the design loads specified in Section 4.
- 3.2.8 Materials used shall satisfy the fire resistance requirements of FAR 25.853(b-2).
- 3.2.9 All hardware shall be securely sewn into the webbing or otherwise attached to prevent loss. Loose webbing ends that pass through adjusting buckles shall be sewn back to form a stop.
- 3.2.10 All webbing ends shall be treated to prevent fraying.

4. DESIGN LOADS AND TEST REQUIREMENTS:

4.1 Design Loads:

- 4.1.1 The Type 1 or Type 2 installation shall restrain a payload of 75 kg (165 lb) per seat position.

4.2 Strength Criteria:

- 4.2.1 For Type 1 and Type 2 installations the strength of the container or strap/rope assembly shall be adequate to accept the following ultimate load factors for each of the directions stated:

Forward	9.0 g
Up	4.2 g
Side	3.0 g*
Aft	1.5 g
Down	7.2 g*

NOTE: Airlines operating within the European Joint Airworthiness Requirements should also satisfy the combined forward, sideways, and vertical accelerations shown in FAR 25.561.