SAE Aerospace
An SAE International Group

AEROSPACE RECOMMENDED PRACTICE

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Superseding ARP36104

Air Cargo Pallets and Nets Compatibility

RATIONALE

ARP36104A has been reaffirmed to comply with the SAE five-year review policy.

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http://www.sae.org/technical/standards/ARP36104A

1. SCOPE

1.1 Purpose

1.1.1 This SAE Aerospace Recommended Practice (ARP) provides the criteria to be applied in order to determine compatibility with each other of an air cargo pallet and air cargo pallet net airworthiness approved under either NAS 3610 [TSO C90c] or AS36100A [TSO pending] performance and testing requirements.

1.1.2 It is intended to provide air cargo carriers/operators with the means of determining both the geometric compatibility and the airworthiness approval compatibility of a given pallet with a given net, as well as any limitations to their approved maximum rated capacity resulting from their being used in conjunction with each other.

1.2 Field of Application

1.2.1 This Aerospace Recommended Practice is intended to apply to the most common airworthiness approved ("certified") air cargo pallets and nets combinations to be encountered on board civil transport aircraft.

1.2.2 It applies to all allowable pallet and net combinations where either the pallet or the net is approved under AS36100A [TSO pending] performance and testing requirements. It does not apply to combinations of pallet and net configurations that are only defined in NAS 3610 [TSO C90c], compatibility of which with each other shall be determined in accordance with the applicable NAS 3610 Rev.10 configuration drawing(s).

1.2.3 It does not apply to any non airworthiness approved ("non certified") pallets or nets, the use of which, where allowable, shall conform to the relevant provisions of the aircraft manufacturer's approved Weight and Balance manual for the aircraft type or sub-type concerned.

1.2.4 It is not intended for use on military transport aircraft. Nothing, however, precludes it being used for guidelines in this case, it pertaining to the military operator to identify and implement any additional applicable criteria.

2. REFERENCES

2.1 Applicable Documents

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.

2.1.1 SAE Publications

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

ARP5486 Air Cargo Pallets - Utilization Guidelines

AS36100A Air Cargo Unit Load Devices - Performance Requirements and Test Parameters [TSO pending]

2.1.2 U.S. Government Publications

Available from U.S. Government Printing Office, Mail Stop SSOP, Washington DC 20402-9325, Tel: 866-512-1800, or the FAA web site at www.airweb.faa.gov/rgl.

Federal Aviation Regulations Title 14 CFR (FAR) Part 21 - Certification Procedures for Products and Parts, Subpart O - Technical Standard Order Authorizations

FAA Technical Standard Order (TSO) C90 - Cargo Pallets, Nets and Containers

Federal Aviation Regulations Title 14 CFR (FAR) Part 25, Airworthiness Standards: Transport Category Airplanes

FAA Advisory Circular 120-59, Air carriers internal evaluation program

2.1.3 European Union Publications

Available from European Aviation Safety Agency, Postfach 10 12 53, D-50452 Koeln, Germany, Tel: +49-221-8999-000, www.easa.eu.int.

European Aviation Safety Agency CS-ETSO, Certification Specifications for European Technical Standard Orders

European Technical Standard Order (ETSO) C90 - Cargo Pallets, Nets and Containers

European Aviation Safety Agency CS-25, Certification Specifications for Large Aeroplanes

2.1.4 AIA Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS 3610 Cargo unit load devices - Specification for [Revision 10, 1990, TSO C90c]

2.1.5 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org or International Organization for Standardization, 1 rue de Varembe, Case postale 56, CH-1211 Geneve 20, Switzerland, Tel: +41-22-749-01-11, www.iso.org or any of the national Standards Institutes worldwide, Members of ISO.

ISO 8097 Aircraft - Minimum airworthiness requirements and test conditions for certified air cargo unit load devices [4th edition, 2001, ETSO C90c]

ISO 21100 Air cargo unit load devices - Performance requirements and testing parameters [in preparation, ETSO pending]

2.2 Terms and Definitions

For the purposes of the present ARP, the following terms and definitions apply unless otherwise defined in the document:

CIVIL TRANSPORT AIRCRAFT: An aircraft operated for civil commercial transport of passengers or freight, and capable of carrying air cargo unit load devices for baggage or freight.

INSTALLATION: The fact of installing a unit load device for flight into an aircraft's cargo compartment and restraint system.

NET (AIR CARGO PALLET -): A webbing or rope net for restraining load onto an air cargo pallet.

PALLET (AIR CARGO -): A unit load device consisting of a flat platform with flat undersurface of standard dimensions, on which goods are assembled and secured by a net before being loaded as a unit onto the aircraft, and which interfaces directly with the aircraft handling and restraint system.

RESTRAINT SYSTEM: Equipment for supporting and restraining unit load devices in an aircraft against the ground/flight loads. It usually consists of such items as rollers, side guides and locks for securing unit load devices to the aircraft structure. It does not include unit load devices, barrier nets and tie-down straps.

UNIT LOAD DEVICE (ULD): Device for grouping, transferring and restraining cargo for transit. It may consist of a pallet with a net or it may be a container.

3. GENERAL

3.1 Identification

Pallets and nets shall be identified and evaluated for compatibility by the airworthiness approval classification identifier code marked on them, e.g. :

"NAS 3610 - 2A3N" = Type 2, size A (2235 mm x 3175 mm, 88 in x 125 in), ULD configuration 2A3, Net [example for pallets or nets approved under TSO C90c based on NAS 3610 requirements], or

"AS36100 - 2A7P" = Type 2, size A (2235 mm x 3175 mm, 88 in x 125 in), ULD configuration A7, Pallet [example for pallets or nets approved under TSO [pending] based on AS36100A requirements].

NOTE: See NAS 3610 or AS36100A, as appropriate, for size codes and classification identifier decoding. Only Type 2 pallets and nets are considered within AS36100A and this ARP.

3.2 Ultimate Load Criteria

For each ULD configuration code, NAS 3610 or AS36100A, as appropriate, defines the maximum ultimate load criteria (maximum ultimate loads in each direction of restraint, maximum allowable center of gravity eccentricity and height) approved for that configuration, regardless of the aircraft of installation.

NOTES:

a. NAS 3610 configurations generally define several sets of ultimate load criteria depending on the restraint system shown. Each AS36100A ULD configuration defines only one set of ultimate load criteria and one testing restraint condition.

b. In order to avoid ambiguity, AS36100A ULD configurations were given the same code as NAS 3610 ones when both geometry and maximum ultimate load criteria are identical, and a different code whenever they present a difference.

3.3 Actual ULD Gross Mass Limits

Applicable actual ULD gross mass (MGW) limits are dictated by the Weight and Balance Manual (WBM) for the aircraft of installation, and will in many cases be less than those resulting from the ULD configuration's approved maximum ultimate load criteria. The limits defined by the Weight and Balance Manual according to the aircraft, compartment and position of installation shall be systematically referred to and complied with.

NOTE: The approved Weight and Balance Manual may be issued by either:
- the Original Equipment Manufacturer (OEM), or
- a Supplemental Type Certificate (STC) holder.

In either case, it defines the Authority approved methods and parameters of installation of unit load devices on board the aircraft type or sub-type concerned.

3.4 Applicable General Principles

When determining pallet and net compatibility, the following general principles shall apply:

3.4.1 Compatibility requires both geometrical and ultimate load criteria identity, or geometrical identity and appropriately reduced ultimate load criteria (see hereafter),

3.4.2 A pallet and net of the same size with the same number and type (i.e., single stud or double stud) of net attachment fittings are geometrically compatible. In the event of a pallet with a continuous seat track, only nets of the same size with at least the same number of net attachment fittings as specified by the pallet's approved configuration are deemed geometrically compatible,

NOTE: In this case, net fittings should be attached to the pallet's track at locations as close as possible from those defined in the pallet's approved configuration (see ARP5486 § 4.4).

3.4.3 A pallet and a net with the same ULD configuration code (same airworthiness approval classification identifier code except for the last letter, respectively P or N) are compatible without restrictions, i.e., when used in conjunction with each other they have the maximum ultimate load criteria for that configuration - subject to any further restrictions as may result from the aircraft's Weight and Balance Manual.

3.4.4 When geometrically compatible pallets and nets with different ULD configuration codes (different airworthiness approval classification except for the last letter) are used in conjunction with each other, the lowest ultimate loads and center of gravity eccentricities and height of both configurations shall apply.

4. AS36100A PALLETS AND NETS

4.1 Whenever only AS36100A approved pallets and nets with the same configuration code are concerned, the principle in 3.4.3 applies: pallet and net are fully compatible with each other, without restrictions. This applies within each of the AS36100A ULD configurations applicable to both pallets and nets: 2A7/2B7/2G1/2K4/2L5/2L6/2M4/2N1/2R1/2S1.

4.2 An AS36100-2L5N net is exclusively compatible with an AS36100-2L5P pallet. An AS36100-2L6N net is compatible with either an AS36100-2L6P pallet or an AS36100-2L5P pallet with a continuous track.

NOTE: See 5 hereafter for restricted compatibility with corresponding NAS 3610 configurations.

4.3 An AS36100A approved net may be compatible with two different AS36100A pallet sizes, under both the requirements that :

a. Its size be adjustable to either, and

b. It received a dual approval (“certification”) for the two pallet configurations concerned, therefore, bears a dual approval classification identifier code marking, e.g., “AS36100 -2A7N/2M4N“.

This exclusively applies to the following possible net dual approvals: 2A7N/2B7N, 2A7N/2M4N, 2G1N/2R1N, or 2N1N/2S1N.

NOTE: Ultimate load criteria for dual 2A7N/2M4N or 2N1N/2S1N approval are the same. In the other dual cases, the most stringent ultimate load criteria shall be applied at net design and approval.

4.4 Where two ULD configurations, respectively intended for main deck and lower deck use, exist in AS36100A for a same base size (A7/A8, B7/B8, M4/M5):

a. Lower deck configurations A8, B8, M5 are intended to apply for containers and pallets. he mention of nets on configuration sheets results from an overlook and will be deleted in subsequent revisions of AS36100A.

b. Nets for these base sizes, regardless of their height, shall be approved exclusively as 2A7N, 2B7N, or 2M4N with maximum ultimate loads, in order to preclude the operational possibility of a net approved to the lower ultimate loads being used on main deck without noticing its reduced limitations.

c. Pallets shall be limited to the maximum load allowed by their own approval configuration. Pallets may be tested or substantiated to both the "main deck" and "lower deck" intended configurations, and thus receive a dual approval and marking as either 2A7P/2A8P, or 2B7P/2B8P, or 2M4P/2M5P.

4.5 The compatibility results between all AS36100A ULD configurations concerned are shown in Table 1 hereafter (**C** = Compatible).

TABLE 1 - AS36100A PALLETS AND NETS COMPATIBILITY

Pallet MGW is applicable to the pallet and net assembly.

Pal / net config.	**2A7N** 18 fitgs	**2B7N** 18 fitgs	**2G1N** 40 fitgs	**2K4N** 12 fitgs	**2L5N** 14 fitgs	**2L6N** 20 fitgs	**2M4N** 18 fitgs	**2N1N** 14 fitgs	**2R1N** 36 fitgs	**2S1N** 14 fitgs
2A7P	C	C if net 2A7/2B7					C if net 2A7/2M4			
2A8P	C	C if net 2A7/2B7					C if net 2A7/2M4			
2B7P	C if net 2A7/2B7	C								
2B8P	C if net 2A7/2B7	C								
2G1P			C						C if net 2G1/2R1	
2K4P				C						
2L5P					C	C if cont track pal				
2L6P						C				
2M4P	C if net 2A7/2M4						C			
2M5P	C if net 2A7/2M4						C			
2N1P								C		C if net 2N1/2S1
2R1P			C if net 2G1/2R1						C	
2S1P								C if net 2N1/2S1		C

5. AS36100A AND NAS 3610 PALLETS AND NETS

5.1 Whenever the pallet and net (whether AS36100A or NAS 3610 approved) bear a same ULD configuration code (same airworthiness approval classification identifier code except for the last letter), the principle in 3.4.3 applies, and they remain fully compatible with each other. This exclusively applies to configuration codes 2G1 and 2R1.

5.2 An approved net may be compatible with two different AS36100A or NAS 3610 pallet sizes, under both the requirements that:

a. its size be adjustable to either, and

b. it received a dual approval ("certification") for the two pallet configurations concerned, therefore, bears a dual approval classification identifier code marking " -2G1N/2R1N ".

This, however, exclusively applies to this case of dual approval.

NOTE: Dual 2G1N /2R1N approval ultimate load criteria are the same in AS36100A and NAS 3610. No dual AS36100A/NAS 3610 approval is possible, due to different TSOs.

5.3 Application of the general principles in 3.4.1 through 3.4.4 above results in compatibility, between the AS36100A and most common NAS 3610 ULD configurations concerned, shown in Tables 2A and 2B hereafter. (**C** = Compatible).

6. NAS 3610 PALLETS AND NETS

NAS 3610 pallets and nets compatibility with each other, including sizes not shown herein, is shown in the relevant configuration drawings of NAS 3610 Revision 10.

7. OPERATING RULES

7.1 Operating Instructions

7.1.1 The carrier shall ensure that the cargo equipment procured and operated, including air cargo pallets and pallet nets, meets the applicable regulatory (TSO) requirements, and only compatible pallets and nets are used in conjunction with each other.

7.1.2 The carrier shall establish and distribute to all concerned, including sub-contractors and shippers where they are allowed to build-up air cargo pallets for loading aboard aircraft, pallet and net compatibility instructions taking into account the requirements of the approved Weight and Balance Manual(s) for the aircraft type(s) operated, as well as the recommendations of the present ARP.

7.1.3 The above requirements also apply whenever all or part of palletization is sub-contracted, and should be included by the carrier in the corresponding handling contracts (see IATA AHM 810, Standard Ground Handling Agreement).

7.2 Training and Qualification

7.2.1 The carrier shall establish and implement recurrent training programs (which may be part of broader palletization training, see ARP5486) to ensure his pallet and net compatibility instructions are fully known and practiced by a sufficient number of competent persons throughout his organization, his subcontractors', and any shippers he allows to directly prepare air cargo pallets for loading aboard aircraft.

7.2.2 The basic contents of such training programs do not require understanding of or fluency with the airworthiness approval reference documents, but should include the contents of the present ARP, or at least the parts of it pertaining to the types of pallets and nets the carrier concerned operates or encounters on its flights.

TABLE 2A - AS36100A AND NAS 3610 PALLETS AND NETS COMPATIBILITY - SIZES A, B, M

Pallet MGW is applicable except where otherwise noted (net MGW).

Reference standard		AS36100A			NAS 3610					
	Pal / net config.	**2A7N** 18 fitgs	**2B7N** 18 fitgs	**2M4N** 18 fitgs	**2A1N** 18 fitgs	**2A2N** 28 fitgs	**2A6N** 28 fitgs	**2B2N 2B5N 2B6N** 18 fitgs	**2M1N** 28 fitgs	**2M2N** 18 fitgs
AS36100A	**2A7P** contin. track optional	**C**	**C** if net 2A7/2B7	**C** if net 2A7/2M4	**C net MGW**	**C** if cont track pal **net MGW**	**C** if cont track pal.	**C** if net 2A1/2Bx **net MGW**	**C** if net 2A2/2M1 2A6/2M1 & contin. track pal.	**C** if net 2A1/2M2
	2A8P contin. track optional	**C**	**C** if net 2A7/2B7	**C** if net 2A7/2M4	**C**	**C** if cont track pal.	**C** if cont track pal.	**C** if net 2A1/2Bx		**C** if net 2A1/2M2
	2B7P contin. track optional	**C** if net 2A7/2B7	**C**		**C** if net 2A1/2Bx **net MGW**			**C net MGW**		
	2B8P contin. track optional	**C** if net 2A7/2B7	**C**		**C** if net 2A1/2Bx			**C**		
	2M4P contin. track optional	**C** if net 2A7/2M4		**C**	**C** if net 2A1/2M2 **net MGW**	**C** if net 2A2/2M1 & contin. track pal. **net MGW**	**C** if net 2A6/2M1 & contin. track pal.		**C** if cont. track pal.	**C**
	2M5P contin. track optional	**C** if net 2A7/2M4		**C**	**C** if net 2A1/2M2	**C** if net 2A2/2M1 & contin. track pal.	**C** if net 2A6/2M1 & contin. track pal.		**C** if cont. track pal.	**C**
NAS 3610	**2A1P**	**C**	**C** if net 2A7/2B7	**C** if net 2A7/2M4	SEE NAS 3610 CONFIGURATION DRAWINGS					
	2A2P	Not geometrically compatible								
	2A4P contin. track	**C**	**C** if net 2A7/2B7	**C** if net 2A7/2M4						
	2A6P	Not geometrically compatible								
	2B2P	Not geometrically compatible								
	2B3P contin. track	**C** if net 2A7/2B7	**C**							
	2B5P	Not geometrically compatible								
	2B6P	**C** if net 2A7/2B7	**C**							
	2M1P	Not geometrically compatible								
	2M2P	**C** if net 2A7/2M4		**C**						
	2M3P contin. track	**C** if net 2A7/2M4		**C**						