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Superseding AS1131B

**Air and Air/Surface (Platform) Cargo Pallet Nets**

**RATIONALE**

AS1131C has been reaffirmed to comply with the SAE five-year review policy.

**1. SCOPE:**

This SAE Aerospace Standard (AS) provides dimensional, structural and environmental requirements for pallet nets to be used in conjunction with 2.44 m (8 ft) wide pallets described in AS1130. The pallet/net combination are used in freighter versions of certificated aircraft equipped to provide restraint to pallets tested to the requirements of NAS 3610 Class II restraint system. 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 serviceable, economical, and practical air transport pallet nets. Deviation from recommended criteria should occur only after careful consideration, extensive testing, and thorough service evaluation have shown alternate methods to be satisfactory.

This document establishes five sizes of basic pallet nets as follows:

- a. Size F (10 ft) (NAS 3610-2F1N): To restrain a 2.44 m x 2.99 m x 3 m (96 in x 117.75 in x 118 in) high (max) load
- b. Size R (16 ft) (NAS 3610-2R1N): To restrain a 2.44 m x 4.98 m x 3 m (96 in x 196 in x 118 in) high (max) load
- c. Size G (20 ft) (NAS 3610-2G1N): To restrain a 2.44 m x 6.06 m x 3 m (96 in x 238.5 in x 118 in) high (max) load
- d. Size H (30 ft) (NAS 3610-2H1N): To restrain a 2.44 m x 9.12 m x 3 m (96 in x 359.25 in x 118 in) high (max) load
- e. Size J (40 ft) (NAS 3610-2J1N): To restrain a 2.44 m x 12.19 m x 3 m (96 in x 480 in x 118 in) high (max) load

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## 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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AIR1490 Environmental Degradation of Textile Used in Air Cargo Restraint Equipment  
AS1130 Air and Air/Surface (Platform) Cargo Pallets

#### 2.1.2 ISO Publications: Available from International Organization for Standardization, Case Postale 56, CH-1211, Geneve 20, Switzerland.

ISO 4115 Air Cargo Equipment - Air/Land Nets

#### 2.1.3 FAR Publications: Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.

Federal Aviation Regulation (FAR) Part 25, United States Department of Transportation

#### 2.1.4 NAS Standards: Available from Aerospace Industries Association, 1250 Eye Street, NW, Washington, DC 20005.

NAS 3610 Cargo Unit Load Devices, Specification for

#### 2.1.5 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MS 33601A Track and Stud Fitting for Cargo Transport Aircraft, Standard Dimensions for

#### 2.1.6 IATA Publications: Available from International Air Transport Association, 800 Place Victoria, P.O. Box 113, Montreal, Quebec, Canada H4Z 1M1.

IATA 50/0 Requirements for Interlining of ULDs  
IATA 50/2 Aircraft Pallet Nets

### 3. BASIC REQUIREMENTS:

3.1 The net assembly shall include netting, adjustment hardware and pallet attachment fittings. Configuration and details shall be as specified in Figures 1 and 2 and MS33601A.

#### 3.2 Construction:

3.2.1 Net construction shall be rugged, weatherproof, minimizing maintenance and original cost by having no moving parts other than net attachment and adjustment fittings.

3.2.2 All fittings and appurtenances shall be within the maximum outside dimensions of the net.

3.2.3 Net construction shall have sufficient structural strength to withstand the design loads and test requirements of 3.4 and Section 5 of this document.

3.2.4 The net assembly shall be so constructed that it adequately encompasses the pallet load and attaches to fittings on all four edges of the pallet, the locations of which are shown in Figure 3.

#### 3.2.5 Hardware:

3.2.5.1 The net hardware shall be so designed and constructed so that it can be easily operated in confined areas.

3.2.5.2 All hardware shall be securely sewn or otherwise attached to the net assembly to preclude loss.

3.2.5.3 Free ends that pass through adjusting buckles shall be equipped with stops to preclude detachment from the buckle.

3.2.5.4 Tensioning mechanisms shall be capable of applying tension loads of not less than 155 N (35 lb) by manual application of a 222 N (50 lb) force. To release a 1000 N (225 lb) tension load in any strap shall require an operating force of 155 N (35 lb) or less.

3.2.6 Color: The color of the net material and hardware shall be optional. However, contrasting colors may be used to distinguish net components for simplifying installation of the net to the pallet.

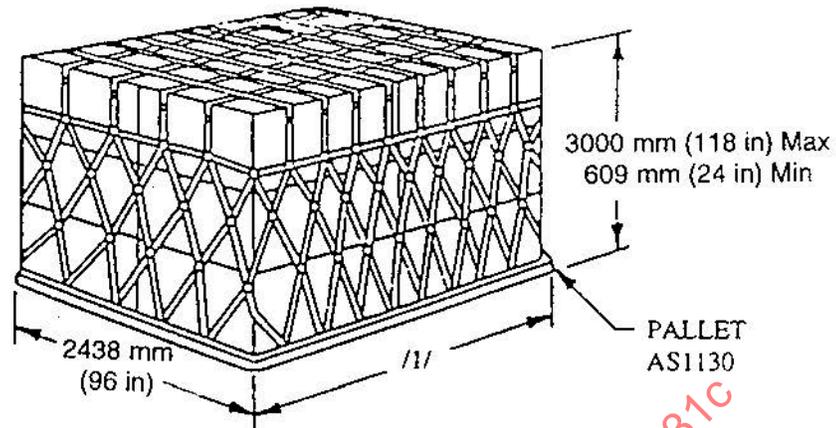
#### 3.2.7 Netting Mesh and Configuration:

3.2.7.1 The maximum mesh size should not exceed 254 mm (10 in).

3.2.7.2 The net design shall provide for easy installation and shall minimize the possibility of improper installation.

3.2.7.3 The net shall be constructed in such a manner that entanglement during installation and storage is minimized.

3.2.7.4 Nets shall be adequately treated to minimize shrinkage.



- /1/ Size F (10ft) (NAS 3610-2F1N): 2991mm (117.75in)
- Size R (16ft) (NAS 3610-2R1N): 4978mm (196in)
- Size G (20ft) (NAS 3610-2G1N): 6058mm (238.5in)
- Size H (30ft) (NAS 3610-2H1N): 9125mm (359.25in)
- Size J (40ft) (NAS 3610-2J1N): 12192mm (480in)

FIGURE 1 - Net Assembly (Typical-Pattern Optional)

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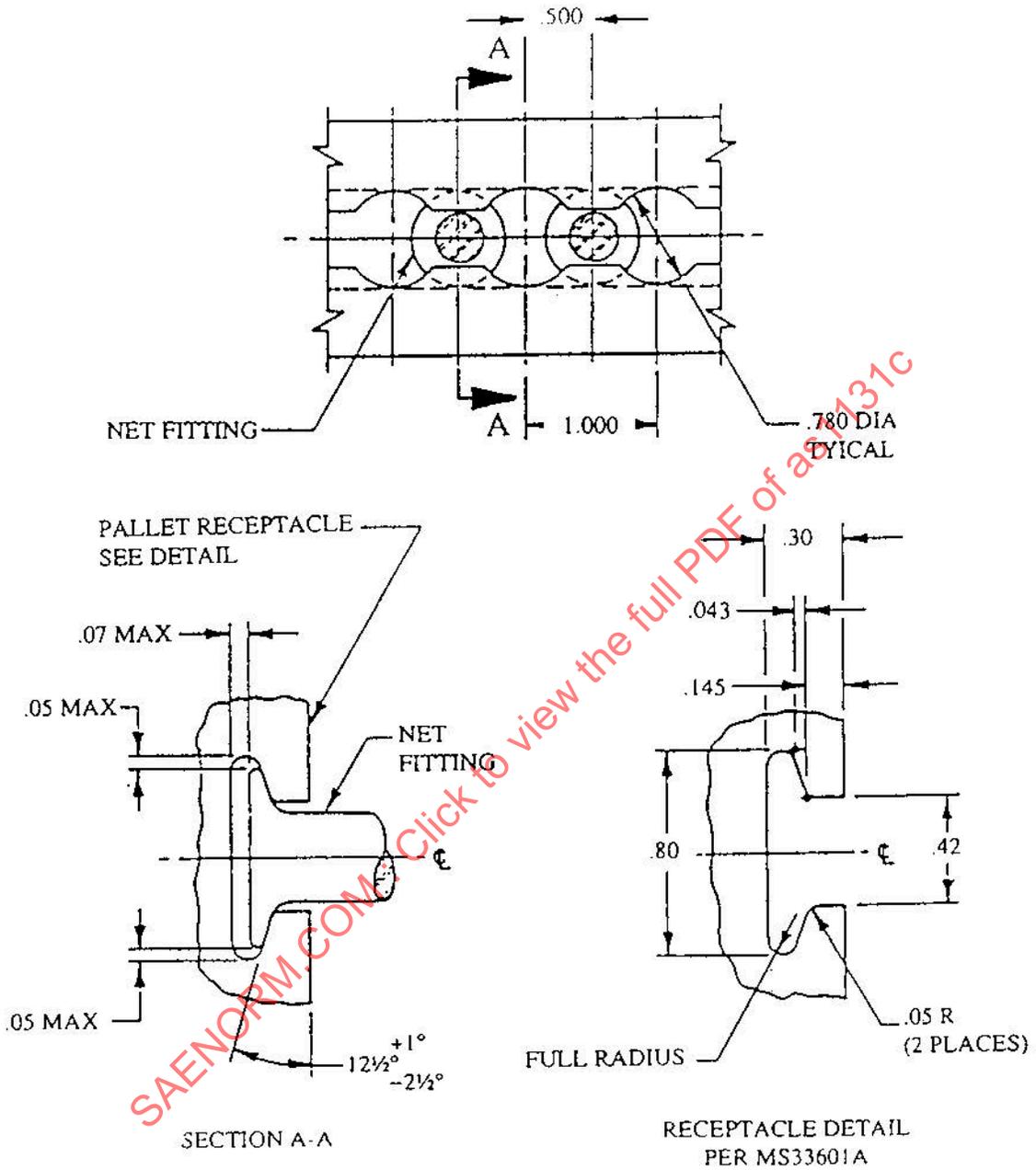


FIGURE 2A - Cargo Net Tie-Down Fitting  
Dimensions in Inches

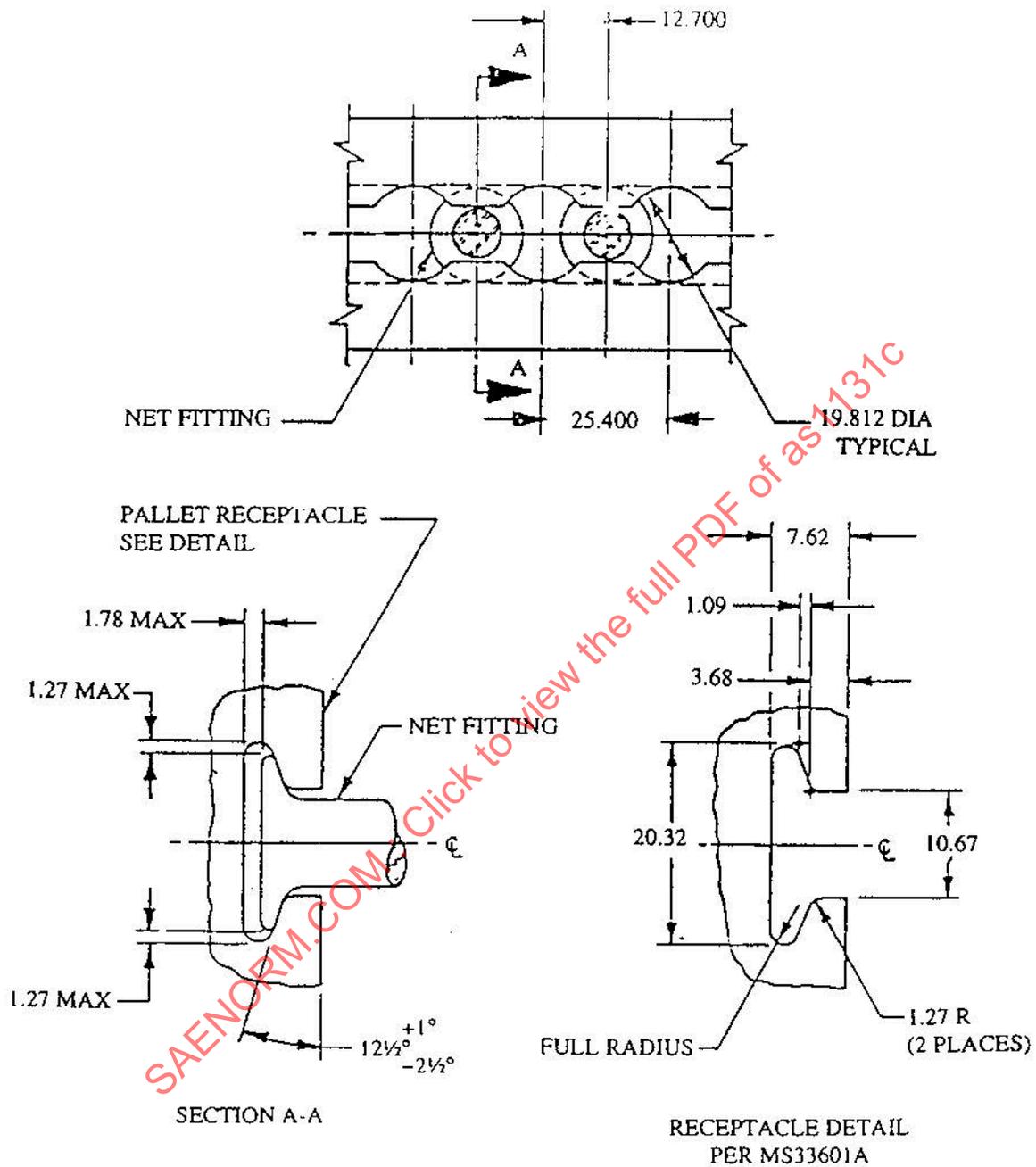
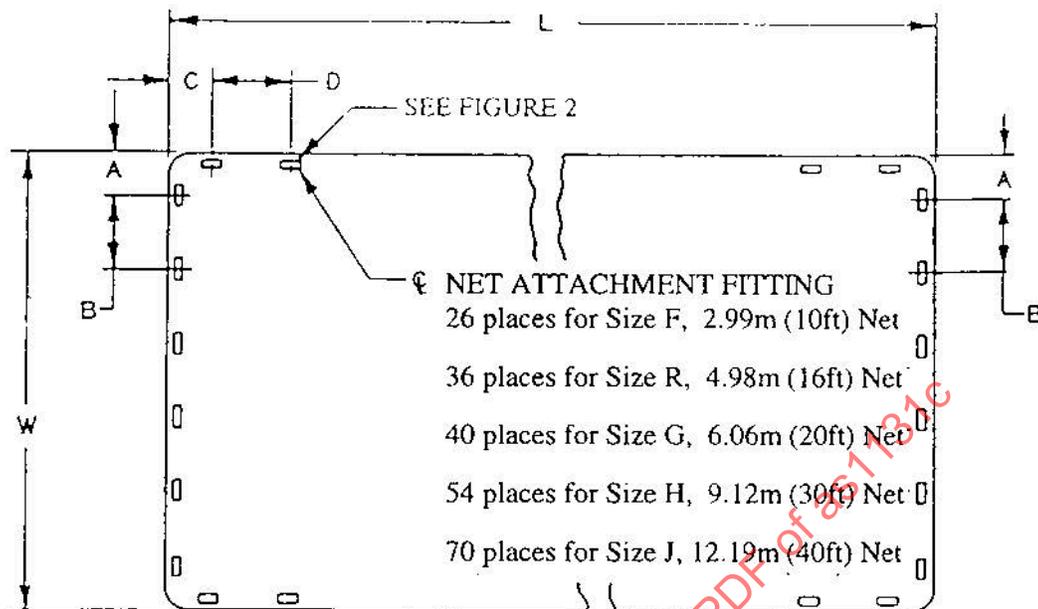


FIGURE 2B - Cargo Net Tie-Down Fittings  
Dimensions in Millimeters



Overall Length L mm	Overall Length L (in)	Overall Width W mm	Overall Width W (in)	Dim A mm	Dim A (in)	Dim B mm	Dim B (in)	Dim C mm	Dim C (in)	Dim D mm	Dim D (in)
12 192	480	2 438	96	239.27	9.42	391.92	15.43	238	9.37	419.10	16.50
9 125	359.25	2 438	96	239.27	9.42	391.92	15.43	238	9.37	429.26	16.90
6 058	238.50	2 438	96	239.27	9.42	391.92	15.43	238	9.37	432.31	17.02
4 978	196	2 438	96	239.27	9.42	391.92	15.43	238	9.37	409.19	16.11
2 991	117.75	2 438	96	239.27	9.42	391.92	15.43	238	9.37	418.34	16.47

FIGURE 3 - Tie-Down Fitting Locations

- 3.2.7.5 All netting ends shall be designed to prevent fraying.
- 3.2.7.6 The material used for netting shall meet the appropriate regulatory standards for cargo aircraft restraint per Federal Aviation Regulation (FAR) 25.
- 3.2.7.7 If netting is made from nylon or equivalent, consideration should be given for strength degradation resulting from exposure to ultraviolet. See AIR1490.
- 3.2.8 **Special Marking:** The net shall be clearly marked to facilitate rigging on the pallet. If the net operation is not omni directionally top and bottom, the inside and outside shall be included. Character marking or color coding may be used to facilitate rapid attachment of net fittings to the pallet.
- 3.2.9 **Reefing Adjustment:** The net shall be constructed to provide adjustment at vertical intervals for stacked height from approximately 24 in (610 mm) to a maximum allowable height of 96 in (2.44 m) or 118 in (3 m) as applicable.
- 3.3 **Ratings:**
- The net when attached to the pallet shall be designed/rated for the following gross weights:
- 3.3.1 2.99 m (10 ft) pallet: 5670 Kgs (12,500 lb)
- 3.3.2 4.98 m (16 ft) pallet: 11,340 Kgs (25,000 lb)
- 3.3.3 6.06 m (20 ft) pallet: 13,608 Kgs (30,000 lb)
- 3.3.4 9.12 m (30 ft) pallet: 15,876 Kgs (35,000 lb)
- 3.3.5 12.19 m (40 ft) pallet: 20,412 Kgs (45,000 lb)

### 3.4 Design Loads:

3.4.1 Table of Loads: The net assembly shall be used in conjunction with a pallet per AS1130 to restrain the loads listed in Table 1:

TABLE 1

	Dimensions	Maximum Gross Loads
Size F (NAS 3610-2F1N)	2438 mm x 2991 mm (96 in x 117.75 in)	5,670 kg (12,500 lb)
Size R (NAS 3610-2R1N)	2438 mm x 4978 mm (96 in x 196.00 in)	11,340 kg (25,000 lb)
Size G (NAS 3610-2G1N)	2438 mm x 6058 mm (96 in x 238.50 in)	13,608 kg (30,000 lb)
Size H (NAS 3610-2H1N)	2438 mm x 9125 mm (96 in x 359.25 in)	15,876 kg (35,000 lb)
Size J (NAS 3610-2J1N)	2438 mm x 12,192 mm (96 in x 480 in)	20,412 kg (45,00 lb)

3.4.2 Ultimate Loads: The net assembly shall be designed to the ultimate loads per NAS 3610 with the center of gravity located at any point within the range specified in 3.4.3. Under these loads the net may exhibit permanent deformation, but shall not rupture to the extent of discharging cargo.

### 3.4.3 Center of Gravity:

3.4.3.1 The center of gravity shall be assumed to vary up to:

- ±10% of the net/pallet width measured from the centerline
- ±5% of the net/pallet length measured from the centerline
- 1219 mm (48 in) vertically measured from the pallet bottom surface
- To achieve asymmetric conditions, cargo density shall be assumed to vary linearly

## 4. ENVIRONMENTAL CRITERIA:

### 4.1 Materials:

4.1.1 The net assembly should be designed and built using materials which will provide maximum serviceability and protection of contents under intended environmental conditions.

4.1.2 The structural and operational integrity of the net shall be maintained in a temperature environment from -65 to +160 °F (-54 to +71 °C).

4.1.3 All components of the net shall be protected against deterioration or loss of strength in service due to weathering, corrosion, or other causes where the type of material used required such protection. A design strength factor applied to the ultimate strength factor for the netting materials should be at least 1.25.

4.1.4 The net shall be so designed that it will withstand handling common to air/land freight terminal and ramp operations.

#### 4.2 Weight Limits:

The tare weight of the net assembly shall be a minimum consistent with the requirements and within limits of sound design practices.

#### 4.3 Materials and Processes:

4.3.1 The materials and processes selected should give consideration to the extremely hard usage to which the net will be subjected to provide for maximum service life. All metal parts should be suitably protected against corrosion. All nonmetallic materials which are liquid absorbent should be sealed or treated to prevent liquid absorption.

4.3.2 Materials shall be flame resistant in accordance with the regulatory requirements.

4.3.3 All fasteners must conform to approved industry standards that ensure their having the properties assumed in the design data. No slotted head screws shall be used.

### 5. TESTING REQUIREMENTS:

#### 5.1 Scope:

5.1.1 The tests are static in nature to minimize complexity and cost of required testing facilities. As far as practical, applied static loads take into account the combined static and dynamic loads anticipated in service.

5.1.2 It is intended that tests shall be nondestructive in nature and not result in damage to the net unless ultimate load conditions are employed.

5.1.3 Test equipment and methods of testing described are not meant to be restrictive. Alternate equivalent methods to accomplish the desired result may be employed.

5.1.4 In selected cases, tests may be repeated under ultimate load conditions when required for substantiation of analytical data. Any net used for ultimate load test must be scrapped (totally).

#### 5.2 Test Criteria:

5.2.1 A net assembly shall be considered satisfactory if, upon inspection before and after testing, its dimensions fall within those specified in Figure 1 and in applicable manufacturing drawings.

5.2.2 Permanent deformation is permitted under ultimate load conditions. The net assembly shall be considered within acceptable limits if it exhibits permanent deformation but does not rupture to the extent of discharging cargo.

### 5.3 Recommended Test Equipment:

#### 5.3.1 Handling and Securing:

5.3.1.1 A pallet per AS1130 or a base with equivalent net attachments shall be used.

5.3.1.2 A crane or lifting means with capacity to lift the gross weight of the loaded pallet, lift fixture and net assembly shall be provided. Sufficient height shall exist under the hook to permit positioning the pallet, lift fixture and net assembly vertically on either side or end.

5.3.1.3 When conducting structural test, sufficient payload to meet test load requirements shall be provided. Where appropriate, water or load producing devices may be used.

#### 5.4 Test Procedure - Operational Loads:

5.4.1 Test 1 - Net Strength, Upload: The net assembly attached to a pallet per AS1130 or equivalent base shall be loaded with a uniformly distributed load equal to the gross weight as specified in Table 1 and suspended upside down per Figure 4. After lifting, the net assembly shall be suspended for not less than 5 min and then lowered to the ground. No permanent deformation or failure shall occur.

5.4.2 Test 2 - Net Strength, Forward Load: With the net assembly attached to a pallet per AS1130 or equivalent base, a uniformly distributed load equal to the gross weight as specified in Table 1 shall be applied for not less than 5 min to one 2.44 m (96 in) end of the net. The center of gravity of the load shall be 1.22 m (48 in) vertically measured from the pallet bottom surface and within the lateral and longitudinal limits specified in 3.4.3. No permanent deformation or failure shall occur.

5.4.3 Test 3 - Net Strength, Side Load: With the net assembly attached to a pallet per AS1130 or equivalent base, a uniformly distributed load equal to the gross weight as specified in Table 1 shall be applied for not less than 5 min to one 2.44 m (96 in) end of the net. The center of gravity of the load shall be 1.22 m (48 in) vertically measured from the pallet bottom surface and within the lateral and longitudinal limits specified in 3.4.3. No permanent deformation or failure shall occur.

#### 5.5 Test Procedure - Environmental:

5.5.1 Subject any parts that cannot be adequately protected against corrosion to a test duplicating the anticipated environment. Subsequent corrosion shall not preclude the parts from performing their design functions or incur failure of a pallet net during the design life of the net.

5.5.2 The net assembly shall be placed empty in a suitable test chamber of 160 °F (71 °C) ambient temperature for 48 h.

5.5.2.1 At the end of 48 h, its condition shall be evaluated while the structure is at or near the test temperature.

5.5.2.2 The net assembly shall then be placed empty in a suitable test chamber in a -65 °F (-54 °C) ambient temperature for 48 h.