

INCH-POUND

MIL-DTL-27443F (USAF)

15 July 2003

SUPERSEDING

MIL-P-27443E (USAF)

24 February 1967

DETAILED SPECIFICATION

PALLETS, CARGO, AIRCRAFT, TYPE HCU-6/E AND HCU-12/E

1. SCOPE.

1.1 Scope. Pallets, cargo, aircraft, covered by this specification have a capacity of 10,000 pounds and 5,000 pounds.

1.2 Classification. Aircraft cargo pallets covered by this specification are of the following types:

Type I - 10,000 pounds capacity designated HCU-6/E.

Type II - 5,000 pounds capacity designated HCU-12/E.

1.3 Part or Identifying Number (PIN). The PIN to be used for pallets acquired to this specification are created as follows:

M27443	-	1	└─	Type 1	Type I
			└─	2	Type II
				Specification	

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: WR-ALC/LEEV, 295 Byron Street, Robins AFB GA 31098-1611 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1670

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONFEDERAL

A-A-50271	Plate, Identification
MMM-A-132	Adhesive, Heat Resistant, Airframe Structural, Metal to Metal

DEPARTMENT OF DEFENSE

MIL-S-7998	Sandwich Construction Core Material, Balsa Wood
MIL-PRF-81733	Sealing and Coating Compound, Corrosion Inhibitive

STANDARDSFEDERAL

FED-STD-595	Colors Used In Government Procurement
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DEPARTMENT OF DEFENSE

MIL-STD-130	Identification Marking of U.S. Military Property Ground and Ground Support Equipment
MIL-STD-810	Environmental Engineering Considerations And Laboratory Tests
MIL-STD-889	Dissimilar Metals

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HANDBOOKSDEPARTMENT OF DEFENSE

MIL-HDBK-831 Preparation of Test Reports

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government drawings. The following other Government drawings form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

7031843	U.S. Air Force (HCU-6/E) (Delete Notes 3, 5; Delete MIL-P-27443 from note 6 and the list of materials and substitute "MIL-S-7998")
7133047	U.S. Air Force (HCU-12/E)

(Drawings required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 864	Surface Preparation of Aluminum Alloys to be Adhesively Bonded in Honeycomb Shelter Panels (DoD adopted)
ASTM D4690	Adhesive, Urea-Formaldehyde Resin (DoD adopted)

(Applications for copies should be addressed to the American Society for Testing and Materials, 1916 Race St., Philadelphia PA 19103.)

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AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes
(DoD adopted)

(Application for copies should be addressed to the American Society for Quality Control, 611 East Wisconsin Avenue, Milwaukee WI 53202.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.2 Materials.

3.2.1 Protective treatment. The materials shall be as specified by applicable drawings and details thereof. When materials are used in the construction of the pallets that are subject to deterioration when exposed to climatic and environmental conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that will in no way prevent compliance with performance requirements of this specification (see 4.5.1). The use of any protective coating that will crack, chip, or scale with age or extreme of climatic and environmental conditions shall be avoided.

3.2.2 Metals. Metals shall be of the corrosion-resistant type or treated to resist corrosion due to salt spray or atmospheric conditions likely to be met in storage or normal service (see 4.5.1).

3.2.2.1 Dissimilar metals. Contact between dissimilar metals shall be avoided wherever possible (see 4.5.1). Wherever such contacts are unavoidable, they shall be insulated in a manner approved by the procuring activity. Dissimilar metals are defined in MIL-STD-889.

3.2.3 Adhesive. The adhesive used for bonding the core to the skin and the rails shall be vinyl phenolic FM-47 liquid adhesive in accordance with MMM-A-132, Type I, Class 3. The adhesive to be used to bond the balsa shall be a Urea-Resin type in accordance with ASTM D4690 and the following requirements.

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Requirement	Minimum	Maximum
Insoluble Matter	---	20%
Amylaceous Matter	---	None
pH	2.5	---
Working Life, hours	2	8
Storage Life	2 years	---

The adhesives shall be identified when received and the certified test report of each container shall be retained and identified to the container. Tensile shear specimens, not less than 4, shall be prepared and tested prior to use of each adhesive in production. The minimum acceptable test result of any specimen shall be 4,200 psi at 75°F. The minimum acceptable test result of any urea-resin specimen shall be as specified in ASTM D4690. After a container of adhesive has been out of production 96 hours or longer, it shall be tensile shear tested as above before placing it back into production. The contractor shall develop a control procedure to ensure that the adhesives are controlled at all times. This shall include, but not be limited to, storage control, method of issue to production, method of specimen preparation, amount of adhesive, cleaning, cure pressure and temperature. Specification MMM-A-132 shall be used as guide in test specimen fabrication for metal to metal and metal to balsa bonds. Urea-Resin test specimens shall be prepared according to ASTM D4690 (see 4.5.1).

3.2.3.1 Adhesive dye. A red dye shall be added to the adhesive (see 3.2.3) to identify the pallet as one manufactured with a thermally cured adhesive (see 4.5.1).

3.2.4 Balsa Wood. The balsa wood shall be in accordance with MIL-S-7998. Paragraphs 3.3, 3.5, and 4.3.2 of MIL-S-7998 shall not apply. The density requirements of paragraph 3.4 of MIL-S-7998 shall be deleted and a minimum of 6 pounds per cubic foot substituted. In addition to the defects listed in paragraph 3.7 of MIL-S-7998, the following defects are acceptable:

- a. Scattered pin holes shall not exceed 0.093 inch diameter (see 4.5.1).
- b. Stains (mild blue or mineral) not associated with decay (see 4.5.1).
- c. Four checks or splits are permitted per lateral surface; however, these checks or splits shall not cause the wood to separate during fabrication. The check or split shall not be wider than 3/32 inch. There shall be no limitation on the lengths of such defects (see 4.5.1).
- d. Sound, tight knots (see 4.5.1).
- e. Occasional bird's eye blemishes shall not exceed 0.375 inch in width (see 4.5.1).
- f. Wane shall be permitted on two edges; the width shall not exceed 0.093 inch (see 4.5.1).

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3.3 Construction. The pallet shall be constructed so that no parts shall work loose in service. It shall be built to withstand the strains, jars, vibration, and other conditions incident to shipping, storage, installation, and service (see 6.1). The pallet shall be constructed as an integral unit and shall not require assembly or attachment of separate parts during operational use. The pallet shall be constructed and assembled according to requirements herein and applicable drawing 7031843 or 7133047. The top and bottom skins shall each be 1 continuous sheet (see 4.5.1).

3.3.1 Reliability. The pallet shall be constructed as specified herein (see 4.5.1) to assure optimum service life under all service conditions specified herein, and shall be acceptably demonstrated during the testing specified herein. The pallet shall be designed for life of a minimum of 10 years.

3.3.2 Core layout. Core layout shall be such that the bond line between the core and rails shall include no gap that exceeds 0.020 inch in width and the total accumulation of all core to rail gaps shall not exceed 8 inches in length. No single gap shall exceed 4 inches in length. Allowable gaps shall be filled to their depths with the adhesive specified (see 3.2.3) and shims shall not be inserted between the core and the rails. Wedges may be inserted between the core modules and no part of the core shall be movable (see 4.5.9 d., 4.5.11).

3.3.3 Load Center of Gravity. The vertical center-of-gravity shall be 48 inches above the pallet surface of the Type I pallet and 36 inches above the pallet surface of the Type II pallet. The loads shall be uniformly distributed for each type of pallet.

3.3.4 Load configuration. The load for each pallet shall be rectangular cubes (boxes). The cubes for Type I pallets shall be approximately 20 inches wide by 20 inches long by 12 inches high. The cubes for the Type II pallets shall be approximately 24 inches wide by 20 inches long by 12 inches high. All cubes shall be free to move relative to adjacent cubes.

3.3.5 Edge structure. The bonded sandwich construction shall be fastened to the edge structure as specified (see 3.3.2) and applicable drawings. The top and bottom skins shall be flush to not more than 0.020 inch below flush with the edge structure as shown on applicable drawings. Mitered corners of the rails shall be reinforced to withstand the tests (see 4.5.5.1 and 4.5.3.1).

3.4 Performance.

3.4.1 Bond continuity. Each pallet skin is bonded to 4 side rails and the balsa wood core. This bond shall be continuous and without voids (see 4.5.2).

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3.4.2 Tie down rings.

3.4.2.1 Ring location and movement. Tie down rings shall be provided according to the requirements herein and applicable drawings 7031843 or 7133047. When not used for tie down, the rings shall not interfere with the entry of the pallet into a rail section. The pivot point of the ring shall be outside the usable surface edge. Each ring shall be capable of at least 225° of free movement in a vertical plane that intersects the pallet edge at right angles (see 4.5.3.1).

3.4.2.2 Ring capacity one. Each ring shall be designed to sustain a 7,500 pound tension load along any line in a vertical plane that intersects the pallet edge at right angles within the angular limits (see 4.5.3.2).

3.4.2.3 Ring capacity two. Each ring shall also be designed to sustain a 7,500 pound load along any line originating at the attachment point in a vertical plane extending above the pallet and parallel to the edge without permanent deformation (see 4.5.3.3).

3.4.2.4 Ring capacity three. The rings shall be designed such that two adjacent corner rings can be pulled simultaneously and then two center rings pulled simultaneously without permanent deformation (see 4.5.3.4).

3.4.3 Static load. When supported by conveyors as specified (see 3.4.5.1), the pallet shall be capable of supporting a uniformly distributed static load (see 6.3.2) for 40 hours without permanent deformation (see 4.5.4).

3.4.4 Lifting capabilities.

3.4.4.1 Corner lifting. When uniformly loaded (see 6.3.3), the pallet shall be capable of withstanding, without permanent deformation, lifting by means of 4 cables attached to the 4 tie down rings adjacent to the 4 corners (see 4.5.5.1).

3.4.4.2 Forklift lifting. When uniformly loaded to rated capacity (see 6.3.1), a pallet shall withstand lifting from a conveyor (see 3.4.5.1) without deformation. A forklift truck having 72 inch long by 6 to 8 inch wide tines spaced 42 inches center-to-center shall lift the Type I pallets. A forklift truck having 54 inches long by 6 inches wide tines spaced 42 inches center-to-center shall lift the Type II pallets. Forklift truck tines shall have an end radius of not less than 0.250 inch (see 4.5.5.2).

3.4.4.3 Forklift "wedge" lifting. When uniformly loaded to rated capacity (see 6.3.1), a pallet shall withstand lifting from a smooth, dry, concrete surface without deformation. The tines shall be wedged under the pallet perpendicular to a pallet rail. A forklift truck having 72 inch long by 6 to 8 inch wide tines spaced 42 inches center-to-center shall lift the Type I pallets. A forklift truck having 54 inches long by 6 inches wide tines spaced 42 inches center-to-center shall lift the Type II pallets. Forklift truck tines, with an end radius of not less than 0.250 inch (see 4.5.5.3).

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3.4.5 Traversable capabilities.

3.4.5.1 Conveyor. When uniformly loaded to rated capacity (see 6.3.1), the pallet shall be capable of transversing roller conveyors with 2-inch diameter by 3.5 inch long rollers spaced on 10 inch centers. The pallet shall be supported by four rows of conveyors, one row along each side, and one row along a line 10 inches each side of the center line (see 4.5.6.1).

3.4.5.2 Conveyor ramp. When uniformly loaded to rated capacity (see 6.3.1), the pallet shall withstand being towed over a 17°, 10-foot long ramp connecting two horizontal surfaces. The pallet shall be supported by conveyors as specified (see 3.4.5.1). The pallet shall be towed parallel to both 88 and 108-inch sides for Type I pallets, and both the 54-inch and 88-inch sides for the Type II (4.5.6.2).

3.4.6 Ultimate load. When uniformly loaded to rated capacity (see 6.3.1), the load being restrained to the pallet by nets (see 6.3.4), the pallet installed between restraining rails locked to the rails by 2 locks through each rail and engaging 2 lock notches on each side of the pallet, and resting on 4 rows of conveyor as specified (see 3.4.5.1), the loaded pallet shall withstand a dynamic load of 3 times the force of gravity (g's) for a period of 0.1 second. The pallet shall be serviceable after undergoing the test. In addition, the pallet shall withstand a dynamic load of 8 g's for a period not less than 0.1 second. The pallet need not be serviceable after undergoing such a load; however, the pallet shall remain in one piece (see 4.5.7).

3.4.7 Environmental conditions. The pallet shall be capable operating in the following conditions without permanent damage :

- a. Temperatures ranging from -65° to +160° F (see 4.5.8.1, 4.5.8.2).
- b. Rain (see 4.5.8.3).
- c. Salt-sea atmosphere(see.4.5.8.4)

3.4.8 Mechanical properties.

- a. The lap joint between the skin and rail sections shall meet the minimum average strength requirements listed in MMM-A-132, Table I, test number 1 (see 4.5.9 a.).
- b. After curing, the balsa core is the weakest component in a peel situation. An acceptable metal-to-wood joint shall consist of not less than 100% wood failure in a peel situation (see 4.5.9 b.).
- c. The surface of the pallet shall be capable of withstanding 900 pounds per square inch (see 4.5.9 c.).

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3.5 Dimensions and weight. The nominal dimensions of the Type I pallet are: 88 x 108 x 2.250 inches thick (see 4.5.1). The Type II pallet is 88 x 54 x 2.250 inches thick (see 4.5.1). The Type I pallet maximum allowable weight is 300 pounds. The Type II pallet maximum allowable weight is 160 pounds.

3.6 Component preparation for assembly.

3.6.1 Preparation of balsa wood for bonding. Balsa wood core segments shall be oven-dried for 120 \pm 10 minutes at 225° \pm 5° F in preparation for bonding. Core segments shall be cleaned of dust with dry, oil-free, filtered and compressed air or vacuum prior to delivery to lay up and assembly area. Acceptable moisture content of balsa wood should be no higher than 12% at the time of bonding. If higher, dry at 190-200°F or higher for one-hour minimum (see 4.5.1).

3.6.2 Preparation of skins and rails. Skins and rails shall be prepared for bonding in accordance with Table 3 or Table 4 of ASTM E 864. Unless otherwise specified herein, preparation shall include all necessary materials, apparatus, test methods, procedures, quality assurance, and certification(s) specified in ASTM E864 (see 4.5.1).

3.6.3 Adhesive application. Adhesive shall be applied to skins and rails within 16 hours after drying. Skins and rails which have not been coated within 16 hours shall be reprocessed as specified (see 3.6.2). Adhesive shall be applied to all balsa segments within 2 hours following oven drying. The adhesive shall be uniformly applied in accordance with the manufacturer's instruction sheet as required in MMM-A-132 (see 4.5.1).

3.6.3.1 Rail bond seat. Scrim tape impregnated with MMM-A-132 adhesive (FM-47) shall be applied to the bond seat area of the assembled rails prior to assembling the skins. Vertical bond surface of the rails shall also be coated with adhesive prior to assembly of balsa (see 4.5.1).

3.7 Assembly. Pallets shall be assembled according to applicable portions of drawings DL 7031843 and DL 7133047 (see 4.5.1).

3.7.1 Corner sealant. A $0.531 \frac{+0.125}{-0}$ x 45-degree chamfer shall be cut from 1 corner of the 4 core segments. The core sections shall be positioned within the interior perimeter of the rail frame with the chamfered corner of the core segment(s) positioned at the mitered corners. The sealant (MIL-PRF-81733, Type II) shall be injected into the 4 corner cavities to completely fill the cavities. The sealant shall be troweled level with the horizontal bonding surface at the mitered corners. The pallet assembly shall be inspected for complete corner cavity fill with sealant prior to assembly of top facing.

3.7.2 Press fabrication. A metal sheet or pressure padding sheet shall be placed between the surfaces of the pallet and the press plate to ensure even distribution of pressure and overall contact between the surfaces to be bonded.

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3.7.3 Curing the assembled parts. The pallet assembly shall be cured in accordance with the adhesive manufacturer's instruction sheet.

3.9 Finishes and protective coatings. The finishes and protective coatings shall be as specified by the applicable drawings (see 4.5.1).

3.10 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130. Each pallet shall have "Property of US Air Force" centered and stenciled in 1.00-inch high letters on the top of the locking lips on each long (108 inches for HCU-6/E and 88 inches for HCU-12/E) rail. The markings shall be made with manufacturers standard commercial paint closest to color number 17038 of FED-STD-595 (see 4.5.1).

3.10.1 Identification plate. Two identification plates which conform to A-A-50271 and are marked in accordance with MIL-STD-130 shall be attached to the pallet (see 4.5.1). The identification plates shall be of a size and shape consistent with the information required thereon. One plate shall be located above the locking lips on a long rail; the other shall be located above the locking lips on a short rail. The identification plates shall contain the following information:

MANUFACTURER'S FEDERAL SUPPLY CODE

MANUFACTURER'S SERIAL NUMBER

CONTRACT NUMBER

DATE OF MANUFACTURE

3.10.2 Bar code. The maintenance facility shall furnish and affix 2 bar codes to each pallet (see 4.5.1). One bar code shall be located on one corner of the pallet above the locking lips on a long rail; the other shall be located above the locking lips on the short rail located diagonal to the first bar code. The bar codes shall be an aluminum plate or a weather and fade resistant decal. The bar codes shall use code 39 format, shall be at least 0.625" tall, and shall have no less than 6 characters. At time of contract award, supplier shall furnish sequential serial numbers to equal quantities in releases against contract. These sequential serial numbers will be different for each pallet. Also, the supplier shall assign lot numbers. The serial numbers and lot number shall be approved by WR-ALC/LESVG prior to delivery.

3.11 Painting and marking. Each pallet shall have: "Property of U. S. Air Force - Return to the nearest Air Force Base", stenciled in 1 inch high block letters on the locking lips on both long rails (see 4.5.1). Clean surface with an industrial cleaner (e.g. Skykleen 1000 or equivalent). The markings shall be made with the manufacturers standard commercial paint closest to color number 17038 of FED-STD-595.

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3.12 Workmanship. Workmanship shall be of the highest quality to ensure proper functioning under conditions to which the pallet may be subjected. Unsatisfactory workmanship, such as loose, cocked, or inadequately headed rivets; distorted or loose bushings and pins; or rough, malformed, misaligned, or improperly fabricated fittings shall be considered as defects. All corners shall be rounded, sharp edges, burrs, or protrusions shall not be permitted. Tie down ring attaching hardware shall be positively attached to the pallet rail. Pallets shall be prepared and bonded in accordance with specified procedures (see 4.5.1).

3.13 Government loaded property. The following property will be furnished by the Government to be used in testing pallets. These items shall be furnished in as close to new condition as possible.

- a. For Type I pallets, 12 each HCU-7/E side nets and 6 each HCU-15/C top nets.
- b. For Type II, 12 each HCU-11/C side nets and 6 each HCU-16/C top nets.

4. VERIFICATION.

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Test rejection criteria.

4.2.1 Test rejection criteria. Throughout all tests specified herein, the pallet shall be closely observed for the following conditions, which shall be cause for rejection:

- a. Failure to conform to design or performance requirements specified herein.
- b. Structural failure of any component, including permanent deformation, or evidence of impending failure.
- c. Evidence of excessive wear or delamination.
- d. Misalignment of components.
- e. Conditions which present a safety hazard to personnel during operation, service or maintenance.

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4.3 First article testing.

4.3.1 Test samples. The first article test sample shall consist of 6 pallets representative of the production pallets except the test samples shall not have skins riveted. The samples shall be identified with the manufacturer's part number and such other information as required by the procuring activity.

4.3.2 First article tests. The preproduction tests shall consist of all tests described under 4.5 and shall be conducted on each sample in the following sequence:

Samples No. 1-3	Samples No. 4-6
Examination of product (4.5.1)	Examination of product (4.5.1)
Tap test (4.5.2)	Tap test (4.5.2)
Tie down ring test (4.5.3.1 through 4.5.3.4)	
Static load test (4.5.4)	Static load test (4.5.4)
Lifting capabilities tests (4.5.5.1 through 4.5.5.3)	
Conveyor test (4.5.6.1)	
	Ultimate load test (4.5.7)
	Environmental tests (4.5.8)
Destruction analysis (4.5.8)	Destruction analysis (4.5.9)

4.4 Quality conformance inspection. The quality conformance inspection shall consist of the following:

- a. Individual test (see 4.4.1)
- b. Sampling test (see 4.4.2)
- c. Adhesive testing (see 4.4.3)

4.4.1 Individual test. Each pallet shall be subjected to the test specified (see 4.5.1, 4.5.1.1, and 4.5.11).

4.4.2 Sampling test.

4.4.2.1 Lot. A lot shall consist of pallets manufactured under the same conditions and submitted for inspection at the same time.

4.4.2.2 Sampling. Sampling for examination and tests shall be in accordance with ANSI/ASQC Z1.4, general inspection level II, single sampling plan for normal inspection.

4.4.2.3 Examination. Samples selected in accordance with 4.4.2.2 shall be examined as specified (see 4.4.2.5).

4.4.2.4 Tests. Samples selected in accordance with 4.4.2.2 shall be tested as specified in 4.5.5.1.

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4.4.2.5 Classification of defects. All dimensional characteristics are considered defective when out of tolerance. The classification of defects for pallets shall be as follows:

Critical

1. Length, width, and lip dimensions out of tolerance.
2. Skin not bonded/delamination .
3. Pallet not processed in accordance with approved process specification.
4. Failed lift test.
5. Exceeds shear tie gap test.
6. Flatness out of tolerance.

Major

1. Lock notches out of tolerance.
2. Tie down ring and corner bracket fastening device not coated with wet primer when installed.
3. Tie down ring missing.
4. Tie down ring mounting hardware loose.
5. Rivet missing.
6. Wrong rivets.
7. Wrong skin material.
8. Parts not plated in accordance with drawing.
9. Part not marked in accordance with MIL-STD-130.
10. Thickness exceeds tolerance.
11. Tie down ring and corner bracket fastening devices not coated as specified after installation.

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Minor

1. Corner gap exceeds tolerances.
2. Skin to rail gap exceeds tolerance.
3. Adhesive flash not cleaned off.
4. Rivet too close to edge of skin.
5. Cocked rivet.
6. Weight exceeds maximum.

4.4.2.6. Rejection and retest. When a specified sample (see 4.4.2.2) from a lot fails to meet the specification, acceptance of all pallets in the lot shall be withheld until the extent and cause of failure have been determined. The contractor shall fully explain to the Government representative the cause of failure and the action taken to preclude recurrence. After correction of the lot, all of the sampling tests shall be repeated on one pallet from this lot.

4.4.2.6.1 Individual tests may continue. For production reasons, individual tests or other sampling plans may be continued pending the investigation of a sampling test failure. However, final acceptance of the entire lot shall not be made until it is determined that the lot meets all the requirements of the specification.

4.4.2.6.2 Defects in pallets already accepted. The investigation of a test failure could indicate that defects may exist in pallets already accepted. If so, the contractor shall fully advise the procuring activity of all the defects likely to be found and the method of correcting them.

4.4.3 Adhesive tests. For each 4 hours run of pallets cured, 1 test specimen shall be fabricated for production rates of 1 to 20 pallets per day; 2 test specimens shall be fabricated for production rates of 21 to 40 pallets per day; for production rates of 41 pallets or more per day three 3 test specimens shall be fabricated. The specimens shall be 4 x 9 x 2.250 inches thick (tolerances on width and length, +0.500 -0.062 inch; thickness, +0.125 -0.031 inch). All test specimens shall be fabricated from the same materials as the pallets, processed and bonded in the same manner as the pallets they represent. Specimens shall be tested as specified (see 4.5.10).

4.4.3.1 Tensile shear tests. Tensile shear tests shall be performed in accordance with MMM-A-132, test number 1. These tests shall be performed as specified (see 3.2.3) for quality control of adhesives and processing solutions.

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4.4.4.1 Rejection and retest. When a pallet fails to meet the requirements of this specification, pallets to be delivered pursuant to the contract may not be accepted until the cause of the failure is determined, corrective action is taken by the contractor, and the components that failed is successfully retested to assure compliance with this specification. Tests not involving the failed component may be continued pending the investigation of a test failure.

4.5 Test Methods.

4.5.1 Examination of product. The pallet shall be inspected to determine compliance with all requirements specified herein with respect to materials, dimensions, workmanship, and marking. For the first article and random sample pallets this examination shall be accomplished by use of a checklist which lists each requirement not validated by a test and the results of the examination.

4.5.2 Tap test. Each pallet shall be inspected for continuity of bond (see 3.4.1), top and bottom surface, by tapping the bonded area with a small metal or plastic hammer. The surface area of each skin on the Type I pallet shall be divided into 72 equally sized quadrants. The surface area of each skin on the Type II pallet shall be divided into 32 equally sized quadrants. Each quadrant shall be tapped not less than one time. Any void area or blister, which is evidenced by a comparatively dull tapping sound, shall be cause for rejection of the pallet. The metal-to-metal bond between the rail and the top and bottom skin shall be tap tested continually around their entirety for bond. Special attention shall be given to the corners of the pallet for continuity of bond. No delamination is allowed.

4.5.3 Tie down ring tests.

4.5.3.1 Ring location and movement test. Compliance with the ring location and free movement requirements (see 3.4.2.1) shall be demonstrated for each ring.

4.5.3.2 Ring load test one. Two tie down rings, one located at the pallet corner and the other located midway on the long side, shall be subjected to loading tests. In a plane that intersects the attachment point and is perpendicular to the pallet surface and edge, the ring shall be sequentially loaded to 7,500 pounds along lines that form 30°, 45°, 90°, 135°, and 180° with the upper pallet surface (see 3.4.2.2).

4.5.3.3 Ring load test two. In a vertical plane that intersects the attachment point and is parallel to the pallet edge, a 7,500-pound load shall be applied sequentially in two directions parallel to the upper pallet surface and at 45° and 135° angles with this surface (see 3.4.2.3).

4.5.3.4 Ring load test three. The pallet shall be placed in a horizontal plane and two adjacent corner rings pulled simultaneously and then two center rings pulled simultaneously. Evidence of permanent deformation to the pallet shall be criteria for rejection. The load during each test shall be applied for not less than 3 times each (see 3.4.2.4).

4.5.4 Static load test. While supported by four rows of conveyors as specified (see 3.4.5.1), parallel to the shortest side, the pallet shall be loaded with a static load (see 6.3.2). The load shall remain on the pallet for 40 hour. Permanent deformation as a result of this test shall be cause for rejection (see 3.4.3).

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4.5.5 Lifting capabilities tests.

4.5.5.1 Corner hoist test. The pallet shall be completely raised off the floor (see 3.4.4.1), held in that position for 1 minute, and then returned to the floor. This procedure shall be repeated 10 times. For sample testing, the test load procedure shall be reduced on each test sample to 2 times. During the test, any separation of the mitered corners shall be cause for rejection. Upon completion of the test, evidence of permanent deformation shall be cause for rejection (see 3.4.4.1).

4.5.5.2 Forklift lifting test. The pallet shall be raised according to (see 3.4.4.2) to a height of 1 foot and held 1 minute, then lowered to rest on the conveyor. This procedure shall be repeated 10 times. At the completion of the tests any permanent deformation shall be cause for rejection.

4.5.5.3 Forklift "wedge" lifting test. The pallet shall be raised according to (see 3.4.4.3) until it clears the floor. The pallet shall then be lowered to the floor and forklift tines withdrawn. This test shall be conducted 5 times from each side of the pallet. Upon completion of the tests, any evidence of permanent deformation shall be cause for rejection.

4.5.6 Traversable capabilities tests.

4.5.6.1 Conveyor test. According to (see 3.4.5.1), the pallet shall be subjected to the following tests. Any permanent deformation of the pallet shall be cause for rejection.

- a. The Type I pallet shall be moved a minimum of 10,000 feet in a direction parallel to the 108-inch dimension at a minimum speed of 30 feet per minute (fpm). Any increment of movement shall be a minimum of 25 feet.
- b. Type I pallet shall be moved a minimum of 15,000 feet in a direction parallel to the 88-inch dimension at a minimum speed of 30 fpm. Any increment of movement shall be a minimum of 25 feet.
- c. The Type II pallets shall be moved a minimum of 15,000 feet in a direction parallel to the 54-inch dimension at a minimum speed of 30 fpm.

4.5.6.2 Conveyor ramp test. According to (see 3.4.5.2), the pallet shall be towed up and over a 17° 10-foot long conveyor ramp connecting two horizontal conveyors. The pallet shall then travel back over the ramp and onto the lower horizontal conveyor. This procedure shall constitute one cycle. Throughout this test, the minimum towing speed of the pallet shall be 20 fpm. This test shall be repeated 30 cycles, 10 cycles in a direction parallel to the longest dimension and 20 cycles in a direction parallel to the shortest dimension. The ramps shall be constructed of roller conveyors as specified (see 3.4.5.1).

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4.5.7 Ultimate load. When uniformly loaded to rated capacity (see 6.3.1), the load being restrained to the pallet by nets (see 6.3.4), the pallet installed between restraining rails locked to the rails by 2 locks through each rail and engaging 2 lock notches on each side of the pallet, and resting on 4 rows of conveyor as specified (see 3.4.5.1), the loaded pallet shall withstand a dynamic load of 3 times the force of gravity (Gs) for a period of 0.1 second. The pallet shall be serviceable after undergoing the test. In addition, the pallet shall withstand a dynamic load of 8Gs for a period of time not less than 0.1 second. The pallet need not be serviceable after undergoing such a load; however, the pallet shall remain in one piece (see 3.4.6).

4.5.8 Environmental tests. The pallet shall be subjected to the following environmental tests in the order shown:

4.5.8.1 High temperature test. The pallet shall be subjected to high temperature in accordance with procedure I guidelines, method 501.4 of MIL-STD-810. After a 24-hour soak period at 125°F, the pallet shall be loaded with a flexible, uniformly distributed load (see 6.3.1) and subject to 50 consecutive cycles of loading as follows without permanent deformation. One cycle shall have a maximum duration of 30 seconds (see 3.4.7).

- a. Lift the pallet completely off the floor by four tie down rings located adjacent to the corners on the 88-inch sides.
- b. Lower the pallet to rest on three 4x4x88 inch long supports equally spaced and aligned with the short centerline. The lifting device shall be completely free of weight support while the pallet is at rest on the supports.

4.5.8.2 Core resistance and low temperature test. Five 3/8-inch diameter holes shall be drilled through the sandwich construction. One hole shall be in the center of the pallet and two each on the transverse and longitudinal centerline 25 inches from the pallet edge. The pallet shall then be subjected to the following immersions in the sequence listed (see 3.4.7):

- a. Immerse 3 hours in water at room temperature; the upper surface of the pallet shall be covered by at least 2 feet of water.
- b. Remove from water and soak in a cold chamber for 4 hours at -65°F.
- c. Stabilize at room temperature.
- d. Repeat steps a and b.
- e. While the temperature remains at -65°F, the pallet shall be subjected to 20 cycles of the same lift test specified (see 4.5.8.1).

4.5.8.3 Humidity test. The pallet shall be subjected to humidity in accordance with Procedure III guidelines, Method 507.4 of MIL-STD-810 (see 3.4.7).

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4.5.8.4 Salt fog test. The pallet shall be subjected to salt fog in accordance with Procedure I guidelines, Method 509.4, of MIL-STD-810. Duration of exposure shall be 24 hours. Test shall be repeated for 4 cycles (see 3.4.7).

4.5.9 Destruction analysis. Each test sample shall be cut up and tested for bond, shear tie, and penetration. Care shall be used in cutting the test samples for analysis so that excess heat is not induced into the adhesion line. All parts of the pallet shall be permanently identified. The tests shall be as follows:

- a. Each rail shall be cut from the pallet so that 6 inches of the sandwich structure is still intact. From each rail section, 4 each 1 inch samples shall be prepared, 1 from each end and 2 from the center, for lap joint tensile shear tests between the skin and rail sections. MMM-A-132 shall be used as a guide in preparing and performing lap joint tensile shear tests. The test specimens shall meet the requirements of MMM-A-132 test number 1. The remainder of the sandwich construction shall be cut into 8 equal (approximately) pieces (see 3.4.8 a.).
- b. One test specimen 4 x 9 inches shall be cut from each quadrant of the pallet. These samples shall be subjected to the peel test (see 4.5.10).
- c. Using a 1 inch square steel mandrel, apply a 900-pound load to the top surface of one test panel. At the option of the supplier, the corners of the mandrel may be slightly rounded. The test panel may be from either test pallet number 1 or 2. The test specimen shall withstand the 900-pound load. Permanent deformation of the test panel in the load area shall not exceed 0.005 inch in depth. Deflection while under load shall not exceed 0.015 inch.
- d. After cutting the pallet (see 4.5.9.a) inspect the shear-tie bond between the core and rail and the core modules. Any gap (lack of shear-tie bond) between the core and side rail, or between the core modules that exceeds 0.020 inches in width and 4 inches in length (along the bond line) shall be cause for rejection.

4.5.10 Peel test. After curing, each specimen shall be peeled top and bottom and the metal-to-wood joints on the peeled specimens inspected. An acceptable metal-to-wood joint shall consist of not less than 100% wood failure. Local areas of high density wood (growth rings) shall be exempt from this requirement providing the high density wood is randomly scattered and does not exceed 3% of the surface area. Core block glue lines are not considered as wood. After 1000 consecutive samples are tested without a failure, the peel test shall be reduced to one test specimen per shift.

4.5.11 Shear-tie inspection. The shear-tie-bond line, between the core and side rails, shall be inspected prior to assembling the top skin. Nonconformance to (see 3.3.2) shall be cause for rejection.

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5. PACKAGING.

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. The HCU-6/E and HCU-12/E pallets are intended for use in conjunction with the 463L Cargo Handling System to transport cargo in aircraft, within air freight terminals, and on motorized and non-motorized vehicles.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).
- c. Type required (see 1.2).
- d. Packaging requirements (see 5.1).

6.3 Definition. For the purpose of this specification, the following definitions will apply.

6.3.1 Uniformly distributed load. A uniformly distributed load is defined as rectangular units. The total load weight for the Type I pallet is 10,000 pounds. The total load weight for the Type II pallet is 5,000 pounds.

6.3.2 Static load. The static load for the Type I pallet is 45,000 pounds, for the Type II pallet the static load is 22,500 pounds.

6.3.3 Load test. The load for the Type I pallet is a uniformly distributed load of 18,000 pounds; for the Type II pallet the uniformly distributed load of 9,000 pounds.

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6.3.4 Nets. For Type I pallet use 2 each side nets HCU-7/E, and 1 each HCU-15/C top net. For Type II pallets; use 2 each HCU-11/C side nets and 1 each HCU-16/C top net.

6.4 Government-furnished property. The contracting officer should arrange to furnish the property listed (see 3.14). These items should be furnished in as close to new condition as possible.

6.5 Subject term (key word) listing.

Forklift wedge

Load test

Nets

Static load

Tie down ring

Ultimate load

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodian:

Air Force - 99

Preparing activity:

Air Force - 84

(Project 1670-1052)

Agent:

Air Force - 99

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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-DTL-27443F

2. DOCUMENT DATE (YYYYMMDD)
20030714

3. DOCUMENT TITLE

PALLETS, CARGO, AIRCRAFT, TYPE HCU-6/E AND HCU-12/E

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include ZIP Code)

d. TELEPHONE (Include Area Code)
(1) Commercial
(2) DSN
(If applicable)

7. DATE SUBMITTED
(YYYYMMDD)

8. PREPARING ACTIVITY

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WR-ALC/TILCC

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