

MIL-P-87089 (SA)
30 November 1981

MILITARY SPECIFICATION

PALLETS, MATERIAL HANDLING, MOLDED WOOD PARTICLES

40 x 48 INCH, 4-WAY

This specification is approved for use by The Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers performance requirements and design characteristics for reusable 4-way, 40 x 48 inch pallets for military general cargo (see 6.1) molded from composite, chipped-wood particles.

1.2 Classification. Pallets shall have the following load ratings (see 6.2):

Type I - 1,000 pound dynamic load capacity; 4,000 pound static load capacity.

Type II - 2,000 pound dynamic load capacity; 8,000 pound static load capacity.

Type III - 3,000 pound dynamic load capacity Navy shipboard pallet; 12,000 pound static load capacity.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Fitting Out Supply Assistance Team, Bldg. 143, U. S. Naval Base, Norfolk, Virginia 23512 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS

FEDERAL

- QQ-S-781
 - PPP-S-760
- Strapping, Steel, and Seals
 - Strapping, Nonmetallic (and Connectors).

STANDARDS

FEDERAL

- FED. TEST METHOD
 - STD. No. 101
 - FED. STD. No. 313
- Preservation, Packaging, and Packing Materials: Test Procedures.
 - Material Safety Data Sheets, Preparation and Submission of.

MILITARY

- MIL-STD-105
 - MIL-STD-129
- Sampling Procedures and Tables for Inspection by Attributes.
 - Marking for Shipment and Storage.

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D1185 - Standard Methods of Testing Pallets.
- D1929 - Standard Method of Test for Ignition Properties of Plastics.

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

UNIFORM CLASSIFICATION COMMITTEE, AGENT

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, ATTN: Tarriff Publishing Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606).

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NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Associations, Inc., ATTN: Traffic Department, 1616 P Street, NW, Washington, DC 20036).

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies).

3. REQUIREMENTS

3.1 First Article (preproduction model). The contractor shall furnish 20 pallets (see 6.2), for examination and testing within the time frame specified to prove, prior to starting production, that his production methods will produce pallets that comply with the requirements of this specification. Examination and tests shall be as specified in Section 4.3 and shall be subject to surveillance and approval by the Government (see 6.3).

3.2 Materials. The materials used for pallet fabrication shall be:

- a. Hardwood and softwood chips properly sized and proportioned (approximately 80%).
- b. Polymeric bonding agent(s) properly formulated and intermixed with the wood material (approximately 20%).
- c. Other materials as (and if) required to give the proper characteristics and physical properties to the completed pallets.
- d. The above materials shall be molded in a compressive manner with the correct addition of heat and other techniques and methodologies to yield high strength pallets meeting these requirements.

3.3 Dimensions and weight. Pallets shall be $40 \pm 1/8$ x $48 \pm 1/8$ inches in length and width. The diagonal dimensions of the deck (corner to corner) shall not differ more than 1/4 inch. The leading edge legs (at the bearing surface) shall be not less than $6 \frac{5}{8}$ inches long, in the dimension parallel to the 48 inch pallet dimension, by not less than $2 \frac{5}{16}$ inches wide. Pallet weight shall not exceed 50 pounds. The maximum overall pallet height shall not exceed 7 inches.

3.4 Color. Pallets shall be a dark lusterless color.

3.5 Design Characteristics.

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3.5.1 Handling provisions. Pallets shall provide full 4-way entry. Not less than 3 1/2 inches of unobstructed height shall be provided to accommodate pallet jacks and fork trucks. The design shall permit easy entry of pallet jacks. Wings or other provisions shall permit handling of loaded pallets with bar slings, chains, rope, and cable normally found on Navy piers and ships. Pallets shall be capable of being moved on both roller and belt type conveyor systems without creating delays or blockages (see 4.5.2.3).

3.5.2 Load securement. Pallets shall be designed to permit securement loads to the pallet with strapping conforming to QQ-S-781, Class 1, or PPP-S-760, with shrink film or with stretch film.

3.5.3 Cleanability. Pallets shall have no places which cannot be directly and openly reached for cleaning. Fabrication materials and coatings shall be unaffected by industrial solvents and detergents. Drain holes shall be provided in each leg to prevent moisture accumulation.

3.5.4 Nestability. Pallets shall be nestable to permit quantities of empty pallets to be stored together in minimum space and handled at one time. Acceptable degree of nesting shall be determined in accordance with 4.5.2.6.

3.6 Performance Characteristics.

3.6.1 Ignition properties of pallet material. The flash ignition temperature of pallet materials in finished form shall be not less than red oak when tested as specified in 4.5.2.8.

3.6.2 Health hazard characteristics. Harmful concentrations of identifiable toxic vapors or chemicals shall not be released from the pallet as a consequence of the heat experienced during expected transportation and storage conditions. In addition, the contractor shall determine and identify the products or compounds released from the pallet as a result of combustion, and any special precautions required as a result thereof. Compliance with this requirement shall be in the form of certification in accordance with 4.5.2.9.

3.6.3 Handleability. The pallet shall be capable of being moved without suffering damage by fork trucks by normal pick up and carry, and by pushing, pulling and lifting when tested as specified in 4.5.2.3.

3.6.4 Structural integrity. The pallet shall not suffer damage which will impair its intended functions or exceed the limits specified when subjected to the standard pallet tests specified in 4.5.2.2 and the stacking test specified in 4.5.2.7.

3.6.5 Coefficient of friction. When specified (see 6.2), the coefficient of friction between the bottom surface of a pallet and a smooth steel surface shall be not less than 0.3; and for a broom finish concrete surface not less

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than 0.35. The coefficient of friction between the pallet upper surface and corrugated fiberboard shall be not less than 0.3. Determination shall be as specified in 4.5.2.10.

3.6.6 Strapability. The edges of the top deck of the pallet shall be capable of withstanding the force created by tensioning of strapping used to secure loads to the pallet. Permanent deformation of any top deck edge shall not exceed 1/2 inch when tested as specified in 4.5.2.11.

3.7 Marking. Each Type III pallet shall be marked with the manufacturer's name, and the letters "US NAVY". The markings shall be applied during manufacture of the pallet by being molded in. Characters shall be not less than 1/2 inch high. Location of the marking shall not interfere with normal use of the pallet. Types I and II pallets do not require Navy markings.

3.8 Workmanship. Finished pallets shall be smooth and free of slivers or other surface imperfections having the potential for causing personal injury or restricting use of the pallet. Each pallet shall have a constant height and all four legs of the empty pallet shall rest evenly on a flat surface. Finished pallets shall be clean and free from unintentional inclusions or embedded extraneous matter. Formulation mix and pallet density shall be consistent throughout the pallet deck and legs unless the design requires otherwise.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified (see 6.2), in the contract, the contractor is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspections unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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

- (a) Preproduction inspection.
- (b) Quality conformance inspection.
- (c) Inspection of packaging.

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4.3 Preproduction inspection.

4.3.1 Examination. The preproduction pallets shall be examined as specified in 4.5.1. Presences of one or more defects shall be cause for rejection.

4.3.2 Tests. The preproduction pallets shall be tested as specified in 4.5.2. Failure of any test shall be cause for rejection.

4.4 Quality conformance inspection.

4.4.1 Examination. Samples selected in accordance with MIL-STD-105 shall be examined for the defects listed in 4.5.1. AQL shall be 2.5 percent defective.

4.5 Inspection procedure.

4.5.1 Examination. The pallets shall be examined for the following major defects:

101. Size or weight not as specified.
102. Provisions for forklifts and pallet jacks and straddle trucks not adequate.
103. Wings or other provisions for sling handling not incorporated.
104. Pallet not nestable.
105. Difficulties or inability for water to drain.
106. Design will not permit securing of load by various means as specified.
107. Pallet will not lie flat on level surface.
108. Required markings not on pallet.
109. Workmanship not as specified.
110. Color not as specified.
111. Ignition properties not as specified.
112. Health hazard requirements not complied with.
113. Coefficient of friction is less than specified.

4.5.2 Tests. Pallets shall be tested in accordance with the following procedures and exceptions.

4.5.2.1 Test conditions and conditioning. Unless otherwise specified (see 6.2), all tests shall be performed after pallets have been conditioned for not less than 6 hours at $75^{\circ} \pm 5^{\circ}$ F. In addition, for tests specified in 4.5.2.4 pallets shall be conditioned for not less than 6 hours at $-25^{\circ} \pm 2^{\circ}$ F; the tests shall be performed immediately after removal from the conditioning atmosphere.

4.5.2.2 Standard pallet tests. Pallets shall be subjected to all tests contained in ASTM D1185 following the procedures contained herein with the following exceptions. Lumber supports used in the static load and shock load tests need not be seasoned. Except for the diagonal rigidity test, the pallet shall be loaded with its rated load. Drop height for the diagonal rigidity test shall be 40 inches (see 6.2). Twelve pallets, three for each of the four required tests, shall be utilized.

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4.5.2.3 Handling tests. Five previously untested pallets shall be tested in accordance with Method 5011 of FED. TEST METHOD STD. NO. 101 with the following exceptions. The procedure for hoisting with grabs is not applicable for pallets. A roller, instead of skate-wheel, conveyor with a capacity to support the pallet with its rated dynamic load, shall be used for the conveying test. The procedure for hoisting with slings shall be limited to that part concerned with undersling handling utilizing the wings or other provisions for such handling. Pallets shall be loaded with their rated weight fully distributed for these tests. A fully distributed load is one which has its weight evenly distributed over the top surface of the pallet as it rests on a flat surface, and which has its elements interlocked.

4.5.2.4 Low temperature test. Three previously untested pallets, conditioned at the low temperature as specified in 4.5.2.1, shall be subjected to the diagonal rigidity test in accordance with 4.5.2.2.

4.5.2.5 Failure criteria. For standard pallet tests, including the low temperature tests, the failure criteria shall be as specified in the appropriate procedure. In the diagonal rigidity test, change in the diagonal measurement in excess of 1 inch shall constitute failure. For the handling tests, inability to perform any of the procedures, damage to the pallet resulting in unserviceability or dumping of the load shall be considered failure.

4.5.2.6 Nesting. One pallet shall be placed onto a like pallet to determine the degree of nesting. A pallet, other than the bottom one, nesting with over one-third of its overall height exposed shall be termed not nestable.

4.5.2.7 Stacking. Pallets shall be stacked four high each with their rated dynamic load, on a stable, level surface. The load on each pallet shall be stable and rigid. The stack shall remain for a period of 48 hours. Collapse of the stack, or any tilting or instability caused by deformation of any pallet shall constitute failure of the test.

4.5.2.8 Ignition temperature. The flash ignition temperature of the pallet material, in finished form, shall be determined in accordance with ASTM D1929.

4.5.2.9 Health hazard characteristics.

4.5.2.9.1 During transportation and storage. The pallet contractor shall certify that the pallet, when subjected to a temperature of $210^{\circ}\text{F} \pm 10$, will not release harmful vapors or chemicals in amounts exceeding the threshold limit values for the materials involved. Certification and threshold limit values shall be in accordance with FED. STD. NO. 313.

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4.5.2.9.2 During combustion. The pallet contractor shall provide certification which itemizes the products of combustion, states the threshold limit values for the combustion products, describes any special fire fighting procedures and personal protective equipment required. Findings and certification, in the form of a Material Safety Data Sheet, shall be in accordance with FED, STD. NO. 313.

4.5.2.10 Coefficient of friction.

4.5.2.10.1 Lower surface. The coefficient of friction of the lower pallet surface shall be calculated with the formula

$$CF = \frac{F}{W}$$

where: F = horizontal force or pull required to move loaded pallet.
W = weight of loaded pallet.

A low coefficient indicates low resistance to sliding; a high coefficient indicates the opposite. A pallet, carrying an evenly distributed load of 250-400 pounds, shall be pulled over the specified surfaces. A suitable measuring device shall be used to determine the magnitude of the force required to move the loaded pallet. Surfaces over which the pallet shall be moved to determine the coefficient of friction shall be galvanized steel and broom finished concrete.

4.5.2.10.2 Upper surface. The coefficient of friction of the upper pallet surface shall be calculated with the formula

$$C_{fu} = \tan \phi$$

where ϕ = the maximum angle of inclination of the pallet before the load begins to slide due to its weight alone. The pallet shall be loaded with an evenly distributed load as specified in 4.5.2.10.1. If the load is not contained in a corrugated fiberboard box, a sheet of domestic class corrugated fiberboard, 350 pound bursting strength, shall be secured to the bottom of the load. One edge of the pallet shall be raised until the load begins to slide because of its weight alone. The angle of inclination of the pallet just before the load begins to slide shall be measured. The tangent of the angle is the coefficient of friction.

4.5.2.11 Strapping test. Position a 40 x 40 x 40 inch wood container (crate or box) on the upper deck of the pallet so that the container edges and pallet edges are parallel and no portion of the container overhangs the pallet edges. The container shall be centered on the pallet with respect to the 48 inch direction. Strap the container to the pallet with a single strap running over the top, down the sides and under the top deck of the pallet. If the pallet design incorporates a unique method of securing

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strapping to the pallet edges, that method shall be used. A turnbuckle and a tension measuring device shall be incorporated in a vertical section of the strap. The strapping shall conform to QQ-S-781, Class 1, Type 1 or IV, finish optional, 1/2 x 0.020 inch. Tension shall be applied to the strap until 100 pounds is indicated on the measuring device or until the pallet edge fails, whichever occurs first. Permanent deformation of the pallet edges by more than 1/2 inch or destruction of the pallet edges, or inability to achieve the specified tension level because of pallet edge flexibility shall constitute failure of this test. The test shall be repeated on the remaining two pallet edges.

4.6 Inspection of packaging.

4.6.1 Quality conformance inspection.

4.6.1.1 Unit of product. A bundle of pallets prepared for shipment shall be the unit of product.

4.6.1.2 Sampling. Sampling for examination shall be in accordance with MIL-STD-105.

4.6.1.3 Examination. Samples selected in accordance with 4.6.1.2 shall be examined for the following defects. AQL shall be 2.5 percent defective.

- 112. Pallet bundles exceed specified height.
- 113. Pallet bundles not secured as specified.
- 114. Marking incomplete, illegible, or missing.

5. PACKAGING

5.1 Packing. Packing of pallets shall be Level A or C, as specified (see 6.2).

5.1.1 Level A. Pallets shall be nested or stacked together in bundles which do not exceed 7'-3" in height. Each bundle shall be secured with not less than two straps which shall pass under the bottom pallet, encircle the bundle, and pass over the top pallet. Straps shall be parallel with each other and shall be located just inside the pallet outer legs. Strapping shall conform to QQ-S-781, Class 1, Type 1 or IV, Finish A or B, 3/4 x 0.020 inch minimum size.

5.1.2 Level C. Unless otherwise specified (see 6.2) uniform quantities of pallets shall be secured in bundles which shall not exceed 7'-3" in height. Bundles shall be secured together in a manner which will assure safe delivery at lowest rates in accordance with Uniform Freight Classification Rules or National Motor Freight Classification Rules.

5.2 Marking. Marking for shipment and storage shall be in accordance with MIL-STD-129.

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6. NOTES

6.1 Intended use. Pallets covered by this specification are intended to be used as an alternate to 40 x 48 inch wood pallets for carrying Department of the Navy general cargo. Pallets are compatible with all modes of transport and types of handling and storage utilized throughout the Department of Defense. The pallets are not intended for ammunition. Pallets produced in accordance with this specification are intended to be reusable.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type of pallet required (see 1.2).
- (c) Time frame required for submission of preproduction model (see 3.1).
- (d) When specific coefficient of friction values are required (see 3.6.5).
- (e) additional markings required (see 3.7).
- (f) If contractor is not to perform inspection (see 4.1).
- (g) If conditioning is to be other than specified (see 4.5.2.1).
- (h) When diagonal rigidity test height shall be other than 40 inches (see 4.5.2.2).
- (i) Level of packing required (see 5.1).
- (j) If pallets are not to be bundled for Level C (see 5.1.2).
- (k) Pallets similar to these described herein may be available from LITCO Inc., and other manufacturers.

6.3 Preproduction model. Any changes or deviations of production pallets from the approved preproduction model during production will be subject to the approval of the contracting officer. Approval of the preproduction model will not relieve the contractor of his obligation to furnish pallets conforming to this specification.

Custodians:
Navy - SA

Preparing activity;
Navy - SA

Review Activities:
Navy - OS, SH
DLA - GS

Project 3990-N-174

User Activities:
Navy - SA

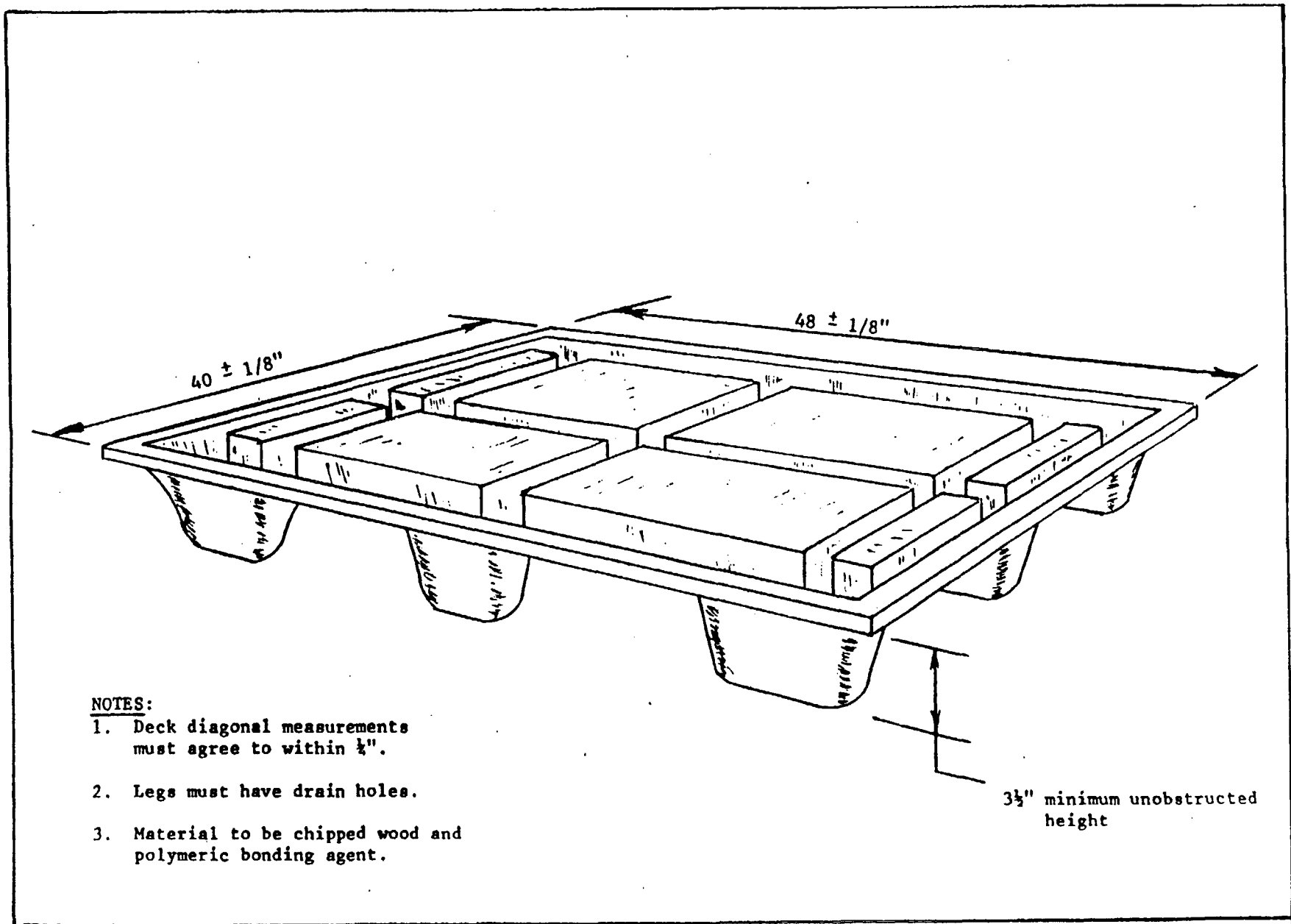


FIGURE I Typical Chipped Wood Molded Pallet

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DOCUMENT IDENTIFIER AND TITLE MIL-P-87089 (SA), Pallets, Material Handling Molded Wood Particles		
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