

METRIC

MIL-STD-1816

20 April 1992

SUPERSEDING

MIL-P-25621B(USAF)

8 March 1974

MILITARY STANDARD

PRESERVATION, PACKAGING, AND PACKING  
OF RUBBER AND NYLON FUEL,  
OIL, AND WATER-ALCOHOL CELLS

AMSC N/A

AREA PACK

DISTRIBUTION STATEMENT A. Approved for public release;  
distribution is unlimited.

MIL-STD-1816

F O R E W O R D

1. This military standard is approved for use by the Air Force Packaging Evaluation Activity, HQ AFLC/LGTP, Wright-Patterson AFB, OH 45433-5999, Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: AF Packaging Evaluation Activity, HQ AFLC/LGTP, Wright-Patterson AFB OH 45433-5999, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

## MIL-STD-1816

## CONTENTS

<u>PARAGRAPH</u>		<u>PAGE</u>
1.	SCOPE . . . . .	1
1.1	Scope . . . . .	1
2.	APPLICABLE DOCUMENTS . . . . .	2
2.1	Government documents . . . . .	2
2.1.1	Specifications, standards, and handbooks . . .	2
2.1.2	Other Government documents, drawings, and publications . . . . .	3
2.2	Non-Government publications . . . . .	3
2.3	Order of precedence . . . . .	3
3.	DEFINITIONS (Not applicable) . . . . .	5
4.	GENERAL REQUIREMENTS (Not applicable) . . . . .	6
5.	DETAILED REQUIREMENTS . . . . .	7
5.1	Materials . . . . .	7
5.2	Temperature precautions . . . . .	7
5.2.1	Handling . . . . .	7
5.2.2	Storage . . . . .	7
5.3	Preservation and packaging . . . . .	7
5.3.1	Preservation and packaging, level A . . . . .	7
5.3.1.1	Cleaning and drying . . . . .	7
5.3.1.2	Exposed, unpainted ferrous, and critical nonferrous metal surfaces (except aluminum) .	7
5.3.1.3	Openings . . . . .	7
5.3.2	Preservation and packaging, level C . . . . .	7
5.4	Blocking, bracing, and cushioning . . . . .	7
5.4.1	Bladder and pliocel cell . . . . .	8
5.4.2	Self-sealing, collapsible cells . . . . .	8
5.4.3	All cells . . . . .	8
5.5	Packing . . . . .	8
5.5.1	Packing, level A . . . . .	8
5.5.2	Packing, level B . . . . .	9
5.5.3	Packing, level C . . . . .	9
5.6	Special container . . . . .	9
5.6.1	Materials . . . . .	9
5.6.2	Base . . . . .	9
5.6.3	Sides and ends . . . . .	9
5.6.4	Top . . . . .	9
5.6.5	Fabrication . . . . .	10
5.6.6	Waterproofing of top . . . . .	10
5.6.7	Assembly . . . . .	10
5.6.8	Corner reinforcing strap . . . . .	10

## MIL-STD-1816

## CONTENTS - Continued

<u>PARAGRAPH</u>		<u>PAGE</u>
5.7	Marking . . . . .	10
5.7.1	Special marking . . . . .	10
5.7.2	New cell marking . . . . .	11
5.8	Test methods . . . . .	11
5.8.1	Examination of product . . . . .	11
5.8.2	Rough-handling tests . . . . .	11
5.8.2.1	Lightweight or small dimensions . . . . .	11
5.8.2.2	Heavyweight or large dimensions . . . . .	11
5.8.3	Rejection and retest . . . . .	11
6.	NOTES . . . . .	12
6.1	Intended use . . . . .	12
6.2	Subject term (key word) listing . . . . .	12
 <u>FIGURE</u>		
1	Special container base . . . . .	13
2	Special container side . . . . .	14
3	Special container end . . . . .	15
4	Special container top . . . . .	16
5	Special container . . . . .	17

## MIL-STD-1816

### 1. SCOPE

1.1 Scope. This standard covers the general requirements for the preservation, packaging, and packing of new and repaired rubber and nylon fuel, oil, and water-alcohol cells (see 6.1).

## MIL-STD-1816

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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.

## SPECIFICATIONS

## FEDERAL

TT-C-00598	Calking Compound, Oil and Resin Base Type (For building construction)
UU-P-268	Paper, Kraft, Wrapping
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-C-1752	Cushioning Material, Packaging, Polyethylene Foam
PPP-C-1797	Cushioning Material, Resilient, Low Density, Unicellular, Polypropylene Foam
PPP-F-320	Fiberboard, Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes
PPP-P-291	Paperboard, Wrapping and Cushioning
PPP-T-60	Tape: Packaging, Waterproof

## MILITARY

MIL-C-104	Crates, Wood: Lumber and Plywood Sheathed, Nailed and Bolted
MIL-P-116	Preservation, Method of
MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible

## STANDARDS

## FEDERAL

FED-STD-101	Test Procedures for Packaging Materials
-------------	--------------------------------------------

## MILITARY

MIL-STD-129	Marking for Shipment and Storage
-------------	----------------------------------

MIL-STD-1816

MIL-STD-1472 Human Engineering Design Criteria  
for Military Systems, Equipment and  
Facilities

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

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

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification

(Application for copies should be addressed to the Uniform Classification Committee, Suite 1120, 222 South Riverside Plaza, Chicago, IL 60606).

2.2 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D3953 Standard Specification for Strapping, Flat Steel and Seals (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC.

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Association, Inc., 2200 Mill Road, Alexandria, VA 22314-4677.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the

MIL-STD-1816

text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



## MIL-STD-1816

### 3. DEFINITIONS

This section is not applicable to this standard.

MIL-STD-1816

4. GENERAL REQUIREMENTS

This section is not applicable to this standard.

## MIL-STD-1816

## 5. DETAILED REQUIREMENTS

5.1 Materials. Materials shall conform to the applicable specifications. Materials which have no governing specification, but are suitable for the purpose intended, shall be submitted to the procuring activity for approval. Material shall be free from all defects and imperfections that may affect its intended purpose.

5.2 Temperature precautions.

5.2.1 Handling. Flexing of cells shall not be attempted until cell temperature is above 18°C (65°F).

5.2.2 Storage. Cells should not be stored in areas where temperature is below 7°C (45°F) or above 21°C (70°F).

5.3 Preservation and packaging. Preservation and packaging shall be level A or C as specified by the procuring activity.

5.3.1 Preservation and packaging, level A.

5.3.1.1 Cleaning and drying. All exposed surfaces shall be cleaned of foreign matter that might contribute to corrosion. All surfaces to which a preservative is to be applied shall be first cleaned in accordance with method C-1 and dried in accordance with method D-1 of MIL-P-116.

5.3.1.2 Exposed, unpainted ferrous, and critical nonferrous metal surfaces (except aluminum). These item surfaces shall be coated with type P-3 preservative of MIL-P-116 and wrapped or covered with a greaseproof barrier material conforming to MIL-B-121, type I, grade A, class 2. The wrap or cover shall be secured in place with tape conforming to PPP-T-60.

5.3.1.3 Openings. Access openings of 51 mm (2 in) or less shall be sealed with tape conforming to PPP-T-60. Large access openings shall be closed with the applicable access cover or a temporary cover constructed of aluminum, plywood, or other similar material. Hygroscopic material shall be separated from metal parts by a layer of barrier material conforming to MIL-B-121, type II, grade A, class 2.

5.3.2 Preservation and packaging, level C. This level shall afford adequate protection under known favorable conditions during shipment, handling, and limited tenure of storage.

5.4 Blocking, bracing, and cushioning. The blocking, bracing, and cushioning shall be designed not only to support the item but also to protect the part from damage when the container

## MIL-STD-1816

is subjected to the tests in 5.8. The blocking, bracing, and cushioning shall be of the lightest design and construction commensurate with its ability to meet the tests specified herein.

5.4.1 Bladder and pliocel cell. Each bladder and pliocel cell shall be enclosed in a snug-fitting wrap conforming to UU-P-268, type I, grade A or B, and shall be secured by PPP-T-60 tape applied only to the wrap. All protruding fittings and connections shall be adequately cushioned with neutral barrier material conforming to MIL-B-121, type I, grade A, class 2 prior to wrapping. Each wrapped bladder cell shall then be folded or rolled so as to occupy a minimum amount of space. Folding shall be accomplished as smoothly and lightly as possible with the least number of folds. A roll of single-faced corrugated fiberboard conforming to PPP-P-291, type III, style 2, or PPP-C-1797, type I cushioning material, measuring not less than 102 mm (4 in) in diameter shall be inserted inside and adjacent to each fold to prevent creases. Upon completion of folding, or rolling, the outer ends of the package shall be secured with a suitable PPP-T-60 tape. When cells are prohibited from being folded or rolled, restrictions shall be as specified by the procuring activity.

5.4.2 Self-sealing, collapsible cells. Each self-sealing, collapsible cell shall be blocked to prevent collapse. When integral hangers are provided, support may be effected by use of cross members which are positioned in the container with pocket cleats and hold-down blocks. End grain nailing shall not be permitted. When such hangers are not available, the cell shall be blocked internally with a suitable framework. All corners and edges of the internal support framework shall be covered with a sufficient amount of cushioning material to prevent damage. There are some cells that can be shipped in a collapsed position, with cushioning pads conforming to PPP-C-1752 or PPP-C-1797, type I inserted into the interior to prevent cracking, deformity, or adhesion of the inner liner.

5.4.3 All cells. Shifting or moving of the cells within the containers shall be prevented by blocking with padded restraints of sufficient area to prevent damage or by filling the unused spaces in the containers with cushioning material conforming to PPP-C-1752 or PPP-C-1797, type I.

5.5 Packing. Packing shall be level A, B, or C as specified.

5.5.1 Packing, level A. Each cell, preserved and packaged in accordance with 5.3 and 5.4, shall be packed in an overseas-type exterior container conforming to PPP-B-601 or PPP-B-621. The container shall be of minimum cube and tare weight consistent with the protection required. Strapping and closure shall be in accordance with the applicable container specification or appendix thereto. The interior surfaces of plywood containers shall be

## MIL-STD-1816

lined with double-faced fiberboard such as PPP-F-320 at least 5 mm (0.2 in) thick which, if attached, shall be glued, not nailed or stapled. The container size and weight in accordance with MIL-STD-1472 shall determine the need for skid use. Cells requiring containers wider than 1.1 m (44 in) shall be packed in special containers conforming to the requirements specified in 5.6 and subparagraphs thereto. The interior surfaces of special containers shall be lined as specified above.

5.5.2 Packing, level B. This level shall conform to 5.5.1 except that the exterior container(s) shall be domestic grade and type. Containers and packing shall comply with the Uniform Freight Classification Rules and National Motor Freight Classification Rules, as applicable.

5.5.3 Packing, level C. Level C packing shall afford protection against damage during direct shipment from the supply source to the first receiving activity for immediate use. Containers and packing shall comply with the Uniform Freight Classification Rules and National Motor Freight Classification Rules, as applicable.

5.6 Special container. The container for which the requirements are herein specified is a demountable, plywood-sheathed crate. It is intended for fuel cells that require containers wider than 1.1 m (44 in) and is suitable for level A, B, or C packs.

5.6.1 Materials. The requirements for lumber, plywood, nails, bolts, lag screws, and metal strapping shall conform to those requirements in MIL-C-104.

5.6.2 Base. The base shall be composed of cross skids, stringers, and plywood flooring (see figure 1). Cross skids shall be evenly spaced and shall not exceed 914 mm (36 in) center to center. There shall be at least 4 stringers evenly spaced and not exceeding 610 mm (24 in) center to center. The flooring shall be plywood of 10 mm (0.375 in) thickness and the direction of the face grain shall be perpendicular to the stringers.

5.6.3 Sides and ends. The sides and ends shall be constructed with struts and spaced no greater than 610 mm (24 in) center to center, and the direction of the grain of the plywood face plies vertical (see figures 2 and 3).

5.6.4 Top. The top shall be constructed in the same manner as the sides (see figure 2). The cross members shall be 25 by 102 mm (1 by 4 in) for tops up to 1.5 m (60 in) wide and 51 by 102 mm (2 by 4 in) for tops over 1.5 m (60 in) wide. For tops 2.4 m (96 in) wide and over, the cross members shall be placed on edge (see figure 4).

## MIL-STD-1816

5.6.5 Fabrication. The base, sides, ends, and top shall be fabricated as panels except that tops over 1.5 m (60 in) wide shall be fabricated (as during assembly) on the sides and ends. The stringers of the base shall be attached to the cross skids with at least one 4.5 mm shank dia., 9.5 mm head dia., by 95 mm long (20d) sinker nail driven through and clinched at each crossing. Interior crossings shall have at least 2 nails (see figure 1). Plywood flooring and sheathing shall be attached to framing members of nominal 51 mm (2 in) thickness with 2.3 mm shank dia., 5.9 mm head dia., by 48 mm long (6d) sinker nails staggered in 2 rows and spaced 152 mm (6 in) apart in each row. Plywood sheathing of sides, ends, and top shall be attached to framing members of nominal 25 mm (1 in) thickness with nails driven through the plywood and clinched on the frame member a minimum of 6 mm (0.25 in). The nails shall be staggered in 2 rows for framing 102 mm (4 in) and narrower, 3 rows for wider framing, and shall be spaced 152 mm (6 in) apart in each row. Nailing shall be doubled at butt joints of plywood.

5.6.6 Waterproofing of top. A bead of caulking compound conforming to TT-C-00598 shall be applied at all butt joints of the plywood in the top prior to nailing (see figure 4).

5.6.7 Assembly. The sides, ends, and top shall be fastened together with nails and assembled to the base with lag screws. Size and spacing of nails and lag screws shall be in accordance with figure 5. Tops of crates over 1.5 m (60 in) wide shall be constructed by positioning and nailing the cross members in place on the sides and then applying the top sheathing.

5.6.8 Corner reinforcing strap. Reinforcing straps shall be applied (see figure 5). Straps shall be no less than 15.87 by 0.51 by 406 mm (0.625 by 0.02 by 16 in) (minimum) annealed band, in prepunched or plain style, treated to resist rust and conforming to ASTM D3953. Straps shall be applied: (a) at the corners formed by the juncture of top to side, top to end, and end to side, (b) at the edges formed by the juncture of the top to sides and ends with maximum average spacing of 914 mm (36 in), and (c) at the edges formed by the juncture of sides to ends with maximum average spacing of 914 mm (36 in). Nails shall be galvanized roofing nails 29 mm (1.125 in) long (maximum). Strapping shall be located so that the nailing is in a frame member and a minimum of three nails shall be used for each strap leg.

5.7 Marking. In addition to any special marking required by the contract or order, each shipping container shall be marked in accordance with MIL-STD-129.

5.7.1 Special marking. Precautionary marking shall be applied to exterior containers by stencil or label on one end and one side as follows:

## MIL-STD-1816

"CAUTION - Cell temperature should be above 18°C (65°F) before removing or flexing cells."

"CAUTION - Cells should be stored in areas where the temperature is above 7°C (45°F) and below 21°C (70°F)."

"CAUTION - This side up - use no hooks. ↑ "

5.7.2 New cell marking. Cells that have never contained fuel shall be identified on the exterior container with the following legend by stencil or label applied on one end and one side:

"NEW CELL - PURGING NOT REQUIRED."

## 5.8 Test methods.

5.8.1 Examination of product. Each completed pack submitted for acceptance shall be carefully examined to determine conformance with the applicable specifications. Any unapproved changes from the first article inspection sample shall constitute cause for rejection.

### 5.8.2 Rough-handling tests.

5.8.2.1 Lightweight or small dimensions. FED-STD-101, method 5007, procedure B shall be used for all containers having a gross weight up to 60 kg (150 lbs), except those with skids or those having any edge or diameter over 115 mm (60 in).

5.8.2.2 Heavyweight or large dimensions. FED-STD-101, methods 5005, 5008, and 5012 shall be used with all containers having a gross weight exceeding 60 kg (150 lbs).

<u>TITLE</u>	<u>TEST METHOD</u>
ROTATIONAL DROP TESTS:	
Edgewise test	5008
Cornerwise test	5005
IMPACT TESTS:	
Incline-impact (or)	5023
Pendulum-impact test	5012

5.8.3 Rejection and retest. Packs which have been rejected may be reworked or replaced to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished to the inspector. Units rejected after retest shall not be resubmitted without the specific approval of the procuring activity.

## MIL-STD-1816

## 6. NOTES

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

6.1 Intended use. This standard is intended to provide general requirements for the preservation, packaging, and packing of new or repaired cells for adequate protection in level A (maximum), B (limited), or C (minimum). Cells that have been contaminated by fuel (used cells) should be purged, internally preserved, and marked before packaging to this standard (see TO 00-85A-03-1).

6.2 Subject term (key word) listing.

Bladder  
Collapsible  
Fuel cells  
Oil cells  
Packaging  
Packaging, preservation  
Pliocel  
Self-sealing  
Water-alcohol cells



# \* NAIL SIZES

(1) 5.9 mm HEAD DIA.  
2.3 mm SHANK DIA.  
78 mm LONG  
(6<sup>d</sup>) NAIL

(2) 9.5 mm HEAD DIA.  
4.5 mm SHANK DIA.  
95 mm LONG  
(70<sup>d</sup>) NAIL

NOTE:  
RUBBING STRIPS SHALL BE 89 mm WIDE x  
73 mm MINIMUM HIGH (NOMINAL 4 in WIDE x  
2.875 in HIGH) WITH ENDS BEVELED AT A  
45° ANGLE ±5°. STRINGERS SHALL BE  
38 mm x 89 mm (NOMINAL 2 in x 4 in).

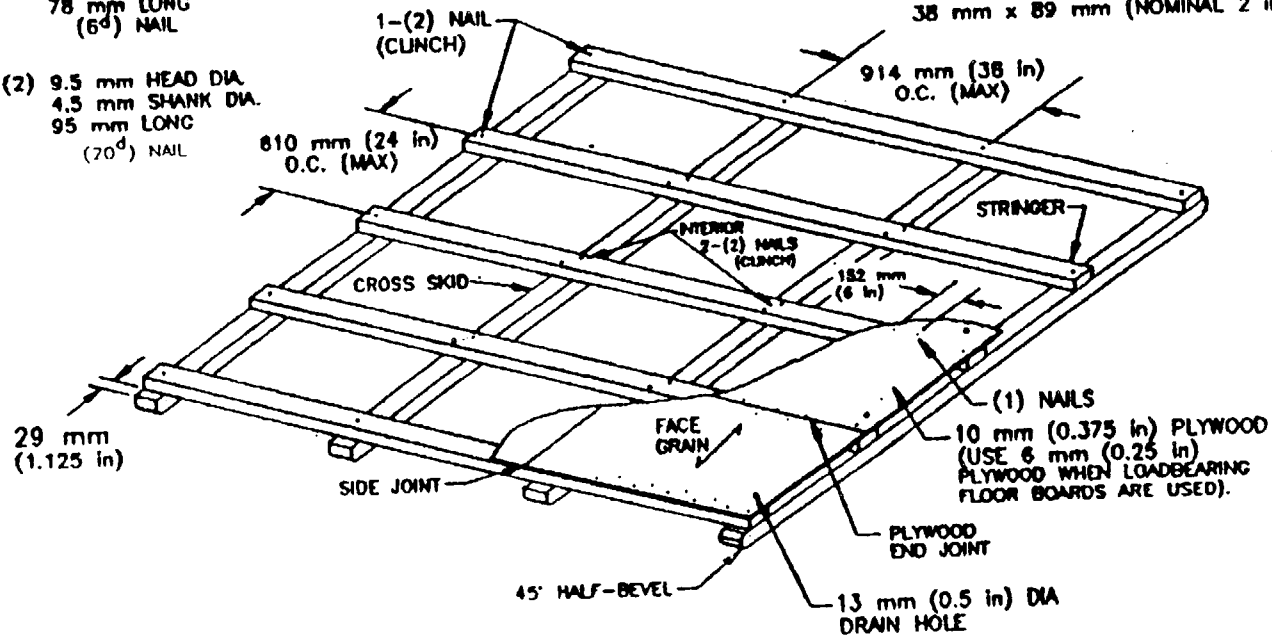


FIGURE 1. Special container base

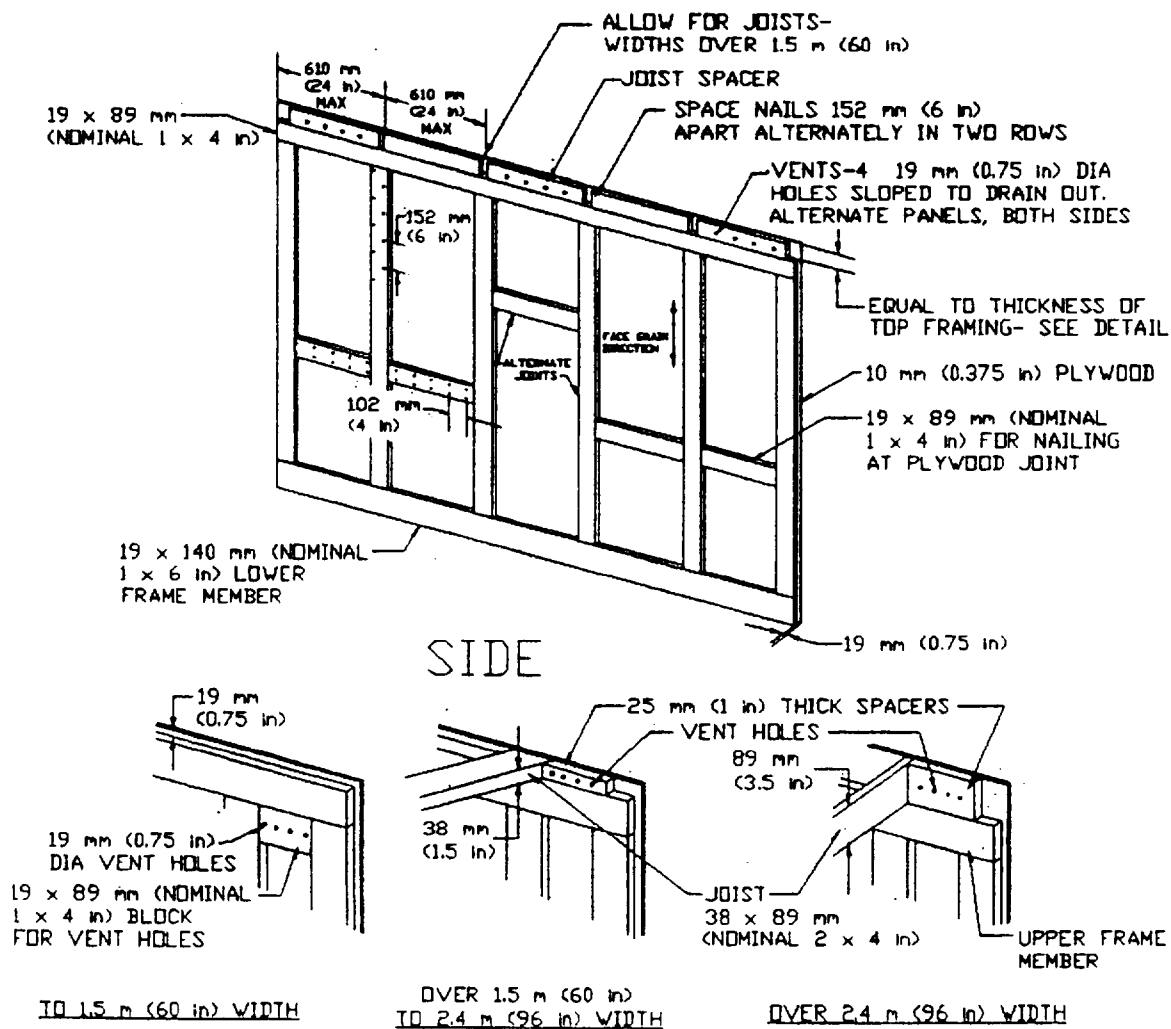


FIGURE 2. Special container side

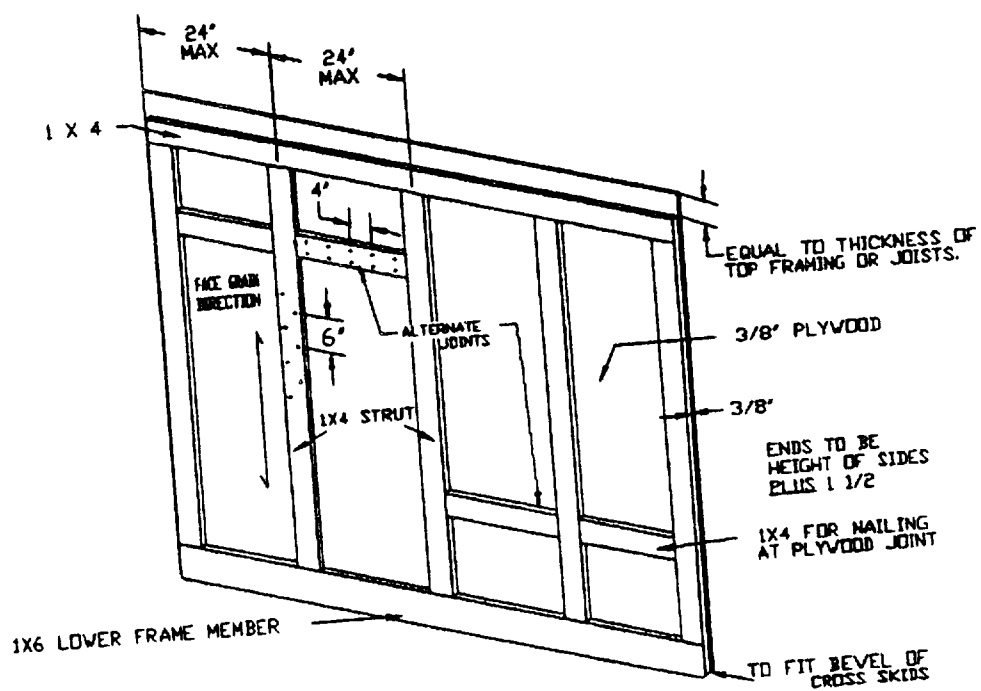


FIGURE 3. Special container end

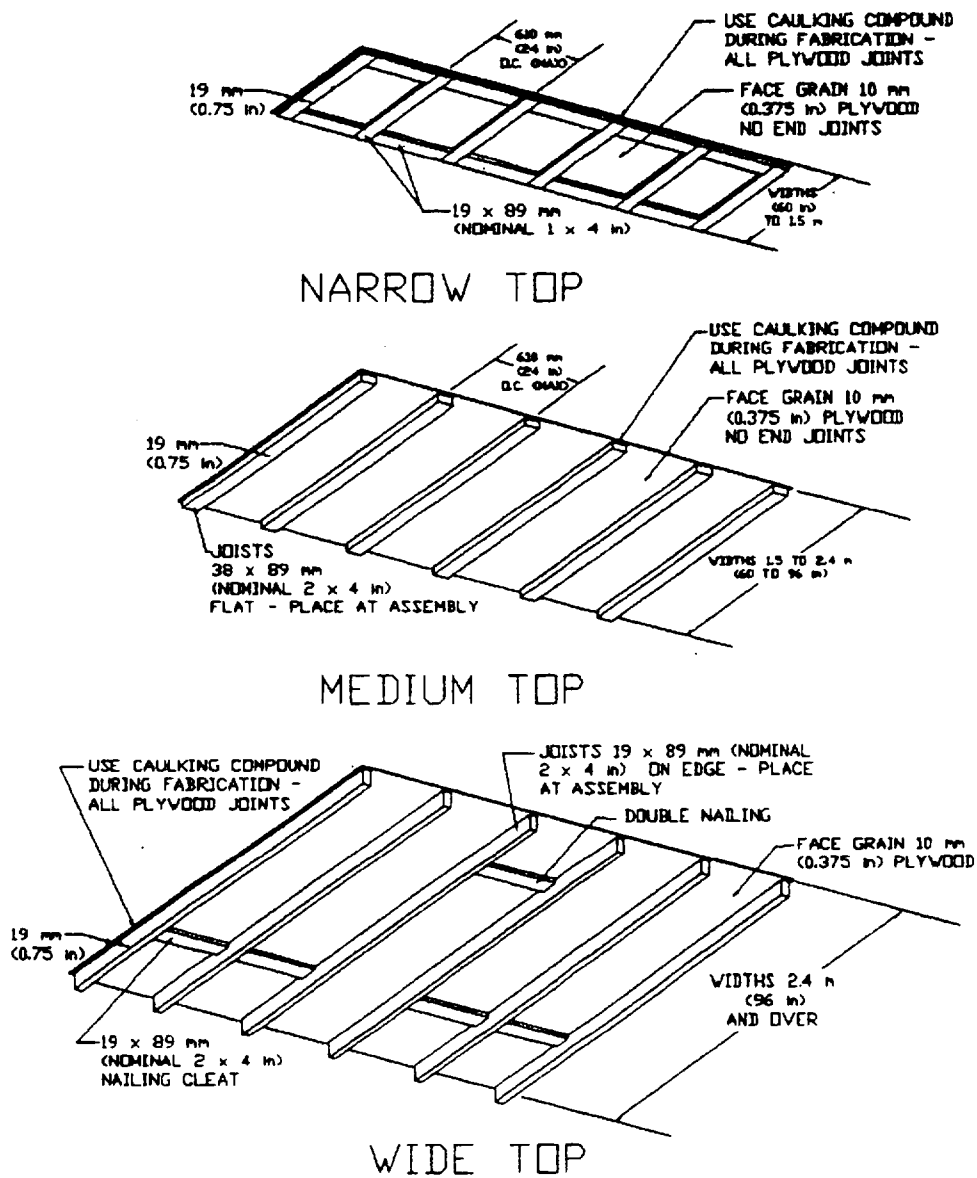
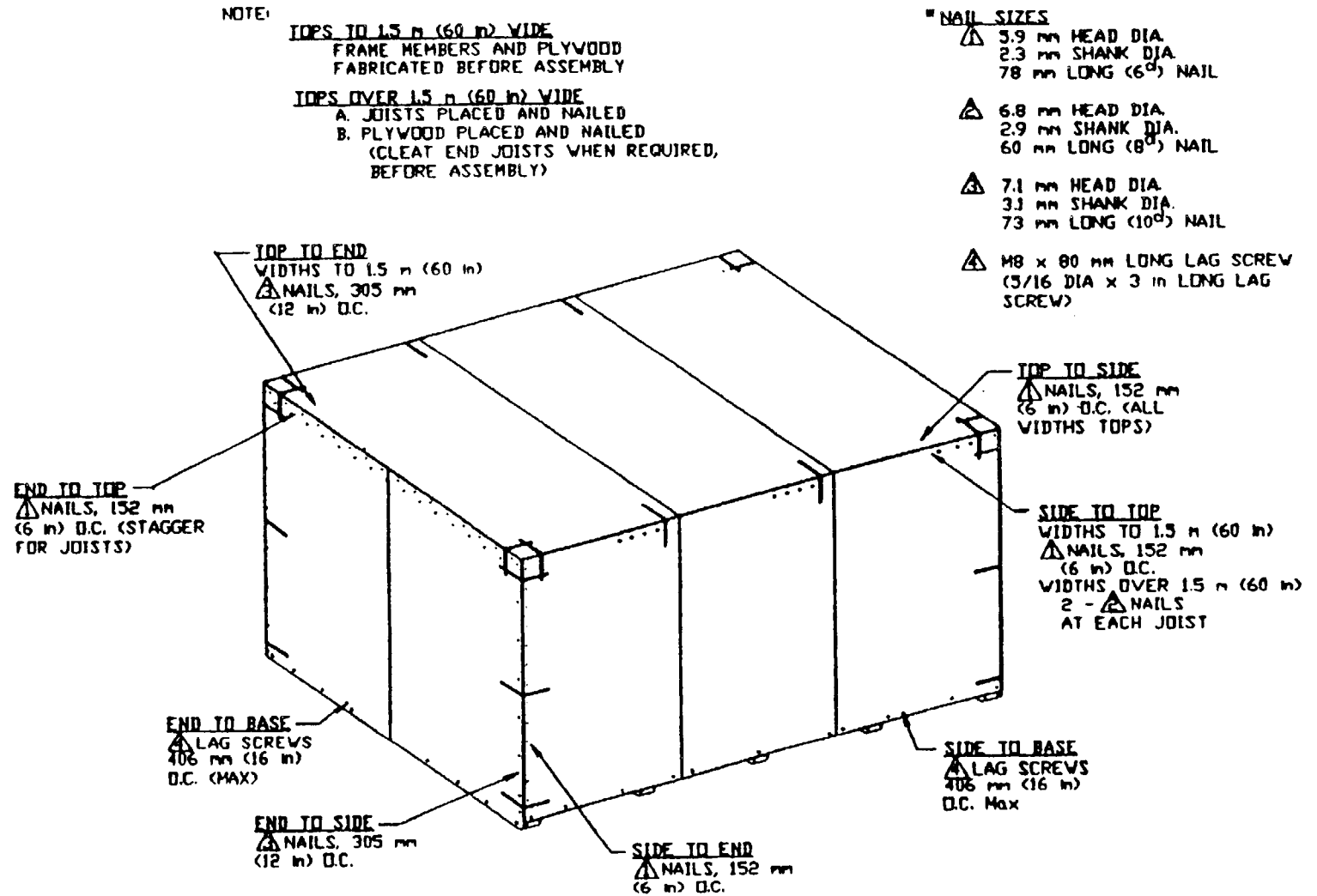


FIGURE 4. Special container top

FIGURE 5. Special Container



## MIL-STD-1816

## INDEX

	<u>PARAGRAPH</u>	<u>PAGE</u>
Base . . . . .	5.6.2	9
Bladder . . . . .	5.4.1	8
Cleaning and drying . . . . .	5.3.1.1	7
Collapsible cell . . . . .	5.4.2	8
Container . . . . .	5.6	9
Corner reinforcing strap . . . . .	5.6.8	10
Fabrication . . . . .	5.6.5	10
Flooring . . . . .	5.6.2	9
Free-fall drop test . . . . .	5.8.2.1	11
Handling . . . . .	5.2.1	7
Impact tests . . . . .	5.8.2.2	11
Lag screws . . . . .	5.6.7	10
Marking . . . . .	5.7	10
Materials (general) . . . . .	5.1	7
Materials (special container) . . . . .	5.6.1	9
New cell marking . . . . .	5.7.2	11
Openings . . . . .	5.3.1.3	7
Packing . . . . .	5.5	8
Packing, level A . . . . .	5.5.1	8
Packing, level B . . . . .	5.5.2	9
Packing, level C . . . . .	5.5.3	9
Pliocel . . . . .	5.4.1	8
Preservation and packaging, level A . . . . .	5.3.1	7
Preservation and packaging, level C . . . . .	5.3.2	7
Rejection . . . . .	5.8.3	11
Retest . . . . .	5.8.3	11
Rotational drop tests . . . . .	5.8.2.2	11
Rough-handling tests . . . . .	5.8.2	11
Self-sealing cell . . . . .	5.4.2	8
Sides and ends . . . . .	5.6.3	9
Sinker nails . . . . .	5.6.5	10
Skids . . . . .	5.6.2	9
Special container . . . . .	5.6	9
Special marking . . . . .	5.7.1	10
Storage . . . . .	5.2.2	7
Stringers . . . . .	5.6.2	9
Struts . . . . .	5.6.3	9
Temperature precautions . . . . .	5.2	7
Test methods . . . . .	5.8	11
Top . . . . .	5.6.4	9
Waterproofing . . . . .	5.6.6	10

MIL-STD-1816

CONCLUDING MATERIAL

Custodian:

Air Force - 69

Navy - SA

Army - SM

Preparing activity:

Air Force - 69

(Project PACK-0949)

Review activities:

Air Force - 70, 71, 80, 99

Army - ME

Navy - AS

User activities:

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-STD-1816

2. DOCUMENT DATE (YYMMDD)  
920420

3. DOCUMENT TITLE Preservation, Packaging, and Packing of Rubber and Nylon Fuel, Oil, and Water-Alcohol cells

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)

7. DATE SUBMITTED (YYMMDD)

(1) Commercial  
(2) AUTOVON (if applicable)

### 8. PREPARING ACTIVITY

a. NAME

KEITH VOSSLER

b. TELEPHONE (Include Area Code)

(1) Commercial

(2) AUTOVON

513-257-4519

787-4519

c. ADDRESS (Include Zip Code)

HQ AFLC/LGTPM

Wright-Patterson AFB, OH 45433-5999

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

Defense Quality and Standardization Office

5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466

Telephone (703) 756-2340 AUTOVON 289-2340