

MIL-C-25731A (USAF)
26 February 1968

SUPERSEDING

MIL-C-25731 (USAF)

12 June 1957

MIL-C-25139 (USAF)

8 April 1955

MIL-C-25010 (USAF)

25 March 1955

MILITARY SPECIFICATION

CRATES, WOOD, FOR DOMESTIC AND OVERSEAS SHIPMENT OF AIRFRAME COMPONENTS
(2,000 - POUND MAXIMUM NET LOAD)

1. SCOPE

1.1 Scope. This specification covers the requirements for the construction of non-demountable, semi-demountable and fully demountable wood shipping crates for the packaging of aircraft control surfaces, lightweight bulky airframe items and other similar parts for air and surface domestic or overseas shipment.

1.2 Classification. Crates shall consist of the following Types and Classes as specified (see 6.2):

- | | |
|---------|---|
| Type I | Semi-demountable crates for net loads not exceeding 200 pounds and dimensions not exceeding 12 feet in length, 2 feet in width and 5 feet in height. |
| Class 1 | Open (for air shipments or level B, limited military packing; and suitable for level C, minimum military packing). |
| Class 2 | Sheathed (for level B, limited military packing). |
| Type II | Fully demountable crates with skids for net loads not exceeding 2,000 pounds and dimensions not exceeding 48 feet in length, 4 feet in width and 16 feet in height. |

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

FSC 8115

MIL-C-25731A (USAF)

- Class 1 Open (for air shipments or level B, limited military packing; and suitable for level C, minimum military packing).
- Class 2 Sheathed (for level A, military packing).
- Type III Semi-demountable, plywood, sheathed crates for net loads not exceeding 2,000 pounds and dimensions not exceeding 20 feet in length, 12 feet in width and 12 feet in height. (For level A, military and level B, limited military packing).
- Type IV Inner crates
- Class 1 Open (for air shipments or level B, limited military packing; and suitable for level C, minimum military packing).
- Type V Outer crates
- Class 1 Plywood sheathed crate (for level A, military packing).
- Class 2 Cleated plywood crate for net (maximum) weight of 250 pounds (for level A, military packing).
- Type VI Non-demountable crates without skids 1/ for net loads not exceeding 500 pounds and dimensions not exceeding 12 feet in length, 5 feet in width and 2 feet in height.
- Type VII Crates with skids for net loads not exceeding 1,000 pounds and dimensions not exceeding 32 feet in length, feet in width and 10 feet in height. For lengths greater than 10 feet, the height shall not be less than 2 feet.
- Class 1 Non-demountable open (for air shipments or level B, limited military packing; and suitable for level C, minimum military packing).
- Class 2 Semi-demountable sheathed (for level A, military packing).

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids or request for proposal, shall form a part of this specification:

- 1/ Skids may be added to Type VI crates to facilitate handling by mechanical lifting equipment. When skids are added, lifting areas shall be so marked; and protective sheathing, as may be needed, shall be applied at such lifting areas.

MIL-C-25731A (USAF)

SPECIFICATIONS**Federal**

FF-B-561	Bolts, Lag
FF-B-571	Bolts, Nuts, Studs and Tap Rivets (and materials for same)
FF-N-103	Nails (Small) and Tacks: Cut
FF-N-105	Nails, Wire Brads and Staples
FF-S-111	Screws, Wood, Slotted Head
NN-P-530	Plywood, Flat Panel
QQ-S-781	Steel, Strapping, Flat
TT-C-598	Compound, Caulking, Plastic (for Masonry and other Structures)
TT-W-572	Wood-Preservative: Water-Repellent
PPP-B-1055	Barrier Material, Waterproofed, Flexible
PPP-V-205	Veneer, Paper-Overlaid

Military

MIL-A-8421	Air Transportability Requirements, General Specification for
MIL-D-1000	Drawings, Engineering and Associated Lists

STANDARDS**Military**

MIL-STD-105	Sampling, Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-731	Quality of Wood Members for Containers
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking and Waterproofing with Appropriate Tests.

MILITARY HANDBOOK

MIL-HDBK-7	Military Handbook, Lumber and Allied Products
------------	---

3. REQUIREMENTS

3.1 Preproduction Sample. This specification requires the submission of preproduction samples for preproduction testing (see 4.). (Preproduction sample shall, upon acceptance, be used by inspector as guide in inspecting future items.)

3.1.1 Materials. Materials shall conform to the applicable specification, except that materials used for which there is no governing specification shall be entirely suitable for the purpose intended and approved by the procuring activity.

3.1.1.1 Wood Members. Wood members manufactured or cut from lumber shall be

MIL-C-25731A (USAF)

free from all defects otherwise allowed that would interfere with the prescribed nailing in fabrication and assembly. At least one surface of the frame members on sides and ends of open crates shall be dressed and the dressed side placed on the outside for the purpose of marking.

3.1.1.1.1 Moisture Content. See MIL-STD-731.

3.1.1.1.2 Knots. See MIL-STD-731.

3.1.1.1.3 Cross Grain. See MIL-STD-731.

3.1.1.1.4 Wood Groups. See MIL-STD-731 and MIL-HDBK-7.

3.1.1.1.5 Size of Lumber. See MIL-STD-731. When lumber or part sizes are mentioned in this specification, they shall be considered nominal.

3.1.2 Plywood. Unless otherwise specified, plywood used in the manufacture of these crates shall conform to CS-35, Grade 3-4, Type I; PS-1, Standard Interior with exterior glue; or CS-157, Grade C-C exterior, all of which are covered in NN-P-530 referenced commercial and product standards, and are furnished unsanded. Smooth finished or sanded and treated panels, when required, will be specified in the contract or purchase order. Also, when treatment of plywood with wood preservative is required, use water-repellent conforming to TT-W-572 (see 6.2). Defects, such as knot holes, worm holes, etc., that extend completely through the panel shall not be permitted.

3.1.3 Paper-Overlaid Veneer. Paper-overlaid veneer shall conform to PPP-V-205, Type II.

3.1.4 Nails. Nails shall be sinkers, coolers, corkers, clout, annual ring, helically threaded, or common and shall conform to FF-N-105 or FF-N-103. When used unclinched as in assembly, they shall be cement-coated or chemically etched.

3.1.5 Screws. Screws shall conform to FF-S-111.

3.1.6 Lag Screws. Lag screws shall conform to FF-B-561.

3.1.7 Bolts. Bolts shall be machine, carriage or as specified, and shall conform to FF-B-571.

3.1.8 Caulking Compound. Caulking compound shall conform to TT-C-598.

3.2 General Construction.

3.2.1 Nailing. Unclinched nails shall be at least three times as long as the thickness of the piece holding the nailhead or as specified. Assembly nailing of the ends of members to the edge of others shall follow the details in Figure 1 or as specified. The patterns to be used in nailing two pieces of lumber together flatwise are shown in Figure 1.

3.2.2 Lag Screw Application. The portion of the lead hole for the shank of

MIL-C-25731A (USAF)

the lag screw shall be the same diameter as the shank even though the threaded portion may have a larger diameter than the shank. The portion of the lead holes for threads of the lag screws shall follow the sizes shown in Table I. Lag screws shall be drawn into place by threading them in their lead holes the full distance of the threaded portion. A hammer may not be used to start them. A flat washer shall be used under each head. Counter sinking is prohibited.

TABLE I
LEAD HOLES FOR LAG SCREWS

Diameter of Threaded Portions of Lag Screws	Diameter of Lead Holes (In Inches)	
	Groups I, II and III Woods	Group IV
1/4	3/16	3/16
5/16	1/4	1/4
3/8	1/4	5/16

3.2.3 Bolting. Bolt holes shall not be countersunk. Holes shall be the same diameter as the bolt. A flat washer shall be used under the head and nut of each machine bolt and under the nut of each carriage bolt or step bolt. After placing the nut, the thread of the bolt projecting beyond the nut shall be painted with unthinned lead paint or similar material to prevent the nut from turning.

3.2.4 Splice. Splices and butt joints made in frame members and skids of long crates shall comply with details shown in Figure 2 and as specified in detailed drawings (see 6.2d).

3.2.5 Sheathing for Mechanical Protection. When required for mechanical protection of the item or for unit packing, sheathing shall be used to cover part or all surfaces of the open Type I and II crates as needed. The thickness and the type of sheathing shall comply with that specified in 3.3.5 for Type I crates and in 3.4.3.5, 3.4.4.4 and 3.4.5.4 for Type II crates. The sheathing shall be nailed to the frame members.

3.2.6 Lumber Sheathing Alternate. An alternate for plywood sheathing for Type I and Type II, Class 2 (sheathed) crates, shall consist of lumber sheathing not less than 7/16-inch thick. Details of application shall conform to those in 3.3.5 for Type I crates and 3.4.3.5, 3.4.4.4 and 3.4.5.4 for Type II crates.

3.3 Type I Crates (see Figure 3).

3.3.1 Base. The base shall consist of 2-by-2-inch skids and 1/4-inch plywood flooring which shall be nailed to the skids with fivepenny nails spaced 4

MIL-C-25731A (USAF)

inches apart and staggered as shown in Figure 3. When load-bearing floorboards are required to support the item, the required size shall be determined from Table II.

3.3.2 Sides. The sides shall consist of longitudinal members, struts and diagonals arranged as shown in Figure 3. The upper longitudinal members shall be 1-by-4 inches and all other members 1-by-3 inches. Struts shall be spaced a maximum of 42 inches on centers with diagonals placed as close to a 45-degree angle as possible. When an odd number of panels are used, the diagonal in each end panel shall slope downward toward the bottom corner of the side panel. For heights over 48 inches, a 1-by-3-inch intermediate longitudinal member shall be placed between the upper and lower longitudinal members. This additional member shall not be required for Class 2 sheathed crates. Fabrication shall comply with the nailing patterns in Figure 1 and details in Figure 3.

3.3.3 Ends. The ends shall consist of 1/4-inch plywood nailed to the end struts of the sides as shown in Figure 3. Nails shall be placed on 5-inch centers.

3.3.4 Top. The top shall consist of 1/4-inch plywood. If the length of the top is such that a butt joint is required, the splice shall be backed and nailed to a 1/4-by-4-inch plywood cleat placed on the interior.

3.3.5 Sheathing for Class 2 Crates. Plywood 1/4-inch thick or paper-overlaid veneer 3/16-inch thick shall be used for sides, using 1-by-2-inch filler strips between vertical members along the upper and lower edges.

3.3.6 Assembly. Type I crates shall be assembled to form a nailed cap, combining the sides, ends and top. This unit shall be fastened to the base with lag screws.

3.3.6.1 Top to Sides. The plywood of the top shall be nailed to the upper longitudinal members of the sides with fivepenny nails spaced 6 inches apart.

3.3.6.2 Sides to Base. Each strut of the sides shall be fastened to the skids of the base with one 5/16-by-2-inch lag screw.

3.4. Type II Crates.

3.4.1 Base (Figure 4). The base shall consist of skids and rubbing strips with plywood flooring for crates up to 24 inches wide and cross members and diagonals for crates wider than 24 inches.

3.4.1.1 Skids. The size of skids shall comply with the requirements of Table III. When splicing or laminating is required, details in Figure 2 shall be followed. Three skids shall be used when widths are greater than 36 inches. When no rubbing strips are required (3.4.1.2), the ends of each skid shall be chamfered half their thickness (see Figure 15).

MIL-C-25731A (USAF)

TABLE II

LOAD-BEARING FLOORBOARDS
ALLOWABLE LOAD, IN POUNDS PER INCH OF FLOORBOARD WIDTH
GROUPS I AND II WOOD 1/

Length Between Outside Skids	Thickness of Floorboards (Inches)			
	3/4	1-5/8	2-5/8	3-5/8
<u>Inches</u>	<u>Pounds</u>	<u>Pounds</u>	<u>Pounds</u>	<u>Pounds</u>
12	48	220	574	1,095
18	32	147	382	731
24	24	110	287	548
30	19	88	229	438
36	16	73	192	365
42	14	63	164	313
48	12	55	144	274
60	9	44	115	219
72	8	37	96	182
84	7	31	82	156
96	6	27	72	137
108	5	24	64	122
120	5	22	57	110

TABLE III

SIZE OF SKIDS

Size of Skids	Maximum Net Load	Maximum Crate Length
<u>Inches</u>	<u>Pounds</u>	<u>Feet</u>
* 2 x 2	200	12
2 x 3	500	16
2 x 4	1,000	20
** 3 x 3	2,000	32
** 4 x 4	2,000	48

* For widths up to 24 inches.

** Two 2 x 4 members laminated on edge may be used.

1/ If Group III or IV woods are used, the above allowable loads may be increased by 20 percent.

MIL-C-25731A (USAF)

3.4.1.2 Rubbing Strips. Rubbing strips shall be used on each skid for gross loads over 250 pounds as shown in Figure 4. A 2-by-2-inch rubbing strip shall be used for each 2-by-3-inch or 2-by-4-inch skid; a 2-by-3-inch rubbing strip shall be used for each 3-by-3-inch skid, and a 2-by-4-inch rubbing strip for each 4-by-4-inch and doubled 2-by-4-inch skid. Each end shall be beveled at a 45-degree angle and allowances shall be made for slings and forklift handling according to Figure 4. Rubbing strips shall be nailed to the skids with two (2) rows of twelvepenny nails spaced 12 inches apart in each row.

3.4.1.3 End Headers. Two end headers, 2-by-4 inches in size, shall be used at each end of all wide base (over 24 inches in width), and for narrow bases (up to 24 inches in width), when net loads are over 500 pounds. They shall be located as shown in Figure 4 and bolted to the skids with 3/8-inch diameter carriage bolts.

3.4.1.4 Flooring. The flooring for narrow crates shall consist of plywood nailed to the skids. Plywood 1/4 inch thick shall be used for crate widths to 12 inches and 3/8-inch plywood for widths over 12 inches up to 24 inches. Plywood shall be placed and fastened as shown in Figure 4. Floorboards and diagonals for bases wider than 24 inches shall consist of 1-by-4-inch members nailed to the skids as shown in Figure 4, using nailing patterns illustrated in Figure 1.

3.4.1.5 Load-Bearing Floorboards. When concentrated loads occur, load-bearing floorboards shall be used and the sizes shall be determined from Table II. They shall be fastened to the skids with 3/8-inch diameter carriage bolts. Two bolts shall be used for floorboards over 6 inches in width.

3.4.1 Base for Sill-Type Crates. Sill-type crates are used for certain parts with irregular bottom contours, such as rudders or stabilizers, when the load may be carried by blocking or supporting the item on the lower frame members of the sides. This type shall be used only when crate widths are 24 inches or less and the blocking and other supporting cross members are designed to be fastened to the side panels for cross support.

3.4.2.1 Construction of Base. The base shall consist of plywood nailed to 1-by-2-inch runners as shown in Figure 4. For crate widths up to 20 inches, 1/4-inch plywood is required and crates over 20 inches in width require 3/8-inch plywood. For gross loads over 250 pounds, 2-by-2-inch rubbing strips shall be used for sling and forklift loading.

3.4.3 Sides. (See Figure 5).

3.4.3.1 Style A Sides. Style A sides shall be used for crate heights up to 72 inches and loads up to 1,000 pounds. Struts shall be spaced 48 inches on center (maximum) for loads up to 500 pounds and 42 inches (maximum) for loads over 500 pounds. Diagonals shall be arranged as shown in Figure 5 and placed as close to a 45-degree angle as possible. An intermediate longitudinal member shall be used for Class 1 (open) crates when crate heights are over 48 inches, and it shall be placed on the same plane as the upper and lower longitudinal members and as near the mid-point between the longitudinals as possible.

MIL-C-25731A (USAF)

3.4.3.2 Style B Sides. Style B sides shall be used for crates with size or load limits greater than those specified for Style A sides up to the limits of this specification. (Maximum load of 2,000 pounds, length of 48 feet, width of 48 inches and height of 144 inches.) Struts shall be spaced 48 inches on center (maximum) for loads up to 1,000 pounds and 42 inches (maximum) for loads over 1,000 pounds and diagonals placed as close to a 45-degree angle as possible.

3.4.3.3 Framing Members. The size of the upper longitudinal member for Styles A and B sides shall be determined by dividing the crate length by the height. The following sizes shall be used for the various length-to-height ratios:

Length-to-Height Ratio	0 to 5	-	1-by-4
Length-to-Height Ratio	5 to 8	-	1-by-6
Length-to-Height Ratio over 8		-	1-by-8

The lower longitudinal members for both Styles A and B sides shall be 1-by-4-inch members for loads up to 1,000 pounds and 1-by-6-inch members for loads over 1,000 pounds. For sides of sill-type crates up to 20-inch width, the size of lower frame members shall be 1-by-8-inch for loads to 1,000 pounds. For sill-type crates over 20 inches in width, or for loads over 1,000 pounds, lower frame members shall be 1-by-10-inch. Intermediate members shall be 1-by-6-inch for all conditions. Struts and diagonals shall be of the following sizes:

Loads up to 1,000 pounds and lengths up to 20 feet, use 1-by-4 inches.

Loads over 1,000 pounds, lengths over 20 feet, or heights over 96 inches, use 1-by-6 inches.

The edge struts for both Styles A and B crates shall be 1-by-6 inches.

3.4.3.4 Fabrication Nailing. The frame members of the sides shall be nailed together as shown in Figure 5 using nailing patterns shown in Figure 1. Nails shall be clinched at least 1/4-inch.

3.4.3.5 Sheathing for Sides of Class 2 Crates. Filler cleats, 1-by-2 inches, shall be nailed to upper and lower longitudinal members between struts and diagonals. Sheathing shall be 3/16-inch plywood and shall be nailed to the filler cleats and frame members with two (2) rows of 7/8-inch minimum nails spaced 10 inches apart in each row. The sheathing of the sides shall be placed so that the plywood of the ends and top overlaps and provides water-resistant joints.

3.4.4 Ends. (See Figure 6).

3.4.4.1 Panels. The style of end panel shall be determined by the crate width. Plywood crosspieces shall be nailed to struts of ends up to 24 inches wide and a plywood bottom crosspiece and lumber cross members and diagonals shall be used for ends wider than 24 inches. Diagonals shall be placed as near a 45-degree angle as possible. An intermediate strut shall be used for Class 1 crates wider than 42 inches and an intermediate crosspiece when crate height is over 48 inches.

3.4.4.2 Framing Member Sizes. The size of the vertical struts, the size and number of plywood and lumber crosspieces and the placement of members shall be as shown in Figure 6.

MIL-C-25731A (USAF)

3.4.4.3 Fabrication Nailing. The frame members shall be nailed together as shown in Figure 6 and according to the details in Figure 1.

3.4.4.4 Sheathing for Ends of Class 2 Crates. For ends with widths up to 24 inches, the plywood crosspieces shall be replaced with full sheathing, using the same plywood thickness. For crates wider than 24 inches, 1-by-2-inch fillers shall be nailed to the struts between cross members. Plywood sheathing, 3/16-inch in thickness, shall then be nailed to the fillers and the frame members as described in 3.4.3.5 for sides. Vents shall be provided in the ends of Class 2 crates in accordance with 3.7.2.3.5.2 and Figure 33.

3.4.5 Top. (See Figure 7).

3.4.5.1 Panels. The styles of top panels to be used for Type II crates shall be determined by the width of the crate. The style for narrow tops (up to 24-inch width) shall consist of plywood crosspieces fastened to longitudinal members. Tops wider than 24 inches shall consist of lumber crosspieces and diagonals fastened to longitudinal members. Top cross struts shall be spaced the same as the struts of the side.

3.4.5.2 Framing Member Sizes. The longitudinal and end members for narrow tops shall be 2-by-2 inches in size for loads up to 1,000 pounds and 2-by-3 inches for loads over 1,000 pounds. Plywood crosspieces, 3/8-by-12 inches, shall be used as shown in Figure 7. The longitudinal and end framing members for wide tops shall be 2-by-2 inches for loads up to 1,000 pounds and 2-by-3 inches for loads over 1,000 pounds. Cross members and diagonals shall comply with the sizes shown in Figure 7. A reinforcing member, 2-by-3 inches in size, shall be placed at the center of balance between the longitudinal members for grab-hook handling for gross loads over 500 pounds.

3.4.5.3 Fabrication Nailing. The frame members shall be nailed together as shown in Figure 7 and according to the nailing patterns in Figure 1.

3.4.5.4 Sheathing for Tops of Class 2 Crates. Plywood sheathing, 3/8 inch thick, shall replace the plywood crosspieces for narrow tops. For wide tops, 1-x-2-inch filler strips shall be nailed between struts and diagonals (see Figure 7). Plywood sheathing, 1/4 inch thick, shall be nailed to filler strips, struts and diagonals with two (2) rows of nails spaced 8 inches apart in each row. Projection of the plywood on the top shall be sufficient to overlap the plywood sheathing of side and end panels. Butt joints of the plywood shall be made over a strut using a bead of caulking compound along the joint when nailing.

3.4.6 Assembly. (See Figure 8). Type II crates shall be fully demountable and assembly shall be with lag screws and bolts. The use of lag screws and bolts shall conform to 3.2.2 and 3.2.3.

3.4.6.1 Sides to Base. Each strut and diagonal of the sides shall be fastened to the skids of the base with a minimum of one lag screw. Lag screws 5/16-by-3 inches for 2-by-3 and 2-by-4-inch skids, and 3/8-by-3-inch lag screws for larger skids. When a greater number of lag screws are required, based on the gross weight of the crate as outlined in Table IV, the additional lag screws shall be

MIL-C-25731A (USAF)

placed in either the struts or diagonals. For sill type crates (3.4.2) each strut and diagonal of the sides shall be fastened to the 1-by-2-inch runners of the base with two 2-inch wood screws. Struts and diagonals extending below the skid shall be trimmed where they interfere with forklift or sling handling.

3.4.6.2 End to Base. For widths of crates up to 24 inches, no fastenings are required for ends to base. For widths over 24 inches, the plywood crossmember of the end shall be fastened to the header of the base with 5/16-by-3-inch lag screws spaced 12 to 14 inches on centers (see Figure 8).

TABLE IV

NUMBER OF LAG SCREWS REQUIRED TO ASSEMBLE SIDES TO BASE 1/

MAXIMUM WEIGHT OF CRATE AND CONTENTS	TOTAL MINIMUM NUMBER AND SIZE OF LAG SCREWS (SIDES TO BASE) <u>2/</u>	
	5/16-by-3-Inch for 2-by-3 or 2-by-4-Inch (Flat) Skids	3/8-by-3-Inch for 3-by-3-Inch and Doubled (On Edge 2-by-4 Skids)
<u>Pounds</u>		
1,000	8	8
2,000	14	10
3,000	18	16
4,000	24	20

3.4.6.3 Sides to Top. The sides shall be fastened to the top with one (1) 5/16-by-3-inch lag screw or one (1) 5/16-inch bolt at each strut or panel point as shown in Figure 8.

3.4.6.4 Sides to End. The edge struts of the sides shall be fastened to the struts of the end with 5/16-by-2 1/2-inch lag screws (minimum) or 5/16-inch bolts. Fasteners shall be spaced 12 to 14 inches on center.

3.4.6.5 Ends to Top. The edge struts of the sides shall be fastened to the struts of the end with 5/16-by-2 1/2-inch bolts. Fasteners shall be spaced to 12 to 14 inches on center.

3.5.1 Base. (See Figure 9). The base shall consist of cross skids and stringers which are nailed together and covered with plywood.

1/ For Type II crates, use Table when the total number of diagonals and struts on both sides is less than the number of lag screws specified.

2/ Use one-half on each side of crate (Type II or Type III Crates).

MIL-C-25731A (USAF)

3.5.1.1 Cross Skids and Stringers. Cross skids and stringers shall be 2-by-3 inches in size for loads to 500 pounds, widths to 60 inches and lengths to 10 feet; and 2-by-4 inches in size for all other conditions. They shall be spaced as shown in Figure 9 and nailed together with one (1) clinched twentypenny nail at each outside crossing, placing the nails back from the ends of the members to prevent splitting, and two (2) nails at each inside crossing. The ends of each cross skid shall be beveled at 45 degree angle to one-half their depth.

3.5.1.2 Plywood Flooring. Plywood flooring shall be used with the face grain at right angles to the stringers. When loads are uniformly distributed, as in fuel cells, plywood shall be 3/8 inch thick. When load-bearing floorboards are required because of concentrated loads, 1/4-inch plywood shall be used. Plywood shall be nailed to the stringers with sixpenny nails spaced 6 inches apart in two (2) rows. End butt joints shall be made over the center of the stringers.

3.5.1.3 Load-Bearing Floorboards. When concentrated load occurs, because of the nature of the item, load-bearing floorboards shall be used and the sizes determined from Table II. They shall be placed over the plywood and bolted to each stringer with 3/8-inch carriage bolts.

3.5.2 Sides. (Figure 10). Sides shall be constructed so that the top is supported by the upper frame members of the sides. The fabrication or design details of the upper part of the sides depend on the width of the top (see Figure 10). Struts shall be spaced so that plywood joints are made over the center of a strut and any odd panels resulting from spacings less than 24 inches shall be placed either at each end or at the center of the side.

3.5.2.1 Framing Members. The struts and upper frame members shall be 1-by-4 inches and the lower frame members 1-by-16 inches. Joist spacers, which are required for the sides when crate tops are over 60 inches wide, shall be the same depth as the joists, 2-by-4-inch members flat or on edge, and the same thickness as the side frame members as shown in Figure 10.

3.5.2.2 Sheathing. Sheathing for the sides shall be 3/8-inch plywood. Use full length panels for crate height to 96 inches. For length greater than 96 inches, plywood and splices shall be made over a 1-by-4-inch cleat as shown in Figure 10, alternating the joints during fabrication.

3.5.2.3 Ventilation. Sheathed crates shall have side ventilation consisting of 3/4-inch diameter holes drilled at an angle of approximately 45 degrees and sloped to drain outward. These holes are to be placed in the joist spacers, or for crate widths up to 60 inches, in a block placed directly below the upper frame member, (Figure 10). Use four holes in each alternate panel for both side panels.

3.5.2.4 Fabrication Nailing. Frame members of the sides, the joist spacers, vent blocks, and joint cleats when required, shall be fabricated together by means of clinched nails. Nail spacing and arrangement of members shall follow the details in Figure 10.

3.5.3 Ends. (Figure 11). The ends shall be constructed similar to the sides

MIL-C-25731A (USAF)

and as shown in Figure 11, using plywood sheathing nailed to frame members. Individual panels less than 24 inches in width may be placed at the center or at each edge.

3.5.3.1 Framing Members. The struts, upper frame member and the cleat for end plywood joints shall be 1-by-4 inches and the lower frame member 1-by-6 inches.

3.5.3.2 Sheathing. Plywood for end sheathing shall be 3/8 inch thick. Full length panels with no joints shall be used for heights up to 96 inches. For ends higher than 96 inches, the splices in the panels shall be made on 1-by-4 cross cleats (see Figure 11), alternating the location of the joints when the width of the panel exceeds 48 inches.

3.5.3.3 Fabrication Nailing. Frame members, cleats and plywood shall be arranged and nailed together as shown in Figure 11.

3.5.4 Top. (Figure 12). Top design for Type III crates include three styles which are based on the top width. For crates up to 60 inches in width, tops are prefabricated prior to assembly. For crates wider than 60 inches, joists shall be required and shall be nailed in place after sides, ends and base have been assembled. The plywood top sheathing shall then be nailed to the joists.

3.5.4.1 Framing Members.

3.5.4.1.1 Narrow Tops (Widths to 60 Inches). All frame members for narrow tops shall be 1-by-4 inches. Cross struts shall carry through the width of the top and the longitudinal edge members shall be cut between as shown in Figure 12.

3.5.4.1.2 Medium Tops (Widths from 60 to 96 Inches). Frame members for medium tops shall consist of 2-by-4-inch joists placed flat during assembly and spaced a maximum of 24 inches on center (Figure 12).

3.5.4.1.3 Wide Tops (Widths Over 96 Inches). Frame members for tops shall consist of 2-by-4-inch joists placed on edge during assembly and spaced a maximum of 24 inches on center (Figure 12).

3.5.4.2 Sheathing. Sheathing for the tops shall consist of 3/8-inch plywood placed with the face grain parallel to the width of the top. Full length pieces shall be used for tops up to 96 inches in width. For wider tops the plywood, when end joints are used, shall be placed with alternated joints as shown in Figure 12.

3.5.4.3 Fabrication Nailing. The frame members and plywood shall be arranged and nailed together as shown in Figure 12 for narrow tops. Before nailing plywood to frame members, a bead of caulking compound shall be used along each plywood joint for waterproofing. For medium and wide tops, plywood shall be nailed to the joints during assembly, with fivepenny nails using the same nail spacing and placement of caulking compound as described for narrow tops. (See 3.5.4.1.1). Plywood for wide tops requiring butt joints shall be fastened to

MIL-C-25731A (USAF)

the nailing cleats before assembly as shown in Figure 12.

3.5.5 Assembly. (Figure 13). The sides, ends and tops of Type III crates shall be assembled by nailing and the unit fastened to the base by means of lag screws. The use of lag screws shall conform to details in 3.2.2. For crates wider than 60 inches, the top shall be assembled after the sides and ends have been nailed together.

3.5.5.1 Sides to Ends. For crates up to 60 inches in width, the plywood of the sides shall be nailed to the edge members of the ends with sixpenny nails spaced 6 inches apart.

3.5.5.2 Ends to Sides. The ends shall be fastened to the edge struts of the sides by nailing through the plywood and struts of the end with tenpenny nails spaced 12 inches apart.

3.5.5.3 Sides to Top. For crates up to 60 inches in width, the plywood of the sides shall be nailed to the edge members of the top with sixpenny nails spaced 6 inches apart. For tops wider than 60 inches, the top joists shall be fastened to the side by nailing through the plywood of the sides into the end of each joist with two (2) eightpenny nails.

3.5.5.4 Top to Sides. For tops over 60 inches in width, the plywood is nailed to the joists as prescribed in 3.5.4.3. The plywood of the top is nailed to the joist spacers of the sides or the upper frame members of the sides with sixpenny nails spaced 6 inches apart.

3.5.5.5 Top to Ends. For crates 60 inches or less in width, the top is nailed to the upper frame members of the ends with tenpenny nails spaced 12 inches apart.

3.5.5.6 Ends to Tops. The plywood of the end shall be nailed to the edge strut of the top or to the edge joist of the top with sixpenny nails spaced six (6) inches apart. When nailing into joists, the nails shall be staggered.

3.5.5.7 Sides to Base. The sides shall be fastened to the edge stringers of the base with 5/16-by-3-inch lag screws. The total number required for fastening the sides to the base shall be determined from Table IV but spacing shall not exceed 16 inches on center.

3.5.5.8 Ends to Base. The ends shall be fastened to the edge cross skids on the base with 5/16-by-3-inch lag screws spaced sixteen (16) inches on center.

3.6 Type IV Container.

3.6.1 General. (See Figure 14). Type IV container shall consist of lightweight wood members which form a framework and together with the supporting cradles or brackets serve as an air-shipment container. Inner container shall, by means of screws, lag screws or bolts, be reusable to the point where removal of the parts can be readily accomplished. These reusable features shall not interfere with the removal of the inner container from the outer container.

3.6.2 Component Parts. The Type IV crate shall consist of the following: (a) base and top, (b) sides and (c) ends. (In some narrow, lightweight crates, no ends shall be required).

3.6.2.1 Base and Top. The base shall consist of longitudinal runners with cross members of wood or plywood except the narrow crate which shall have a plywood base. The construction of the top shall be similar to that of the base except that longitudinal members shall be used only in the wide crates.

3.6.2.1.1 Construction Detail. The base and top for the Type IV crates shall be divided into three general types: a. Narrow (to 12 inches); b. Intermediate (12 to 24 inches wide); c. Wide (24 to 36 inches wide). The size and arrangement of the members, the limits for use and other details shall conform to Figure 15 and Table V. Holes 1/2 inch in diameter shall be drilled in the plywood of the base where water might be trapped.

3.6.2.1.2 Fabrication. The various parts of the base and the top shall be fabricated by nailing unless certain members must be demountable. In this case, screws or bolts shall be used. The nailing pattern shown in Figure 15 and Figure 1 shall be followed in the fabrication of intermediate and wide tops and bases. Nails shall be long enough to pass through both pieces and shall be clinched a minimum of 1/4 inch. When pieces are of different thicknesses, the nailheads shall be in the thinner piece. In nailing plywood to runners, two rows of nails shall be used as shown in Figure 15. The splicing of runners or other long members shall comply with the details outlined in Table V and shown in Figure 2. When joints are made by means of scabs, the joint shall be positioned between the struts of the side. The ends of the runners or plywood of the base shall be chamfered for easy entry into the outer container.

3.6.2.2 Sides. The following Styles shall be followed in the construction of the sides of the Type IV container except where rectangular shapes are not practical:

3.6.2.2.1 Style A Sides. Style A sides shall be used for net loads to 100 pounds, for heights up to 40 inches and for lengths up to 12 feet. Member sizes and other details shall conform to Figure 16.

3.6.2.2.2 Style B Sides. Style B sides shall be used when heights are less than 60 inches. The size and arrangement of the frame members for various lengths and net loads shall be as shown in Figure 17.

3.6.2.2.3 Style C Sides. Style C sides shall be used for Type IV crates when heights are 60 inches through 80 inches. The size and the arrangement of the frame members under various length and net load conditions shall be as shown in Figure 18.

3.6.2.2.4 Style D Sides. Style D sides shall be used for Type IV crates when heights are 60 inches through 80 inches. The size and arrangement of the frame members shall conform to those shown in Figure 19.

MIL-C-25731A (USAF)

TABLE V
SIZES OF MEMBERS FOR THE BASE AND TOP OF THE INNER CRATE

TYPE OF BASE AND TOP	MAXIMUM DIMENSIONS AND LOAD			MEMBER SIZES			
	Width (Inches)	Length (Feet)	Weight of Item (Pounds)	Base Runners	Cross Cleats	Dia- gonals	Top Design 1/
Narrow	12	12	100	1/4-Inch plywood 2/	None	None	Use square pieces of 1/4-inch plywood for cross member; spaced same as struts of side panels
Intermediate	24	30	300	1-x-4 3/	1/4-x-48- inch ply- wood sheets	None	Use square pieces of 1/4-inch plywood for cross member; spaced same as struts of side panels
Wide	36	48	2,000	2-x-4 4/	1-x-6 5/	1-x-4	Use 1-x-4-inch longi- tudinal member, cross cleats and diagonals; space cleats same as struts of side panel

1/ Add a 1-x-4-inch cross cleat at the center of balance of narrow and intermediate crates and a 2-x-4-inch flat cleat on wide crates for handling by grabhooks.

2/ If more than 8 feet long, splice with a 1-x-4-inch cleat at the joint, placed inside.

3/ If length exceeds 16 feet, splice with a 1-x-4-x-24-inch scab, placed inside.

4/ If length exceeds 16 feet, splice with a 24-inch scarf joint as shown in Figure 2.

5/ Space cross cleat same as vertical struts of sides.

MIL-C-25731A (USAF)

3.6.2.2.5 Style D-1 Sides. Style D-1 sides may be used under the same conditions outlined for Style D sides; crate heights vary from 80 to 144 inches. This Style is included for those control surfaces that require end mounting near the midpoint of the height and the diagonals are so arranged as to more uniformly distribute the stresses. The size of the frame members and the arrangement shall be as shown in Figure 20.

3.6.2.2.6 Special Sides. It is often desirable, and sometimes necessary, to construct the inner crate to conform to the general shape of the control surface. This is especially true of large dorsal fins, rudders and horizontal stabilizers where non-rectangular forms are required to allow entry into cargo planes. Figure 21 illustrates several types of special side designs which are included as suggestions of member arrangement. The size of members, however, shall conform to those designated for Styles B to D-1 in the various height limitations.

3.6.2.2.7 Number of Panels. The number of horizontal panels required for the various types of sides shall be determined by dividing the height of the crate into the length and selecting the nearest whole number. In crates for larger and heavier parts, it is desirable to select the next greater whole number to provide more struts. The exception to this method of determination shall be in Style A where struts are spaced 20 to 30 inches apart and Style D-1 where one panel length is approximately one-half the crate height. Inside Styles C, D and D-1 strut spacing shall be approximately one-half the height of the side. The arrangement of sides into even numbers of full panels is desirable for side Styles B, C and D. Generally, the panels shall be so spaced that the angle of the diagonals shall not be less than 35° nor greater than 55° (45° plus or minus 10°).

3.6.2.2.8 Fabrication. The various parts of the sides shall be fabricated as outlined in 3.6.2.1.2 for top and base. General nailing details shall comply with Figures 1 and 2.

3.6.2.3 Ends. Ends for open crates may serve not only as a means of blocking the part but also to prevent racking during handling. In lightweight narrow crates, ends are not ordinarily required unless needed for blocking or bracing or if preproduction tests indicate a need for plywood ends. As in the base and the top, the ends shall be divided into three types: narrow, intermediate and wide.

3.6.2.3.1 Types of Ends. Types of ends to be used for the open inner crate shall comply with the requirements of Table VI.

3.6.2.3.1.1 The location of the end members and other construction details shall be as shown in Figure 22.

3.6.3 Assembly of the Type IV Crate.

3.6.3.1 General. The assembly of the various sections or parts of the Type IV crates shall be made with nails, screws or bolts, but in no way shall the fastenings (bolt heads, washers, etc.) prevent easy entry of the inner crate into the outer crate. The inner crate shall be assembled so that a section or

MIL-C-25731A (USAF)

sections are demountable for easy removal of the part. General rules, covering assembly by both nails and screws, shall be included with each crate furnished by the manufacturer.

TABLE VI

TYPE	MAXIMUM SIZE		MAXIMUM NET WEIGHT (POUNDS)	CONSTRUCTION
	WIDTH (INCHES)	HEIGHT (FEET)		
Narrow	12	5	100	No ends required. <u>1/</u>
Intermediate	24	12	300	1/4-inch plywood, panel height equal to one-half of the crate height.
Wide	36	12	2,000	1-by-4-inch struts; horizontal members and diagonals.

3.6.3.2 Assembly Schedule. The fastening of the various sections of the open crate shall comply with the schedule outlined in Table VII and shown in Figure 23. In narrow crates, the plywood base shall be nailed to the lower frame member of the sides; in wider crates having runners, the sides shall be fastened to the base.

3.7 Type V Crate.

3.7.1 General. Each inner container shall be provided with a plywood covered outer container for surface shipment. These outer containers shall be of two Classes: A. Class 1, plywood-sheathed crates for the larger and heavier control surfaces, and; B. Class 2, cleated-plywood boxes for smaller and lighter items.

3.7.1.1 Clearances. There shall be provided a clearance between the inner and outer crate to allow easy entry and removal. The clearance shall be the distance between the greatest outside dimensions of the inner crate and the least inside dimensions of the outer container. The clearances to be allowed shall be 1/2 inch in length and height for any width less than 24 inches. When the width is 24 inches or greater, the clearance in width shall be 3/4 inch. (See Footnote 1/, next page).

1/ In some cases, the results of the preproduction tests may indicate the need for plywood ends.

MIL-C-25731A (USAF)

3.7.1.2 Demountable Features. The outer container shall have at least one demountable end to permit removal of the inner crate. Unless otherwise specified, all remaining sections shall be assembled with nails.

3.7.2 Class 1 Crates.

3.7.2.1 General. Plywood-sheathed crates shall be used for exterior containers when net load (weight of item) is no greater than 2,000 pounds and inside dimensions do not exceed the following: (a) Length - 48 feet; (b) Width - 36 inches; (c) Height - 144 inches. For the smaller and lighter items, it is desirable to use a cleated plywood box for exterior containers. These containers shall be as described in 3.7.3.

3.7.2.2 Fastenings. All assembly shall be by nailing except the demountable ends or fully demountable crates which shall be assembled with lag screws. Lag screws shall be 5/16 inch in diameter and 2 1/2 inches long. Lead holes for the threaded portion of the lag screws shall be 3/16 inch in diameter. Washers shall be used under the head of the lag screws and the lag screws shall be set by turning their full length in the lead hole.

3.7.2.3 Construction.

3.7.2.3.1 Plywood Thickness. Plywood 1/4 inch in thickness may be used for sides, ends and the top when the inside dimensions do not exceed 40 inches in height, 12 inches in width and 12 feet in length, and the net weight of the contents does not exceed 100 pounds. Under all other conditions, 3/8 inch thick plywood shall be used for sides, ends and top.

3.7.2.3.2 Base The base shall be of longitudinal skids and plywood flooring as shown in Figure 24. When specified by the procuring activity, rubbing strips shall be added. The plywood flooring shall be 1/4 inch thick for widths to 12 inches, 3/8 inch thick for widths to 24 inches and 1/2 inch thick for widths to 36 inches. The direction of the face grain shall be at right angles to the length of the skids.

3.7.2.3.2.1 Size of Skids and Rubbing Strips. The size of the skids and rubbing strips shall be in accordance with Table VIII.

3.7.2.3.2.2 Details of Fabrication. Details of fabrication shall comply with those shown in Figure 24. When more than one piece of plywood is used in the base, a 1/4-inch space shall be allowed at each joint for drainage. In addition, 1/2-inch holes shall be drilled at each side in any area where water

- 1/ These clearances are based on the use of the wood of normal moisture content. In high and long crates, some wood species may warp slightly and result in an inner crate which is difficult to remove. When such is the case, a slight increase of the clearance for the width usually eliminates this problem. However, dirt or other foreign matter on the bottom of the inner crate may also result in difficult removal. Cleaning the bottom and, when necessary, using a small amount of wax or petroleum grease on the bottom will usually insure easy removal.

MIL-C-25731A (USAF)

TABLE VII
ASSEMBLY OF INNER CRATE

(Screws to be Used for those Sections Requiring Demountability)

FASTENING POINTS KEY NO. <u>1/</u>	SIZE AND SPACING OF FASTENINGS			
	NAILS <u>2/</u>		SCREWS <u>3/</u>	
	SIZE (PENNY)	MAXIMUM SPACING (INCHES)	LENGTH (INCHES)	MAXIMUM SPACING (INCHES)
1. Plywood of base to lower frame member of the side, for narrow crates.	6	6	1	8
2. Lower frame members of sides to runners of base, for intermediate and wide crates.	8	6	2	2
3. Plywood of top to upper members of sides, for narrow and intermediate crates.	6	3	1	6
4. Upper frame members of side to longitudinal frame member of top, for wide crates.	8	6	2	12
5. Plywood of ends to end struts of sides, for intermediate crates	6	3	1	6
6. Diagonals and horizontals of ends to end struts of the sides, for wide crates.	8	Two nails at end of each member	2	One screw at end of each member
7. Struts of sides to struts of ends for wide crates.	8	8	2	12
8. Top and bottom cross member of end to end cross member of top and base, for wide crates.				

1/ See Figure 23 for Key reference illustration.

2/ Nails to be cement-coated or chemically etched.

3/ Use Nrs. 8 or 10 1-inch screws and Nrs. 10 or 12, 2-inch screws with washers under head and predrilled holes.

MIL-C-25731A (USAF)

might be trapped. An area at the center of balance shall be allowed when applying rubbing strips to the skids so that forklift trucks may be used. Ends shall provide space for sling handling as shown in Figure 24.

3.7.2.3.3 Top. Either one of two types of tops, those without side members and those with side members, shall be shown in Figures 25 and 26. Side members shall be required only for tops having widths over 24 inches. The size and arrangement of members for top panels shall comply with the details in Figure 25 for tops through 24 inches in width, and Figure 26 for tops from 24 to 36 inches in width. The direction of the face grain of the plywood shall be at right angles to the length. Reinforcing of the top at the center of balance for grabhook handling shall comply with the details in Figures 25 and 26. To facilitate handling of long tops during assembly, 1-by-4-inch or 2-by-4-inch longitudinal members may be temporarily nailed to the plywood side at the cross struts for reinforcing.

3.7.2.3.3.1 Nailing. Fabrication nailing shall consist of two (2) rows of nails spaced 6 inches apart in each row. Nails shall be driven through the plywood and clinched a minimum of 1/4 inch against the back of the frame member. Double nailing as shown in Figure 27 shall be used at plywood joints.

3.7.2.3.3.2 Fully Demountable Crates. For fully demountable crates, 2-by-2 inch fastening members shall be added to the top as shown in Figures 25 and 26. Nailing shall conform to that shown for fastening members in Figure 28.

3.7.2.3.3.3 Waterproofing. Waterproofing of the top shall consist of: (a) a 4-inch wide strip of C-2 or E-1 crate liner material, in accordance with PPP-B-1055, applied over the joint cleat the full width of the top at each plywood joint; or, (b) a bead of caulking compound, in accordance with TT-C-598, applied at the butt joint of the plywood before nailing as shown in Figure 31.

3.7.2.3.4 Sides. Sides for the outer crate shall be of two types: (a) for heights through 96 inches, no intermediate members shall be required as shown in Figure 29, or; (b) for heights over 96 inches and through 144 inches, 2 intermediate members shall be required as shown in Figure 30. Details of construction for the two types of sides shall comply with those illustrated in Figures 29 and 30. Plywood shall be applied so that the direction of the face grain is vertical. Fabrication nailing shall comply with the details as shown in Figure 27. No liner shall be required. For crates up to 24 inches wide, the plywood and the upper frame member in the sides shall be flush as shown in Figure 31.

3.7.2.3.5 Ends. Two types of ends shall be used for the outer sheathed crate: (a) nondemountable (assembled with nails), and; (b) the fully demountable (assembled with lag screws). All crates shall have at least one demountable end. Two demountable ends shall be used for crates over 12 feet in length, over 96 inches in height, or containing parts weighing over 200 pounds.

3.7.2.3.5.1 Construction. The ends shall be constructed as shown in Figure 32. Member sizes shall comply with those in Table IX.

MIL-C-25731A (USAF)

TABLE IX

SIZES FOR THE FRAME MEMBERS OF THE ENDS OF OUTER CRATES

Maximum Width	Maximum Height	Maximum Weight of Part	NAILED OR NONDEMOUNTABLE END				DEMOUNTABLE END	
			Strut	Upper Frame Member	Lower Frame Member	Intermediate Member (When required)	Add Fastening Members	
Inches	Inches	Pounds	Inches	Inches	Inches	Inches	Inches	
12	40	100	1 x 2	1 x 2	1 x 4	-	1/ 2 x 2	
24	144	2,000	1 x 4	1 x 4	1 x 6	1 x 4	2 x 2	
36	144	2,000	1 x 6	1 x 4	1 x 8	1 x 4	2/ 2 x 2	

1/ No frame members required; use 2-by-2 fastening members in place of struts, upper and lower frame members.

2/ Use 2-by-4-inch lumber for lower fastening members (see Figure 28).

MIL-C-25731A (USAF)

3.7.2.3.5.1.1 Nailing. Fabrication nailing of the ends shall follow the details shown in Figure 27. No liner shall be required.

3.7.2.3.5.1.2 Demountable Ends. Construction of a demountable end shall require fastening members to receive the lag screws from the sides and top. The fastening members shall be secured to the framing members except for light, narrow crates in which the framing members are eliminated (where 1/4-inch plywood is specified. See 3.6.2.3.1). The size of the fastening members and the construction details shall comply with Table IX and Figure 28. This type of end shall also be used for fully demountable outer crates.

3.7.2.3.5.2 Ventilation. Ventilation shall be provided in each end of all outer sheathed crates. The ventilating area in each end shall be a minimum of 1 square inch for each 15 cubic feet of crate volume. The details shall comply with those shown in Figure 33.

3.7.2.4 Assembly of the outer crate shall comply with the details outlined in Table X and shown in Figure 34. All assembly shall be with nails except for the demountable ends and the fully demountable crate where lag screw fastening shall be used. Two demountable ends shall be used on all crates over 12 feet long or more than 96 inches high or where weight of the item is greater than 200 pounds.

3.7.3 Class 2 Boxes.

3.7.3.1 General. This type of outer container shall be applicable for items having weights no greater than 250 pounds (net weight). The inside dimensions of the container shall not exceed the limits in Table XI.

3.7.3.2 Construction and Fabrication. Cleated-plywood boxes shall be constructed in accordance with the details shown in Figure 35. The top, sides, ends and bottom shall be fabricated by nailing or stapling the plywood sheathing to the lumber cleats as shown in Figure 35.

3.7.3.3 Detail Requirements.

3.7.3.3.1 Sheathing. The minimum thickness of plywood shall be 1/4 inch for Groups I and II woods and 3/16 inch for Groups III and IV. When two or more pieces of plywood are used to sheath a panel, the adjacent edges of the plywood shall be held together by a cleated joint.

3.7.3.3.2 Cleats. There shall be four (4) edge cleats (2 through and 2 filler for each panel of the box in accordance with Figure 35). All cleats shall be in one piece. Minimum sizes shall be 3/4-by-1 3/4 inches for Groups I and II woods and 5/8-x-1 3/4 inches for Groups III and IV. All cleats at plywood joints shall have minimum width of 2 3/4 inches.

3.7.3.3.2.1 Intermediate Cleats. Sufficient intermediate cleats shall be used so that the clear distance is not greater than 20 inches between cleats. Intermediate cleats shall be arranged in accordance with Figure 35 so that corresponding cleats are placed on four (4) faces to form a complete row of cleats around the container when assembled.

MIL-C-25731A (USAF)

TABLE X

ASSEMBLY OF OUTER SHEATHED CRATES
(See Footnotes at the Top of Page 24)

KEY NO. 1/	FASTENING POINTS	MAXIMUM NAIL 2/ OR LAG SCREW SIZE	MAXIMUM SPACING	NOTES
1.	Plywood of side to skid of base.	7d	3	Use sixpenny nails when 1/4 inch plywood is used.
2.	Corner strut of end to corner strut of side.	8d	10	Use No. 9 for demountable ends.
3.	Plywood of side to corner strut of end.	7d	6	Same as above.
4.	End strut of top to upper frame member of end.	8d	6	Use No. 10 for demount- able ends.
5.	Plywood of end to end strut of top.	7d	4	Same as above.
6.	Side member of top, 24 to 36 inch width, to upper frame member of side.	8d	6	
7.	Plywood of side, to side frame member of top, tops 24 to 36 inch width.	7d	6	Use sixpenny nails for 1/4 inch plywood.
8.	Plywood of top, to 24 inch width, to upper frame member of side.	7d	4	
9.	Corner strut of side to side fastening member of end.	5/16 by 2 1/2 inch lag screw 3/	16	Use No. 9 in place of No. 2 and 3 for demountable ends.
10.	End strut of top to top fastening member of end.	5/16 by 2 1/2 inch lag screw	12 4/	Use No. 10 in place of No. 4 and 5 demountable ends.
11.	Plywood of side to skid of base.	5/16 by 2 1/2 inch lag screw	16	Use No. 9, 10, 11 and 12 when entire crate is demountable.
12.	Side to fastening member of top.	5/16 by 2 1/2 inch lag screw	16	Same as above.

(Footnotes to TABLE X, Page 24)

- 1/ See Figure 34 for Key reference illustration.
- 2/ Nails to be cement-coated or chemically etched.
- 3/ Use washers and predrilled holes for all lag screws.
- 4/ Use one (1) lag screw for tops up to 12 inches wide.

TABLE XI

MAXIMUM LENGTH (FEET)	WIDTH AND DEPTH	
	MAXIMUM (INCHES)	MINIMUM (INCHES)
14	30	12
8	30	8
6	30	7

3.7.3.3.2.2. Joint Cleats. Intermediate cleats may also serve as joint cleats except that they shall have a minimum width of 2 3/4 inches. Plywood joints shall be made along the center of these cleats.

3.7.3.4 Assembly. Cleated-plywood boxes shall be assembled by nailing the top and bottom to the sides and fastening the top, bottom and sides to the ends. This end closure shall be made with nails when ends are fixed and with screws when ends are demountable. Two ends shall be removable when the box is longer than 12 feet or carries an item weighing over 200 pounds. Nailing shall comply with the details in Figure 36.

3.7.3.4.1 Demountable Ends. For demountable ends, wood screws with washers shall be used and ends shall be predrilled. Two-inch screws in size Nos. 10 or 12 shall be used. Screws shall be spaced 8 inches apart with a minimum of two (2) on each side.

3.7.3.4.2 Strapping. Girthwise, strapping shall be used on all end and intermediate cleats on the sides, top and bottom as shown in Figure 36. Straps or wires shall be stapled to the cleats at a distance not to exceed 4 inches from the edge or face of the box with staples spaced at intervals of approximately 8 inches.

3.8 Type VI Crates. (See Figure 37).

3.8.1 Fabrication and Assembly. Type VI crates shall consist of a framework

MIL-C-25731A (USAF)

of sides and ends with top and bottom cross members assembled as shown in Figure 37. Minimum nominal 1-by-4 inch lumber shall be used.

3.8.1.1 Sides and Ends.

3.8.1.1.1 Horizontal Members. The maximum number of horizontal members on the sides and ends shall be 1 for 7 1/2 inch depths, 2 for 7 1/2 to 15 inch depths and 3 for 12 to 24 inch depths. When the side or end panels are formed of more than 1 horizontal member, a maximum space of 1 inch shall be allowed between the horizontal members.

3.8.1.1.2 Side Panel Vertical Cleats. Side vertical cleats shall be fastened to the outer surface at each end of the horizontal members forming the end panel. End panels exceeding 36 inches in length, fabricated with more than one horizontal member, shall require an additional vertical cleat at the midpoint of the panel.

3.8.1.1.4 Nailing of Cleats. Side and end panel cleats shall be nailed to the sides and ends with two rows of clinched nails. Three nails shall be used in each cleat for 1-by-4-inch side or end boards, 5 nails for 1-by-6-inch members, 6 nails for 1-by-8 inch side or end boards, etc.

3.8.1.2 Tops and Bottoms.

3.8.1.2.1 Top and Bottom Cross Members. Cross members for crates 36 inches or less in width shall be minimum nominal 1-by-4 inch lumber. Cross members for crates exceeding 36 inches in width shall be minimum nominal 1-by-6-inch lumber. Cross members may be employed to frame and hold interior blocking.

3.8.1.2.2 Outer Cross Members. Each top and bottom panel shall be fabricated with a minimum of two outer cross members. One of the long edges of the outer cross member shall adjoin a long edge of the end panel.

3.8.1.2.3 Intermediate Cross Members. Intermediate cross members shall be spaced so that diagonals are placed as close to 45 degrees as possible but are no further apart than 1 1/2 times the width of the panel. Intermediate cross members shall be placed so that there is even panel spacing along the crate length.

3.8.1.2.4 Diagonal Bracing. Diagonal braces shall be spaced so that diagonals are placed as close to 45 degrees as possible but are no further apart than 1 1/2 times the width of the panel. Intermediate cross members shall be placed so that there is even panel spacing along the crate length.

3.8.2 Assembly Nailing. When nominal 4 inch wide lumber is used, there shall be 2 sevenpenny nails in each end of each board for Group I wood, 2 sixpenny nails for Group II woods and 2 fivepenny nails for Groups II and III woods. Where nominal 6 inch wide lumber is used, there shall be 3 nails instead of 2 as specified above. A board wider than 6 inches shall be nailed with the same spacing as indicated for the 6 inch boards. Where the long edges of two (2) members adjoin each other at right angles, they shall be fastened together with the same size nails as specified above for the different wood Groups, and the

MIL-C-25731A (USAF)

nails shall be spaced approximately 6 inches apart. To facilitate application of the various types of sheathing, when required, the fastening for sheathing shall be at the option of the shipper.

3.8.3 Strapping. When the contents of a Type VI crate weigh more than 200 pounds, the crate shall be strapped with at least two (2) nailless steel straps not less than 0.50 by 0.20 inch in size and conforming to QQ-S-781. Such straps shall be placed on the outer cross members except when two or more intermediate cross members are used, in which case the straps shall be applied to the intermediate cross members nearest the ends of the crate. When crates are 2 feet or less in width and greater than 8 feet in length, an additional strap shall be placed at or near the center of the lengthwise dimension of the crate.

3.9 Type VII Crates. (See Figure 38). Unless otherwise specified, the following requirements are applicable to both Class 1, non-demountable; and Class 2, semi-demountable crates.

3.9.1 Base. (See Figure 39).

3.9.1.1 Skids. The base shall be framed on longitudinal skids. The skids, when placed flat, shall have the minimum nominal dimensions shown in Table XII.

TABLE XII

LENGTH IN FEET	SKID SIZE IN INCHES
0 to 16	2 x 4
16 to 24	3 x 4
24 to 32	4 x 4

The end of the skids shall be beveled the lower one-half of the depth of the skid at an angle of approximately 45 degrees. Splicing of skids, where required, shall be as specified in Figure 2. Crates having a gross weight over 250 pounds shall have rubbing strips as specified in 3.4.1.2.

3.9.1.2 Number of Skids. A minimum of two (2) skids shall be required for bases not exceeding four (4) feet in width, and a minimum of three (3) skids shall be required for bases from 4 to 6 feet in width.

3.9.1.3 Flooring. Floor boards shall be not less than nominal 4 inches wide. Plywood, when used, shall be not less than 3/8 inch in thickness.

3.9.1.3.1 Load-Bearing Floor Boards. Load-bearing floorboards shall be placed where the concentrated loads of the contents occur. The size of load-bearing boards shall be determined from Table II.

MIL-C-25731A (USAF)

3.9.1.3.1.1 Forklift Area Floor Boards. Floorboards in the forklift area shall be the same size as load-bearing floor boards. Forklift area shall extend from both ends of the skids to a distance of 42 inches toward the center of the crate. A maximum space of 1 inch is permitted between such boards.

3.9.1.3.1.2 Fastening of Load-Bearing Floor Boards. One inch thick floor boards shall be fastened to each skid with sevenpenny nails and floor boards 2 inches thick or over shall be fastened with 3/8-inch carriage bolts. Two bolts shall be used for floor boards over 6 inches in width.

3.9.1.3.2 Diagonal Floor Boards. Diagonal floor boards placed between load-bearing boards and between load-bearing boards and the ends of the crate shall be as near a 45-degree angle with the skids as possible. The number of diagonal floor boards shall depend upon the length and width of the crate and upon the location of the load-bearing floor boards. They shall be of the same width and thickness as the diagonals specified for the side panels.

3.9.1.3.2.1 Fastening of Diagonal Floor Boards. When 4 inch wide boards are used, diagonals shall be nailed to the skids with at least four (4) sevenpenny nails at each contact point. Five (5) nails shall be used for 6 inch wide boards.

3.9.1.3.3 Plywood Flooring. Plywood flooring may be used, in lieu of diagonal floor boards and forklift area floor boards, to accomplish the necessary bracing. Plywood, when used, shall conform to NN-P-530.

3.9.1.3.3.1 Fastenings of Plywood Flooring. Plywood shall be nailed to the skids with two (2) rows of fivepenny nails placed not less than 1/2 inch in from the edge of the skid. The distance between nails in any row shall not exceed 6 inches. The distance between rows shall not be less than 1 inch.

3.9.2 Top. (See Figure 40).

3.9.2.1 Panels. The number of panels shall be determined by the length and width of the crate and by the placing of diagonals at an angle of approximately 45 degrees. Cross members shall be located directly over each vertical strut and enough additional cross members shall be placed so that the diagonals can be located on a 45-degree angle. There shall be one (1) diagonal between each two (2) cross members and, where there is more than one panel, the diagonals shall slope in alternate directions. On crates two feet and under in width the diagonals may be omitted and an additional cross member added equidistant between each 2 cross members located over the vertical struts. Three-eighths inch plywood may also be used in lieu of cross members and diagonal on crates 2 feet and under in width. Where the crate is more than 42 inches in outside width, an additional longitudinal member shall be placed in the center of the top. Tops which would normally require splicing due to the length of the crate shall be fabricated in two sections so that when the sections are butted together the butt joint will fall where a cross member would normally be placed. The end of each of the two sections to be located at the butt joint shall have a cross member and framing member added so that all four members will butt together at the joint when the crate is assembled.

MIL-C-25731A (USAF)

3.9.2.2 Framing Members.

3.9.2.2.1 Non-Demountable Tops. Non-demountable tops shall have framing members of the sizes shown in Table XIII. The cross members are the same as the vertical members in the Table. (See page 30).

3.9.2.2.2 Demountable Tops. Framing members for demountable tops shall be minimum nominal 2-by-3 inches when placed flat. Cross members shall be of the sizes specified for non-demountable tops.

3.9.2.3 Fabrication Nailing. At each intersection of members, the nailing shall be in accordance with 3.7.2.2 and Figure 1. Nailing for plywood, when used in lieu of cross members and diagonals, shall be as specified in

3.9.1.3.3.1. To facilitate application of the various types of sheathing permitted in this specification, the fastening for sheathing, whether applied during initial fabrication or after assembly of the crate, shall be at the option of the shipper.

3.9.2.4 Top Bracing Joists. When the gross weight of the crate is 500 pounds or over, a top bracing joist shall be placed under the top of the center of balance. The joist shall reach from the upper longitudinal member of one side to the upper longitudinal member of the other side. A nominal 2 by 4 inch piece placed flat or on edge shall be used. The joist may be nailed in place when the crate is assembled using three (3) twelvepenny nails through the members of the sides into each end of the joist.

3.9.3 Sides. (See Figure 42)

3.9.3.1 Side Panels. The number of side panels shall be determined by the length and height of the crate as well as the spacing of the struts. Diagonals shall be placed near 45 degrees when possible. The side panels shall be of the following general Styles determined by the height of the crate:

Style A: Side panels for crate heights up to and including 48 inches with 48-inch maximum strut spacing (see Figure 42).

Style B: Side panels for crate heights over 48 inches through 80 inches. An additional longitudinal shall be added at the center with maximum strut spacing of 48 inches. (See Figure 42).

Style C: Side panels for crate heights over 80 inches through 120 inches. Two additional longitudinal members shall be added and maximum strut spacing shall be 60 inches (see Figure 42).

3.9.3.2 Framing Members. The sides shall have framing members of the sizes shown in Table XIII. If sides are of sufficient length to require splicing of the longitudinal members, they shall be spliced approximately equidistant between two (2) vertical members. The splicing brace shall be the same width and thickness as the longitudinal member and of sufficient length to fit between the two (2) vertical members on each side of the splice. Splices shall be staggered so that they do not fall above, below or opposite one another.

MIL-C-27531A (USAF)

TABLE XIII
MEMBER SELECTION (SIDES/TOPS) TYPE VII CRATES

LOAD (POUNDS)	LENGTH (FEET)	HEIGHT (INCHES)	FRAME MEMBER SIZE				HORIZONTAL MEMBER (INCHES)
			UPPER (INCHES)	LOWER (INCHES)	STRUT (INCHES)	DIAGONAL (INCHES)	
0-500	0-20	Up to 48	1 x 6	1 x 4	1 x 4	1 x 4	-
	0-20	2/ 48- 80	1 x 4	1 x 4	1 x 4	1 x 4	1 - 1 x 4
	0-20	3/ 80-120	1 x 6	1 x 6	1 x 4	1 x 4	2 - 1 x 4
	1/ 20-32	Up to 48	1 x 6	1 x 4	1 x 6	1 x 6	-
	1/ 20-32	2/ 48- 80	1 x 6	1 x 6	1 x 6	1 x 6	1 - 1 x 4
	1/ 20-32	3/ 80-120	1 x 6	1 x 6	1 x 6	1 x 6	2 - 1 x 4
500-1000	0-20	Up to 48	1 x 6	1 x 4	1 x 4	1 x 4	-
	0-20	2/ 48- 80	1 x 6	1 x 4	1 x 4	1 x 4	1 - 1 x 4
	0-20	3/ 80-120	1 x 6	1 x 6	1 x 6	1 x 6	2 - 1 x 6
	1/ 20-32	Up to 48	1 x 8	1 x 6	1 x 6	1 x 6	-
	1/ 20-32	2/ 48- 80	1 x 6	1 x 6	1 x 6	1 x 6	1 - 1 x 6
	1/ 20-32	3/ 80-120	1 x 6	1 x 6	1 x 6	1 x 6	2 - 1 x 6

1/ Over 20 Feet - EXAMPLE: 20.1 Inches

2/ Over 48 Inches - EXAMPLE: 48.1 Inches

3/ Over 80 Inches - EXAMPLE: 80.1 Inches

MIL-C-25731A (USAF)

In addition, for semi-demountable crates with demountable ends, a corner post having a minimum nominal size of 2-by-3 inches shall be placed flat against each vertical end member of both sides and shall run from the upper to the lower longitudinal member of the sides. If the sides are of sufficient height to require a center longitudinal member, the corner posts may be cut to run from the upper and lower longitudinal member to each edge of the center members (see Figure 41).

3.9.3.3 Fabrication Nailing. At each intersection of members nailing shall be in accordance with 3.7.2.2. In nailing the corner posts to the vertical side members of semi-demountable crates, ninepenny nails shall be used to permit clinching. They shall be staggered in two (2) rows and placed eight inches center to center in each row. Sheathing shall be nailed as specified in 3.9.2.3.

3.9.4 End. (See Figure 41)

3.9.4.1 Panels. The number of end panels shall be determined by the width and height of the crate. A center vertical member shall be added if the diagonal in a single panel is over 5 feet long and the crate is 5 feet or more in width. Otherwise, a center horizontal member shall be added and 2 diagonals shall be used: One (1) in the upper half and one (1) in the lower half of the panel. The two (2) diagonals shall be sloped in opposite directions.

3.9.4.2 Framing Members. The ends shall have framing members of the sizes shown in Table XIII.

3.9.4.3 Nailing. Nailing shall be the same as that specified for sides.

3.9.5 Assembling. Assembly of this crate shall be accomplished by nailing or by a combination of lag bolting and nailing, depending on whether the crate is designed to be non-demountable or semi-demountable.

3.9.5.1 Nailing. When the crate is constructed from nominal 4 inch wide lumber, there shall be two (2) sevenpenny nails in each end of each board where Group I woods are used, two (2) sixpenny nails where Group II woods are used and two (2) fivepenny nails where Groups III or IV are used; except where boards are being fastened to skids, three (3) nails shall be used instead of two (2) as specified above, and five (5) where three (3) are specified above. Where the long edges of two members adjoin each other at right angles, they shall be fastened together with the same size nails specified above for the different wood Groups, and the nails shall be spaced approximately 7 inches apart.

3.9.5.2 Bolting for Semi-Demountable Crates.

3.9.5.2.1 Attaching Sides to Top. Sides shall be fastened to the top by means of lag bolts at each intersection of the vertical side members with the upper longitudinal side members. A 3/8 inch diameter lag bolt shall be used and shall be of sufficient length to approximately equal the sum of three (3) thicknesses of the members being attached.

MIL-C-25731A (USAF)

3.9.5.2.2 Attaching Ends to Sides, Top and Bottom. Ends shall be attached to the sides by means of lag bolts placed approximately 16 inches on center along the length of the vertical framing members of the ends. When the crate width is two feet or under, ends shall be attached to the top and bottom with a lag bolt in the center of the horizontal framing member at the top and bottom of the end. Crates 2 to 6 feet in width shall have a lag bolt in each of the four corners of the center of the end placed 5 inches in from the side. In addition, crates 2 to 4 feet in width shall have two lag bolts spaced evenly between the corner bolts in the top and bottom horizontal end members; and those four (4) to six (6) feet in width shall have three bolts. Lag bolts shall be 3/8 inch in diameter and of sufficient length to approximately equal the sum of the thicknesses of the members being attached.

3.10 Need for Additional Strength. Any point or detail of construction or materials used in the crate shall be strengthened when necessary to meet the testing requirements of the materials or the handling requirements of the crate or its components for the various levels of packing for which the crate is intended.

3.11 Marking. All crates shall be marked in accordance with MIL-STD-129 and as follows:

3.11.1 Position Marking. On each end and side panel shall appear, in 3-inch letters, the word "UP" with a 3-inch arrow pointing to the crate top.

3.11.2 Opening Instructions. On one end and one side in 1-inch letters near the removable fasteners the words "TO OPEN, REMOVE LAG SCREWS", "REUSABLE CRATE - DO NOT DESTROY - TO REMOVE PART - REMOVE SCREWS", "REMOVABLE END - REUSABLE END - REUSABLE CONTAINER - DO NOT DESTROY" or other necessary phrasing for opening a particular type of crate shall appear.

3.12 Reports and Drawings. Reports, drawings and data shall be furnished as specified. All reports and drawings required in this specification (see 4.4.1, 4.4.2.2 and 4.4.3.2) shall be prepared in accordance with MIL-D-1000.

3.13 Government Loaned Property. When the contract or purchase order so provides, the Government will loan to the contractor, upon his request, equipment of the type for which the container is designed for use in final preproduction testing (see 6.2).

3.14 Workmanship. Workmanship shall be in accordance with detail requirements of this specification and shall have no defects, of construction or design, that will prevent the crate from performing as required when tested according to Section 4.

4.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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.

MIL-C-25731A (USAF)

4.2 Sampling.

4.2.1 Size of Lot. For purposes of sampling, a lot shall consist of all containers on the contract or order of the same type or design manufactured from substantially the same materials and processes for which approval is desired.

4.2.2 Preproduction Test Samples. One container of each design for which approval is desired shall be subjected to the preliminary preproduction tests specified in 4.4.2. After successful completion of the preliminary preproduction tests, the samples shall be subjected to the final preproduction tests specified in 4.4.3 unless otherwise specified by the procuring activity (see 6.2).

4.2.3 Quality Conformance Test Sample. Quality conformance test sampling shall be in accordance with MIL-STD-105. The inspection level shall be S-1.

4.3 Classification of Inspection. The inspection and testing of crate shall be classified as follows:

- a. Preproduction Inspection. (See 4.4).
- b. Quality Conformance Inspection. (See 4.5).

4.4 Preproduction Test. Unless otherwise specified by the procuring activity, preproduction testing shall be performed at the place of manufacture of the crate. (See 6.2).

4.4.1 Preliminary Reports and Drawings. Prior to preproduction tests, the contractor shall submit to the procuring activity a report in triplicate showing measured or computed deflections and accelerations of the cushioned contents which would occur on a basis of the drop and impact tests set forth in 4.6.4 within a temperature range of minus 40° and plus 135°F. The deflections and accelerations shall be determined as appropriate for the load mounting points, the center of gravity, the extremities of the load and also the natural frequency of vibration of the load mass in its cushioning medium shall be computed or measured (see 6.4). One copy of the master assembly drawings and parts list shall accompany each copy of the report.

4.4.2 Preliminary Preproduction Tests. The preliminary preproduction tests shall consist of all the tests described and in sequence listed under 4.6 Test Methods, with the exception of the shipping test in 4.6.7.2.

4.4.2.1 Applicability. The preliminary preproduction tests shall be applicable to a sample container loaded with dummy loads (see 4.6.1.1) to determine adequate performance prior to testing with live loads.

4.4.2.2 Test Report. When preliminary preproduction tests are conducted at the contractor's plant, the contractor shall, upon completion of tests, submit a certified test report in triplicate to the procuring activity for approval showing results of the tests. Three copies of assembly prints and parts lists shall accompany the report. Approval of the report shall release the container for final preproduction tests.

MIL-C-25731A (USAF)

4.4.3 Final Preproduction Tests. The final preproduction tests (see 4.2.2) shall consist of all the tests described in sequence listed under 4.6 Test Methods and when specified, they shall include the shipping test (see 6.2 and 4.6.7.2).

4.4.3.1 Applicability. The final preproduction tests are applicable to a sample container loaded with live loads (see 4.6.1.2) to assure ability of the container to protect the contents.

4.4.3.2 Test Report. When final preproduction tests are conducted at the contractor's plant, the contractor shall submit a test report as specified in 4.4.2.2 outlining the procedures and results of the tests. Three complete sets of assembly prints, including one reproducible set, and three sets of crate and contents installation instructions (see 3.10) and description of time and motion study (see 3.3.1.6 and 4.6.7) shall accompany the final report.

4.5 Quality conformance inspection shall consist of the following:

- a. Examination of each crate in accordance with 4.6.2.
- b. Testing of sample crates selected in 4.2.3 in accordance with Test Methods described under 4.6.

4.6 Test Methods. The test containers shall be tested in accordance with the applicable methods of Federal Test Standard No. 101, specified herein.

4.6.1 Test Conditions.

4.6.1.1 For the preliminary preproduction tests, the container shall be loaded with an appropriate dummy load prior to testing. The dummy load shall conform in size, weight and weight distribution to the live load for which the crate is designed. The structural rigidity at the points where the dummy load will be supported in the crate during the various impact and drop tests shall not be greater than the rigidity of the actual item which the dummy simulates. Interim approval for production of the container may be granted by the procuring activity upon successful completion of the preliminary tests conducted with an appropriate dummy load.

4.6.1.2 For the final preproduction tests, the container shall be loaded with the live load (see 4.6.1.2.1) and designated accessories for which it is designed, fully assembled and in a prepared-for-shipment condition. At the discretion of the procuring activity, a dummy load with critical characteristics identical to the live load may be substituted for the live load. Final approval for production of the container shall be withheld until the final preproduction test utilizing the live load has been satisfactorily completed.

4.6.1.2.1 The live load used for final preproduction tests shall be a serviceable unit. Unless otherwise specified the unit shall be inspected by, or under the supervision of, the procuring activity before and after the tests (see 6.2).

4.6.2 Acceptance Test. The point of final inspection shall be specified by the procuring activity.

MIL-C-25731A (USAF)

4.6.2.1 Examination of Product. Unless otherwise specified by the procuring activity, containers shall be sampled in accordance with the provisions of MIL-STD-105 and shall be visually inspected to determine conformance with this specification and applicable drawings with respect to materials, workmanship, blocking, bracing, cushioning and Type and Class of crate.

4.6.2.2 The acceptance of any detail of construction or material during the course of manufacture shall not relieve the contractor of responsibility for faulty workmanship or materials which may be discovered at any time prior to final acceptance. Inspection may be made throughout the entire process of manufacture.

4.6.2.3 Examination of the end item for defects in materials, design, finish and workmanship.

EXAMINE	DEFECT	CATEGORY			
		MAJOR	A Q L	MINOR	A Q L
Type	Not as specified.	101	2.5		
Panel Length	Longer than specified.	102	6.5		
Member Size:					
Struts	Larger than specified.			201	10
	Smaller than specified.	103	6.5		
	Not within $\pm 10^0$ tolerance.	104	6.5		
Upper (Side or End)	Larger than specified.			202	10
	Smaller than specified.	105	6.5		
Lower (Side or End)	Larger than specified.			203	10
	Smaller than specified.	106	6.5		
Skids	Larger than specified.			204	10
	Smaller than specified.	107	6.5		
	Missing when specified.	108	6.5		
	Not parallel to each other	109	6.5		
	Less than the full length of the crate			205	10
	More than 3 inches from end of crate	110	6.5		

(CONTINUED ON NEXT PAGE)

MIL-C-25731A (USAF)

4.6.2.3 (Continued)

EXAMINE	DEFECT	CATEGORY			
		MAJOR	A Q L	MINOR	A Q L
Skids (Cont'd)	Spaced greater distance apart than specified.	111	6.5		
	End of skids not chamfered as specified.			206	10
Fasteners:					
Nails	Size smaller than specified.	112	6.5		
	Size larger than specified.			207	10
	Distance between nails greater than specified.	113	6.5		
Bolts	Size smaller than specified.	114	6.5		
	Size larger than specified.			208	10
	Required number of bolts less than specified	115	6.5		
Cleats (Type V, Class 2)	Spacing greater than max.	116	6.5		
	Nail spacing greater than specified.	117	6.5		
	Nails not clinched.	118	6.5		
	Strapping not as specified.	119	6.5		
Lumber	Does not meet the requirements of MIL-STD-731	120	6.5		
Assembly of Crate	Not assembled according to applicable Figure for the Type crate specified by order.	121	6.5		

MIL-C-25731A (USAF)

4.6.3 Air Transportability Tests. As prescribed in MIL-A-8421.

4.6.4 Drop and Impact Tests. The test container of the applicable gross weight and dimensions shall be subjected to the following drop and impact tests for level A and level B protection:

4.6.4.1 Free-Fall Drop Test. The crate shall be dropped once on each corner in accordance with Method 216.

4.6.4.2 Edgewise (Rotational) Test. The crate shall be subjected to the edgewise drop test in accordance with Method 213.

4.6.4.3 Cornerwise Drop Test. The crate shall be subjected to the cornerwise drop test in accordance with Method 214.

4.6.4.4 Impact Tests. Any crate having a gross weight exceeding 200 pounds or any dimensions more than 60 inches, closed as for shipment, shall be subjected to one of the following impact tests. The test shall be applied once to each side and end that has dimensions of less than 9.5 feet.

4.6.4.4.1 Incline Impact Test. The crate shall be subjected to the incline impact test in accordance with Method 211.

4.6.4.4.2 Pendulum Impact Test. The crate shall be subjected to the pendulum impact test in accordance with Method 212.

4.6.5 Static Loading Test.

4.6.5.1 Concentrated Load Resistance. The crate shall be tested in accordance with Method 209, except that a load shall be applied equal to that produced by a number of like crates, including weight of contents for which designed, when stacking a minimum of 20 feet.

4.6.5.2 Distributed Load Resistance. The container shall be tested in accordance with Method 210, except that a load sufficient to insure a bearing pressure of 175 pounds per square foot (psf) shall be applied.

4.6.6 Assembly and Disassembly. The contents shall be placed in the container and a record shall be maintained of the tools required for this work and the number of manhours consumed (see 4.4.3.2).

4.6.7 Transportation Test.

4.6.7.1 Forklift Test. The loaded container shall be lifted clear of the ground by a forklift truck with forks spaced 30 inches center-to-center, perpendicular to the skids, and transported for a distance of not less than 100 feet. The container shall then be deposited, the fingers of the truck placed between the skids of one end of the container, the container lifted free of the ground and again transported for a distance of 100 feet. If the location of the center of gravity does not permit the free lift of the container from one end, using fork extensions, the one end shall be raised to a height of 6 inches by the forklift and the container drawn along a concrete or similarly smooth

MIL-C-25731A (USAF)

surface for a distance of not less than 100 feet. If the loaded container weighs 2,000 pounds or less, the forks shall be approximately 36 inches long. Observations concerning the stability of the container on the forks and any tendency of the forks to distort or puncture the container shall be recorded.

4.6.7.2 Shipping Test. When specified (see 4.4.2), the shipping test shall be performed in accordance with method 239, except that inspection shall be performed by or under the supervision of the procuring activity (see 6.2).

4.6.7.3 Vibration Test. Unless otherwise specified by the procuring activity, the crate shall be tested according to Method 278.

4.6.8 Rejection and Re-Test. Failure of any crate to conform to any of the requirements of this specification shall be cause for rejection of the crate. Crates which have been rejected may be reworked to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects shall be furnished to the inspector.

4.7 Packing and Marking. Examination of packing and marking for shipment shall be made for conformance with requirements of Section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging and Packing. Unless otherwise specified by the procuring activity, crates shall be shipped knocked down and packed together in a manner which will insure acceptance by common carrier for safe transportation at the lowest rate to the point of delivery.

5.2 Marking. Unless otherwise specified by the procuring activity, shipments of crates shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended Use. The crates covered in this specification are suitable for packing lightweight, bulky airframe parts for all types of military shipments. Type I, Class 1; Type II, Class 1; Type IV; Type VI and Type VII, Classes 1 and 2 crates are intended for air shipments or level B, limited military packing, and are suitable for level C, minimum military packing. Type III and Type V, Classes 1 and 2 are intended for level A military and level B, limited military packing.

6.2 Ordering Data.

- a. Title, number and date of this specification
- b. Type and Class required (see 1.2)
- c. Type of equipment to be accommodated by crates
- d. Applicable detailed drawings

MIL-C-25731A (USAF)

- e. Whether accessory mounting provisions are to be included.
- f. Whether a shipping test or substitute vibration test, or both, will be performed (see 4.6.7.2 and 4.6.7.3)
- g. Whether Government loaned property is to be furnished (see 3.13)
- h. Whether final preproduction testing is to be waived (see 4.2.2)
- i. Where preproduction testing is to be performed (see 4.4)
- j. Plywood finish required (see 3.1.2)
- k. Plywood treatment required (see 3.1.2)
- l. Whether live load is to be tested by the procuring activity before and after the preproduction test.

6.3 Air Cargo Loading Considerations. Applicable official publications should be consulted, such as T.O. 00-85-9 or USAF Specification Bulletin No. 518 for Air Force which depict the cargo compartment and door dimensions of military, including LOGAIR, aircraft and commercial transport aircraft.

6.4 Classification Cross-Reference.

MIL-C-25731A (USAF)	MIL-C-25731 (USAF)	MIL-C-25139 (USAF)	MIL-C-25010 (USAF)
Type I	Type I	-	-
Type II	Type II	-	-
Type III	Type III	-	-
Type IV	-	-	Type I
Type V	-	-	Type II
Type VI	-	Type I	-
Type VII	-	Type II	-

6.5 Plywood Cross-Reference.

NN-P-515 (Cancelled)	NN-P-530		
	CS 35	PS 1	CS 157
Type I	Grade 3-4 Type I	Standard Int. with Ext. Glue	Grade C-C Exterior
Type II	Grade 3-4 Type II	Standard Int.	Grade C-D Interior
Type III	Grade 3-4 Type III	Standard Int.	Grade C-D Interior

MIL-C-25731A (USAF)

- a. Plywood comparable to Class 2 formerly specified in NN-P-515.
- b. When plywood comparable to Class 2, formerly specified in NN-P-515, is required, treatment of plywood with wood preservative: water-repellent, conforming to TT-W-572, must be specified in the contract or order (see 6.2). Plywood of higher grades and quality is available under commercial and product standards outlined in the preceding chart; however, these higher grades, etc., must be specified if required.

Custodian:

Air Force 69

Preparing Activity:

Air Force 69

Project No. 8115-F009

Reviewer:

Air Force 10, 80, 84, 85

MIL-C-25731A (USAF)

INDEX

- 1. SCOPE.
 - *1.1 Scope
 - *1.2 Classification
- *2. APPLICABLE DOCUMENTS
- *3. REQUIREMENTS
 - 3.1 Materials
 - 3.2 General Construction
 - 3.3 Type I Crates
 - 3.4 Type II Crates
 - 3.5 Type III Crates
 - *3.6 Type IV Crates
 - *3.7 Type V Crates
 - *3.8 Type VI Crates
 - *3.9 Type VII Crates
 - 3.10 Need for Additional Strength
 - 3.11 Marking
 - *3.12 Reports and Drawings
 - *3.13 Government Loaned Property
 - 3.14 Workmanship
- 4. QUALITY ASSURANCE PROVISIONS
- 5. PREPARATION FOR DELIVERY
- 6. NOTES
 - 6.1 Intended Use
 - 6.2 Ordering Data
 - 6.3 Air Cargo Loading Considerations
 - *6.4 Classification Cross-Reference

APPENDIX

- 10. SCOPE
- 20. APPLICABLE DOCUMENTS
- 30. BLOCKING AND BRACING
- 40. CUSHIONING
- *Items Added or Revised

MIL-C-25731A (USAF)

FIGURE INDEX

<u>Figure Number</u>	<u>Title</u>
1	Nailing Patterns
2	Splicing of Members
3	Type I Crate Assembly, Side and Base
4	Type II Crate - Base
5	Type II Crate - Sides
6	Type II Crate - Ends
7	Type II Crate - Tops
8	Type II Crate - Assembly
9	Type III Crate - Base
10	Type III Crate - Sides
11	Type III Crate - Ends
12	Type III Crate - Tops
13	Type III Crate - Assembly
14	Typical Two-Way Crate
15	Base Design for Type IV Inner Crate
16	Style A Side for Type IV Inner Crate
17	Style B Side for Type IV Inner Crate
18	Style C Side for Type IV Inner Crate
19	Style D Side for Type IV Inner Crate
20	Style D-1 Side for Type IV Inner Crate
21	Arrangement of Frame Members for Type IV Inner Crate Special Sides
22	Ends for Type IV Inner Crate
23	Assembly of Type IV Inner Crate
24	Base Design for Type V Class 1 Outer Crate
25	Top Design (Up to 24" Width) For Type V Class 1 Outer Crate
26	Top Design (24" through 36" Width) for Type V Class 1 Outer Crate
27	Fabrication Nailing - Plywood to Frame Members for Type V Class 1 Outer Crate
28	Fastening Members for Demountable Ends Type V Class 1 Outer Crate
29	Style A Side for Type V Class 1 Outer Crates
30	Style B Side for Type V Class 1 Outer Crates
31	Detail of Top for Type V Class 1 Outer Crates
32	End Design for Type V Class 1 Outer Crates
33	Crate Ventilation
34	Assembly of Type V Class 1 Outer Crate
35	Fabrication and Member Arrangement of Cleated Plywood Crate Type V Class 2 Outer Crate
36	Assembly and Strapping of Cleated Plywood Box Type V Class 2
37	Type VI Crate
38	Type VII Crate
39	Type VII Crate Base
40	Type VII Crate Crate Top
41	Type VII Crate End
42	Type VII Crate Sides
43	Cleats and Support Panels (Supporting a Horizontal Stabilizer)
44	Saddle Supports
45	Cradles

MIL-C-25731A (USAF)

10. SCOPE

10.1 This appendix covers detailed instructions for constructions of Types I, II, III, IV, V, VI and VII crates and suggested methods for blocking, bracing and cushioning items within Types I, II, III, IV, VI and VII crates.

20. APPLICABLE DOCUMENTS

20.1 The following specification and standards, of the issue in effect on date of invitation of bids or request of proposal, shall form a part of this specification:

SPECIFICATIONS

Military

MIL-B-121

STANDARDS

Military

MIL-STD-1186

30. BLOCKING AND BRACING

30.1 General. One of the most important functions of the open crate is to provide blocking and bracing that adequately supports the part with a minimum of weight and cubic. The following suggestions for blocking and bracing are included merely as an aid to the designer and are not mandatory. The final criteria of all blocking and bracing, however, is based on its ability to protect the part during the preproduction tests and prevent any damage which will affect its use.

30.1.1 Functions. The four main functions of blocking and bracing of aircraft component parts are: (a) to support the part from beneath, (b) to hold the part down, (c) to prevent edgewise movement, or (d) to prevent sidewise movement of the part. The type of blocking and bracing used shall depend, to a great extent, on the size and shape of the item to be crated.

30.2 Types. The following types of blocking and bracing have proved satisfactory in the two-way crate. They are grouped, where possible, according to the function which they perform. In some cases, such as where the part is bolted directly to the end or base where brackets are used, one type may serve to accomplish two or more of the above functions. In other cases, a combination of two or more types may be required to accomplish one of these functions. The types cited are intended to serve as guides in the blocking and bracing of control surfaces. Certain irregular items may require modifications of these types.

30.2.1 Support Blocking.

MIL-C-25731A (USAF)

30.2.1.1 Crate Base. The simplest method of supporting a part is to place it directly on the crate base. This method can be used only when the bottom edge is generally flat and sturdy enough to support the weight of the item. This method has been used for such parts as dorsal fins.

30.2.1.2 Support Block. Where the edge is strong enough to support the item but has slight irregularities or projections which prevent resting the part on the base, plywood panels or solid wood blocks may be attached to the base and spaced so as to raise the item sufficiently to clear the projections.

30.2.1.3 Support Cleats. Where it is necessary, because of irregularities or projections, to raise the part considerably above the base, cleats attached to the side struts may be used for support. If the load bearing surface area of the cleats is not adequate, it may be increased by placing a support panel of solid wood or plywood on top of the cleats. (See Figure 43.) In some instances, support cleats may also serve as end-thrust blocking.

30.2.1.4 Saddles. Saddles consist of wooden members of beveled 2-by-2 inches, or larger, pieces which are placed longitudinally in the crate, either on the base or on cleats attached to the side struts, to form a shallow trough in which the edge of the part may rest (see Figure 44). The slope of the beveled edges will depend upon the contour of the edge of the part to be placed in the saddle. Saddles serve to prevent sidewise movement as well as to support the item. They are especially suitable for parts which have rounded edges (leading edges) and are relatively light in weight. They do not provide as much protection to the part as do cradles (30.2.1.5). Two saddles will usually be necessary and should be placed at or near the quarter points. The length of each saddle often depends upon the spacing of the structural member of the item.

30.2.1.5 Cradles. Cradles are used in the same manner and for the same purpose as are saddles. Cradles are more difficult to build, but they provide more bearing surfaces and, therefore, more protection to the part. They are used to support heavier parts or parts whose leading edges require more protection than that provided by saddles.

30.2.1.5.1 Slat Cradles. Slat cradles consist of two or more supports joined together with thin wood slats as shown in Figure 45. These supports are made of solid wood or solid wood faced with plywood to prevent splitting. Contours are cut in the supports to match the rounded edge of the part, with allowance made for thickness of slats and cushioning. Cradles may also be made from solid wood sections. A convenient method of fabrication is to laminate sections of beveled 2-inch lumber to form the desired contour as shown in Figure 45.

30.2.1.6 Brackets. Many aircraft parts have clevises, arms, posts or other rigid attaching members that may be used to suspend the part in the crate. Parts, such as wings, dorsal fins and rudders, may often be bolted to the end of the crate. Other items, such as wing-tips, may be bolted to the base. In still other cases, it may be necessary to construct brackets of wood or steel (angle iron, channel iron, bar steel) that can be bolted to the part and attached to the base, sides or ends, or to cleats or blocks inserted for this purpose. This type of blocking usually serves more than one purpose, such as

MIL-C-25731A (USAF)

support and thrust blocking, or support, holddown and thrust blocking. Some examples of this type of blocking are shown in Figure 46.

30.2.2 Holddown Blocking.

30.2.2.1 Holddown Cleats. When the upper edge of the part to be held down is sturdy enough to withstand shock, one or more cleats attached to the side struts may be sufficient to hold the part down. Cleats are most likely to be used in connection with some other type of holddown device, but they may be used alone where they can be placed against some heavy structural member of the item.

30.2.2.2 Yokes. Yokes are plywood or wood panels, notched to fit the upper (trailing) edge of the part, that are placed over the part and attached to the side struts of the crate. (See Figure 47.) Because the bearing surface is quite small, yokes should be used on light parts or parts with sturdy trailing edges, and should be placed over structural members of the part, such as the ribs. Two yokes will usually be necessary to hold the item down and prevent sidewise movement, unless they are used in connection with some other device.

30.2.2.3 Yoke Panels. If the trailing edge of the part is so fragile as to require more protection than that provided by yokes, yoke panels may be used to hold the part down. These consist of two plywood panels (1/4 to 3/8 inch thick) attached to the base or sides, one on each side of the part. When cradles are used for support, the yoke panels may be secured to the cradle supports. After the part has been set in the crate (between the yoke panels), the yoke panels are pulled together and bolted at the top (see Figure 48). Some type of cleat arrangement is usually employed to prevent sidewise movement of the top of the panels. Two sets of yoke panels are often required unless this method is used in connection with some other method.

30.2.2.4 Inverted Saddles. Saddles (30.2.1.4) may be inverted and used as holddown braces (see Figure 49) for parts that have sturdy trailing edges and longitudinal structural members close enough to the trailing edge to be gripped by the side members of the brace. This type of brace prevents sidewise movement of the part when it is attached to the side struts by means of cleats.

30.2.2.5 Steel Strapping. Steel straps may be used to tie the parts to the crate base, particularly when the part rests flat on the base. Paper-overlaid veneer, or similar material, together with cushioning, should be placed between the strap and the surface of the part when this method is used.

30.2.3 Endwise Blocking.

30.2.3.1 General. Blocking, in the endwise direction, is often neglected. It is important, however, to provide this blocking in order to prevent damage to the item from shocks, such as those encountered during humping and switching, by freight cars. The blocking described herein is designed to prevent damage from impact in the endwise direction.

30.2.3.2 Thrust Cleats. The use of cleats is probably the most common method of preventing endwise movement. Parts, such as flaps and ailerons which have

MIL-C-25731A (USAF)

flat, thickened ends, may be blocked by cleats attached to the side struts so that they fit tightly against the ends of the part (see Figure 50). Thrust cleats may also be inserted through slots in the leading edge of the part. These cleats may be attached directly to the side struts, or they may be held in position by plywood panels notched to fit over their ends (see Figure 50).

30.2.3.3 Thrust Blocks. If the part has a large opening or slot in its leading edge or heavy members projecting from the edge, large wood blocks (3-by-3 inches or larger) may be bolted to the base of the inner crate so that they fit into the slots or bear against the projecting members so as to prevent endwise movement.

30.2.3.4 Steel Strapping. Endwise movement of some parts may be prevented by fastening the item to the base or ends with steel straps.

30.2.4 Sidewise Blocking.

30.2.4.1 Side Braces. Sidewise movement is usually prevented by either the support blocking or the holddown blocking, or both. If not, simple side braces which bear against the sides of the part may be attached to the side struts.

30.3 Demountability. As in both the inner and outer crates, the blocking and bracing should be designed so that, by removal of screws or bolts, the part can be freed from the inner crate. This may mean that a holddown yoke or brace must be fastened with screws or bolts so that the removal of end thrust blocks, together with the ends of the open crate, may be sufficient to release the part. In all cases, however, the designer should keep the number of demountable members to a minimum and yet have a sufficient number for easy removal of the part.

40. CUSHIONING

40.1 General. The primary functions of cushioning material when used in the packaging of aircraft control surfaces are: (a) to protect the thin skin surfaces against abrasion at the points of contact with the blocking, and (b) to distribute the stresses and pressure created by rough handling during shipment.

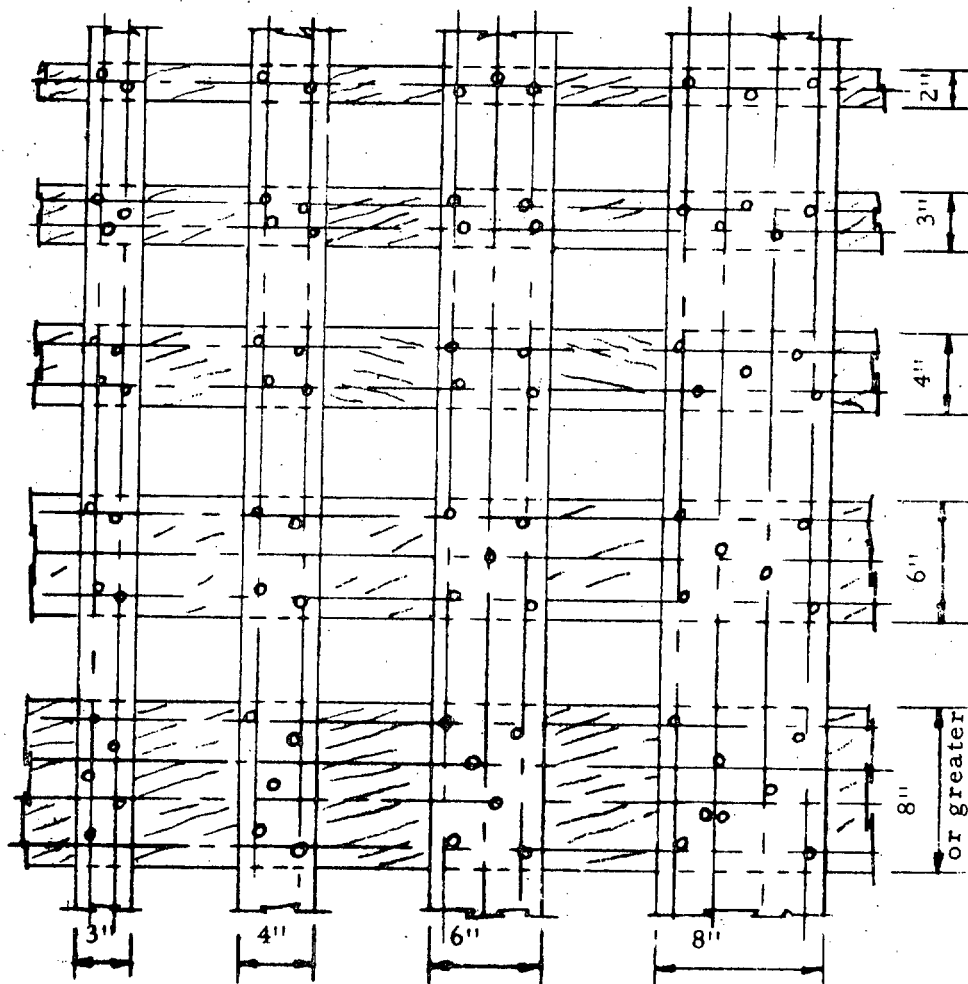
40.2 Materials. The materials used for this purpose are generally supplied in sheet form, often with a paper backing which may serve to add strength to the cushioning as well as facilitate the application. This backing material should have the non-corrosive properties described in MIL-B-121 if it is in direct contact with the surface of the item. Cushioning materials generally used in this specific application may include felt materials and cellulosic materials, such as wadding, wood fiber felt and cotton.

40.3 Type and Thickness. The type and thickness of the cushioning to be used for various parts should be chosen on the basis of the weight of the part, the size of the support area and the nature and form of the part. It is logical to assume that a light part with a large support area would require a low-density cushioning material. The qualification tests serve somewhat as a check in the proper selection of cushioning. Where compression has been too great because of an inadequate cushioned area, or because of a low-density material, the part is often loose. This should be corrected in the redesign.

MIL-C-25731A (USAF)



ASSEMBLY NAILING
(OPEN CRATES)

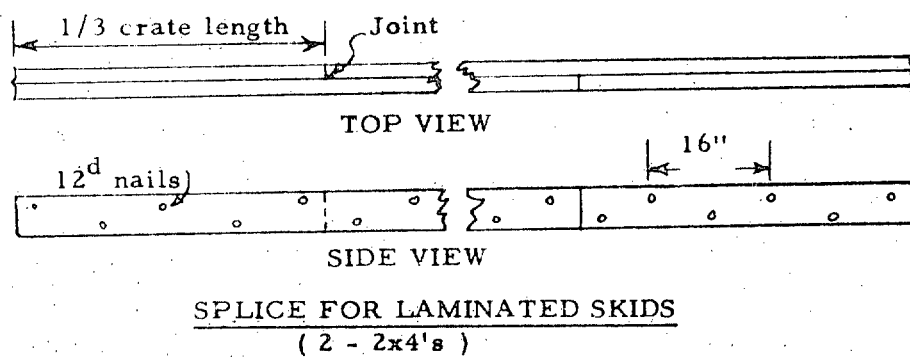
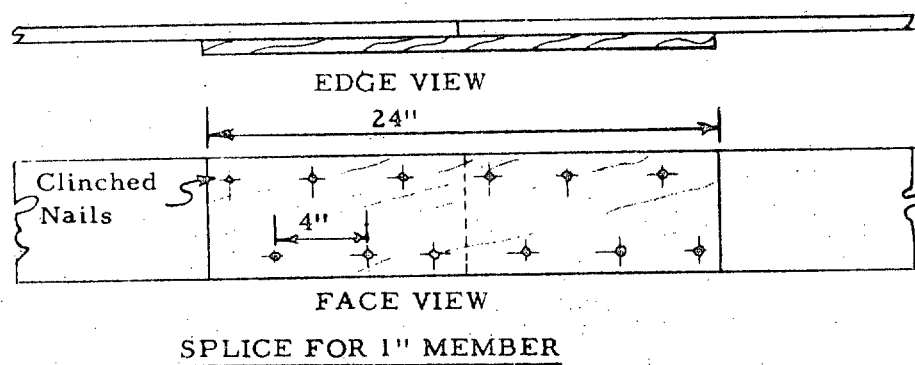
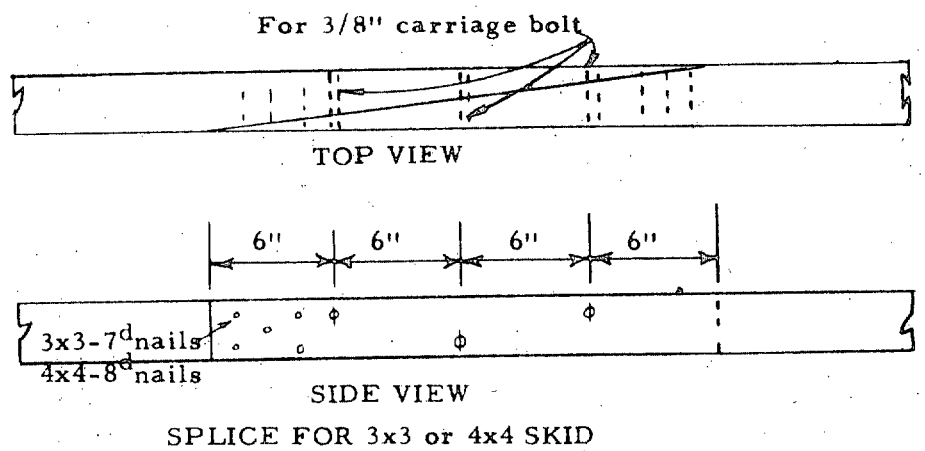


FABRICATION NAILING

- NOTE:
1. All widths nominal.
 2. Use similar nailing patterns when boards cross at angles other than 90 degrees.
 3. Two nails shall not be placed in one grain line of the same board crossing.

FIGURE 1 - NAILING PATTERNS

MIL-C-25731A(USAF)

FIGURE 2 - SPLICING OF MEMBERS

MIL-C-25731A(USAF)

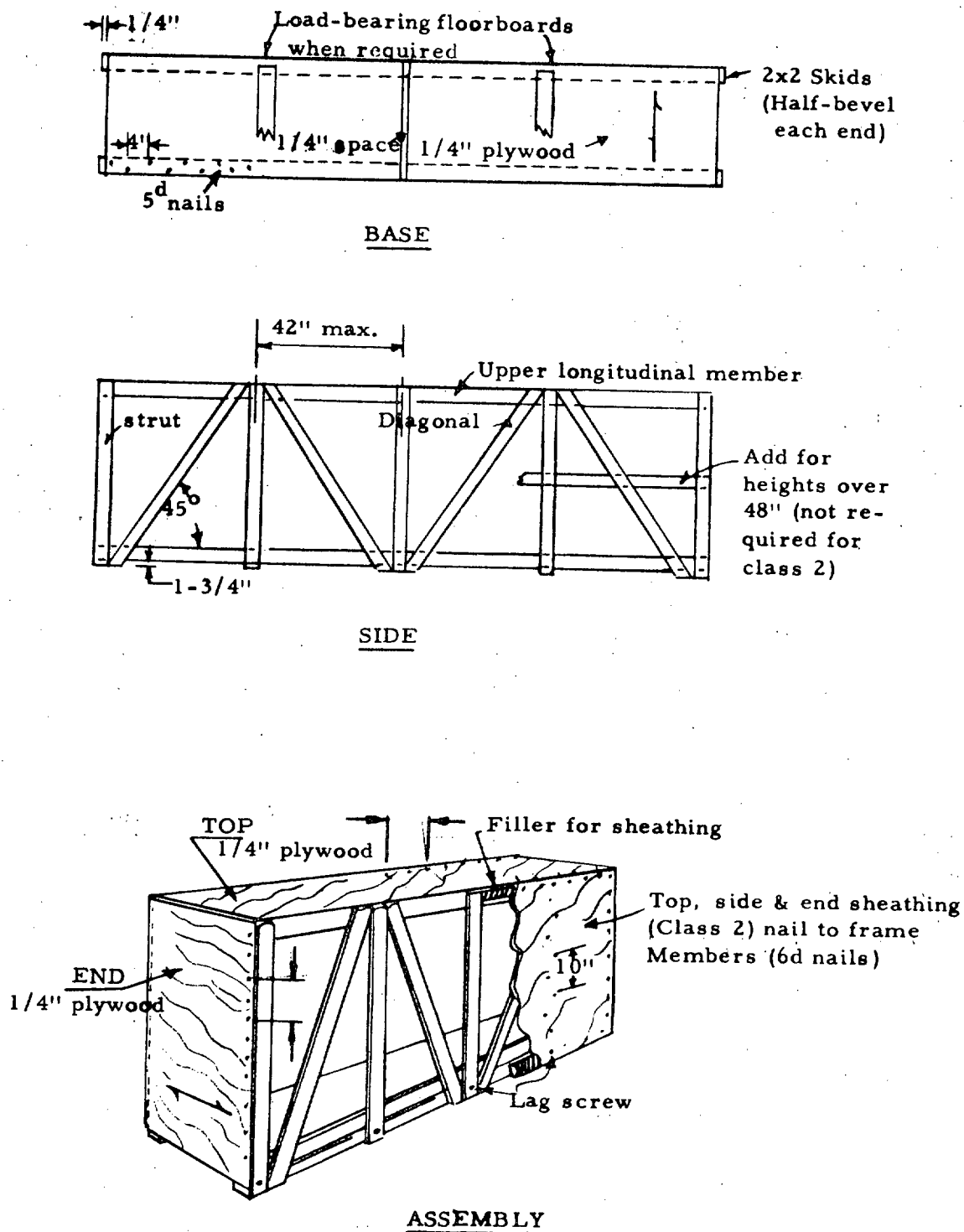


FIGURE 3 - TYPE I CRATE "SIDE AND BASE"

MIL-C-25731A(USAF)

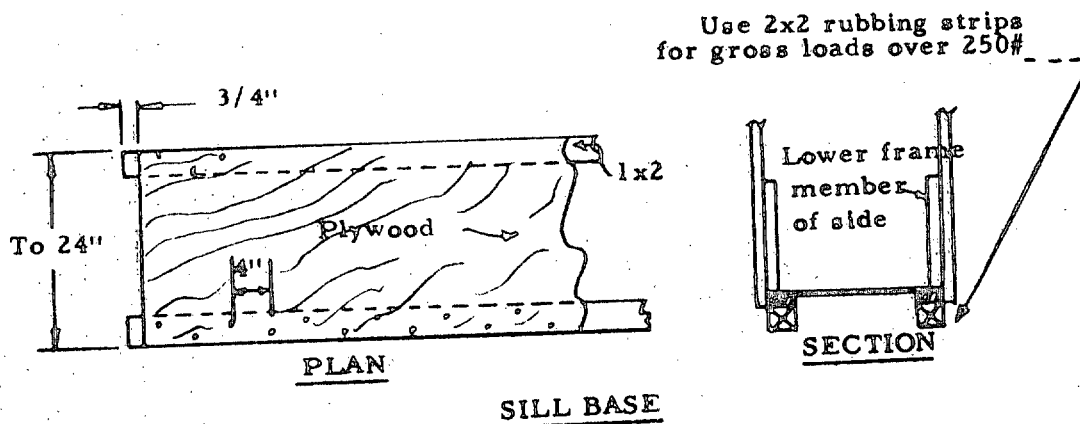
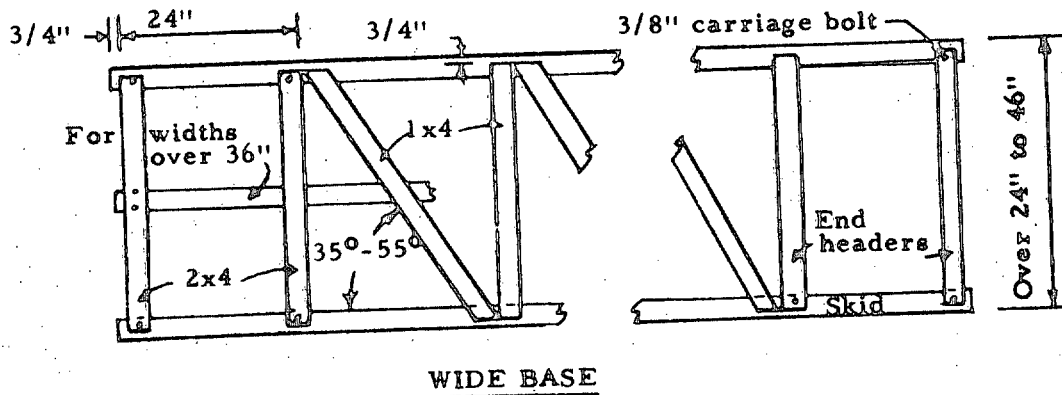
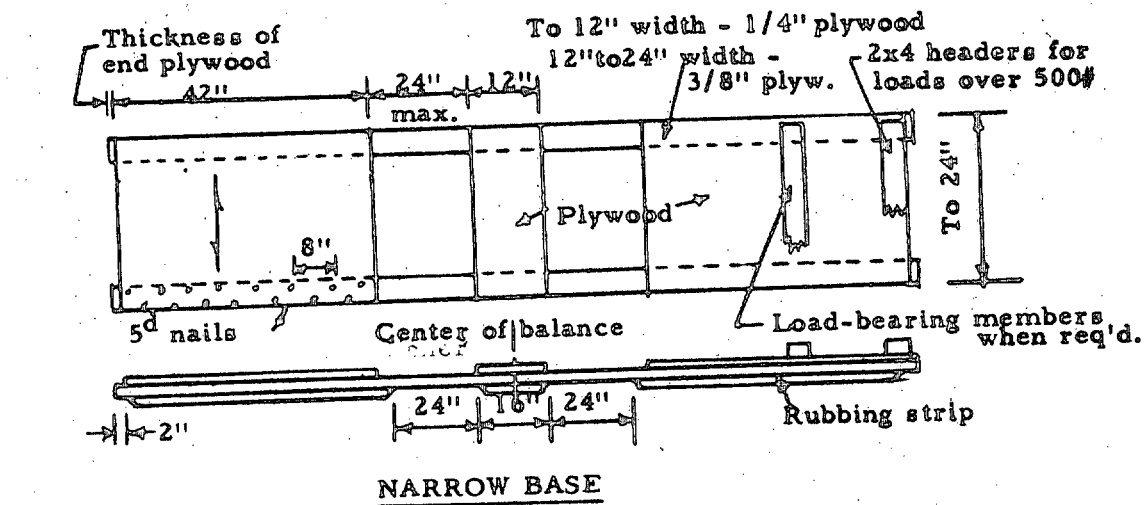
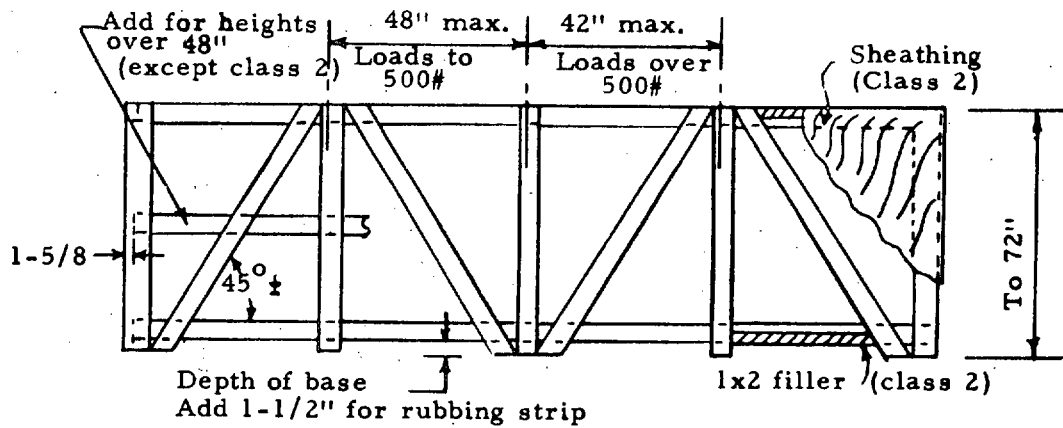
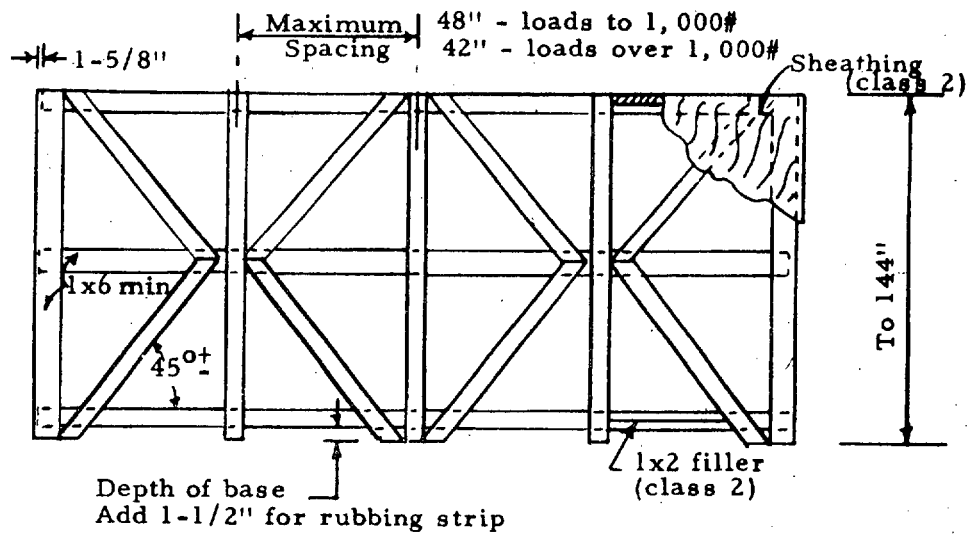


FIGURE 4 - TYPE II CRATE - BASE

MIL-C-25731A (USAF)

STYLE A SIDESTYLE B SIDEFIGURE 5 - TYPE II CRATE - SIDES

MIL-C-25731A(USAF)

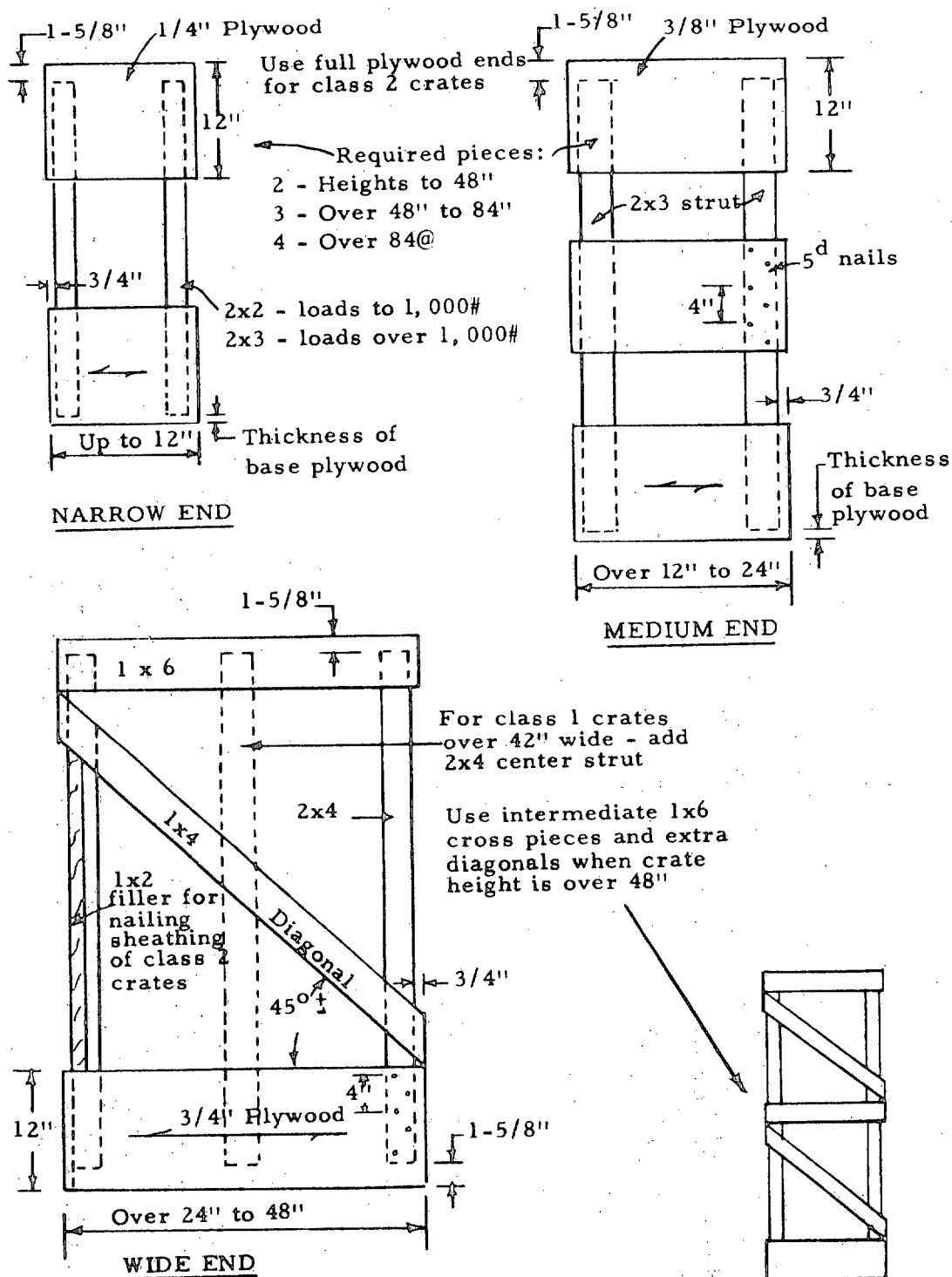
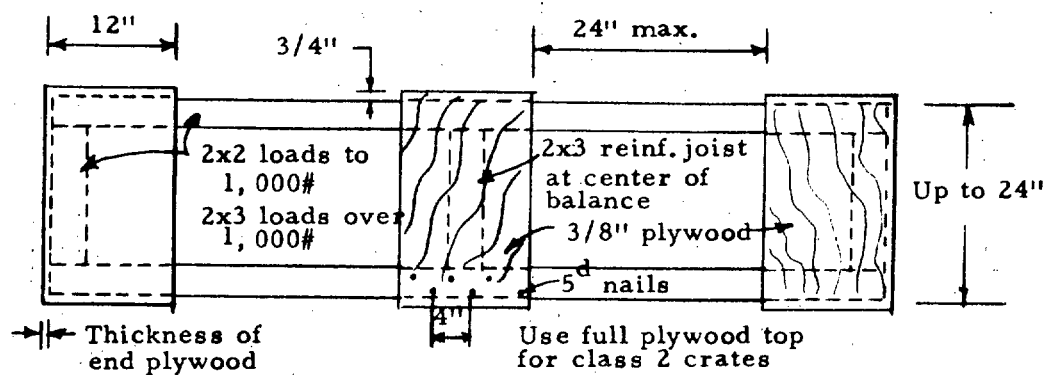
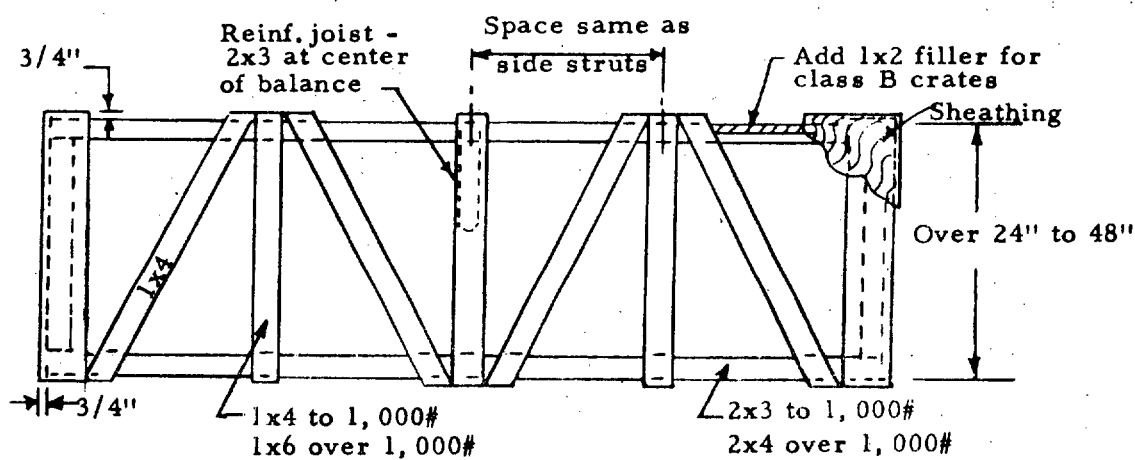
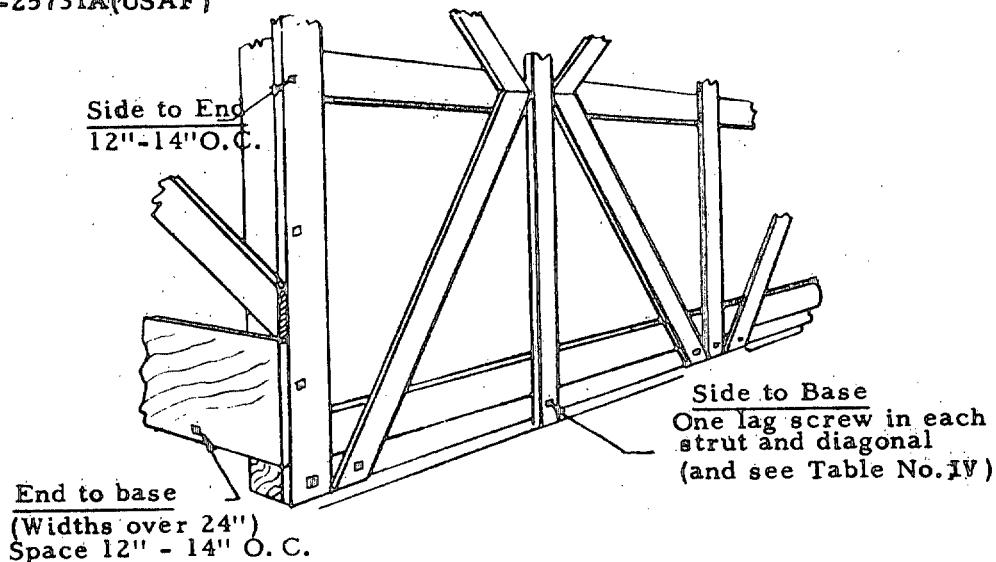


FIGURE 6 - TYPE II CRATE - ENDS

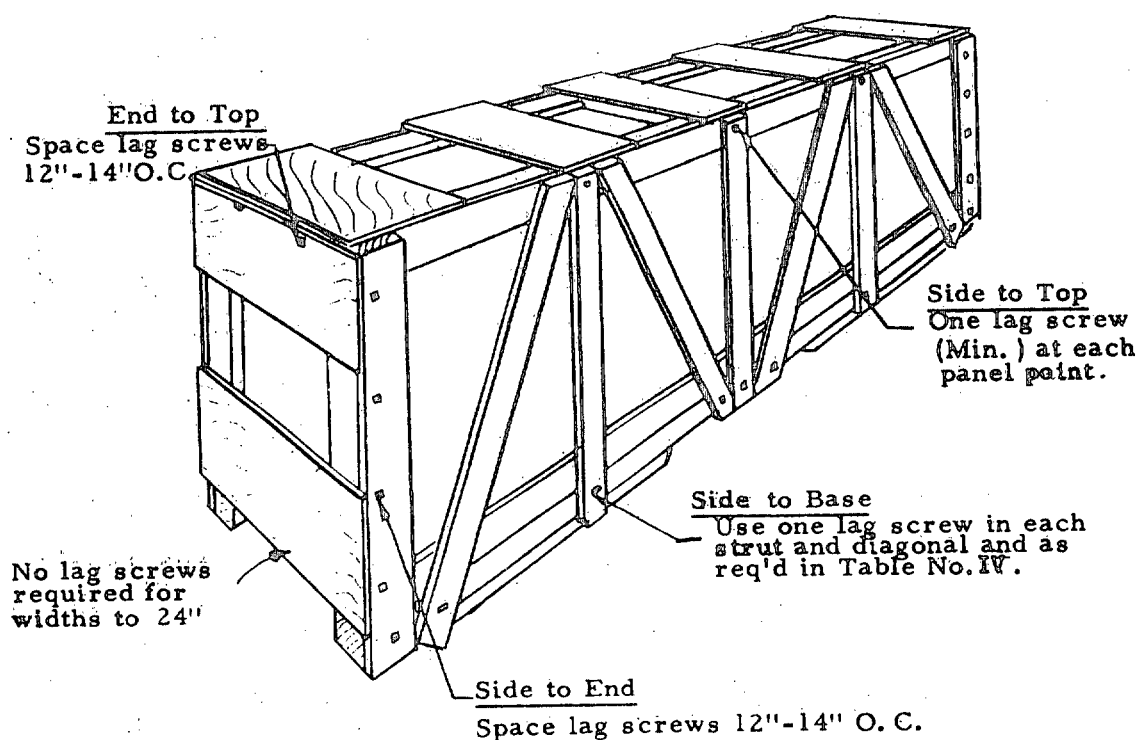
MIL-C-25731A(USAF)

NARROW TOPWIDE TOPFIGURE 7 - TYPE II CRATE - TOPS

MIL-C-25731A(USAF)



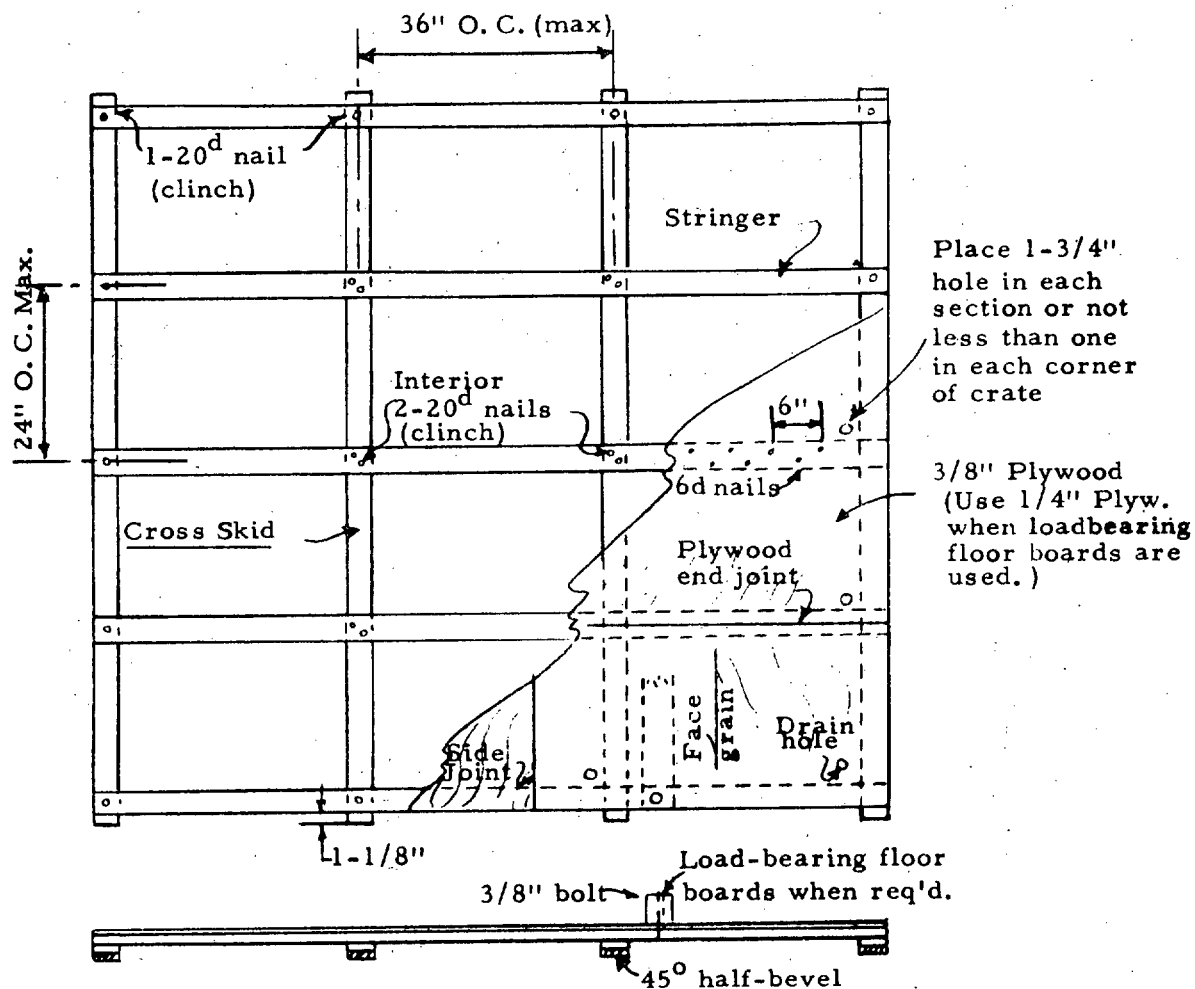
ASSEMBLY FOR STYLE B SIDES



ASSEMBLY FOR STYLE A SIDES

FIGURE 8 - TYPE II CRATE - ASSEMBLY

MIL-C-25731A(USAF)



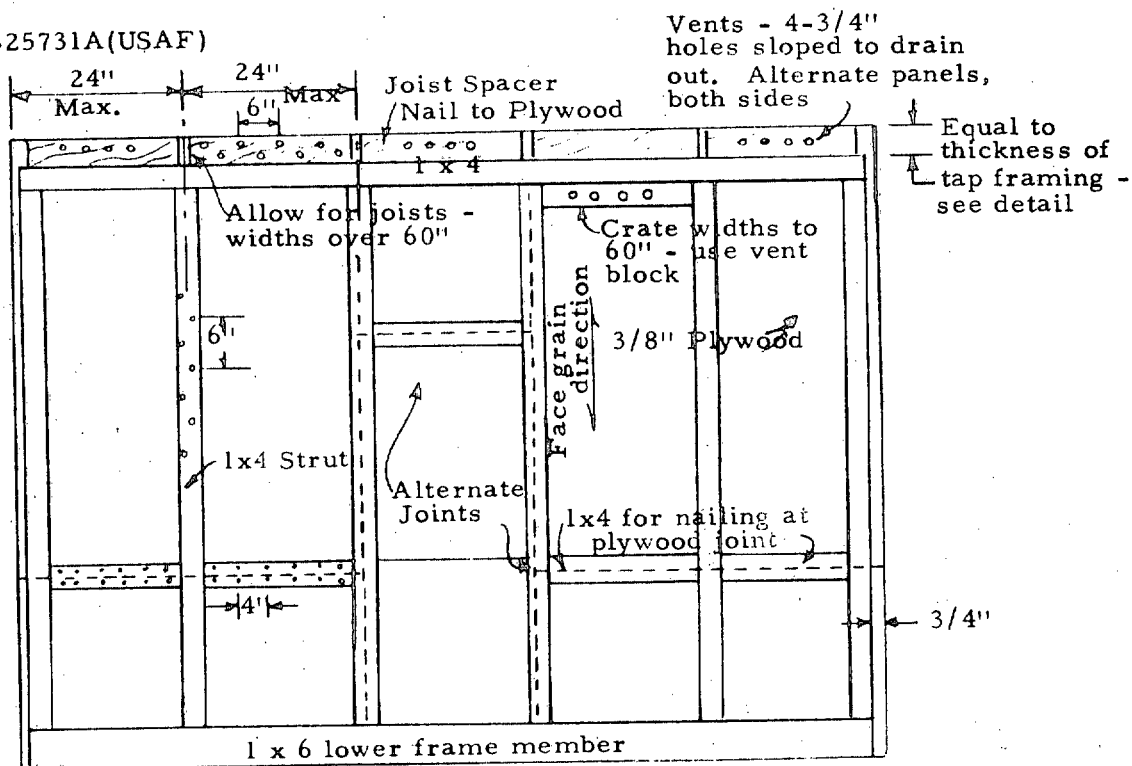
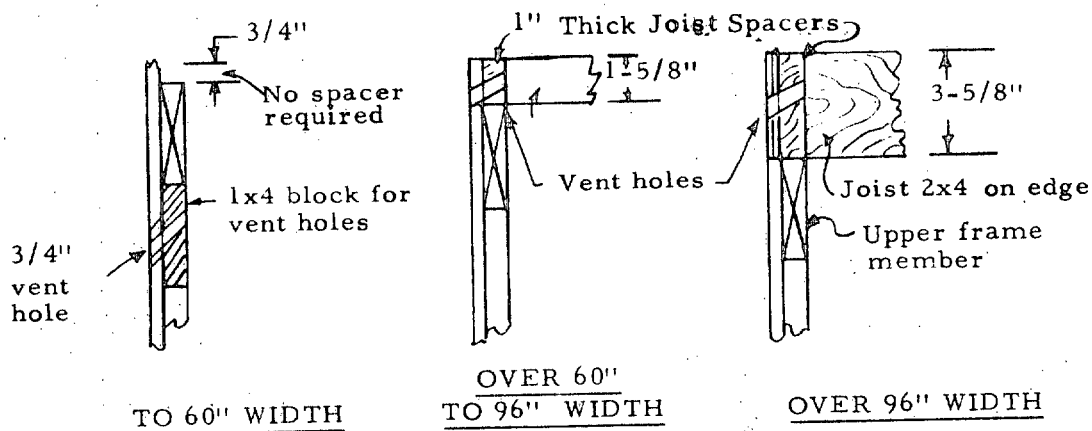
Note:

2x3 Cross skids and stringers:
Loads to 500# length to 10 ft

2x4 Cross skids and stringers:
All other conditions.

FIGURE 9 - TYPE III CRATE - BASE

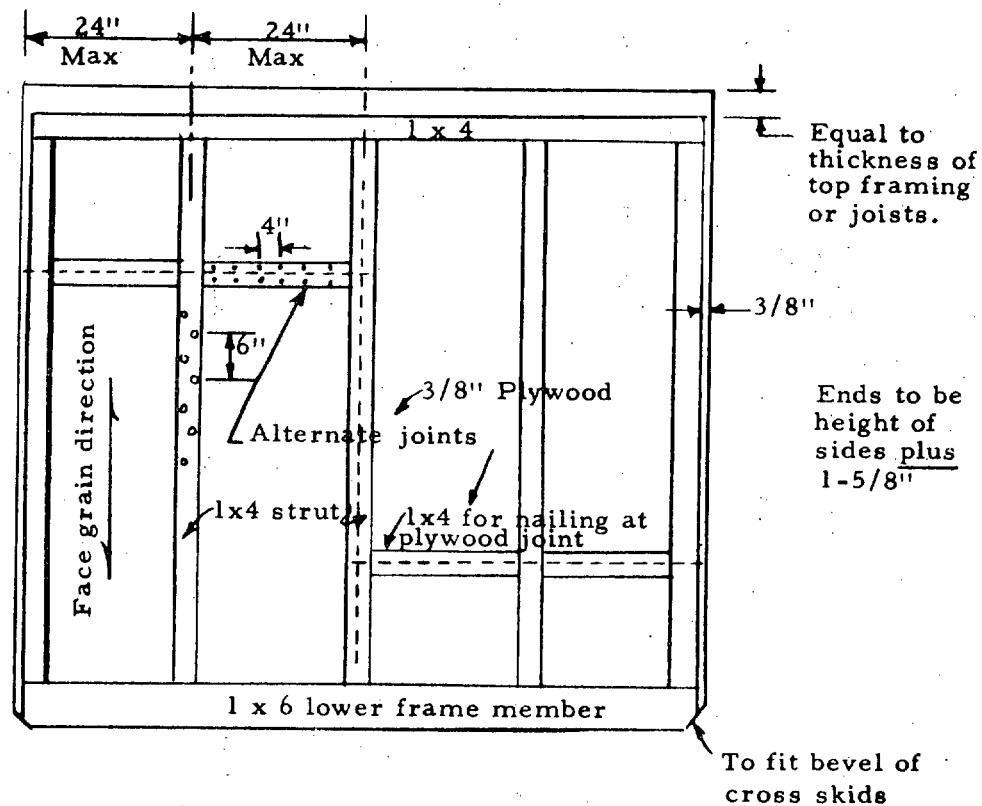
MIL-C-25731A(USAF)

S I D E

DETAIL OF SIDE PANELS
FOR VARIOUS CRATE WIDTHS

FIGURE 10 - TYPE III CRATE - SIDES

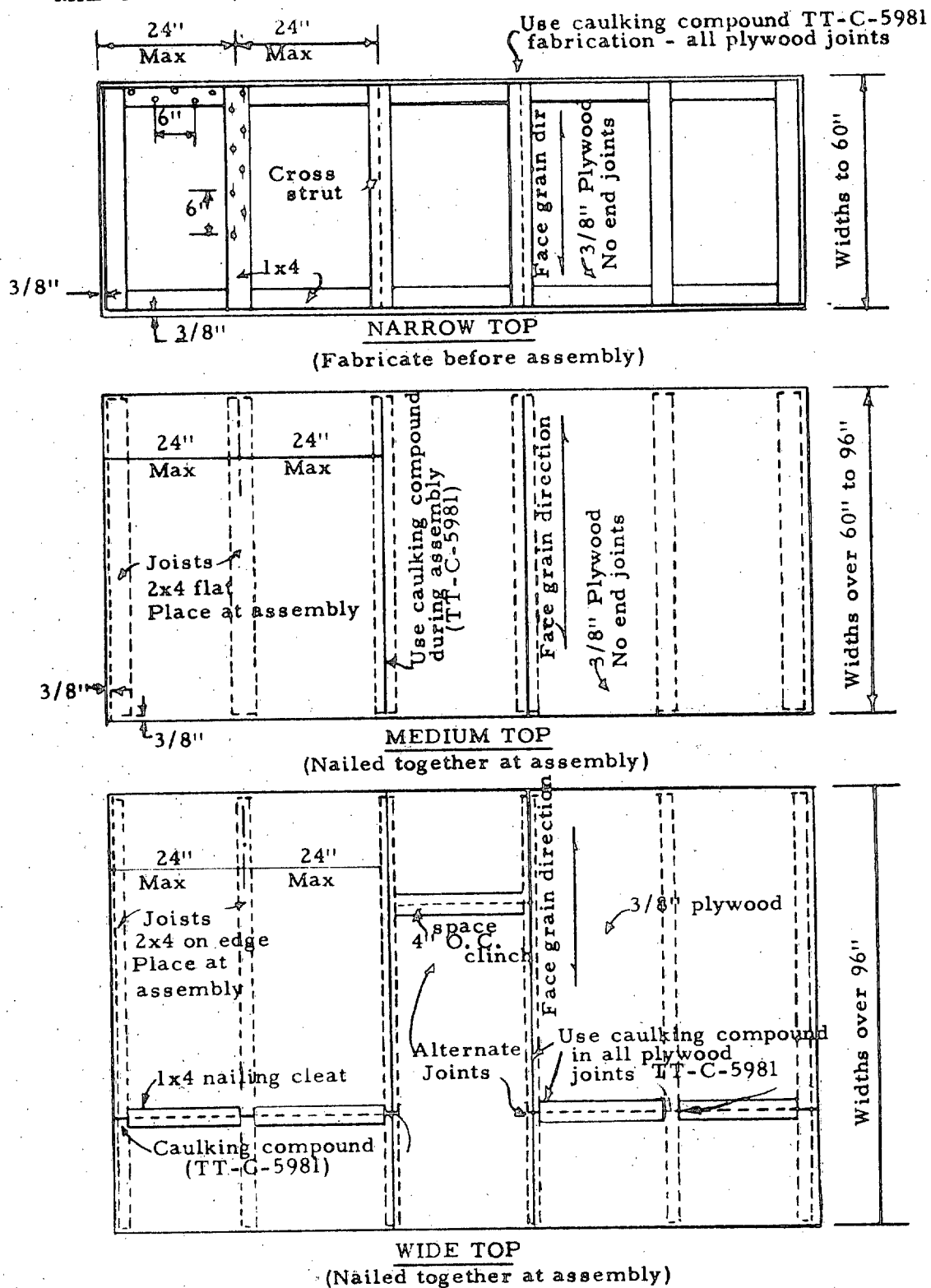
MIL-C-25731A(USAF)



E N D

FIGURE 11 - TYPE III CRATE - ENDS

MIL-C-25731A(USAF)



INSIDE VIEWS
FIGURE 12 - TYPE III CRATE - TOPS

MIL-C-25731A(USAF)

NOTE:

1. Tops to 60" wide
Frame members and plywood
fabricated before assembly
2. Tops over 60" wide
 - a. Joists placed and nailed
 - b. Plywood placed and nailed
(cleat end joints when required,
before assembly)

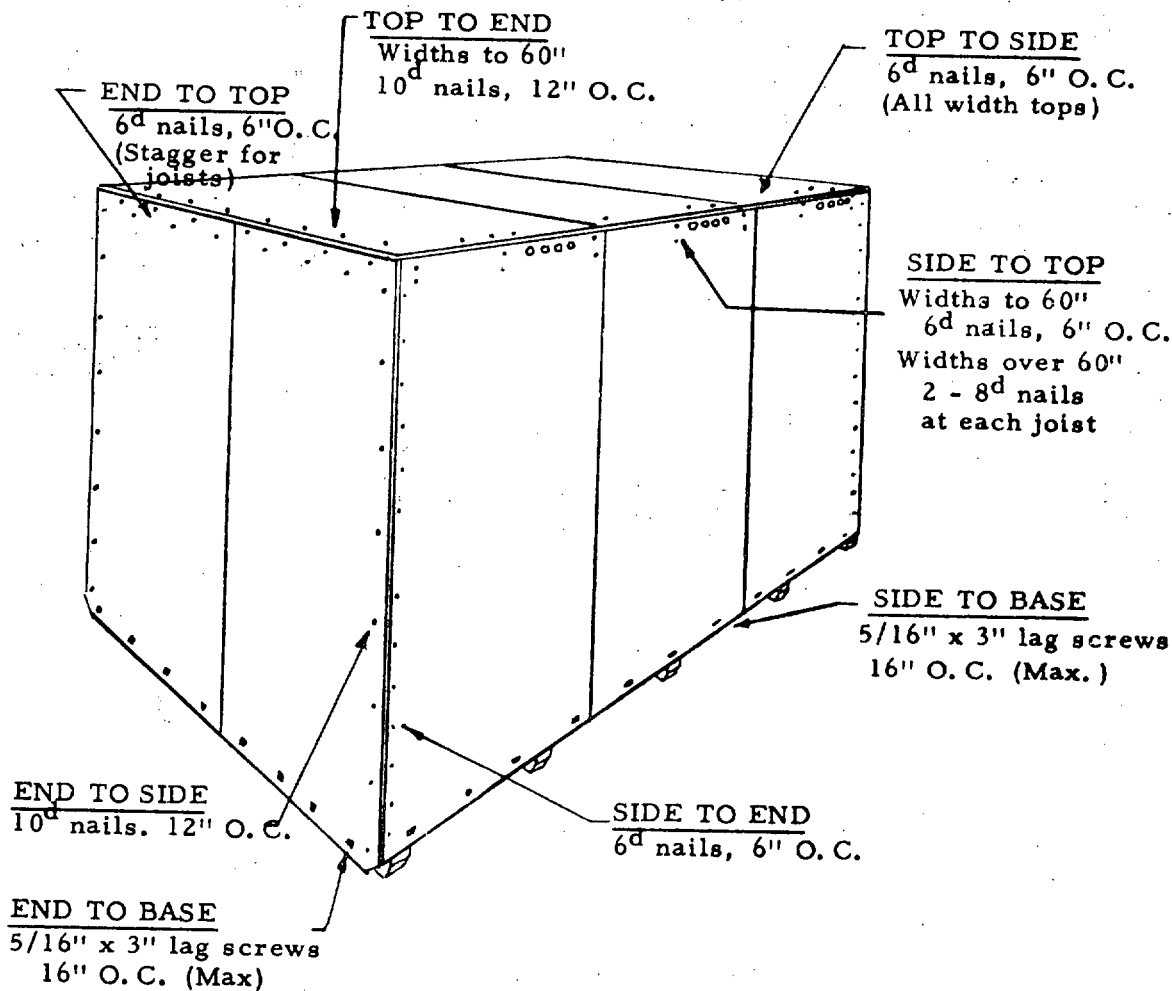


FIGURE 13- TYPE III CRATE - ASSEMBLY

MIL-C-25731A(USAF)

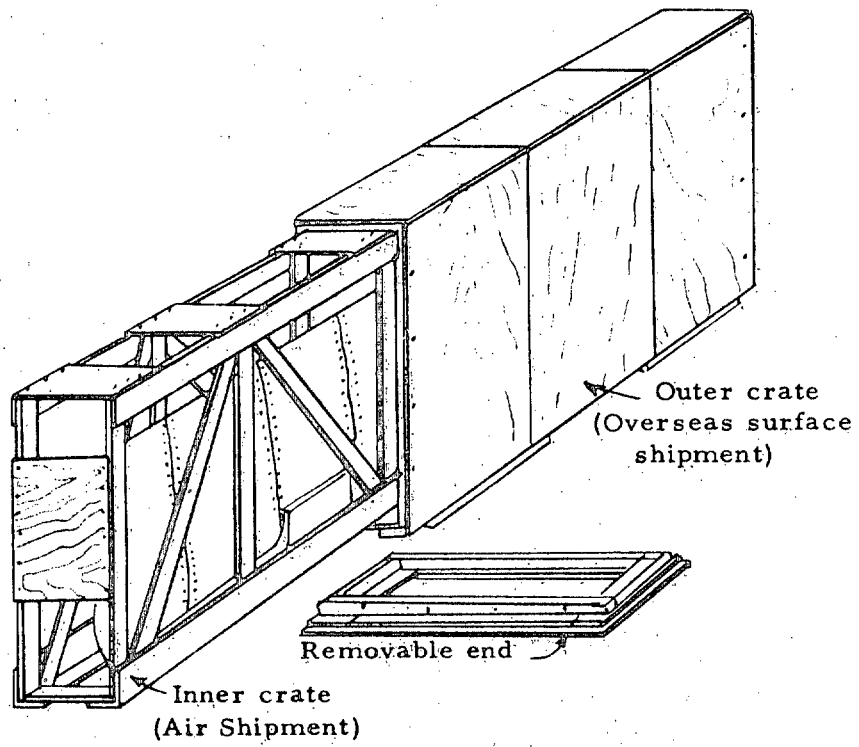
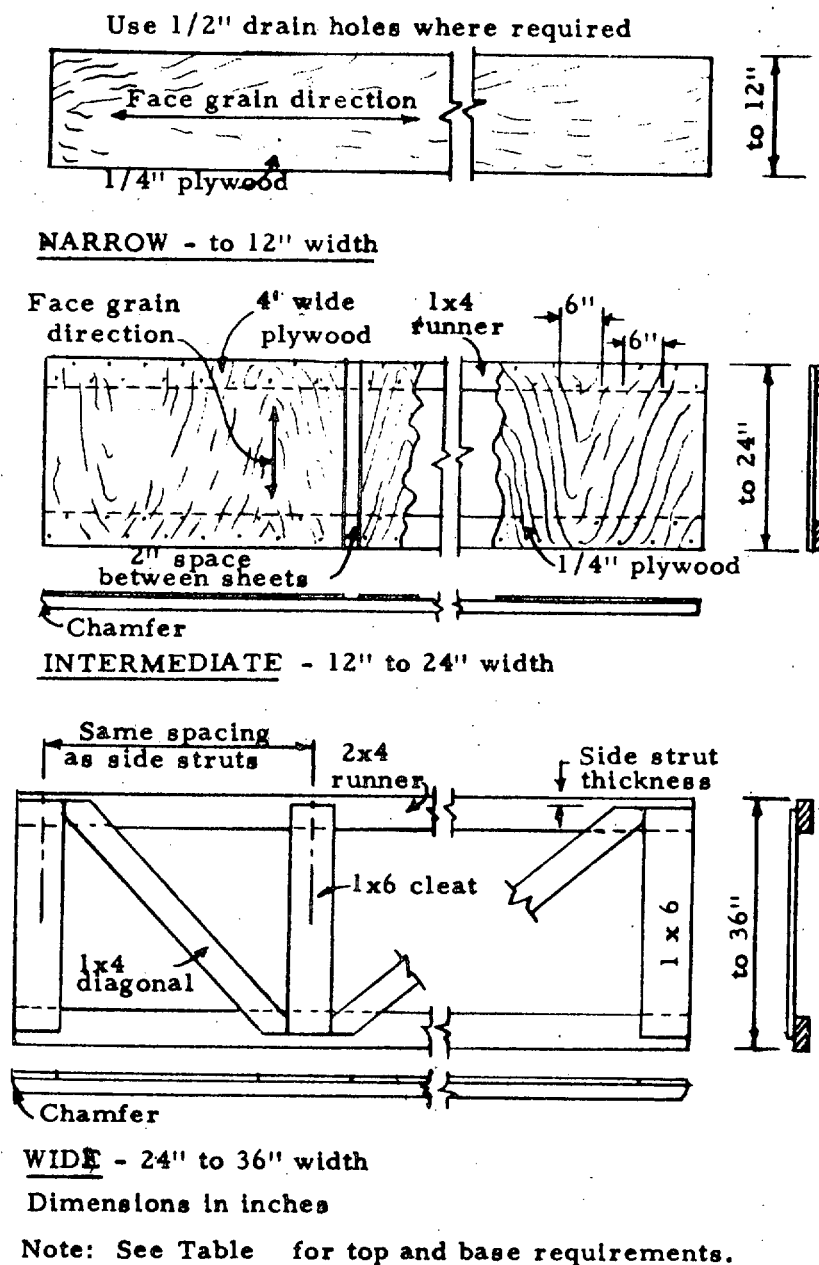
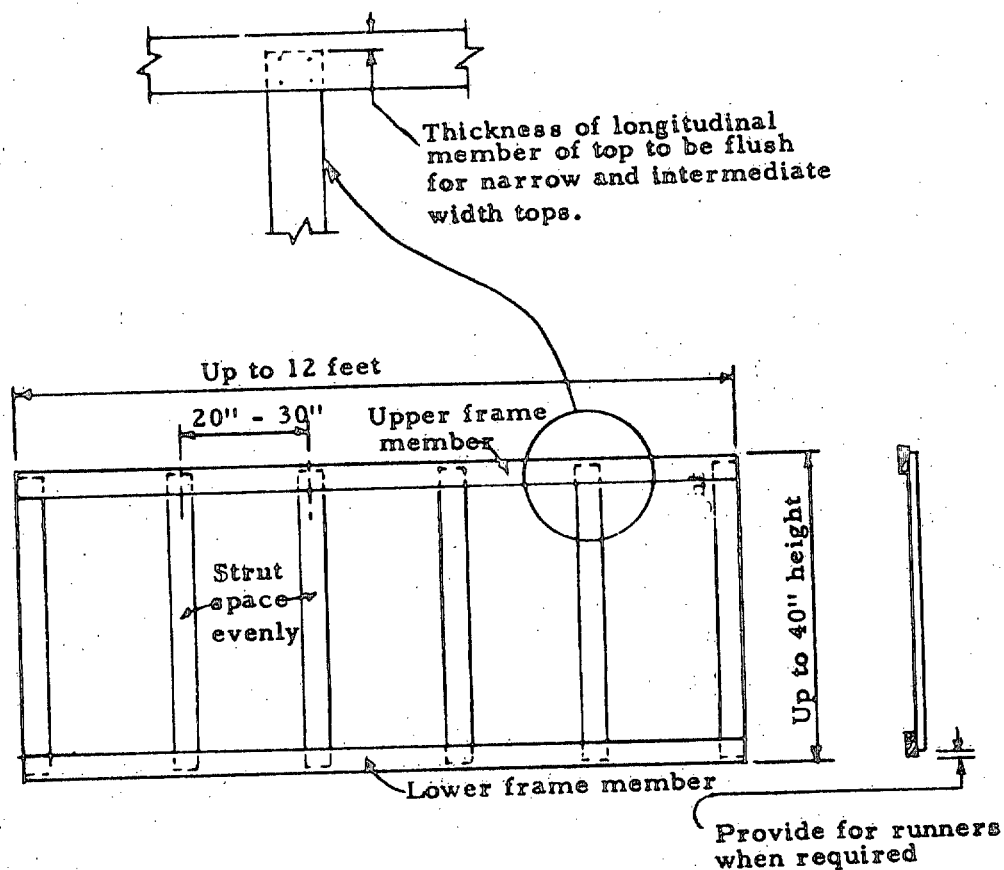


FIGURE 14 - TYPICAL TWO-WAY CRATE

MIL-C-25731A(USAF)

**FIGURE 15 - BASE DESIGN FOR TYPE IV INNER CRATE**

MIL-C-25731A(USAF)

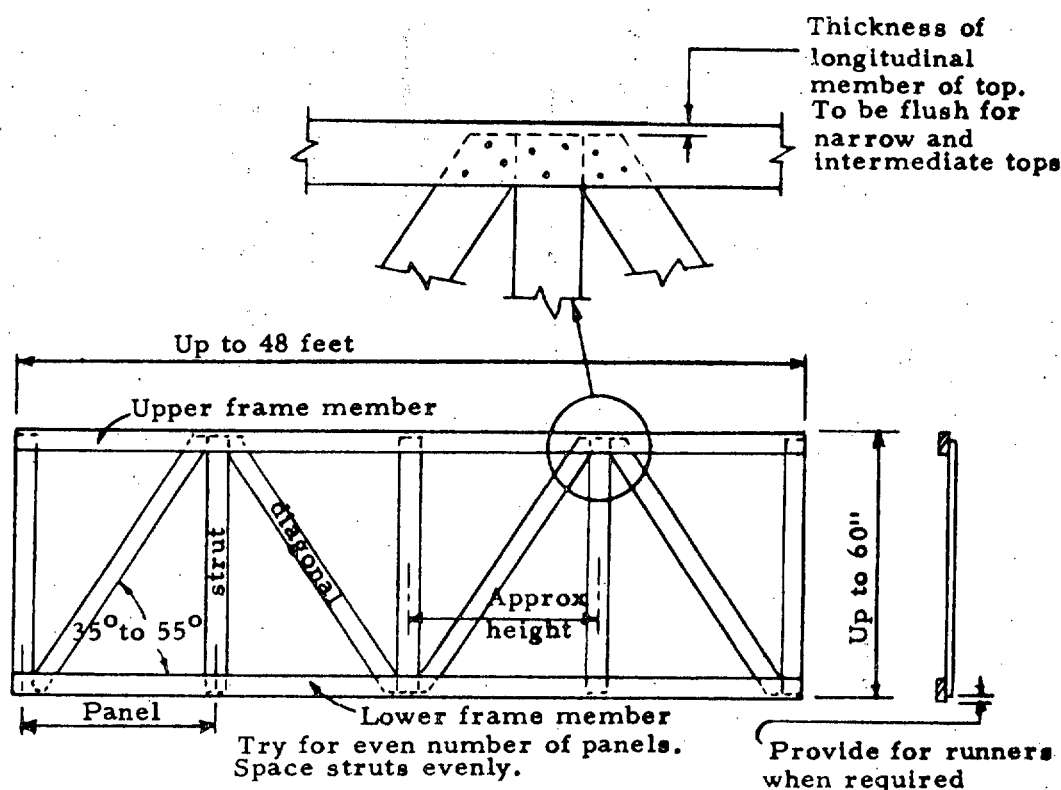
USE

- Length up to 12 feet
- Height up to 40 inches
- Weight of part up to 100 pounds
- Member size - all 1 x 4's

Dimensions in inches, unless otherwise specified

FIGURE 16 - STYLE A SIDE FOR TYPE IV INNER CRATE

MIL-C-25731A(USAF)

**USE**

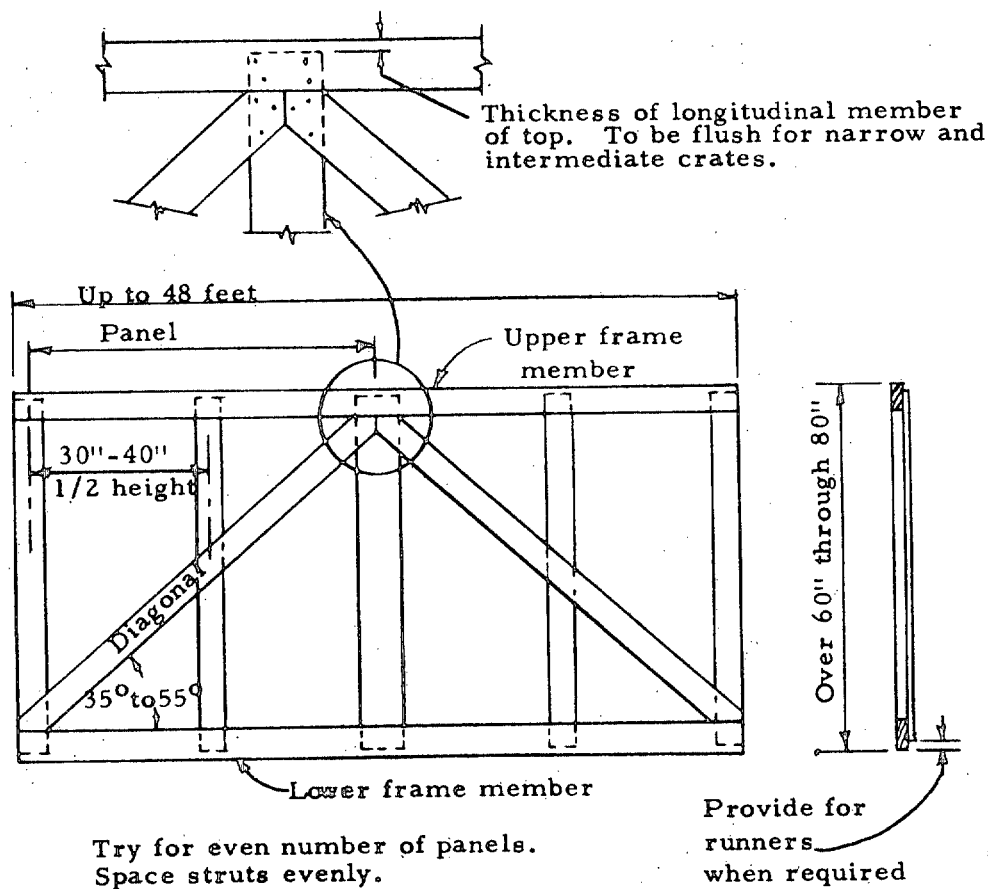
- Length - up to 48 feet
- Height - up to 60 inches
- Weight of part - up to 2,000 pounds

Length	Weight of part	Member size	
		Upper and lower frame members	Other frame members
Less than 20 feet	Less than 200 pounds	Inches 1 x 4	Inches 1 x 4
Over 20 feet	Over 200 pounds	1 x 6	1 x 4

Dimensions in inches unless otherwise specified.

FIGURE 17 - STYLE B SIDE FOR TYPE IV INNER CRATE

MIL-C-25731A(USAF)

USE

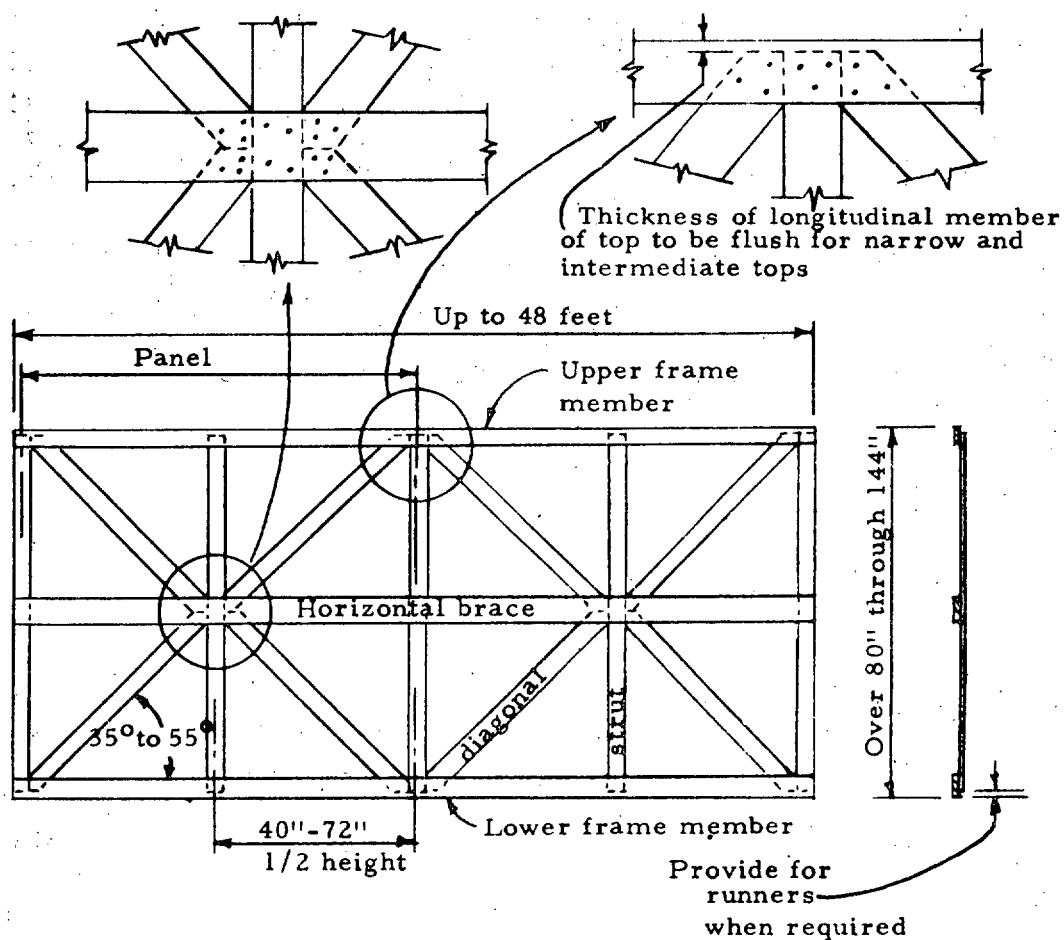
- Length - up to 48 feet
- Height - over 60 inches through 80 inches
- Weight of part - up to 2,000 pounds

Length	Weight of Part	Member size		
		Connecting Strut	Upper & Lower frame members	Other frame members
Less than 20 feet	Less than 200 pounds	Inches 1 x 6	Inches 1 x 4	Inches 1 x 4
Over 20 feet	Over 200 pounds	1 x 6	1 x 6	1 x 4

Dimensions in inches, unless otherwise specified

FIGURE 18 - STYLE C SIDE FOR TYPE IV INNER CRATE

MIL-C-25731A(USAF)



Space struts evenly

USE

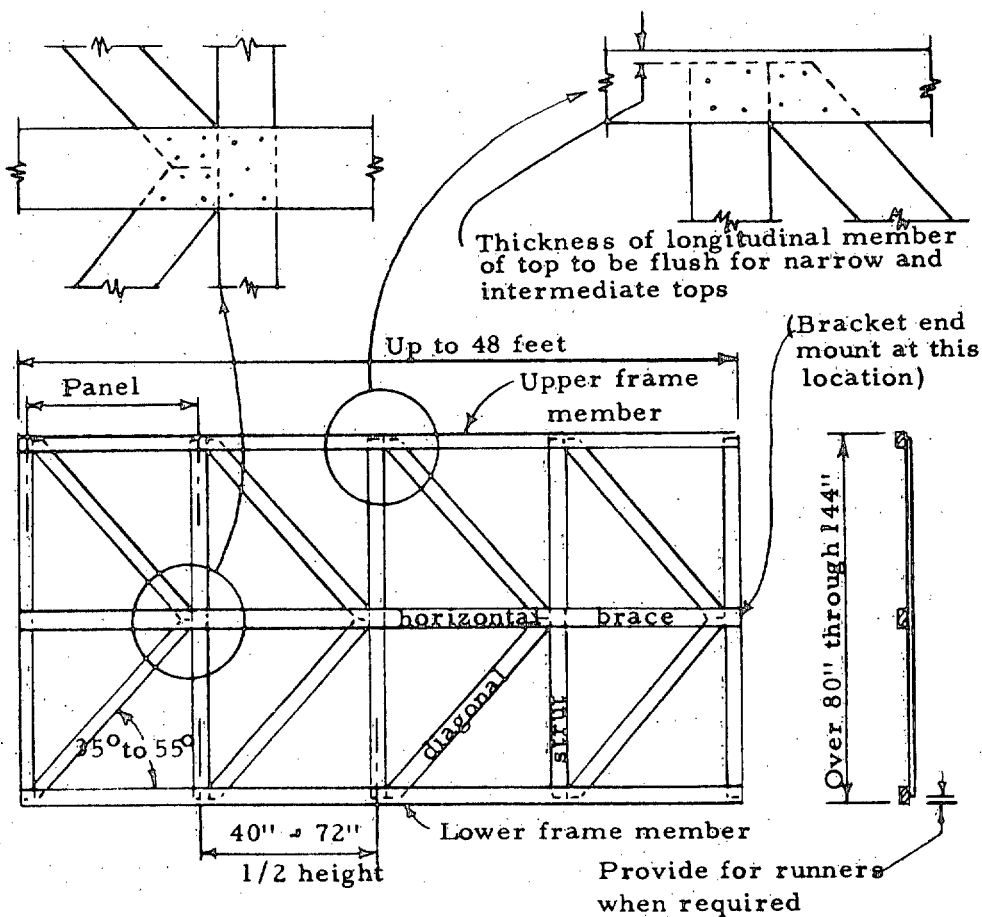
- Length - up to 48 feet
- Height - over 80 inches through 144 inches
- Weight of part - up to 2,000 pounds

Length	Weight of Part	Member size		
		Horizontal Brace	Upper & Lower frame members	Other frame members
Less than 20 feet	Less than 200 pounds	<u>Inches</u> 1 x 6	<u>Inches</u> 1 x 4	<u>Inches</u> 1 x 4
Over 20 feet	Over 200 pounds	1 x 6	1 x 6	1 x 4

Dimensions in inches, unless otherwise specified.

FIGURE 19 - STYLE D SIDE FOR TYPE IV INNER CRATE

MIL-C-25731A(USAF)



Space struts evenly

USE

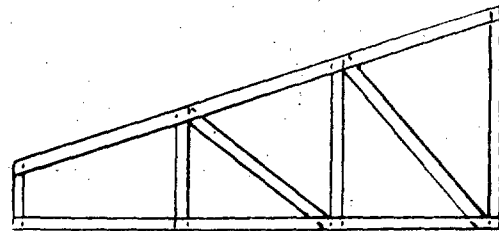
- Length - up to 48 feet
- Height - Over 80 inches through 144 inches
- Weight of part - up to 2,000 pounds

Length	Weight of part	member size		
		Horizontal brace	Upper & Lower frame members	Other frame members
Less than 20 feet	Less than 200 pounds	Inches 1 x 6	Inches 1 x 4	Inches 1 x 4
Over 20 feet	Over 200 pounds	1 x 6	1 x 6	1 x 4

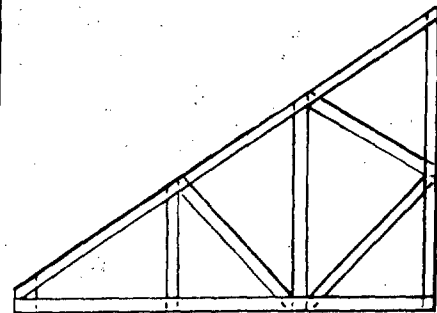
Dimensions in inches, unless otherwise specified

FIGURE 20 - STYLE D-1 SIDE FOR TYPE IV INNER CRATE

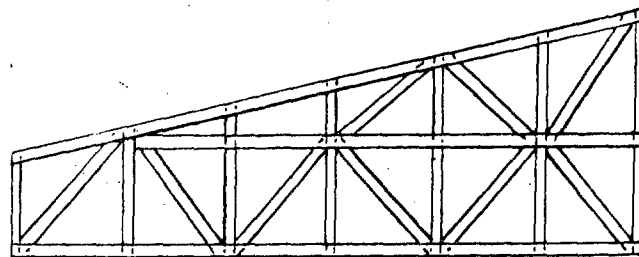
MIL-C-25731A(USAF)



A. Single Diagonals



B. Steeply sloped
upper frame member

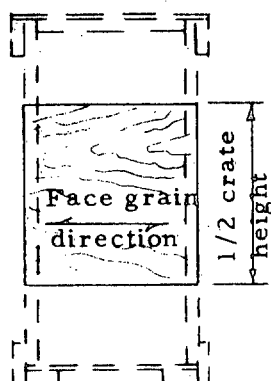


C. Style D side adapted to large, open
crate with sloping top

Suggested designs for odd-shaped items. Use shall be as outlined for Types B to D-1, use Figures 17 to 20.

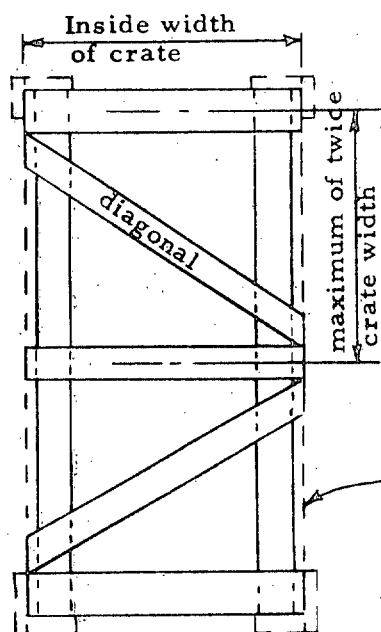
**FIGURE 21 - ARRANGEMENT OF FRAME MEMBERS FOR TYPE IV
INNER CRATE SPECIAL SIDES**

MIL-C-25731A(USAF)



INTERMEDIATE END
(12" to 24")

Use 1/4-inch plywood panel.
Size - crate width by one-half
crate height.



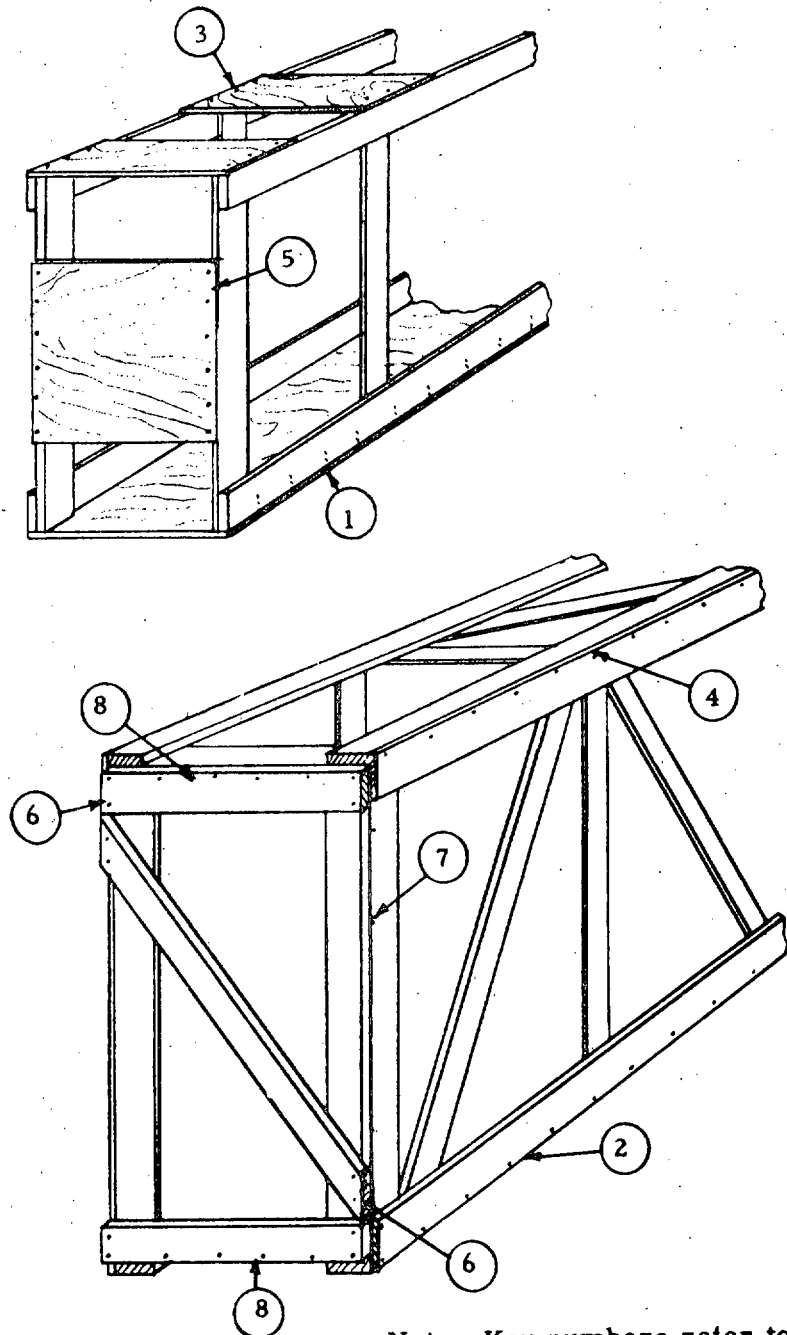
WIDE END
(24" to 36")

All members are 1x4. Space
intermediate members no greater
than twice the width of the crate.

Dimensions in inches.

FIGURE 22 - ENDS FOR TYPE IV INNER CRATE

MIL-C-25731A(USAF)

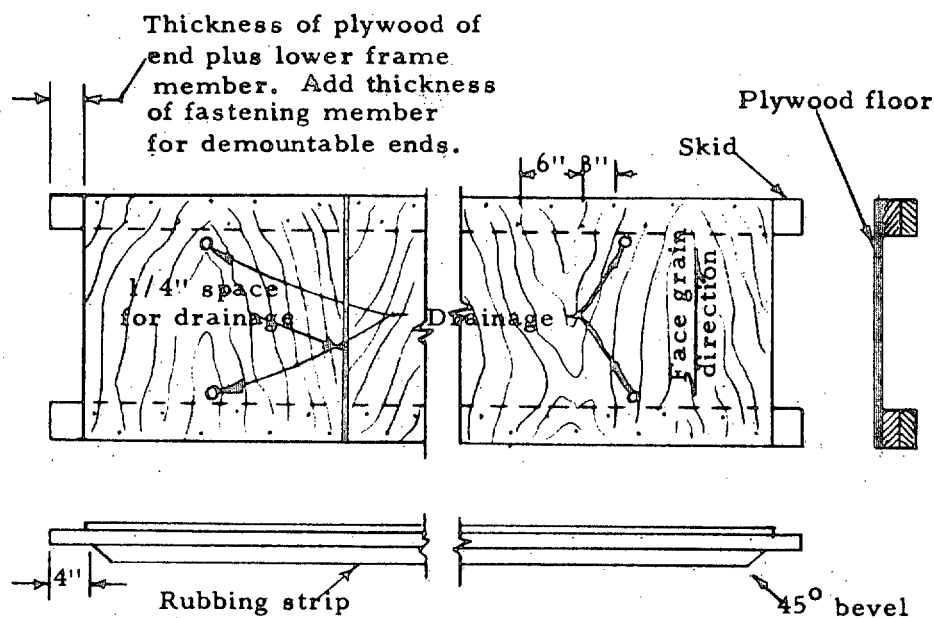


Note: Key numbers refer to requirements in Table VII

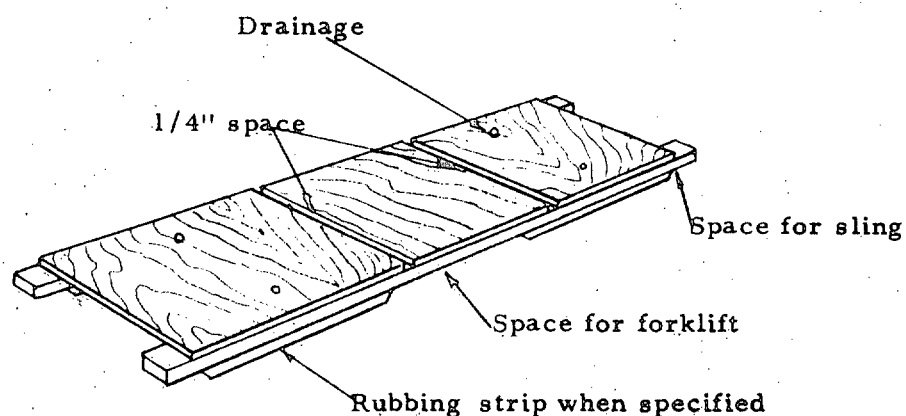
Dimensions in inches.

FIGURE 23 - ASSEMBLY OF TYPE IV INNER CRATE

MIL-C-25731A(USAF)



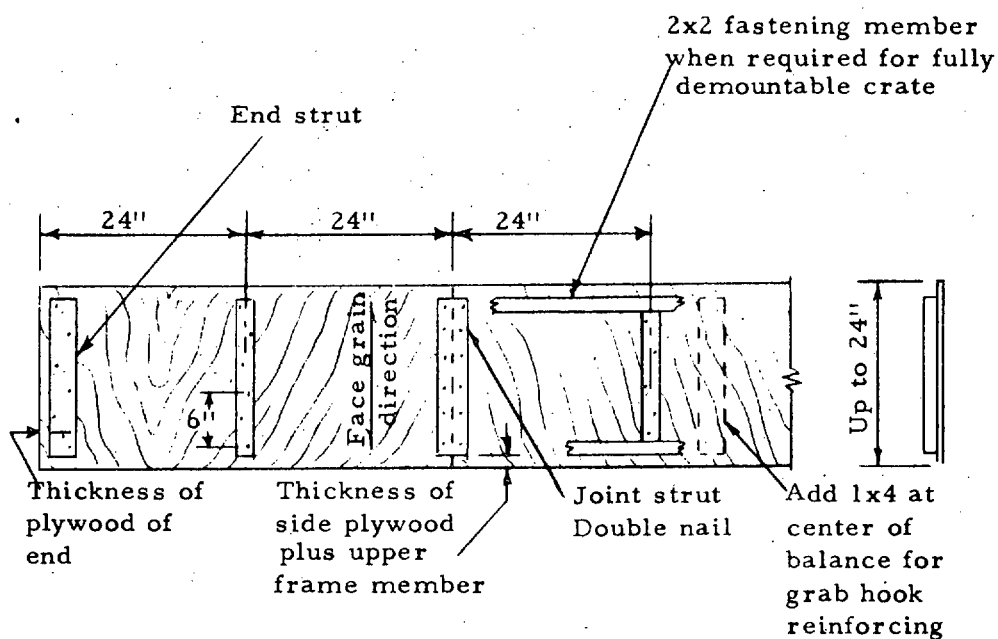
1. Nail rubbing strips to skids with 12 penny nails staggered in 2 rows and spaced 12 inches in each row.
2. Nail plywood to skids using 5 penny nails for 1/4-inch plywood and 6 penny nails for 3/8 and 1/2-inch plywood.
3. All nails cement coated or etched.
4. Bevel ends of skids when rubbing strips are not required.



Dimensions in inches.

FIGURE 24 - BASE DESIGN FOR TYPE V CLASS I OUTER CRATE

MIL-C-25731A(USAF)



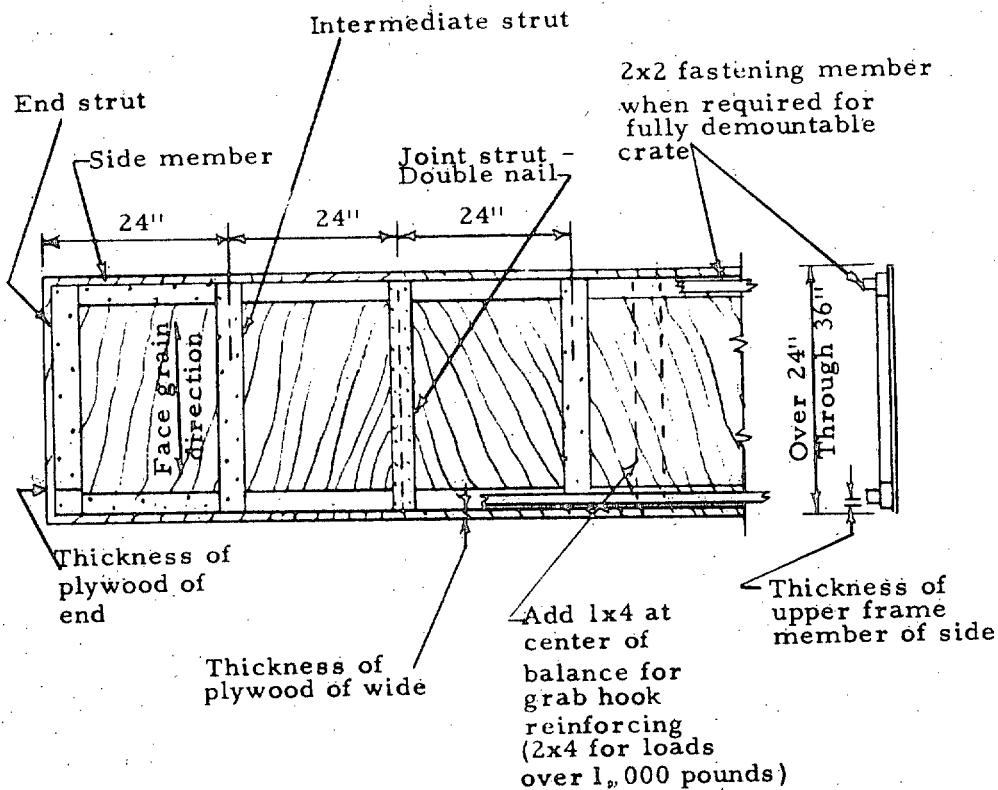
Note: Use full length 2 x 2 fastening members when crate is fully demountable. See Figure 28 for nailing pattern. Partial panels may be placed at the center or at each end.

Width of top	Plywood Thickness	Member size		Maximum weight of part	Maximum length
		End and joint strut	Other struts		
Inches	Inches	Inches	Inches	Pounds	Feet
Through 12	1/4	1 x 4	1 x 2	100	12
Over 12 Through 24	3/8	1 x 4	1 x 4	2,000	48

Dimensions in inches, unless otherwise specified.

FIGURE 25 - TOP DESIGN (UP TO 24" WIDTH) FOR TYPE V CLASS 1 OUTER CRATE

MIL-C-25731A(USAF)



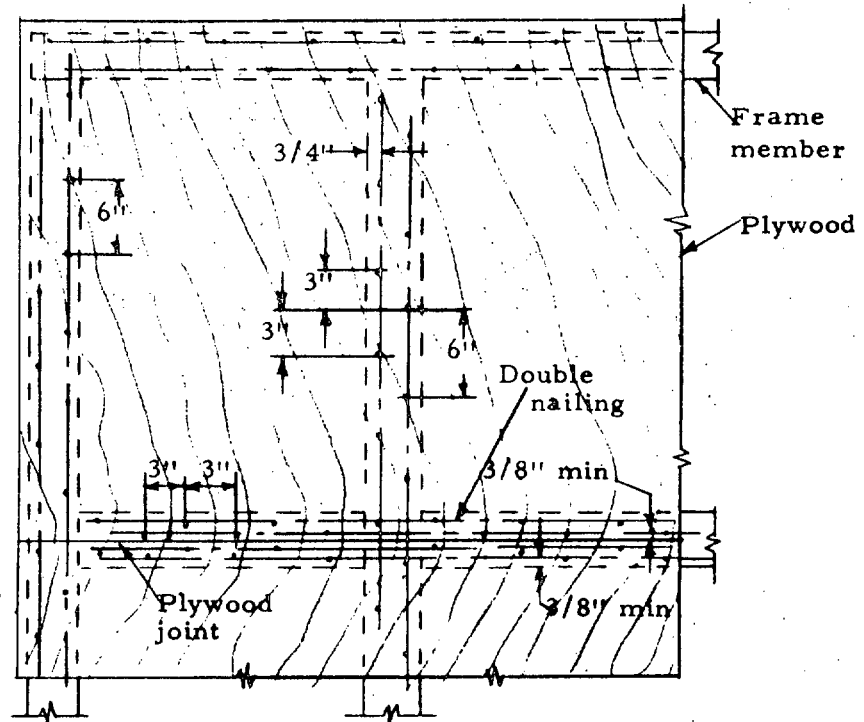
Note: Use 2x2 fastening members over side members when crate is fully demountable. See Figure 28 for nailing pattern. Partial panels may be placed at the center or at each end.

Width of top	Plywood thickness	Member size		
		End strut	Intermediate strut	Side Member
Inches	Inches	Inches	Inches	Inches
Over 24 through 30	3/8	1 x 4	1 x 4	1 x 4
Over 30 through 36	3/8	1 x 4	1 x 6	1 x 4

Dimensions in inches.

FIGURE 26 - TOP DESIGN (24" THROUGH 36" WIDTH) FOR TYPE V CLASS I OUTER CRATE

MIL-C-25731A(USAF)

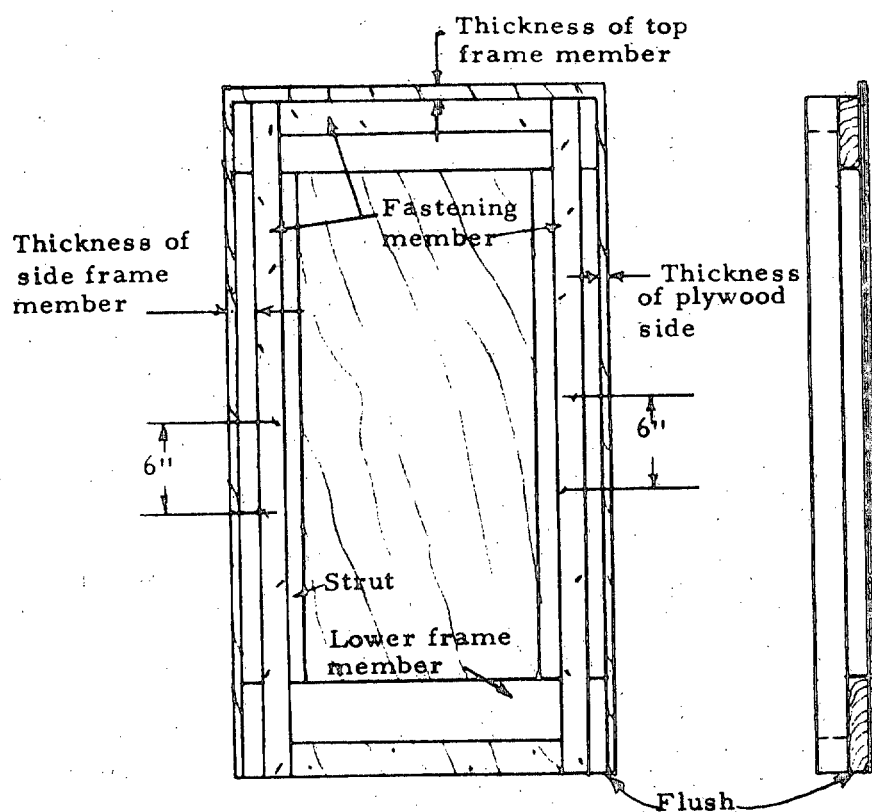


- a. Nail through plywood.
- b. Clinch nails a minimum of 1/4-inch on frame members.
- c. Double nail at plywood joints.

Dimensions in inches.

**FIGURE 27 - FABRICATION NAILING - PLYWOOD TO FRAME MEMBERS
FOR TYPE V CLASS I OUTER CRATE**

MIL-C-25731A(USAF)



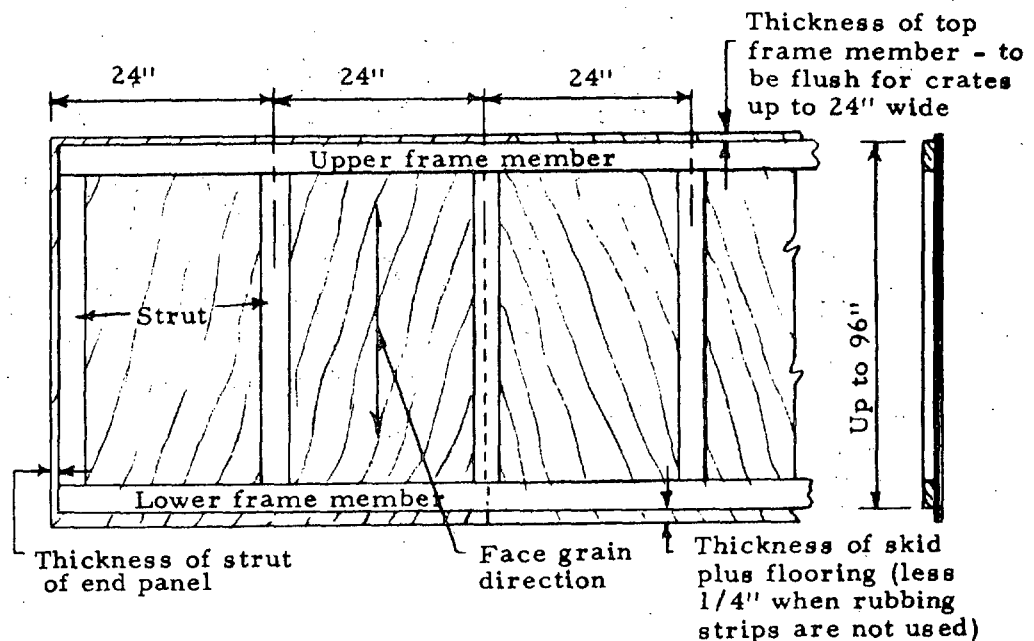
When nailing fastening members to the end:

- Nail through the plywood, the frame member, and the fastening member, and clinch the nail 1/4-inch.
- Space the nails 6" apart in a staggered pattern.

Dimensions in inches

**FIGURE 28 - FASTENING MEMBERS FOR DEMOUNTABLE ENDS
TYPE V CLASS 1 OUTER CRATE**

MIL-C-25731A(USAF)



No horizontal joints allowed in plywood.

All plywood shall be 3/8 inch thick except that 1/4 inch plywood may be used for crates with lengths to 12 feet widths to 12 inches, heights to 40 inches, and when weight of part is less than 100 pounds.

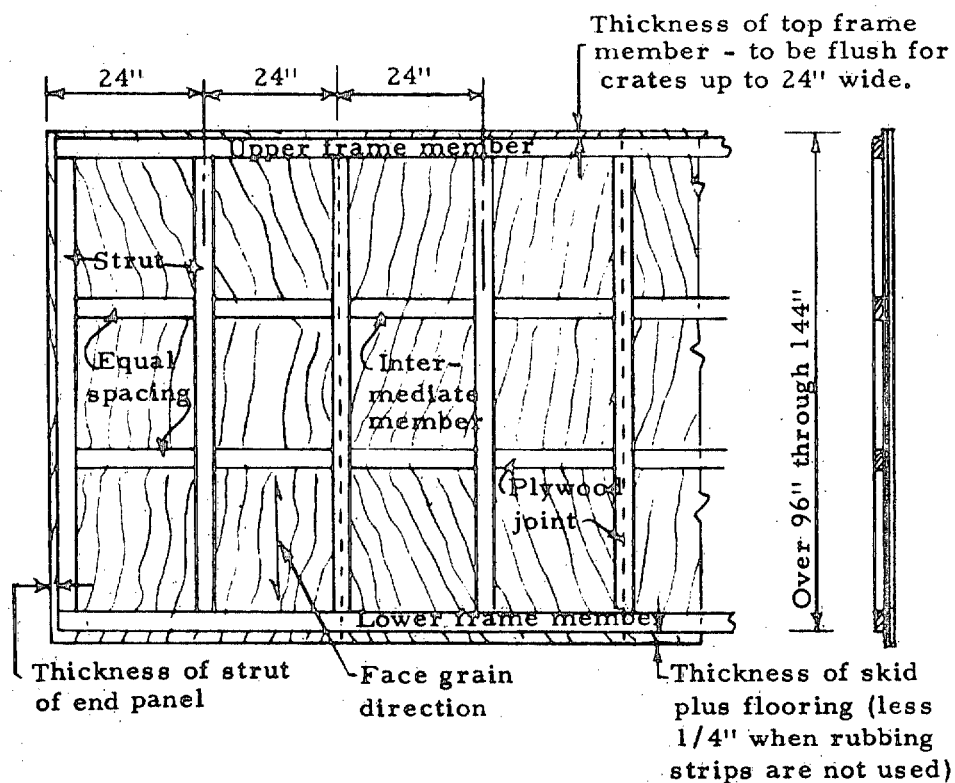
All frame members shall be 1x4's except when the crate length is over 40 feet or the weight of part is over 1,000 pounds - then upper frame member is 1x6 in size.

Partial panels may be placed at the center or at each end (see tops).

Dimensions in inches.

FIGURE 29 - STYLE A SIDE FOR TYPE V CLASS 1 OUTER CRATES

MIL-C-25731A(USAF)

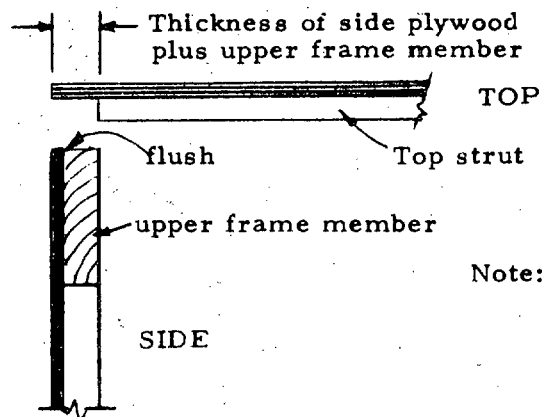


All frame members - 1 x 4
 All plywood - 3/8-inch thick
 Partial panels may be placed
 at the center or at each end
 (see tops).

Dimensions in inches.

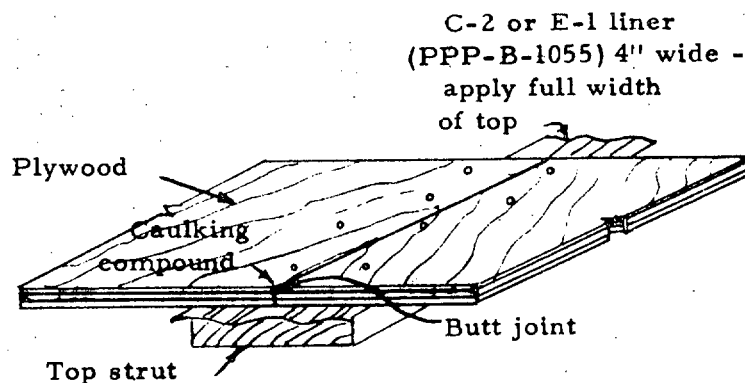
FIGURE 30 - STYLE B SIDE FOR TYPE V CLASS I OUTER CRATES

MIL-C-25731A(USAF)



Note: Plywood and upper frame member of side flush when tops are less than 24" wide.

TOP AND SIDE DESIGN - For crates up to 24" wide

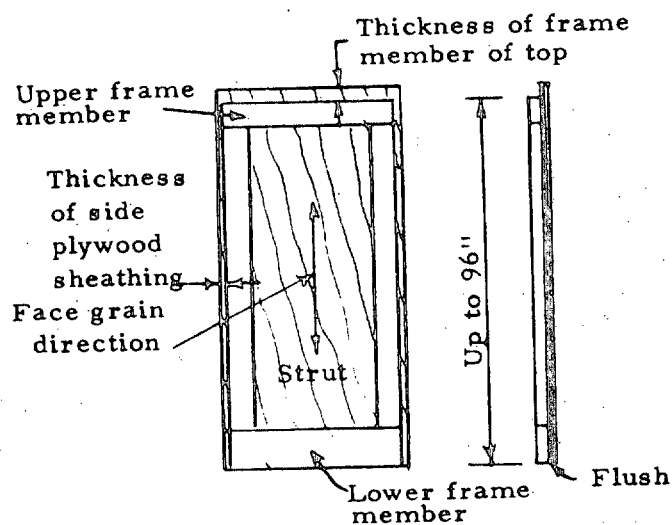


WATERPROOFING OF TOP AT PLYWOOD JOINT

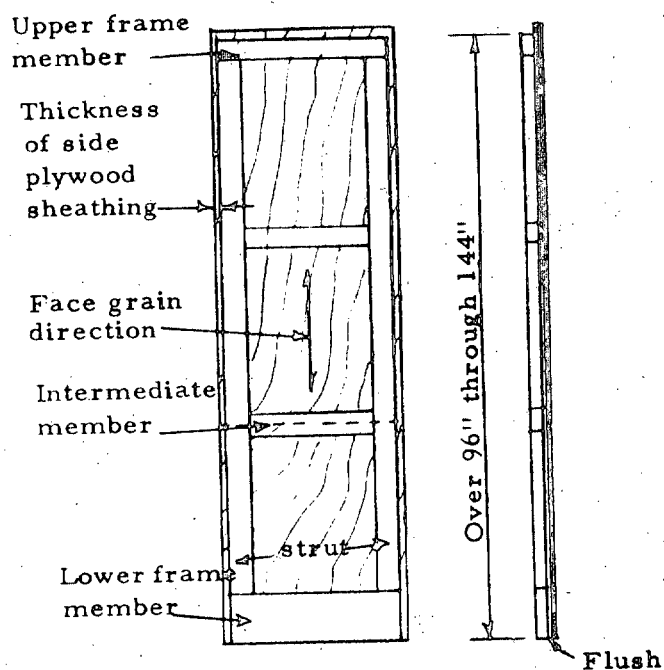
Dimensions in inches.

FIGURE 31 - DETAILS OF TOP FOR TYPE V CLASS 1 OUTER CRATE

MIL-C-25731A(USAF)



Plywood thickness same as sides

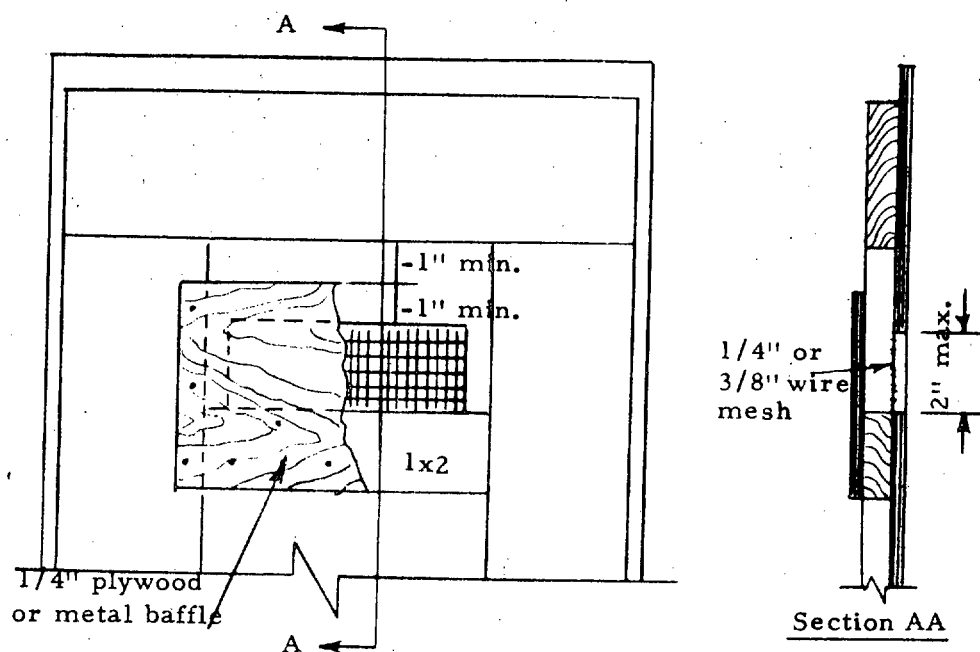


See Table IX for size of members

Dimensions in inches.

FIGURE 32 - END DESIGN FOR TYPE V CLASS 1 OUTER CRATES

MIL-C-25731A(USAF)

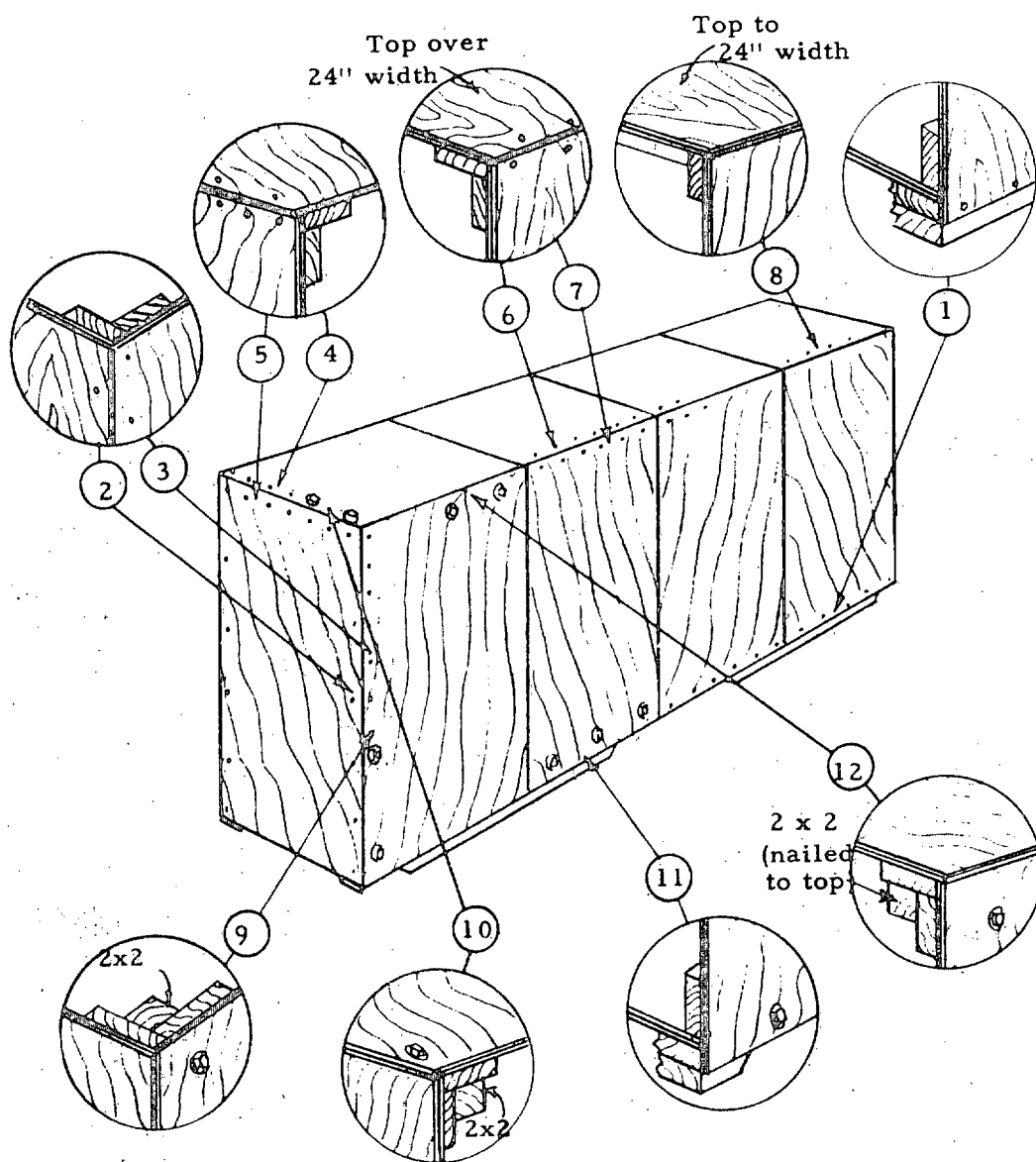


1. Use 1 square inch of ventilation area in each end for every 15 cubic feet of crate volume.
2. Use a minimum of 3 square inches or four 1-inch holes in each end.
3. For small crates, use 1-inch diameter holes spaced 2-1/2" O.C.

Dimensions in inches.

FIGURE 33 - CRATE VENTILATION

MIL-C-25731A(USAF)

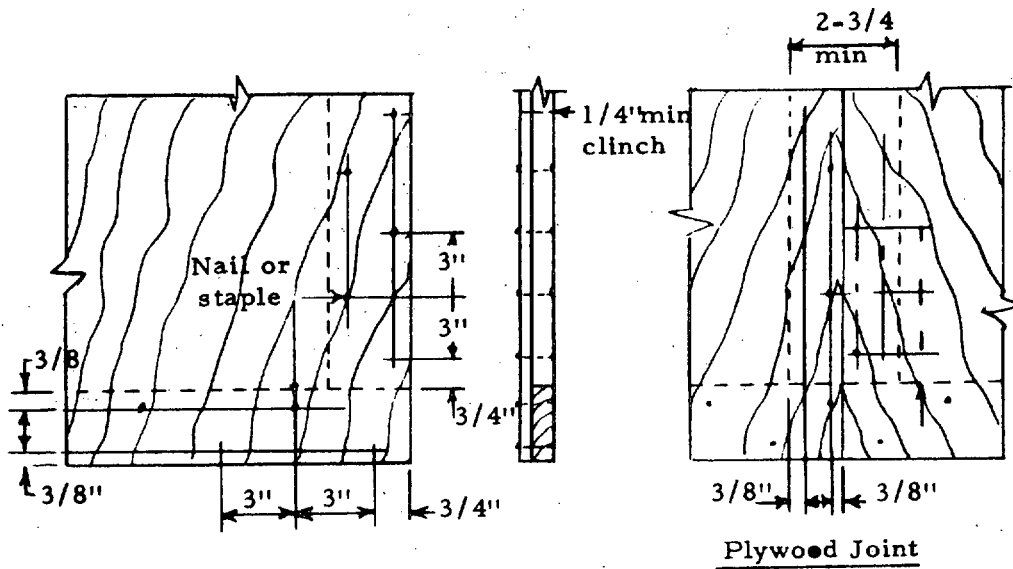
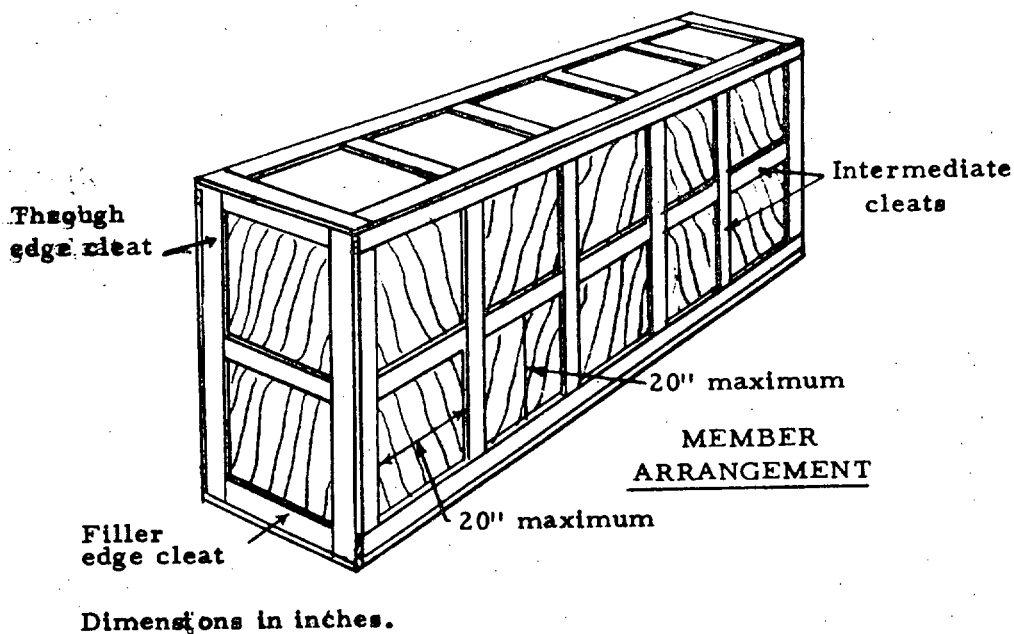


See Table X. for key no., nail sizes, etc.
 Use No. 1 through 8 for nailed crate.
 Use No. 9 - 10 for demountable end.
 Use No. 9 through 12 for fully demountable crate.

Dimensions in inches

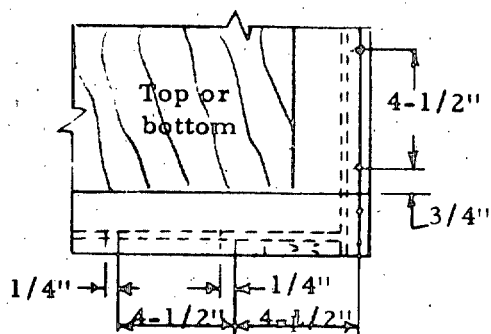
FIGURE 34 - ASSEMBLY OF TYPE V CLASS I OUTER CRATE

MIL-C-25731A(USAF)

FABRICATION

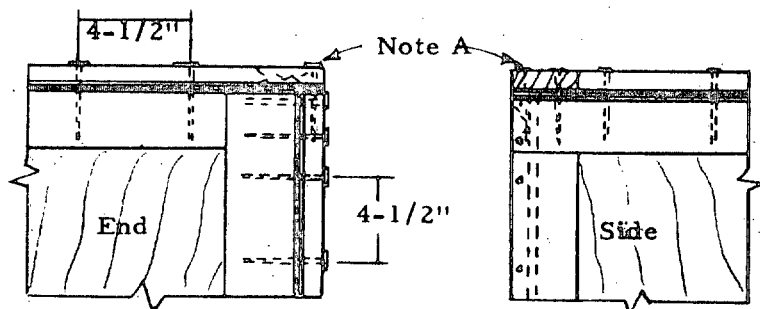
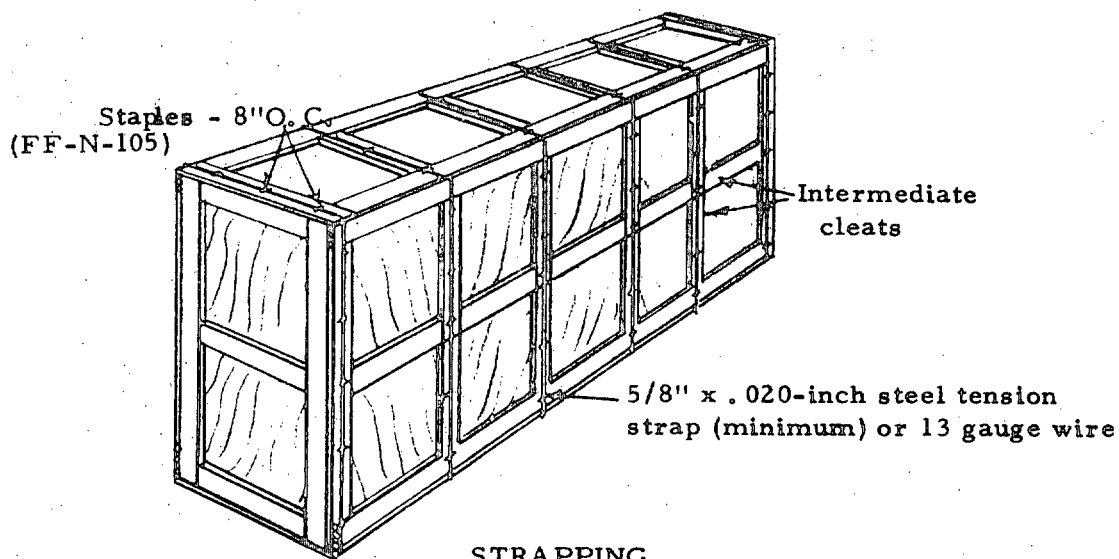
**FIGURE 35 - FABRICATION AND MEMBER ARRANGEMENT OF
CLEATED-PLYWOOD CRATE TYPE V CLASS 2 OUTER CRATE**

MIL-C-25731A(USAF)



Notes:

- Wood Group I and II use 9^d nail and for III and IV use 7^d nail.
- If specified nail splits cleat, use next smaller size.
- For demountable ends use screws spaced 8" O.C.

ASSEMBLY (Nails)STRAPPING

Dimensions in inches.

FIGURE 36 - ASSEMBLY AND STRAPPING OF CLEATED-PLYWOOD CRATE TYPE V CLASS 2

MIL-C-25731A(USAF)

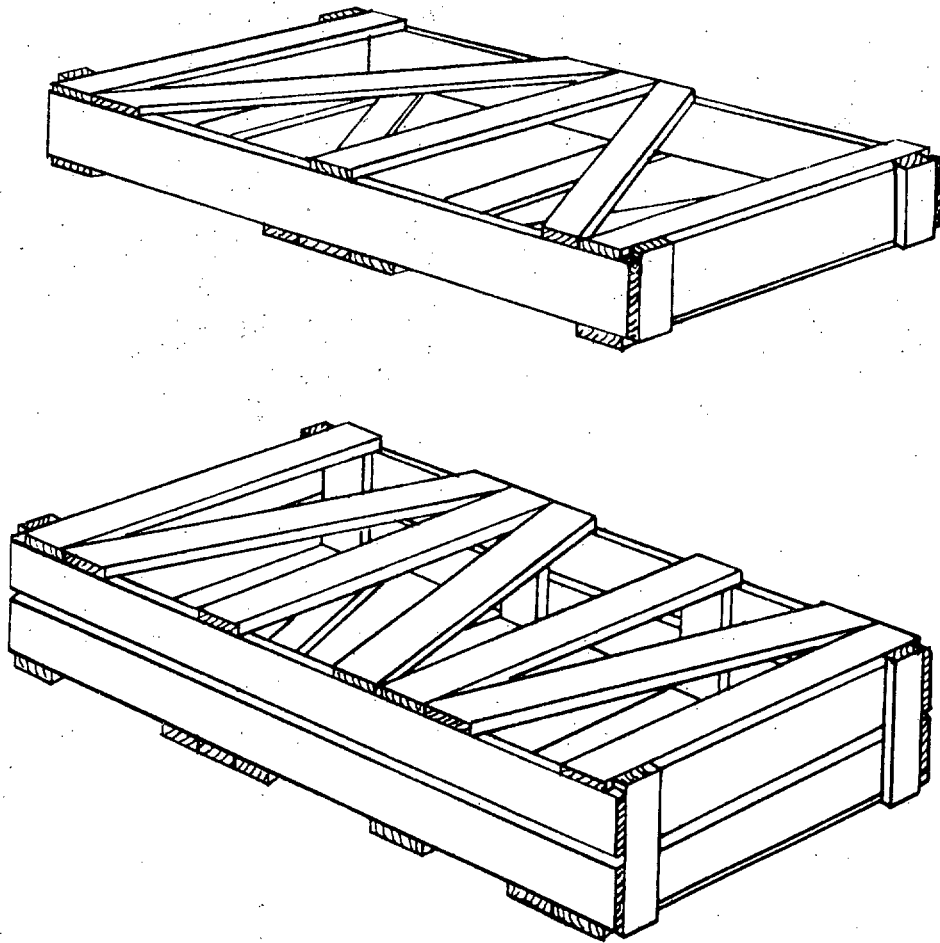


FIGURE 37 - TYPE VI CRATE

MIL-C-25731A(USAF)

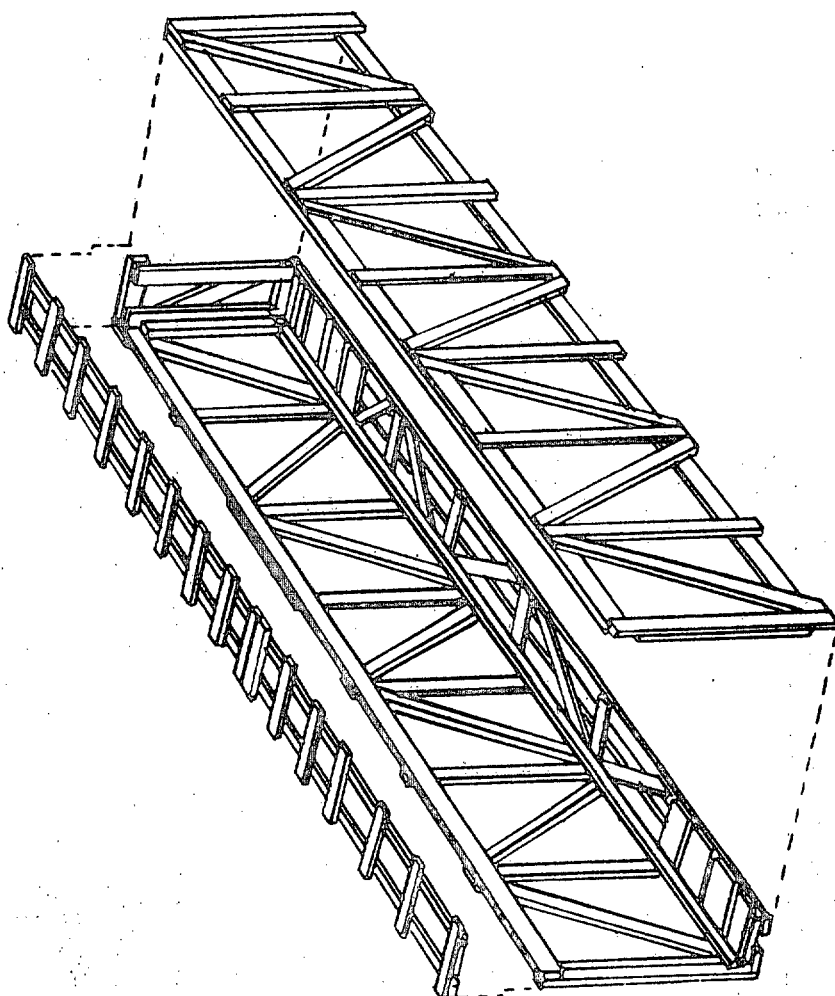


FIGURE 38 - TYPE VII CRATE

MIL-C-25731A(USAF)

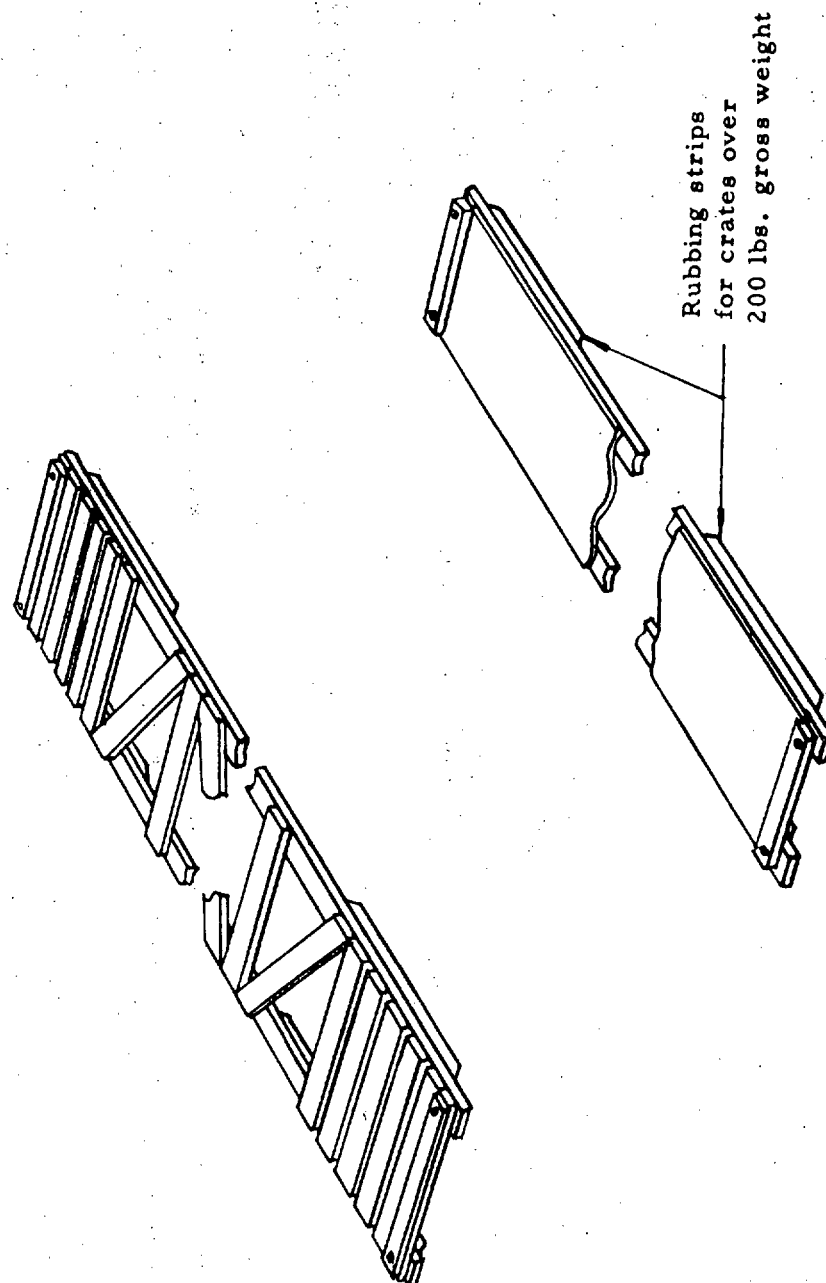


FIGURE 39 - TYPE VII CRATE - BASE

MIL-C-25731A(USAF)

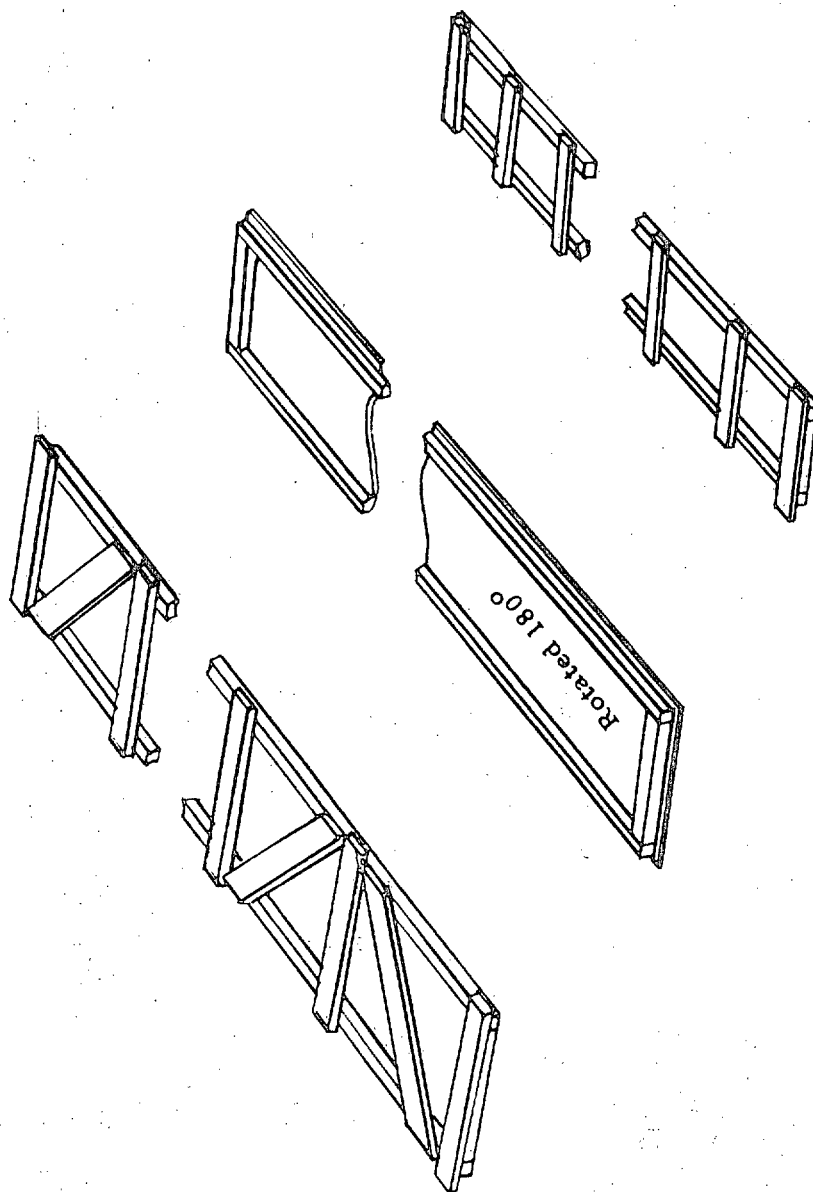


FIGURE 40 - TYPE VII CRATE - TOP

MIL-C-25731A(USAF)

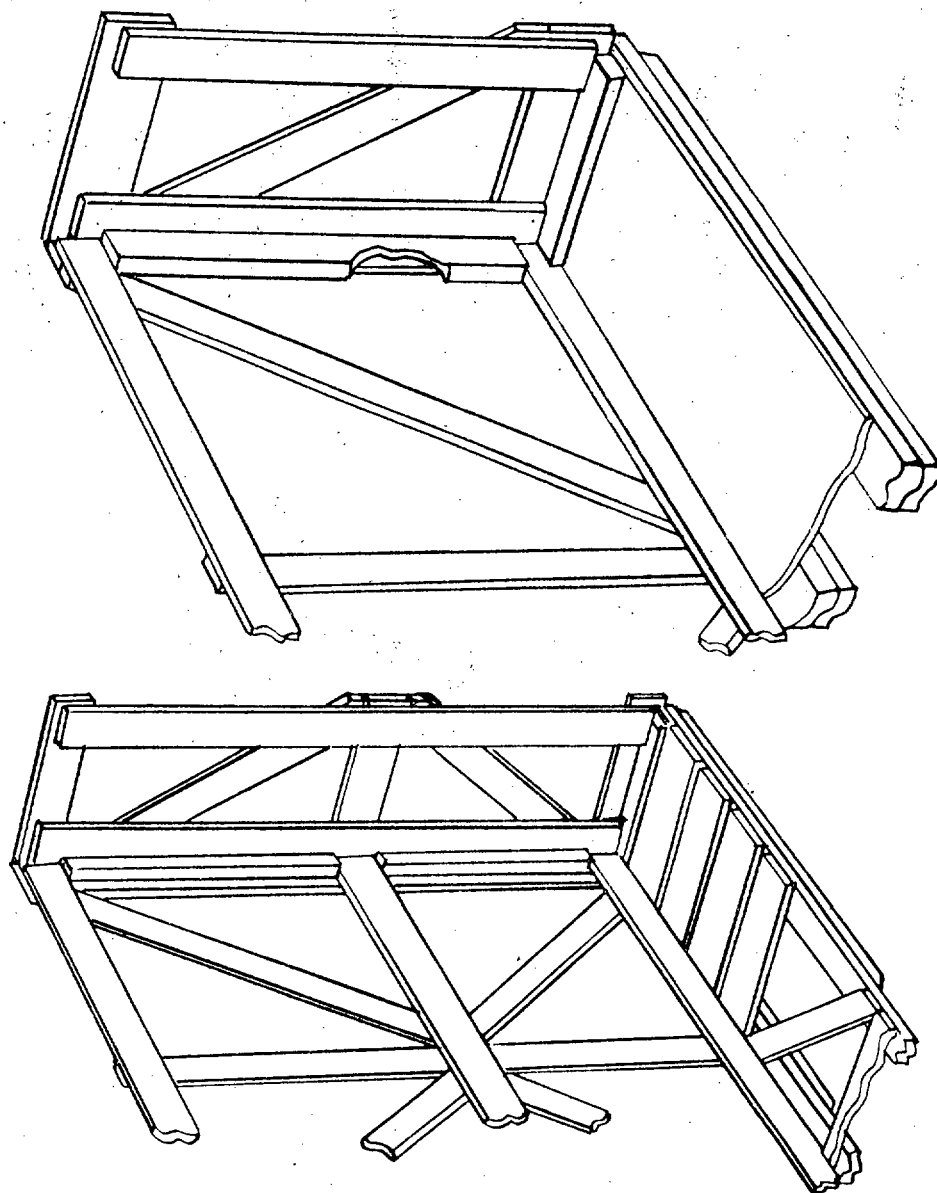


FIGURE 41 - TYPE VII CRATE - END

MIL-C-25731A(USAF)

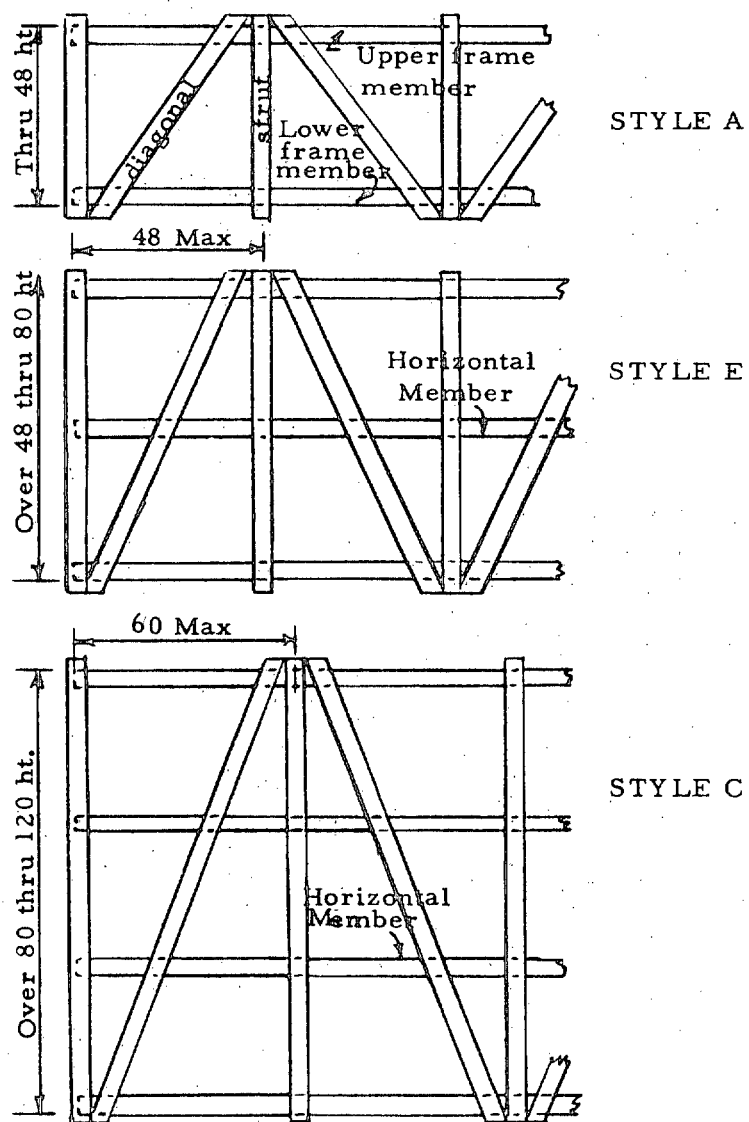
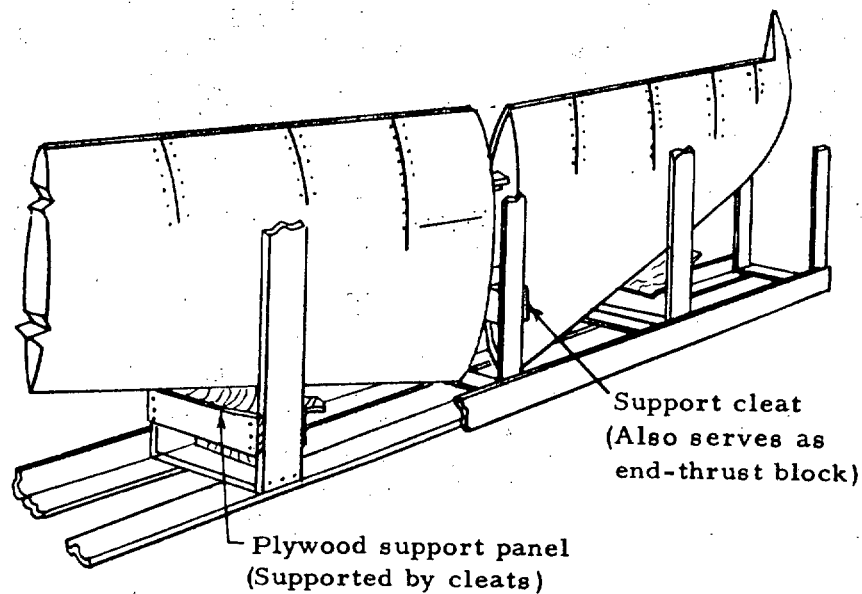


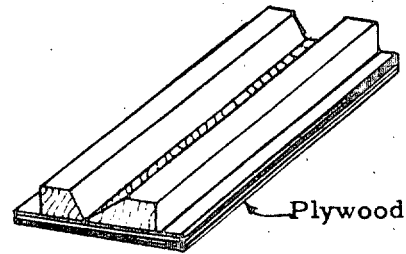
FIGURE 42 - TYPE VII CRATES - SIDES

MIL-C-25731A(USAF)



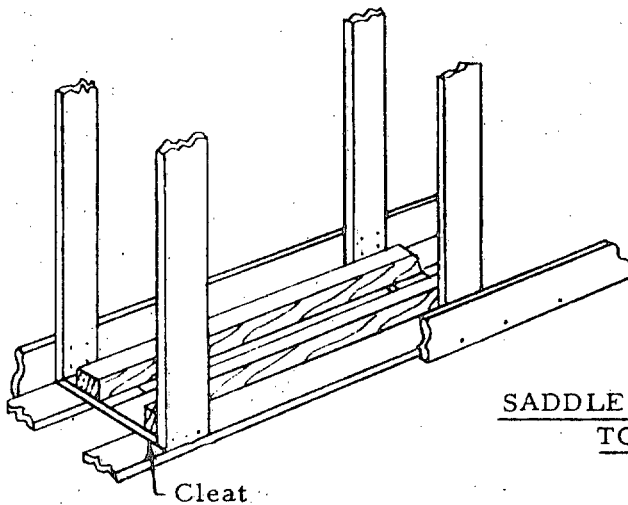
**FIGURE 43 - CLEATS AND SUPPORT PANELS (SUPPORTING A
HORIZONTAL STABILIZER)**

MIL-C-25731A(USAF)



SADDLE MEMBERS ON
PLYWOOD BASE

(May be supported by cleats
attached to struts)



SADDLE MEMBERS ATTACHED
TO BASE CLEATS

FIGURE 44. - SADDLE SUPPORTS

MIL-C-25731A(USAF)

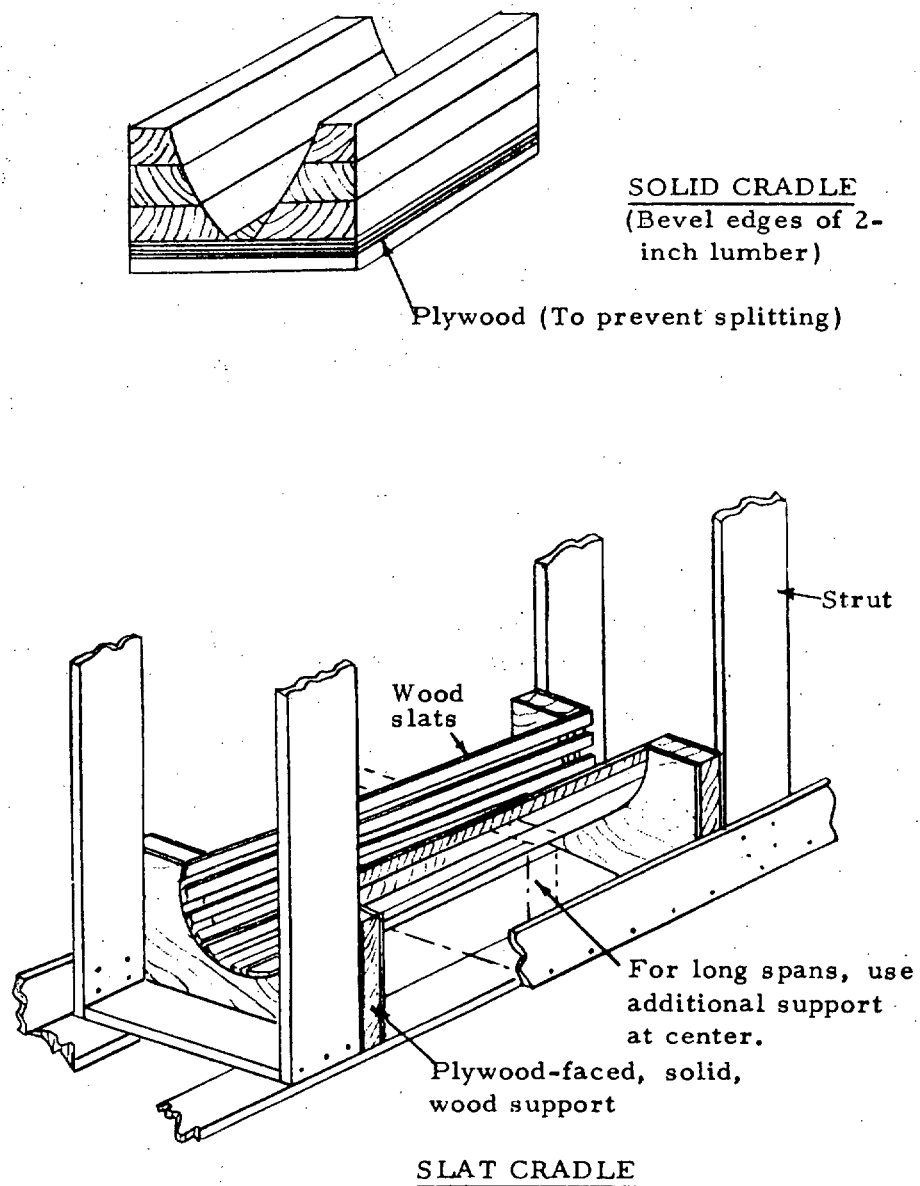
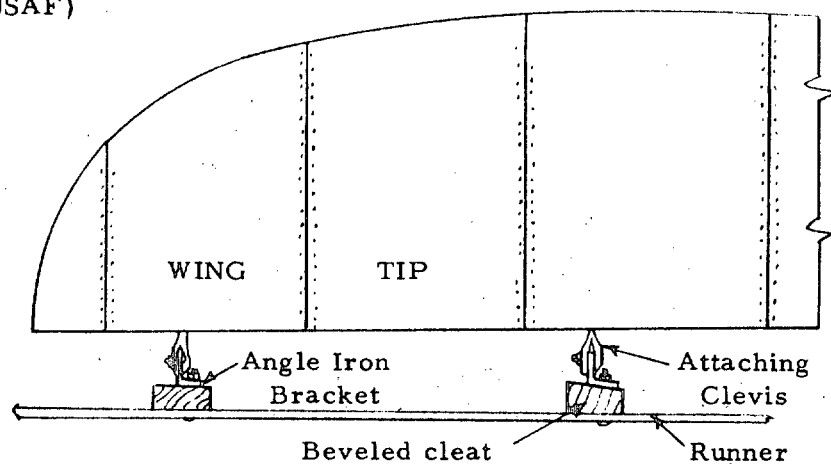
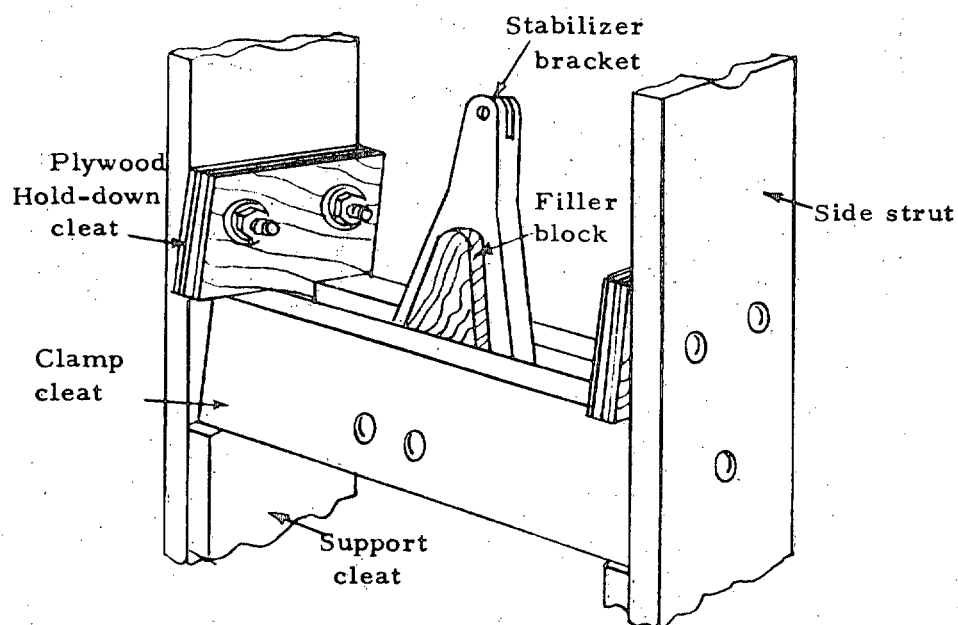


FIGURE 45 - CRADLES

MIL-C-25731A(USAF)



BRACKET - USED AS SUPPORT, HOLD-DOWN AND THRUST BLOCKING



BRACKET - STABILIZER BRACKET USED AS SUPPORT AND HOLD-DOWN

FIGURE 46 - BRACKET ATTACHMENTS

MIL-C-25731A(USAF)

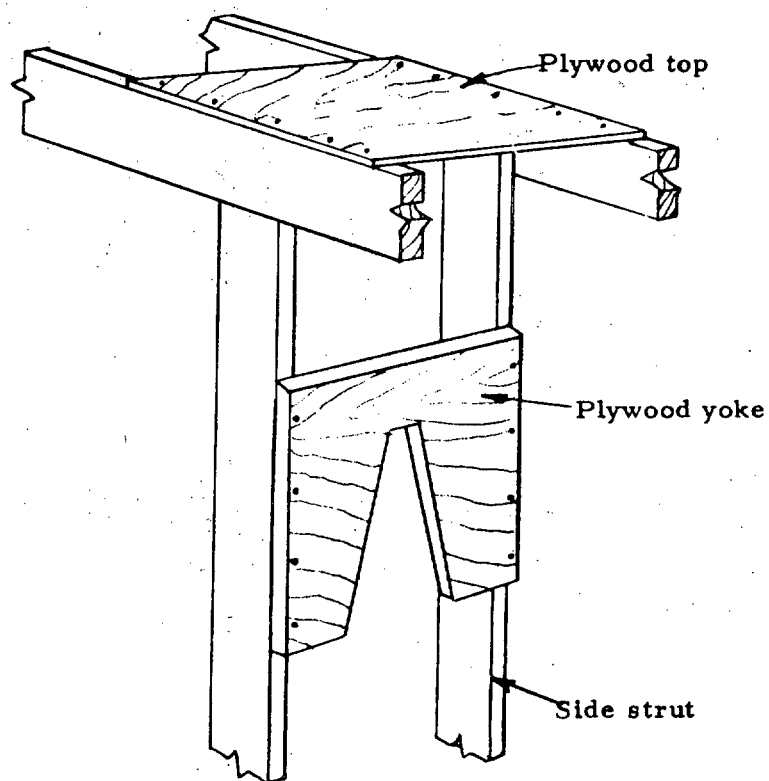
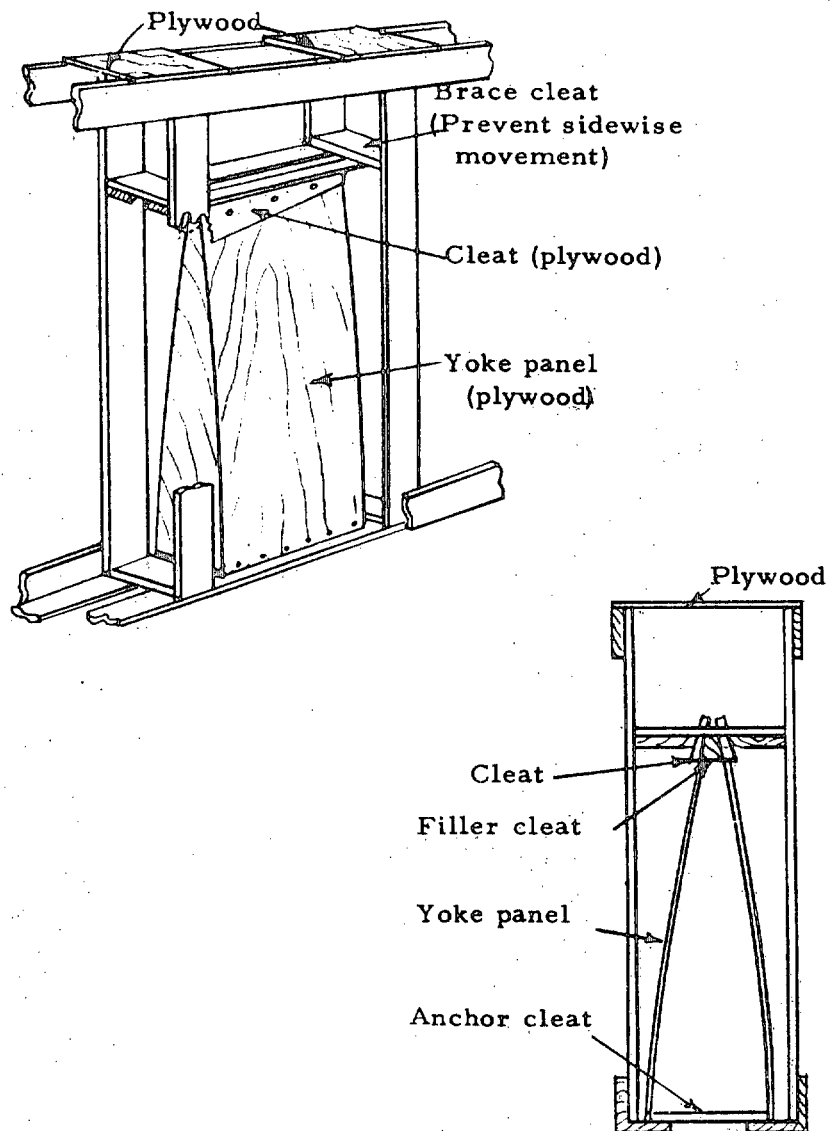
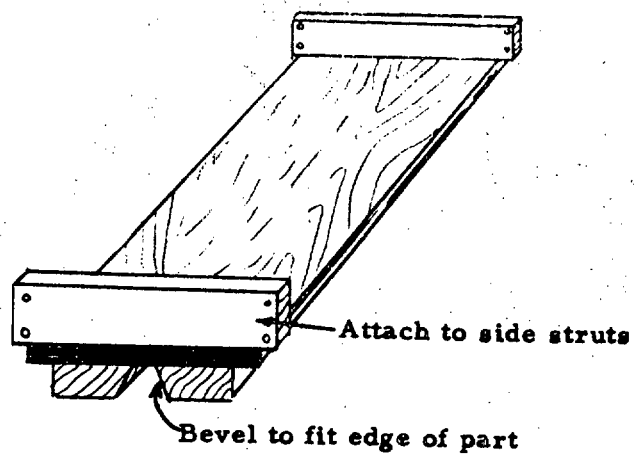


FIGURE 47 - HOLD-DOWN YOKE

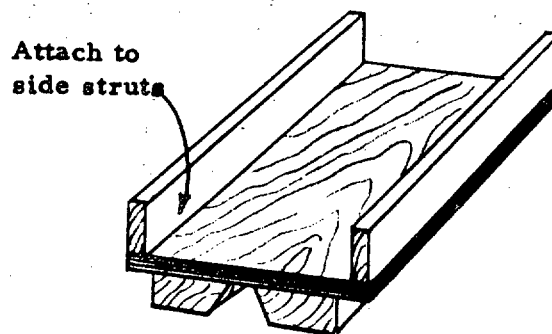
MIL-C-25731A(USAF)

FIGURE 48 - YOKE PANEL

MIL-C-25731A(USAF)



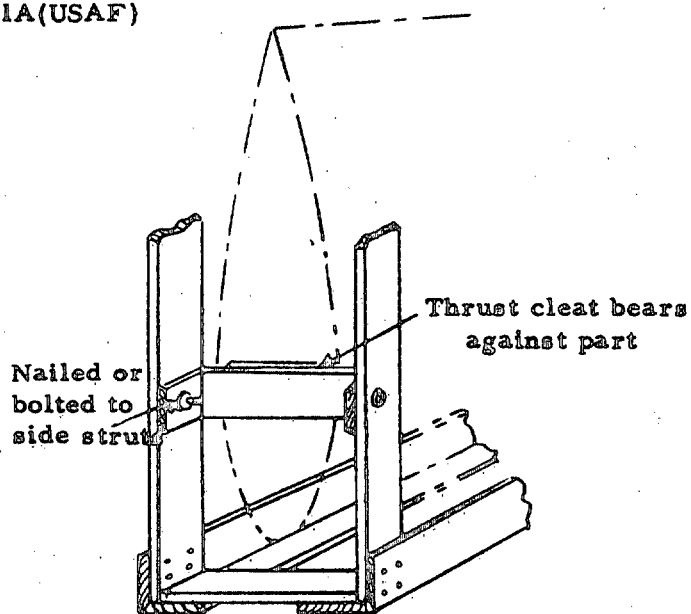
HOLD-DOWN BRACE WITH CROSS CLEATS



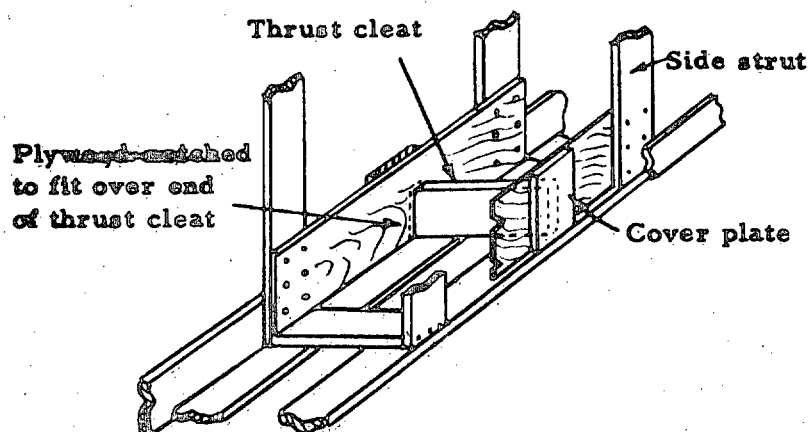
HOLD-DOWN BRACE WITH LONGITUDINAL CLEATS

FIGURE 49 - INVERTED SADDLE, HOLD-DOWN BRACE

MIL-C-25731A(USAF)



END-THRUST CLEAT - ONE AT EACH END OF PART



THRUST CLEAT - FITS INTO SLOT IN LEADING EDGE OF PART

FIGURE 50 - THRUST CLEATS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL*(See Instructions - Reverse Side)*

1. DOCUMENT NUMBER		2. DOCUMENT TITLE					
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION <i>(Mark one)</i>					
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>		<input type="checkbox"/> VENDOR					
		<input type="checkbox"/> USER					
		<input type="checkbox"/> MANUFACTURER					
		<input type="checkbox"/> OTHER <i>(Specify):</i> _____					
5. PROBLEM AREAS							
a. Paragraph Number and Wording:							
				b. Recommended Wording:			
c. Reason/Rationale for Recommendation:							
6. REMARKS							
7a. NAME OF SUBMITTER <i>(Last, First, MI)</i> - Optional		b. WORK TELEPHONE NUMBER <i>(Include Area Code)</i> - Optional					
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code)</i> - Optional		8. DATE OF SUBMISSION <i>(YYMMDD)</i>					

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification 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.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Commander
AF Packaging Evaluation Agency
AFLC (SGTE)
Wright-Patterson AFB, OH 45433

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES