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SUPERSEDING  
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## MILITARY SPECIFICATION

### CRATES, SLOTTED ANGLE, STEEL OR ALUMINUM, FOR LIGHTWEIGHT AIRFRAME COMPONENTS AND BULKY ITEM (FOR MAXIMUM LOADS OF 3000 POUNDS)

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers material and fabrication requirements for two types of reusable metal (slotted angle) crates for air and surface, domestic and overseas shipment of lightweight airframe components and lightweight bulky items.

1.2 Classification. Crates shall be of the following types, styles, and grades as specified: (See 6.2.)

TYPE I	Crate, slotted angle, steel or aluminum, open.
TYPE II	Crate, slotted angle, steel or aluminum, fully enclosed or sheathed with solid material.
STYLE A	Crate, slotted angle, steel or aluminum without skids or rubbing strips.
STYLE B	Crate, slotted angle, steel with skid blocks or skids with rubbing strips and provisions for forklift truck handling.
GRADE 1	Crate for domestic and overseas shipments intended for outside or indeterminate storage.
GRADE 2	Crate for domestic and overseas shipments intended for inside or protected storage.

#### 2. APPLICABLE DOCUMENTS

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

FSC 8145

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SPECIFICATIONSFederal

FF-B-575 Bolts, Hexagon And Square

FF-B-584 Bolts, Finned Neck; Key Head; Machine; Ribbed Neck; Square Neck; Tee Head

FF-N-105 Nails, Brads, Staples And Spikes: Wire, Cut And Wrought

NN-P-530 Plywood, Flat Panel

QQ-S-698 Steel, Sheet And Strip, Low-Carbon

QQ-S-781 Strapping, Steel, Flat And Seals

TT-E-527 Enamel, Alkyd, Lustreless

TT-P-1757 Primer Coating, Zinc Chromate Low Moisture - Sensitivity

TT-W-546 Wood Preservative; Acid Copper Chromate Mixture

TT-W-550 Wood Preservative; Chromated Copper Arsenate Mixture

TT-W-571 Wood Preservation: Treating Practices

UU-T-81 Tags, Shipping And Stock

PPP-F-320 Fiberboard: Corrugated And Solid, Sheet Stock (Container Grade), And Cut Shapes

PPP-V-205 Veneer, Paper Overlaid, Container Grade

Military

MIL-S-21041 Slotted Metal Framing: Angles And Panels

STANDARDSFederal

FED-STD-595 Colors

Military

MIL-STD-105 Sampling Procedures And Tables For Inspection By Attributes

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MIL-STD-129 Marking For Shipment And Storage  
MIL-STD-163 Steel Mill Products Preparation For Shipment  
And Storage  
MIL-STD-649 Aluminum And Magnesium Products Preparation  
For Shipment And Storage  
MIL-STD-731 Quality Of Wood Members For Containers And Pallets  
MS 51922 Nut, Self-Locking, Hexagon - Prevailing Torque,  
General Purpose, 250°F, UNC-2B and UNF-2B

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

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

U.S. DEPARTMENT OF COMMERCE

Products Standard 1

Product Standard 51

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington DC 20402.)

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

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

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC.

National Motor Freight Classification Rules

(Application for copies should be addressed to the American Trucking Association, 1616 P Street, N.W., Washington DC 20036.)

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

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### 3. REQUIREMENTS

3.1 Materials. Materials shall conform to the requirements specified herein.

3.1.1 Slotted Metal Angle. Slotted Metal Angle shall conform to unit A, type 1, 2, 3, 4 or 5 of MIL-S-21041.

3.1.1.1 Surface Finish of Slotted Angle. Steel for Grade 1 crates shall have the surface finish conforming to class 2 of MIL-S-21041 applied. Grade 2 crates shall have a surface finish conforming to class 1 of MIL-S-21041 applied. Aluminum shall require no additional finish.

3.1.2 Bolts and Nuts. Bolts and Nuts used in assembling metal members shall conform to those specified in MIL-S-21041 except that nuts shall conform to MS 51922 with the exception that 5/16 nuts shall be .551 to .564 inches across the flats (width). Bolts and nuts used in wood members (sheathing, blocking, bracing, skids, etc.) shall be zinc coated and conform to FF-B-584 or FF-B-575.

3.1.3 Strapping. Steel strapping used for banding or tension braces shall conform to type I, finish B, of QQ-S-781.

3.1.4 Wood Members. Components such as skids, rubbing strips, filler strips, load bearing members and blocking and bracing shall conform to the applicable structural class of MIL-STD-731, Group II, III or IV woods.

3.1.5 Plywood.

3.1.5.1 Grade 1 crates. Plywood for Grade 1 crates shall conform to PS-51, type I, Grade 3-4 or PS-1, standard with exterior glue.

3.1.5.2 Grade 2 crates. Plywood for Grade 2 crates shall conform to PS-51, type II, Grade 3-4 or PS-1, Standard.

3.1.5.3 Plywood finish. Unless otherwise specified plywood shall be finished unsanded (see 6.2).

3.1.5.4 Plywood defects. Plywoods used for sheathing shall have no defects (knot holes, worm holes, etc) extending through the panel.

3.1.6 Veneer, paper-overlaid. Paper-overlaid veneer used for sheathing shall conform to Type II of PPP-V-205.

3.1.7 Fiberboard. Fiberboard used for sheathing shall conform to PPP-F-320, Type SF, class weather-resistant, grades V2s, V3s, or V4s.

3.1.8 Wood preservative. Wood or plywood components shall be treated in accordance with TT-W-571 with preservatives conforming to either TT-W-546 or TT-W-550.

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3.1.9 Sheet steel. Steel used for marking panels shall conform to QQ-S-698.

### 3.2 Fabrication.

3.2.1 Selection of slotted angle members. Tables I, II, III and IV may be used as a guide for the selection of slotted angle based on size of crate and weight of load.

3.2.2 Splicing of members. Steel or aluminum components should be of continuous lengths. When splicing is necessary, a minimum of four bolts shall be used to secure a lap splice and a minimum of eight bolts shall be used for a butt splice (see figure 1).

#### 3.2.3 Cutting of slotted angle.

3.2.3.1 Lateral, vertical and horizontal members. Cutting of the members should be made at 3/4 inch increments to fully utilize the slot and hole pattern.

3.2.3.2 Diagonal members. Cutting the wide flange of the angle on a miter to provide maximum area of contact and positive bolting locations can be accomplished when cutting of diagonals is required.

3.2.4 Assembly. Slotted metal shall be assembled with bolts of the same diameter for which the slotted metal angle was intended or designed. Bolts and nuts shall be drawn tight and the nuts shall be secured against loosening (see 3.1.2).

3.2.4.1 Diagonal braces. Full diagonal braces shall extend from one corner diagonally across to the other corner of the panel being braced. These braces shall be installed as close as possible to the apex of the angle and secured with a minimum of one bolt in each end. Short or corner braces, when used, shall be placed in each corner and secured at each end with a minimum of one bolt. These braces shall be installed at an angle of 45 degrees or as close to that angle as possible. Placement and securing of braces are illustrated in figures 2. All diagonal braces shall be installed with maximum utilization of the round holes in the metal angle.

3.2.4.2 Steel strapping braces. Full cross "or "X" braces" (see figure 3) of flat steel strapping placed in tension may be used when vertical frame members or other crate members interfere with the placement of diagonal braces or when it is determined that this type of bracing meets minimum bracing requirements. Steel strapping shall be not less than 1-1/4 inches wide by 0.032 inch thick and shall comply with 3.1.3. The bolt holes in the strapping shall be drilled or die punched and shall be no larger than required for the bolt. The bolt hole shall be placed in the center of the strap and shall not be closer to the end than half the width of the strap.

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3.2.4.3 Structural joints. Ends of the horizontal, vertical, and lateral member shall be bolted together to form the corner joints (see figure 4). Intermediate vertical members (struts), horizontal members and intermediate lateral members shall be bolted together to effect the joints as illustrated in figure 1. Additional vertical or horizontal members which are provided for the purpose of using shock and vibration mounts shall be secured by using a minimum of two bolts in the wide flange and one bolt in the narrow flange of the slotted angle. It may be necessary to use short pieces of slotted angle to effect this type of joint (see figure 1 and 5). Forklift truck handling members and load bearing members shall be joined to the lower horizontal member with a minimum of two bolts at each end (see figure 6).

3.3 Type I, style A crate. This crate is of simple fabrication, usually consisting of one panel to each section, requiring minimum bracing and used for light bulky and small items not exceeding 200 pounds. Dimensions of this crate shall not exceed 80 inches in length by 30 inches in width by 48 inches in height, except when specific designs are approved by the procuring activity (see figure 7 and 8).

3.3.1 Sides of crate. Crate sides shall consist of horizontal members (side rails), vertical members and braces.

3.3.1.1 Intermediate vertical members (struts). Intermediate struts shall be evenly and systematically spaced throughout the length of the crate side between the end or corner vertical members (struts). Distance between the vertical members (struts and intermediate struts) shall not exceed  $1\frac{1}{3}$  the height of the crate (see figure 8).

3.3.1.2 Assembly of crate sides. Vertical members (struts), horizontal members (side rails) and braces shall be bolted together using bolts as specified in 3.1.2. The vertical members (struts) shall be uniform in length and bottom within horizontal members (side rails). The metal angle used for the side rails shall be positioned with the wide flange of the angle in a vertical position. When the packed item is to be placed in an upright position and anchored to the crate base, the end and intermediate vertical members (struts) shall be positioned with the wide flange of the angle against the wide flange of the horizontal members (side rails) of the crate. Where greater side strength or special mounting provisions are required along the side of the crate, extra vertical members (struts) may be added.

3.3.2 Crate ends. The crate ends shall consist of slotted angle cross members joining the two crate sides. Additional cross members or intermediate struts to provide mounting or attaching points within the crate for specific items may be added to the crate end as required. The distance between the lateral members (cross members and intermediate struts) shall not exceed  $1\frac{1}{3}$  the width of the crate.

**3.3.3 Crate base.** The base shall consist of flooring, cross members, loadbearing members and braces as necessary. The flooring need not be continuous throughout the base; however, it shall be placed in such locations as will provide protection to the areas of the contained item that is subject to damage by forklift trucks or other material handling equipment. Plywood flooring (except loadbearing floorboards) shall have a minimum thickness of 1/4 inch for crates through 12 inches wide, 3/8 inch for crates over 12 inches wide through 24 inches wide and 3/4 inch for crates over 24 inches wide. Flooring shall be cut to fit snugly in place and securely bolted to the lower side rails of the crate. Each piece of flooring shall be bolted in place with a minimum of two bolts in each lower side rail. The distance between bolts used to secure the flooring to side rails shall not exceed 12 inches. When 3/8 inch or thinner plywood is used for flooring, a nominal 1 inch by 2 inch wood hold down strip shall be used on top of the flooring with the bolts passing through the hold down strip, flooring and side rail. Bolts used for securing floorboards shall not be less than 5/16 inch in diameter. Typical fabrication details of the base structure is illustrated in figure 6.

**3.3.3.1 Loadbearing members.** Loadbearing members shall be located within the crate base to carry the load of the contained item, except when suspension systems are used or when the item load is attached to the side structure. Wood loadbearing members are selected from Table V. Steel loadbearing members are selected from Tables I, II and III (see 6.5).

**3.3.3.2 Cross members.** The minimum strength and quality of the slotted angle cross member for the base shall not be lower than the slotted angle used in the side rails and struts. The maximum distance between base cross members shall not exceed 24 inches. When loadbearing members are used, they shall be considered adequate for cross member requirements and other cross members spaced accordingly.

**3.3.3.3 Braces.** Braces of the same material used as cross members shall be used in the crate base. When 1/3 of the base is floored with 12 inch or wider floor panels, braces will not be required.

**3.3.4 Crate top.** The crate top shall consist of metal angle cross members, cross ties and braces installed between the two crate sides.

**3.3.4.1 Crate top cross members.** Cross members shall be located at the same point along the length of the crate where the struts are located (see figure 1).

**3.3.4.2 Crate top cross ties.** Cross ties are slotted metal angle members positioned at intermediate points between the cross members to reinforce the crate sides and increase the superimposed load capacity and lateral strength of the crate. Distance between the lateral members (cross members and cross ties) of the crate top shall not exceed 1-1/3 the width of the crate. The cross ties shall be bolted to the upper side rails with bolts

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as specified in 3.1.2. The bolting of cross members and cross ties to the side rails and struts is illustrated in figure 1.

3.3.4.3 Assembly of slotted angle crates. Metal components of the crate shall be bolted together as specified in 3.2.4 through 3.2.4.3.

3.3.5 Light crates with short diagonal braces. Crates with dimensions not in excess of 60 inches in length by 30 inches in width by 48 inches in height and with anticipated loads not to exceed 200 pounds, may be braced with short diagonal braces placed in the corners of the areas to be braced. When this type of bracing is used, the suggested pattern is illustrated in figure 2. All other fabrication and material requirements for this crate shall be as specified in 3.3 through 3.3.4.3.

3.4 Type II, style A crate. The metal fabrication requirements for this crate shall be as specified in 3.3 through 3.3.5.

3.4.1 Sheathing. The crate shall be fully enclosed or sheathed with plywood, paper-overlaid veneer, or fiberboard as specified (see 6.2). Crate sheathing shall comply with the requirements of paragraphs 3.1.5 through 3.1.7 as applicable. When plywood of 1/4 inch or heavier is used for sheathing and is bolted directly to the metal angle, diagonal braces may be omitted from the sheathed section. Sheathing shall be fastened to the metal angle with a minimum of two bolts in each edge of the panel. When any dimension of a sheathing panel exceeds 14 inches, three or more bolts shall be used in that edge. The spacing between these bolts shall not exceed 12 inches. Several methods of securing covering and sheathing to the metal angle is illustrated in figure 9.

3.4.1.1 Sheathing for top of crate. Sheathing for the top of the crate may be nailed to wood nailing strips secured to the slotted angle portion of the crate. When this method of sheathing is used, the minimum size of nailing strips shall not be less than nominal 1 by 2 inch wood with the width increased in accordance with the length of nails used. Each nailing strip shall be secured to the slotted angle with a minimum of two bolts, maximum spacing of these bolts shall not exceed 24 inches. Bolts shall conform to FF-B-584. Sheathing shall be nailed to the nailing strips with cement-coated or chemically etched common or box nails conforming to FF-N-105. Minimum size of nail shall be six-penny spaced a maximum of 5 inches apart.

3.4.1.2 Fiberboard sheathing (slipcover). Crates requiring only fiberboard covering for protection to the contained item may be enclosed with a fiberboard slipcover fabricated of material meeting the requirements of FPP-F-320 as stated in 3.1.7 (see figure 10).

3.4.2 Ventilation. Crates completely enclosed or sheathed with plywood or veneer paper overlaid, shall be provided with ventilating holes or slots. These holes or slots shall be located at each end or at ends and sides around the perimeter of the crate and placed immediately below the top frame members of the ends and sides. In crates over 10 feet in

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length, the ventilating holes and slots shall be divided equally between the sides and ends and located as near the midpoint of the ends and sides as practical. Ventilating holes or slots located in the end, sides or both, shall be provided with a baffle or shield placed over the holes or slots on the inside of the crate to prevent water from being blown onto the crate contents. The following chart furnishes required ventilating area for each end or side of the crate:

## PLYWOOD OR VENEER SHEATHED CRATES

VOLUME OF CRATE (CU. FT.)	AREA OF VENTILATING SPACE REQUIRED IN EACH END OR SIDE OF CRATE (SQ. IN.)
0-100	7
101-150	10
151-200	14
201-400	27
401-600	40
601-800	52
801-1000	66
1001-1200	80
Over-1200	100

3.5 Crates not fully sheathed or other special features. Special features (see paragraph 3.8).

3.6 Type I, style B crate. This crate has a skidded base, braced sides, ends and top, loadbearing and attaching members for specific items and provisions for forklift truck and cargo sling handling. Slotted metal angle used in the fabrication of this crate shall be steel and conform to the requirements of 3.1.1 through 3.1.9. The dimensions of this crate shall not exceed 360 inches (30 feet) in length by 48 inches (4 feet) in width by 84 inches (7 feet) in height, except when specific designs are submitted to and approved by the procuring activity. A typical crate of this type and style is illustrated in figure 11.

3.6.1 Side of crate. Crate sides shall consist of horizontal members (side rails), vertical members (struts) and full diagonal braces. When splices are used, they shall be placed in alternate positions within the crate fabrication and in such locations that will not interfere with the placement of other crate members.

3.6.1.1 Intermediate horizontal or longitudinal members. Sides of crates which are in excess of 48 inches high, or when it is determined that extra strength is required to carry the anticipated load, shall be provided with one or more intermediate horizontal members (see 3.2.1). When extra horizontal or longitudinal members are necessary, they shall be evenly or systematically spaced between the upper and lower horizontal members and shall extend the full length of the crate sides (see figure 13).

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3.6.1.2 Intermediate vertical members (struts). Intermediate struts shall be evenly and systematically spaced throughout the length of the crate side between the end or corner vertical members (struts).

3.6.1.2.1 Intermediate struts without intermediate horizontal members. The spacing of intermediate struts for crates with sides not provided with an intermediate horizontal member shall be determined by height and length. Distance between the vertical members (struts and intermediate struts) shall not exceed  $1-1/4$  the height of the crate (see figure 12).

3.6.1.2.2 Intermediate struts with intermediate horizontal members. The spacing of intermediate struts for crates with sides provided with intermediate horizontal members shall be determined by the same method as specified in 3.6.1.2.1 except that the height shall be considered as the distance between two adjacent horizontal members (see figure 13).

3.6.2 Crate end. Crate ends are not assembled panels which may be removed from the crate as such, but consist of upper and lower lateral (cross) members, intermediate cross members if required, and braces which join the two crate sides.

3.6.2.1 Upper and lower lateral (cross) members. The upper and lower cross members are major parts of the crate end joining the sides at the top and bottom of the crate. These cross members shall be installed with the wide flange of the angle in a vertical position.

3.6.2.2 Intermediate lateral (cross) members. Crate ends shall be provided with intermediate cross members when the height of the crate exceeds 48 inches or when the height of the crate exceeds  $1-1/4$  the width of the crate. In either of the above instances, the maximum distance between intermediate cross members and the upper or lower cross member shall not exceed 48 inches. Position of wide flange shall be as specified in 3.6.2.1 (see figure 12).

3.6.2.3 Intermediate vertical members. Intermediate vertical members may be added to the crate ends as necessary to provide for special mounting systems or special blocking and bracing methods.

3.6.2.4 Bracing of ends. Bracing of the crate ends shall be accomplished with slotted angle of the same size used in bracing the crate sides, or tension braces of flat steel strapping may be used when it is determined that tension braces would be more effective. Provisions of 3.2.4.1 and 3.2.4.2 shall apply when installing braces (see figures 2, 3, and 11).

3.6.2.5 Push plates. Crates in excess of 60 inches long, or 18 inches wide, and all crates subject to pushing by forklift trucks or other materials handling equipment shall be equipped with push plates to protect the crates and contents against damage that may be caused by forklift truck handling. Push plates shall be positioned across the lower part of the end panel with lower part of plate flush with top of skids, and shall be bolted to the corner struts with a minimum of two bolts (specified in 3.1.2) in each end of the plate. Push plates may be Group II, III, or

IV wood of MIL-STD-731, or plywood for gross weights (crate and contents) up to 500 pounds. Push plates shall be Group III or IV wood only when the gross weight of the crate exceeds 500 pounds. Push plates shall be a minimum of 1-1/2 inches thick by 7-1/2 inches wide when fabricated from MIL-STD-731 lumber, or a minimum of 3/4 inch thick by 12 inches wide when fabricated from plywood (3.1.5) (see figure 14).

### 3.6.3 Crate top. (see 3.3.4.)

#### 3.6.3.1 Crate top cross members. Comply with 3.3.4.1.

3.6.3.2 Crate top cross ties. Cross ties are slotted metal angle members positioned at intermediate points between the cross members to reinforce the crate sides and increase the superimposed load capacity and lateral strength of the crate. Distance between the lateral members (cross members and cross ties) of the crate top shall not exceed 1-1/4 the width of the crate. The cross ties shall be bolted to the upper side rails with bolts as specified in 3.1.2 (see figure 1).

3.6.3.3 Crate top braces. Braces shall be provided for the top of the crate and located in each space between the cross members and between the cross ties and cross members. These braces shall be full diagonal and installed in accordance with the provisions of 3.2.4.1 and figure 2. Tensions braces may be used in some instances (see 3.2.4.2 and figure 3). Arrangement of braces is illustrated in figures 11 and 12.

3.6.4 Crate base. Base structure of the crate shall consist of cross members and cross ties to fasten the crate sides together at the bottom of the crate with load-bearing members, forklift truck handling members, skid blocks, full skids and flooring as required.

3.6.4.1 Skids and rubbing strips. Minimum dimensions of rubbing strips shall be 2-7/8 inches thick by 3-1/2 inches wide by 16 inches long, and the strips shall be beveled 45 + 5 degrees on bottom half on each end. Rubbing strips located at the end of the crate shall be set back 2-1/2 to 4 inches from the crate end to permit the use of slings. The center of balance of the loaded crate shall also be a determining factor in locating intermediate rubbing strips to provide openings for forklift truck entry. Maximum spacing between rubbing strips shall not exceed 48 inches. When the contained (net) load exceeds 500 pounds, full length skids shall be used. (Full length skids may be used for lesser contained weight, but are not mandatory). Unless otherwise specified (see 6.2) when full length skids are used, they shall have minimum nominal dimensions of 2 inches by 4 inches for contained (net) loads up to 1000 pounds, and minimum nominal dimensions of 4 inches for contained loads exceeding 1000 pounds. All full length skids shall be provided with minimum 2-7/8 inch by 3-1/2 inch rubbing strips. Skids and rubbing strips shall be bolted to the lower side rails of the crate with minimum 5/16 inch diameter bolts specified in 3.1.2 (see figures 6 and 11) with spacing between these bolts not to exceed 24 inches except that 12 inch bolt spacing shall be used for rubbing strips where 24 inch spacing cannot be accomplished in a single piece.

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3.6.4.2 Load-bearing members. Load-bearing members shall be wood, plywood, metal or a combination of wood and metal placed in a crosswise position to the crate length and bolted to the lower side rail with bolts as specified in 3.1.2. When wood is used for load-bearing members, the size and thickness shall be determined by Table V. When metal angle is used for load-bearing members, the size shall be determined by Tables I, II, III, and IV (see 6.5).

3.6.4.3 Flooring for crate base. Flooring shall comply with 3.3.3 except that plywood flooring shall have a minimum thickness of 3/8 inch for crates up to 12 inches wide, 1/2 inch for crates 12 to 24 inches wide, and 3/4 inch for crates over 24 inches wide. Wood flooring (except load-bearing, see 3.6.4.2) shall have a minimum thickness of 3/4 inch.

3.6.4.4 Forklift truck handling members. Crates shall be provided with forklift truck handling members positioned crosswise to the crate at a distance of 24 inches from each end. Crates which have a width in excess of 36 inches shall be equipped with forklift truck handling members positioned at the location provided for side entry of forklifts. These members shall be in addition to the ones located 24 inches from the end when the length of the crate exceeds eight feet. The size of the forklift truck handling member shall be determined by strength required and the use of Table I (see 6.5) or V.

3.6.4.4.1 Load-bearing members used as handling members. Load-bearing members may be utilized as forklift truck handling members if suitably located. All forklift truck handling members shall be bolted to the lower side rails with bolts as specified in 3.1.2.

3.6.4.5 Cross members. When the distance between load-bearing members exceeds the width of the crate and the flooring is less than 3/4 inch thick, intermediate cross ties shall be installed in the base. Cross members, cross ties and load-bearing members shall be bolted to both flanges of the lower horizontal member where possible.

3.7 Type II, style B crate (see Table VI). The metal fabrication requirements for this crate shall be as specified in 3.6 through 3.6.4.5.

3.7.1 Sheathing. Complete sheathing is required, and shall be accomplished in accordance with 3.4.1 through 3.4.1.2.

3.7.2 Ventilation. Ventilation requirements shall be as specified in 3.4.2.

3.8 Special features. Crates covered by this specification may be procured with special features not described herein. Special features may be partial sheathing, special panels, special cradles and contours, special blocking and bracing requirements, shock and vibration isolation systems,

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etc. Requirements for special features shall be fully stated in the contract or order including descriptive and detailed drawings for cradles, contours, and blocking. Complete information including spring rate, deflection, etc, on shock and vibration isolation systems shall also be furnished with the contract or order. Special features proposed by the contractor for shipments to or for the government shall be approved by the procuring activity (see 6.2).

3.9 Panel for marking. Panels required for placement of markings on Type I crates shall be of 1/4 inch thick plywood of the quality specified in 3.1.5, or .047 thick plate as specified in 3.1.9 and shall be painted with one coat of primer conforming to TT-P-1757 and two coats of TT-E-527, color #37886 of Federal Standard Number 595 and shall be bolted to the crate members, in the appropriate place, with bolts meeting the requirements of 3.1.2.

3.9.1 Marking panel sizes. When crates are used by contractors furnishing material to the government, the size of the marking panel will be determined by the contractor in accordance with the amount of marking required. When crates are procured by the government, the size of the marking panels will be specified in the contract or order (see 6.2).

3.10 Workmanship. The crates shall be uniformly constructed and free from all imperfections which might impair their strength or usefulness. The crates shall also be free of all sharp corners, rough spots, etc, which might be injurious to personnel or property.

#### 4. QUALITY ASSURANCE PROVISIONS

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 in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.4 Inspection. Inspection shall be continuous throughout the entire process of manufacturing. The passing of any detail of construction or material shall not relieve the contractor of responsibility of faulty workmanship or material which may be recognized at any time prior to final acceptance.

#### 4.2 Sampling.

4.2.1 Sampling for inspection. Samples shall be randomly selected from assembled crates, crate parts or components for inspection by using level

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1 of MIL-STD-105. The acceptable quality level (AQL) shall be 25 defects per 100 units.

#### 4.3 Examination of samples.

4.3.1 Selected samples. Samples selected (see 4.2.1) shall be examined and assembled to verify conformance with all the requirements of this specification. The sample set of parts and components selected shall be assembled as far as necessary to demonstrate that the parts can be assembled which will conform to this specification. If any defect or error is found, all of the parts and components shall be examined for that error (see 4.3.2).

#### 4.3.2 Examination of the end stem for materials and construction.

<u>EXAMINE</u>	<u>DEFECT</u>	<u>MAJOR</u>	<u>MINOR</u>
Quality and workmanship of fastening devices (bolts, screws).	Wrong size or type or spacing greater than specified.	101	
	Nuts not drawn tight.	102	
Construction and workmanship of fabricated wood and metal components.	Width of flooring boards not even, or board ends not square, by more than 1/8 inch.		201
	Frame members not fitted properly, such as struts or diagonals cut too short.	103	
	Splice joints not tightly bolted or not enough lap. (see figure 1)	104	
Construction and workmanship of assembled crate components.	Not rigidly assembled, visibly out of square or fastening devices improperly applied.	105	
	Any component under size.	106	

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<u>EXAMINE</u>	<u>DEFECT</u>	<u>MAJOR</u>	<u>MINOR</u>
	Framing members and skids improperly spaced or omitted when required.	107	
	Type, style, or grade not as specified.	108	
	Ventilation requirements less than required by volume of crate.	109	
	Improper spacing of floor members.		202
	Inadequate clearance for the item. (Ref. contract or order.)	110	
Preparation for delivery.	Crate or crate components not packaged and packed as specified (see 5.2).	111	

#### 4.4 Test procedures.

4.4.1 Testing. Measuring instruments shall be used in determining sizes and dimensions of the crates or parts and components of unassembled samples. Testing of samples required to construct the crate shall be performed by the supplier (see 4.1).

#### 5. PREPARATION FOR DELIVERY

5.1 Disassembly. Disassembly shall be accomplished to reduce cubage. Bolts, nuts, washers and pins shall be placed in the mating parts and secured to prevent their loss.

5.1.1 Match marking. When necessary to facilitate reassembly, parts removed shall have match marking identification on cloth shipping tags conforming to UU-T-81, type A, attached to the mating parts. The tags shall be waterproofed in accordance with MIL-STD-129.

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5.2 Packaging and Packing. Packaging and packing shall be level A or C as specified (see 6.2).

5.2.1 Level A. Crate components shall be packaged and packed in accordance with MIL-STD-163 or MIL-STD-649 as applicable.

5.2.2 Level C. Crate components shall be packaged and packed in such a manner as to insure arrival at destination in a serviceable condition and be acceptable to the carrier at lowest rates. Containers shall comply with Uniform Freight Classification Rules or National Motor Freight Classification Rules. The supplier's commercial practice may be used when it meets the requirements of this level.

5.3 Marking. In addition to any assembly or special marking specified in the contract or order, shipments of crates shall be marked in accordance with MIL-STD-129.

## 6. NOTES

6.1 Intended use. Crates covered in this specification are suitable for packing lightweight bulky airframe components and other lightweight bulky items. These crates are suitable for overseas and domestic air and surface shipments. These crates are suitable for items requiring rigid blocking and bracing assemblies such as support panels, cushioned saddles, solid and slat cradles, specially designed brackets, yoke panel assemblies, etc. These crates are also readily adaptable to shock mount suspension systems or other types of suspension systems which may be attached to the side and end members of the crate or special members provided for that purpose. Also, the crates are intended for packing repairable, returnable items where a desirable lightweight reusable container is specified.

6.2 Ordering data. Procurement documents should specify the following:

- a. Type sheathing required (see 3.4.1).
- b. Type, style and grade of crate, including inside dimensions.
- c. Whether sanded plywood is required (see 3.1.5.3).
- d. Level of packaging and packing required (see 5.2).
- e. Special features (see 3.8).
- f. Marking panel size (see 3.9.1).
- g. Whether full length skids are required (see 3.6.4.1).

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6.3 Fabrication aids. Prefabrication of crate panels may be simplified by using a panel for a jig. This type of jig may be set up by prefabricating a panel of the desired size and setting up enough guide pins throughout the panel to hold the pieces of metal angle required for another panel in proper alignment. A suggested jig and detail dimensions for the guide pins are illustrated in figures 15 and 16.

6.4 Shock mounting. Figure 5 illustrates several suggestions for the use of shock mounts. The shock mount systems shall be designed to meet the requirements for each item or piece of equipment to be packed.

6.5 The values in Tables I, II, III, and IV will be used for metal slotted angle with flange tolerances that are plus or minus 1/8 of an inch of the flange sizes as stated in the tables.

## CUSTODIANS:

Air Force - 69

Navy - SA

Army - GL

## PREPARING ACTIVITY:

Air Force - 69

PROJECT NUMBER: 8115-0265

## REVIEWER:

Air Force - 70, 71, 80, 82, 84

Navy - YD

Army - AV, SM, ME

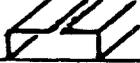
## USER:

Navy - OS

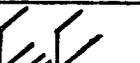
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TABLE I

## SLOTTED ANGLE (STEEL) 12 GAUGE (.104) 1-1/2" X 3"

		(Length of Beam in Feet - Load in Pounds)				
		2'	3'	4'	5'	6'
Recommended Load		1450	980	740	500	350
Recommended Load		4500	3100	2100	1200	1000
Recommended Load		10400	7500	5300	4350	3500
Recommended Load		1550	1000	760	580	490

## SLOTTED ANGLE (STEEL) 14 GAUGE 1-1/2" X 2-1/4"

		(Length of Beam in Feet - Load in Pounds)				
		2'	3'	4'	5'	6'
Recommended Load		1260	850	610	400	200
Recommended Load		2400	1700	1150	820	625
Recommended Load		5190	3350	2700	2100	1700
Recommended Load		800	510	390	300	250

## SLOTTED ANGLE (STEEL) 14 GAUGE 1-1/2" X 1-1/2"

		(Length of Beam in Feet - Load in Pounds)			
		3'	4'	5'	6'
Recommended Load		495	270	190	145
Recommended Load		590	395	297	190
Recommended Load		1335	1035	693	540

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TABLE II

SLOTTED ANGLE (STEEL) 14 GAUGE (.074) 1-1/2" X 1-1/2"  
VERTICAL SUPPORTING SECTIONS

(Length of Column in Feet - Load in Pounds)

		3'	4'	5'	6'
Recommended Load		1480	1180	940	742
Recommended Load		3830	3475	2970	2475
Recommended Load		3900	3565	3170	2620

SLOTTED ANGLE (STEEL) 14 GAUGE (.074) 1-1/2" X 2-1/4"  
VERTICAL SUPPORTING SECTIONS

(Length of Column in Feet - Load in Pounds)

		3'	4'	5'	6'	7'
Recommended Load		2490	1850	1530	1280	940
Recommended Load		5500	5000	4350	3800	3350
Recommended Load		5600	5390	5000	4480	4150

SLOTTED ANGLE (STEEL) 12 GAUGE (.104) 1-1/2" X 3"  
VERTICAL SUPPORTING SECTIONS

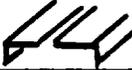
(Length of Column in Feet - Load in Pounds)

		3'	4'	5'	6'	7'
Recommended Load		3450	2870	2360	1670	1150
Recommended Load		7960	7040	6240	5400	4500
Recommended Load		8900	7940	6700	5800	4650

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TABLE III

## SLOTTED ANGLE (ALUM) 13 GAUGE (.089) 1-1/2" X 2-1/4"

		(Length of Beam in Feet - Load in Pounds)			
		3'	4'	5'	6'
Recommended Load		450	350	260	180
Recommended Load		950	600	*400	*350
Recommended Load		2200	1600	1240	940
Recommended Load					

\*On spans of this length, cross bracing gives a better structure, higher recommended load.

SLOTTED ANGLE (ALUM) 13 GAUGE 1-1/2" X 2-1/4"  
VERTICAL SUPPORTING SECTIONS

		(Length of Column in Feet - Load in Pounds)				
		3'	4'	5'	6'	7'
Recommended Load		1000	900	700	600	
Recommended Load		3100	2730	2430	2170	1750
Recommended Load		3500	3100	2700	2400	2100



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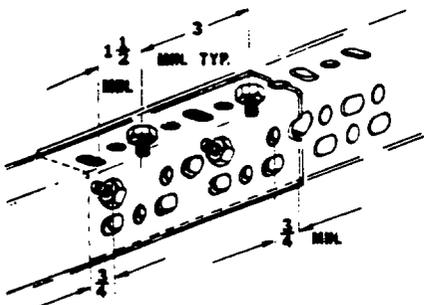
TABLE V

ALLOWABLE LOAD PER INCH OF  
FLOORBOARD WIDTH FOR GROUPS  
II, III, AND IV WOODS

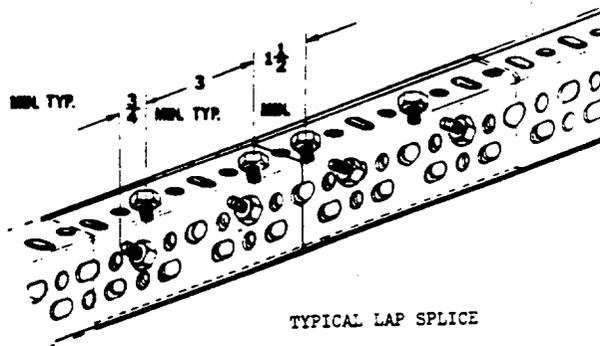
LENGTH BETWEEN OUTSIDE SKIDS	THICKNESS OF FLOORBOARDS (INCHES)			
	3/4	1-1/2	2-1/2	3-1/2
INCHES	POUNDS	POUNDS	POUNDS	POUNDS
12	48	220	574	1,095
18	32	147	382	731
24	24	110	287	548
30	19	88	229	438
36	16	73	192	365
42	14	63	164	313
47	12	55	144	274
60	9	44	115	219
72	8	37	96	182

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

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TYPICAL LAP SPLICE



TYPICAL LAP SPLICE

### JOINING OF MEMBERS

TYPICAL METHOD OF ATTACHING VERTICAL SIDE MEMBERS, CROSS MEMBERS & CROSS TIE MEMBERS TO SIDE RAILS OF CRATE.

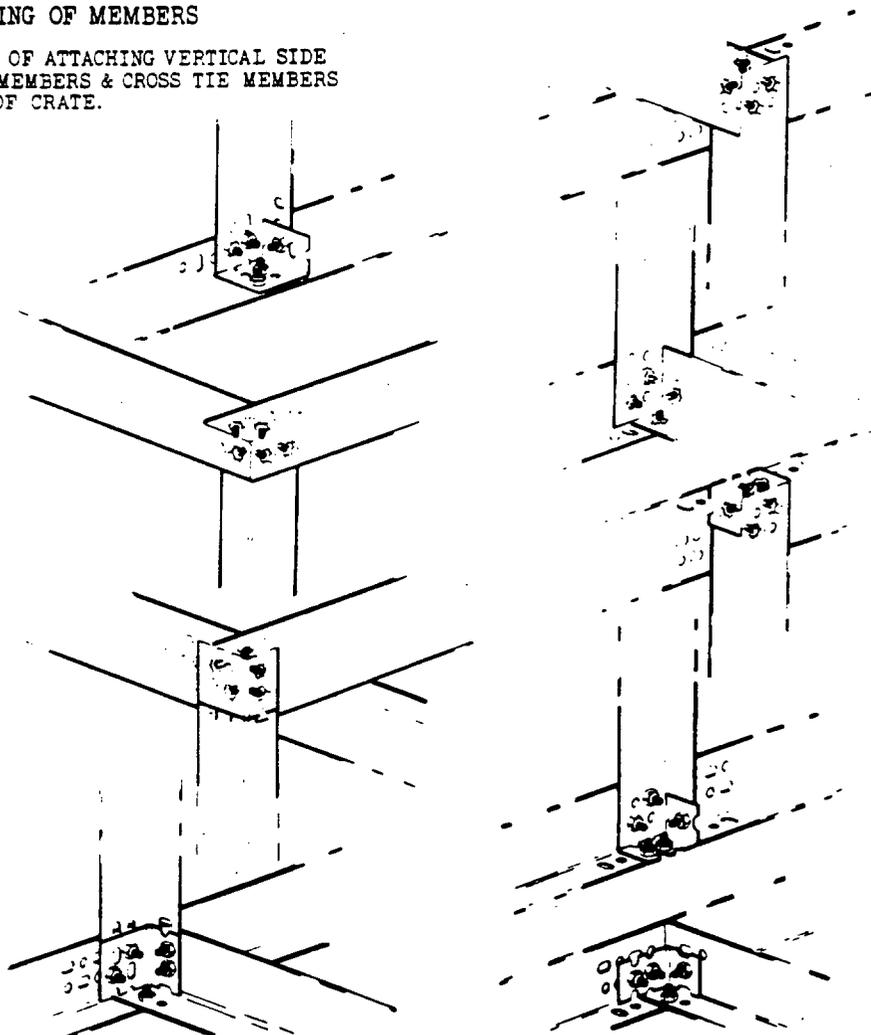
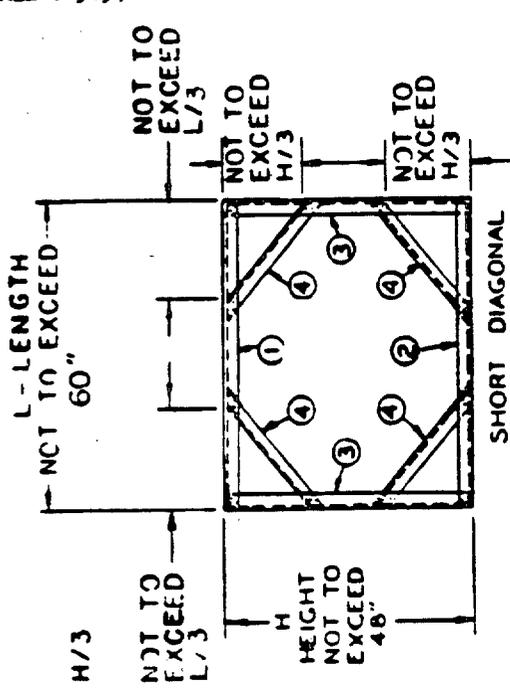
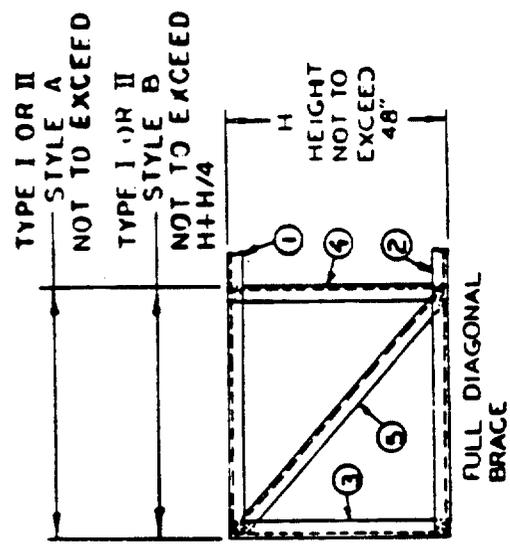


FIGURE 1

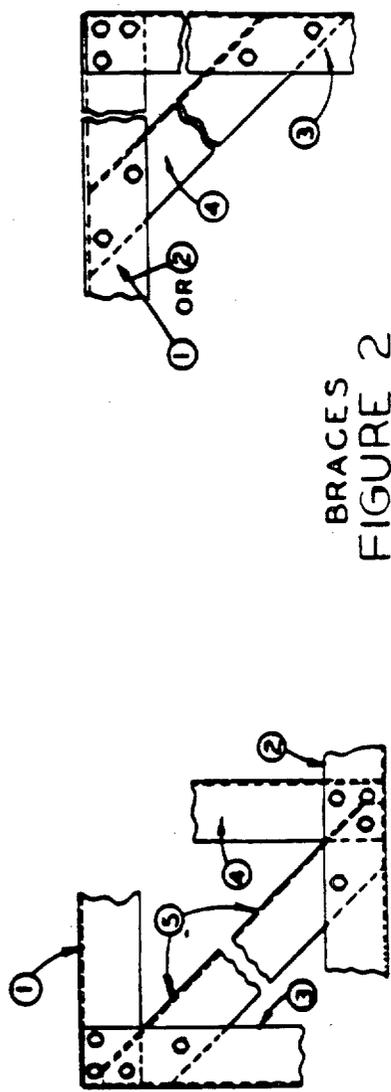
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- 1 - UPPER OR LOWER HORIZONTAL MEMBERS
- 2 - CORNER OR END VERTICAL MEMBERS
- 3 - SHORT DIAGONAL BRACE



- 1 - UPPER HORIZONTAL MEMBER
- 2 - LOWER HORIZONTAL MEMBER
- 3 - CORNER VERTICAL MEMBER
- 4 - INTERMEDIATE VERTICAL MEMBER
- 5 - DIAGONAL BRACE



BRACES  
FIGURE 2

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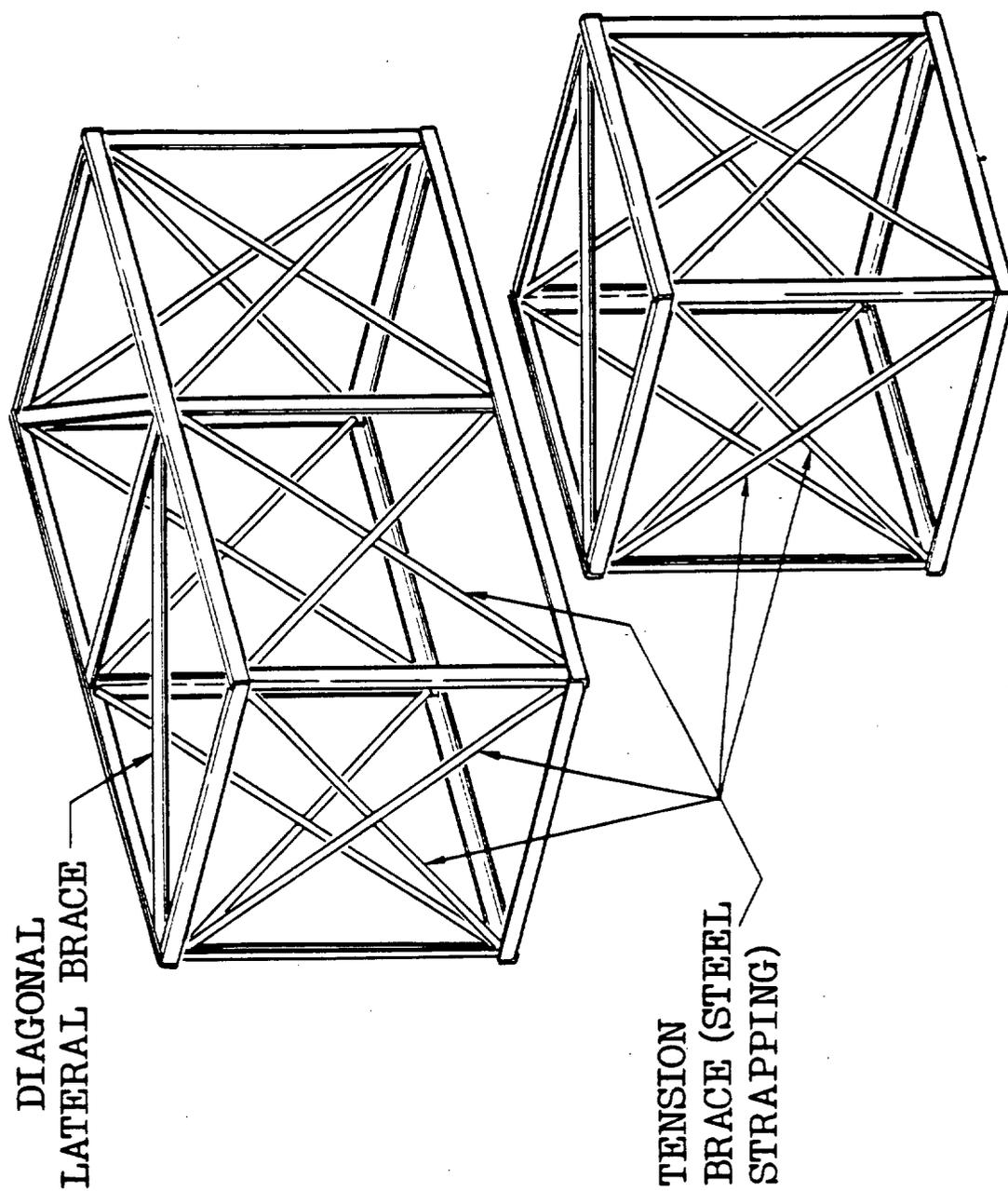


FIGURE 3

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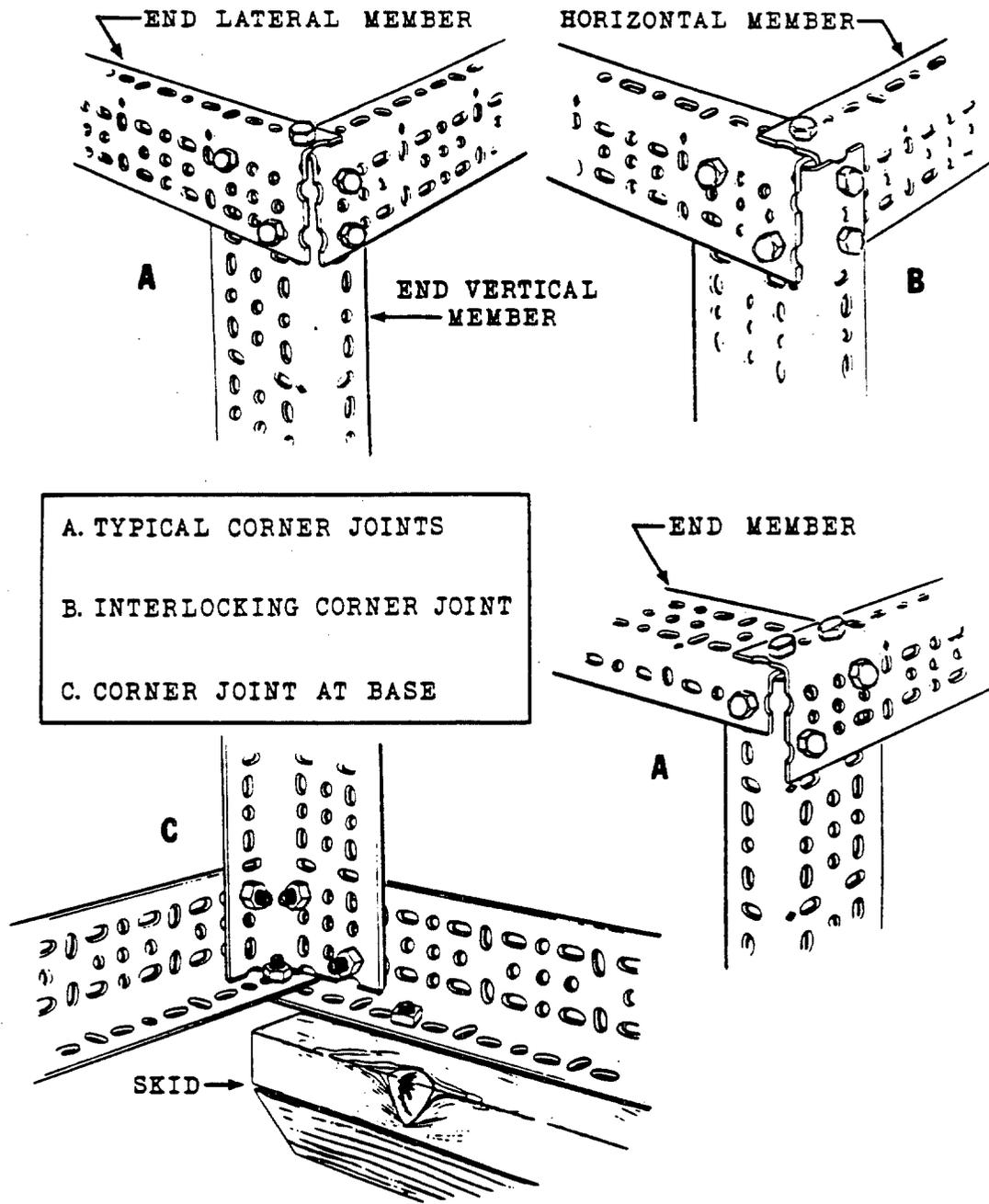


FIGURE 4

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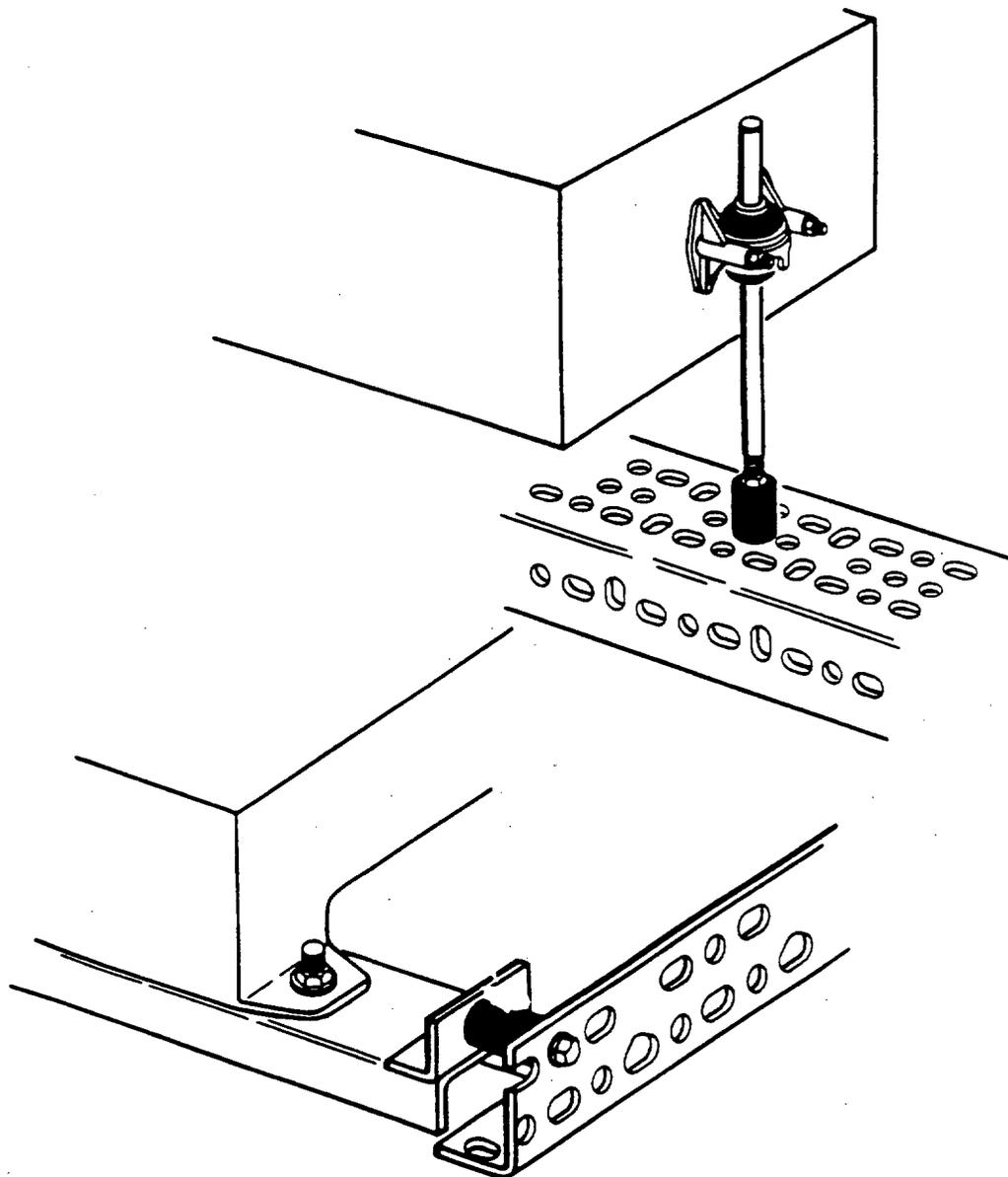


FIGURE 5

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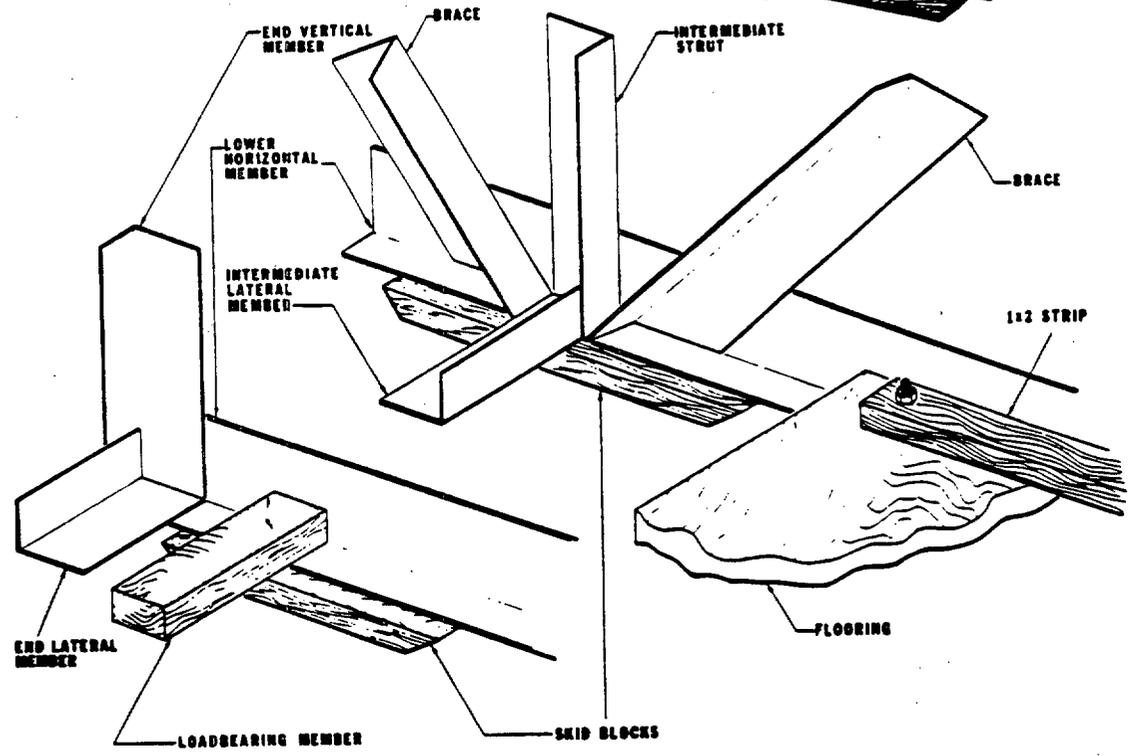
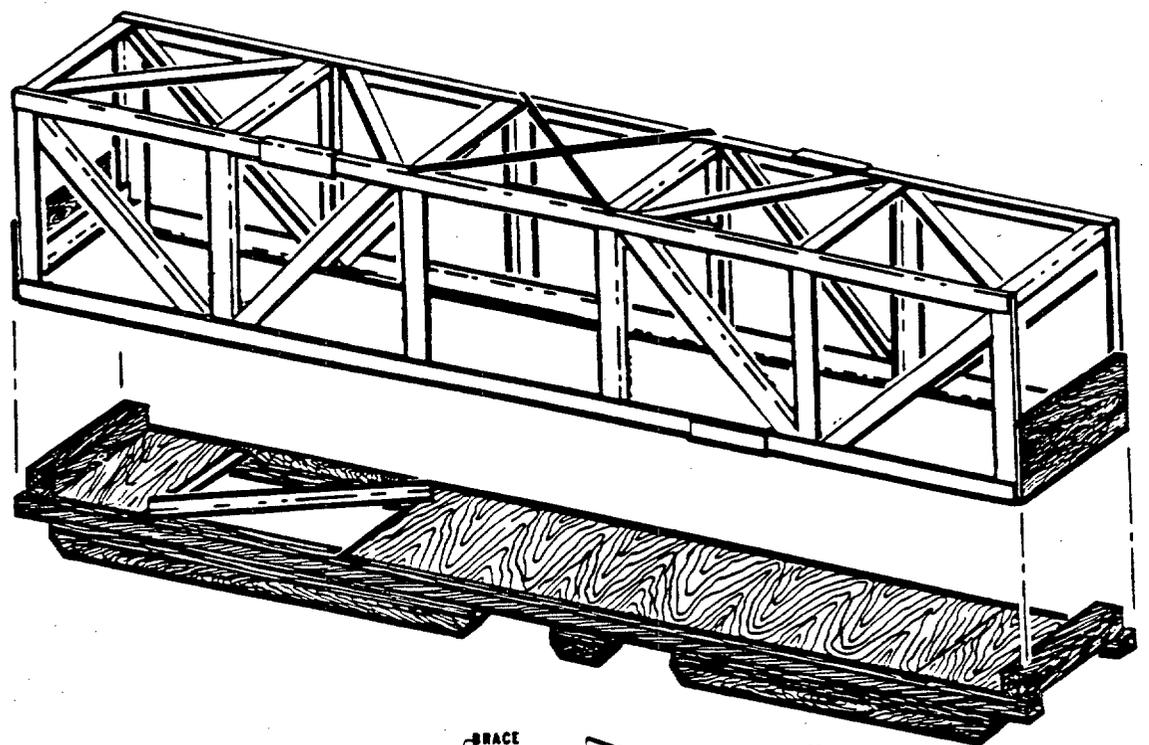
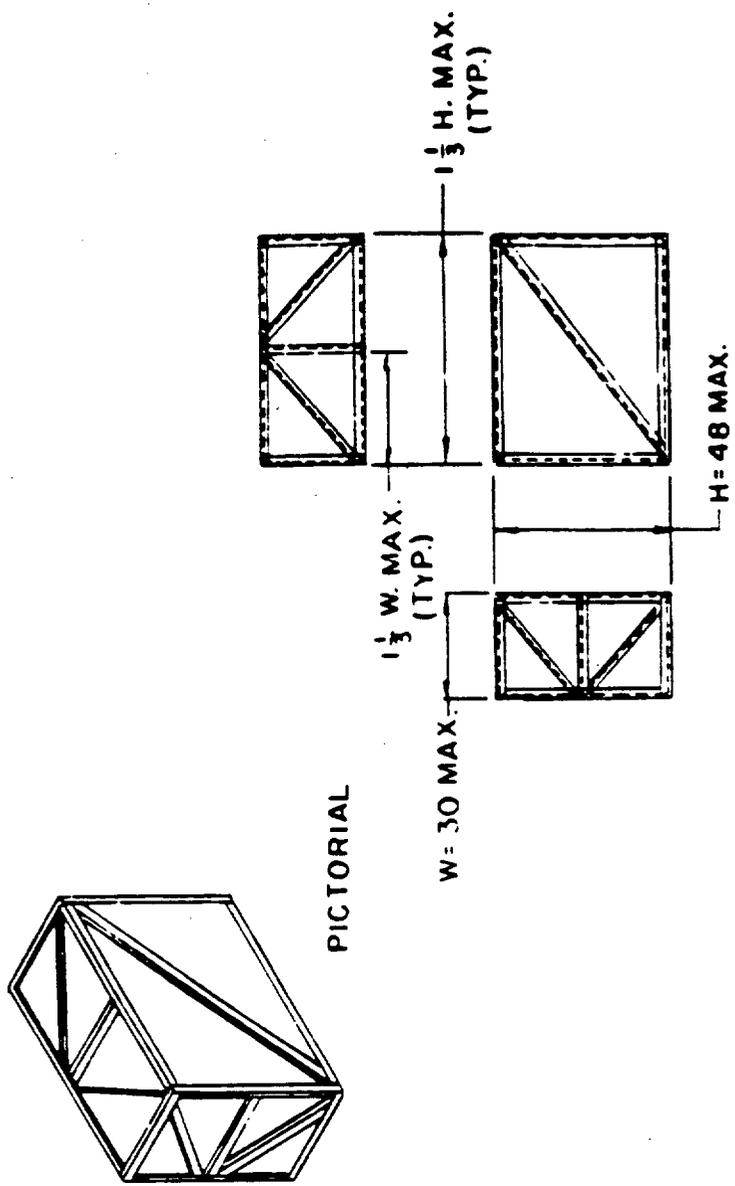


FIGURE 6

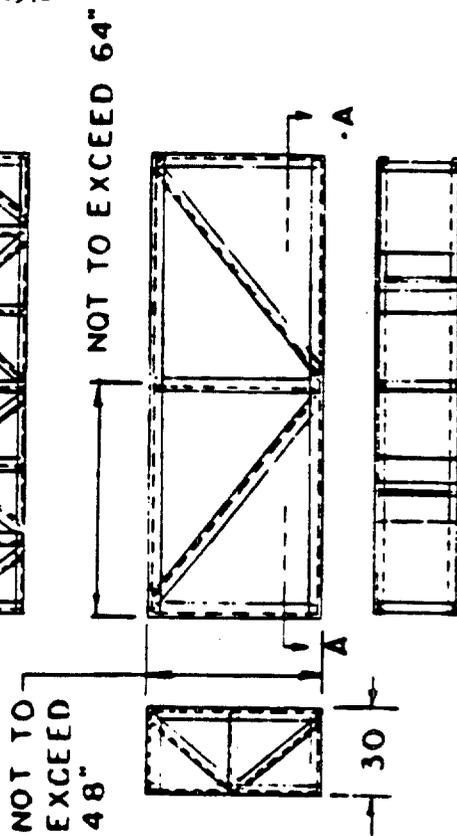
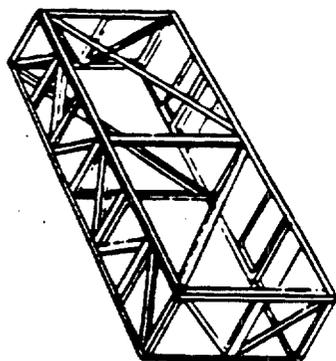


PICTORIAL

TYPE J, STYLE A, CRATE - PANEL SIDE

FIGURE - 7

MIL-C-9897B

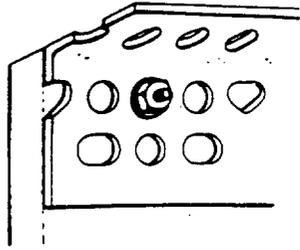


SECTION A-A

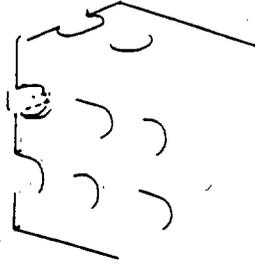
TYPE I, STYLE A, CRATE - 2 PANEL SIDE

FIGURE 8

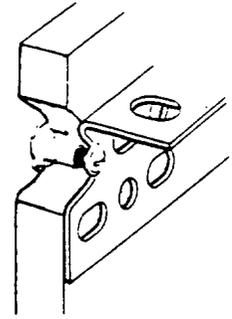
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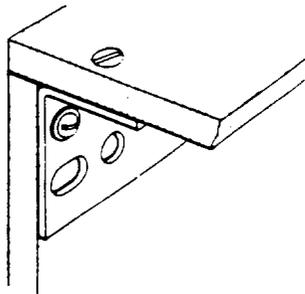
1. STOVE BOLT



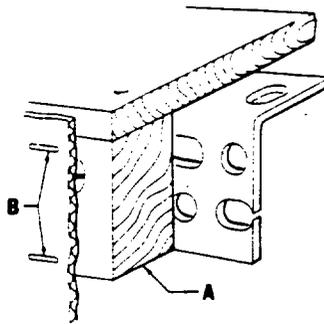
2. SPEED NUT



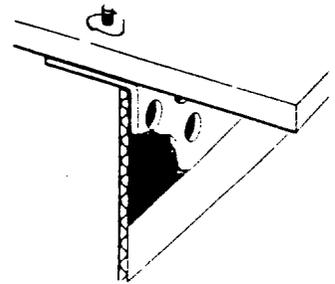
3. BARREL PRONG  
OR "TEE" NUT



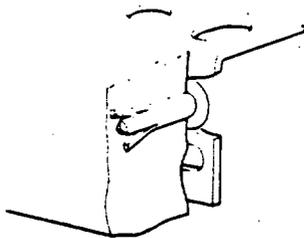
4. WOOD SCREW, SPEED NUT  
HOLDING THE TOP



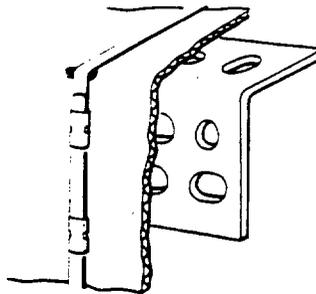
5. NAILING STRIP - A  
STAPLES - B



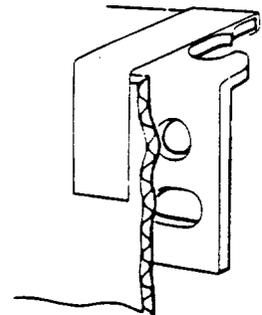
6. ADHESIVES, "TEE" NUT  
HOLDING THE TOP



7. DRIVE RIVET, SELF  
EXPANDING



8. STRAP



9. TAPE

FIGURE 9

MIL-C-9897B

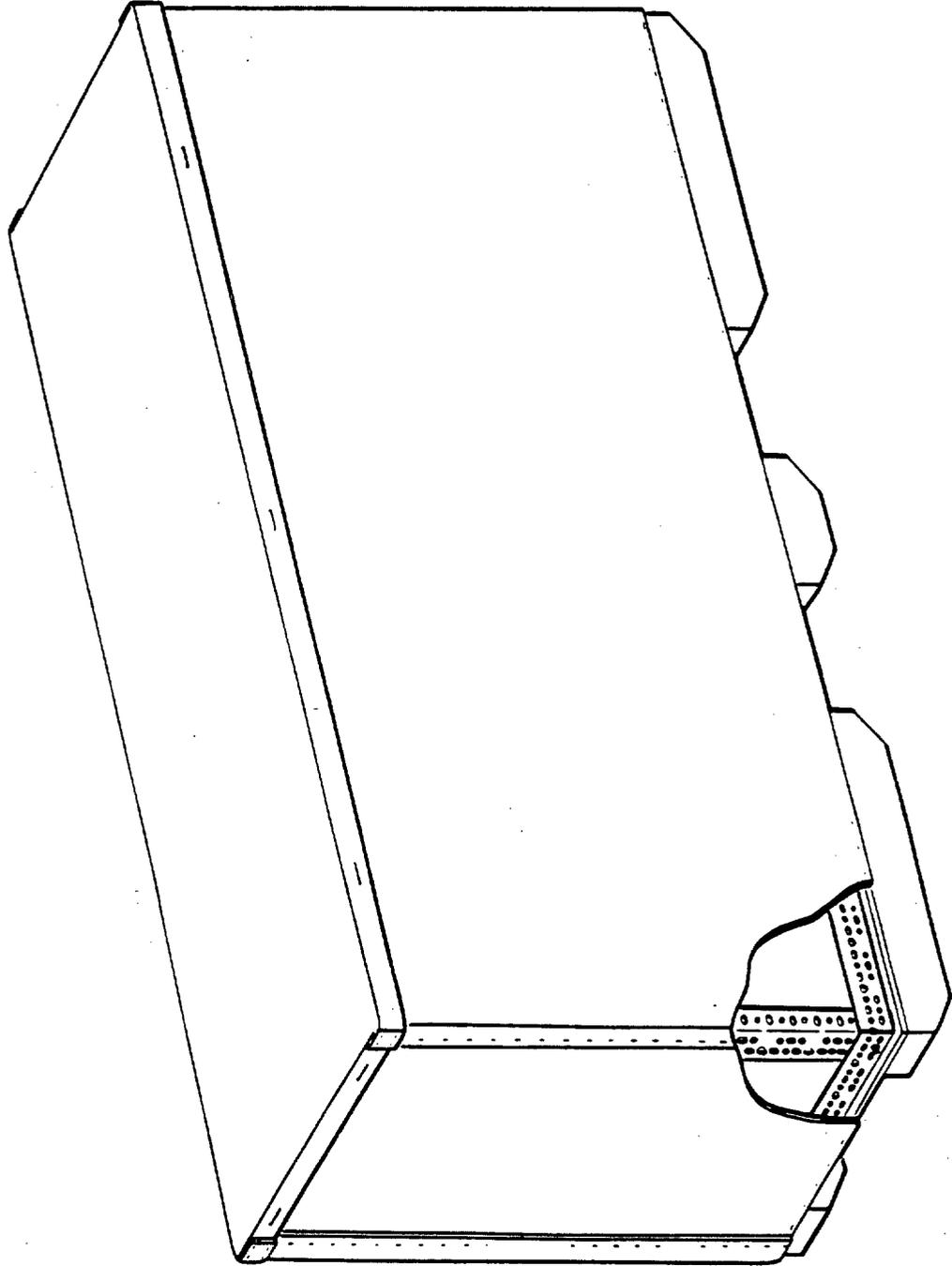
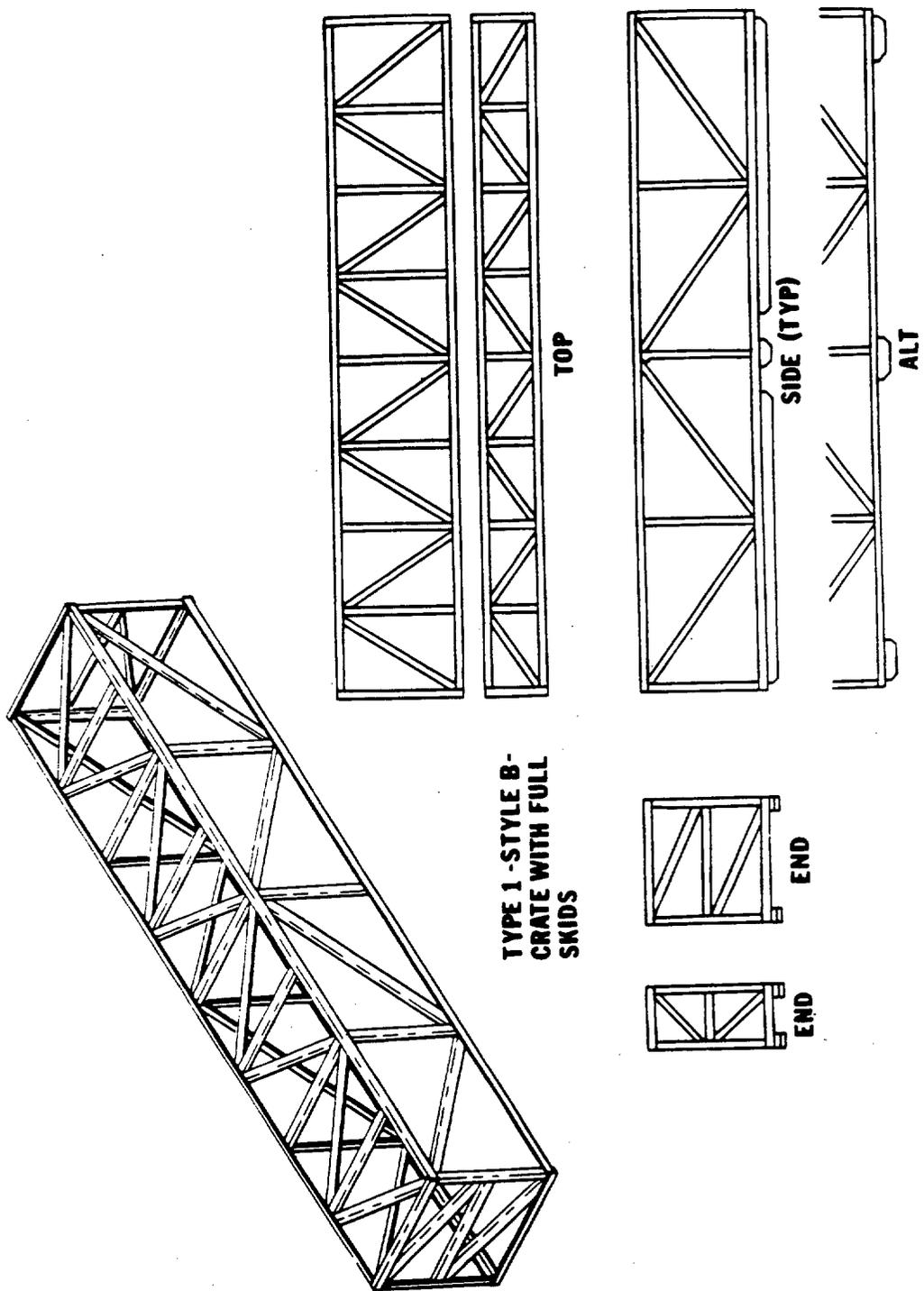


FIGURE 10

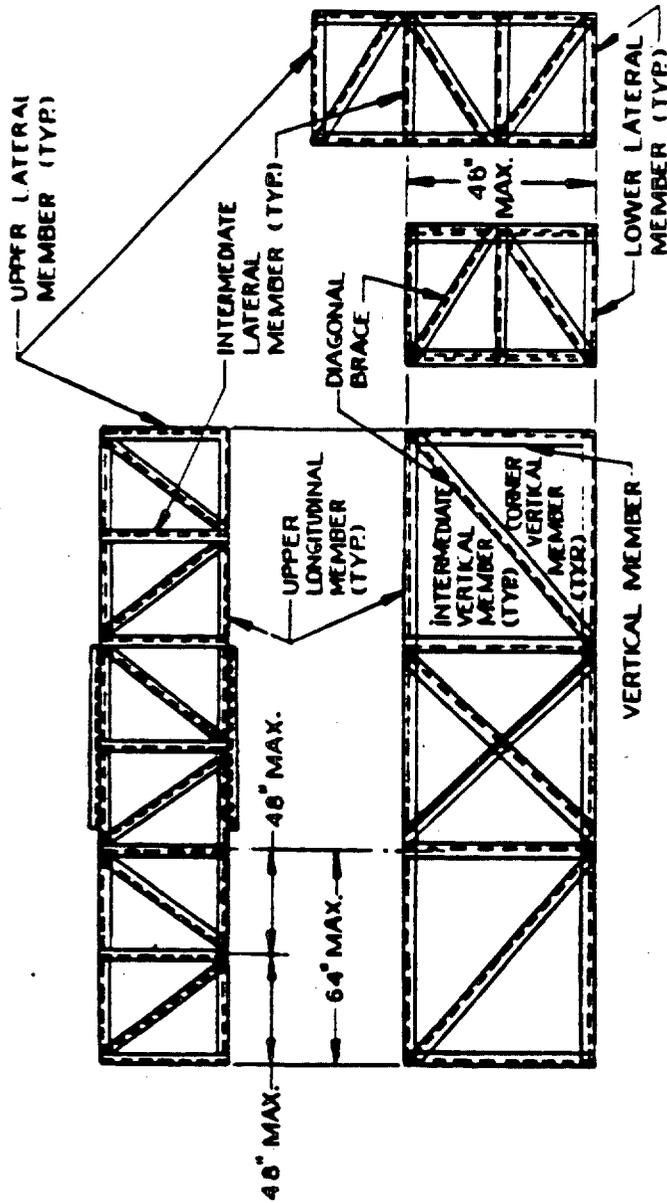
MIL-C-9897B



**TYPE 1-STYLE B-  
CRATE WITH FULL  
SKIDS**

**FIGURE 11**

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SPACING OF CROSSMEMBERS  
AND INTERMEDIATE LATERAL MEMBERS

FIGURE 12

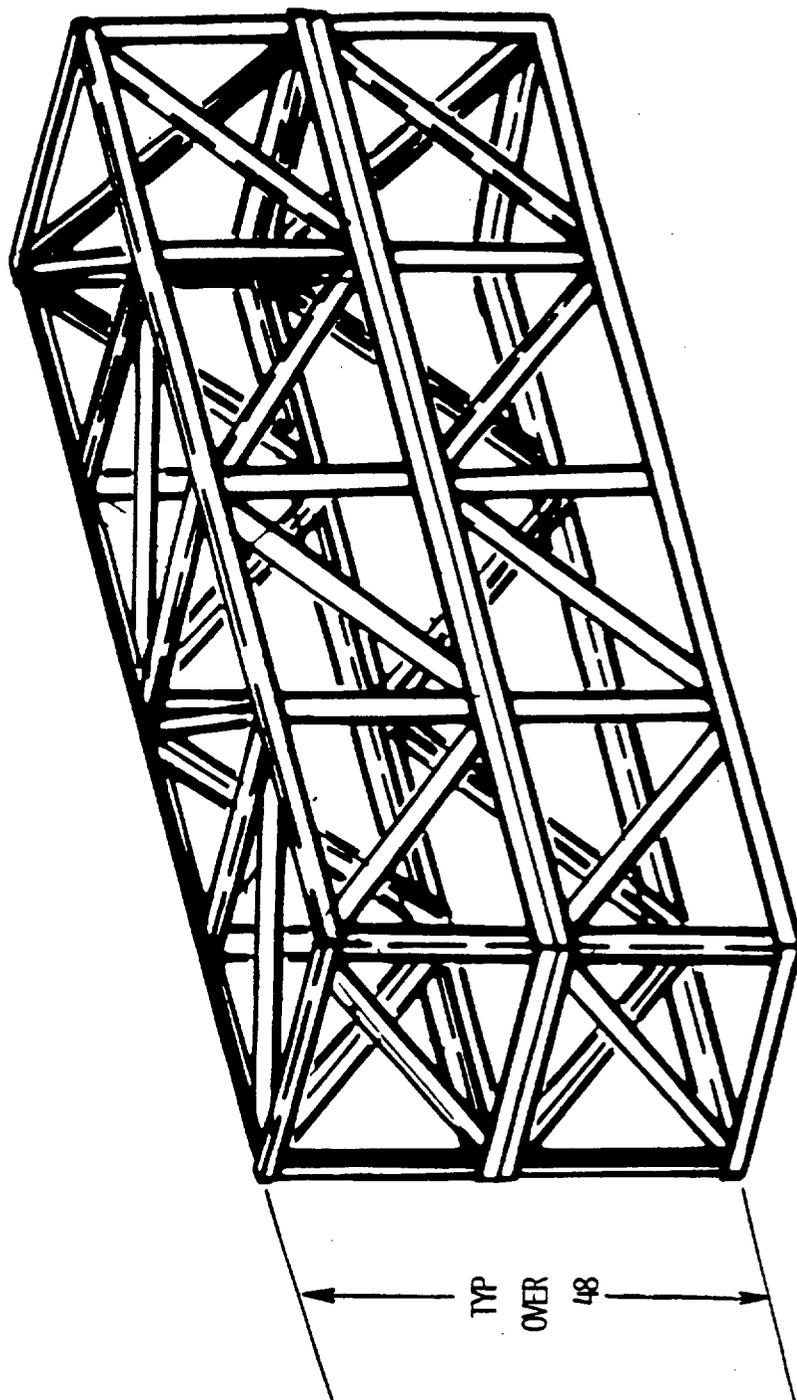


FIGURE 13

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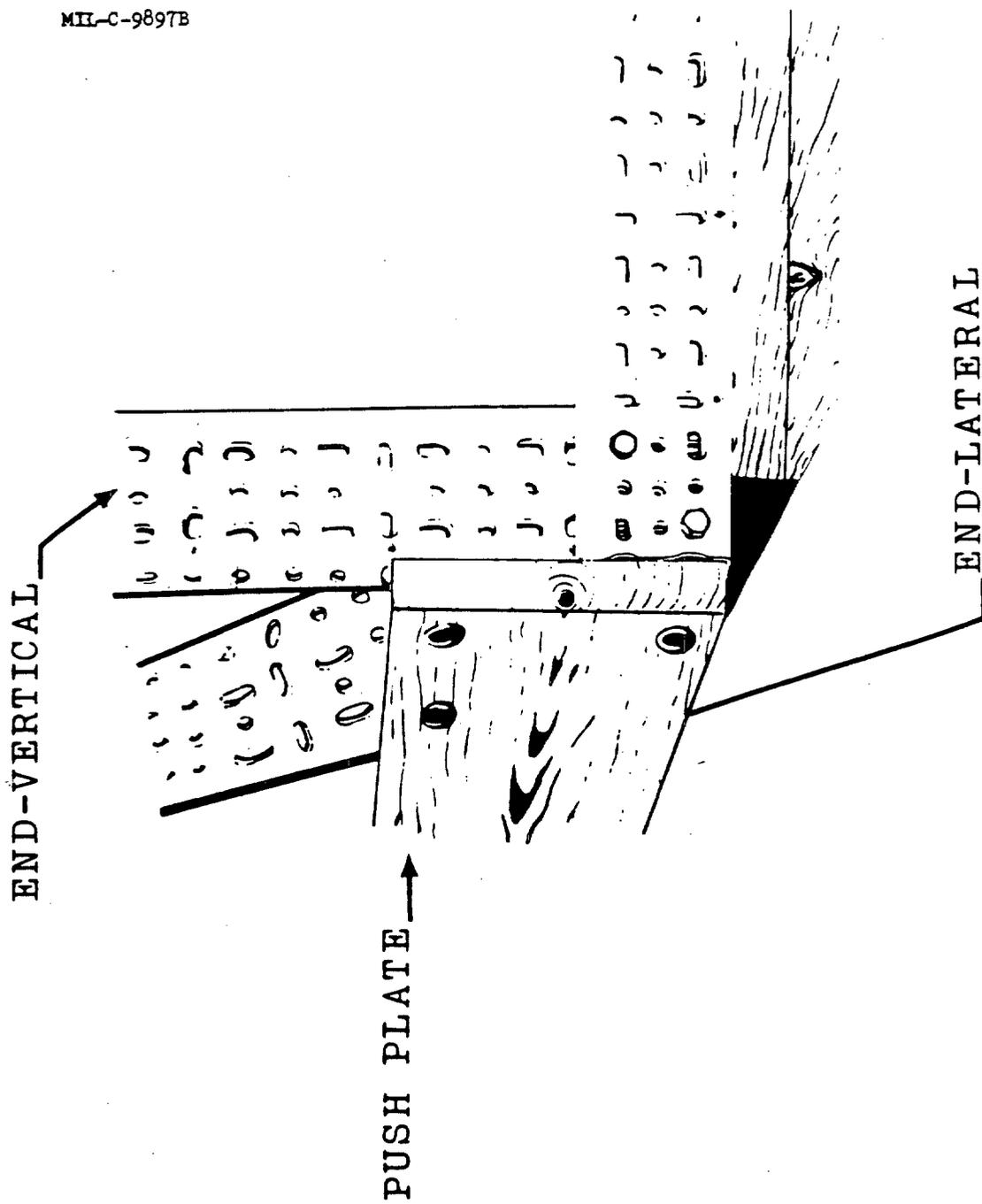
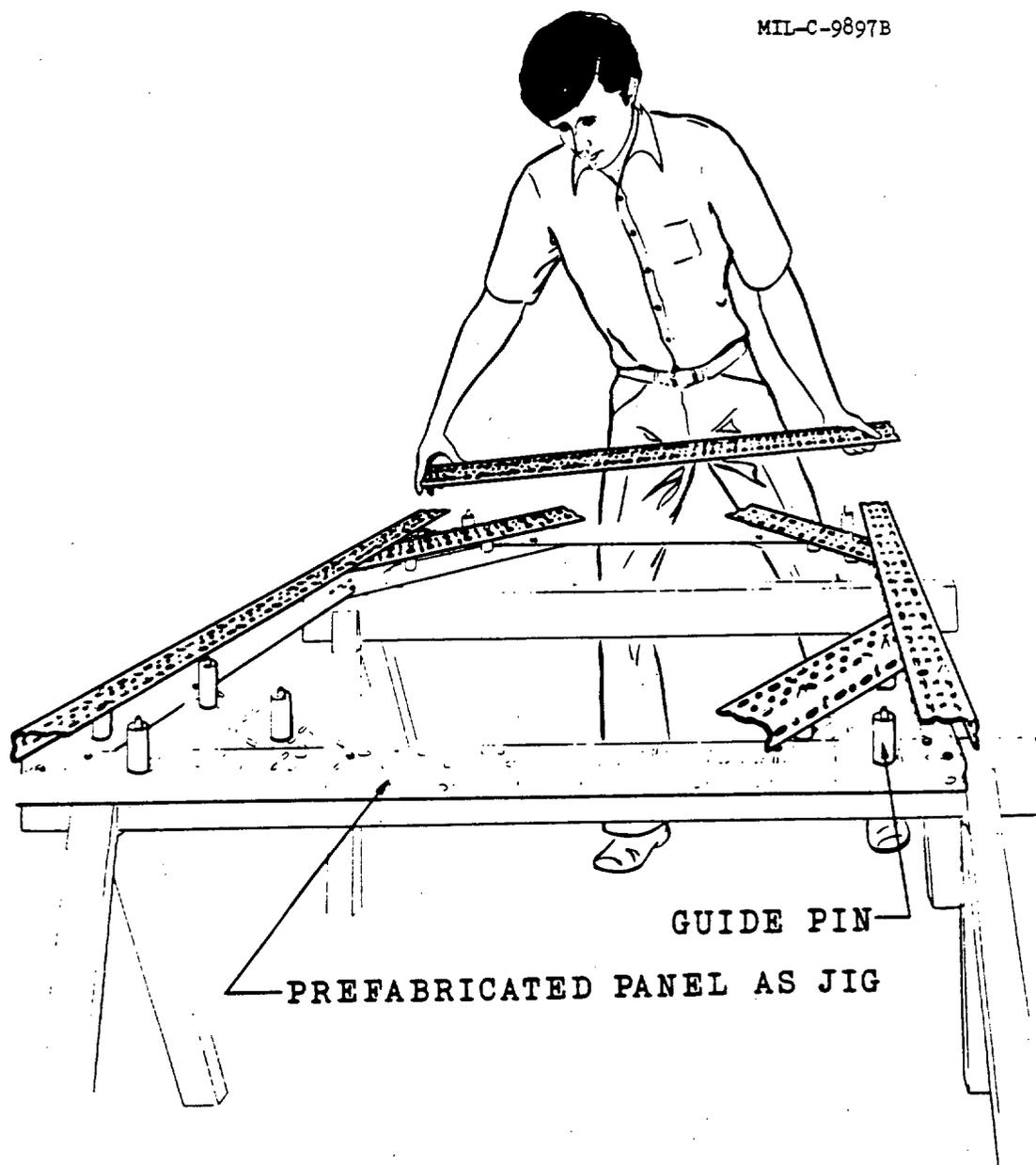


FIGURE 14

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JIG FOR CONSTRUCTION OF PANELS

FIGURE 15

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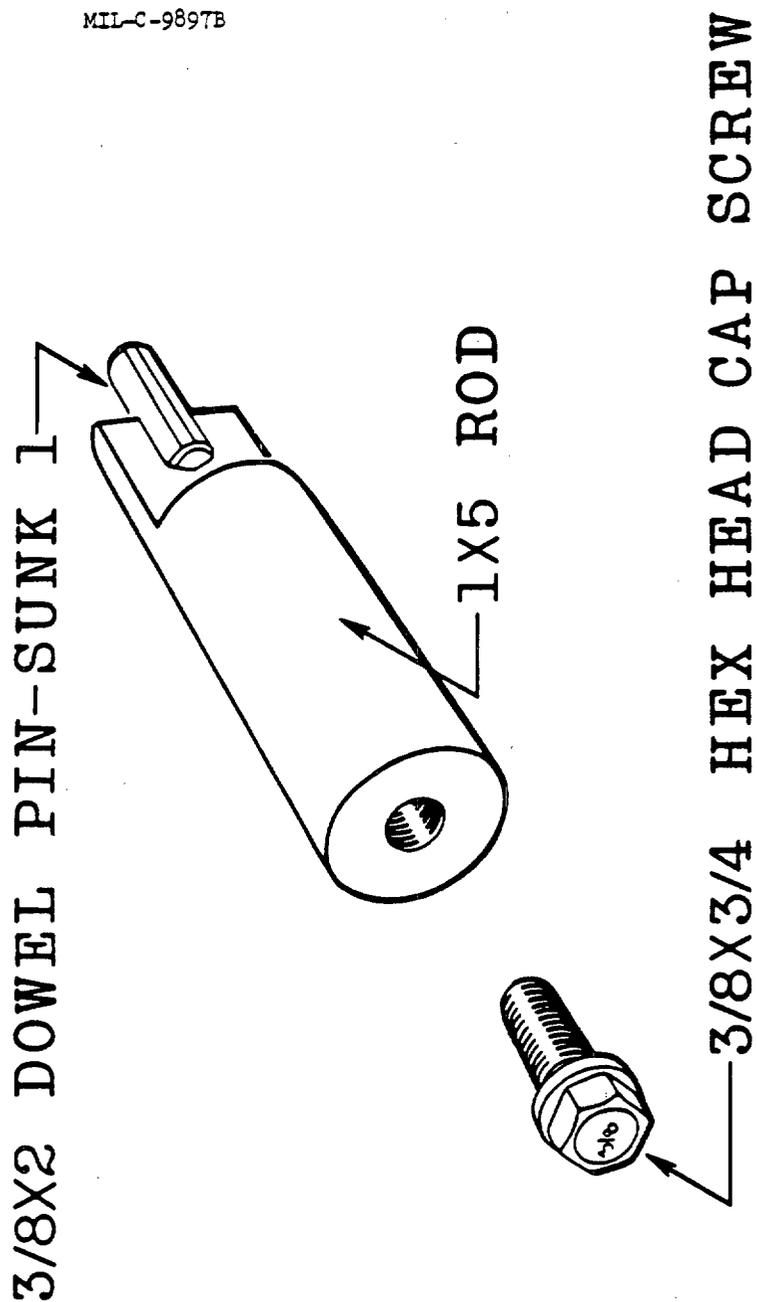
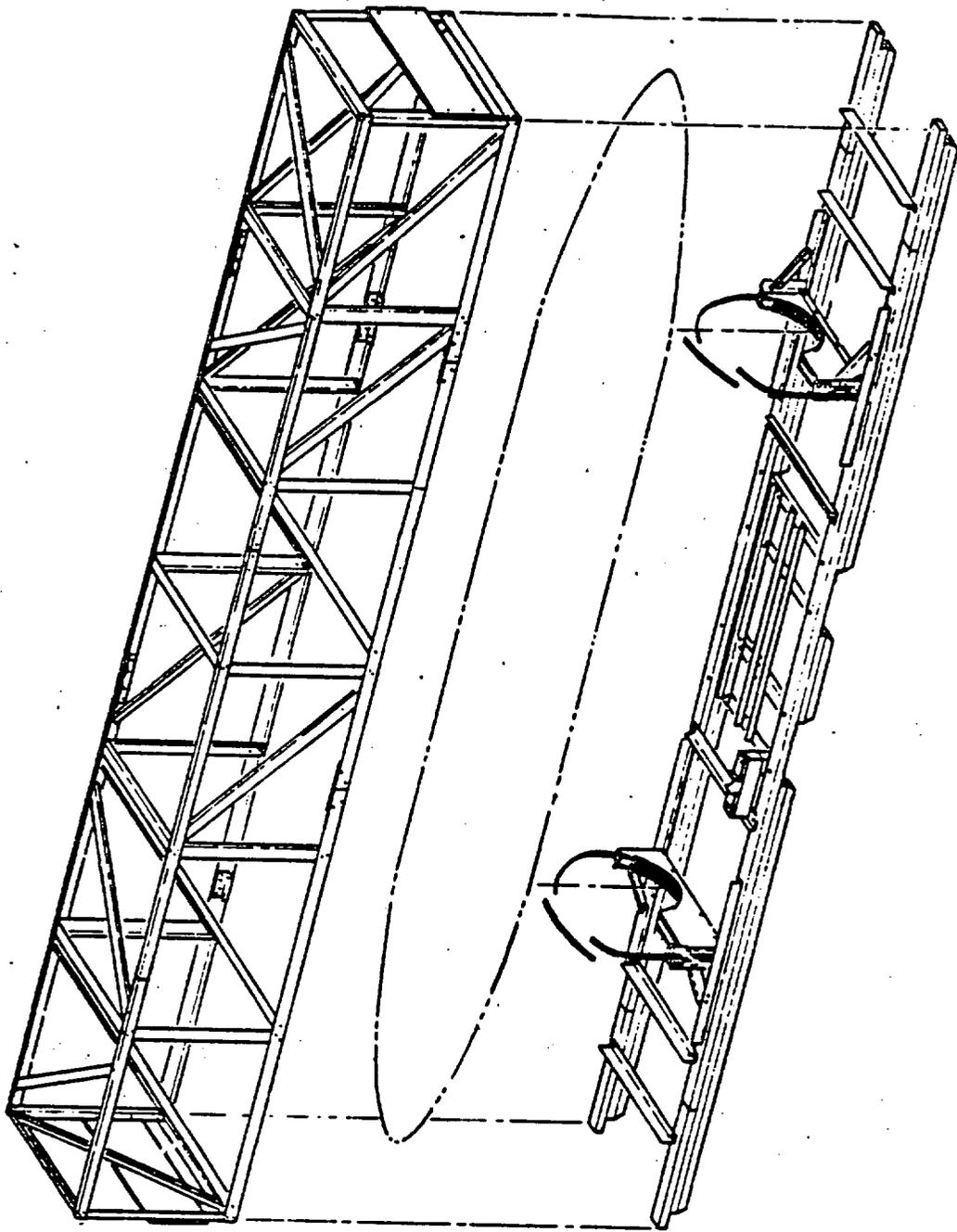


FIGURE 16



REMOVABLE SUPERSTRUCTURE

FIGURE 17

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*(See Instructions - Reverse Side)*

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b. Recommended Wording:	
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6. REMARKS	
7a. NAME OF SUBMITTER <i>(Last, First, MI) - Optional</i>	b. WORK TELEPHONE NUMBER <i>(Include Area Code) - Optional</i>
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