

METRIC

MIL-C-9897C
15 April 1992
 SUPERSEDING
 MIL-C-9897B
 23 July 1974

MILITARY SPECIFICATION

CRATES, SLOTTED ANGLE, STEEL OR ALUMINUM, FOR LIGHTWEIGHT AIRFRAME COMPONENTS AND BULKY ITEMS (FOR MAXIMUM LOADS OF 1363 KGS (3000 POUNDS))

This specification is approved 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.

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

AMSC N/A

FSC 8145

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

MIL-C-9897C

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

FEDERAL

- A-A-55057 - Panels, Wood/Wood Based; Construction and Decorative
- FF-B-575 - Bolts, Hexagon and Square
- FF-B-584 - Bolts, Square Neck and Tee Head
- FF-N-105 - Nails, Brads, Staples and Spikes. Wire, Cut and Wrought
- QQ-S-698 - Steel Sheet and Strip, Low-Carbon
- TT-E-527 - Enamel, Alkyd, Lustreless, Low VOC Content
- TT-P-1757 - Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity
- 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

STANDARDS

FEDERAL

- FED-STD-595 - Colors Used in Government Procurement

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-163 - Steel Mill Products Prepared for Shipment and Storage
- MIL-STD-731 - Quality of Wood Members for Containers and Pallets

MIL-C-9897C

- MIL-STD-1189 - Standard Department of Defense Bar Code Symbology
 MS51922 - Nut Self-Locking, Hexagon-Prevailing Torque, General Purpose, 250°F, UNC-2B and UNF-2B

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

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

U.S. DEPARTMENT OF COMMERCE

PS 1 Construction and Industrial Plywood

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

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

HP 83 Hardwood and Decorative Plywood

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B660 Standard Practices for Packaging/Packing of Aluminum and Magnesium Products
 D3951 Standard Practice for Commercial Packaging
 D3953 Standard Specification for Strapping, Flat Steel and Seals
 E380 Standard Practice for Use of the International System of Units (SI) (the Modernized Metric System)

MIL-C-9897C

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

AMERICAN WOOD PRESERVERS ASSOCIATION

AWPA P5 - Standard for Waterborne Preservatives

(Application for copies should be addressed to the American Wood Preservers Association, P.O. Box 849, Stevensville, MD 21666.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC.

National Motor Freight Classification Rules

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

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

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

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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

3. REQUIREMENTS

3.1 Materials. Metric conversions of the physical properties of materials shall be in accordance with ASTM E380.

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

3.1.1.1 Surface finish of slotted angle. Steel for grade 1 crates shall have the surface finish conforming to class 3 of MIL-S-21041 applied. Steel for grade 2 crates shall have a surface finish conforming to class 1 or 2 of MIL-S-21041 applied. Aluminum slotted angle shall require no additional finish.

MIL-C-9897C

3.1.2 Bolts and nuts. Bolts used in assembling metal members shall conform to those specified in MIL-S-21041. Nuts used in assembling metal members shall conform to MS51922 with the exception that 8mm (5/16 inch) nuts shall be 13.99 to 14.33mm (0.551 to 0.564 inches) across the flats (width). All other bolts and nuts used 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 ASTM D3953, type I, zinc-coated.

3.1.4 Wood members. Wood used for skids, rubbing strips, load-bearing members, blocking and bracing, and all other wooden components shall conform to the applicable structural class of MIL-STD-731, group II, III or IV woods.

3.1.5 Plywood. Plywood shall conform to NN-P-530. Plywood shall have no defects (knot holes, worm holes, etc) extending through the panel. Plywood for grade 1 crates shall conform to ANSI HP 83, type I, grade 3-4 or to PS 1, type exterior, grade C. Plywood for grade 2 crates shall conform to ANSI HP 83, type II, grade 3-4 or to PS 1, type interior with exterior glue, grade C-D. Unless otherwise specified, plywood shall be finished unsanded (see 6.2).

3.1.6 Wood preservative Wood or plywood components shall be treated in accordance with TT-W-571 with preservatives conforming to AWPA P5.

3.1.7 Veneer, paper overlaid. Paper overlaid veneer used for sheathing shall conform to PPP-V-205, type II.

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

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

3.1.10 Nails. Nails used to secure top sheathing shall be cement-coated or chemically etched common or box nails conforming to FF-N-105.

3.2 Fabrication.





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

MIL-C-9897C

TABLE I. Load capacity of slotted angle steel beams. 1/





SLOTTED ANGLE STEEL - 2.6mm - 38mm X 76mm
(12 GAUGE (0.104") - 1-1/2" X 3")

(Length of beam in cm (feet) - load in kg (pounds))

		60 (2)	90 (3)	120 (4)	150 (5)	180 (6)
Recommended load		659 (1450)	445 (980)	336 (740)	227 (500)	159 (350)
Recommended load		2045 (4500)	1409 (3100)	954 (2100)	545 (1200)	454 (1000)
Recommended load		4727 (10400)	3409 (7500)	2409 (5300)	1977 (4350)	1590 (3500)
Recommended load		704 (1550)	454 (1000)	345 (760)	263 (580)	222 (490)

SLOTTED ANGLE STEEL - 1.9mm - 38mm X 57mm
(14 GAUGE (0.074") - 1-1/2" X 2-1/4")

(Length of beam in cm (feet) - load in kg (pounds))




		60 (2)	90 (3)	120 (4)	150 (5)	180 (6)
Recommended load		572 (1260)	386 (850)	277 (610)	181 (400)	90 (200)
Recommended load		1090 (2400)	772 (1700)	522 (1150)	372 (820)	284 (625)
Recommended load		2359 (5190)	1522 (3350)	1227 (2700)	954 (2100)	772 (1700)
Recommended load		363 (800)	231 (510)	177 (390)	136 (300)	113 (250)

1/ Table I is usable for slotted angle steel with flange dimensions that are plus or minus 3mm (1/8 inch) the flange sizes stated.

MIL-C-9897C

TABLE I. Load capacity of slotted angle steel beams. 1/ -
Continued.SLOTTED ANGLE STEEL - 1.9mm - 38mm X 38mm
(14 GAUGE (0.074") - 1-1/2" X 1-1/2")




(Length of beam in cm (feet) - load in kg (pounds))

		90 (3)	120 (4)	150 (5)	180 (6)
Recommended load		225 (495)	122 (270)	86 (190)	65 (145)
Recommended load		268 (590)	179 (395)	134 (295)	86 (190)
Recommended load		606 (1335)	470 (1035)	313 (690)	245 (540)

1/ Table I is usable for slotted angle steel with flange dimensions that are plus or minus 3mm (1/8 inch) the flange sizes stated.

TABLE II. Load capacity of slotted angle steel columns. 1/SLOTTED ANGLE STEEL - 1.9mm - 38mm X 38mm
(14 GAUGE (0.074") - 1-1/2" X 1-1/2")

(Length of column in cm (feet) - load in kg (pounds))

		90 (3)	120 (4)	150 (5)	180 (6)
Recommended load		672 (1480)	536 (1180)	427 (940)	336 (740)
Recommended load		1740 (3830)	1579 (3475)	1350 (2970)	1125 (2475)
Recommended load		1772 (3900)	1620 (3565)	1440 (3170)	1190 (2620)

1/ Table II is usable for slotted angle steel with flange dimensions that are plus or minus 3mm (1/8 inch) the flange sizes stated.

MIL-C-9897C

TABLE II. Load capacity of slotted angle steel columns. 1/
- Continued.SLOTTED ANGLE STEEL - 1.9mm - 38mm X 57mm
(14 GAUGE (0.074") - 1-1/2" X 2-1/4")

(Length of column in cm (feet) - load in kg (pounds))

		90 (3)	120 (4)	150 (5)	180 (6)	210 (7)
Recommended load	γ	1131 (2490)	840 (1850)	695 (1530)	581 (1280)	427 (940)
Recommended load	$\gamma \Gamma$	2500 (5500)	2272 (5000)	1977 (4350)	1727 (3800)	1522 (3350)
Recommended load	Γ L	2545 (5600)	2450 (5390)	2272 (5000)	2036 (4480)	1886 (4150)

SLOTTED ANGLE STEEL - 2.6mm - 38mm X 76mm
(12 GAUGE (0.104") - 1-1/2" X 3")

(Length of column in cm (feet) - load in kg (pounds))

		90 (3)	120 (4)	150 (5)	180 (6)	210 (7)
Recommended load	γ	1568 (3450)	1304 (2870)	1072 (2360)	759 (1670)	522 (1150)
Recommended load	$\gamma \Gamma$	3618 (7960)	3200 (7040)	2836 (6240)	2454 (5400)	2045 (4500)
Recommended load	Γ L	4045 (8900)	3609 (7940)	3045 (6700)	2636 (5800)	2113 (4650)



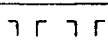
1/ Table II is usable for slotted angle steel with flange dimensions that are plus or minus 3mm (1/8 inch) the flange sizes stated.

MIL-C-9897C

TABLE III. Load capacity of slotted angle aluminum configurations. 1/




SLOTTED ANGLE ALUMINUM - 2.3mm - 38mm X 57mm
(13 GAUGE (0.089") - 1-1/2" X 2-1/4")

(Length of beam in cm (feet) - load in kg (pounds))

		90 (3)	120 (4)	150 (5)	180 (6)
Recommended load		204 (450)	159 (350)	118 (260)	81 (180)
Recommended load		431 (950)	272 (600)	2/181 (400)	2/159 (350)
Recommended load		1000 (2200)	727 (1600)	563 (1240)	427 (940)

SLOTTED ANGLE ALUMINUM - 1.9mm - 38mm X 57mm
(13 GAUGE (0.089") - 1-1/2" X 2-1/4")

(Length of column in cm (feet) - load in kg (pounds))

		90 (3)	120 (4)	150 (5)	180 (6)	210 (7)
Recommended load		454 (1000)	409 (900)	318 (700)	272 (600)	
Recommended load		1409 (3100)	1240 (2730)	1104 (2430)	986 (2170)	795 (1750)
Recommended load		1590 (3500)	1409 (3100)	1227 (2700)	1090 (2400)	954 (2100)

1/ Table III is usable for slotted angle aluminum with flange dimensions that are plus or minus 3mm (1/8 inch) the flange sizes stated.

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

3.2.2 Splicing of members. Steel or aluminum components shall 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 to secure a butt splice, as shown in figure 1.

MIL-C-9897C

3.2.3 Cutting of slotted angle.

3.2.3.1 All members. Cutting of members shall be made at 76mm (3 inch) increments to properly utilize the slot and hole pattern. After cutting, members shall be trimmed to the required length.

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.

3.3 Construction. One slotted metal angle crate shall consist of six faces consisting of two sides, two ends, one top, and one base. Each face shall be rectangular in shape and consist of one or more panels. A panel is an area bounded by slotted metal angle members. Normally, the sides are constructed and the ends, top, and base are used to hold the sides together.

3.3.1 Assembly. Slotted metal angle 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 to secure against loosening. Bolts and nuts shall be as specified in 3.1.2.

3.3.2 Braces. All panels shall have either diagonal braces or steel strapping braces for support.

3.3.2.1 Diagonal braces. Placement of diagonal braces is shown on figure 2. All diagonal braces shall be installed with maximum utilization of the round holes in the metal angle.

3.3.2.1.1 Full diagonal braces. Full diagonal braces shall extend from one corner diagonally across to the other corner of the panel being braced. The braces shall be installed as close as possible to the apex of the angle and shall be secured at each end with a minimum of one bolt.

3.3.2.1.2 Short or corner braces. Short or corner braces shall be placed in each corner of the panel being braced and secured at each end with a minimum of one bolt. The braces shall be installed at an angle of 45 degrees or as close to that angle as possible.

3.3.2.2 Steel strapping braces. Full cross or "X" braces of flat steel strapping placed in tension (see figure 3) 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 not be less than 31mm (1-1/4 inches) wide by 0.8mm (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.

MIL-C-9897C

3.3.3 Structural joints. Ends of the horizontal, vertical, and lateral members shall be bolted together to form the corner joints as shown on figure 4. Intermediate vertical members, 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 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 figures 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.

3.4 Type I, style A crate. This is a crate of simple fabrication, usually consisting of one panel to each section, requiring minimum bracing, and is used for lightweight, bulky, and small items not exceeding 75 kilograms (165 pounds), as shown in figures 6 and 7. Dimensions of this crate shall not exceed 2000mm (78-3/4 inches) in length by 750mm (29-1/2 inches) in width by 1200mm (47-1/4 inches) in height, except when specified designs are approved by the procuring activity.

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

3.4.1.1 Intermediate struts. Intermediate struts shall be required when the spacing between the struts exceeds 1-1/3 the height of the crate. Intermediate struts, when required, shall be evenly and systematically spaced along the length of the crate side between the end struts. Where greater side strength or special mounting provisions are required along the side of the crate, extra intermediate struts may be added.

3.4.1.2 Assembly of crate sides. The metal angle used for the side rails shall be positioned with the wide flange of the slotted angle in a vertical position. The struts shall be uniform in length and bolted to the inside edge of the side rails. When the packed item is to be placed in an upright position and anchored to the crate base, all struts shall be positioned with the wide flange of the slotted angle against the wide flange of the side rails of the crate.

3.4.2 Crate ends. The crate ends shall consist of slotted angle lateral (cross) members and braces joining the two crate sides. A minimum of two cross members, one joining the top corners of the sides and one joining the bottom corners of the sides, shall be used on each end. Additional cross members or intermediate struts to provide mounting or attachment points within the crate for specific items may be added to the crate end as required.

3.4.2.1 Intermediate cross members. The distance between cross members shall not exceed 1-1/3 the width of the crate. When required, intermediate cross members shall be evenly and

MIL-C-9897C

systematically spaced along the height of the end.

3.4.3 Crate base. The base shall consist of flooring, cross members, load-bearing members and braces as required.

3.4.3.1 Flooring. Although the flooring need not be continuous throughout the base, 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 load-bearing floorboards) shall have a minimum thickness of 6mm (1/4 inch) for crates through 300mm (11-7/8 inches) wide, 9mm (3/8 inch) for crates over 300mm (11-7/8 inches) wide through 600mm (23-5/8 inches), and 19mm (3/4 inch) wide, for crates over 600mm (23-5/8 inches) wide. Flooring shall be cut to fit in place. The flooring shall be bolted to the lower side rails of the crate with bolts as specified in 3.1.2 as shown in figure 8 unless a removable superstructure is specified (see figure 9). 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 300mm (11 -7/8 inches). When 9mm (3/8 inch) or thinner plywood is used for flooring, a minimum 19mm (3/4 inch) by 35mm (1-3/8 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. Bol used for securing floorboards shall not be less than 8mm (5/16 inc) in diameter.

3.4.3.2 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 IV. When slotted metal angle is used for load-bearing members, the size shall be determined by tables I, II, and III.

MIL-C-9897C

TABLE IV. Allowable load per inch of floorboard width for groups II, III, and IV woods. 1/

LENGTH BETWEEN OUTSIDE SKIDS	THICKNESS OF FLOORBOARDS mm (inches)			
	19 (3/4)	38 (1-1/2)	63 (2-1/2)	89 (3-1/2)
MILLIMETERS (INCHES)	KILOGRAMS (POUNDS)	KILOGRAMS (POUNDS)	KILOGRAMS (POUNDS)	KILOGRAMS (POUNDS)
300 (11-3/4)	21 (48)	100 (220)	260 (574)	497 (1095)
450 (17-3/4)	14 (32)	66 (147)	178 (382)	332 (731)
600 (23-5/8)	10 (24)	50 (110)	130 (287)	249 (548)
750 (29-1/2)	8 (19)	40 (88)	104 (229)	199 (438)
900 (35-1/2)	7 (16)	33 (73)	87 (192)	165 (365)
1050 (41-3/8)	6 (14)	28 (63)	74 (164)	142 (313)
1150 (45-1/4)	5 (12)	25 (55)	65 (144)	124 (274)
1500 (59)	4 (9)	20 (44)	52 (115)	99 (219)
1800 (70-7/8)	3 (8)	16 (37)	43 (96)	82 (182)

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

3.4.3.3 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 650mm (25-9/16 inches). When load-bearing members are used, they shall be considered adequate for cross member requirements and other cross members spaced accordingly.

MIL-C-9897C

3.4.3.4 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 300mm (11-7/8 inches) or wider floor panels, braces will not be required.

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

3.4.4.1 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). Cross members shall be bolted to the upper side rails with bolts as specified in 3.1.2.

3.4.4.2 Crate top cross ties. Cross ties shall be slotted metal angle members. Cross ties shall be positioned at intermediate points between the cross members to reinforce the crate top 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 as specified in 3.1.2 (see figure 1).

3.4.5 Light crates with short diagonal braces. Crates with dimensions not in excess of 1500mm (59 inches) in length by 750mm (29-1/2 inches) in width by 1200mm (47-1/4 inches) in height, with anticipated loads not to exceed 75 kg (165 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 pattern illustrated in figure 2 may be used. All other fabrication and material requirements for this crate shall be as specified in 3.4 through 3.4.4.2.

3.5 Type II, style A crate. The fabrication requirements for the frame of this crate shall be as specified in 3.4 through 3.4.5.

3.5.1 Sheathing. The crate shall be fully enclosed or sheathed with plywood, paper overlaid veneer, or fiberboard as specified (see 6.2 and figure 11). Materials for crate sheathing shall comply with the requirements of paragraphs 3.1.5 through 3.1.8 as applicable. When plywood of 6mm (1/4 inch) thick 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 along each edge of the panel. When any dimensions of a sheathing panel exceed 350mm (13-3/4 inches), three or more bolts shall be used along that edge. The spacing between these bolts shall not exceed 300mm (11-7/8 inches). Several methods of securing covering and sheathing to the metal angle are illustrated in figure 10.

3.5.1.1 Sheathing for top of crate. Sheathing for the top of the crate may be nailed to wood nailing strips secured to the slotted

MIL-C-9897C

angle portion of the crate. When this method of sheathing is used, the minimum size of nailing strips shall not be less than nominal 19mm (3/4 inch) by 35mm (1-3/8 inch) wood with the size 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 600mm (23-5/8 inches). Bolts shall conform to FF-B-584. Sheathing shall be nailed to the nailing strips with nails conforming to 3.1.10. Minimum size of the nail shall be 8mm (six-penny), spaced a maximum of 120mm (4-3/4 inches) apart.

3.5.2 Ventilation. Crates completely enclosed or sheathed with plywood or paper overlaid veneer shall be provided with ventilating holes or slots.

3.5.2.1 Location of ventilating holes. Ventilating holes or slots shall be located at each end or at the ends and sides around the perimeter of the crate. Ventilating holes or slots shall be placed immediately below the top frame members of the ends and sides. In crates over 3000mm (118 inches) 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 ends, sides, or both shall be provided with a baffle or shield placed over the holes or slots on the inside of the crate. Baffles or shields shall prevent water from being blown onto the crate contents. Table V shall be used to determine the required ventilating areas for each end or side of the crate.

TABLE V. Required ventilating areas for plywood or veneer sheathed crates.

VOLUME OF CRATE CU. METERS (CU. FEET)	AREA OF VENTILATING SPACE REQUIRED IN EACH END OR SIDE OF CRATE SQ. CM. (SQ. INCHES)
0 THRU 3 (0-106)	45 (7)
3 THRU 4 (106-141)	65 (10)
4 THRU 5 (141-176)	90 (13)
5 THRU 11 (176-388)	175 (27)
11 THRU 17 (388-600)	250 (39)
17 THRU 22 (600-777)	350 (54)
22 THRU 28 (777-989)	425 (66)
28 THRU 35 (989-1236)	525 (81)
OVER-35 (OVER-1236)	650 (101)

3.6 Type I, style B crate. This crate has a skidded base, braced sides, ends, and top, load-bearing and attaching members for specific items, and provisions for forklift truck and cargo sling handling. Slotted metal angle used in the fabrication of style B

MIL-C-9897C

crates shall be steel and conform to the requirements of 3.1.1 and 3.1.1.1. Other materials used shall conform to the requirements of 3.1.3 through 3.1.10. The dimensions of this crate shall not exceed 1000cm (393-3/4 inches) in length by 130cm (51-3/16 inches) in width by 225cm (88-1/2 inches) 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 12.

3.6.1 Sides of crate. Crate sides shall comply with 3.4.1 except that only full diagonal braces shall be used. When splices are used, they shall be placed in locations that will not interfere with the placement of other crate members.

3.6.1.1 Intermediate side rails. When the height of the crate sides are in excess of 1300mm (51-3/16 inches) high, or when it is determined that extra strength is required to carry the anticipated load, one or more intermediate side rails shall be provided (see 3.2.1). When intermediate side rails are necessary, they shall be evenly or systematically spaced between the upper and lower side rails and shall extend the full length of the crate sides (see figure 13). The maximum distance between any two adjacent side rails shall not exceed 1300mm (51-3/16 inches).

3.6.1.2 Intermediate struts. Intermediate struts shall comply with 3.4.1.1.

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 side rail shall be determined by height and length. Distance between the struts shall not exceed the lesser of 1500mm (59 inches) or 1-1/4 the height of the crate (see figure 14).

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 side rails (see figure 13).

3.6.1.3 Assembly of crate sides. Assembly of the crate sides shall comply with 3.4.1.2.

3.6.2 Crate end. The crate ends shall comply with 3.4.2, except that intermediate cross members shall be used when the height of the crate exceeds the lesser of 1300mm (51-3/16 inches) or 1-1/4 the width of the crate. In either of the above instances, the maximum distance between any two adjacent cross members shall not exceed 1300mm (51-3/16 inches). Position of the wide flange on all cross members shall be in the vertical direction.

MIL-C-9897C

3.6.2.1 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 3.3.2.1 and 3.3.2.2 shall apply when installing braces (see figures 2, 3, and 12).

3.6.2.2 Push plates. Crates in excess of 1500mm (59 inches) long or 450mm (17-3/4 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 placed across the lower part of the end panel with the lower part of the plate flush with the top of the skids. The push plates shall be bolted to the corner struts with a minimum of two bolts, as specified in 3.1.2, in each end of the plate. For gross weights of up to 180 kg (400 pounds), push plates may be plywood or MIL-STD-731 group II, III, or IV wood. For gross weights exceeding 225 kg (500 pounds), push plates shall be MIL-STD-731 group III or IV wood only. Push plates shall be a minimum of 38mm (1-1/2 inches) thick by 190mm (7-1/2 inches) wide when fabricated from MIL-STD-731 lumber, or a minimum of 19mm (3/4 inch) thick by 300mm (11-7/8 inches) wide when fabricated from plywood (see figure 15).

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

3.6.3.1 Skids and rubbing strips. Minimum dimensions of rubbing strips shall be 63mm (2-1/2 inches) thick by 89mm (3-1/2 inches) wide by 400mm (15-3/4 inches) long, and the strips shall be beveled 45 ± 5 degrees on the bottom half of each end. Rubbing strips located at the end of the crate shall be set back 70 to 100mm (2-3/4 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 1250mm (49-1/4 inches). When the contained (net) load exceeds 185 kg (407 pounds), full length skids shall be used. Full length skids may be used for lesser contained weight but are not required. Unless otherwise specified (see 6.2) when full length skids are used, they shall have minimum nominal dimensions of 38mm (1-1/2 inches) by 89mm (3-1/2 inches) for net loads up to 375 kg (825 pounds), and minimum dimensions of 89mm (3-1/2 inches) by 89mm (3-1/2 inches) for net loads exceeding 375 kg (825 pounds). All full length skids shall be provided with minimum 63mm (2-1/2 inches) thick by 89mm (3-1/2 inches) inch wide rubbing strips. Skids and rubbing strips shall be bolted to the lower side rails of the crate with minimum 8mm (5/16 inches) diameter bolts as specified in 3.1.2 with spacing between these bolts not to exceed 600mm (23-5/8 inches), except that 300mm (11-7/8 inches) bolt spacing shall be used for

MIL-C-9897C

rubbing strips where 600mm (23-5/8 inches) spacing cannot be accomplished in a single piece.

3.6.3.2 Load-bearing members. Load-bearing members shall comply with 3.4.3.2.

3.6.3.3 Flooring for crate base. Flooring shall comply with 3.4.3.1, except that plywood flooring shall have a minimum thickness of 9mm (3/8 inch) for crates up to 300mm (11-7/8 inches) wide, 12mm (1/2 inch) for crates 300 to 600mm (11-7/8 to 23-5/8 inches) and 19mm (3/4 inch) for crates over 600mm (23-5/8 inches) wide. Wood flooring (except load-bearing, see 3.6.3.2) shall have a minimum thickness of 19mm (3/4 inch).

3.6.3.4 Forklift truck handling members. Crates shall be provided with forklift truck handling members positioned crosswise to the crate at a distance of 600mm (23-5/8 inches) from each end. Crates which have a width in excess of 900mm (35-7/16 inches) shall be equipped with forklift truck handling members positioned at the location provided for end entry of forklifts. These members shall be in addition to the ones located 600mm (23-5/8 inches) from the end when the length of the crate exceeds 2400mm (94-1/2 inches). The size of the forklift truck handling member shall be determined by strength required and the use of table I or V. Loadbearing members may be utilized as forklift truck handling members if suitably located.

3.6.3.5 Cross members. When the distance between load-bearing members exceeds the width of the crate and the flooring is less than 19mm (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.

3.6.4 Crate top. The crate top shall comply with 3.4.4.

3.6.4.1 Crate top cross members. The crate top cross members shall comply with 3.4.4.1.

3.6.4.2 Crate top cross ties. The crate top cross ties shall comply with 3.4.4.2, except that the distance between the cross members and cross ties of the crate top shall not exceed 1-1/4 the width of the crate.

3.6.4.3 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 braces and installed in accordance with the provisions of 3.3.2.1 and figure 2. Tension braces may be used in some instances (see 3.3.2.2 and figure 3). Arrangement of braces is illustrated in figures 12 and 14.

MIL-C-9897C

3.7 Type II, style B crate. The metal fabrication requirements for this crate shall be as specified in 3.6 through 3.6.4.3.

3.7.1 Sheathing. Complete sheathing is required, and shall be accomplished in accordance with 3.5.1 through 3.5.1.1.

3.7.2 Ventilation. Ventilation requirements shall be as specified in 3.5.2.

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, removable superstructures (see figure 9), 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 6mm (1/4 inch) minimum thick plywood of the quality specified in 3.1.5, or 1.1mm (.047 inch) thick steel plate as specified in 3.1.9. The panel shall be painted with one coat of primer conforming to TT-P-1757 and two coats of TT-E-527, color #37886 of FED-STD-595. The panel shall be bolted to the crate members in the appropriate place with bolts as specified in 3.1.2. Type II crates normally do not require marking panels.

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 shall be as specified in the contract or order (see 6.2).

3.10 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4 and 6.3).

3.11 Workmanship. The crates shall be uniformly constructed and free from all imperfections which might impair their strength or usefulness. The crates shall 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 contractor is responsible for the performance of all inspection requirements (examinations and

MIL-C-9897C

tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in this specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- a. First article inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the applicable test method document or applicable paragraph(s) in this specification.

4.3.1 Classification of defects. All defects shall be classified as either a critical, major, or minor defect. A critical defect shall be justified as a defect that may cause injury to personnel or property. A major defect shall be justified as a defect that may affect performance and quality of the container. A minor defect shall be justified as a defect that is a discrepancy in this specification but does not apply to a critical or major defect. All critical and major defects shall constitute a failure of the container to meet the requirements of this specification and shall deem the container unacceptable by the Government (see 4.1.1). All minor defects shall be under the discretion of the contracting officer to either deem the container acceptable or unacceptable.

4.4 First article inspection. First article inspection shall consist of one container, representative of production design and construction, subjected to all inspections specified herein (see

MIL-C-9897C

4.6). A technical representative, approved by the procuring activity, shall witness all first article tests to assure ability of the container to conform to this specification (see 3.10).

4.4.1 Location of first article inspection. All tests shall be conducted at the container manufacturer's plant or as specified by the procuring activity (see 6.2).

4.5 Quality conformance inspection. Each container submitted for acceptance shall be subjected to and shall pass the examination of product (4.6).

4.6 Inspection methods.

4.6.1 Measuring device. A standard metric measuring tape or metric ruler with increments no greater than one centimeter shall be used to determine the sizes and dimensions of the crates or of parts and components of unassembled samples. Testing of samples required to construct the crate shall be performed by the supplier (see 4.1).

4.6.2 Examination of product. Examination of product shall be for defects classified in table VI.

TABLE VI. Classification of defects.

Examine	Defect	Classification
<u>Materials.</u>		
3.1	Conversions of the physical properties of materials from Metric to English units are not in accordance with ASTM E380.	MAJOR
3.1.1	Slotted metal angle does not conform to MIL-S-21041, unit A, type 1, 2, 3, 4, or 5.	MAJOR
3.1.1.1	Steel for grade 1 crates are not surface finished in accordance with MIL-S-21041, class 3 applied.	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	Steel for grade 2 crates are not surface finished in accordance with MIL-S-21041 class 1 or 2.	MAJOR
3.1.2	Bolts used in assembling metal members do not conform to MIL-S-21041.	MAJOR
	Nuts used in assembling metal members do not conform to MS51922.	MAJOR
	8mm (5/16 inch) nuts are not 13.99 to 14.33mm (0.551 to 0.564 inches) across the flats (width).	MAJOR
	All other bolts and nuts used are not zinc coated and do not conform to FF-B-584 or FF-B-575.	MAJOR
3.1.3	Steel strapping used for banding or tension braces do not conform to ASTM D3953, type I, zinc-coated.	MAJOR
3.1.4	Wood used for skids, rubbing strips, load-bearing members, blocking and bracing, and all other wooden components do not conform to the applicable structural class of MIL-STD-731, group II, III or IV woods.	MAJOR
3.1.5	Plywood does not conform to NN-P-530.	MAJOR
	Plywood has defects (knot holes, worm holes, etc.) extending through the panel.	MAJOR
	Plywood for grade 1 crates do not conform	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	to ANSI HP 83, type I, grade 3-4 or to PS 1, type exterior, grade C.	
	Plywood for grade 2 crates do not conform to ANSI HP 83, type II, grade 3-4 or to PS 1, type interior with exterior glue, grade C-D.	MAJOR
	Plywood is not finished as specified.	MINOR
3.1.6	Wood or plywood components are not treated in accordance with TT-W-571 with preservatives conforming to either AWPA P5	MAJOR
3.1.7	Paper overlaid veneer used for sheathing does not conform to PPP-V-205, type II.	MAJOR
3.1.8	Fiberboard used for sheathing does not conform to PPP-F-320, type SF, class weather resistant, grades V2s, V3s or V4s.	MAJOR
3.1.9	Steel used for marking panels do not conform to QQ-S-698.	MAJOR
3.1.10	Nails used to secure top sheathing are not cement-coated or chemically etched common or box nails conforming to FF-N-105.	MAJOR
3.2.1	Selection of slotted angle is not based on the size of the crate and the weight of the load.	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	Tables I, II, and III were not used as a guide for the selection of slotted angle.	MINOR
3.2.2	Steel or aluminum components are not of continuous lengths.	MAJOR
	Less than four bolts are used to secure a lap splice.	MAJOR
	Less than eight bolts are used to secure a butt splice.	MAJOR
3.2.3.1	Cutting of members are not made at 76mm (3 inch) increments to properly utilize the slot and hole pattern.	MINOR
	Members are not trimmed to the required length.	MAJOR
3.2.3.2	Cutting of diagonals are not made on the wide flange of the angle on a miter.	MINOR
<u>Construction.</u>		
3.3	One slotted metal angle crate does not consist of six faces.	MAJOR
	Each face is not rectangular in shape and consist of one or more panels.	MAJOR
3.3.1	Slotted metal angle is not assembled with bolts of the same diameter for which the slotted metal angle was intended or designed.	MAJOR
	Bolts and nuts are not drawn tight.	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	The nuts are not secured against loosening.	MAJOR
	Bolts and nuts are not as specified in 3.1.2.	MAJOR
3.3.2	All panels do not have either diagonal braces or steel strapping braces.	MAJOR
3.3.2.1	All diagonal braces are not installed with maximum utilization of the round holes in the metal angle.	MAJOR
3.3.2.1.1	Full diagonal braces do not extend from one corner diagonally across to the other corner.	MAJOR
	The braces are not installed as close as possible to the apex of the angle.	MAJOR
	The braces are not secured at each end with a minimum of one bolt.	MAJOR
3.3.2.1.2	Short or corner braces are not placed in each corner of the panel being braced.	MAJOR
	Short or corner braces are not secured at each end with a minimum of one bolt.	MAJOR
	The braces are not installed at an angle of 45 degrees or as close as possible.	MAJOR
3.3.2.2	Steel strapping is less than 31mm (1-1/4 inches) wide by 0.8mm (0.032	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	inches) thick.	
	Steel strapping does not comply with 3.1.3.	MAJOR
	The bolt holes in the strapping are not drilled or die punched.	MAJOR
	The bolt holes are larger than required for the bolt.	MAJOR
	The bolt hole is not placed in the center of the strap.	MAJOR
	The bolt hole is closer to the end than half the width of the strap.	MAJOR
3 3.3	Ends of the horizontal, vertical, and lateral members are not bolted together to form the corner joints.	MAJOR
	Intermediate vertical members, horizontal members and intermediate lateral members are not bolted together to effect the joints as illustrated in figure 1.	MAJOR
	Less than three bolts are used to secure additional vertical and horizontal members used for shock and vibration mounts.	MAJOR
	Forklift truck handling members and load bearing members are joined to the lower horizontal member with less than two bolts at each end.	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.Type 1, Style A Crate.

3.4	Type 1, Style A crate dimensions exceed 2000 mm (78-3/4 inches) in length by 750mm (29-1/2 inches) in width by 1200mm (47-1/4 inches) in height.	MAJOR
3.4.1	Crate sides do not consist of horizontal members (side rails), vertical members (struts), and diagonal braces.	MAJOR
3.4.1.1	Distance between the struts exceed 1-1/3 the height of the crate.	MAJOR
	Intermediate struts are not evenly and systematically spaced along the length of the crate side between the end struts.	MAJOR
3.4.1.2	The metal angle used for the side rails are not positioned with the wide flange of the slotted angle in a vertical position.	MAJOR
	The struts are not uniform in length.	MAJOR
	The struts are not bolted to the inside edge of the side rails.	
	All struts are not positioned with the wide flange of the slotted angle against the wide flange of the side rails of the crate.	MAJOR
3.4.2	The crate ends	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	do not consist of slotted angle lateral (cross) members and braces joining the two crate sides.	
	Less than two cross members are used on each end.	MAJOR
	Cross members do not join top and bottom corners of the sides.	MAJOR
3.4.2.1	The distance between cross members exceed 1-1/3 the width of the crate.	MAJOR
	Intermediate cross members are not evenly and systematically spaced along the height of the end.	MAJOR
3.4.3	The base does not consist of flooring, cross members, load-bearing members and braces as required.	MAJOR
3.4.3.1	The flooring is not 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.	MAJOR
	Plywood flooring thickness is less than 6mm (1/4 inch) for crates through 300mm (11-7/8 inches) wide.	MAJOR
	Plywood flooring thickness is less than 9mm (3/8 inch) for crates over 300mm	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

(11-7/8 inches) wide through 600 mm (23-5/8 inches) wide.	
Plywood flooring thickness is less than 19mm (3/4 inch) for crates over 600mm (23-5/8 inches) wide.	MAJOR
Flooring is not cut to fit in place.	MAJOR
The flooring is not bolted to the lower side rails of the crate.	MAJOR
Less than two bolts are used to bolt flooring to each lower side rail.	MAJOR
Bolts are not as specified in 3.1.2.	MAJOR
The distance between bolts used to secure the flooring to side rails exceed 300mm (11-7/8 inches).	MAJOR
When 9mm (3/8 inch) or thinner plywood is used for flooring, a wood hold-down is not used on top of the flooring.	MAJOR
The wood hold-down strip is less than 19mm (3/4 inch) by 35mm (1-3/8 inches).	MAJOR
Plywood flooring, 9mm (3/8 inch) or thinner, is not secured with the bolts passing through the hold-down strip, flooring, and side rail.	MAJOR
Bolts used for securing floorboards are less than 8mm (5/16 inch) in	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	diameter.		
3.4.3.2	Load-bearing members are not wood, plywood, metal or a combination of wood and metal.	MAJOR	
	Load-bearing members are not placed in a crosswise position to the crate length.	MAJOR	
	Load-bearing members are not bolted to the lower side rail with bolts as specified in 3.1.2.	MAJOR	
	When wood is used for load-bearing members, the size and thickness was not determined by table IV.		MINOR
	When slotted metal angle is used for load-bearing members, the size was not determined by tables I, II, and III.		MINOR
3.4.3.3	The minimum strength and quality of the slotted angle cross member for the base is lower than the slotted angle used in the side rails and struts.	MAJOR	
	The maximum distance between base cross members exceed 650mm (25-9/16 inches).	MAJOR	
	When load-bearing members are used, they are not considered adequate for cross member requirements and other cross members spaced accordingly.	MAJOR	

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

3.4.3.4	Braces of the same material used as cross members is not used in the crate base.	MAJOR
3.4.4	The crate top does not consist of metal angle cross members, cross ties, and braces installed between the two crate sides.	MAJOR
3.4.4.1	Cross members are not located at the same point along the length of the crate where the struts are located.	MAJOR
	The cross members are not bolted to the upper side rails with bolts as specified in 3.1.2.	MAJOR
3.4.4.2	Cross ties are not slotted metal angle members.	MAJOR
	Cross ties are not positioned at intermediate points between the cross members.	MAJOR
	Distance between the lateral members (cross members and cross ties) of the crate top exceed 1-1/3 the width of the crate.	MAJOR
	The cross ties are not bolted to the upper side rails with bolts as specified in 3.1.2.	MAJOR
3.4.5	Crates with dimensions in excess of 1500mm (59 inch) in length by 750mm (29-1/2 inches)	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	in width by 1200mm (47-1/4 inches) in height and with anticipated loads exceeding 75 kg (165 pounds) are braced with short diagonal braces placed in the corners of the areas to be braced.	
	All fabrication and materials requirements for this crate are not as specified in 3.4 through 3.4.4.2.	MAJOR
<u>Type II, Style A crate.</u>		
3.5	The fabrication requirements for the frame of Type II, Style A crate are not as specified in 3.4 through 3.4.5	MAJOR
3 5.1	The crate is not fully enclosed or sheathed with plywood, paper overlaid veneer, or fiberboard as specified (see 6.2).	MAJOR
	Materials for crate sheathing does not comply with the requirements of paragraphs 3.1.5 through 3.1.8.	MAJOR
	Sheathing is not fastened to the metal angle.	MAJOR
	Sheathing is bolted with less than two bolts along each edge of the panel.	MAJOR
	Bolts are not as specified in 3.1.2.	MAJOR
	Dimensions of a sheathing	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	panel exceeding 350mm (13-3/4 inches), use less than three bolts along edge.	
	The spacing between bolts are greater than 300mm (11-7/8 inches).	MAJOR
3.5.1.1	When sheathing for the top of the crate is nailed to wood nailing strips secured to the slotted angle portion of the crate the minimum size of nailing strips is less than 19mm (3/4 inch) by 35mm (1-3/8 inches) wood.	MAJOR
	Nailing strips are secured to the slotted angle with less than two bolts.	MAJOR
	Bolt spacing is greater than 600mm (23-5/8 inches).	MAJOR
	Bolts do not conform to FF-B-584.	MAJOR
	Sheathing is not nailed to the nailing strips.	MAJOR
	Nails do not conform to 3.1.10.	MAJOR
	The size of the nails are less than 8mm (six-penny).	MAJOR
	Nail spacing is greater than 120mm (4-3/4 inches) apart.	MAJOR
3.5.2	Crates completely enclosed or sheathed with plywood or paper overlaid veneer are not	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	provided with ventilating holes or slots.	
3.5.2.1	Ventilating holes or slots are not located at each end or at the ends and sides around the perimeter of the crate.	MINOR
	Ventilating holes or slots are not placed immediately below the top frame members of the ends and sides.	MINOR
	In crates over 3000mm (118 inches) in length, the ventilating holes and slots are not divided equally between the sides and ends.	MINOR
	In crates over 3000mm (118 inches) in length, the ventilating holes and slots are not located as near the midpoint of the ends and sides.	MINOR
	Ventilating holes or slots located in the end, sides, or both are not provided with a baffle or shield placed over the holes or slots on the inside of the crate.	MAJOR
	Baffles or shields do not prevent water from being blown onto the crate contents.	MAJOR
	Table V was not used to determine the required ventilating areas for each end or side of the crate do not comply with Table V requirements.	MINOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.Type I, Style B crate.

3.6	Slotted metal angle used in the fabrication of style B crates is not steel and does not conform to the requirements of 3.1.1 and 3.1.1.1.	MAJOR
	Other materials used does not conform to the requirements of 3.1.3 through 3.1.10.	MAJOR
	The dimensions of this crate exceeds 1000cm (393-3/4 inches) in length by 130cm (51-3/16 inches) in width by 225cm (88-1/2 inches) in height	MAJOR
3.6.1	Crate sides do not comply with 3.4.1.	MAJOR
	Crate sides do not have full diagonal braces.	MAJOR
	Splices are placed in locations that interfere with the placement of other crate members.	MAJOR
3.6.1.1	When the height of the crate sides are in excess of 1300mm (51-3/16 inches) high, or when it is determined that extra strength is required to carry the anticipated load, one or more intermediate side rails are not provided (see 3.2.1).	MAJOR
	Intermediate side rails are not evenly or systematically spaced between the upper and	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	lower side rails.	
	Intermediate side rails do not extend the full length of the crate sides.	MAJOR
	The maximum distance between any two adjacent side rails is greater than 1300mm (51-3/16 inches).	MAJOR
3.6.1.2	Intermediate struts do not comply with 3.4.1.1.	MAJOR
3.6.1.2.1	The spacing of intermediate struts for crates with sides not provided with an intermediate side rail exceeds the lesser of 1500mm (59 inch) or 1-1/4 the height of the crate.	MAJOR
3.6.1.2.2	The spacing of intermediate struts for crates with sides provided with intermediate horizontal members exceeds the lesser of 1500mm (59 inch) or 1-1/4 the distance between two adjacent side rails.	MAJOR
3.6.1.3	Assembly of the crate sides do not comply with 3.4.1.2.	MAJOR
3.6.2	The crate ends do not comply with 3.4.2.	MAJOR
	Intermediate cross members are not used when the height of the crate exceeds the lesser of 1300mm (51-3/16 inches) or 1-1/4 the	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	width of the crate.	
	The maximum distance between any two adjacent cross members is greater than 1300 mm (51-3/16 inches).	MAJOR
	Position of the wide flange on all cross members is not in the vertical direction.	MAJOR
3.6.2.1	Bracing of the crate ends is not accomplished with slotted angle of the same size used in bracing the crate sides, or tension braces of flat steel strapping.	MAJOR
	Provisions of 3.3.2.1 and 3.3.2.2 were not applied when installing braces.	MAJOR
3.6.2.2	Crates in excess of 1500mm (59 inch) long or 450mm (17-3/4 inches) wide, and all crates subject to pushing by forklift trucks or other materials handling equipment are not equipped with push plates.	MAJOR
	Push plates are not placed across the lower part of the end panel with lower part of the plate flush with the top of the skids.	MAJOR
	Push plates are not bolted to the corner struts.	MAJOR
	Push plates are not	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	bolted at each end of the plate.	
	Push plates are bolted with less than two bolts at each end.	MAJOR
	Bolts are not as specified in 3.1.2.	MAJOR
	For gross weights exceeding 180 kg (400 pounds), push plates are plywood or MIL-STD-731 group II, III, or IV wood.	MAJOR
	For gross weights exceeding 225 kg (500 pounds), push plates are not MIL-STD-731 group III or IV wood only .	MAJOR
	Push plates are less than 38mm (1-1/2 inches) thick by 190mm (7-1/2 inches) wide when fabricated from MIL-STD-731 lumber, or less than 19mm (3/4 inch) thick by 300mm (11-7/8 inches) wide when fabricated from plywood.	MAJOR
3.6.3	The crate base does not consist of cross members and cross ties to fasten the crate sides together at the bottom of the crate, load-bearing members, forklift truck handling members, skid blocks, full skids and flooring as required.	MAJOR
3.6.3.1	Rubbing strips dimensions are less than 63mm (2-1/2 inches) thick by 89mm (3-1/2 inches) wide by 400mm (15-3/4 inches) long.	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

Rubbing strips are not beveled 45 ± 5 degrees on the bottom half of each end.	MAJOR
Rubbing strips located at the end of the crate are not set back 70 to 100mm (2-3/4 to 4 inches) from the crate end.	MAJOR
Location of intermediate rubbing strips do not provide openings for forklift truck entry at the center of balance of the loaded crate.	MAJOR
Maximum spacing between rubbing strips is greater than 1250mm (49-1/4 inches).	MAJOR
When the contained (net) load exceeds 185 kg (407 pounds), full length skids are not used.	MAJOR
For net loads up to 375 kg (825 pounds), full length skids have dimensions less than 38 mm (1-1/2 inches) by 89mm (3-1/2 inches).	MAJOR
For net loads exceeding 375 kg (825 pounds), full length skids have dimensions less than 89mm (3-1/2 inches) by 89mm (3-1/2 inches).	MAJOR
All full length skids are not provided with rubbing strips.	MAJOR
Rubbing strips attached on full length skids have dimensions less than 63mm (2-1/2 inches)	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	thick by 89mm (3-1/2 inches) wide.	
	Skids and rubbing strips are not bolted to the lower side rails of the crate.	MAJOR
	Bolts are less than 8mm (5/16 inch) diameter bolts.	MAJOR
	Bolts are not as specified in 3.1.2.	MAJOR
	Spacing between bolts is greater than 600mm (23-5/8 inches).	MAJOR
3.6.3.2	Load-bearing members do not comply with 3.4.3.2.	MAJOR
3.6.3.3	Flooring does not comply with 3.4.3.	MAJOR
	Plywood flooring is less than 9mm (3/8 inch) thick for crates up to 300mm (11-7/8 inches) wide, 12 mm (1/2 inch) for crates 300mm (11-7/8 inches) to 600mm (23-5/8 inches) wide, and 19mm (3/4 inch) for crates over 600mm (23-5/8 inches) wide.	MAJOR
	Wood flooring (except load-bearing) have a thickness less than 19mm (3/4 inch).	MAJOR
3.6.3.4	Crates are not provided with forklift truck handling members positioned crosswise to the crate at a distance of 600 mm (23-5/8 inches) from each end.	MAJOR
	Crates which have a	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	width in excess of 900 mm (35-7/16 inches) are not equipped with forklift truck handling members positioned at the location provided for end entry of forklifts.	
	The size of the forklift truck handling member was not determined by strength required as specified in table I or V.	MAJOR
3.6.3.5	Intermediate cross ties are not installed in the base as required.	MAJOR
	Cross members, cross ties, and load-bearing members are not bolted to both flanges of the lower horizontal member where possible.	MAJOR
3.6.4	The crate top does not comply with 3.4.4.	MAJOR
3.6.4.1	The crate top cross members do not comply with 3.4.4.1.	MAJOR
3.6.4.2	The crate top cross ties do not comply with 3.4.4.2.	MAJOR
	The distance between the cross members and cross ties of the crate top exceeds 1-1/4 the width of the crate.	MAJOR
3.6.4.3	Braces are not provided for the top of the crate.	MAJOR
	Braces are not located in each space between the cross members and between the cross ties and cross members.	MAJOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	Braces are not full diagonal braces.	MAJOR
	Braces are not installed in accordance with the provisions of 3.3.2.1.	MAJOR
<u>Type II, Style B crate.</u>		
3.7	The metal fabrication requirements for this crate is not as specified in 3.6 through 3.6.4.3.	MAJOR
3.7.1	Complete sheathing is not accomplished in accordance with 3.5.1 through 3.5.1.1.	MAJOR
3.7.2	Ventilation requirements are not as specified in 3.5.2.	MAJOR
3.8	Special features proposed by the contractor for shipments to or for the Government were not approved by the procuring activity.	MAJOR
3.9	Panels required for placement of markings on type I crates are less than 6mm (1/4 inch) thick plywood or 1.1mm (.047 inch) thick steel plate.	MINOR
	Plywood panels do not meet the quality specified in 3.1.5.	MINOR
	Steel plates are not as specified in 3.1.9.	MINOR
	The panel is not painted with one coat of primer.	MINOR
	Primer does not	MINOR

MIL-C-9897C

TABLE VI. Classification of defects - Continued.

	conform to TT-P-1757	
	The panel is not painted with two coats of TT-E-527, color #37886 of FED-STD-595.	MINOR
	The panel is not bolted to the crate members, in the appropriate place, with bolts.	MINOR
	Bolts are not as specified in 3.1.2.	MINOR
3.9.1	The size of the marking panels are not as specified in the contract or order.	MINOR
3.10	A sample was not subjected to first article inspection as specified in the contract or purchase order.	MAJOR
3.11	The crates are not uniformly constructed and free from all imperfections.	MAJOR
	The crates have sharp corners, rough spots, etc., which might be injurious to personnel or property.	CRITICAL

5. PACKAGING

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.

MIL-C-9897C

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

5.2.1 Level A. Crate components shall be preserved and packaged in accordance with MIL-STD-163 or ASTM B660 as applicable

5.2.2 Level C. Crate components shall be preserved and packaged in such a manner as to insure arrival at destination in a serviceable condition and be acceptable to the carrier at lowest rates. Container shall comply with Uniform Freight Classification Rules or National Motor Freight Classification Rules. ASTM D3951, Commercial Packaging 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. The identification marking shall have the national stock number and contract number bar coded in accordance with MIL-STD-1189.

6. NOTES

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

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 Acquisition requirements. Procurement documents should specify the following:

- a. Type, style and grade of crate, including inside dimensions (see 1.2).
- b. Whether sanded plywood is required (see 3.1.5).
- c. Type sheathing required (see 3.5.1).
- d. Whether full length skids are required (see 3.6.3.1).
- e. Special features (see 3.8).

MIL-C-9897C

- f. Marking panel size (see 3.9.1).
- g. Level of packaging and packing required (see 5.2).

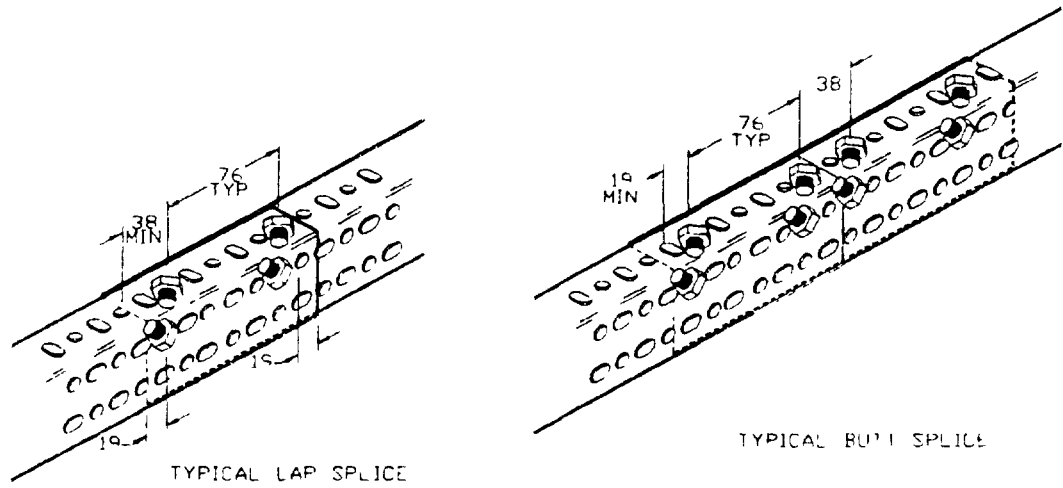
6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first 10 production items, a standard production item from the contractor's current inventory (see 3.10), or the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Subject term (key word) listing.

Crates
 Crates, airframe components
 Crates, reusable metal
 Crates, slotted angle
 Packaging
 Packaging, airframe components
 Packaging, crates

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

MIL-C-9897C



JOINING OF MEMBERS
TYPICAL METHOD OF ATTACHING VERTICAL SIDE
MEMBERS CROSS MEMBERS & CROSS THE MEMBERS
TO SIDE RAILS OF CRATE

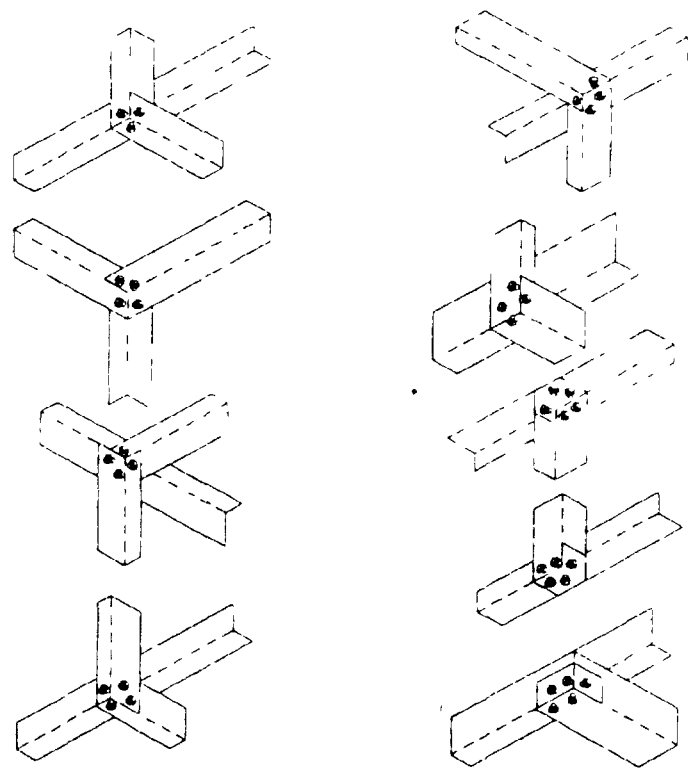


FIGURE 1. Splices and joining of members.

MIL-C-9897C

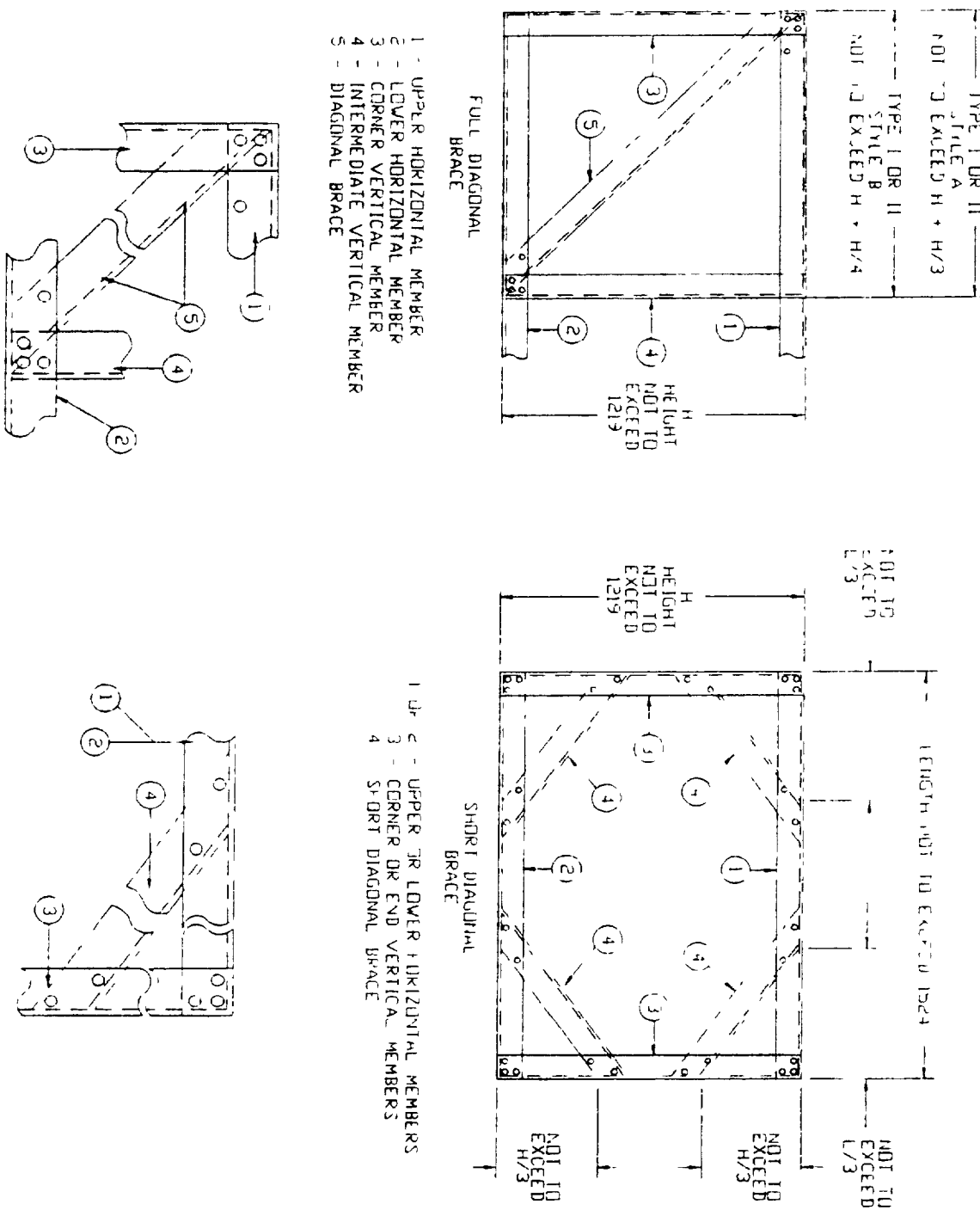


FIGURE 2. Braces.

MIL-C-9897C

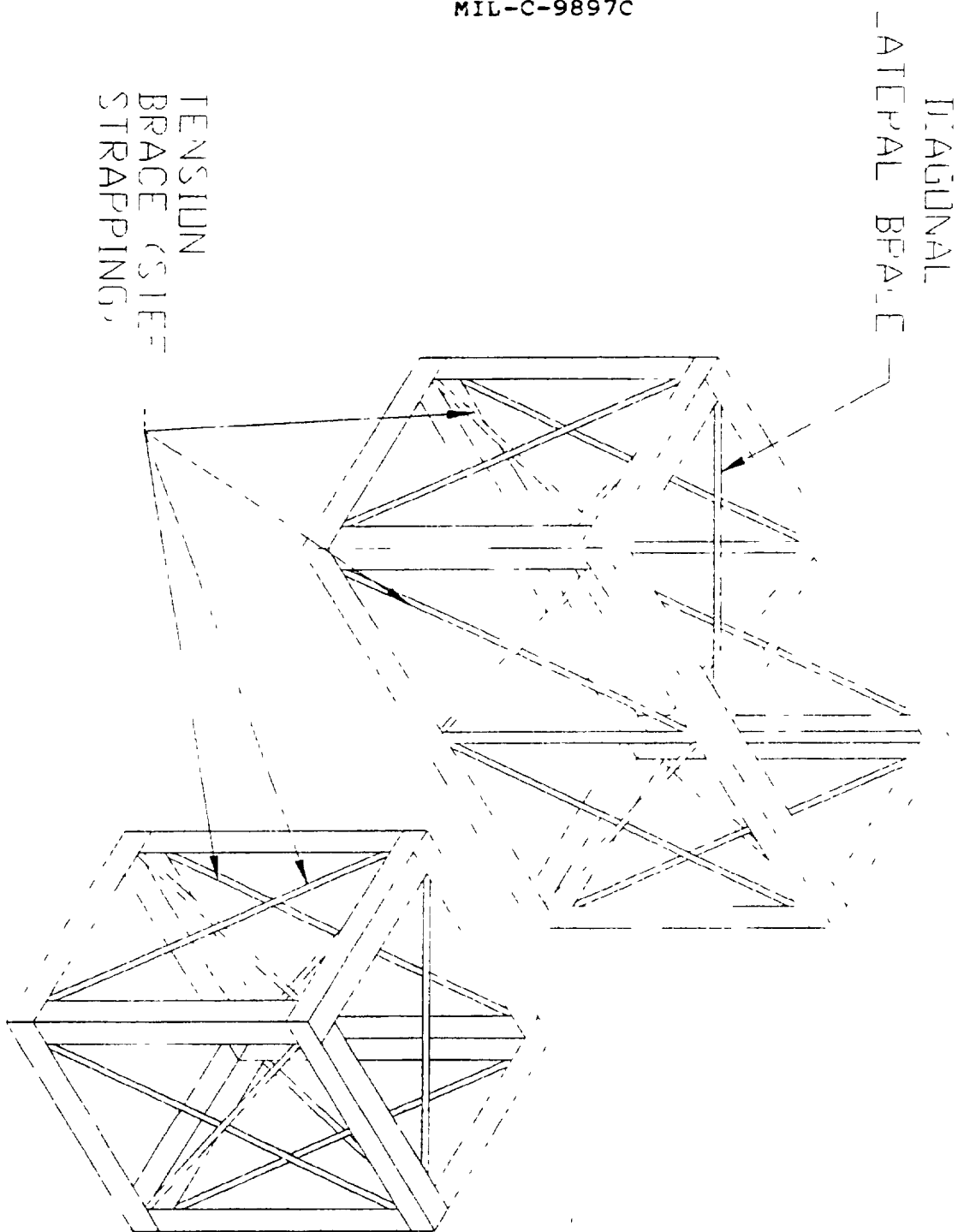


FIGURE 3. Steel strapping braces.

MIL-C-9897C

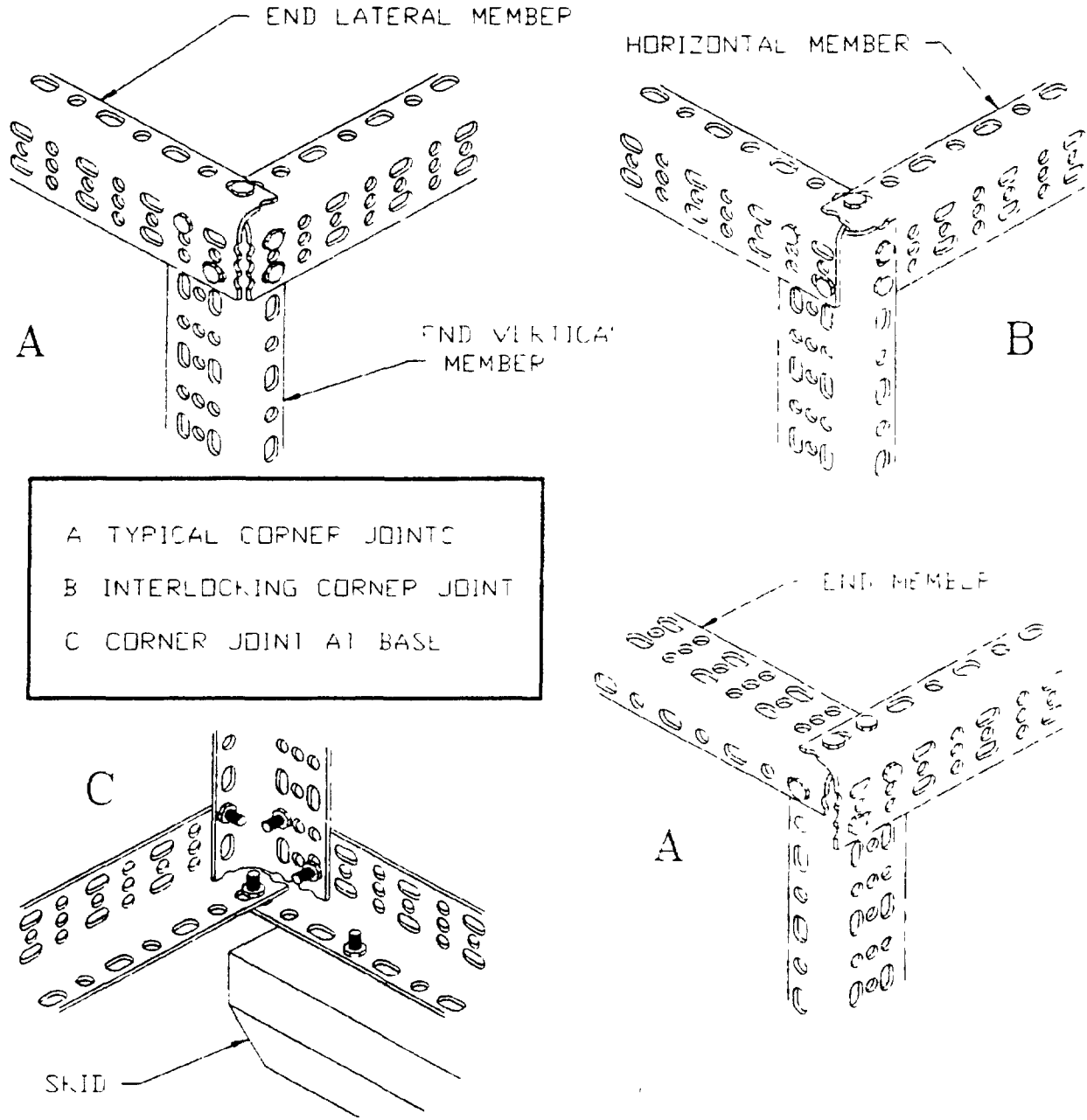


FIGURE 4. Corner joints.

MIL-C-9897C

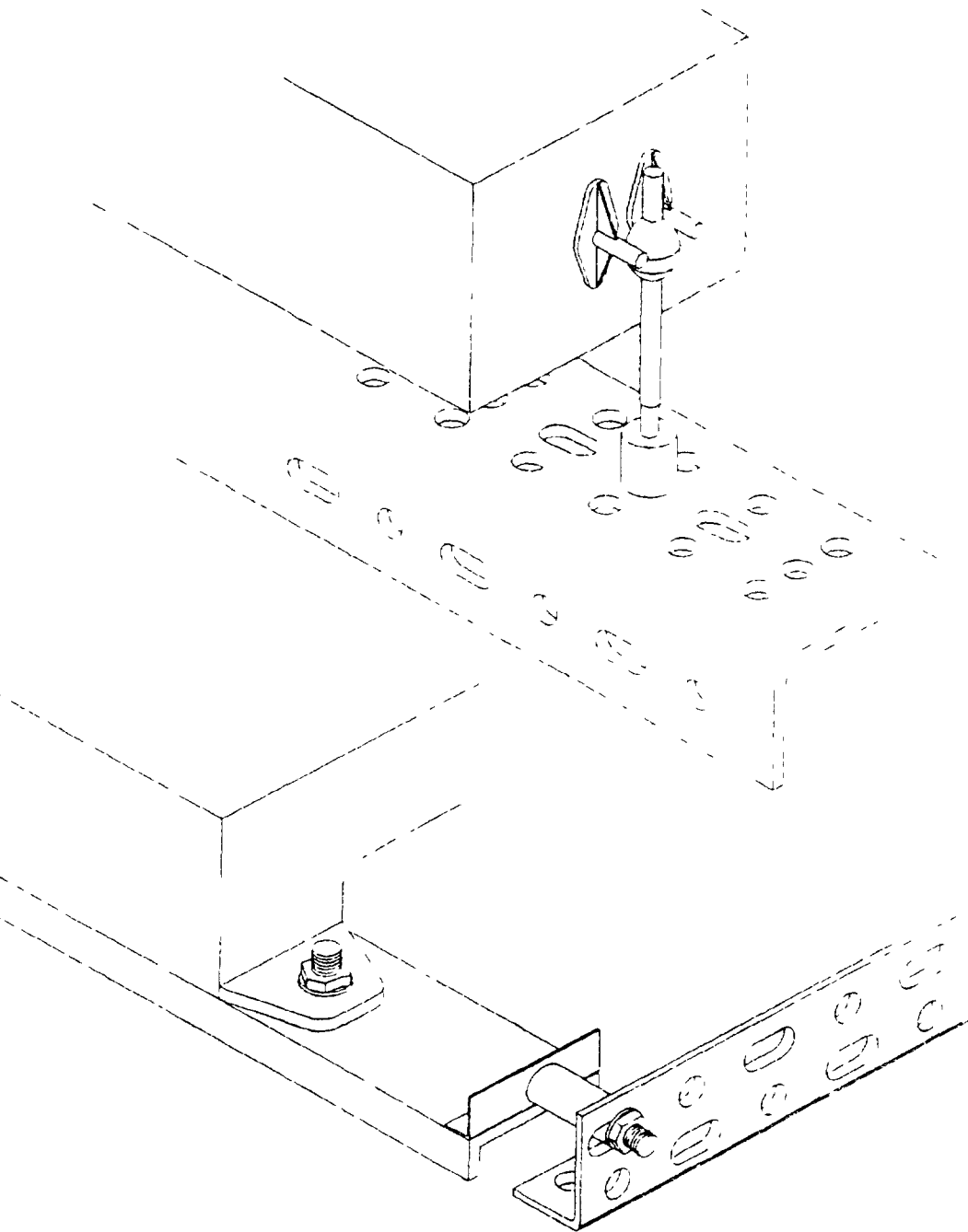
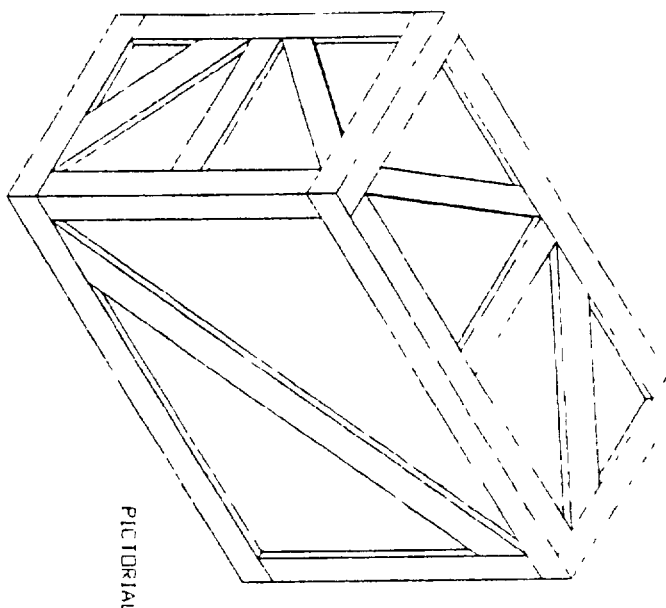


FIGURE 5. Shock and vibration mountings.

MIL-C-9897C



PICTORIAL

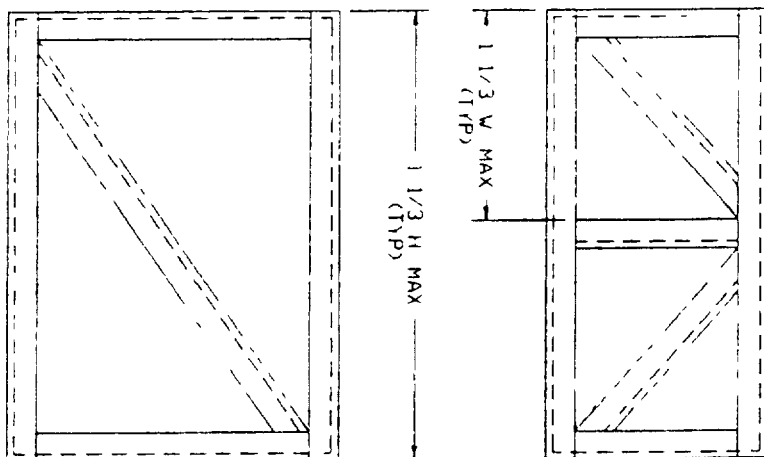
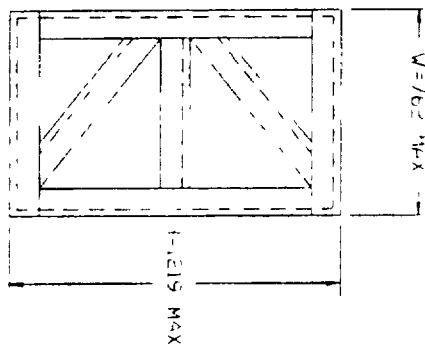


FIGURE 6. Type 1, style A, crate-panel side.

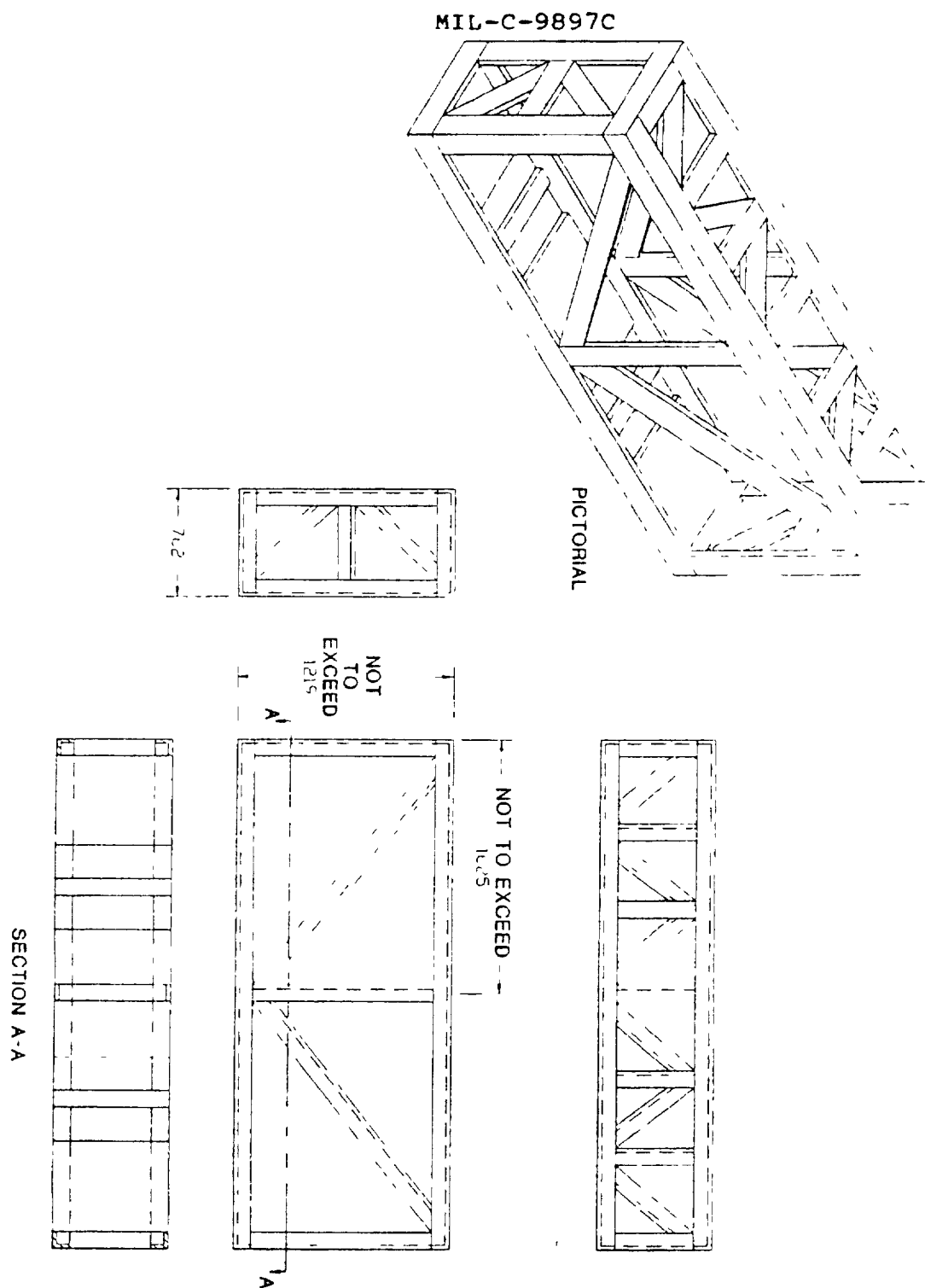


FIGURE 7. Type 1, style A, crate-2 panel side.

MIL-C-9897C

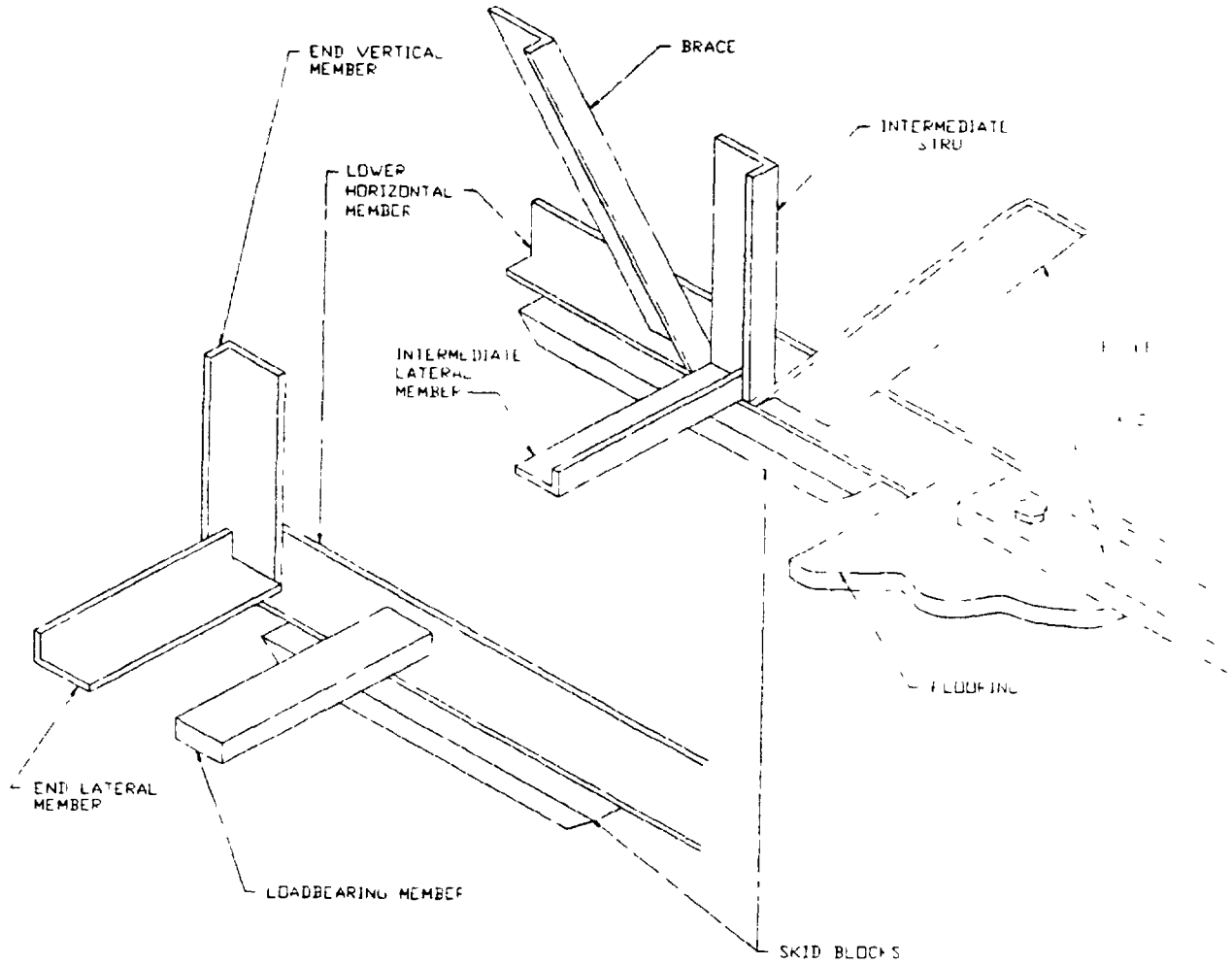


FIGURE 8. Bolting of Flooring.

MIL-C-9897C

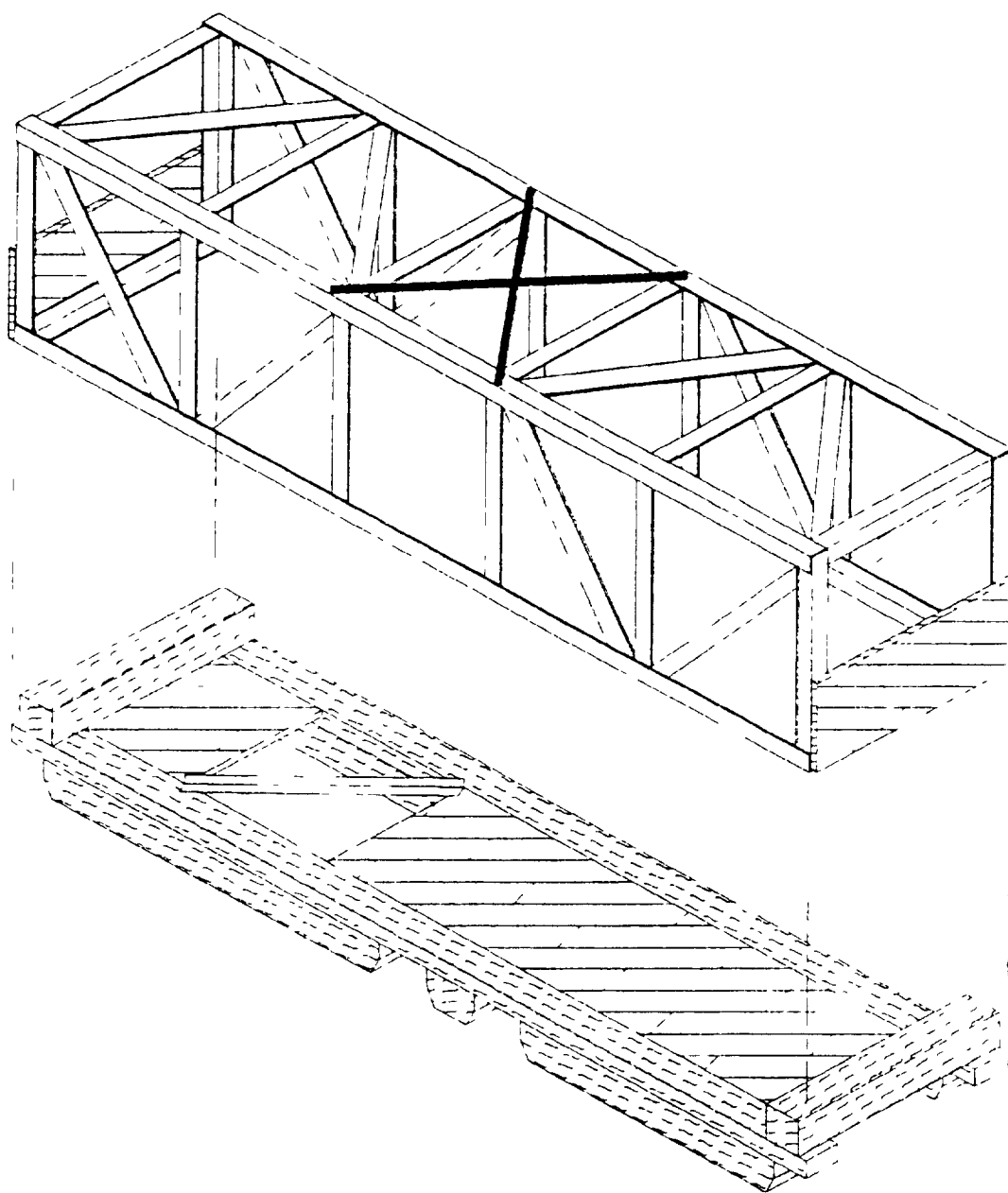
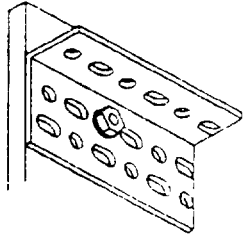
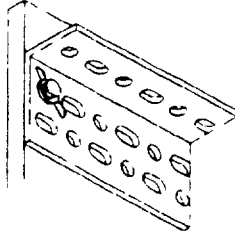


FIGURE 9. Removable Superstructure.

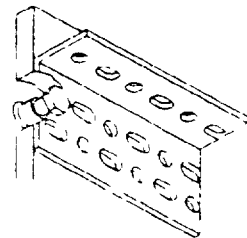
MIL-C-9897C



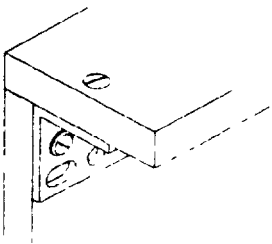
1 STOVE BOLT



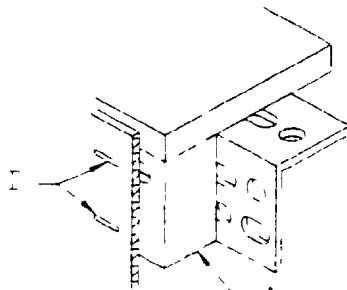
2 SPEED NUT



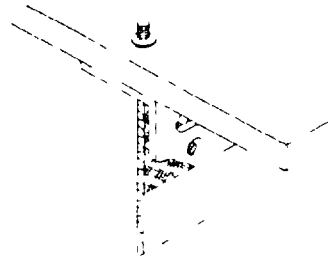
3 BARREL PORTION OF TEE NUT



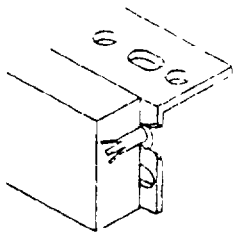
4 WOOD SCREW SPEED NUT HOLDING THE TOP



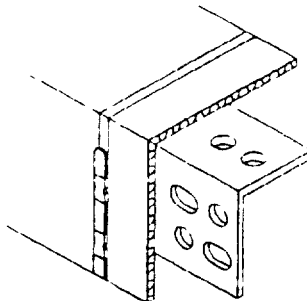
5 NAILING STRIP - A STAPLES - B



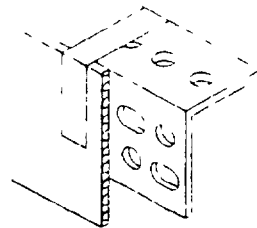
6 ADHESIVE - A HOLDING THE TOP



7 DRIVE RIVET SELF EXPANDING



8 STRAP



9 TAPE

FIGURE 10. Securing covering and sheathing.

MIL-C-9897C

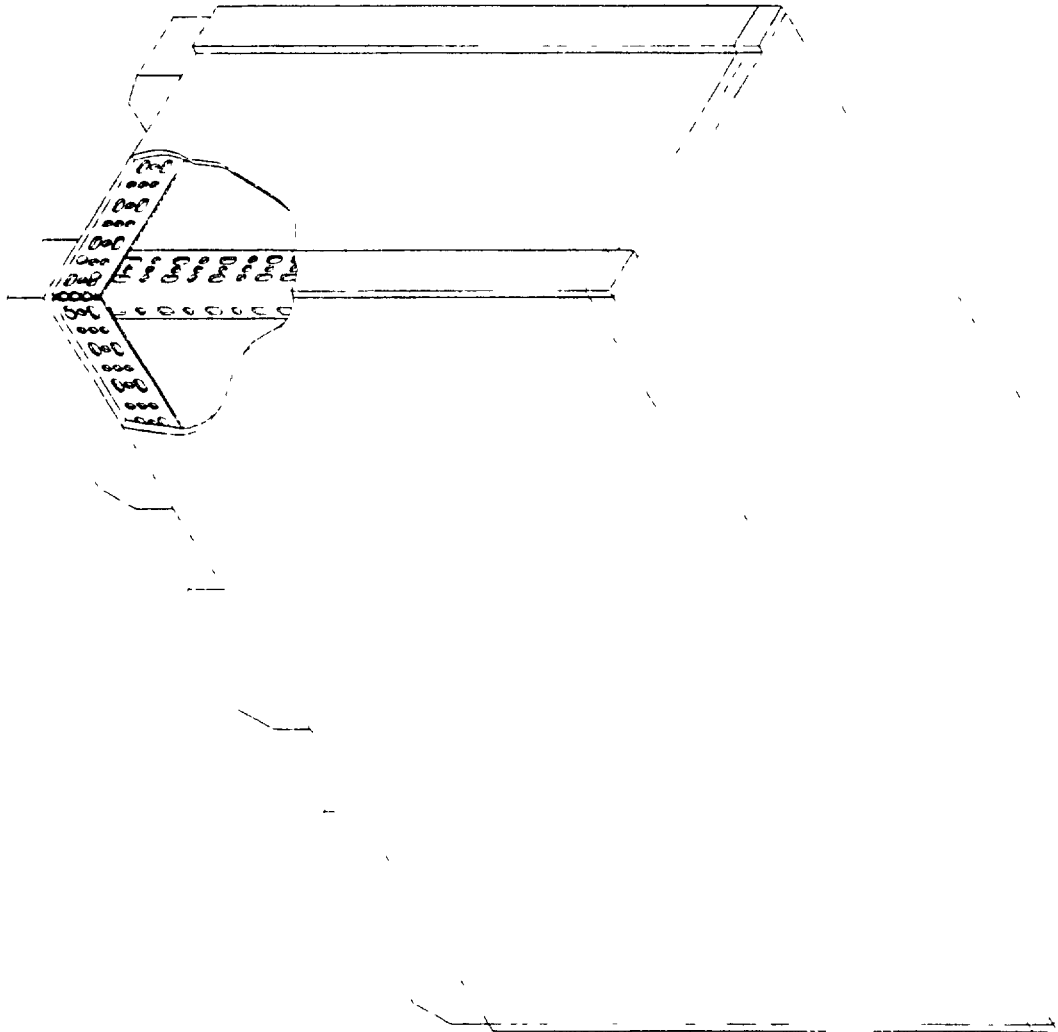


FIGURE 11. Sheathed crate.

MIL-C-9897C

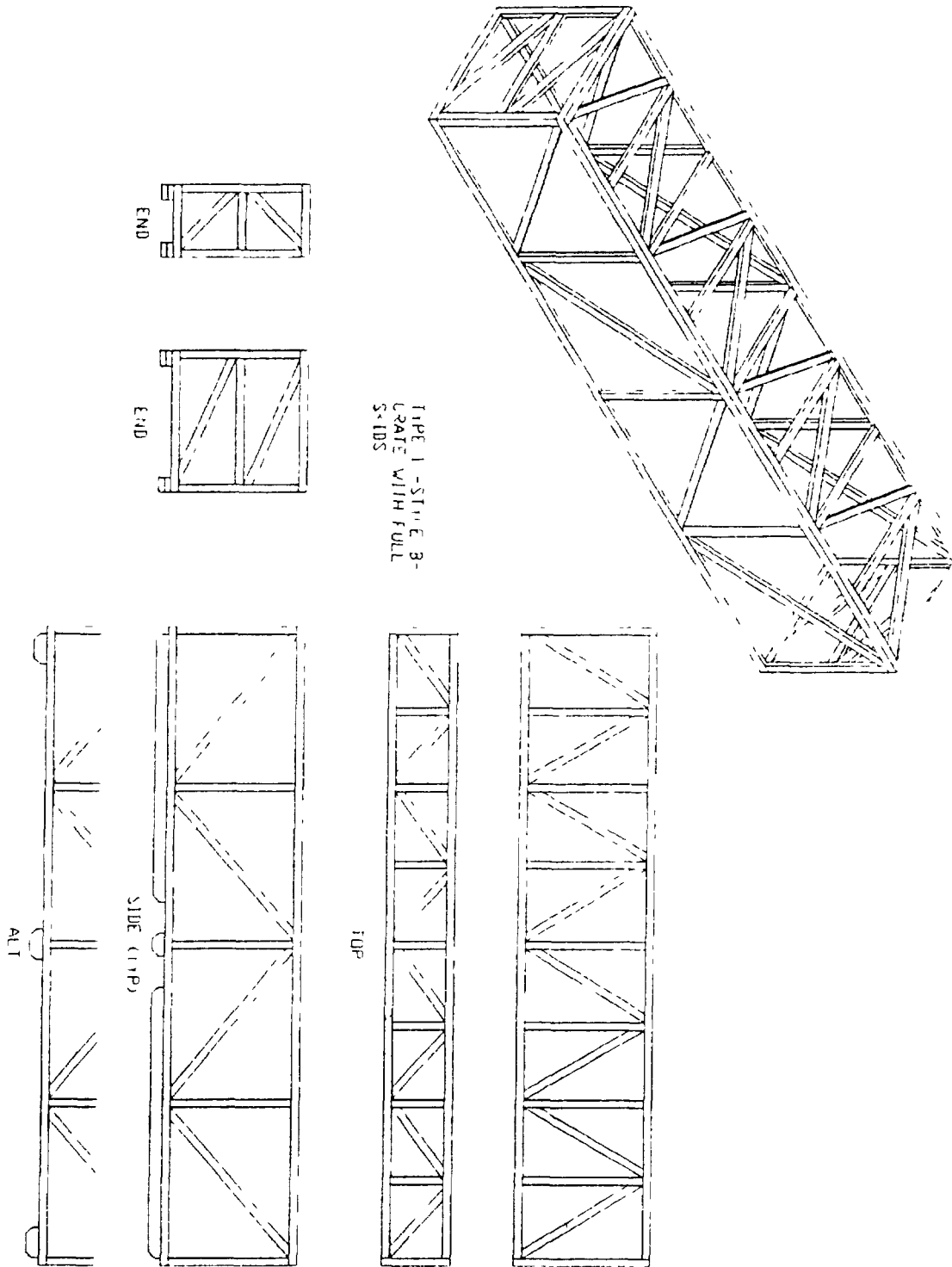


FIGURE 12. Type 1, style B crate.

MIL-C-9897C

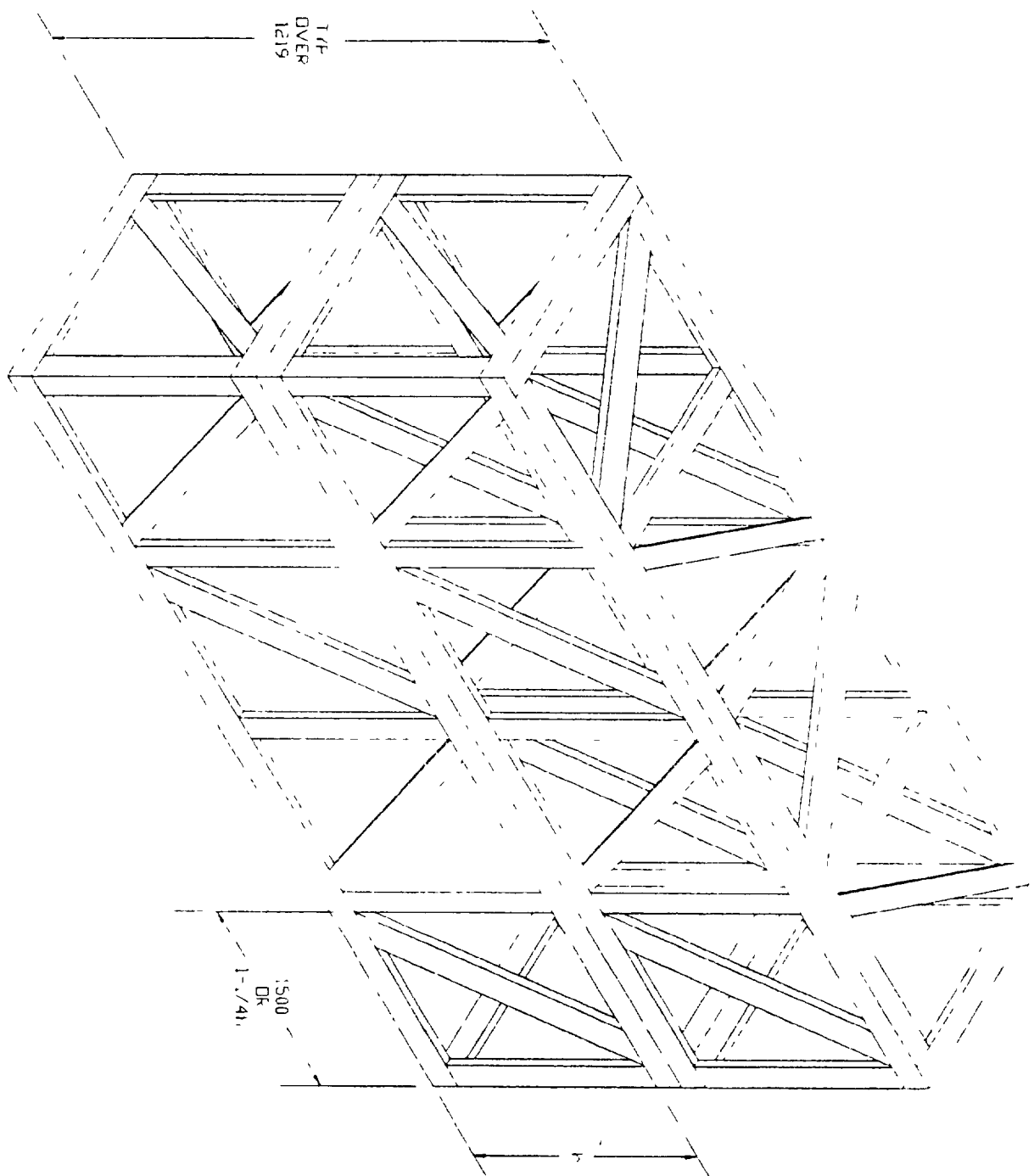


FIGURE 13. Spacing of intermediate side rails.

MIL-C-9897C

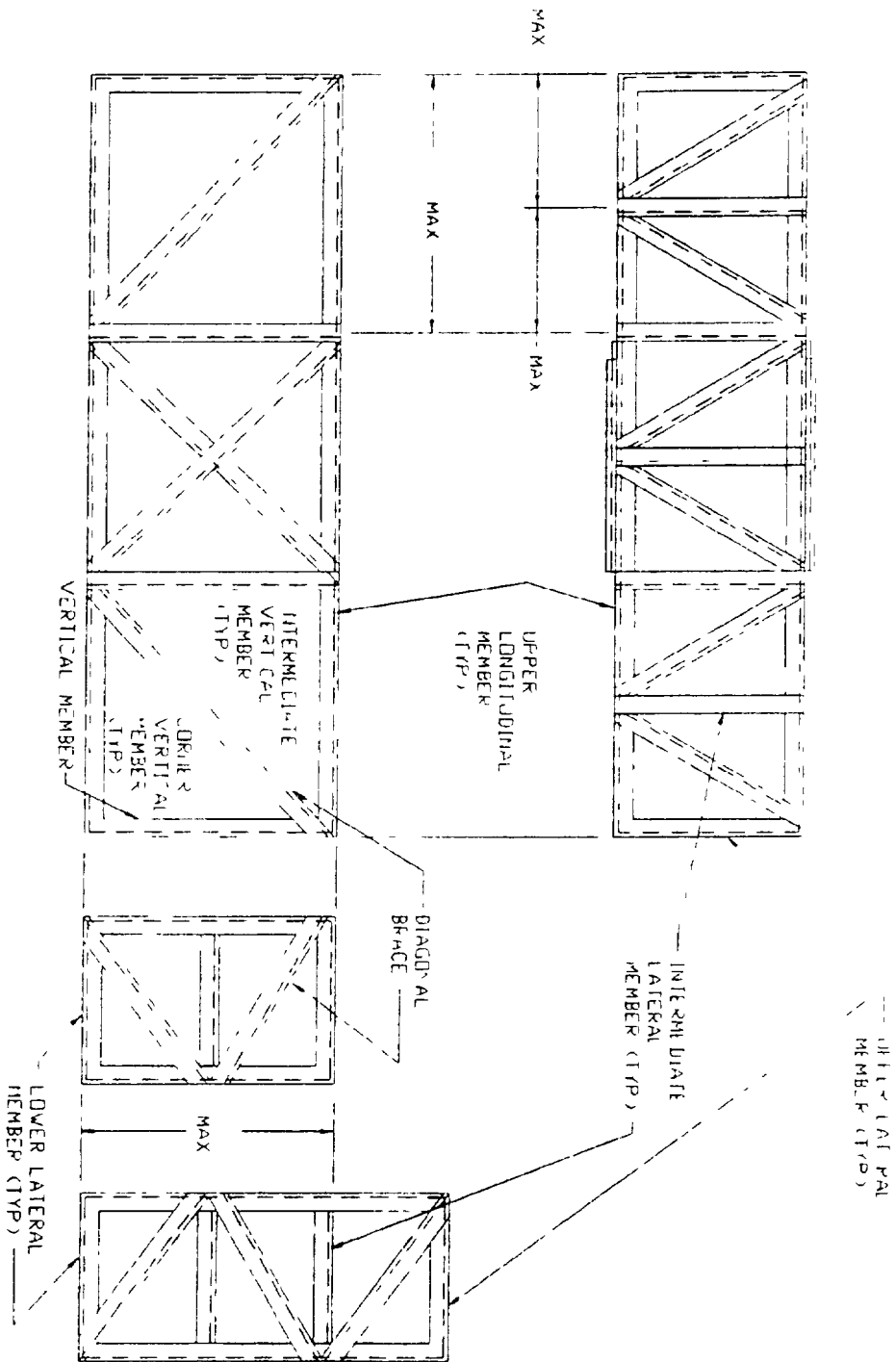


FIGURE 14. Spacing of crossmembers and intermediate lateral members.

MIL-C-9897C

Custodians:

Air Force - 69

Navy - SA

Army - GL

Preparing activity:

Air Force - 69

(Project 8145-0026)

Review activities:

Air Force - 99

Navy - YD

Army - AV, SM, ME

User activities:

Navy - OS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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

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

↓ RECOMMEND A CHANGE:

1 DOCUMENT NUMBER
MIL-C-9897C

2 DOCUMENT DATE (YYMMDD)
15 April 1992

3 DOCUMENT TITLE
Crates, Slotted Angle, Steel or Aluminum, for Lightweight Airframe Components and Bulky Items (for Maximum Loads of 1363 KGS (3000 Pounds))

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

5 REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (include Area Code)

7 DATE SUBMITTED (YYMMDD)

(1) Commercial

(2) AUTOVON
(if applicable)

8 PREPARING ACTIVITY

a. NAME

ROBERT S. TEKESKY, Mech. Eng.

b. TELEPHONE (include Area Code)

(1) Commercial

513-257-3362

(2) AUTOVON

787-3362

ADDRESS (Include Zip Code)

HQ AFLC/LGTP
Wright-Patterson AFB, OH 45433-5999

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT
Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403 Falls Church, VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340