

### Standard Specification for Steel or Aluminum Slotted Angle Crates<sup>1</sup>

This standard is issued under the fixed designation D6255/D6255M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\varepsilon$ ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

#### 1. Scope

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1.1 This specification covers the material and fabrication of new reusable metal (slotted angle) crates intended for use as containers for domestic and overseas shipment of lightweight airframe components and lightweight bulky items, not exceeding 3000 lb [1361 kg] for domestic or overseas air and surface shipments.

1.2 Slotted angle crate performance is dependent on its fabricated components; therefore, a variety of types, classes, and styles reflecting varied performance are specified. This specification, however, does not cover slotted angle crate performance under all atmosphere, handling, shipping, and storage conditions.

1.3 If the use of other construction methods or techniques are acceptable and permitted (see 5.1.12), the resulting packaging systems shall be of equal or better performance than would result from the use of these specified materials and procedures. The appropriate distribution cycle specified in Practice D4169 can be used to develop comparative procedures and criteria.

1.4 The values stated in either inch-pound or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the standard. See IEEE/ ASTM SI 10 for conversion of units.

1.5 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of the standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

#### 2. Referenced Documents

- 2.1 ASTM Standards:<sup>2</sup>
- A109/A109M Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
- A123/A123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A924/A924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- D996 Terminology of Packaging and Distribution Environments
- D1990 Practice for Establishing Allowable Properties for Visually-Graded Dimension Lumber from In-Grade Tests of Full-Size Specimens
- D3951 Practice for Commercial Packaging
- D3953 Specification for Strapping, Flat Steel and Seals
- D4169 Practice for Performance Testing of Shipping Containers and Systems
- D4727/D4727M Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes
- D6199 Practice for Quality of Wood Members of Containers and Pallets
- F1667 Specification for Driven Fasteners: Nails, Spikes, and Staples
- IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System
- 2.2 Federal Specifications: TT-W-572 Wood Preservative: Water-Repellent<sup>3</sup>
- 2.3 National Institute of Standards and Technology (NIST) PS1-95 Construction and Industrial Plywood<sup>4</sup>

<sup>&</sup>lt;sup>1</sup>This specification is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.12 on Shipping Containers, Crates, Pallets, Skids and Related Structures.

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<sup>&</sup>lt;sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>&</sup>lt;sup>3</sup> Available from the Federal Supply Service Bureau, Specification Section, Suite 8100, 480 L'Enfant Plaza, SW, Washington, DC 20408.

<sup>&</sup>lt;sup>4</sup> Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 3460, Gaithersburg, MD 20899-3460.

2.4 American Society of Mechanical Engineers (ASME) Standards:

B18.2.1 Square and Hex Bolts and Screws (Inch Series)<sup>5</sup> B18.2.2 Square and Hex Nuts (Inch Series)<sup>5</sup> B18.2.3.5M Metric Hex Bolts<sup>5</sup> B18.2.4.1M Metric Hex Nuts, Style 1<sup>5</sup> B18.2.4.2M Metric Hex Nuts, Style 2<sup>5</sup> B18.5 Round Head Bolts (Inch Series)<sup>5</sup> B18.5.2.2M Metric Round Head Square Neck Bolts<sup>5</sup> 2.5 Hardwood Plywood and Veneer Association: HPVA HP-1-1994 Hardwood and Decorative Plywood<sup>6</sup> 2.6 National Motor Freight Traffic Association: National Motor Freight Classification<sup>7</sup> 2.7 Uniform Classification Committee Standard: Uniform Freight Classification<sup>8</sup> 2.8 American Iron and Steel Institute (AISI) Standard: Cold-Formed Steel Design Manual<sup>9</sup>

2.9 International Standards ISPM Publication #15

#### 3. Terminology

3.1 *Definitions*— General definitions for packaging and distribution environments are found in Terminology D996.

#### 4. Classification

4.1 *Type:* 

4.1.1 Type I-Open.

4.1.2 *Type II*—Fully-enclosed or sheathed with solid material.

4.2 Class:

4.2.1 Class 1-Outside or indeterminate storage.

4.2.2 Class 2—Inside or protected storage.

4.3 Style:

4.3.1 Style A—Without skids or rubbing strips.

4.3.2 *Style B*—With skid blocks or skids with rubbing strips and provisions for forklift truck handling.

#### 5. Ordering Information

5.1 Purchasers should select the preferred permitted options and include the following information in procurement documents:

5.1.1 Specification title, number, and date.

5.1.2 Crate type, class, and style (see Section 4).

5.1.3 Box inside dimensions specified in order of length by width by depth.

5.1.4 Whether sanded plywood is required (see 6.1.5).

5.1.5 Type sheathing required (see 7.6.1).

5.1.6 Whether full-length skids are required (see 7.7.3.2).

5.1.7 Special features (see 7.9).

5.1.8 Marking panel size (see 7.10.1).

5.1.9 Whether crates are to be shipped assembled or disassembled (see 8.1).

5.1.10 Bolt and nut quantities required (see 6.1.2).

5.1.11 If self-locking nuts are required (see 6.1.2).

5.1.12 Whether other construction methods or techniques are acceptable and permitted (see 1.3).

5.1.12.1 Whether proof that other construction methods or techniques are acceptable (see 1.3) is required.

5.1.13 All wood packaging materials must be ISPM Publication 15 compliant.

#### 6. Materials and Manufacture

6.1 *Materials*—It is encouraged that recycled material be used when practical. All recovered, recycled, or virgin materials used in crate manufacture shall meet the requirements of this specification and referenced documents. In addition, materials shall not affect or be affected by the product being packed.

6.1.1 *Slotted Metal Angle*—Slotted metal angle shall conform to the Supplemental Requirements of this specification.

6.1.1.1 *Slotted Angle Surface Finish*—Steel for Class 1 crates shall have a Class 3 surface finish (S4.7.1.3) applied. Steel for Class 2 crates shall have a Class 1 or 2 surface finish (S4.7.1.1 or S4.7.1.2) applied. Aluminum slotted angle shall require no additional finish.

6.1.2 *Nuts and Bolts*— Nuts and bolts used to assemble the slotted angle shall be of hardened steel and zinc plated after machining. All other bolts and nuts shall be zinc-coated and conform to ASME B18.5 (B18.5.2.2M) or B18.2.1 (B18.2.3.5M), for bolts; and, B18.2.2 (B18.2.4.1M), for nuts.

6.1.2.1 The slotted angle bolts shall be minimum  $\frac{5}{16}$ -in. [8-mm] shank diameter,  $\frac{5}{8}$ -in. [16-mm] length for Types I, II, and IV, and  $\frac{3}{4}$ -in. for Type III and  $\frac{9}{16}$ -in. [14-mm] hexagon head. Bolts shall have an unthreaded load bearing shoulder to prevent shearing action on the threads. Bolts shall conform to ASME B18.2.1 (B18.2.3.5M).

6.1.2.2 The slotted angle nuts shall be prevailing torque, hexagon, self-locking, to prevent loosening after extended storage/handling and vibration during shipment. The  $\frac{5}{16}$ -in. [8-mm] nuts shall be 0.551 to 0.564-in. [13.99 to 14.33-mm] across the flats (width). Other size nuts shall be  $\frac{9}{16}$  in. [14 mm] across the hexagon flats. Nuts shall conform to ASME B18.2.2 (B18.2.4.2M).

6.1.3 *Strapping*—Steel strapping used for banding or tension braces shall conform to Practice D3953, Type I, zinc-coated.

6.1.4 *Wood Members*— Wood used for skids, rubbing strips, load-bearing members, blocking and bracing, and all other wooden components shall conform to the applicable Practice D6199, Group II, III or IV woods structural class and shall conform to commercial standards in accordance with Practice D1990.

6.1.5 *Plywood*—Plywood for Class 1 crates shall conform to ANSI/HPVA HP-1-1994, Type I, Grade 3-4; NIST PS1-95, Interior with Exterior Glue; or, NIST PS1-95, Exterior, Grade C-C. Plywood for Class 2 crates shall conform to ANSI/HPVA

<sup>&</sup>lt;sup>5</sup> Available from the American Society of Mechanical Engineers, 345 East 47th St., New York, NY 10017; American National Standard (ANSI) adopted.

<sup>&</sup>lt;sup>6</sup> Available from Hardwood Plywood and Veneer Association, P.O. Box 2789, Reston, VA 22090–0789; American National Standards Institute (ANSI) adopted.

<sup>&</sup>lt;sup>7</sup> Available from National Motor Freight Traffic Association, American Trucking Associations, 2200 Mill Road, Alexandria, VA 22314.

<sup>&</sup>lt;sup>8</sup> Available from the Uniform Classification Committee, Tariff Publishing Officer, 151 Ellis St., N.E., Suite 200, Atlanta, GA 30335.

<sup>&</sup>lt;sup>9</sup> Available from the American Iron and Steel Institute, ATTN: Publication Orders, P.O. Box 4327, Chestertown, MD 21690.

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HP-1-1994, Type II, Grade 3-4; or, NIST PS1-95, Interior, Grade C-D. Plywood shall have no defects (knot holes, worm holes, etc.) extending through the panel. Unless otherwise specified, plywood shall be finished unsanded (see 5.1.4).

6.1.6 Wood Preservative-Wood or plywood components shall be treated in accordance with TT-W-572, or a commercial equivalent.

6.1.7 Fiberboard—Fiberboard used for sheathing shall conform to Specification D4727/D4727M, Type Class-Weather-Resistant, Grades V2s, V3s, or V4s.

6.1.8 Sheet Steel- Steel used for marking panels shall conform to Specification A109/A109M.

6.1.9 Nails-Nails used to secure top sheathing shall be cement-coated or chemically-etched common or box nails conforming to Specification F1667.

#### 7. Construction

7.1 Slotted Angle Member Selection-Slotted angle selection shall be based on crate size and load weight. Tables 1-3 shall be used as a guide for slotted angle selection.

7.2 Member Splicing—Steel or aluminum components shall be continuous lengths. When splicing is necessary, four bolts (minimum) shall be used to secure a lap splice and eight bolts (minimum) shall be used to secure a butt splice, as shown in Fig. 1.

#### 7.3 Cutting Slotted Angle:

7.3.1 All Members— Members shall be cut at 3-in. [76-mm] increments to utilize the slot and hole pattern properly. After cutting, members shall be trimmed to the required length.

7.3.2 Diagonal Members— When cutting of diagonals is required, the wide flange of the angle can be cut on a miter to provide maximum contact area and positive bolting locations.

7.4 Construction— One slotted metal angle crate shall have six faces (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.

7.4.1 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 6.1.2.

7.4.2 *Braces*—All panels shall have either diagonal braces or steel strapping braces for support.

7.4.2.1 Diagonal Braces— Diagonal brace placement is shown in Fig. 2. All diagonal braces shall be installed to maximize utilization of the round holes in the metal angle.

7.4.2.2 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 angle apex and shall be secured at each end with one bolt (minimum).

7.4.2.3 Short or Corner Braces-Short or corner braces shall be placed in each panel corner being braced and secured at each end with one bolt (minimum). The braces shall be installed at a 45° angle or as close to that angle as possible.

TABLE 1 Slotted Angle Steel Beam Load Capacity<sup>A</sup>

Slotted Angle Steel 12-Gage, 0.105-in. [2.7-mm] 11/2 by 3-in. [38 by 76-mm] Beam Length ft [mm] 2 3 4 5 6 [1200] [1800] [600] [900] [1500] Recommended Load 1450 980 740 500 350 lb [kg] [658] [445] [336] [227] [159] Г ٦ Recommended Load 4500 3100 2100 1200 1000 lb [kg] [2041] [1406] [953] [544] [454] ר זר Recommended Load 10400 7500 5300 4350 3500 lb [kg] [4717] [3402] [2404] [1973] [1588] Recommended Load 1 1 1550 1000 760 580 490 lb [kg] [703] [454] [345] [263] [222]

Slotted Angle Steel							
14-Gage, 0.075-in. [1.9-mm]							
1 1⁄2 by 21⁄4-in.							
[38 by 57-mm]							
			Beam	Length f	t [mm]		
	2 3 4 5 6						
		[600]	[900]	[1200]	[1500]	[1800]	
Recommended Load lb [kg]		1260 [572]	850 [386]	610 [277]	400 [181]	200 [91]	
Recommended Load lb [kg]	Γ٦	2400 [1089]	1700 [771]	1150 [522]	820 [372]	625 [284]	
Becommanded Load	זר זר	E100	2250	0700	2100	1700	
hecommended Load		5190	3330	2700	2100	[774]	
id [kg]		[2354]	[1520]	[1225]	[955]	[//1]	
Recommended Load lb [kg]	ΓJ	800 [363]	510 [231]	390 [177]	300 [136]	250 [113]	
Slotted Angle Steel 14-Gage, 0.075-in. [1.9-mm] 1½ by 1½-in. [38 by 38-mm]							
			B	eam Len	gth ft [mr	n]	
			3	4	5	6	
			[900]	[1200]	[1500]	[1800]	
Recommended Load lb [kg]			495 [225]	270 [123]	190 [86]	145 [66]	
Recommended Load lb [kg]	Γ٦		590 [268]	395 [179]	295 [134]	190 [86]	
Recommended Load lb [kg]	זר זר		1335 [606]	1035 [470]	690 [313]	540 [245]	

<sup>A</sup> Table 1 is usable for slotted angle steel with flange dimensions that are  $\pm \frac{1}{8}$  in. [±3 mm] the flange sizes stated.

7.4.2.4 Steel Strapping Braces-Flat steel strapping placed in tension in full cross or "X" braces (Fig. 3) may be used when vertical frame or other crate members interfere with diagonal brace placement, or when it is determined that this type of bracing meets minimum bracing requirements. Steel strapping shall not be less than 1<sup>1</sup>/<sub>4</sub>-in. [32-mm] wide by 0.032-in. [0.8-mm] thick and shall comply with 6.1.3. 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 than half the strap width to the end.

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#### TABLE 2 Slotted Angle Steel Column Load Capacity<sup>A</sup>

Slotted Angle Steel 14-Gage 0.075-in [1.9-mm]							
1½ by 1½-in.							
[38 by 38-mm]							
			Co	lumn Lei	ngth ft [m	im]	
			[900]	4 [1200]	э [1500]	0 [1800]	
Decommended Lood	7		1400	1100	040	740	
Recommended Load	1		1480 [672]	[535]	940 [426]	740	
in [va]			[0/2]	[000]	[420]	[000]	
Recommended Load	٦Г		3830	3475	2070	2475	
lb [kg]	1.6		[1737]	[1576]	[1347]	[1123]	
			[]	[]	[]	[=•]	
Recommended Load	Б		3900	3565	3170	2620	
lb [ka]	·Ľ		[1769]	[1617]	[1438]	[1188]	
	Slotte	d Angle S	teel				
	14-Gage, (	0.075-in. [	1.9-mm]				
	[38	by 57-mm	1				
	[00]	<i>by 01</i> mm	Colum	Length	ft [mm]		
		3	4	5	6	7	
		[900]	[1200]	[1500]	[1800]	[2100]	
Recommended Load	Г	2490	1850	1530	1280	940	
lb [kg]	•	[1130]	[839]	[694]	[581]	[426]	
Recommended Load	٦٢	5500	5000	4350	3800	3350	
lb [kg]	• •	[2495]	[2268]	[1973]	[1724]	[1520]	
	_						
Recommended Load	Г	5600	5390	5000	4480	4150	
lb [kg]	-	[2540]	[2445]	[2268]	[2032]	[1882]	
	12-Gage (	0 105-in	2 7-mml				
	1½ by 3-in.						
	[38 by 76-mm]						
	Column Length ft [mm]						
		3	4	5	6	7	
	_	[900]	[1200]	[1500]	[1800]	[2100]	
Recommended Load		3450	2870	2360	1670	1150	
lb [kg]		[1565]	[1302]	[1071]	[758]	[522]	
_							
Recommended Load	I,	7960	7040	6240	5400	4500	
id [kg]		[3611]	[3193]	[2830]	[2449]	[2041]	
	F						
Recommended Load	'L	8900	7940	6700	5800	4650	
ib [kg]		[4037]	[3602]	[3039]	[2631]	[2109]	

<sup>A</sup> Table 2 is usable for slotted angle steel with flange dimensions that are  $\pm$ <sup>1</sup>/<sub>9</sub> in. [ $\pm$ 3 mm] the flange sizes stated.

7.4.3 *Structural Joints*—Horizontal, vertical, and lateral members ends shall be bolted together to form the corner joints as shown in Fig. 4. Intermediate vertical, horizontal, and intermediate lateral members shall be bolted together to construct the joints as illustrated in Fig. 1. Additional vertical or horizontal members, which are provided for shock and vibration mounts, shall be secured using two bolts (minimum) in the slotted angle wide flange and one bolt in the narrow flange. It may be necessary to use short pieces of slotted angle to construct this type of joint (see Fig. 1 and Fig. 5). Forklift truck handling and load bearing members shall be joined to the lower horizontal member with two bolts (minimum) at each end.

7.5 Type I, Style A Crate—This simply fabricated crate usually consists of one panel to each section and requires

#### TABLE 3 Slotted Angle Aluminum Configurations Load Capacity<sup>A</sup>

Slotted Angle Aluminum							
13-Gage, 0.089-in. [2.3-mm]							
11/2 by 21/4-in.							
	[38 by 57-mn	n]					
		В	eam Len	gth ft [mr	n]		
		3	4	5	6		
		[900]	[1200]	[1500]	[1800]		
Recommended Load lb [kg]		450 [204]	350 [159]	260 [118]	180 [82]		
Recommended Load lb [kg]	ר	950 [431]	600 [272]	400 <sup><i>B</i></sup> [181]	350 <sup><i>B</i></sup> [159]		
Recommended Load lb [kg]	זר זר	2200 [998]	1600 [726]	1240 [563]	940 [426]		
Slotted Angle Aluminum							

13-Gage, 0.089-in. [2.3-mm]							
1½ by 2¼-in.							
	[38	by 57-mn	ן]				
			Beam	Length f	t [mm]		
		3	4	5	6	7	
		[900]	[1200]	[1500]	[1800]	[2100]	
Recommended Load lb [kg]	٦	1000 [454]	900 [408]	700 [318]	600 [272]	—	
Recommended Load lb [kg]	J Ľ	3100 [1406]	2730 [1238]	2430 [1102]	2170 [984]	1750 [794]	
Recommended Load lb [kg]	ГL	3500 [1588]	3100 [1406]	2700 [1225]	2400 [1089]	2100 [953]	

<sup>A</sup> Table 3 is usable for slotted angle aluminum with flange dimensions that are  $\pm$ <sup>1</sup>/<sub>8</sub> in. [ $\pm$ 3 mm] the flange sizes stated.

<sup>B</sup> On spans of this length, cross bracing gives a better structure, higher recommended load.

TABLE 4 Allowable Load Per Inch of Floorboard Width for Groups II, III, and IV Woods<sup>A</sup>

Length Between	Floorboard Thickness in. [mm]					
Outside Skids -	3⁄4 [19]	1½ [38]	21/2 [64]	31⁄2 [89]		
III. (IIIII) -	lb [kg]	lb [kg]	lb [kg]	lb [kg]		
11 ¾ [299]	48 [21]	220 [99]	574 [260]	1095 [496]		
17 ¾ [451]	32 [14]	147 [66]	382 [173]	731 [331]		
23 5⁄8 [600]	24 [10]	110 [49]	287 [130]	548 [248]		
29 1/2 [749]	19 [8]	88 [39]	229 [103]	438 [198]		
35 1/2 [902]	16 [7]	73 [33]	192 [87]	365 [165]		
41 ¾ [1051]	14 [6]	63 [28]	164 [74]	313 [141]		
45 1⁄4 [1149]	12 [5]	55 [24]	144 [65]	274 [124]		
59 [1499]	9 [4]	44 [19]	115 [52]	219 [99]		
70 7⁄8 [1800]	8 [3]	37 [16]	96 [43]	182 [82]		

 $^{\rm A}$  If Group III or IV woods are used, the above allowable loads may be increased by 20 %.

minimum bracing. Type I, Style A crates are used for lightweight, bulky, and small items not exceeding 165 lb [75 kg], as shown in Figs. 6 and 7. Crate dimensions shall not exceed  $78^{3}/_{4}$ -in. [2000-mm] length by  $29^{1}/_{2}$ -in. [750-mm] width by  $47^{1}/_{4}$ -in. [1200-mm] height, except when specific designs are approved by the purchaser.

7.5.1 *Crate Sides*— Crate sides shall consist of horizontal members (side rails), vertical members (struts), and diagonal braces.

7.5.1.1 *Intermediate Struts*—Intermediate struts shall be required when the spacing between the struts exceeds  $1\frac{1}{3}$  the

#### TABLE 5 Required Ventilating Areas for Plywood or Veneer Sheathed Crates

Crate Volume	Ventilating Space Area
ft <sup>3</sup> [m <sup>3</sup> ]	Required in Each
	Crate End or Side
	in. <sup>2</sup> [mm <sup>2</sup> ]
0-100 [0-2.8]	7 [4 516]
100-150 [2.8-4.3]	10 [6 451]
150-200 [4.3-5.7]	14 [9 032]
200-400 [5.7-11.3]	27 [17 419]
400-600 [11.3-17]	40 [25 806]
600-800 [17-22.7]	54 [34 839]
800-1000 [22.7-28.3]	66 [42 581]
1000-1200 [28.3-34]	81 [52 258]
Over 1200 [Over 34]	101 [65 161]

**TABLE 6 Approximate Metal Gage Thickness** 

			Gage		
	12	13	14	18	22
Approximate	0.1046	0.0897	0.0747	0.0478	0.0299
Thickness in. [mm]	[2.657]	[2.278]	[1.897]	[1.214]	[0.759]

crate height. 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 crate side, extra intermediate struts may be added.

7.5.1.2 *Crate Side Assembly*—The metal angle used for the side rails shall be positioned with the slotted angle wide flange in a vertical position. The struts shall be uniform in length and bolted to the side rails' inside edge. 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 slotted angle wide flange against the crate side rails' wide flange.

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

7.5.2.1 *Intermediate Cross Members*—The distance between cross members shall not exceed  $1\frac{1}{3}$  the crate width. When required, intermediate cross members shall be spaced evenly and systematically along the end height.

7.5.3 *Crate Base*—The base shall consist of flooring, cross members, load-bearing members, and braces as required.

7.5.3.1 *Flooring*—Although the flooring need not be continuous throughout the base, it shall be placed in areas to provide protection to the contained item from damage by forklift trucks or other material handling equipment. Plywood flooring, except load-bearing floorboards, shall have a minimum thickness of <sup>1</sup>/<sub>4</sub> in. [6 mm] for crates through 117/<sub>8</sub> in. [300 mm] wide, <sup>3</sup>/<sub>8</sub> in. [9 mm] for crates over 117/<sub>8</sub> in. [300 mm] wide through 235/<sub>8</sub> in. [600 mm], and <sup>3</sup>/<sub>4</sub> in. [19 mm] for crates over 235/<sub>8</sub> in. [600 mm] wide. Flooring shall be cut to fit in place. The flooring shall be bolted to the crate lower side rails with bolts as specified in 6.1.2 and as shown in Fig. 8, unless a removable superstructure is specified (see Fig. 9). Each piece of flooring shall be bolted in place with two bolts (minimum) in each lower side rail. The distance between bolts used to secure the flooring to side rails shall not exceed 117/8 in. [300 mm]. When 3/8 in. [10 mm] or thinner plywood is used for flooring, a minimum 3/4 by 13/8-in. [19 by 29-mm] wood hold-down strip shall be used on top of the flooring. The bolts shall pass through the hold-down strip, flooring, and side rail. Bolts used for securing floorboards shall not be less than 5/16-in. [8-mm] diameter.

7.5.3.2 *Load-Bearing Members*—Load-bearing members shall be wood, plywood, metal, or a combination of wood and metal. The members shall be placed in a crosswise position to the crate length and bolted to the lower side rail with bolts as specified in 6.1.2. When wood is used for load-bearing members, the size and thickness shall be determined by Table 4. When slotted metal angle is used for load-bearing members, the size shall be determined by Tables 1-3.

7.5.3.3 Cross Members— The slotted-angle cross member minimum strength and quality 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  $25\%_{16}$  in. [649 mm]. When load-bearing members are used, they shall be considered adequate for cross member requirements and other cross members spaced accordingly.

7.5.3.4 *Braces*—Crate base braces shall be of the same material as cross members. Braces will not be required when  $\frac{1}{3}$  of the base is floored with 117/s in. [300 mm] or wider floor panels.

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

7.5.4.1 *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 Fig. 1). Cross members shall be bolted to the upper side rails with bolts as specified in 6.1.2.

7.5.4.2 *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 crates' superimposed load capacity and lateral strength. Distance between the crate top lateral members (cross members and cross ties) shall not exceed  $1\frac{1}{3}$  the crate width. The cross ties shall be bolted to the upper side rails with bolts as specified in 6.1.2 (see Fig. 1).

7.5.5 Light Crates With Short Diagonal Braces—Crates with dimensions not in excess of 59-in. [1500-mm] length by 29<sup>1</sup>/<sub>2</sub>-in. [750-mm] width by 47<sup>1</sup>/<sub>4</sub>-in. [1200-mm] height, with anticipated loads not to exceed 165 lb [75 kg], may be braced with short diagonal braces placed in the corners of the areas to be braced. The pattern illustrated in Fig. 2 may be used for this type of bracing. All other fabrication and material requirements for this crate shall be as specified in 7.5 through 7.5.4.2.

7.6 *Type II, Style A Crate*—The fabrication requirements for this crate frame shall be as specified in 7.5 through 7.5.5.

7.6.1 *Sheathing*—The crate shall be fully enclosed or sheathed fully with plywood, or fiberboard, as specified (see 5.1.5 and Fig. 10). Crate sheathing materials shall comply with 6.1.5 and 6.1.7, as applicable. When <sup>1</sup>/<sub>4</sub>-in. [6-mm] thick or heavier plywood is used for sheathing and is bolted directly to

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FIG. 1 Splices and Joining of Members



the metal angle, diagonal braces may be omitted from the sheathed section. Sheathing shall be fastened to the metal angle with two bolts (minimum) along each panel edge. When any sheathing panel dimensions exceed  $13\frac{3}{4}$  in. [350 mm], three or more bolts shall be used along that edge. The spacing between these bolts shall not exceed  $11\frac{7}{8}$  in. [300 mm]. Several methods of securing covering and sheathing to the metal angle are illustrated in Fig. 11.

7.6.1.1 *Crate Top Sheathing*—Crate top sheathing may be nailed to wood nailing strips secured to the slotted angle portion of the crate. When this sheathing method is used, the nailing strips' minimum size shall not be less than nominal  $\frac{3}{4}$  by  $\frac{13}{8}$  in. [16 by 29 mm] wood with the size increased in accordance with the nail length used. Each nailing strip shall be secured to the slotted angle with two bolts (minimum); maximum bolt spacing shall not exceed 235% in. [600 mm]. Bolts shall conform to ASME B18.5 (B18.5.2.2M). Sheathing shall be nailed to the nailing strips with nails conforming to 6.1.9. Nail minimum size shall be six-penny [8 mm], spaced a maximum of  $\frac{43}{4}$  in. [121 mm] apart.

7.6.2 *Ventilation*— Crates enclosed or sheathed completely with plywood shall be provided with ventilating holes or slots.

7.6.2.1 Ventilating Holes Location —Ventilating holes or slots shall be located at each end or at the ends and sides around the crate perimeter. Ventilating holes or slots shall be placed immediately below the ends and sides top frame members. In crates over 118-in. [3000-mm] 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 5 shall be used to determine the required ventilating areas for each crate end or side.

7.7 *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 Style B Crate fabrication shall be steel and conform to the requirements of 6.1.1 and 6.1.1.1. Other materials used shall conform to the requirements of 6.1.3 – 6.1.9. The crate dimensions shall not exceed  $393\frac{3}{4}$ -in. [10 000-mm] length by  $51\frac{3}{16}$ -in. [1300-mm]



width by 88<sup>1</sup>/<sub>2</sub>-in. [2250-mm] height, except when specific designs are submitted to and approved by the purchaser. A typical crate of this type and style is illustrated in Fig. 12.

7.7.1 *Crate Sides*— Crate sides shall comply with 7.5.1 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.

7.7.1.1 *Intermediate Side Rails*—When the crate side height is in excess of  $51_{16}^{3}$  in. [1300 mm], or when extra strength is required to carry the anticipated load, one or more intermediate side rails shall be provided (see 7.1). When intermediate side rails are necessary, they shall be spaced evenly or systematically between the upper and lower side rails and shall extend the full length of the crate sides (see Fig. 13). The maximum distance between any two adjacent side rails shall not exceed  $51_{16}^{3}$  in. [1300 mm].

7.7.1.2 *Intermediate Struts*—Intermediate struts shall comply with 7.5.1.1.

7.7.1.3 Intermediate Struts Without Intermediate Horizontal Members—Intermediate strut spacing 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 59 in. [1500 mm] or 1<sup>1</sup>/<sub>4</sub> the crate height (see Fig. 14).

7.7.1.4 Intermediate Struts With Intermediate Horizontal Members—Intermediate strut spacing for crates with sides provided with intermediate horizontal members shall be determined by the same method as specified in 7.7.1.3 except that

the height shall be considered as the distance between two adjacent side rails (see Fig. 13).

7.7.1.5 *Crate Side Assembly*—Crate side assembly shall comply with 7.5.1.2.

7.7.2 *Crate End*—The crate ends shall comply with 7.5.2, except that intermediate cross members shall be used when the crate height exceeds the lesser of  $51\frac{3}{16}$  in. [1300 mm] or  $1\frac{1}{4}$  the crate width. In either of the above instances, the maximum distance between any two adjacent cross members shall not exceed  $51\frac{3}{16}$  in. [1300 mm]. The wide flange on all cross members shall be positioned in the vertical direction.

7.7.2.1 *End Bracing*— Crate end bracing shall be accomplished with slotted angle of the same size used in bracing the crate sides, or flat steel strapping tension braces may be used when it is determined that tension braces would be more effective. Sections 7.4.2.1 and 7.4.2.2 shall apply when installing braces (see Fig. 2, Fig. 3, and Fig. 12).

7.7.2.2 Push Plates- Crates in excess of 59 in. [1500 mm] in length or 173/4 in. [450 mm] in width, 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. 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 two bolts (minimum), as specified in 6.1.2, in each plate end. For gross weights up to 400 lb [181 kg], push plates may be plywood or Practice D6199 Group II, III, or IV wood. For gross weights exceeding 500 lb [227 kg], push plates shall only be Practice D6199 Group III or IV wood. Push plates shall be a minimum of  $1\frac{1}{2}$ by 7<sup>1</sup>/<sub>2</sub>-in. [38 by 190 mm] wide when fabricated from D6199 lumber, or a minimum of 3/4 by 117/8-in. [19 by 300-mm] wide when fabricated from plywood (see Fig. 15).

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

7.7.3.1 Skids and Rubbing Strips:

(1) Rubbing Strips—Rubbing strips minimum dimensions shall be  $2\frac{1}{2}$ -in. [64-mm] thick by  $3\frac{1}{2}$  in. [89 mm] in width by  $15\frac{3}{4}$  in. [400 mm] in length. The strips shall be beveled  $45 \pm 5^{\circ}$  on the bottom half of each end. Rubbing strips located at the crate end shall be set back  $2\frac{3}{4}$  to 4 in. [70 to 102 mm] from the crate end to permit the use of slings. The loaded crate center of balance also shall be a determining factor in locating intermediate rubbing strips to provide openings for forklift truck entry. Maximum spacing between rubbing strips shall not exceed  $49\frac{1}{4}$  in. [1251 mm].

(2) Skids—When the contained (net) load exceeds 407 lb [185 kg], full-length skids shall be used. Full-length skids may be used for lesser contained weight, but are not required. Unless otherwise specified (see 5.1.6) when full length skids are used, they shall have minimum nominal dimensions of  $1\frac{1}{2}$  in. [32 mm] by  $3\frac{1}{2}$  in. [76 mm] for net loads up to 825 lb [374 kg], and minimum dimensions of  $3\frac{1}{2}$  in. [76 mm] by  $3\frac{1}{2}$  in. [76 mm] for net loads exceeding 825 lb (374 kg). All full length skids shall be provided with minimum  $2\frac{1}{2}$  in. [51 mm] thick by  $3\frac{1}{2}$  in. [76 mm] wide rubbing strips.

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FIG. 4 Corner Joint

(3) Fastening Skids and Rubbing Strips—Skids and rubbing strips shall be bolted to the crate lower side rails with  $\frac{5}{16}$ -in. [8-mm] diameter (minimum) bolts as specified in 6.1.2 with spacing between these bolts not to exceed 235% in. [600 mm], except that 117%-in. [300-mm] bolt spacing shall be used

for rubbing strips where 23<sup>5</sup>/<sub>8</sub>-in. [600-mm] spacing cannot be accomplished in a single piece.

7.7.3.2 *Load-Bearing Members*—Load-bearing members shall comply with 7.5.3.2.

W = 29.5 in. -

(750 mm) MAX





FIG. 5 Shock and Vibration Mountings

7.7.3.3 *Crate Base Flooring*—Flooring shall comply with 7.5.3.1, except that plywood flooring shall have a minimum thickness of  $\frac{3}{8}$  in. [10 mm] for crates up to  $11\frac{7}{8}$ -in. [300-mm] wide,  $\frac{1}{2}$ -in. [13-mm] for crates  $11\frac{7}{8}$  to  $23\frac{5}{8}$ -in. [300 to 600-mm] and  $\frac{3}{4}$ -in. [19-mm] for crates over  $23\frac{5}{8}$ -in. [600-mm] wide. Wood flooring, except load-bearing, (see 7.7.3.2), shall have a minimum thickness of  $\frac{3}{4}$  in. [19 mm].

7.7.3.4 Forklift Truck Handling Members—Crates shall be provided with forklift truck handling members positioned crosswise to the crate of 23<sup>5</sup>/<sub>8</sub> in. [600 mm] from each end. Crates, which have a width in excess of 35<sup>7</sup>/<sub>16</sub> in. [900 mm], shall be equipped with forklift truck handling members positioned at the location provided for forklift end entry. These members shall be in addition to the ones located 23<sup>5</sup>/<sub>8</sub> in. [600 mm] from the end when the crate length exceeds 94<sup>1</sup>/<sub>2</sub> in. [2400 mm]. The forklift truck handling member size shall be determined by the strength required and Table 1 or Table 5. Load bearing members may be utilized as forklift truck handling members if suitably located.

7.7.3.5 *Cross Members*— When the distance between loadbearing members exceeds the crate width and the flooring is less than <sup>3</sup>/<sub>4</sub>-in. [19-mm] thick, intermediate cross ties shall be installed in the base. Cross members, cross ties, and loadbearing members shall be bolted to both flanges of the lower horizontal member where possible.

7.7.4 Crate Top—The crate top shall comply with 7.5.4.

FIG. 6 Type 1, Style A, Crate-Panel Side

H = 47.25 in.

(1200 mm) MAX

-1 1/3 W. MAX →

1/3 H. MAX

(TYP)

(TYP)

7.7.4.1 *Crate Top Cross Members*—The crate top cross members shall comply with 7.5.4.1.

7.7.4.2 *Crate Top Cross Ties*—The crate top cross ties shall comply with 7.5.4.2, except that the distance between the cross members and the crate top cross ties shall not exceed  $1\frac{1}{4}$  the crate width.

7.7.4.3 *Crate Top Braces*— Braces shall be provided for the crate top 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 7.4.2.1 and Fig. 2. Tension braces may be used in some instances (see 7.4.2.4 and Fig. 3). Brace arrangement is illustrated in Fig. 12 and Fig. 14.

7.8 *Type II, Style B Crate*—The metal fabrication requirements for this crate shall be as specified in 7.7 through 7.7.4.3.

7.8.1 *Sheathing*—Complete sheathing is required, and shall be accomplished in accordance with 7.6.1 through 7.6.1.1.



FIG. 7 Type 1, Style A, Crate-2 Panel Side

7.8.2 *Ventilation*— Ventilation requirements shall be as specified in 7.6.2.

7.9 Special Features— Crates covered by this specification may be procured with special features not described herein. Special features may include partial sheathing, special panels, cradles and contours, blocking and bracing requirements, shock and vibration isolation systems, removable superstructures (see Fig. 9), etc. Requirements for special features shall be stated fully in the contract or order including descriptive and detailed drawings for cradles, contours, and blocking. Complete information including spring rate, deflection, etc., for shock and vibration isolation systems also shall be furnished with the contract or order.

7.10 *Marking Panels*— Marking panels on Type I crates shall be <sup>1</sup>/<sub>4</sub>-in. [6-mm] thick (minimum) plywood of the quality

specified in 6.1.5, or 0.047-in. [1.2-mm] thick steel plate as specified in 6.1.8. The panel shall be painted with one coat of a low-moisture-sensitivity zinc chromate primer and two coats of a lusterless white, air drying, alkyd enamel paint suitable for use on primed exterior and interior metal and wood surfaces. The panel shall be bolted to the crate members in the appropriate place with bolts as specified in 6.1.2. Type II crates normally do not require marking panels.

7.10.1 *Marking Panel Sizes*—The marking panel size will be determined depending on the amount of marking required or as specified in the contract or order (see 5.1.8).

7.11 *Workmanship*— The crates shall be constructed uniformly and free from all imperfections that 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.

#### 8. Shipping Preparation

8.1 Crates can be disassembled to reduce cubage. Bolts, nuts, washers, and pins shall be placed in the mating parts and secured to prevent their loss. When necessary to facilitate reassembly, parts removed shall have matching marking identification on waterproofed cloth shipping tags attached to the mating parts. Boxes shall be packed in a manner that will ensure carrier acceptance and safe delivery to destination at the lowest rating in compliance with Uniform Freight Classification rules. Preserved assembly instructions, if required, shall be secured in a protected location on the bundle, box, or crate of complete boxes or components.

8.2 *Packing and Marking*—Boxes shall be packed and marked in accordance with Practice D3951.

#### 9. Notes

9.1 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 also are readily adaptable to shock mount suspension systems or other types of suspension systems, which may be attached to the crate side and end members 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.

#### 10. Keywords

10.1 airframe components crate; angle; crate; packaging; shipping container; slotted angle

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FIG. 10 Sheathed Crate

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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

FIG. 11 Securing Covering and Sheathing



9. TAPE

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FIG. 12 Type 1, Style B, Crate With Full Skids



FIG. 13 Intermediate Side Rail Spacing

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#### SUPPLEMENTARY REQUIREMENTS

#### S1. Scope

S1.1 These Supplementary Requirements cover the slotted metal angle used for crate assembly. In the event of a conflict between this specification and the references cited herein, this specification takes precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

#### S2. Classification

S2.1 Types:

S2.1.1 *Type I*—Steel, No. 14 gage, 0.075-in., [1.9-mm], minimum dimensions: 1<sup>1</sup>/<sub>2</sub> by 1<sup>1</sup>/<sub>2</sub> in. [38 by 38 mm].

S2.1.2 *Type II*—Steel, No. 14 gage, 0.075-in. [1.9-mm], minimum dimensions:  $1\frac{1}{2}$  by  $2\frac{1}{4}$  in. [38 by 57 mm].

S2.1.3 *Type III*—Steel, No. 12 gage, 0.105-in. [2.7-mm], minimum dimensions: 1<sup>1</sup>/<sub>2</sub> by 3 in. [38 by 76 mm].

S2.1.4 *Type IV*—Aluminum Alloy, No. 13 gage, 0.089-in. [2.3-mm], minimum dimensions:  $1\frac{1}{2}$  by  $2\frac{1}{4}$  in. [38 by 57 mm].

#### **S3.** Ordering Information

S3.1 Purchasers should select the preferred permitted options and include the following information in procurement documents:

S3.1.1 Specification title, number, and date.

S3.1.2 Number of slotted angles by types and dimensions required (see S4.4).

S3.1.3 Class of finish required (S4.7.1).

S3.1.4 Class 1 finish color required if other than lusterless gray (S4.7.1.1).

#### **S4.** General Requirements

S4.1 Material covered by this specification shall be of good design, new construction, convenient to handle and suitable for the intended purpose. Bending, flanging, perforating, forming, and similar operations shall be performed in a manner to ensure that there are no ruptures, cracks, unsightly wrinkles, or other defects in the material.

S4.1.1 All like items furnished under any one contract, including parts and subassemblies, shall be new and interchangeable. The angles nominal thickness shall be the manufacturer's standard thickness corresponding to the required gages so long as these thicknesses approximate the current industry standards relating gages and thickness.

S4.2 Types I, II, and III shall be formed slotted steel angle conforming to Specification A109/A109M, Half-Hard Temper, 60 000 psi [413685 kPa] minimum yield, or Specification A924/A924M Class D, Cold-Rolled Half-Hard No. 2 Temper, 60 000 psi [413685 kPa] minimum yield.

S4.3 Type IV shall be formed slotted aluminum angle alloy No. 5052H34 in accordance with Specification B209 with a minimum yield of 31 000 psi [213737 kPa].

S4.4 *Length*—All types shall be supplied in lengths of 10, 12, or 15 ft [3048, 3658, or 4572 mm] or special lengths when required as specified in S3.1.2.

S4.5 *Camber*—Slotted angle camber, if any, shall not exceed  $\frac{3}{16}$  in. [5 mm] in a length of 10 ft [3048 mm].

S4.6 *Hole Pattern*—The hole pattern for the  $1\frac{1}{2}$  by  $1\frac{1}{2}$ -in. [38 by 38-mm] angle shall be of such design as to provide one line of holes, or slots, or both, in each flange. The  $1\frac{1}{2}$  by  $2\frac{1}{4}$ -in. [13 by 57-mm] angle shall have one line of holes and slots in the narrow flange and two lines of holes and slots in the wide flange. The  $1\frac{1}{2}$  by 3-in. [38 by 76-mm] angle shall have one line of holes and slots in the narrow flange and slots in the narrow flange and three lines of holes and slots in the wide flange. The hole pattern shall be of continual repetition and shall be indexed visibly at 3-in. [76-mm] intervals.

S4.7 *Surface Finish*—The material surface finish shall be free from grease, oil, scale, rust or other extraneous matter. All exposed edges shall be rounded, beveled, deburred, or fabricated in such a manner to prevent injury to the user.

S4.7.1 Surface Finish Classes:

S4.7.1.1 *Class 1*—Primer or phosphatized base and baked-on synthetic enamel. The method of paint application shall be at the discretion of the supplier provided it assures a strong bond with the base metal. Color shall be lusterless gray, unless otherwise specified (see S3.1.4).

S4.7.1.2 *Class* 2—Protective zinc coat in accordance with Specification B633, Type I, Service Condition SC4, applied after perforating, or by Hot Dipping process, in accordance with Specification A123/A123M applied after perforating. Items manufactured from Specification A924/A924M, Class D material, will not require further coating to comply.

S4.7.1.3 *Class 3*—Same as Class 2 finish with the exception at a coating thickness of not less than 0.001 in. [0.025 mm] is to be applied after perforating. The surface finish shall conform to Specification B633, Type I, Service Condition SC1.

S4.8 *Workmanship*—The finished material shall be free of defects, blemishes, burrs, ragged or sharp edges, or breaks in coating or plating, which would detract from appearance or impair serviceability.

#### **S5.** Shipping Preparation

S5.1 *Packing and Marking*—Slotted angle crates shall be packed in accordance with Practice D3951 to ensure carrier acceptance and safe delivery to destination at the lowest rating in compliance with Uniform Freight Classification rules or National Motor Freight Classification rules.

#### S6. Notes

S6.1 *Intended Use*—Material described herein is intended for the construction of steel or aluminum slotted angle crates.

S6.2 The gage of metal used in the fabrication of angles covered by this specification shall be dimensionally defined by the thickness specified in the AISI Cold Formed Steel Design Manual. As these are only approximate thicknesses, they only are listed for guidance and are not for inspection purposes. The acceptability of the thickness of metal furnished shall be determined in accordance with S4.1.1.

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