

ASTM-D5168

ADOPTION NOTICE

ASTM-D5168, "CONTAINERS, FABRICATION AND CLOSURE OF TRIPLE- WALL CORRUGATED FIBERBOARD", was adopted on 15-SEP-91 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: LOGSA Packaging, Storage, and Containerization Center, Attn: AMXLS-TP-P, Hap Arnold Blvd., Tobyhanna, PA 18466-5097. Copies of this document may be purchased from the American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, Pennsylvania, United States, 19428-2959. <http://www.astm.org/>

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Standard Practice for Fabrication and Closure of Triple-Wall Corrugated Fiberboard Containers¹

This standard is issued under the fixed designation D 5168; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the fabrication and closure of new, 1100-unit, triple-wall corrugated fiberboard containers.

1.2 This practice indicates the factors and components that must be controlled in the manufacture of triple-wall fiberboard containers.

1.3 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.4 *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 this 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:

- D 996 Terminology of Packaging and Distribution Environments²
- D 3950 Specification for Strapping, Nonmetallic (and Joining Methods)²
- D 3951 Practice for Commercial Packaging²
- D 3953 Specification for Strapping, Flat Steel and Seals²
- D 4675 Guide for Selection and Use of Flat Strapping Materials²
- D 4727 Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes²
- D 5330/D 5330M Specification for Pressure-Sensitive Tape for Packaging, Filament-Reinforced²
- D 5486/D 5486M Specification for Pressure-Sensitive Tape for Packaging, Box Closure, and Sealing²
- E 380 Practice for Use of the International System of Units (SI)³

2.2 TAPPI Standards:

- T 411 Test Method for Thickness of Paper and Paperboard⁴

- T 803 Puncture and Stiffness Test of Container Board⁴
 - T 810 Bursting Strength of Corrugated and Solid Fiberboard⁴
 - T 811 Edgewise Compression Strength of Corrugated Fiberboard (Short Column Test)⁴
 - T 812 Ply Separation of Solid and Corrugated Fiberboard (Wet)⁴
- 2.3 *Federal Specifications:*
- PPP-B-621 Boxes, Wood Nailed and Lock Corner⁵
 - PPP-B-638 Boxes, Caps, Liners and Sleeves, Fiberboard, Knocked Down, Flat; Packing of⁵
 - FF-N-105 Nail, Brads, Staples and Spikes, Wire, Cut and Wrought⁵

2.4 Military Standard:

- MIL-STD-731 Quality of Wood Members for Containers and Pallets⁶

2.5 Code of Federal Regulations:

- CFR Parts 107-180 Title 49, Hazardous Materials Regulations⁷

2.6 Other Standards:

- National Motor Freight Classification⁸
- Uniform Freight Classification⁹

2.7 Use of Other Specifications:

- 2.7.1 Nothing in this practice shall be construed to prohibit the use of containers of special design or of fiberboard containers identified by package number in the current Uniform Freight Classification and National Motor Freight Classification when in the experience and judgment of the purchaser, the nature of the articles or material to be shipped justifies such containers.
- 2.7.2 Exceptional commodities may require better containers than are specified herein. Containers for explosives and dangerous articles shall comply with the specifications prescribed in the Department of Transportation's (DOT) Office of Hazardous Materials Code of Federal

¹ This practice is under the jurisdiction of ASTM Committee D-10 on Packaging and is the direct responsibility of Subcommittee D10.27 on Paper and Paperboard.

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² *Annual Book of ASTM Standards*, Vol 15.09.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ Available from TAPPI, Technology Park, P.O. Box 105113, Atlanta, GA 30348-5113.

⁵ Available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

⁶ Available from Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120.

⁷ Available from the United States Government Printing Office, Superintendent of Documents, Washington, DC 20402.

⁸ Available from the National Motor Freight Classification, 2200 Mill Road, Alexandria, VA 22314.

⁹ Available from the Rail Publication Service, 151 Ellis St., N.E., Suite 200, Atlanta, GA 30335-6021.

Regulations, Title 49 CFR Parts 107-180. In addition, for the particular articles to which these regulations apply, if the requirements contained in this practice are more stringent, then they must also meet the requirements specified herein. (The DOT regulations apply to such articles as explosives, flammable liquids and solids, compressed gases, oxidizing materials, poisons, and so forth).

3. Terminology

3.1 *Definitions*—General definitions for packaging are found in Terminology D 996.

4. Significance and Use

4.1 Triple-wall corrugated fiberboard containers are used to unitize products into containers of size and shape suitable for manual or mechanical handling and to protect the contents against environmental, handling, shipping, and storage conditions.

4.2 This practice is intended to cover some of the basic constructions and styles of commercially available triple-wall fiberboard packaging used to unitize and protect contents.

5. Classification

5.1 *Classes and Styles*—Triple-wall corrugated fiberboard containers may be furnished in the following classes, styles, and types of ends, as specified:

5.2 *Class:*

5.2.1 Non-weather-resistant containers are for domestic shipments and storage.

5.2.2 Weather-resistant containers are for export shipments and storage where high humidities or extreme climatic conditions may be encountered.

5.2.3 *Fire-Retardant Containers*—When specified, triple-wall containers shall use materials as specified in Specification D 4727.

5.3 *Style:*

5.3.1 *Style A*—One-piece fiberboard, five-panel, with one of four types of ends (see Fig. 1), and with ends inserted in the container body (see Fig. 2).

5.3.2 *Style B*—One-piece fiberboard, five-panel, with one of four types of ends (see Fig. 1), and with ends inserted with the container body, overlapped on container ends (see Fig. 3).

5.3.3 *Style C*—Two-piece, fiberboard, three-panel, with one of four types of ends (see Fig. 1) and with ends inserted in container body (see Fig. 4).

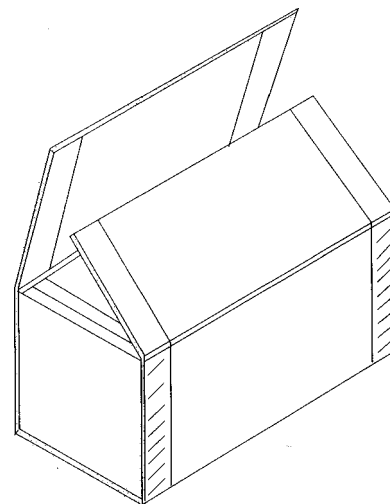


FIG. 2 Style A Box With No. 2 End

5.3.4 *Style D*—Two-piece, fiberboard, three-panel, with one of four types of ends (see Fig. 1), and with ends inserted with the container body overlapped on box ends (see Fig. 5).

5.3.5 *Style E*—Regular slotted container or alternate construction (see Fig. 6).

5.3.6 *Style F*—Full telescope container (see Fig. 7).

5.3.7 *Style G*—Half regular slotted container with short top flaps and cover or alternate construction (see Fig. 8).

6. Ordering Information

6.1 Purchasers should select the preferred options offered herein and include the following data in procurement documents:

6.1.1 Title, number, and date of this specification,

6.1.2 Class and style of container (see 5.1). For containers Styles A through D, the type of end, if desired, and any special requirement for closing,

6.1.3 Inside dimensions (see 7.2),

6.1.4 Special features for Style E, F, and G containers,

6.1.5 Unless otherwise specified, packing and marking shall be in accordance with Practice D 3951,

6.1.6 Whether containers are to be shipped partly assembled or knocked down and in bundles,

6.1.7 When pallet bases are required (see 7.10.2), and

6.1.8 When gluing is permitted.

6.2 *Size and Weight Limitations*—When size and weight

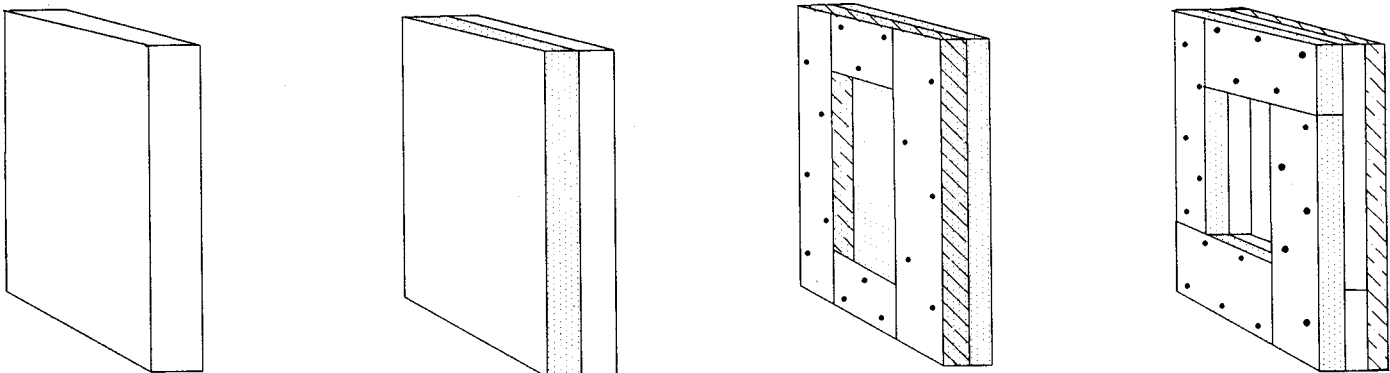


FIG. 1 Four Types of Ends for Use with Styles A through D

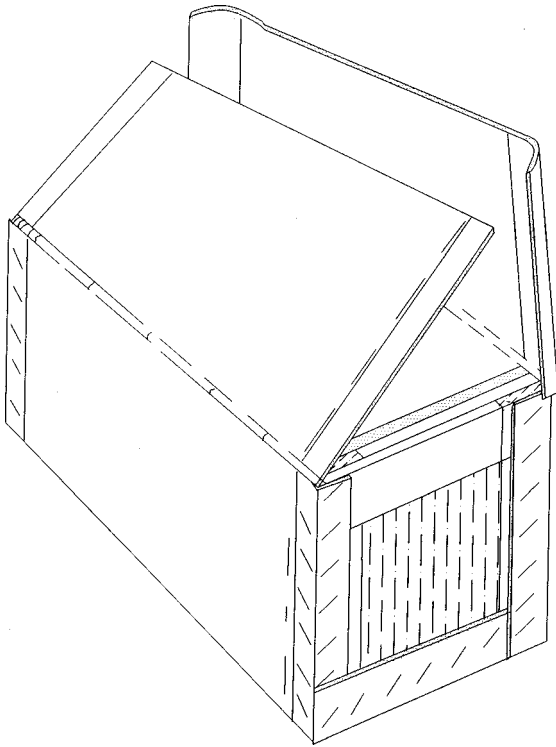


FIG. 3 Style B Box With No. 4 End

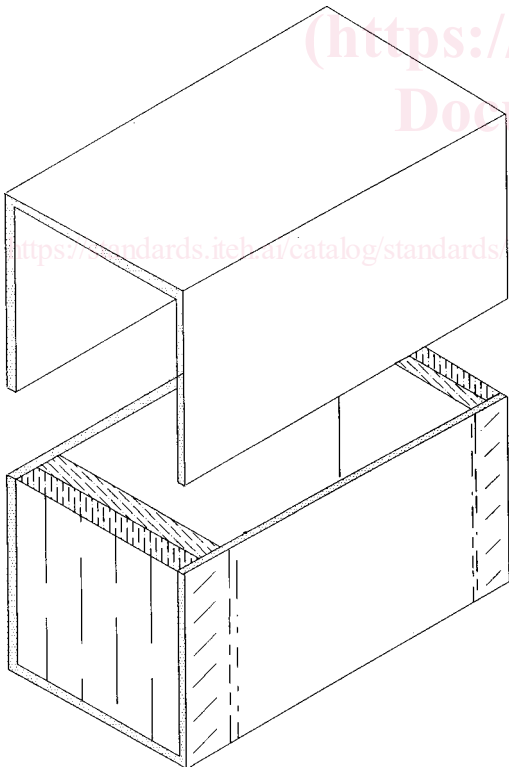


FIG. 4 Style C Box With No. 2 End

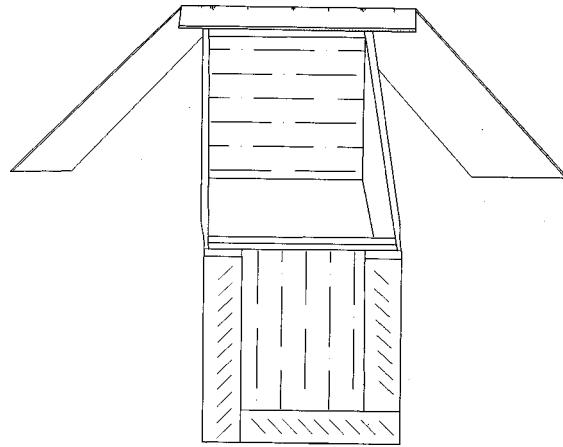


FIG. 5 Style D Box With No. 2 End

7. Materials and Manufacture

7.1 Materials:

7.1.1 *Lumber*—The lumber used for the wood ends of container Styles A through D, shall be Groups I and II woods in accordance with the provisions of MIL-STD-731.

7.1.2 *Fiberboard*—The fiberboard shall consist of three corrugated mediums and four facings fabricated into a triple-wall structural material.

7.1.2.1 *Corrugating Mediums:*

(1) *Weight of Mediums*—The weight of material used to fabricate the corrugated medium shall be no less than 26 lb/1000 ft² (127 g/m²).

(2) *Flute Arrangement*—There shall be two A Flutes, with the remaining flute being either A or C Flute. Flute arrangement shall be agreed upon between the purchaser and the supplier. In accordance with Department of Defense requirements, the flute combination shall be C-A-A (or meet equivalent performance levels).

7.1.2.2 *Facings*—The combined weight of facings shall be not less than 264 lb/1000 ft² (1289 g/m²), with the heaviest facings on the outside. For weather-resistant boxes the outer facings shall be highly water-resistant paperboard which has been treated with a suitable high-grade, wet strength resin. Water-resistant paperboard shall have a 35 % minimum wet mullen retention versus dry mullen when tested in accordance with TAPPI T 810 and T 812.

7.1.2.3 *Caliper*—The thickness of the finished fiberboard shall be $\frac{9}{16}$ in. (14 mm) (with a $\frac{1}{32}$ -in. (1-mm) tolerance), when tested in accordance with TAPPI T 411.

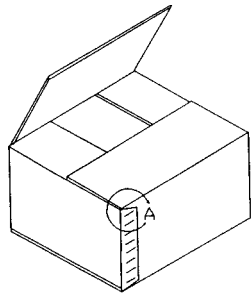
7.1.2.4 *Puncture Resistance*—The fiberboard shall have a minimum puncture test value of 1100 in. oz per in. of tear (36 J) when tested in accordance with TAPPI T 803. Only one puncture reading on each specimen may fall below the allowable minimum and that reading shall be not more than 10 % below the allowable minimum reading.

7.1.2.5 *Short Column Crush*—The short column crush strength of the fiberboard shall be not less than 155 lb/in. (27 kN/m), minimum average, when tested in accordance with TAPPI T 811.

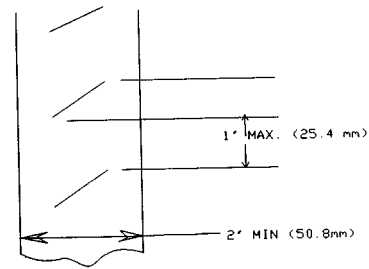
7.1.3 *Adhesive:*

7.1.3.1 For non-weather-resistant containers, the facings and corrugated medium shall be securely bonded with adhesive

limitations of the carrier's classification (see National Motor Freight Classification and Uniform Freight Classification) are exceeded, a special package permit should be obtained, when applicable.

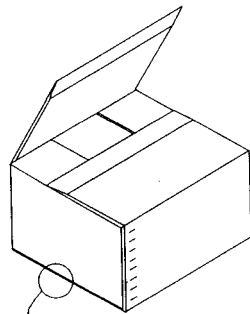


REGULAR SLOTTED BOX

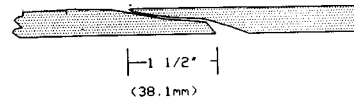


DETAIL "A"

NOTE:
LAP MAY BE INTEGRAL WITH END OR SIDE PANEL AND MAY BE ON INSIDE OR OUTSIDE OF ADJACENT PANEL



REGULAR SLOTTED BOX WITH CRUSHED ROLLED OVERLAPPING FLAPS



DETAIL "B"

ALTERNATE CONSTRUCTION

FIG. 6 Style E Box

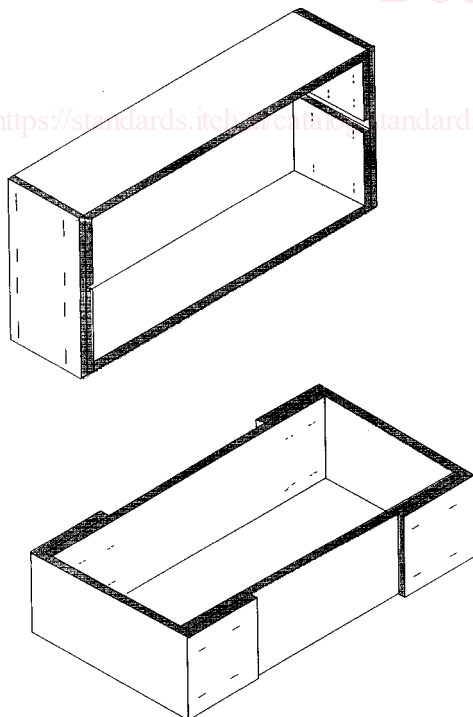
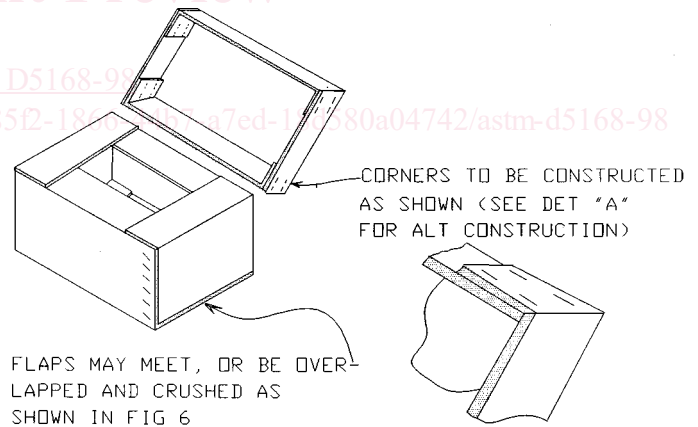


FIG. 7 Style F Box



DETAIL "A"

FIG. 8 Style G Box

water-resistant type and the fiberboard shall show no ply separation greater than 1/4 in. (6 mm) when tested in accordance with TAPPI T 812.

7.1.4 *Metal Fasteners (3x)*—Metal fasteners shall be commercially preformed staples or staples formed from commercial steel stitching wire. All metal fasteners shall have commercially applied coating of zinc or copper wash.

7.2 *Dimensions*—Dimensions of the containers furnished shall be as specified (see 6.1). Unless otherwise specified, the container dimensions shall be inside measurements with a

over the entire area of contact.

7.1.3.2 For weather-resistant containers, in addition to the requirements specified in 7.1.3.1, the adhesive shall be of the

tolerance of $\pm 1/4$ in. (6 mm).

7.3 Certification— The manufacturer shall furnish the procuring activity with certification that containers furnished under this specification meet the requirements specified herein.

7.4 Style A Containers:

7.4.1 Construction:

7.4.1.1 Container Body— The container body shall consist of a single piece of triple-wall corrugated fiberboard so scored as to provide five panels forming the bottom, sides, and full overlapping top flaps. All scoring shall be uniform and of such depth and width as to prevent surface breaks in the board when folded 90° along the score line.

7.4.1.2 Wood Ends—The ends shall be made of wood in accordance with the requirements of MIL-STD-731, Group I or II, and shall be fabricated in accordance with PPP-B-621 except for cleat sizes specified herein. Unless otherwise specified, the ends shall be any selected design described in (1) through (4) at the supplier's option.

(1) **Number 1 End**—A single piece of nominal 2-in. (50-mm) material.

(2) **Number 2 End**—Two thicknesses of nominal 1-in. (25-mm) material with the grain direction at right angles, the two thicknesses securely joined by clinched nailing. The ends shall be comprised of pieces no less than 2½ in. (64 mm) in width.

(3) **Number 3 End**—Cleated panel ends consisting of two sets of overlapped cleats with a panel of triple-wall, corrugated fiberboard. The cleats shall be nominal 1 in. (25 mm) thick, 2¼ in. (57 mm) wide, and shall be assembled with clinched nailing. The fiberboard shall be fastened to the inside of the cleats by either method as specified in (1) or (2).

(4) **Number 4 End**—Cleated panel ends consisting of two sets of overlapped cleats with a panel of triple-wall, corrugated fiberboard. The cleats shall be nominal 1 in. (25 mm) thick, 2¼ in. (57 mm) wide, and shall be assembled with clinched nailing. The fiberboard shall be fastened to the inside of the cleats by either method as specified in (1) or (2).

7.4.1.3 Ends without cleats shall be inserted into the container body so that the outer face of the end is flush with the edge of the body end. Cleated ends shall be inserted so that the cleats are on the outside surface of the ends. When practical to do so, the corrugations of the triple-wall fiberboard shall be crushed on each edge of the body in the area joining the ends. The container body shall be joined to the edges of the ends with metal fasteners (see 7.4.2). The area where fasteners are driven must be crushed to prevent rupture of outer fiberboard face (see Fig. 2).

7.4.2 Fabrication— The fiberboard shall be fastened to the ends by either of the following methods:

7.4.2.1 With zinc-coated steel roofing nails not less than 1¼ in. (35 mm) long, 0.14833 in. (44 mm) in diameter, and with not less than ½-in. (13-mm) diameter heads as specified in FF-N-105. Spacing of the nails shall be as shown in Fig. 9.

7.4.2.2 With double-pointed staples driven in either power- or mallet-operated machines with chisel, chisel divergent, or divergent points. Spacing of staples shall be as shown in Fig. 9.

7.5 Style B Containers:

7.5.1 Construction:

7.5.1.1 Container Body— The container body shall be as specified in 7.4.1.1 and shall be scored in accordance with Fig. 3 to allow 2 in. (50 mm) of the outer top flap, bottom, and side panels to overlap, and the fiberboard shall be crushed on each edge of the body contacting the faces of the container side.

7.5.1.2 Wood Ends—The ends shall be one of the designs specified in 7.4.2. The ends shall be inserted into the container body so that 2 in. (50 mm) of the outer top flap, bottom, and side panels overlap the outside faces of the ends. (See Fig. 3.)

7.5.2 Fabrication— Fabrication shall be as specified in 7.4.2.

7.6 Style C Containers:

7.6.1 Construction:

7.6.1.1 Container Body— The container body shall consist of two pieces of triple-wall corrugated fiberboard, each scored to form a top or bottom face and two sides. The two pieces shall be assembled to form a body with double thickness sides (see Fig. 4). All scoring shall be uniform and of such depth and width as to prevent surface breaks in the board when folded 90° along the score lines. Scores on the bottom section of the body shall be located to provide closefitting joints on the wood ends. Scores on the top section shall be located to provide a snug fit over the side walls of the container.

7.6.1.2 Wood Ends—The ends shall be inserted into the container body as specified in 7.4.1.2 (1) (see Fig. 4).

7.7 Style D Containers:

7.7.1 Construction:

7.7.1.1 Container Body— The container body shall consist of two pieces of triple-wall corrugated fiberboard (top and bottom). The two pieces shall be scored in accordance with Fig. 5 to allow 2 in. (50 mm) of the ends of the top, bottom, and side panels to overlap the outside faces of the container ends. Each edge score shall be slotted the width of the overlap and the fiberboard shall be crushed on each edge of the body contacting faces of the container ends. There shall be no surface breaks in the board when folded 90° along the score line.

7.7.1.2 Wood Ends—The ends shall be one of the designs as specified in 7.4.2. The ends shall be inserted into the container body as specified in 7.4.1.3.

7.7.2 Fabrication— Fabrication shall be as specified in 7.4.2.

7.8 Style E Containers:

7.8.1 Construction— Construction shall be in accordance with Fig. 6 (regular slotted container). This container shall be one piece of triple-wall corrugated fiberboard scored and slotted (slots shall have a minimum width of 3/8 in. (10 mm)) to form a body piece having four flaps for closing each of two opposite faces. The flaps along the longer edge are the outer flaps, and those along the shorter edge are the inner flaps. Flaps shall not project beyond the edge of the container. All length flaps shall be equal in length, and all width flaps shall be equal in length. The outer flaps shall not overlap when closed nor have a gap to exceed ¼ in. (7 mm). The body joint (manufacturers joint) overlap shall be not less than 2 in. (50 mm) wide, and both the overlap and the overlapped portion of the body shall be crushed prior to stapling or gluing. The container may be constructed from two sheets of triple-wall corrugated