



Designation: D5118/D5118M – 22

Standard Practice for Fabrication of Fiberboard Shipping Boxes¹

This standard is issued under the fixed designation D5118/D5118M; 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.

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

1. Scope*

1.1 This practice covers the fabrication of new fiberboard boxes, liners, and sleeves.

1.2 This practice points out the factors and components that must be controlled in the manufacture of corrugated and solid fiberboard boxes, liners, and sleeves.

1.3 This practice does not directly cover the adequacy of fiberboard containers under all conditions of exposure to atmosphere, handling, shipping, and storage. However, references regarding how to assess the adequacy of container under these conditions are included in the practice.

1.4 The values stated in either inch-pound units 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 non-conformance with the standard.

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 this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This practice is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.27 on Fiberboard Shipping Containers, Containerboard and Related Structures and Materials.

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2. Referenced Documents

2.1 ASTM Standards:²

D996 Terminology of Packaging and Distribution Environments

D1968 Terminology Relating to Paper and Paper Products

D1974 Practice for Methods of Closing, Sealing, and Reinforcing Fiberboard Boxes

D2658 Test Method for Determining Dimensions of Fiberboard Boxes

D3950 Specification for Strapping, Nonmetallic (and Joining Methods)

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

D5639 Practice for Selection of Corrugated Fiberboard Materials and Box Construction Based on Performance Requirements

D6198 Guide for Transport Packaging Design

2.2 Federal Specifications:³

CID A-A-59692 Adhesives, Water-Resistant (For Closure of Fiberboard Boxes)

FED-STD-123 Marking for Shipment (Civil Agencies)

MIL-STD-129 Military Marking for Shipment and Storage

2.3 Code of Federal Regulations:³

Title 49 Transportation

² 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.

³ Available from Standardization Documents, Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, attn: NPODS.

*A Summary of Changes section appears at the end of this standard

2.4 Other Publications:

National Motor Freight Classification⁴
 Uniform Freight Classification⁵
 Federal Food, Drug and Cosmetic Act⁶
 TAPPI 402 Standard Conditioning and Testing Atmospheres
 for Paper, Board, Pulp Hand sheets and Related Products⁷
 ISTA Distribution Simulation⁸

3. Terminology

3.1 Definitions of terms relating to packaging are found in Terminologies D996 and D1968.

4. Significance and Use

4.1 Corrugated and solid fiberboard boxes, sleeves, and liners are used to unitize products into packages 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 covers some of the basic constructions and styles of commercially available fiberboard packaging used to unitize and protect contents. This practice also provides references to aid in box design for performance and for testing boxes to gauge actual performance.

4.3 *Use of Other Specifications*—Nothing in this practice shall be construed to prohibit the use of boxes of special design or of fiberboard packages 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 boxes or packages. Some commodities may require less protection while other commodities may require better boxes than are specified herein. Containers for explosives and dangerous articles must also comply with regulations for the Transport of Hazardous Materials (CFR Title 49).

5. Styles

5.1 Fiberboard boxes covered by this practice may be of the following styles:

- 5.1.1 *RSC/0201*⁹—Regular slotted box (Fig. 7).
- 5.1.2 *OSC/0202*⁹—Overlap slotted box (Fig. 8).
- 5.1.3 *FOL/0203*⁹—Full overlap slotted box (Fig. 9).
- 5.1.4 *SFF/0206*⁹—Special full flap slotted box (Fig. 10).
- 5.1.5 *CSSC/0204*⁹—Center special slotted box (Fig. 11).

⁴ Available from National Motor Freight Classification, Inc., 1001 N. Fairfax St., Suite 600, Alexandria, VA 22314-1798, <http://www.nmfta.org>.

⁵ Available from National Railroad Freight Committee, 151 Ellis St., N.E., Suite 260, Atlanta, GA 30335-6021.

⁶ Available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

⁷ Available from Technological Association of the Pulp and Paper Industry (TAPPI), 15 Technology Parkway South, Suite 115, Peachtree Corners, GA 30092, <http://www.tappi.org>.

⁸ Available from International Safe Transit Association (ISTA), 1400 Abbott Rd., Suite 380, East Lansing, MI 48823, <http://www.ista.org>.

⁹ Available from European Federation of Manufacturers of Corrugated Board (FEFCO), 37 Rue d'Amsterdam, 75008, Paris, France. Also known as the International Box Code System, that is, in RSC/0201, RSC stands for regular slotted container and 0201 is the international box code number for the RSC.

5.1.6 *CSOSC/0205*⁹—Center special overlap slotted box (Fig. 11).

5.1.7 *HSCC/0312*⁹—Half slotted box with cover (Fig. 12).

5.1.8 *DBLCC/0310*⁹—Double cover box (Fig. 13).

5.1.9 *IC/0325*⁹—Interlocking double cover box (Fig. 14).

5.1.10 *FTC/0301*⁹—Full telescope box (Fig. 15).

5.1.11 *FTHS/0320*⁹—Full telescope half slotted box (Fig. 16).

5.1.12 *OPF/0401*⁹—One piece folder (Fig. 17).

5.1.13 *FPF/0410*⁹—Five panel folder (Fig. 18).

5.1.14 Rigid Box/0600 Series—Bliss Style Box (Fig. 19).

5.1.15 *TSC*—Tongue and slot closure box (Fig. 20).

5.1.16 *TS*—Triple Slide Box (Fig. 21).

5.2 Other styles may also be applicable (see 8.1.3).

6. Requirements

6.1 Materials:

6.1.1 Fiberboard shall conform to type, class, variety, and grade of Specification D4727/D4727M unless otherwise specified. Flute structure shall be as specified in Specification D4727/D4727M (see 8.1.2).

6.1.2 Manufacturer's joints shall be secured by one of the following materials: (The joint is that seam of a box where the ends of the box blank are joined.)

6.1.2.1 *Cold adhesive* shall conform to CID-A-A-59692 and as specified herein. When boxes are used for packaging or packing food and the adhesive used may contact or be in proximity to the food, the adhesive shall comply with the Federal Food, Drug and Cosmetic Act and regulations promulgated thereunder.

6.1.2.2 *Hot melt adhesives* can be used when gross weight does not exceed 65 lb [30 kg], by overlapping the sides of box forming the joint not less than 1 ¼ in. [32 mm] and by firmly gluing this joint with hot melt adhesive consisting of 100 % solids contents of thermal-plastic materials, which will maintain bond at temperatures ranging from -20 °F [-29 °C] to +165 °F [+74 °C] above zero.

6.1.2.3 *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.

6.1.2.4 *Manufacturer's joint tapes* shall be of the following constructions:

(1) For boxes not exceeding 65 lb [30 kg] gross weight sealing strips must not be less than 2 in. [51 mm] wide, and must comply with one of the following requirements:

(a) Two thicknesses of sulphate paper, total basis weight not less than 80 lb [130 g/m²] combined with a water-resistant compound and reinforced with not less than double strand nylon fiber not less than 210 denier forming a pattern with strands not more than ½ in. [13 mm] apart.

(b) Cloth having crosswise (filler) threads having a minimum tearing strength of 40 Elmendorf units. Inside and outside strips of sulphate paper not less than 2 in. [51 mm] wide; outside strip having a basis weight of not less than 60 lb [100 g/m²] having a bursting strength of not less than 60 psi [414 kPa]; inside strip having a basis weight not less than 40 lb [65 g/m²], and a bursting strength of not less than 40 psi [275 kPa].

(2) For boxes exceeding 65 lb [30 kg] gross weight, sealing strips must be not less than 3 in. [76 mm] wide, unless otherwise provided, and must comply with one of the following requirements:

(a) One thickness of sulphate paper, the fibers of which are integrally bonded and reinforced with rubber, basis weight not less than 175 lb [285 g/m²], embossed and varnished. Two thicknesses of sulphate paper, total basis weight not less than 80 lb [130 g/m²], reinforced in the cross direction with alternating bands of 840 denier and 420 denier nylon, not less than 4 bands every 2 in. [51 mm]. One thickness of sulphate paper having a basis weight not less than 70 lb [114 g/m²] reinforced in the cross direction with alternating bands of 840 denier and 420 denier nylon, not less than 4 bands every 2 in. [51 mm], nylon bands firmly adhered to the surface of the paper by means of a water-resistant compound.

NOTE 1—Kraft tape basis weights are calculated as a ream weight of 500 sheets of 24 in. [610 mm] by 36 in. [915 mm] paper. The base stocks are 90 lb [41 kg], 120 lb [55 kg] or 140 lb [64 kg] kraft ream weight. These convert to 30 lb/1000 ft² [150 g/m²], 40 lb/1000 ft² [195 g/m²], and 47 lb/1000 ft² [230 g/m²] kraft liner board equivalents.

(b) Two thicknesses of sulphate paper, total basis weight not less than 80 lb [130 g/m²] combined with a water-resistant compound and with reinforcing as follows:

—With glass, rayon, or glass and rayon fibers combined, running crosswise of tape not more than $\frac{3}{8}$ in. [10 mm] apart, the rayon fibers to be not less than 1100 denier.

—With glass fibers in a diamond pattern the sides of which, parallel to each other, are formed by a cluster of yarn not less than two per inch as measured in the machine direction. Each cluster shall be formed of at least two 150-1/0 threads or the equivalent in weight of 75-1/0 yarn.

(c) Two thicknesses of sulphate paper, one 30 lb [50 g/m²] basis weight and the other 60 lb [98 g/m²] basis weight reinforced with cotton or linen fibers.

(d) Two or more thicknesses of sulphate paper, total basis weight not less than 150 lb [244 g/m²] and having a bursting strength of not less than 150 psi [1034 kPa], all plies firmly glued together not less than $\frac{1}{4}$ in. [6 mm] wide along both edges. Cloth having crosswise (filled) threads having a minimum tearing strength of 70 Elmendorf units. Inside and outside strips of sulphate paper not less than 2 in. [50.0 mm] wide, each having a basis weight not less than 90 lb [147 g/m²], and having a bursting strength of not less than 90 psi [621 kPa].

6.2 Boxes shall be designed for type, class, variety, and grade as set forth in Specification **D4727/D4727M**, **Tables 1 and 2**, and styles specified herein (see **5.1**, **5.2**, and **6.2.2**).

6.2.1 *Design and Strength Consideration*—Selection of materials and box design are highly dependent on a number of factors which are described in standards referenced in **6.2.1.1** and **6.2.1.2**.

6.2.1.1 Practice **D5639** assists users in selecting appropriate performance characteristics of corrugated fiberboard or box construction, or both, commensurate with their user's needs for packing and distribution of goods. This practice describes several attributes of fiberboard and boxes which relate to various hazards encountered in distribution and describes test parameters which may be specified by the user to ensure

sufficient strength in the box for containment, storage, handling, transport and protection of contents.

6.2.1.2 Guide **D6198** assists users in design and development of packaging intended for the protection of goods while they are in transit from point of origin to final destination.

6.2.2 *Style*:

6.2.2.1 The style of box or folder shall be as specified (see **8.1.3**). The location of the openings shall be determined by the specified dimensions, which shall always be furnished in the order of length, width, and depth (see **6.3** and **Fig. 1**).

6.2.2.2 *Regular Slotted (RSC/0201)*—This box shall meet the requirements of **Fig. 7**. The box shall be scored and slotted to form a body piece having four flaps for closing each of two opposite faces. The flaps along the longer edge of the box openings are the outer flaps and those along the shorter edge are the inner flaps. Flaps shall not project beyond an edge of the box. All flaps shall be of equal width with the outer flaps meeting in the center of the width panel but shall not overlap. The gap not to exceed $\frac{1}{4}$ in. [6 mm] will be permitted unless otherwise specified.

6.2.2.3 *Overlap Slotted (OSC/0202)*—This box shall meet the requirements of **Fig. 8**. This box shall be scored and slotted to form a body piece having four flaps for closing each of two opposite faces. When closed, the inner flaps shall not overlap and the outer flaps shall overlap the distance specified (see **8.1.9**). Inner flaps shall be the same width as the outer flaps, except where the relation of width to length would cause the inner flaps to overlap, in which case, the inner flaps shall be cut so that, when in closed position, they shall meet.

6.2.2.4 *Full Overlap Slotted (FOL/0203)*—This box shall meet the requirements of **Fig. 9**. The box shall be constructed in accordance with **6.2.2.3**, except that the width of the outer flaps shall be the full width of the box and shall not extend beyond the edge of the box (see **6.6**).

6.2.2.5 *Special Full Flap Slotted (SFF/0206)*—This box shall meet the requirements of **Fig. 10**. This box shall be constructed in accordance with **6.2.2.3**, except that the width of the inner flaps in the closed position shall be such that they meet in the center of the box but do not overlap. A gap not to exceed $\frac{1}{4}$ in. [6 mm] will be permitted.

6.2.2.6 *Center Special Slotted (CSSC/0204)*—This box shall meet the requirements of **Fig. 11**. The box shall be constructed in accordance with **6.2.2.3**, except that the width of the inner and outer flaps shall be such that they meet in the center of the box but do not overlap. A gap not to exceed $\frac{1}{4}$ in. [6 mm] will be permitted.

6.2.2.7 *Center Special Overlap Slotted (CSOCS/0205)*—(See **Fig. 11**.) This box shall be as specified herein. When closed, the inner flaps shall meet in the middle of the face with a gap not to exceed $\frac{1}{4}$ in. [6.4 mm] when in the closed position. Outer flaps shall be the same width as the inner flaps and may overlap (no flap cutting is required). Dimension of the box shall be such that the outer flaps do not extend beyond the configuration of the box.

6.2.2.8 *Half Slotted With Cover (HSCC/0312)*—This box shall meet the requirements of **Fig. 12**. The box consists of a box body and a cover. The body shall be scored, slotted and secured to form a tube having four flaps, of equal width on the

bottom. The outer flaps shall meet when closed with a gap not to exceed ¼ in. [6.4 mm]. Unless otherwise specified, the cover shall be a Type I (see Fig. 4) stitch locked cover. When specified (see 8.1.5), the cover shall be Type II (see Fig. 4). Unless otherwise specified, (see 8.1.11 and 8.1.12) the cover depth shall be 3 in. [76 mm] and shipped unassembled. The body may be used as an HSC alone.

6.2.2.9 *Double Cover (DBLCC/0310)*—This box shall meet the requirements of Fig. 13. The box consists of a body tube and two covers. The body consists of fiberboard, scored and secured to form a tube having parallel ends. Unless otherwise specified, the covers shall be Type I (see Fig. 4) stitch lock covers, 3 in. [76 mm] deep. When specified (see 8.1.10 and 8.1.11), the cover shall be Type II (see Fig. 4), and the cover or covers of any type may be other than 3 in. [76 mm] in depth. Unless otherwise specified (see 8.1.12), the cover shall be unassembled.

6.2.2.10 *Interlocking Double Cover (IC/0325)*—This box shall meet the requirements of Fig. 14. The box consists of a body tube with top and bottom flanges and two interlocking covers. The box body shall be fiberboard (SW or DW) scored, slotted, and secured to form a tube having double scored short flanges (flaps) which form a lock with the flanges of the cover. The top and bottom covers shall be Type III (see Fig. 4) flange interlock covers and shall be secured by means of horizontal straps. Unless otherwise specified, (see 8.1.3) the flanges shall be 3 in. [76 mm] long for boxes made of variety SW fiberboard and 4 in. [102 mm] long for boxes made of variety DW fiberboard.

6.2.2.11 *Full Telescope (FTC/0301)*—This box shall meet the requirements of Fig. 15. The box consists of a body and a cover, each constructed of one piece of fiberboard, scored and slotted. The box dimensions shall be the inside measurements of the assembled box body. The cover shall be a snug fit on the body. When specified, flaps shall be positioned inside the side panels of the body and inside the end panels of the cover or inside the side panels of the body and outside the end panels of the cover (see 8.1.15). When set up, the flaps shall not overlap but shall be of sufficient length to allow them to be securely fastened to the adjoining walls by one of the following means:

(1) With not less than five staples applied per flap illustrated in Fig. 4. The edge flaps on the body and cover (see Fig. 4) shall not protrude more than ¼ in. [6 mm] beyond the edge of the member to which it is secured. Fastening along the free edges shall be not more than 4 in. [102 mm] apart.

(2) The flaps, when specified (see 8.1.14) shall be securely glued together with adhesive specified in 6.1.2.1 and 6.1.2.2 covering a minimum of 50 % of the area.

(3) The flaps and adjoining walls may be die cut to allow them to be fastened securely to the adjoining wall with a snap-together tongue or tuck lock corner without causing the fiberboard to rupture.

(4) Unless otherwise specified (see 8.1.15), the flaps on the body and cover shall be positioned in one of the following combinations, at the option of the supplier:

(a) Flaps outside the side panels of the body and inside the end panels of the cover.

(b) Flaps outside the end panels of the body and inside the side

panels of the cover.

(c) For snap-together or tuck lock corner, the flaps shall be outside the end panels of the body and outside the side panel of the cover.

When specified (see 8.1.12), flaps shall be inside the side panels of the body and outside the end panels of the cover. Unless otherwise specified (see 8.1.12), the body and cover shall be shipped unassembled.

6.2.2.12 *Full Telescope Half Slotted Box (FTHS/0320)*—This box shall meet the requirements of Fig. 16. The box consists of a body and a telescoping cover, each constructed of one piece of scored and slotted fiberboard. The box dimensions shall be the inside measurements of the assembled box body. The cover shall be a snug fit on the body. The flaps along the longer edge of the box openings are the outer flaps and those along the shorter edge are the inner flaps. Flaps shall not project beyond an edge of the box. All flaps shall be of equal width with the outer flaps meeting in the center of the box but shall not overlap. A gap not to exceed ¼ in. [6 mm] will be permitted unless otherwise specified.

6.2.2.13 *One Piece Folder (OPF/0401)*—This folder shall meet the requirements of Fig. 17. The folder shall be constructed of one piece of fiberboard, scored and slotted as indicated in the referenced figure. When closed, outer flaps shall meet. A gap not to exceed ¼ in. [6 mm] will be permitted. Unless otherwise specified, the inner flaps shall not be less than 2 in. [51 mm] long for folders under 18 in. [457 mm] in width and not less than 3 in. [76 mm] long for folders 18 in. [457 mm] and over in width.

6.2.2.14 *Five-Panel Folder (FPF/0410)*—This folder shall meet the requirements of Fig. 18. The folder shall be scored and slotted as indicated in the referenced figure. When set up, outer flaps shall overlap (full overlap). The tuck flap length (see Fig. 18, width) shall be equal to the length of the side panel (see Fig. 18, width) less ¼ in. [6 mm] ± ⅛ in. [3 mm].

6.2.2.15 *Rigid Box (Bliss Box/0600 Series)*—This box shall meet the requirements of Fig. 19. The three pieces of a rigid box style include two identical end panels and a body that folds to form the two side panels, an unbroken bottom, and the top. Flaps used to form the joints can be on the end pieces or the body or both. The end panels are attached to the body with special equipment, usually at the user's plant. Six or more joints must be sealed to set up the box before it is filled. The name *Rigid Box* comes from the fact that once the six or more joints are sealed, the box is rigid.

6.2.2.16 *Tongue and Slot Closure (TSC)*—This box shall meet the requirements of Fig. 20. The box shall be constructed of one piece of fiberboard, scored and slotted as indicated in the referenced figure.

6.2.2.17 *Triple Slide (TS)*—This box shall meet the requirements of Fig. 21. The box shall be constructed of three pieces of fiberboard scored to provide three tubes that, when assembled, completely cover six faces of the box. The inner tube shall be left open as illustrated, the middle tube shall be taped at the body joint and shall be a sliding fit on the assembled inner tube, the outer tube shall be taped at the body joint and shall be a sliding fit on the assembled inner and

middle tubes. The box dimensions shall be the inside dimensions of the inner tube in the sequence of length, width, and depth, and shall be as illustrated in the referenced figure. Corrugations shall be at right angles to the scoreline in each tube.

6.2.3 Reinforcements:

6.2.3.1 *Sleeves*—When specified (see 8.1.5) sleeves shall be constructed from fiberboard as specified in 6.4.1.2. If butt joint, it may be taped, or the overlap joint may be stapled, stitched or glued (see Fig. 3). Alternatively, the location of the body joint shall be in the center of the top or bottom panel, providing the joint does not interfere with the required marking. The sleeve shall fit closely over the top, bottom and end panels of the box for which it is intended. Space between the sleeve and box shall not exceed $\frac{3}{16}$ in. [5 mm] when opposite surfaces of sleeve and box are in direct contact with each other.

6.2.3.2 *Liners*—When specified (see 8.1.6), liners shall be constructed from fiberboard as specified in 6.4.1.3 and 6.4.2.2 (see Fig. 6). The liner shall be scored to cover the end and side panels of the box for which it is intended. The flutes of the liner shall be perpendicular to the top of the box. Unless otherwise specified (see 8.1.16), the height of the liner shall be the full inside depth of the box for which intended, and the ends of the liner shall abut (gap not to exceed $\frac{1}{8}$ in. [3 mm]) in the center of a side panel of the box.

6.3 *Dimensions*—Box dimensions shall be as specified in the contract or order (see 8.1.17). The dimensions shall be the inside measurements and shall be cited in the sequence of length, width, and depth (see Fig. 1). Use of Test Method D2658 is recommended for determining inside dimensions. The length dimension shall be the larger of the two dimensions of the open face of the box or folder; the width dimension shall be the lesser dimension of the open face of the box or folder; the depth dimension shall be the distance between the innermost surfaces of the box or folder measured perpendicular to the length and width. Unless otherwise specified, a tolerance of $\pm \frac{1}{8}$ in. [3 mm] shall be permitted in each overall dimension of the box, when conditioned in accordance with TAPPI 402. When boxes are ordered complete with sleeves, for example, RSC-SL, the fit shall be as specified in 6.2.3.1. When boxes are ordered complete with liners, for example, RSC-L, the liners shall fit snugly inside the box.

6.3.1 *Size and Weight Limits*—Unless otherwise specified, (see 8.1.4) size and weight limitations of boxes furnished under this specification shall be in accordance with Tables 1-3. Boxes, folders, sleeves, or liners shall be made from one piece of fiberboard, except that when the length of the box blank (two lengths plus two widths plus manufacturer's joint) exceeds the largest fiberboard sheet length available to the manufacturer, two pieces of fiberboard may be used provided that the manufacturer's joints are placed at diagonally opposite corners.

6.4 Construction of Boxes, Sleeves, and Liners:

6.4.1 *Type CF and SF, Class Weather-Resistant and WWVR Boxes*—Unless otherwise specified (see 8.1.7), type CF or SF, class weather-resistant and WWVR boxes shall be of style (see 6.2.2), material (see 6.1.1), dimensions (see 6.3), and grade of fiberboard (specified in Table 3). Variety SW fiberboard used to

fabricate type CF boxes shall be either A, B, or C flute, as specified (see 8.1.2). Variety DW fiberboard used to fabricate type CF boxes may be any combination of A, B, C, or E flutes, or as otherwise specified. Conventional slotted, type CF, variety SW or DW boxes shall have the flutes running perpendicularly to the scoreline of the box opening, unless otherwise specified (see 8.1.18). When specified (see 8.1.18), end loading, conventional slotted, type CF, variety SW or DW boxes shall have the flutes running parallel to the scoreline of the box opening. The flutes in DBLCC (see 6.2.2.9) and IC (see 6.2.2.10) boxes shall run the depth of the box perpendicular to the openings.

6.4.1.1 *Manufacturer's Joint, Class Weather-Resistant and WWVR Boxes* (see Fig. 2)—The joint of type CF and SF boxes shall be a fiberboard overlap not less than $1\frac{1}{2}$ in. [38 mm] wide extending the full inside depth of the box. The joint tab may be an extension of either the end or side panel of the box and shall not extend beyond the top and bottom scorelines of the adjoining panel. The joint shall be fastened either inside or outside the adjoining panel, and the top and bottom edges of the joint tab shall be not more than $\frac{3}{16}$ in. [5 mm] below the top scoreline or $\frac{3}{16}$ in. [5 mm] above the bottom scoreline of this panel. When specified, the inside joint tab may extend into the flap area and be secured (see 8.1.19). Except as specified in 6.4.1.1 (1), the overlapped joint shall be secured with adhesive specified in 6.1.2.1 and 6.1.2.2 except the toxicity requirements may be waived when packing items other than food that may contact the adhesive. The adhesive shall cover 85 % of the area between the joint tab and adjoining panel with a minimum of 75 % fiber tear of the total overlap area of cold or hot adhesive.

(1) *Metal Fastener Manufacturer's Joint*—Alternatively, the joint for grades W5c, W5s, W6s, and V3c boxes may be secured with metal fasteners specified in 6.1.2.3. The metal fasteners shall be spaced not more than 2 in. [51 mm] apart, center to center, and the distance between the ends of the joint and the nearer end of the fastener shall not exceed 1 in. [25 mm]. An additional metal fastener (tie stitch) shall be placed $\frac{1}{4}$ in. [6 mm] to $\frac{3}{4}$ in. [19 mm] from each end of the joint. Tie stitches will not be required, provided the joint is fastened with the same total number of fasteners required (including tie stitches) equally spaced on not more than 2 in. [50.0 mm] centers with the distance between the outer fasteners and the ends of the joint not exceeding 1 in. [25 mm].

(2) *Butted Manufacturer's Joint*—When specified (see 8.1.20), the joint of W5c boxes shall be made by butting the panels closely together and securing them with tape. The tape shall be a minimum of 2 in. [50.8 mm] wide, and affixed to the outside surface of the joint. The tape shall be centered $\pm \frac{1}{4}$ in. [6 mm] on the joint, extend full depth, or within $\frac{3}{8}$ in. [10 mm] of full depth, and shall adhere over not less than 90 % of area of contact.

6.4.1.2 *Sleeves of Class Weather-Resistant and WWVR Boxes*—Sleeves for class weather-resistant and WWVR boxes shall be the design specified in 6.2.3.1 and fabricated from class weather-resistant and WWVR fiberboard of the same type and grade as the box for which it is intended. Sleeves

fabricated from type CF fiberboard shall have the flutes parallel to the scores. Overlap joints shall be formed in the same manner as in 6.2.3.1.

6.4.1.3 *Liners for Class Weather-Resistant and WWVR Boxes*—Liners for class weather-resistant and WWVR boxes shall be of the design specified in 6.2.3.2, unless otherwise specified, (see 8.1.22) shall be fabricated from material conforming to Specification **D4727/D4727M** grades W5c, V3c or V13c. Unless otherwise specified, (see 8.1.21) the abutting ends shall be taped, at least three quarters the length of the joint, with tape at least 2 in. [51 mm] wide conforming to 6.1.2.4 (1). The tape shall adhere over not less than 90 % of the area of contact and shall be centered on the joint. Liners fabricated from type CF, variety SW fiberboard shall be A or C flute, and liners fabricated from type CF, variety DW fiberboard shall be any combination of A, B, C, or E flutes, or as otherwise specified. When boxes are ordered complete with liner, the dimensions as stated in the contract or order will be the dimensions of the box (see 6.3). The dimensions of the liner shall be such that the liner shall fit snugly (see 6.2.3.2) inside the box. When specified (see 8.1.21), the liner joint shall be affected by overlapping and fastening with adhesive, as specified for type CF box joints in 6.4.2.1 (1) or 6.1.2.1.

6.4.2 *Type CF and SF, Class Domestic Boxes*—Unless otherwise specified, (see 8.1.7) type CF and SF, class domestic boxes shall be of the style (see 6.2.2), material (see 6.1.1 and 8.1.2), dimensions (see 6.3) and grade of fiberboard specified in Table 1 or Table 2. Variety SW fiberboard used to fabricate Type CF boxes shall be A, B, C, or E flute. Variety DW fiberboard used to fabricate type CF boxes may be a combination of A, B, C, or E flutes, or as otherwise specified. Type CF boxes shall have flute direction as specified in 6.4.1. The manufacturer's joint of the boxes shall be formed and secured in accordance with 6.4.2.1.

6.4.2.1 *Manufacturer's Joint, Class Domestic Boxes, (see 6.1.2)*—The joint of the type CF, variety SW box shall be overlapped or butted. The joint of the type SF, shall be overlapped. The joint of the type CF, variety DW box, shall be overlapped or butted. The formed joint shall be secured as specified in 6.4.2.1 (1) or 6.4.2.1 (2), as applicable. Large boxes (see 6.3.1) may be fabricated with two joints positioned at diagonally opposite corners at the option of the supplier.

(1) *Overlapped Joint (Joint Tab)*—The joint shall be made with a fiberboard joint tab overlap not less than 1¼ in. [32 mm] wide with the length of the overlap equal to the inside depth of the box. The joint tab may be an extension of either the end or side panel of the box. When specified, (see 8.1.19) the joint tab may extend into the flap area and be secured. The joint tab shall be fastened either inside or outside the adjoining panel, and the top and bottom edges of the overlap shall be no more than ⅜ in. [5 mm] below the top scoreline or ⅜ in. [5 mm] above the bottom scoreline of this panel. The overlapped joint of type CF boxes shall be fastened with adhesive as specified in 6.1.2.1 or 6.1.2.2, except the toxicity requirement may be waived when packing items other than food that may contact the adhesive, or with metal fasteners. When adhesive is used it shall be applied so as to cover the full area between the joint tab and the adjoining panel. The adhesive shall substantially extend to all

edges of the overlap. The overlapped joint of type SF boxes shall be fastened with metal fasteners as specified in 6.1.2.3 and 6.4.1.1 (1). Metal fasteners for the type CF and type SF boxes having a depth dimension of 18 in. [457 mm] or less shall be spaced not more than 3 in. [76 mm] apart, center to center. Metal fasteners for the type SF box having a depth dimension greater than 18 in. [457 mm] shall be spaced not more than 2½ in. [64 mm] apart, center to center. The distance between the ends of the joint and the nearer end of the nearest fastener shall not exceed 1 in. [25 mm]. Metal fasteners may be applied diagonally, vertically, or horizontally at the option of the supplier.

(2) *Butted Joint (Type CF) Boxes Only*—The butted joint shall be made by fitting the edges of the panels to be joined closely together and securing them with gummed tape. Tape used to secure the body joint of boxes having a gross weight of 40 lb [18 kg] or less (grade 125 to 175) shall be that normally used by the industry for this purpose (see 6.1.2.4 (1)). Tape used to secure the joints of boxes having a gross weight of more than 40 lb [18 kg] (grades over 175) shall be reinforced with sisal, cloth, glass, rayon or double strand nylon fibers (see 6.1.2.4 (2)). The tape shall be not less than 2 in. [51 mm] in width for boxes having a gross weight of 65 lb [30 g] or less (grade 200 and below) and not less than 3 in. [76 mm] in width for boxes having a gross weight over 65 lb [30 kg] (grade above 200). The tape shall be centered on the joint and shall extend its full length, or within ⅜ in. [10 mm] of full length and shall adhere over not less than 90 % to the entire area of contact with the fiberboard.

6.4.2.2 *Liners for Class Domestic Boxes*— Unless otherwise specified (see 8.1.22), liners shall be constructed of fiberboard material conforming to Specification **D4727/D4727M**, type CF, class domestic, variety DW, grade 275. The liners shall be designed, as specified in 6.4.1.3. Liners for class domestic/fire retardant boxes shall be class domestic/fire retardant.

6.5 Compliance Marking:

6.5.1 *Types CF and SF, Class Weather-Resistant and WWVR Boxes*—Types CF and SF, class weather-resistant and WWVR boxes made to comply with this specification shall be imprinted with the following data which will legibly occupy a total area of not more than 36 in.² [232 cm²] nor less than 16 in.² [103 cm²] (see Fig. 22):

6.5.1.1 Boxmaker's name or Box Manufacturer's certificate (refer to NMFC and NRFC regulations).

6.5.1.2 Month and year of manufacturer (for example, "6-87").

6.5.1.3 Individual grade or identification symbols.

6.5.1.4 For shipments to Government agencies the national stock number (NSN), inside dimensions, and outside cube shall be marked below the specification data on all exterior type boxes procured as an item of supply. When filled boxes are procured for direct shipment to the Government, the supplemental requirements set forth in Section 9 shall apply.

6.5.1.5 For class weather resistant/fire retardant boxes, the words "Fire Retardant" shall be marked below the boxmaker's name or the Box Manufacturer's certificate.

6.5.2 The above markings shall be located as follows:

6.5.2.1 *Slotted Style Boxes*—On the outer flap in a corner as close to the scoreline as practicable.

6.5.2.2 *All Other Styles*—In a corner of the top panel as close to the scoreline as practicable. Unless otherwise specified (see 8.1.23), no other marking shall appear on the box. The Box Manufacturer's certificate does not relieve the supplier of his responsibility for meeting the requirements of this practice.

6.5.2.3 When the box panel is not large enough to accommodate all of the markings, the markings may cross the scoreline (see 6.5.3).

6.5.3 *Types CF and SF, Class Domestic Boxes*—Each box shall be plainly marked with the appropriate Box Manufacturer's certificate signifying compliance with the Uniform Freight Classification rules, and the National Motor Freight Classification rules, as applicable. The certificate may be located on the box wherever it is customarily placed; however, the preferred location is on the bottom panel or bottom outer flap. The certificate on boxes having a length of less than 10 in. [254.0 mm] or width of less than 9 in. [228.6 mm] may be reduced in size but the outside diameter shall not be less than 2 in. [50 mm]. In the event the box panel is too small to accommodate even the reduced certificate of compliance, the certificate will be permitted to cross the scoreline and cover more than one panel. For class domestic/fire retardant boxes, the words FIRE RETARDANT shall be marked below the boxmaker's certificate. Unless otherwise specified (see 8.1.23), boxes will require no further markings. When specified (see 8.1.23), the specification number, dimensions, and cube shall be marked below the boxmaker's certificate.

6.6 *Workmanship*—The completed box shall be clean, free of frayed or torn edges, improperly aligned panels, improper scores and slots, and the marking shall be clear and legible. Numerous factors have significant impact on boxes' score fracturing/checking tendency, including fabrication, handling, and storage environment. A reasonable time frame for assessment of score cracking should be agreed upon between the supplier and purchaser. All dimensions of the boxmaker's blank shall be accurately cut, scored, and slotted so that the assembled box parts fit closely without binding. No flap shall project beyond an edge of the box by more than 1/8 in. [3 mm] when the box is set up and closed. All metal fasteners shall be well clinched, flush with or below the interior and exterior surfaces of the corrugated fiberboard joined, and shall be flush or slightly above the surfaces for solid fiberboard.

6.7 *Box Testing and Transit Simulation*—Information needed to assist in the design of optimum package or to confirm that the selected package will perform well in storage and transit can be obtained by utilizing sequential testing processes. Common transit testing sequences and selection criteria can be found in Practice D4169 and in ISTA Series 3 testing.

7. Assembly of Class Domestic Boxes

7.1 *Slotted Styles*—All slotted style boxes shall be assembled in accordance with the figures referenced herein. For closure of boxes the use of Practice D1974 is recommended.

7.1.1 *Slotted Styles With Covers*—All slotted style boxes with covers shall be assembled in accordance with the figures referenced herein.

7.1.1.1 *Type I Cover (Stitch Lock)*—The type I cover end flaps (see Fig. 4) shall be securely fastened to the inside of the adjoining side flange by not less than three metal fasteners located not more than 1/4 in. [32 mm] nor less than 1/2 in. [13 mm] by not less than three stitches located not more than 0.47 in. [12 mm] from free edges and scorelines. Metal fasteners shall conform to 6.1.2.3. When specified the flaps may be joined with adhesives detailed in 6.1.2.1 and 6.1.2.2. See 8.1.24.

7.1.1.2 *Type II Cover (Friction Lock)*—The type II cover end flanges B and C (see Fig. 4) shall be slightly wider than the side flanges "A" of the cover in order to produce a friction lock. Metal fasteners shall not be used to assemble these covers.

7.1.1.3 *Type III Cover (Flange Interlock)*—All interlocking flange boxes shall be assembled in accordance with the referenced figures herein. The interlocked flanges shall be secured by means of flat steel strapping applied horizontally one band width above the center line of the fold (see Fig. 4). The strapping shall be not less than 3/8 in. [9.5 mm] by 0.015 in. [0.38 mm], finish A or B, grade 2, as specified in Specification D3953 or Type IV polyester plastic strapping specified in Specification D3950.

7.1.2 *Style FTC*—All body and cover flaps shall be fastened to the adjoining walls, as illustrated in Fig. 15.

7.2 *Assembly of Class Weather-Resistant and WWVR Boxes:*

7.2.1 *Slotted Styles with Covers*—Slotted style boxes shall be assembled in accordance with the figures referenced herein.

7.2.2 *Style FTC*—Body and cover flaps of style FTC boxes shall be securely fastened to the adjoining walls (see 6.2.2.11).

8. Ordering Information

8.1 Purchasers should select the preferred options permitted herein, and should include the following information in procurement documents:

8.1.1 Title, number and date of this practice.

8.1.2 Type, class, variety, and grade of fiberboard (see 6.1.1, 6.4.1 and 6.4.2).

8.1.3 Box style required (see 5.1, 5.2 and 6.2.2).

8.1.4 Size and weight limitations of boxes (see 6.3.1).

8.1.5 When sleeve is required (see 6.2.3.1 and 6.4.1.2).

8.1.6 When liner is required of SW or DW fiberboard and grade of fiberboard required (see 6.2.3.2 and 6.4.1.3).

8.1.7 When box is for special requirements (see 6.4.1 and 6.4.2).

8.1.8 When maximum requirements for V11c boxes may be increased (see Table 3).

8.1.9 Distance of overlap for OSC boxes (see 6.2.2.3).

8.1.10 When type II cover is required for HSC and DBLCC boxes (see 6.2.2.8 and 6.2.2.9).

8.1.11 Depth of cover other than 3 in. [76.2 mm] for HSC and DBLCC boxes (see 6.2.2.8 and 6.2.2.9).

8.1.12 When covers and bodies are to be shipped assembled (see 6.2.2.8, 6.2.2.9 and 6.2.2.11).

8.1.13 Length of flange for IC boxes, if other than specified (see 6.2.2.10).

8.1.14 When glued flaps of FTC are permitted (see 6.2.2.11).

8.1.15 When flaps of the FTC box are required to be arranged in a manner other than that specified (see 6.2.2.11).

8.1.16 When the ends of the liner shall abut in other than the center of the side panel of the box (see 6.2.3.2).

8.1.17 Inside dimensions of box, specified in inches, in order of length, width and depth (see 6.3).

8.1.18 When the direction of flutes is to run parallel to scoreline of box opening (see 6.4.1).

8.1.19 When the manufacturer's joint tab may extend into the flap area (see 6.4.1.1 and 6.4.2.1 (I)).

8.1.20 When taping of manufacturer's joint is permitted for W5 and W6 boxes (normally for interior boxes) (see 6.4.1.1 (2)).

8.1.21 When liner joints secured with other than tape (see 6.4.1.3).

8.1.22 When other variety or grade fiberboard is required for liners (see 6.4.1.3 and 6.4.2.2).

8.1.23 Printing and marking required in addition to certification (see 6.5.1, 6.5.3, and 9.3).

8.1.24 When other methods of sealing cover assembly joints are required (see 7.1.1.1).

9. Preparation for Delivery

9.1 Unless otherwise specified, packing and marking shall be in accordance with Practice D3951.

9.2 For delivery to agencies of the U.S. Government, packing shall be as specified in the contract or order.

9.3 *Marking for Delivery to U.S. Government Agencies (See 8.1.23):*

9.3.1 *Civil Agencies*—In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with FED-STD-123.

9.3.2 *Military Requirements*—In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129.

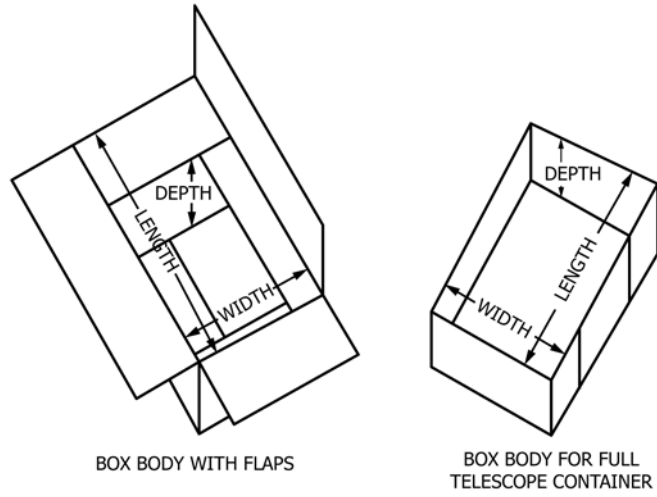
10. Keywords

10.1 boxes; box fabrication; box styles; fiberboard

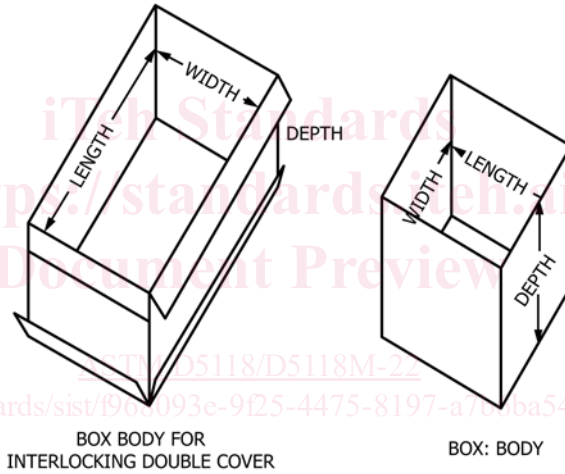
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[ASTM D5118/D5118M-22](#)

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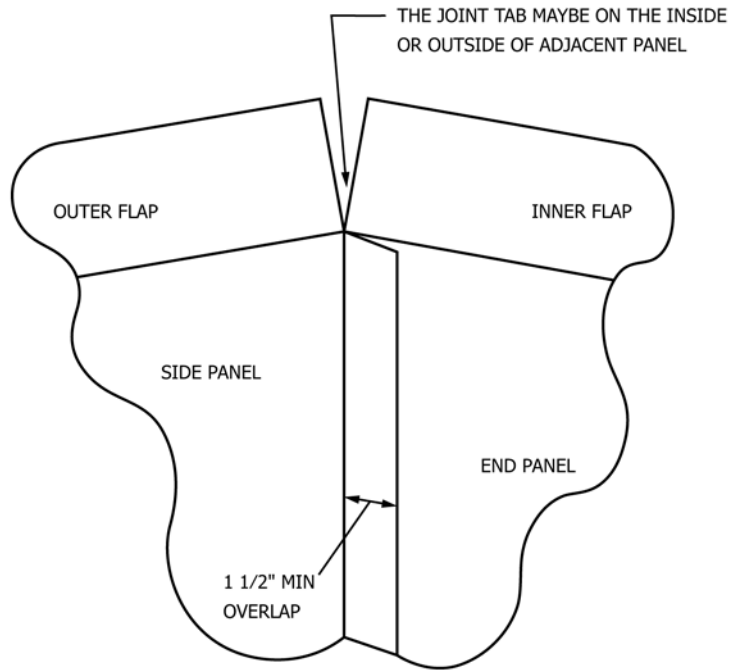
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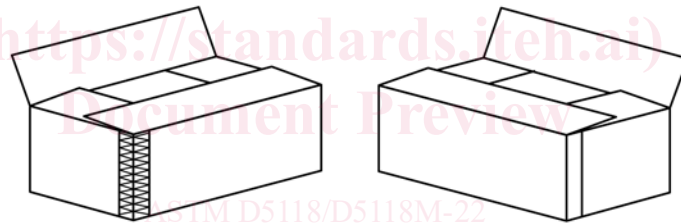
BOX BODY FOR INTERLOCKING DOUBLE COVER BOX: BODY

FIG. 1 Fiberboard Box Dimensioning



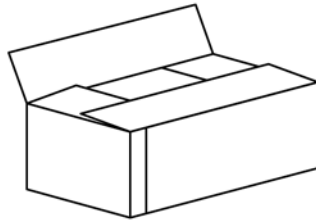
NOTE: The joint tab may be integral with end or side panels.

FIG. 2 Box, Fiberboard; Detail of Manufacturer's Joint Construction for Class Weather Resistant and WWVR Boxes



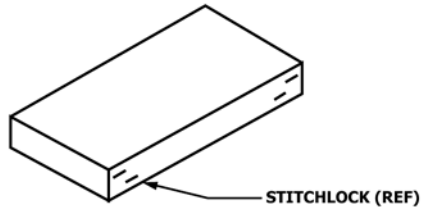
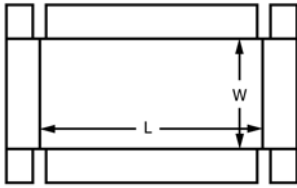
TAPED
See 6.1.2.4.
Refer to 6.4.1.1(2) & 6.4.2.1(2)
for Manufacturer's Joint
Information

STITCHED (INSIDE OR OUT)
See 6.1.2.3.
Refer to 6.4.1.1(1) & 6.4.2.1(1)
for Manufacturer's Joint
Information

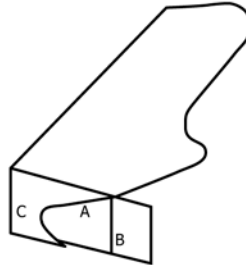
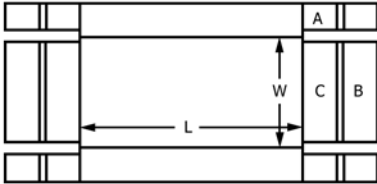


GLUED (INSIDE OR OUT)
See 6.1.2.1 & 6.1.2.2.
Refer to 6.4.1.1 for Manufacturer's Joint Information

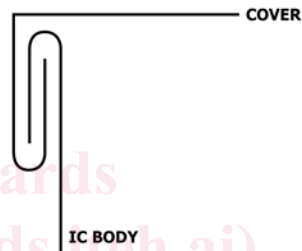
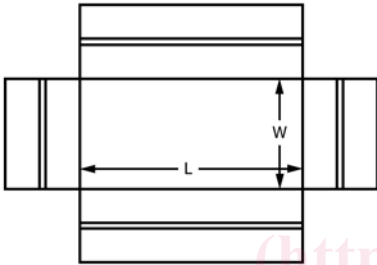
FIG. 3 Box, Fiberboard; Details of Manufacturer's Joint Types



TYPE I GLUED OR STITCHLOCK



TYPE II FRICTION LOCK



TYPE III FLANGE INTERLOCK

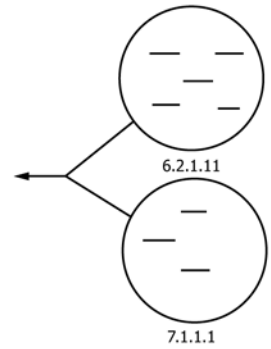


FIG. 4 Cover Assembly

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ASTM D5118/D5118M-22

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