

Document Information

Reference ID	RD-160.2	Issue Date	4/3/2009
Status	Approved	Description	CGS 160 Corrugated Material and Component Construction Requirements
Alternate ID	CGS 160		
Superseding ID			
Superseded By		Issue Category	Revised
Author	Jill Buss	Reason for Issue	General update in all sections: Add Liner Color; Rev. Substitute Board, Deviations; Glued Joint Reqs, Slot Reqs; Updated table, verbiage for all drawings to coincide with table; Revised defects for Board grade and Burst strength
Primary Contact	Kelly Potter		



Description: Corrugated Material and Component Construction Requirement

PURPOSE:

Corporate General Specification 160, or RD-160 defines the general structural requirements for corrugated specifications that reference this document.

GENERAL INFORMATION

Order of Precedence

Specifications will be written to reference this document. In the event that a requirement on the specification contradicts a requirement in this document, the specification requirement will take precedence over any contradicting requirement found between documents.

Other Supplemental Specifications

Referenced Specification

A specification may reference other specifications issued by Trade Associations, Government Agencies or other specification issuing function (see Definitions for example).

Suppliers of corrugated must conform to requirements of RD-180, "Toxic Content of Packaging Materials".

Specification Requirements

The requirements of other supplemental specifications shall be met as indicated in the item specification.

Definitions

UFC - Uniform Freight Classification

NMFC - National Motor Freight Classification

FBA - Fiberboard Box Association

TAPPI - Technical Association of the Pulp and Paper Industry

PMMI - Packaging Machinery Manufacturers Institute

FEFCO - European Federation of Manufacturers of Corrugated Board

Word Construction Rules

- The word "shall" is used in an imperative sense
- The word "must" is used in an imperative sense
- The word "should" is used in a recommendatory sense
- The word "may" is used in a permissive sense
- The word "includes" is used as a word of inclusion not limitation

Identification Number (ID.No) – a unique number assigned by 3M to identify and control each item received by 3M. Typical number configuration 34-XXXX-XXXX-X (+ alpha revision suffix).

Item Specification - A document published by 3M Package Engineering Department describing the printing and construction details of the item to be purchased

Assembly Specification - A specification describing an item made up of two (2) or more parts that is assembled as a single unit when received by 3M.

Purchase Order Information - All items purchased by 3M shall be authorized by the issuing of a Purchase Order from 3M. The item(s) ordered shall be identified on the Purchase Order by ID No., issue, and/or issue date. This information shall be basis for determining the correct construction details for the item.

Questions

All questions from the item manufacturer regarding construction details shall be initially directed to the 3M Sourcing Agent who issued the Purchase Order.

MATERIAL REQUIREMENTS

Board Type

All finished parts furnished under this specification must be made of mill - fresh board. No used board will be acceptable. This requirement does not prohibit the use of recycled fibers in the paperboard as long as the strength and performance of the corrugated board meets the performance grade specified.

Liner Color:

Kraft: The natural raw color produced from local wood using a sulfated pulp process. Note: No inks, dyes or pigments shall be used to add color to the paper.

Mottle White: Mottled liner. The mottled appearance is created by using an underlying ply of kraft fibers that show through the top layer of bleached fiber. Note: Mottle white/oyster/clay white are interchangeable terms.

Bleached White: Fully bleached kraft liner.

Board Quality

Materials used shall be of good commercial quality. "Second Line" materials will be subject to rejection by 3M with a request for replacement with acceptable material.

Substitute Board

No substitutions of material from those indicated in the specification are allowed without prior written agreement with 3M Sourcing Operations and Package Engineering. Note: ECT shall not be used as a substitute for burst strength board.

Deviations

All deviations to the specification must be completed in writing and authorized by a 3M Package Engineer, along with Manufacturing Quality/Supplier Management.

Board Strength

Corrugated board performance will be stated in the specification. The board performance test method and applicable numerical value shall state the minimum performance level required of the board per the prescribed test method.

Edgewise Compressive Strength (ECT) of corrugated fiber board (short column test)

A test method for determining the edgewise compressive strength parallel to the flutes, of a short column of single-, double-, or triple-wall corrugated fiberboard. Test method TAPPI T-811.

Note: The specified board must be made to meet the specific board strength performance test method and value specified. ECT shall not be used as a substitute for Burst Strength specified board.

Bursting Strength Test

A test for measuring the resistance of a material to bursting with the units of measure specified in pounds-force per square inch, measured by the Cady or the Mullen tester.

All single wall and double wall items that are specified under the Burst Strength Test fields shall meet a minimal Burst Strength Test value in accordance with test procedure TAPPI T-810.

Puncture Strength Test:

Triple-wall corrugated board cannot be tested with the Bursting Strength Test method. Board performance is to be specified as Puncture Strength with units of measure and method in accordance with TAPPI puncture test of container board T-803.

Note: Any burst or puncture specified board must also meet the minimal combined weight of facings as specified under Uniform Freight Classification (Rule 41) and the National Motor Freight classification (Item 222).

Corrugation Standard

Corrugation Dimensions

	Flute count, per Lineal ft.	Span between adjacent flutes, mm	Height, in. (mm) ^{A,B}
A-Flute	36 ± 3	7.9 to 9.1	3 / 16 (4.7)
B-Flute	50 ± 3	4.7 to 6.6	3 / 32 (2.4)
C-Flute	42 ± 3	6.8 to 7.8	9 / 64 (3.6)
E-Flute	94 ± 3	3.0 to 3.5	3 / 64 (1.2)

^A The values are approximate

^B Height does not include thickness of facing

Adhesion Quality

Facings and corrugation medium shall be securely adhered at points of contact with corrugating medium.

Drawing Notes

All markings on drawings to be for the side shown except when marked with word "REVERSE" which indicates the far side of the part.

The notation "DIE SIDE" on the drawing shall indicate the side of the item on which the die has initial contact in the die cutting process.

Scores, other than cut scores, may also be indicated as a CREASE.

Cut scores may also be indicated as a SLIT SCORE.

CONSTRUCTION REQUIREMENTS

Dimension Requirements

Dimension Order

Dimensions shall be specified in the order shown for each style (designation) in this section. Note: When the two sheet size dimensions are listed, the first dimension is the direction that is to be parallel with the corrugations (unless otherwise denoted).

Dimension Indicator

L = Length

W = Width

D = Depth

The dimensions specified for various styles are denoted on layout reference with L, W, and D.

Dimensions for boxes, folders, and other types of containers represent the *inside* dimensions of an erected (set-up) and closed container.

The actual dimension from score to score are inside dimensions plus scoring allowance.

Dimensions for flat one-piece sheets of fiberboard represent overall dimensions of the sheet.

Dimension Tolerances

Dimensions shall be within tolerances indicated for the various style (designation).

Erected boxes and other containers:

All die-cut forms (inches - inside dimension)

Up to 24.000 - ± .062

Over 24.000 - ± .094

Regular run (inline slotted containers) forms (inches - inside dimension)

From 3.000 to 24.000 - ± .062

Under 2.999 or over 24.000 - ± .094

Flap Gap Dimensions for Regular Run (Non-die-cut forms /in-line slotted containers)

Box Length ID	Flap Gap Target	Tolerance
Up to 10"	1/8"	+/- 1/8"
Over 10" to 18"	3/16"	+/- 3/16"
Over 18"	1/4"	+/- 3/16"

Folders and other one-piece containers use the same tolerances as boxes.

Flat one-piece sheets - Overall size dimensions shall be ± .062". Location and design dimensions of interior features shall be ± .062". However, the sum of the location dimensions and tolerances shall not exceed the overall dimension and its tolerance.

All dimensions to be in inches. Fractions of an inch shall be specified as three place decimals (ex: 3/4" = .750").

Tolerances for items other than erected boxes or other containers shall be ± .062" for each dimension shown; unless otherwise indicated on drawing. However, tolerances may not be allowed to accumulate along a continuous line of dimensions, so as to result in a greater overall tolerance than ± .062".

Corrugation Direction

The direction of the fiberboard corrugation shall be manufactured as indicated for each style (designation).

For sheets and other styles, corrugated direction is vendor option if it's not called out on the specification.

Manufacturer's Joint

The manufacturer's joint shall be referred to as "joint". Style (designation) shows a flap for a glue or stitched joint. If manufacturer's joint is to be taped, flap shall be deleted.

Glue or Stitched Joint Requirements

The type of joints acceptable to 3M are the taped or glued (flap inside or outside) at the supplier's discretion *unless* the item specification requires a specific type. Stitched joints are allowed *only* if the item specification specifically requires this type of joint. All joint construction must conform to the Uniform Freight Classification requirements and/or other applicable regulations.

Taped Joint Requirements

The gap between joining end flaps after taping, when lying flat, shall be the same as the other flap slots $\pm .125"$. Measurements shall be taken at each end of the tape forming the joint.

The length of the tape must be the same as the specified inside depth dimension of the style $\pm .125"$.

The alignment of the panel ends at the joint should be parallel, but the difference between the two ends of the joint shall not exceed $.125"$.

The tape shall be centered over the gap area in both vertical and lateral direction $\pm .125"$. Tapes used for joints must be in compliance with the requirements of the Uniform Freight Classification and/or other applicable regulations. The choice of specific tape to be used shall be made according to the requirements of the finished container, internal load, etc.

Glued Joint Requirements

The glued joint lap width must not be less than 1.250" but shall not exceed 1.500" unless otherwise specified in the specification.

The alignment of the panel score lines at the joint shall not exceed $.125"$.

The gap between joining ends of the box flaps, after gluing, when lying flat shall be the same as the other flap slots $\pm .125"$.

The glue coverage for cold liquid glue shall be 85% of the lap area and the bond quality (when the joint is pulled apart) must display fiber in at least 90% of contact area.

The glue quantity and application shall be such that there is minimal squeeze-out or transfer. Transfer of glue to adjacent containers or to the inside of the container which results in fiber tear, upon separation, is unacceptable.

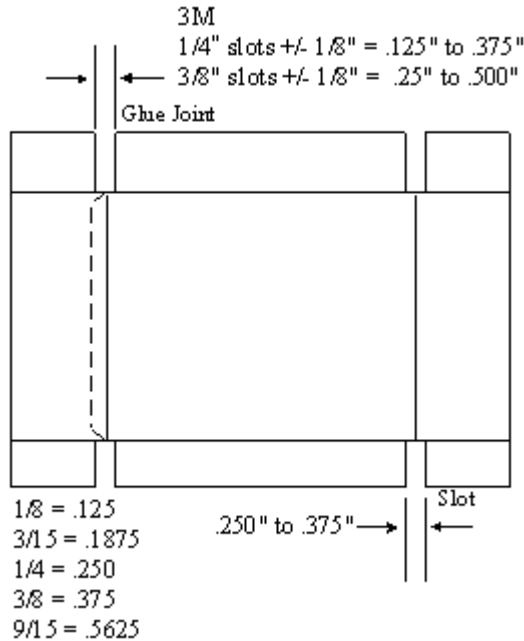
The alignment of the panel ends at the joint should be parallel, but the difference between the two ends of the joint shall not exceed $.125"$. Note: To find the Manufacturer's Joint Gap – Measure gap one inch from top and bottom edge of box. To find the skew – Subtract the larger measurement from the smaller measurement. The difference is the amount of skew.

The glue coverage for hot melt adhesive shall be 25% of the flap contact area and the bond quality (when the joint is pulled apart) must display fiber in at least 90% of the contact area.

Scoring of containers must be adjusted so that the effective inside dimensions (inner most points) of the container are the same as specified in the item specification including tolerances, regardless of whether an inside or outside lap is used.

Slot Requirements

Slot width may range from .250" to .375" ± 1/8.



Style Information

Style Designation

The STYLE designation in the specification shall be either by 3M STYLE NO. or by a drawing of the item.

Style Code System

The STYLE designated by a STYLE NO. in the specification shall be applicable to STYLE NO. indicated in this section. All design codes are prefaced by 3M.

Hierarchy	Active Styles	Description	Inactive 3M Styles
Slotted Container	201	RSC (Regular Slotted Container)	
	203	FOL (Full Overlap Slotted Container)	
	205	CSO (Center Special Overlap Slotted Container)	
Designed Container	Designed Container	Overlap Slotted Container	202
	Die Cut	Center Special Slotted Container	204
	Die Cut	Center Special Full Overlap Slotted Container	206
	Designed Container	Roll End Folder	403
	Die Cut	One-Piece Folder with Flanges	415
	Designed Container	Roll End Folder with Support Panel	1100
Component	Scored Sheet	Sleeve, Corrugations Parallel to Depth	501
	Scored Sheet	Sleeve, Corrugations Parallel to Length	502
	Die Cut	Corner Cut-Out Tray	1004
	Die Cut	Corner Cut-Out Tray (Cut to Fit) Depth Specified	1005
	Slotted/Scored Sheet	Flanged Sleeve	1007
	Slotted/Scored Sheet	Flanged Cap (Cut to Fit)	1008
Tray/Folder	200	Half Slotted Container – Body	
	401	One-Piece Folder, Tuck Dimension Specified	
	402	One-Piece Folder, Full Tuck	
	410	Five Panel Folder, Full Flap Ends	
	1000	Side-Slotted Tray	

	1003	Half-Slotted Container – Cover	
	1006	End-Slotted Tray	
	1101	Five-Panel Folder with Regular Slotted Ends	

- Notes: 1) Items in **red** require drawings that meet 3M RD-191.
 2) Die cuts are die cuts no matter what the finished item turns out to be (i.e. tray). Fully enclosed die cuts are designed containers; all other are components.

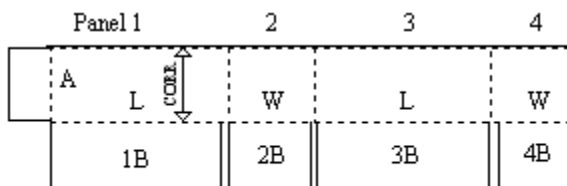
Design Requirements (see Tolerance Section for reference)

Note: Layout is OUTSIDE VIEW. If glue flap is specified in the item specification, the glue flap must be on the panel illustrated, unless noted otherwise.

Style: 3M 200 Half Slotted Container – Body (See 3M 1003 for top)

FEFCO Style: 0200

FBA Style: HSC

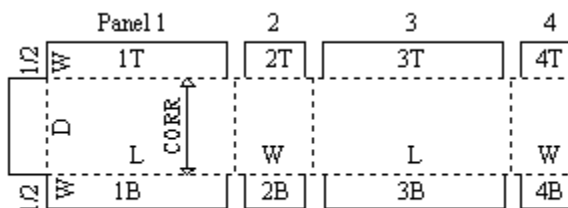
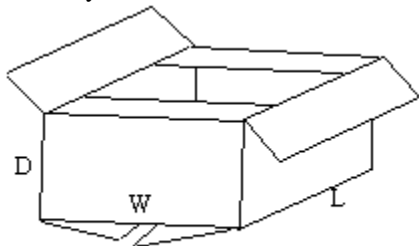


Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 201 Regular Slotted Container

FEFCO Style: 0201

FBA Style: RSC

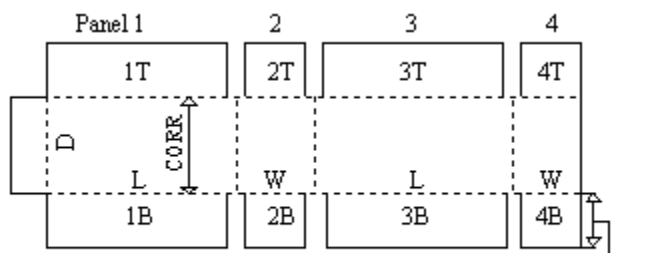
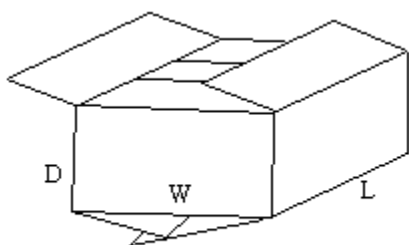


Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 202 Designed Container (Overlap Slotted Container)

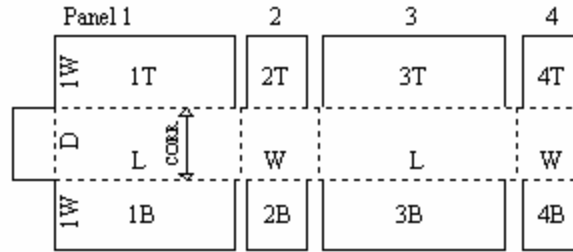
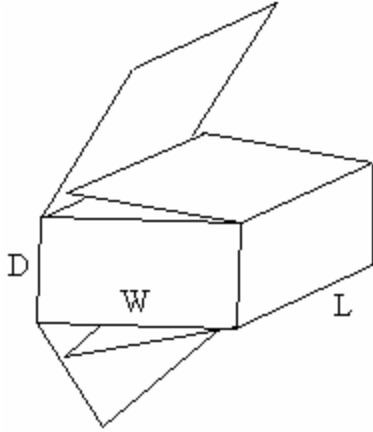
FEFCO Style: 0202

FBA Style: OSC



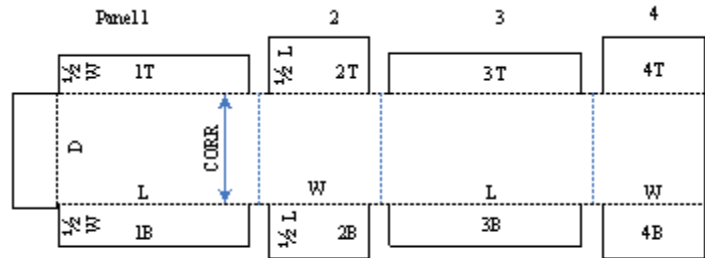
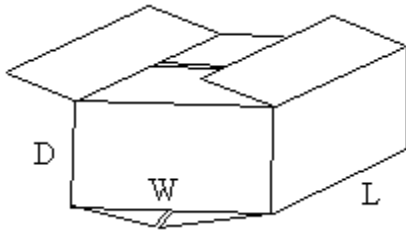
Size Order Designation: L x W x D, Flap Length
 Size = Effective Inside Dimensions, Erected

Style: 3M 203 Full Overlap Slotted Container
 FEFCO Style: 0203
 FBA Style: FOL



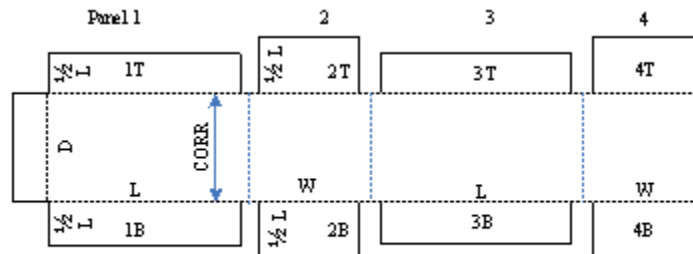
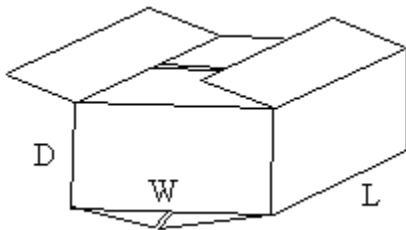
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 204 Die Cut (Center Special Slotted Container)
 FEFCO Style: 0204
 FBA Style: CSSC



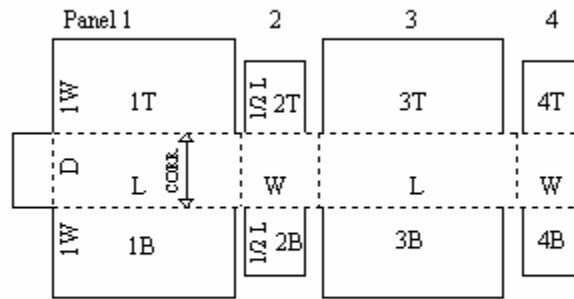
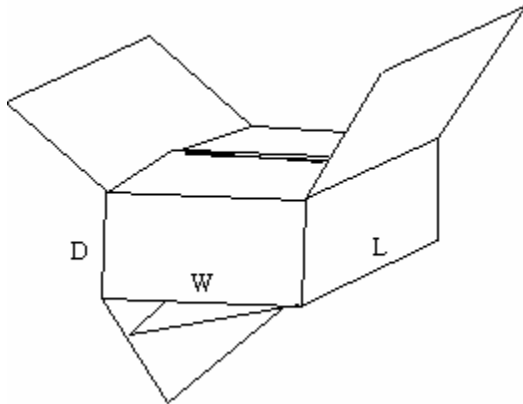
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 205 Center Special Overlap Slotted Container
 FEFCO Style: 0205
 FBA Style: CSO



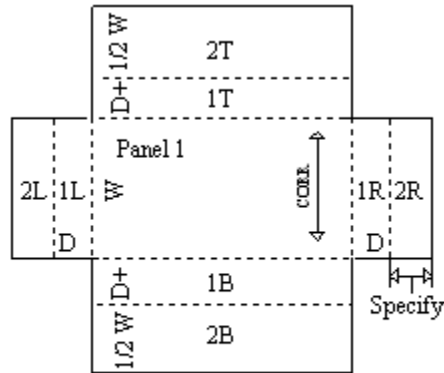
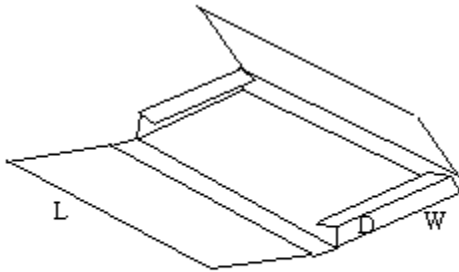
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 206 Die Cut (Center Special Full Overlap Slotted Container)
 FEFCO Style: 0206
 FBA Style: SFF



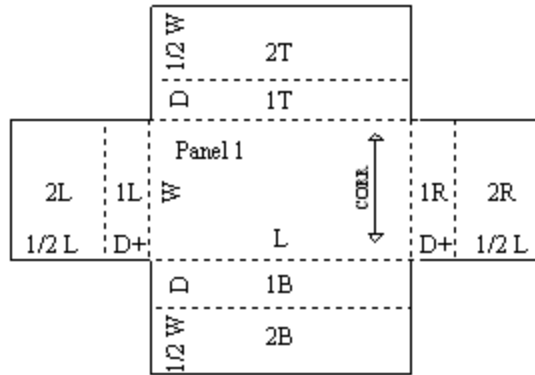
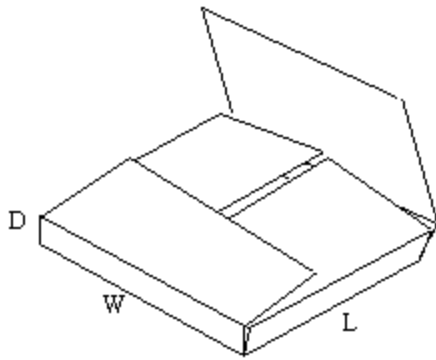
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 401 One-Piece Folder, Tuck Dimension Specified
 FEFCO Style: 0401
 FBA Style: 1PF



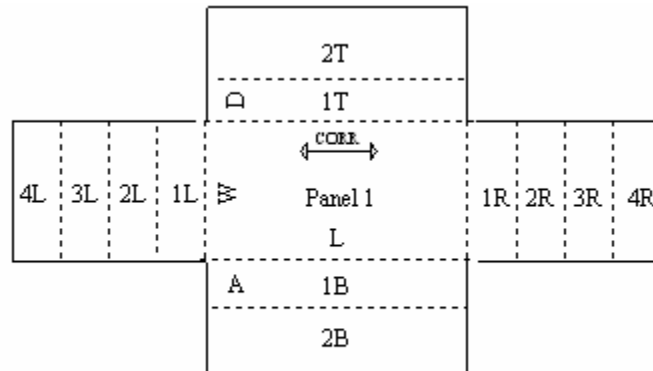
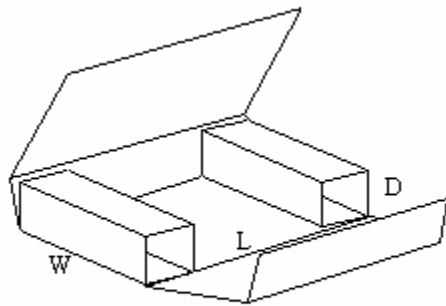
Size Order Designation: L x W x D, Tuck Flap (Specify)
 Size = Effective Inside Dimensions, Erected

Style: 3M 402 One-Piece Folder, Full Tuck
 FEFCO Style: 0402
 FBA Style: 1PF



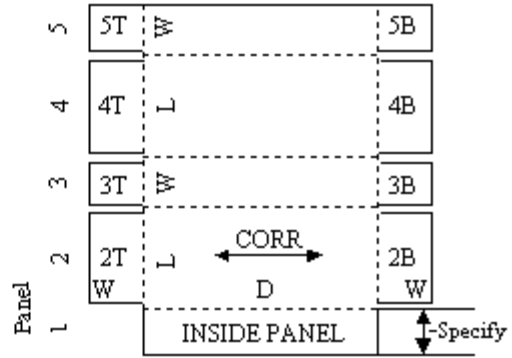
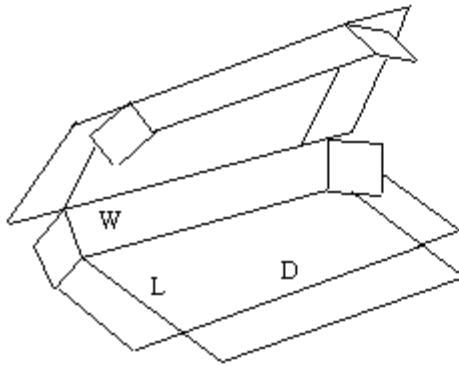
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 403 Designed Container (Roll End Folder)
 FEFCO Style: 0403



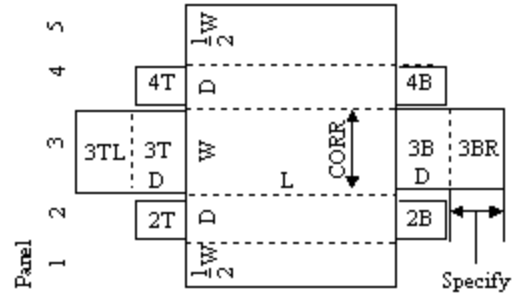
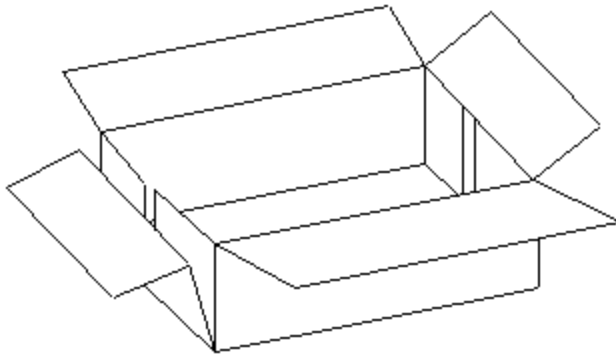
Size Order Designation: L x W x D, Roll End (Specify)
 Size = Effective Inside Dimensions, Erected and Between Roll Ends

Style: 3M 410 Five-Panel Folder, Full Flap Ends
 FEFCO Style: 0410
 FBA Style: FPF



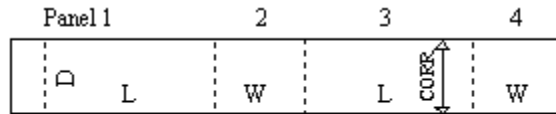
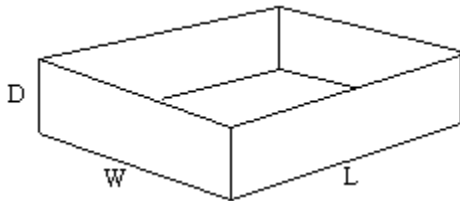
Size Order Designation: L x W x D, Tuck Flap (Specify)
 Size = Effective Inside Dimensions, Erected

Style: 3M 415 Die Cut (One-Piece Folder with Flanges)
 FEFCO Style: 0415



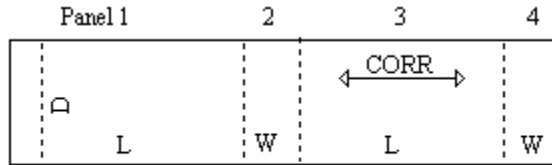
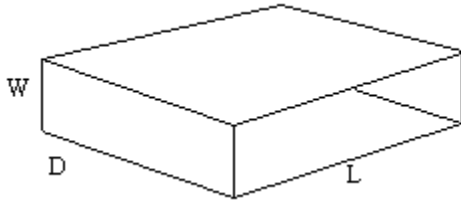
Size Order Designation: L x W x D, Flange (Specify)
 Size = Effective Inside Dimensions, Erected

Style: 3M 501 Scored Sheet (Sleeve, Corrugations Parallel to Depth)
 FEFCO Style: 0501



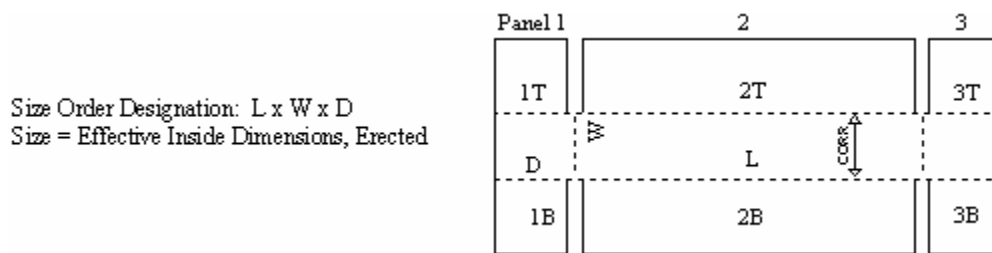
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 502 Scored Sheet (Sleeve, Corrugations Parallel to Length)
 FEFCO Style: 0502



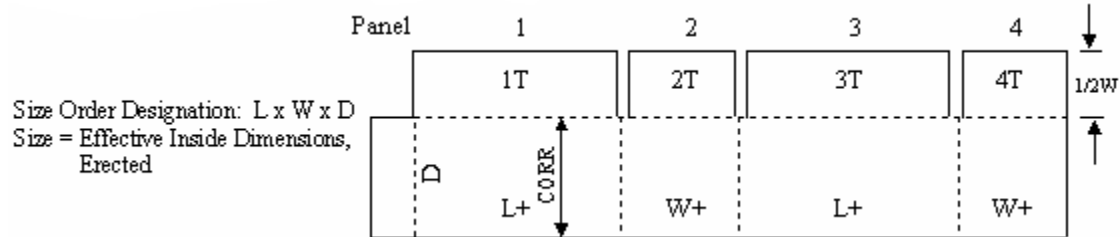
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 1000, 3M 1001, and 3M 1002 Side-Slotted Tray
 Note: For "End Slotted", see 3M 1006



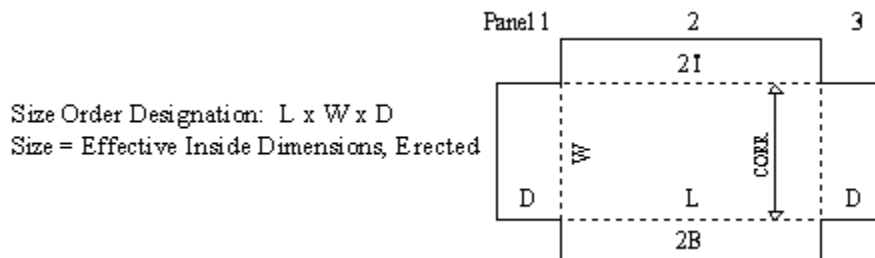
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 1003 Half-Slotted Container, Cover



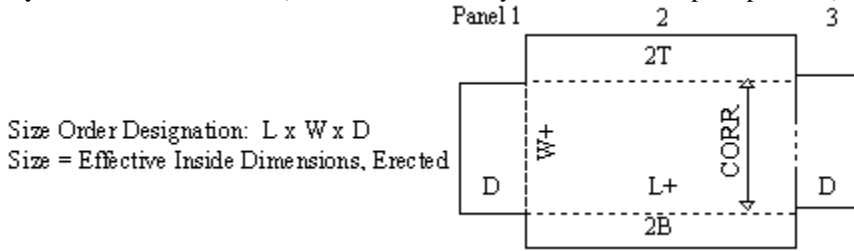
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 1004 Die Cut (Corner Cut-Out Tray)



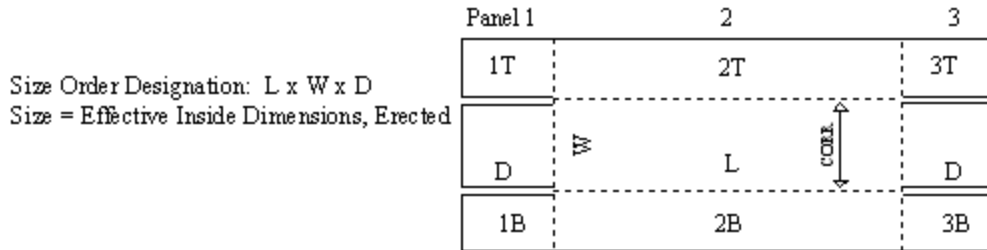
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 1005 Die Cut (Corner Cut-Out Tray - Cut to Fit - Depth Specified)



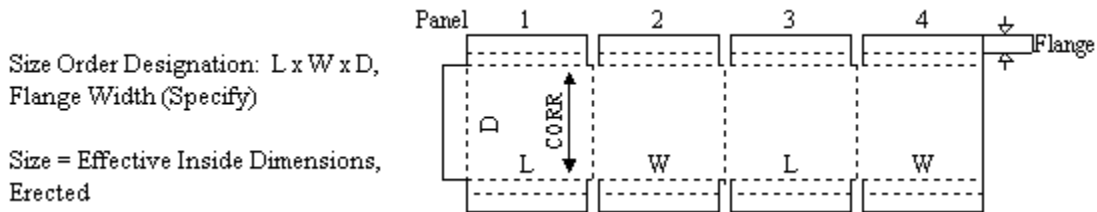
Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

Style: 3M 1006 End-Slotted Tray



Size Order Designation: L x W x D
 Size = Effective Inside Dimensions, Erected

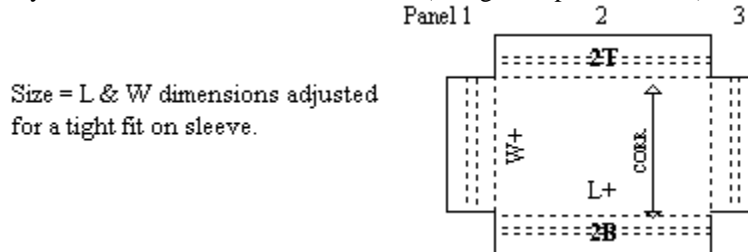
Style: 3M 1007 Slotted/Scored Sheet (Flanged Sleeve)



Size Order Designation: L x W x D,
 Flange Width (Specify)

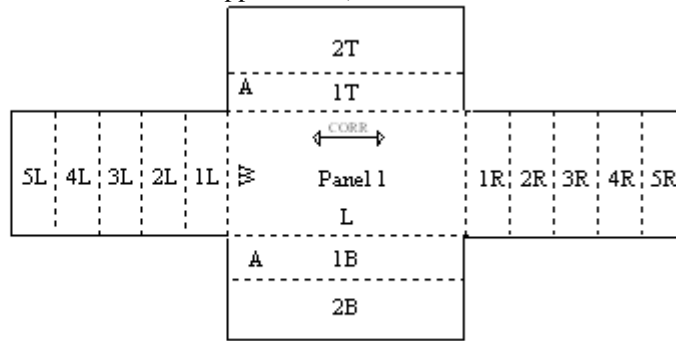
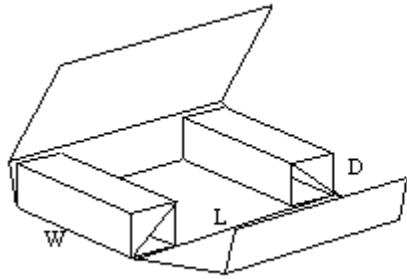
Size = Effective Inside Dimensions,
 Erected

Style: 3M 1008 Slotted/Scored Sheet (Flanged Cap - Cut to Fit)



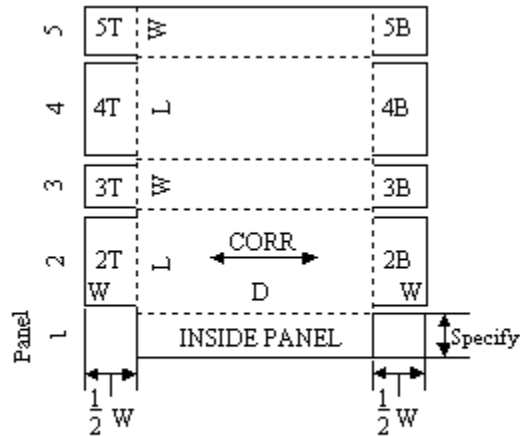
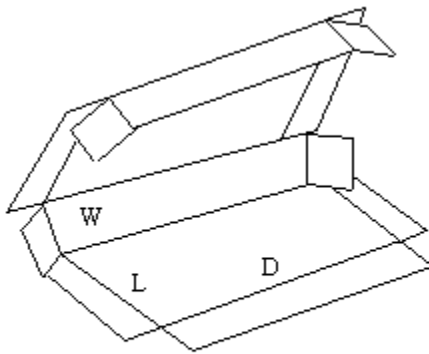
Size = L & W dimensions adjusted
 for a tight fit on sleeve.

Style: 3M 1100 Designed Container (Roll End Folder with Support Panel)



Size Order Designation: L x W x D, Roll End (Specify)
 Size = Effective Inside Dimensions, Erected and Between Roll Ends

Style: 3M 1101 Five-Panel Folder with Regular Slotted Ends
 FBA Style: FPF



Size Order Designation: L x W x D, Tuck Flap (Specify)
 Size = Effective Inside Dimensions, Erected

PREPARATION FOR SHIPMENT

Packing Requirements

Quantities per bundle and other details of bundling, packing and marking may be found in the specification, or 3M RD-113 and 123. If quantity per bundle is not indicated, the quantity shall be 24 ea./bundle.

Cleanliness

Items furnished to 3M Company must be free of all fabrication debris such as die-cut strippings, slotting waste, etc., at a minimum. Refer to specification for additional requirements.

Loading Requirements

Boxes and other parts must be aligned in stacks and bundled in quantities indicated on item specification or in 3M RD-123. Bundles shall be secured with plastic strapping. No wire or steel strapping of bundles is permitted.

Weight Limitations

Bundle weight should be approximately 37 pounds, but not to exceed 40 pounds. See chart in 3M RD-123.

QUALITY REQUIREMENTS

Sampling Procedure

Sampling and inspection of corrugated fiberboard items furnished to 3M will follow quality procedures defined by the receiving location.

Defect Classification

The following is a listing of defects for which corrugated fiberboard items will be inspected. These defects are classified as "SERIOUS", "MAJOR" or "MINOR".

SERIOUS Defects

Serious defects would normally result in rejection of the item and return to the supplier.

- Dimension Accuracy - Items that are not the specified dimensions indicated on the individual specification or are not within the specified tolerances as specified in Construction Requirements section of this specification.
 - A standard test method for determining interior dimensions of fiberboard boxes is ASTM D2658-94 (Box Gauge Method). Other test methods may be used if agreed upon between the 3M receiving location and the supplier of the packaging component. If no previous agreements reside, then ASTM D2658-94 shall be the basis for determining conformance to the published specification.
- Board Quality - Any ply separation greater than .125" from the edge of the sheet.
- Any facing split completely through the board when the board is folded to position for use.
- Manufacturer's Joint – Manufacturer's joint that does not meet minimum of the UFC or other applicable regulations.
 - Tape used on taped joint that does not adhere along edges and/or less than 90% of overall board contact area.
 - Tapes less than 2" wide on gross weights up to and including 65 pounds.
 - Tapes less than 3" wide for gross weights exceeding 65 pounds.
 - Glued joint that is adhered less than 90% of overall board contact area.
- Printed copy that is omitted, incorrect copy or wrong print color.
- Board Strength (Mullen or ECT) - Box certificate showing lower than the minimum board strength as specified on the structure specification.
- Board grade supplied does not meet minimum performance level and/or liner medium basis weight that is specified.

MAJOR Defects

Major defects would normally result in either rejection or rework of the items at supplier's expense.

- Fabrication Conditions - Edges of sheets or slots not cut cleanly.
- Fabrication - Flaps of boxes that are of incorrect length or do not meet within .125" or overlap .062" or greater except when individual specification specifies a special flap length.
- Scorelines that are not sufficiently deep so item is difficult to form. All containers must have flap scores that bend either inward or outward with equal force.
- Depressed Surface - Surface of fiberboard with an impression from printing greater than .040 inch as measured from undisturbed portion of sheet.

- Flute size not as specified
- Incorrect type of coating
- Manufacturer's joint type other than that specified.
- Length of tape less than depth of box by more than .125".
- Gap between abutting ends of box blank and tolerances greater than specified.
- Tape not centered within specified tolerances over joint gap.
- The amount of warp upon delivery shall not exceed .250" for one foot of measurement. Warp shall be measured by placing a 12.000" straight edge ruler against the most concave surface of the blank. The distance from the ruler to the concave surface is the amount of warp.
- Printing requirements not as specified.
 - Ink does not withstand 50 rubs on the Sutherland Rub Test without significant smear or rub-off.
 - Ink coverage insufficient so as to allow "board shown through"
 - Ink coverage is excessive resulting in "fuzzy" edges or "filled in" copy.
- Color(s) does not match specified color standard(s).
- Preparation for shipment not as specified.
- Actual count per bundle varies more than 5% of the marked bundle count.
- Average actual count per bundle is not equal to or greater than the quantity marked on all bundles.
- Load loose on pallet allowing for loss of material.

MINOR Defects

Minor defects would normally result in the use of the items with supplier notification as to the defective items noted.

- Board Appearance - Fiberboard has "washboard" appearance.
- Debris -Occasional bits of cutting debris on or mixed in with items.
- Copy registration is more than .125" from prescribed position but less than .250".
- Print Quality - Ink is smeared slightly causing "fuzzy" edges along printed areas.
- Depressed Surface - Surfaces of fiberboard with an impression from printing greater than .025", as measured from undisturbed portion of sheet, but not more than .040".
- Bundle Quantity - Actual count per bundle varies more than 2% of the marked bundle count.
- Bundle Tie Tension - Excessive, causing damage to container edges resulting in unusable items.
- Bundle Stability - Bundle tie tension not sufficient, causing bundles to be unstable.

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