

GENERAL REQUIREMENTS FOR CORRUGATED BOXES

RECORD OF CHANGES

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CORPORATE STANDARD

File No. 19-0

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1.0 SCOPE

This document provides general material and functional requirements for corrugated boxes used for inbound, interplant, and outbound nonbulk shipments. The boxes described herein are typically “plain brown boxes” of a more robust nature for better part protection and containment. In case of conflicting information, the drawing, contract, or any prevailing laws and regulations shall take precedence.

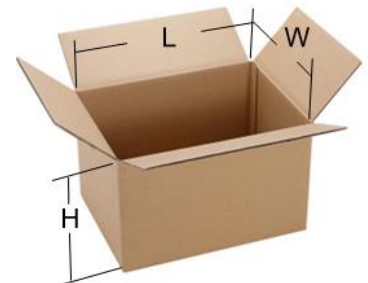
2.0 GENERAL REQUIREMENTS

Physical Properties

Unless otherwise specified on the drawing or purchase agreement, corrugated shipping boxes originating in North America are to be fabricated in accordance with ASTM D5118 and applicable regulations.

- Boxes fabricated in other countries may not have the same physical characteristics. Refer to the tables at the end of this document for a recommended cross-reference. It is the supplier’s responsibility to ensure the adequacy of their boxes regardless of country of origin.

Size: Boxes are specified by their inside dimensions in order of “Length” x “Width” x “Height.” Length or Width dimensions shall be determined as applicable from the inside liner surface of the glue joint.



- L (length) = longest direction of the box opening
- W (width) = shortest direction of the box opening
- H (height/depth) = direction perpendicular to the box opening

Tolerance: The interior dimensions of the box are to be within the limits listed below when it is set up for normal use having adjacent panels forming right angles. Verification of interior dimensions shall be in accordance with ASTM D2658 “Box Gage Method” and adjusted to account for the material thickness represented by and inside glue joint in the direction applicable.

Dimension range:	tolerance:
4” – 25” (102-635 mm),	±0.0625” (±1.6 mm)
26” – 50” (636-1270 mm),	±0.125” (±3 mm)
51” – 75” (1271-1905 mm),	±0.25” (±6 mm)

Board Strength: Board strength will reflect the finished box after converting using one of the following criteria:

- Bursting Strength (Mullen or Burst test) - indicates the box’s ruggedness to withstand rough handling and is expressed in units force per area (lbs-force/square inch) when tested in accordance with ISO Standard 2759, FEFCO TM 3, TAPPI T 810, or CN GB/T 6545.
- Puncture Strength – used to rate triple wall corrugated by its resistance to punctures (inch oz./inch of tear) when tested in accordance with TAPPI T 803.

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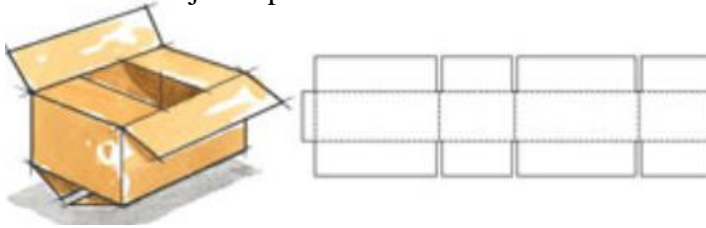
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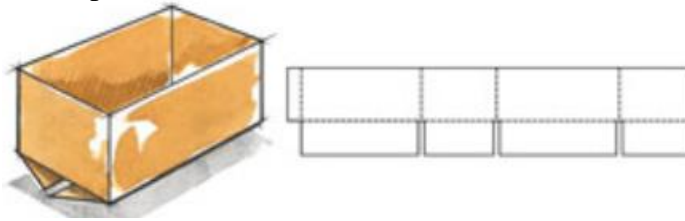
3. Edgewise Compressive Strength (ECT for edge crush test) - relates more to the compressive strength of the box during stacking and is expressed in the amount of force per unit width (lbs-force/inch) when tested in accordance with ISO Standard 3037, FEFCO TM 8, TAPPI T 811, or CN GB/T 6546.

Style: Refers to the flap closure configuration. Usually an acronym followed by the applicable International Case Code designation. The most common styles used by Snap-on are:

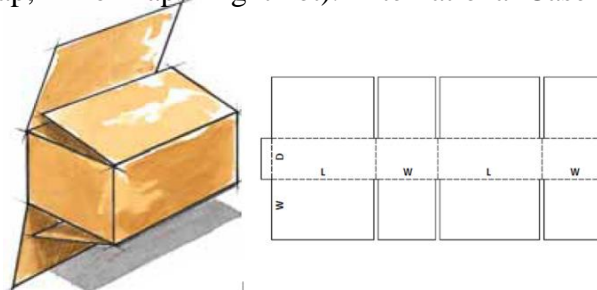
1. RSC/0201 – “Regular Slotted Container.” Top and bottom flaps share the same dimension that allows the major flaps to meet in the middle. International Case Code 0201.



2. HSC/0200 – “Half Slotted Container.” Bottom flaps share the same dimension that allows the major flaps to meet in the middle. There are no top flaps (HSCs are typically mated with a separate top cover). International Case Code 0200.



3. FOL/0203 – “Full Overlap Slotted Container.” Top and bottom flaps share the same dimension that allows the major flaps to extend the full width of the box (major flaps overlap, minor flaps might not). International Case Code 0203.



Notes: These and other box styles are described in the Fibre Box Association Handbook and ASTM D5118. Major flap – the flap following the longest distance of the box opening. Minor flap – the flap following the shortest distance of the box opening.

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Board Construction: Refers to the layer configuration of the corrugated fiberboard:

1. SW = singlewall (3 layers),
2. DW = doublewall (5 layers), or
3. TW = triplewall (7 layers).

Flute Size: Refers to the arch or wave-shaped contour of the paper used as the medium layer of the corrugated board. Flutes are defined by their height, peak-to-peak distance, and/or number per foot.

1. A-flute: height = 0.184" (4.7 mm), peak-to-peak = 0.364" (9.2 mm), flutes/foot = 30-36 (~110/m)
2. B-flute: height = 0.097" (2. mm), peak-to-peak = 0.255" (6.5 mm), flutes/foot = 44-50 (~155/m)
3. C-flute: height = 0.142" (3.6 mm), peak-to-peak = 0.308" (7.8 mm), flutes/foot = 36-42 (~130/m)
4. E-flute: height = 0.047" (1.2 mm), peak-to-peak = 0.133" (3.4 mm), flutes/foot = 86-94 (~295/m)
5. F-flute: height = 0.031" (0.8 mm), peak-to-peak = 0.094" (2.4 mm), flutes/foot = 125-128 (~420/m)

Note: for double or triple wall the first letter given refers to outside flute when the box is set up for use.

Outside Facing: Unless otherwise specified the outside facing shall be brown Kraft or similar paper.

Manufacturer's Joint: The manufacturer's joint shall span the entire depth of the box, may extend onto adjacent flaps, and adhere to the following requirements:

1. Single wall boxes – Manufacturer's joint should be an inside glued joint with a minimum width of 1.25"-1.375". Stapled (stitched) manufacturer joints may be used with prior approval from Snap-on Tools. Glue shall be water resistant and provide 85%-100% surface adhesion. Starting and ending staples shall be 1"-1½" from the flap score lines. Intermediate staples shall be spaced no more than 2½" apart.
2. Double wall boxes – Manufacturer's joint should be an inside glued joint with a minimum width of 1.5"-1.75". Stapled (stitched) manufacturer joints may be used with prior approval from Snap-on Tools. Glue shall be water resistant and provide 95%-100% surface adhesion. Starting and ending staples shall be double stitched no more than 1"-1½" from the flap score lines. Intermediate staples shall be spaced no more than 2½" apart. For products weighing 100 lbs (45 kg) or more, spacing of intermediate staples shall be reduced to 1"-1½" apart.
3. Triple wall boxes – Inside or outside joint at a minimum 2" (50 mm) joint width, stapled (stitched) only. Starting and ending staples shall be double stitched no more than 1"-1½"

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from the flap score lines. Intermediate staples shall be double stitched and spaced no more than 1”-1½” apart.

Adhesives: Resin-enhanced wet strength adhesives are to be used for the manufacture of all corrugated boxes.

1. Moisture Resistant Adhesives (MRA) of 0.5%-1.0% liquid resin (assuming 50% solids content) shall be used in the converting process for boxes manufactured in Europe, North America, and Australia.
2. Water Resistant Adhesive (WRA) of 1.0%-1.5% (assuming 50% solids content) shall be used for boxes manufactured in Asia, Africa, or South America.

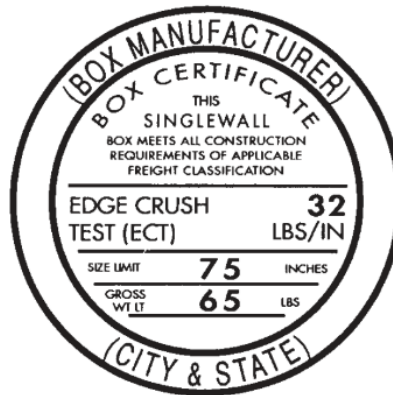
Board Certification: Boxes made in North America are to be certified according to Item 222 of the National Motor Freight Classification unless explicitly excluded by the drawing, contract, or purchase order. Apply the box manufacturer’s certificate stamp on a major bottom flap.

Examples:

Burst certification
Puncture test



ECT certification



Standard Boxes: Suppliers are encouraged to utilize one of the standard box sizes listed below for any “nonmerchandised” item. Standard boxes improve cube utilization, pallet loading/stacking, and warehouse utilization.

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1. Pallet load box sizes:

box #	pallet pattern			box size - inside dims			box classification			box size - outside dims		
				l (id)	w (id)	h (id)	Style	Variety	Grade	L (od)	W (od)	H (od)
8-4-8	8	4	8	9 5/16	5 9/16	4 15/16	RSC	SW	275	9 13/16	5 15/16	5 5/8
8-4-4	8	4	4	9 5/16	5 9/16	10 9/16	RSC	SW	275	9 13/16	5 15/16	11 1/4
4-4-8	4	4	8	11 5/16	9 7/16	4 15/16	RSC	SW	275	11 13/16	9 13/16	5 5/8
4-4-4	4	4	4	11 5/16	9 7/16	10 9/16	RSC, HSC	SW	275	11 13/16	9 13/16	11 1/4
4-2-8	4	2	8	19 3/16	11 1/2	4 15/16	RSC	SW	275	19 11/16	11 7/8	5 5/8
4-2-4	4	2	4	19 3/16	11 1/2	10 9/16	RSC, HSC	SW	275	19 11/16	11 7/8	11 1/4
2-4-8	2	4	8	23 1/8	9 1/2	4 15/16	RSC	SW	275	23 5/8	9 13/16	5 5/8
2-4-4	2	4	4	23 1/8	9 1/2	10 9/16	RSC, HSC	SW	275	23 5/8	9 13/16	11 1/4
2-2-8	2	2	8	18 13/16	5 1/16	21 15/16	FOL	DW	350	19 11/16	5 5/8	23 5/8
2-2-4	2	2	4	22 12/16	19 1/8	10 1/16	RSC, HSC	DW	500	23 5/8	19 11/16	11 1/4
2-2-2	2	2	2	22 1/8	18 11/16	20 1/2	RSC, HSC	TW	1100	23 5/8	19 11/16	22 1/2
2-1-8	2	1	8	22 3/4	5	37 5/8	FOL	DW	500	23 5/8	5 9/16	39 3/8
2-1-4	2	1	4	37 7/8	22 5/8	9 1/4	RSC, HSC	TW	1100	39 3/8	23 5/8	11 1/4
2-1-2	2	1	2	22	38 1/4	20 1/4	RSC, HSC	TW	1300	23 5/8	39 3/8	22 7/16
1-2-8	1	2	8	18 13/16	5 1/16	45 1/2	FOL	DW	500	19 11/16	5 5/8	47 1/4
1-2-4	1	2	4	45 5/8	18 9/16	9	RSC, HSC	TW	1300	47 1/4	19 11/16	11 3/16
1-2-2	1	2	2	45 5/8	18 9/16	20 5/16	RSC, HSC	TW	1300	47 1/4	19 11/16	22 1/2
1-1-4	1	1	4	45 5/8	38 1/4	9 7/8	HSC	TW	1300	47 1/4	39 3/8	11 1/4
1-1-2	1	1	2	45 5/8	38 1/4	21 1/8	HSC	TW	1300	47 1/4	39 3/8	22 1/2
1-1-1	1	1	1	45 5/8	38 1/4	43 5/8	HSC	TW	1300	47 1/4	39 3/8	45

2. Pick & Pack box sizes:

facility	Snap-on box #	box size - inside dims			box classification			box size - outside dims			cu. ft.
		l (id)	w(id)	h(id)	grade	flute	style	L(od)	W(od)	H(od)	
OB	1	15	13	6	200# Burst	C	RSC	15 7/16	13 5/16	6 5/8	0.79
OB	10A	27	14 1/4	13 1/4	275# Burst	C	RSC	27 1/2	14 5/8	13 15/16	3.24
CLK / CC	13SO	13	6 7/8	4 1/4	200# Burst	C	RSC	13 7/16	7 3/16	4 7/8	0.27
CLK / OB / CC	17SO (Barney)	17 1/2	7	5	200# Burst	C	RSC	17 15/16	7 5/16	5 5/8	0.43
CLK / ROBO / CC	22	22 3/4	9 7/8	5	275# Burst	C	RSC	23 1/4	10 1/4	5 11/16	0.79
CLK / OB / ROBO	22H	22 1/8	14	10	275# Burst	C	RSC	22 5/8	14 3/8	10 11/16	2.01
CLK / ROBO / CC	22L	22 1/8	14	6	200# Burst	C	RSC	22 9/16	14 5/16	6 5/8	1.24
CC	24	24	14	10	275# Burst	C	RSC	24 1/2	14 3/8	10 11/16	2.18
CLK / OB / ROBO	25H	25 15/16	12	7 15/16	275# Burst	C	RSC	26 7/16	12 3/8	8 5/8	1.63
CLK / OB / ROBO	25L	25 15/16	12	5 1/2	200# Burst	C	RSC	26 3/8	12 5/16	6 1/8	1.15
CLK / OB	26H	26	15 1/4	6 3/4	275# Burst	C	RSC	26 1/2	15 5/8	7 7/16	1.78
CLK	26L	26	15 3/4	4 1/2	200# Burst	C	RSC	26 7/16	16 1/16	5 1/8	1.26
CC	28	28	6	6	200# Burst	C	RSC	28 7/16	6 5/16	6 5/8	0.69
CLK / CC	32SO	32	8 1/2	5 1/4	200# Burst	C	RSC	32 7/16	8 13/16	5 7/8	0.97
CC	37 H	37	11 1/2	6 1/2	275# Burst	C	RSC	37 1/2	11 7/8	7 3/16	1.85
CC	37 L	37	9	4 1/2	275# Burst	C	RSC	37 1/2	9 3/8	5 3/16	1.06
CLK / OB / ROBO	37SO	37	8 1/2	5 1/4	275# Burst	C	RSC	37 1/2	8 7/8	5 15/16	1.14
CLK	8SO	8 3/4	7	5	32 ECT	C	RSC	9 3/16	7 5/16	5 5/8	0.22
CC	D15 L	26 1/2	16	12	275# Burst	C	RSC	27	16 3/8	12 11/16	3.25
CLK / ROBO	SC319	14 1/2	12 1/2	6 1/2	200# Burst	C	RSC	14 15/16	12 13/16	7 1/8	0.79

CLK = Crystal Lake, IL / OB = Olive Branch, MS / ROBO = Robosonia, PA / CC = Carson City, NV

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3. For nonstandard sized boxes, material selections shall conform to the following:
- Single wall boxes: C-flute, 275# burst test, 69-69 lb liners or
 - Double wall boxes: CB-flute, 350#-500# burst test, 69-42-69 lb or 90-42-90 lb liners
 - Triple wall boxes: AAC-flute, 1100#-1300# puncture test, 90-42-42-90 lb or 90-90-90-90 lb liners

Alternate Materials – The following tables provide cross-reference between the physical properties for typical North American made boxes to equivalent materials more common in other countries or regions.

Table North America → China

Physical Properties in NORTH AMERICA						CHINA						
Style	Construction	Flute	ECT lb-f/in (kN/m)	Burst lb-f/in ² (kPa)	Weight lbs/Msf (g/m ²)	Case Code	Layers	Flute	ECT kN/m	Burst kPa	Weight g/m ²	GB/T 6544-2008
FOL	singlewall	B, C	32 (5.6)	200 (1375)	84 (410)	→ 0203	3-layer	B, C	6.5	1500	500	S-1.5
RSC	singlewall	B, C	32 (5.6)	200 (1375)	84 (410)	→ 0201	3-layer	B, C	6.5	1500	500	S-1.5
FOL	singlewall	B, C	40 (5.6)	250 (1720)	111 (410)	→ 0203	5-layer	CB, EB	5.0	1100	450	D-1.2
RSC	singlewall	B, C	44 (7.7)	275 (1895)	138 (410)	→ 0201	5-layer	CB, EB	7.0	1380	560	D-1.3
FOL	doublewall	CB, EB	48 (5.6)	275 (1895)	110 (537)	→ 0203	5-layer	CB, EB	8.0	1700	640	D-1.4
RSC	doublewall	CB, EB	51 (7.7)	350 (2410)	126 (615)	→ 0201	5-layer	CB, EB	9.0	1900	700	D-1.5
FOL	doublewall	CB, EB	51 (5.6)	350 (2410)	126 (615)	→ 0203	5-layer	CB, EB	9.0	1900	700	D-1.5
RSC	doublewall	CB, EB	61 (7.7)	400 (2755)	180 (879)	→ 0201	7-layer	BCB, ACB	13.0	2200	820	T-1.3

Table North America → Europe

Physical Properties in NORTH AMERICA						EUROPE				
Style	Construction	Flute	ECT lb-f/in (kN/m)	Burst lb-f/in ² (kPa)	Weight lbs/Msf (g/m ²)	Case Code	Layers	Flute	Burst kPa	Weight g/m ²
FOL	singlewall	B, C	32 (5.6)	200 (1375)	84 (410)	→ 0203	singlewall	B, C	1400	400
RSC	singlewall	B, C	32 (5.6)	200 (1375)	84 (410)	→ 0201	singlewall	B, C	1400	400
FOL	singlewall	B, C	40 (5.6)	250 (1720)	111 (410)	→ 0203	doublewall	CB, EB	1750	500
RSC	singlewall	B, C	44 (7.7)	275 (1895)	138 (410)	→ 0201	doublewall	CB, EB	2050	600
FOL	doublewall	CB, EB	48 (5.6)	275 (1895)	110 (537)	→ 0203	doublewall	CB, EB	1765	525
RSC	doublewall	CB, EB	51 (7.7)	350 (2410)	126 (615)	→ 0201	doublewall	CB, EB	2050	725
FOL	doublewall	CB, EB	51 (5.6)	350 (2410)	126 (615)	→ 0203	doublewall	CB, EB	2550	725
RSC	doublewall	CB, EB	61 (7.7)	400 (2755)	180 (879)	→				

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Table North America → India

Physical Properties in NORTH AMERICA						INDIA			
Style	Construction	Flute	ECT lb-f/in (kN/m)	Burst lb-f/in ² (kPa)	Weight lbs/Msf (g/m ²)	Case Code	Layers	Flute	Burst kPa
FOL	singlewall	B, C	32 (5.6)	200 (1375)	84 (410)	0203	doublewall	CB, EB	1275
RSC	singlewall	B, C	32 (5.6)	200 (1375)	84 (410)				
FOL	singlewall	B, C	40 (5.6)	250 (1720)	111 (410)	0203	doublewall	CB, EB	1275
RSC	singlewall	B, C	44 (7.7)	275 (1895)	138 (410)				
FOL	doublewall	CB, EB	48 (5.6)	275 (1895)	110 (537)	0203	triplewall	EBC, CBC	2350
RSC	doublewall	CB, EB	51 (7.7)	350 (2410)	126 (615)				
FOL	doublewall	CB, EB	51 (5.6)	350 (2410)	126 (615)	0203	triplewall	BCB, ACB	2850
RSC	doublewall	CB, EB	61 (7.7)	400 (2755)	180 (879)				

3.0 REFERENCE

The quality and workmanship of corrugated shipping containers shall meet or exceed the industry and/or voluntary standards noted below. It is expected that evidence of compliance with a given standard is readily available.

1. European Federation of Corrugated Board Manufacturers (FEFCO) – Belgium
2. Canadian Corrugated Case Association (CCCA) – Canada
3. Chinese National Standards (CNS)
4. China Packaging Federation (CPF) – China
5. Federation of Corrugated Box Manufacturers of India (FCBM) - India
6. Asian Packaging Federation (APA) – Japan
7. International Standards Organization (ISO) – Switzerland
8. The American Society for Testing and Materials (ASTM) – United States
9. The Fibre Box Association (FBA) – United States
10. National Motor Freight Traffic Association (NMFTA) – United States
11. Technical Association of Pulp and Paper Industries (TAPPI) – United States
12. International Standards Organization (ISO) – Switzerland

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