QUALITY CONTROL RECOMMENDATIONS

BULLETIN 318

Revised 586

PREFACE

Quality Control Recommendations *recommends* the tolerances that generally apply in the manufacture of wirebound boxes and crates, quality of materials, their nominal dimensions, and the manufacture of these into a shipping container that will perform satisfactorily under normal conditions of service.

Occasionally it may be necessary to depart from *some* of the tolerances indicated in Quality Control Recommendations. When this situation is encountered, all remaining tolerances of Quality Control Recommendations not affected by the special conditions should be followed.

When in doubt regarding departures from indicated tolerances, contact Package Research Laboratory.

Quality Control Recommendations are not intended for use as a basis for acceptance or rejection of commercially manufactured boxes and crates.

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I. SPECIES OF WOODS

Species of woods used in wirebound boxes and crates are given in the following table. Usually, when a particular species is specified, any species in the same group of woods may be used at the option of the manufacturer.

GROUP I

Aspen (popple)
Basswood
Buckeye
Butternut
Cedar
Chestnut
Cottonwood*
Cucumbertree
Cypress*
Fir, alpine
Fir, balsam
Fir, noble
Fir, white
Magnolia*
Pine, jack
Pine, lodgepole
Pine, ponderosa (Western yellow)
Pine, red (Norway)
Pine, sugar
Pine, white
Redwood
Spruce*
Willow
Yellow Poplar

GROUP II

Douglas-fir
Hemlock (Western)
Larch (tamarack)
Pine (Southern)

GROUP III

Ash, black
Ash, pumpkin
Black gum
Elm, white
Maple, soft
Sweet gum (red gum)
Sycamore
Tupelo, water

GROUP IV

Ash, white
Beech
Birch
Elm, rock
Hackberry
Hickory
Maple, hard
Oak
Pecan

* *These Group I Woods may be used as Group II and Group III Woods for face material only.*

SOUTHERN YELLOW PINE VENEER AND CLEAT STOCK

Moisture Content

Pine boxes should be run at as high a percentage as possible without excessive mold growth. Pine below 18% tends to become brittle and will split easily. Suggested — 18 to 20%. Higher than 20% moisture content will require dipping to prevent mold growth.

Thickness

If possible to run and use at 18% moisture or above, thicknesses now used on Southern hardwoods are satisfactory. If wood must dry below 18% to prevent mold growth during long warehouse storage, next higher thickness is recommended.

Special Considerations

a. End liners should be hardwoods since Pine splits too easily for this use.

b. Where hand closing of bulge packs is involved, hardwood leading and trailing slats (Rock Fastener slats) should be used.

c. Where machine closing or flat packs are involved all Pine slats may be feasible.

d. Setback clinches should be used on blanks in all cases.

e. Staples should not be overdriven.

f. Government poultry and meat boxes may not be made from Pine.

Southern Yellow Pine used for Cleats

The staple holding power of Southern Yellow Pine is superior to Red Gum by approximately 20%. However, due to the hard annular rings, staple legs are often deflected and run out the sides of the cleats. For this reason it is recommended that minimum width of cleats be ¾".

II. FACE BOARDS

A. DRYNESS

The moisture content at time of manufacture should be not more than 18% and not less than 10%.

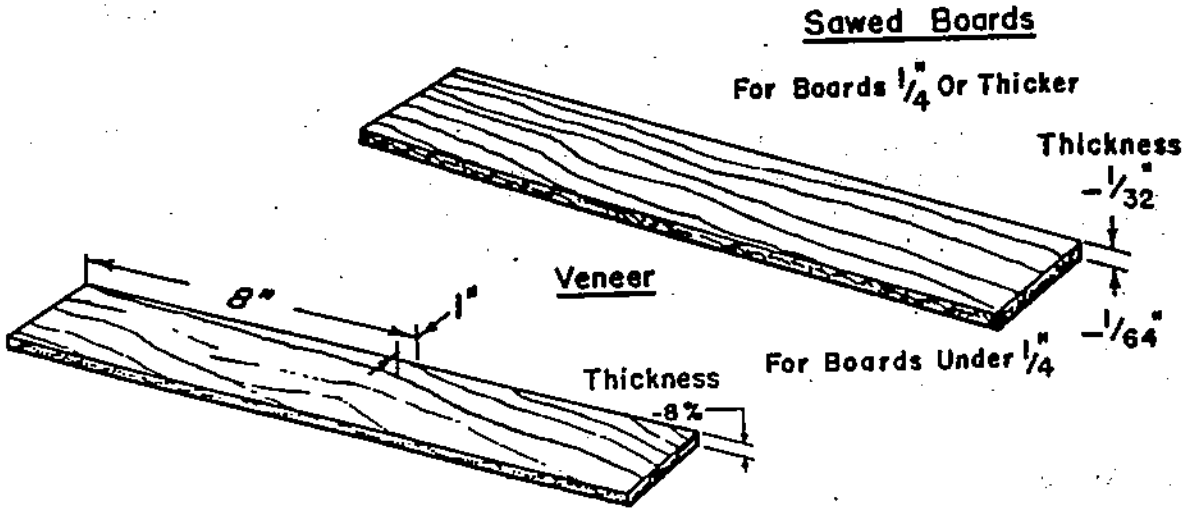
B. QUALITY

The face boards should be straight grained, full thickness and sound; free from knots, knot holes, decay, dote, mildew, and open splits.

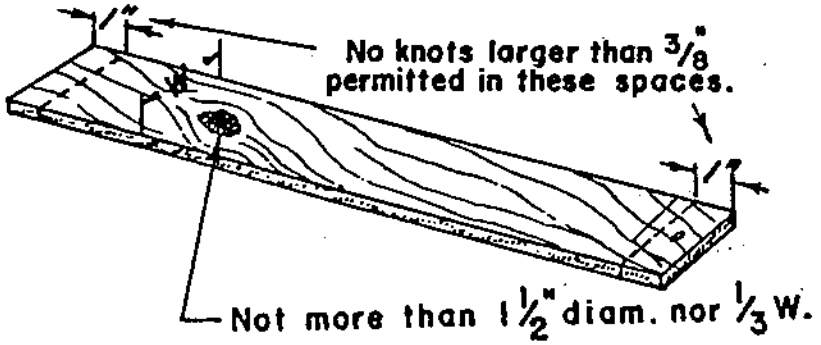
TOLERANCES

Straightness of Grain: Grain which does not diverge more than 1" in 8" of length should be considered straight.

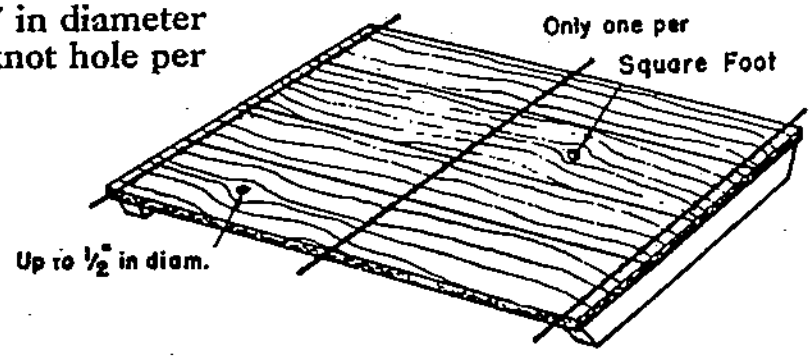
Thickness: Veneer, tolerance, 8% minus. Sawed Boards, 1/64" minus for boards up to 7/32" thick; 1/32" minus for boards 1/4" or thicker.



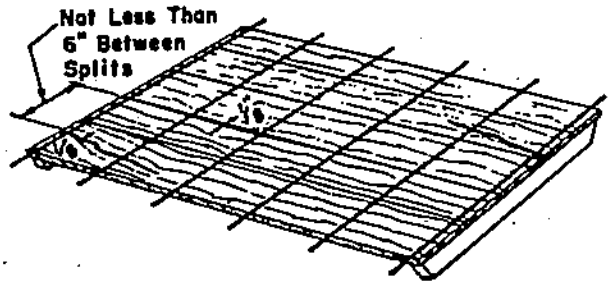
Knots: Boards should be considered free from knots when knots are sound, do not interfere with staples, and are not more than 1-1/2" in diameter nor 1/3 the width of the piece. No knots over 3/8" in diameter should be permitted closer to ends of boards than 1".



Knot Holes: Up to 1/2" in diameter and not more than one knot hole per square foot.



Splits: Not more than 1/8" wide and only one should be permitted for each 6" of width.



Openings: Openings between boards on boxes should not exceed 1/8" where a tight box is required. On other boxes openings between boards should not exceed 1/4".

C. DIMENSIONS

on blank:

Each piece should be cut square. Edges should be smooth and straight.

TOLERANCES

On Solid Sections:

Length: 1/16" plus or minus.
Width: 1/8" plus or minus.

On Slatted Sections:

Length: 1/16" plus or minus.
Width: 1/16" plus or minus for slats not more than 4" wide.
1/8" plus or minus for slats more than 4" wide.

III. CLEATS

A. DRYNESS

The moisture content at time of manufacture should be not more than 18% and not less than 10%.

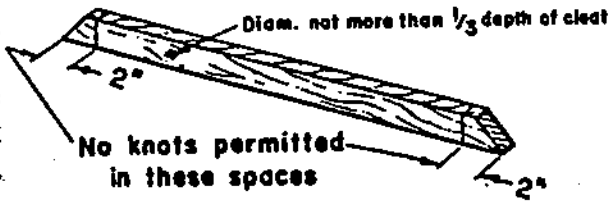
B. QUALITY

The Cleats should be straight grained and sound; free from knots and splits.

TOLERANCES

Straightness of Grain: Grain which does not diverge more than 1" in 8" of length should be considered straight.

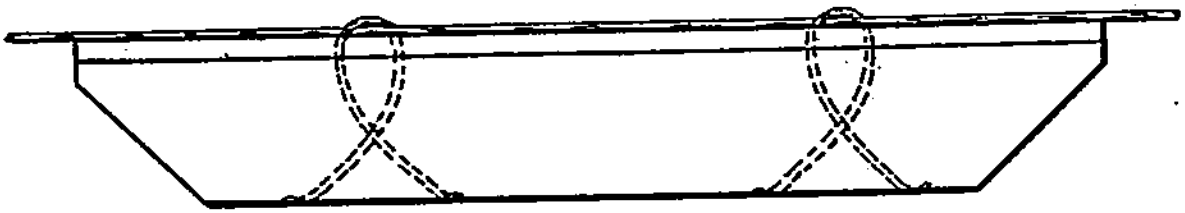
Knots: Cleats should be considered free from knots when the diameter of the knot does not exceed 1/3 the depth of the cleat and the knot is not closer to the end of the cleat than 2".



C. DIMENSIONS

1. *Cleats*

For 5/8" x 13/16" cleats Group III or IV Woods are recommended. Group I or II Woods may be used for 3/4" or wider cleats provided the staples are driven through the cleats and clinched.

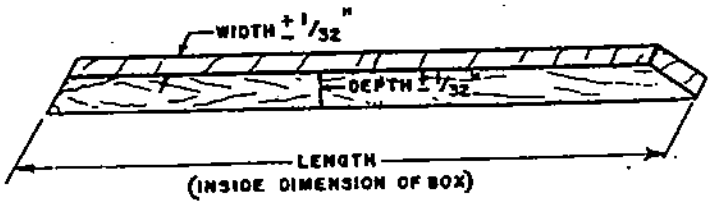


2. *Cleats on Inside of Container*

a) *Full Miter Cleats*

The top and bottom cleats should be cut full length of the inside width of the box.

The side cleats should be cut full length of the inside depth of the box.

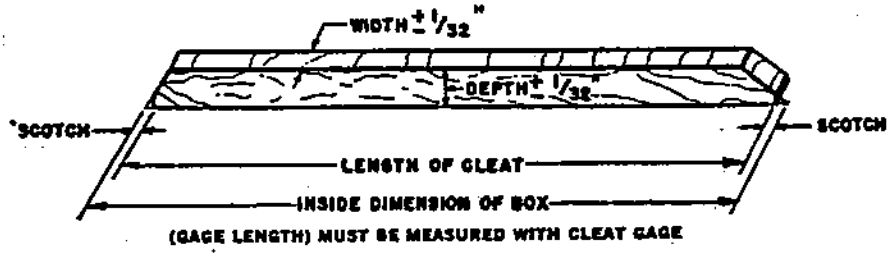


b) *Scotch Miter Cleats*

(See Design Facts, Vol. 1 - No. 12)

The top and bottom cleats should be cut equal to the inside width of the box minus two times the amount of Scotch.

The side cleats should be cut full length of the inside depth of the box minus two times the amount of Scotch.



Tolerances For Full Miter And Scotch Miter Cleats

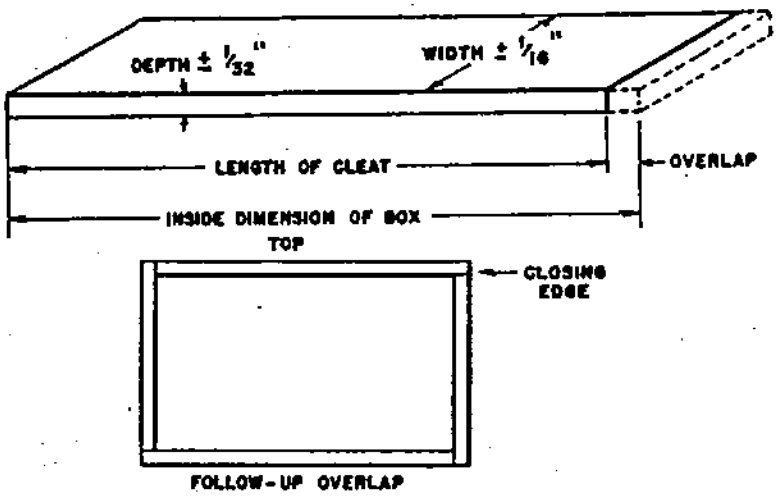
Cross Section: 1/32" plus or minus.

Length: Cleats up to 30", 1/16" plus or 0" minus
Cleats 30" and over, 1/16" plus or minus

c) *Wide, Thin Intermediate Cleats*

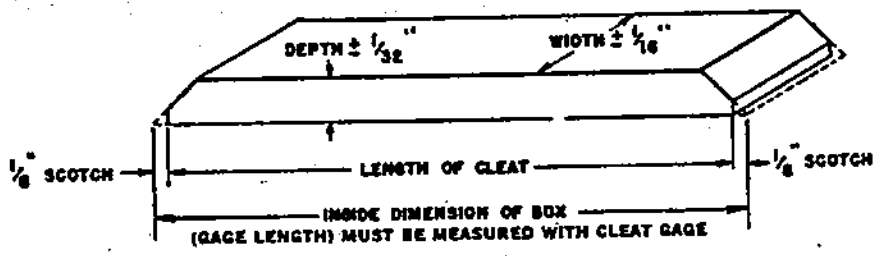
1. Cleats not more than 3/8" thick should be square end and follow-up overlap. The top and bottom cleats should be cut equal to the inside width of the box minus the thickness of one intermediate cleat.

   The side cleats should be cut equal to the inside depth of the box minus the thickness of one intermediate cleat.



2. Cleats 3/8" to 5/8" thick should be Scotch mitered. The top and bottom cleats should be cut equal to the inside width of the box minus two Scotches (1/4").

The side cleats should be cut equal to the inside depth of the box minus two Scotches (1/4").



TOLERANCES

Thickness: 1/32" plus or minus.
Width: 1/16" plus or minus.
Length: Cleats up to 30", 1/16" plus or minus.
Cleats 30" to 45", 3/32" plus or minus.
Cleats 45" and over, 1/8" plus or minus.

3. *Exterior Cleats*

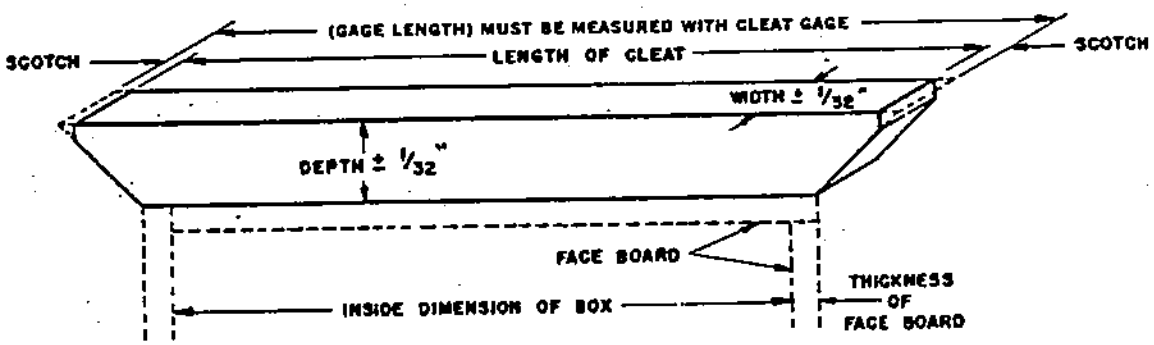
a) *Scotch Miter Cleats*

(SEE DESIGN FACTS, VOL. 1 - NO. 12)

Regular Box or Crate

The top and bottom cleats should be cut equal to the inside width of the box plus two thicknesses of face boards, plus two thicknesses of cleats minus two Scotches.

The side cleats should be cut equal to the inside depth of the box plus two thicknesses of face boards, plus two thicknesses of cleats minus two Scotches.



Pallet Box or Crate

The cleats on the front and back sections of the box shall be cut, in length, equal to the inside width of the box plus two thicknesses of face boards, plus two thicknesses of cleats minus two Scotches.

The cleats on the side sections of the box shall be cut, in length, equal to the inside length of the box plus two thicknesses of face boards, plus two thicknesses of cleats minus two Scotches.

b) *Double Miter Cleats*

(See Design Facts, Vol. 1 - No. 12)

Regular Box or Crate

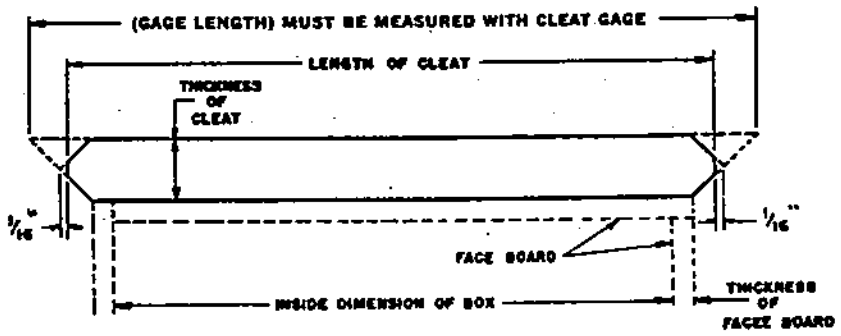
The top and bottom cleats should be cut equal to the inside width of the box plus two thicknessess of face boards plus one thickness of cleat minus two Scotches (1/8″).

The side cleats should be cut equal to the inside depth of the box plus two thicknesses of face boards plus one thickness of cleat minus two Scotches (1/8″).

Pallet Box or Crate

The cleats on the front and back sections of the box shall be cut, in length, equal to the inside width of the box plus two thicknesses of face boards plus one thickness of cleat minus two Scotches (1/8″).

The cleats on the side sections of the box shall be cut, in length, equal to the inside length of the box plus two thicknesses of face boards plus one thickness of cleat minus two Scotches (1/8″).



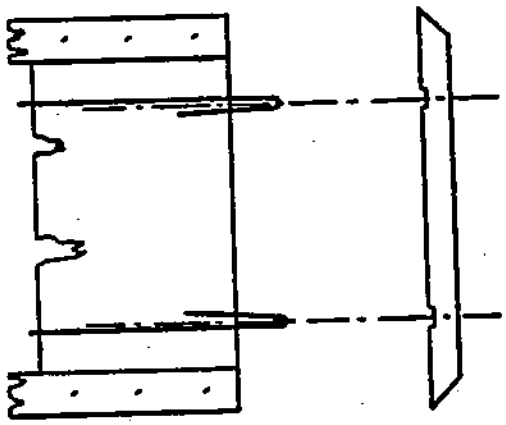
Tolerances for Scotch Miter and Double Miter Cleats.

Cross Section: 1/32″ plus or minus.
Length: Cleats up to 30″, 1/16″ plus or 0″ minus.
Cleats 30″ and over, 1/16″ plus or minus.

D. NOTCHES

These notches apply to cleats on All-Bound Boxes and Crates except Spartan and James type.

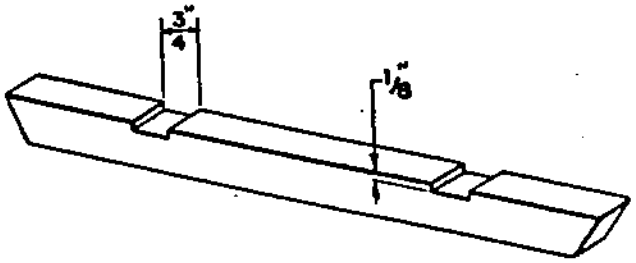
The notches should be located so that centers of the notches will be in line with the centers of the Rock Fasteners on the All-Bound ends.



The notches should be 3/4" wide and 1/8" deep and should be cut squarely across the cleat.

TOLERANCES

Width: 1/32" plus.
Depth: 1/32" plus.
Position: 1/16" plus or minus.



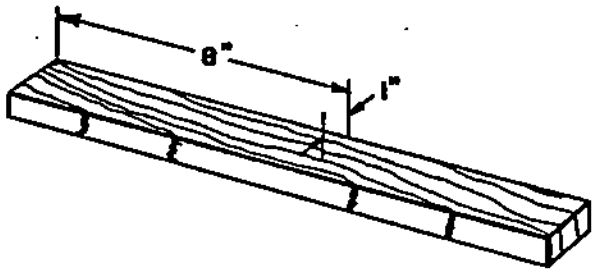
IV. BATTENS

A. QUALITY

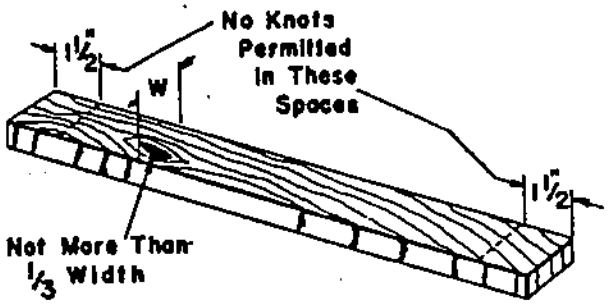
Battens should be straight grained and sound; free from knots and splits.

TOLERANCES

Straightness of Grain: Grain which does not diverge more than 1" in 8" of length should be considered straight.



Knots: Battens should be considered free from knots when the knots are sound, do not interfere with fastenings, and are not more than 1/3 the width of the piece. No knots should be closer to ends of battens than 1-1/2".

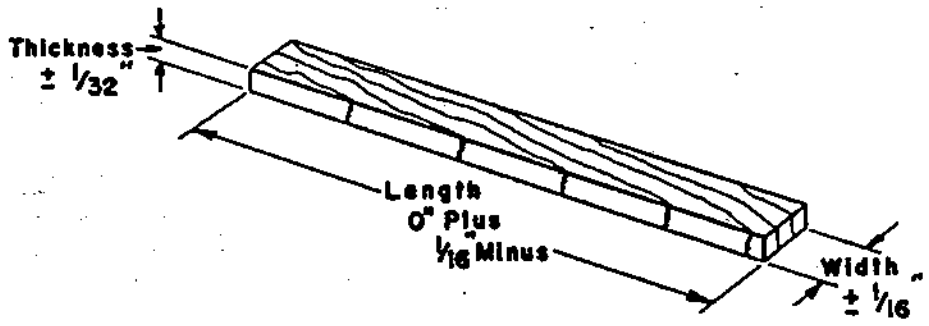


B. DIMENSIONS

Battens should be cut 1/16″ less than the depth (or width) of the box minus twice the depth of the cleat. (e.g. for a box 10″ deep with 7/8″ deep cleats, cut vertical battens 8-3/16″ long.)

TOLERANCES

Length:	0″ plus, 1/16″ minus.
Width:	1/16″ plus or minus.
Thickness:	1/32″ plus or minus.



C. POSITION

Battens should be located so that when a box or crate is assembled, the ends of all battens should fit tightly against the cleats or other battens.

The edges of battens adjacent to cleats should fit tightly against the cleats.

TOLERANCE

1/16″ plus, 0″ minus.

D. FASTENING

The boards should be fastened to each batten by staples, cement-coated nails, or nails driven through the boards and battens and clinched.

V. LINERS

A. QUALITY

Liners should be full thickness, straight grained, and sound; free from knots, decay, dote, mildew, and open splits.

TOLERANCE

Straightness of Grain: Grain which does not diverge more than 1" in 8" of length should be considered straight.

B. DIMENSIONS

The length of liners should be equal to the width of the end.
The width of liners should be:

MINIMUM WIDTH OF LINER

ROWS OF STAPLES IN LINER	LOCATION OF LINER	Combined Thickness of Board and Liner	
		Less than ½"	½" or Greater
1	Edge of End	1-1/4"	1-3/8"
2	Edge of End or Top	3-1/8"	3-3/8"
2	Intermediate on End or Top	2-7/8"	2-7/8"

The thickness of liners should be not less than the thickness of end boards or slats, except that no liner need exceed 1/4" in thickness.

Width: 1/8" minus.
Lengths: 1/8" plus or minus.
Thickness—veneer: 8% minus.
resawn boards: 1/32" plus or minus.

C. FASTENING

Liners should be fastened to the boards or slats with staples driven through the full thickness of the liners and the boards and slats and firmly clinched in the wood. On liners 2-7/8" wide and wider, at least two rows of staples should be used.

VI. FABRICATED PARTS

A. ENDS

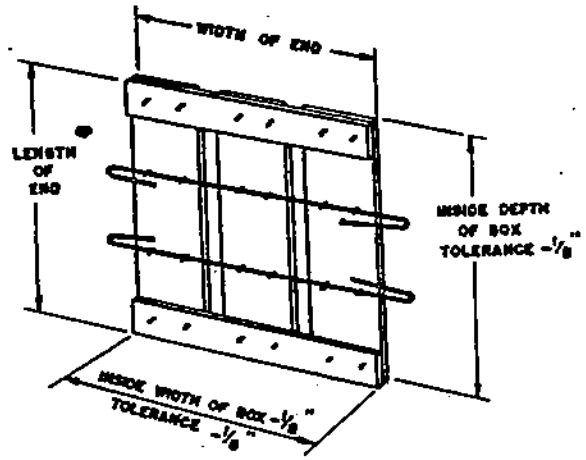
(On Fruit and Vegetable crate and Poultry box ends, it is recommended that all ends be scanted 1/8" in both dimensions.)

(See Design Facts, Vol. 1, No. 8)

ALL-BOUND

Length: (Measured at right angles to the wires) Same as inside *depth* of box.
Tolerance: 1/8" minus.

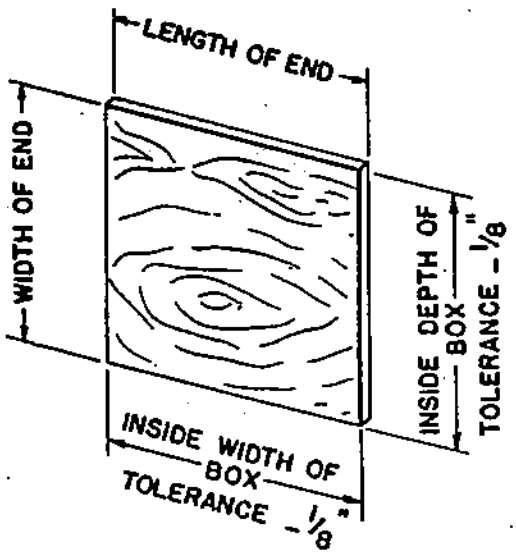
Width: (Measured along the wires) Same as inside *width* of box minus 1/8".
Tolerance: 1/8" minus.

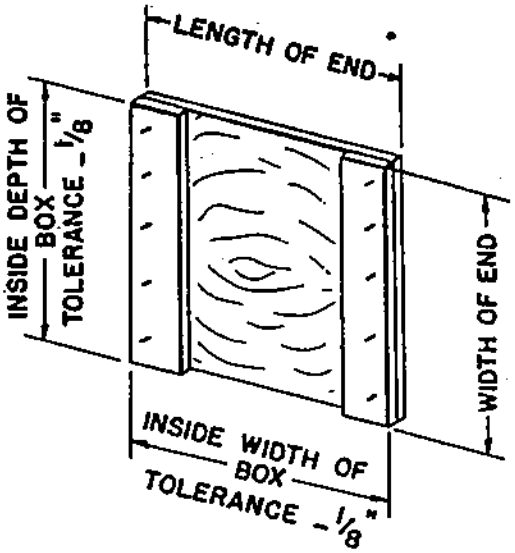


PLAIN, LINERED, AND PLYWOOD

Length: Same as inside *width* of box.
Tolerance: 1/8" minus.

Width: Same as inside *depth* of box.
Tolerance: 1/8" minus.



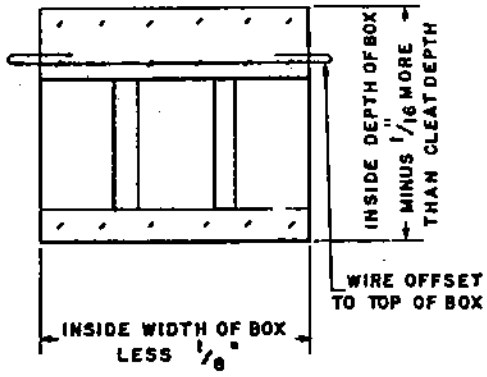


SHORT END

(for some Fruit and Vegetable Crates)

Length: Same as inside *width* of box minus 1/8".

Width: Same as inside *depth* of box minus 1/16" more than cleat depth.

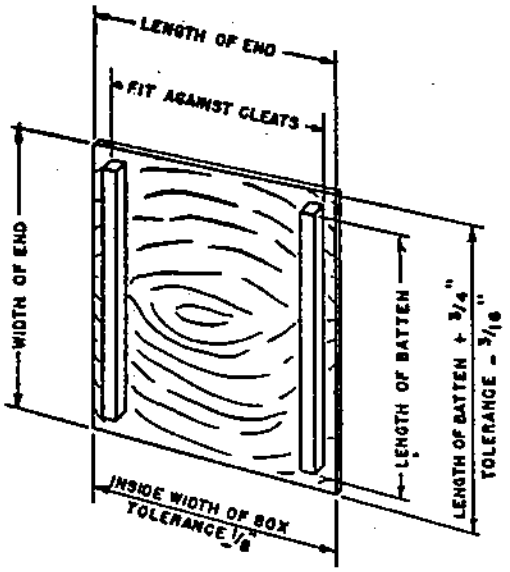


BATTENED END

Battens Vertical

Length: Same as inside *width* of box
Tolerance: 1/8" minus.

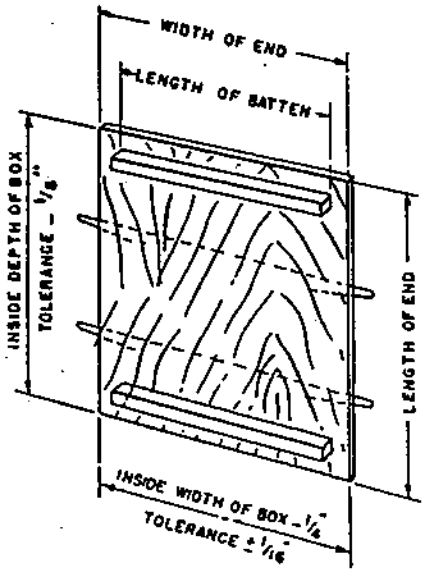
Width: Length of *batten* plus 3/4".
Tolerance: 3/16" minus.



Battens Horizontal

Length: Same as inside *depth* of box.
Tolerance: 1/8" minus.

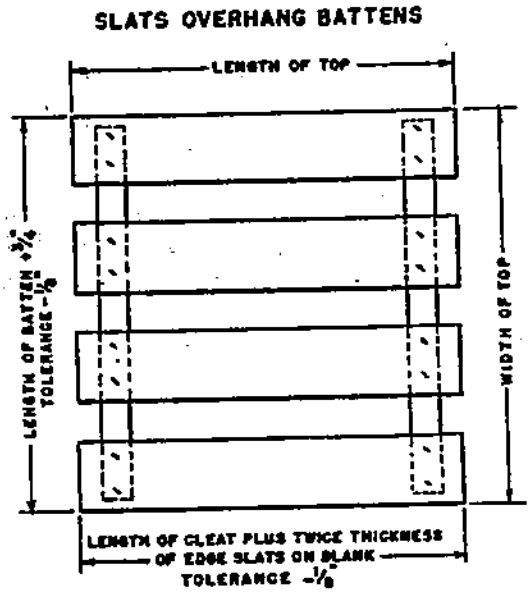
Width: Same as inside *width* of box minus 1/4".
Tolerance: 1/16" plus or minus.



B. TOPS (upright crates)

(See Design Facts, Vol. 1, No. 10)

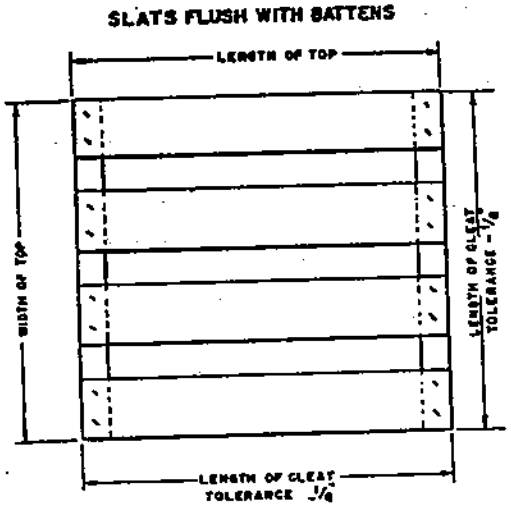
SLATS OVERHANG BATTENS



Length: (measured along slats)
Same as *cleat length* plus twice the thickness of edge slats on blank.
Tolerance: minus 1/8".

Width: (measured along battens)
Same as *batten length* plus 3/4".
Tolerance: minus 1/8".

SLATS FLUSH WITH BATTENS



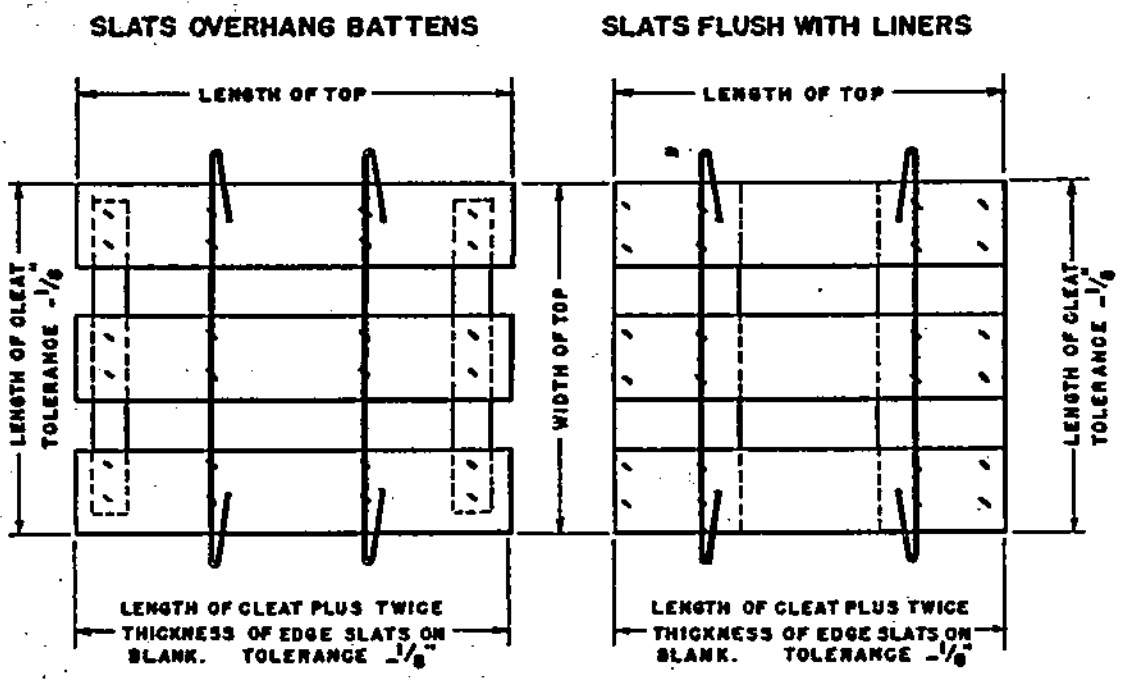
Length: (measured along slats)
Same as *cleat length*.
Tolerance: minus 1/8".

Width: (measured along battens)
Same as *cleat length*.
Tolerance: minus 1/8".

TOPS WITH WIRES

Length: (measured along slats)
Same as *cleat length* plus twice the thickness of edge slats on blank.
Tolerance: minus 1/8".

Width: (measured along battens or liners)
Same as *cleat length*.
Tolerance: minus 1/8".



C. BASES (upright crates)

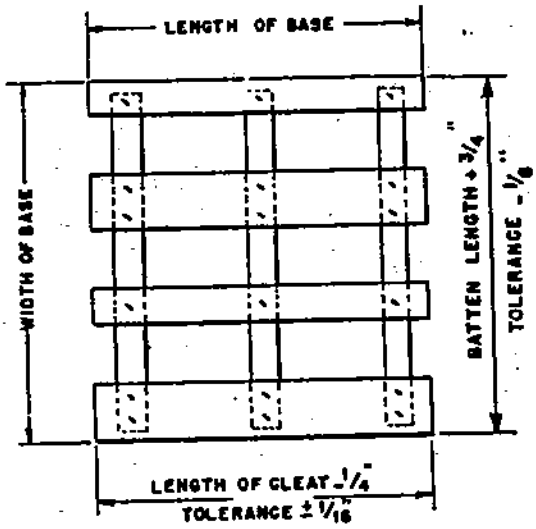
(See Design Facts, Vol. 1, No. 9)

SLATS OVERHANG BATTENS

Length: (measured along slats)
Same as *cleat length* minus 1/4".
Tolerance: 1/16" plus or minus.

Width: (measured along battens)
Same as *batten length* plus 3/4".
Tolerance: minus 1/8".

SLATS OVERHANG BATTENS

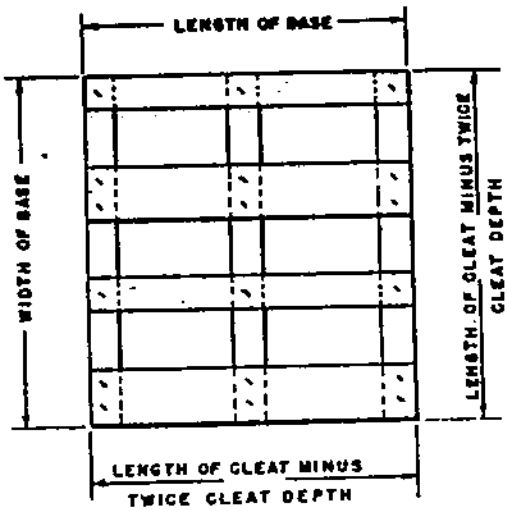


SLATS FLUSH WITH BATTENS

Length: (measured along slats)
Same as *cleat length* minus twice the cleat depth.
Tolerance: minus 1/8".

Width: (measured along battens)
Same as *cleat length* minus twice the cleat depth.
Tolerance: minus 1/8".

SLATS FLUSH WITH BATTENS



VII. WIRE

(See Bulletin No. 309 - WIRE)

GAGE OF WIRE	DIAMETER OF WIRE, INCH	READINGS ON ROCKAWAY WIRE TESTER					MINIMUM ELONGATION IN 10 INCHES, PERCENT	
(W&M)		STAPLING WIRE		BINDING WIRE			BINDING WIRE	
		Group I, II, III, Woods	Group IV Woods	Twist Closure (Soft)	Rock Fastener Closure (Medium) Gr. I, II, III, Woods	Rock Fastener Closure (Hard) Gr. IV Woods	Soft	Medium and Hard
20	0.0348	6-10 (A2)	6-10 (A2)					
19	0.0410	14-17 (A2)	14-17 (A2)					
18	0.0475	11-15 (A)	11-15 (A)					
17	0.0540	26-32 (A)	26-32 (A)	13-20 (A)	18-22 (A)	20-23 (A)		
16	0.0625	13-17 (B)	17-21 (B)*	15-22 (A)	23-29 (A)	28-32 (A)	15	10
15	0.0720	28-32 (B)	30-34 (B)*	7-11 (B)	13-17 (B)	15-18 (B)	15	10
14	0.0800	40-44 (B)*	32-37 (C)*	12-17 (B)	20-25 (B)	24-29 (B)	15	10
13	0.0915			22-40 (B)	20-26 (C)	25-30 (C)	15	10
12	0.1055			27-38 (C)	28-38 (C)	38-48 (C)	15	10
11**	0.1205			50-65 (C)	60-75 (C)	70-85 (C)		

* Special grade steel. Specifications furnished on request.

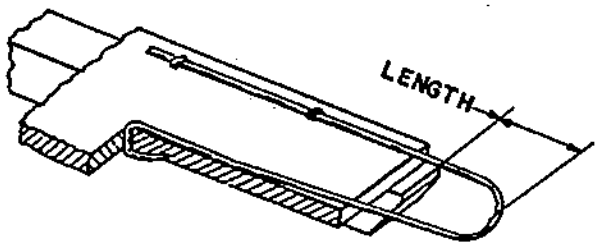
** 11-gage wire can be tested on the new Rockaway Wire Tester scale which has readings from 0 to 100 lbs.

1. These standards apply to wire in original coils.
2. (A) (B) (C) indicates tester pins to be used. (A2) indicates two lengths of wire.
3. Certain conditions may require wire having lower or higher readings than the above.
4. When boxes with Rock Fasteners are to be made for multiple reuse, the binding wire should test in the lower half of the range.
5. Minimum elongation of binding wire — 10%.

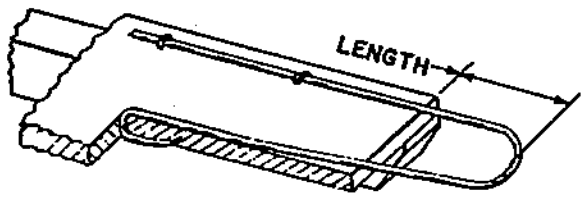
VIII. ROCK FASTENERS

A. PRONGS

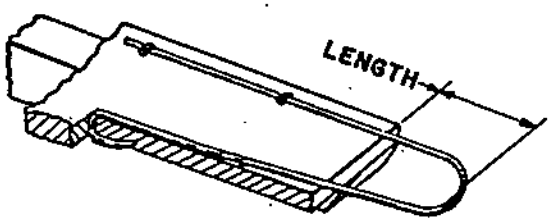
The prongs should be driven through the face boards and be formed into clinched hooks or be driven through the face boards and imbedded in a cleat or batten, as shown below.



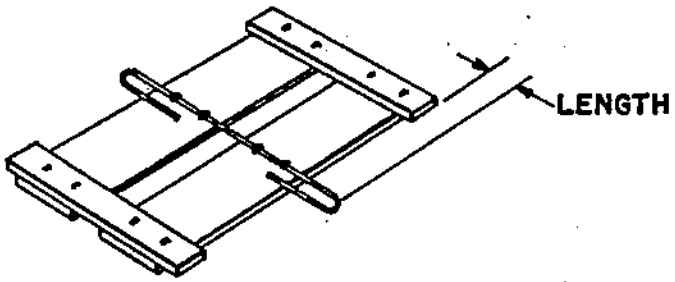
Scotch Miter — Set-Back Slat



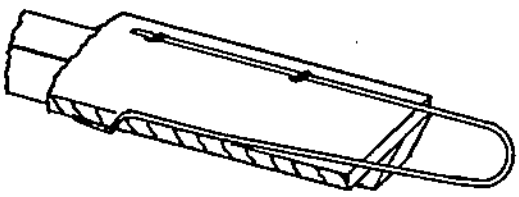
Scotch Miter — Flush Slat



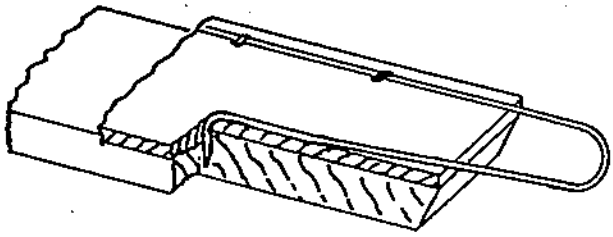
Plain Miter — Flush Slat



End with Set-Back Slat — loop length measured from liner



"Z" Clinch
Acceptable for face material ¼" and up.



Prong driven into Cleat or Batten

LENGTH OF PRONG (ENGLISH & METRIC)					
Thickness of Faceboards (In.)	(mm.)	Group I, II III Woods (In.)	(mm.)	Group IV Woods (In.)	(mm.)
1/10 to 7/32	2.5 to 5.5	7/16	11	7/16	11
7/32 to 5/16	5.6 to 7.9	9/16	14		
5/16 UP	7.9 UP	11/16	17	11/16 or 13/16	17 or 21

A) When driving unclinched prongs into cleats 11/16" (17 mm) prongs should be used.

B) When using Group IV woods 1/4" (6 mm) and up, minimum size binding wire should be 13° (22/10°)

B. LENGTH

Measured from end of cleat, or liner (see page 19)

on blank:

Thickness of Faceboards		LENGTH OF TOP (WIDE) LOOP								LENGTH OF SIDE (NARROW) LOOP					
		Hand Closures				Machine Closures**				Hand Closures				Machine Closures			
(In.)	(mm.)	(Min.)		(Max.)		(Min.)		(Max.)		(Min.)		(Max.)		(Min.)		(Max.)	
		(In)	(mm)	(In)	(mm)	(In)	(mm)	(In)	(mm)	(In)	(mm)	(In)	(mm)	(In)	(mm)	(In)	(mm)
1/6 or less	4.2	3/4	19	1	25	7/8*	22	1*	25	3/4	19	1-1/4	32	1-1/8	29	1-3/8	35
3/16-1/4	4.8-6.4	3/4	19	1-1/8	29	7/8	22	1-1/8	29	7/8	22	1-3/8	35	1-1/8	29	1-3/8	35
5/16-3/8	7.9-9.5	1	25	1-1/4	32	1	25	1-1/4	32	1-1/4	32	1-1/2	38	1-1/4	32	1-1/2	38

*Add 1/8" (3mm) to this dimension for 1/8" (3mm) Scotch on Cleat

**3/4" (19mm) Wide Loops required for Machine Closure.

Note: On bulge packs, longer intermediate side and top loops may be required.

on ends: (With Notched Cleats.)

	WIDTH OF CLEAT		THICKNESS OF FACEBOARDS		LENGTH OF END LOOPS			
					Wires on Outside of End		Wires on Inside of End	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.
BOXES	5/8	16	Up to 1/6	4.2	1-3/8	35	1-5/8	41
	11/16	17	Up to 1/6	4.2	1-1/2	38	1-11/16	43
	3/4	19	Up to 1/6	4.2	1-5/8	41	1-3/4	44
	To	To	3/16 to 7/32	4.8-5.5	1-7/8	48	2-1/8	54
	7/8	22	1/4 to 5/16	6.4-7.9	2	51	2-3/8	60
			3/8 to 7/16	9.5-11.1	2-1/8	54	2-1/2	64
			5/16	7.9	2-3/8	60	2-11/16	68
			3/8	9.5	2-7/16	62	2-13/16	71
			7/16	11.1	2-1/2	64	2-15/16	75
CRATES*	5/8	16	Up to 1/6	4.2	1-1/8	29	1-3/8	35
	3/4 to 7/8	19 to 22	Up to 7/16	11.1	1-3/8	35	1-5/8	41
	1-1/8	29	1/4 to 7/16	6.4-11.1	1-1/2	38	1-7/8	48

Tolerance: 1/8" (3mm) plus or minus.

*When a slat covers the notch in the cleat, the length of the loop shall be the same as for a box.

NOTE: Loops more than 2" (51mm) long require setback clinch equipment.

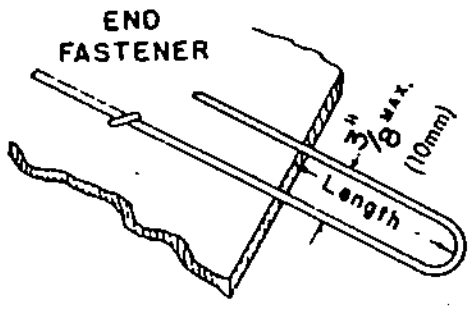
on ends: (Without notched cleats)

For Hand Assembly add 1/4" (6mm) to length of end loops.

C. WIDTH

Dimensions given are recommended for easy engagement of Rock Fastener loops in making a closure.

The width of Rock Fastener loops on the top and side of the box measured at the edge of the board, should be not less than the dimension indicated on the sketches on page 22. The width of the Rock Fastener loops on the end of the box, measured at the edge of the board, should not exceed the dimension given in the sketch below.



on ends:

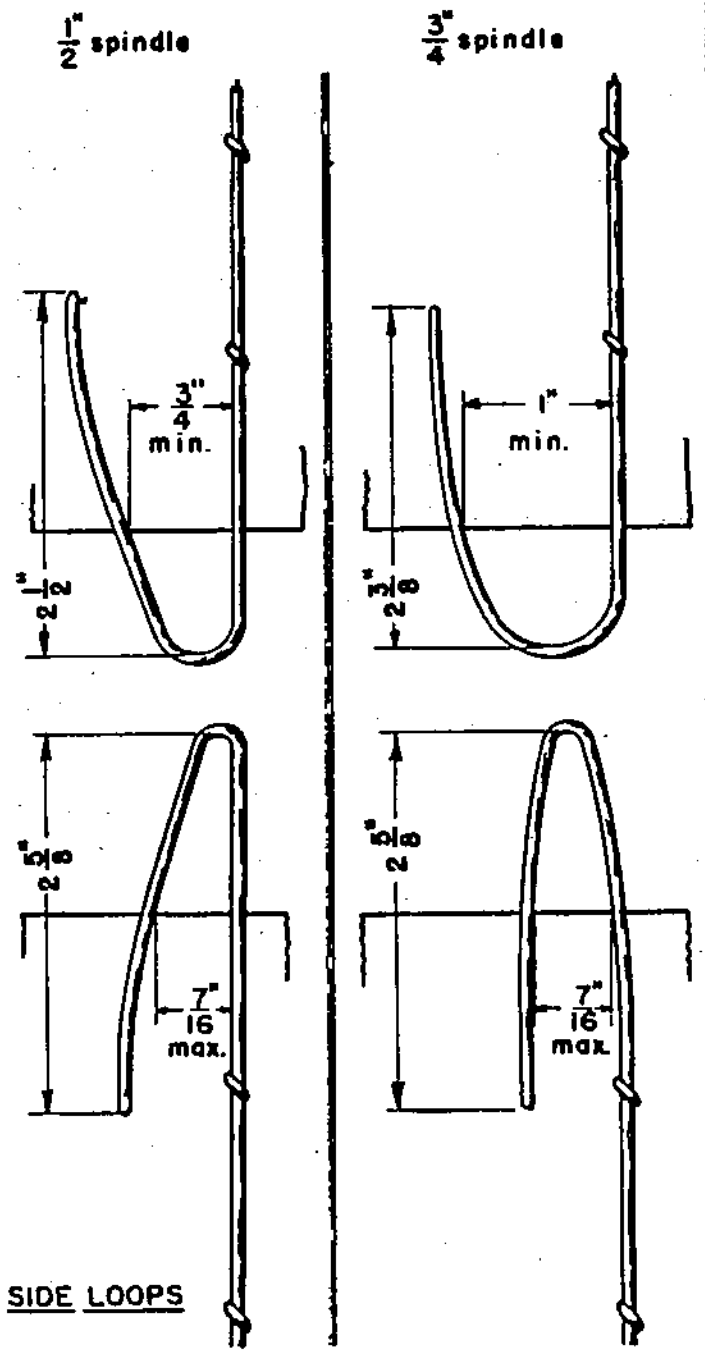
3/8" (10mm) wide, maximum (over wires)

on blank:

ROCK FASTENER LOOPS WITH REGULAR CLINCHES

(See Production Facts, Vol. 2, No. 13)

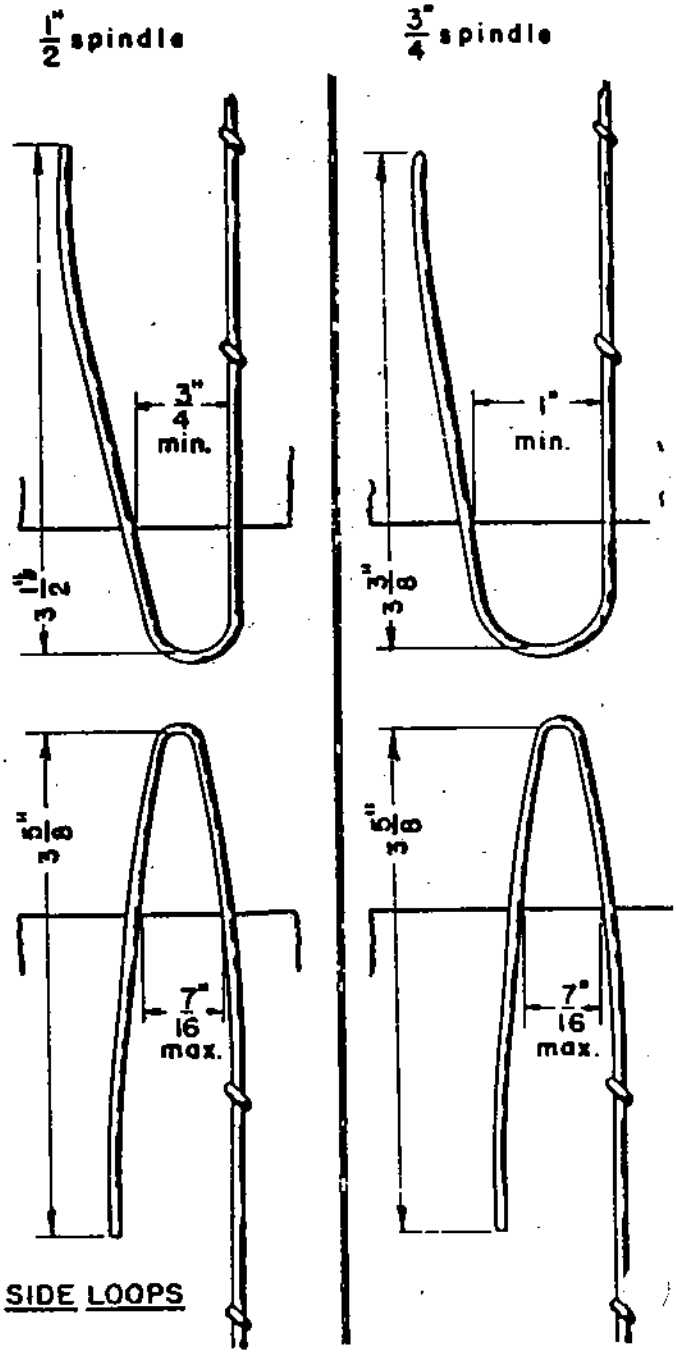
TOP LOOP MADE WITH:



ROCK FASTENER LOOPS WITH SET-BACK CLINCHES

(See Production Facts, Vol. 2, No. 13)

TOP LOOP MADE WITH:



IX. STAPLES

A. SIZE

IN REGULAR CLEATS ON BLANKS:

Size of Cleat		Thickness of Faceboards		LENGTH AND GAUGE OF STAPLES					
				Group I & II Woods		Group III Woods		Group IV Woods	
In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
5/8 x 5/8 or 11/16 x 11/16	16 x 16 or 17 x 17	1/10 to 1/6	2.5 to 4.2			3/4–16°	19.1–16/10°	3/4–16°	19.1–16/10°
5/8 x 13/16	16 x 21	1/10 to 1/6	2.5 to 4.2			7/8–16°	22.2–16/10°	7/8–16°	22.2–16/10°
3/4 x 3/4	19 x 19	1/10 to 1/6	2.5 to 4.2	1–16°	25.4–16/10°	7/8–16°	22.2–16/10°	7/8–16°	22.2–16/10°
13/16 x 13/16	21 x 21	1/8 or 1/7	3.2 or 3.6	1-1/8–16°	28.6–16/10°	1–16°	25.4–16/10°	7/8–16°	22.2–16/10°
		1/6 to 7/32	4.2 to 5.5	1-1/8–16°	28.6–16/10°	1-1/8–16°	28.6–16/10°	1–16°	25.4–16/10°
		1/4	6.4	1-1/4–16°	31.7–16/10°	1-1/8–16°	28.6–16/10°	1-1/8–16°	28.6–16/10°
13/16 x 7/8	21 x 22	1/8 to 3/16	3.2 to 4.8	1-1/8–16°	28.6–16/10°	1–16°	25.4–16/10°	7/8–16°	22.2–16/10°
7/8 x 7/8	22 x 22	7/32 to 3/8	5.5 to 9.5	1-1/4–16°	31.7–16/10°*	1-1/4–16°*	31.7–16/10°*	1-1/8–16°	28.6–16/10°
1-1/8 x 1-1/8	29 x 29	1/4	6.4	1-1/2–14°*	38.1–20/10°*	1-1/2–14°	38.1–20/10°*	1-1/4–14°	31.7–20/10°
		5/16	7.9	1-1/2–14°*	38.1–20/10°*	1-1/2–14°*	38.1–20/10°*	1-3/8–14°	34.9–20/10°
		3/8	9.5	1-5/8–14°*	41.3–20/10°*	1-5/8–14°*	41.3–20/10°*	1-1/2–14°	38.1–20/10°

NOTE: Staples of next length are acceptable. "50" stitchers recommended.

IN WIDE CLEATS OR LINERS:

Combined Thickness of Slat and Cleat or Liner		LENGTH AND GAGE OF STAPLES			
		In Boards Only		In Boards and Over Wires	
(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
3/16	4.8	3/8–20°	9.5–10/10°	7/16–20°	11.1–10/10°
1/4	6.4	3/8–20	9.5–10/10	7/16–20	11.1–10/10
5/16	7.9	7/16–18	11.1–10/10	7/16–18	11.1–10/10
3/8	9.5	1/2–18	12.7–10/10	9/16–18	14.3–12/10
7/16	11.1	5/8–18	15.9–12/10	5/8–18	15.9–12/10
1/2	12.7	5/8–18	15.9–12/10	3/4–18	19.1–12/10
9/16	14.3	3/4–18	19.1–12/10	3/4–18	19.1–12/10
5/8	15.9	3/4–18	19.1–12/10	7/8–16	22.2–16/10
11/16	17.5	3/4–18	19.1–12/10	7/8–16	22.2–16/10
3/4	19.1	7/8–16	22.2–16/10	1–16	25.4–16/10
13/16	20.5	7/8–16	22.2–16/10	1–16	25.4–16/10
7/8	22.2	1–16	25.4–16/10	1-1/8–16	28.6–16/10
15/16	23.8	1–16	25.4–16/10	1-1/8–16	28.6–16/10
1	25.4	1-1/8–16	28.6–16/10	1-1/8–16	28.6–16/10
1-1/16	27.0	1-1/8–16	28.6–16/10	1-1/8–16	28.6–16/10
1-1/8	28.6	1-1/4–16	31.7–16/10	1-1/4–16	31.7–16/10

NOTE: The staples in this table are of sufficient length to provide clinches in most cases. Staples of heavier gage or next length are acceptable.

IN BATTENS ON TOPS:

Combined Thickness of Slat & Batten		LENGTH* AND GAGE OF STAPLES					
				Group I & II Woods		Group III & IV Woods	
(In.)	(mm.)	(In.)	(mm.)				
1 to 1-1/16	25.4 to 27.0	1-1/8	28.6	16°	16/10°	16°	16/10°
1-1/8 to 1-3/16	28.6 to 30.2	1-1/4	31.7	16	16/10	16	16/10
1-1/4 to 1-3/8	31.7 to 34.9	1-3/8	34.9	14	20/10	14	20/10
1-7/16 to 1-5/8	36.5 to 41.3	1-5/8	41.3	14	20/10	14	20/10

*Staple lengths are based on clinching in soft woods. If a consistent clinch is required in hardwoods, a longer staple is recommended.

IN BATTENS OR SKIDS ON BASES:

Combined Thickness of Deckboards and Battens of Skids		LENGTH AND GAGE OF STAPLES					
				Group I & II Woods		Group III & IV Woods	
(In.)	(mm.)	(In.)	(mm.)				
3/4 to 13/16	19. to 20.6	7/8	22.2	16°	16/10°	16°	16/10°
7/8 to 15/16	22.2 to 23.8	1	25.4	16	16/10	16	16/10
1 to 1-1/16	25.4 to 27.0	1-1/8	28.6	16	16/10	16	16/10
1-1/8 to 1-3/16	28.6 to 30.2	1-1/4	31.7	14	20/10	14	20/10
1-1/4 to 1-5/16	31.7 to 33.3	1-3/8	34.9	14	20/10	14	20/10
1-3/8 to 1-7/16	34.9 to 36.5	1-5/8	41.3	14	20/10	14	20/10
1-1/2 to 1-11/16	38.1 to 42.9	1-3/4	44.4	14	20/10	14	20/10

IN FACEBOARDS OR SLATS, OVER WIRES ON BLANKS, ENDS, TOPS, BASES:

Faceboard or Slat Thickness		SIZE OF STAPLES (ALL WOOD GROUPS)	
		Length* Gage	Length* Gage
(In.)	(mm.)	(In.)	(mm.)
1/10	2.5	5/16 x 20°	7.9 x 10/10°
1/8	3.2	5/16 x 20	7.9 x 10/10
1/7	3.6	5/16 x 20	7.9 x 10/10
1/6	4.2	3/8 x 20	9.5 x 10/10
3/16	4.8	3/8 x 20	9.5 x 10/10
7/32	5.5	7/16 x 18	11.1 x 10/10
1/4	6.4	7/16 x 18	11.1 x 10/10
5/16	7.9	1/2 x 18	12.7 x 10/10
3/8	9.5	9/16 x 18	14.3 x 12/10

NOTE: Staples of heavier gage or next length, are acceptable.
20° staples should not be used on industrial on containers.

*Staple lengths are based on clinching in soft woods. If a consistent clinch is required in hardwoods, a longer staple is recommended.

B. POSITION

Position and Measurements refer to center of staple.

STAPLES IN CLEATS

Staple points should not protrude through the sides or ends of the cleats, nor through the bottom unless clinched.

STAPLES AT ENDS OF CLEATS OR BATTENS

The distance of the staple from the ends of cleats or battens should be as follows:

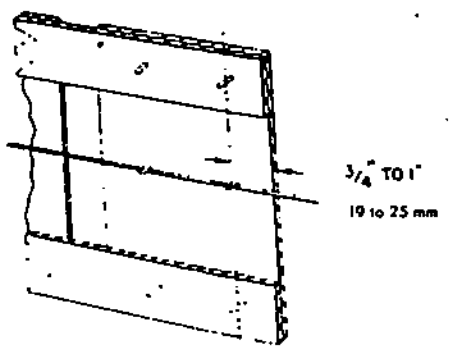
LENGTH OF STAPLE		DISTANCE FROM END OF CLEAT OR BATTEN							
		Miter Cleat				Tongue and Groove Cleat		Batten	
		Plain		1/8 Scotch					
(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
3/4	19.1	1	25	7/8	22			5/8	16
7/8	22.2	1-1/8	29	1	25	1-1/2	38	3/4	19
1–1-1/8	25.4–28.6	1-1/4	32	1-1/8	29	1-1/2	38	7/8	22
1-1/4	31.7	1-3/8	35	1-1/4	32	1-5/8	41	1	25
1-3/8	34.9	1-1/2	38	1-3/8	35	1-3/4	44	1-1/8	28
1-1/2	38.1	1-5/8	41	1-1/2	38	1-7/8	48	1-1/8	28
1-5/8	41.3	1-3/4	44	1-5/8	41	2	51	1-1/8	28
1-3/4	44.4							1-1/8	28
Tolerance: 1/8", (3mm) plus or minus									

STAPLES IN BATTENS

Staples should not protrude through the sides or ends of the battens, nor through the bottom unless clinched.

STAPLES IN LINERED ENDS, TOPS AND BOTTOMS

Staples should be 3/4", (–1/8) to 1", 19 (–3 mm) to 25 mm from each edge of end.

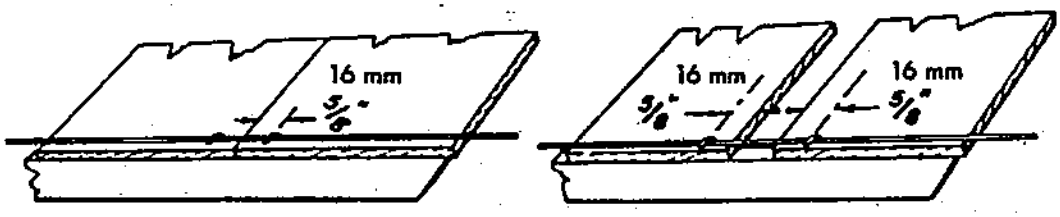


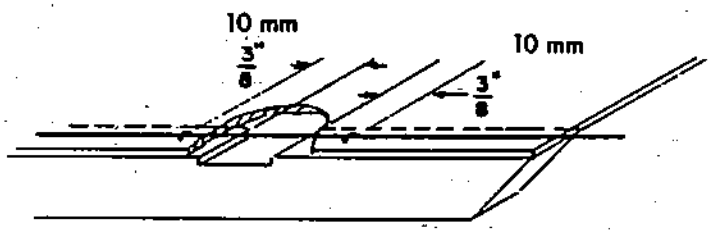
INTERMEDIATE STAPLES

Staples adjacent to an opening or edge of a piece as shown below—

On Boxes: Preferably not less than 5/8" (–1/8"), 16 mm (–3 mm) from edge of piece.

On Crates: Staples should be not less than 5/8" (–1/8"), 16 mm (–3 mm) from edge of slats.

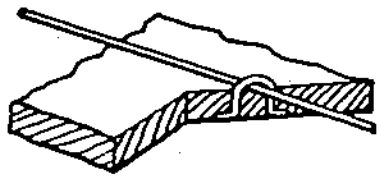




DISTANCE FROM EDGE OF NOTCH TO CENTER LINE OF STAPLE SHOULD BE NOT LESS THAN $\frac{3}{8}$" 10 mm

C. CLINCHED STAPLES

Staples clinched in the face boards should be driven full length and the points should be fully embedded in the wood.



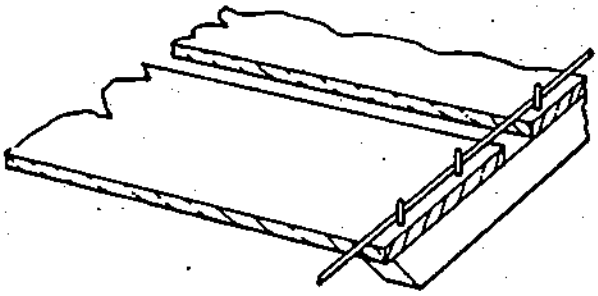
D. GALVANIZED STAPLES

Galvanized staples should be used in wirebounds designed for reuse or outdoor storage.

X. MANUFACTURE - GENERAL

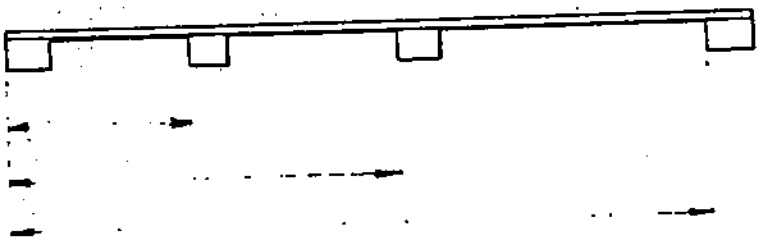
A. ENDS OF BOARDS

The ends of the boards on the blank should be flush with the outside edges of the cleats.



B. LOCATING CLEATS

The dimension between rows of cleats should not vary more than 1/8" plus or minus, measured as shown below.



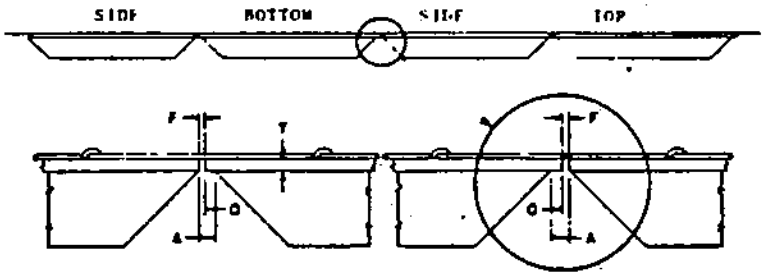
C. SPACING OF SECTIONS AND CLEATS

The boards and cleats on adjacent sections should be spaced in accordance with the distances shown in the following sketches.

1. *Cleats on Inside of Container*

a) *Full Miter Cleats*

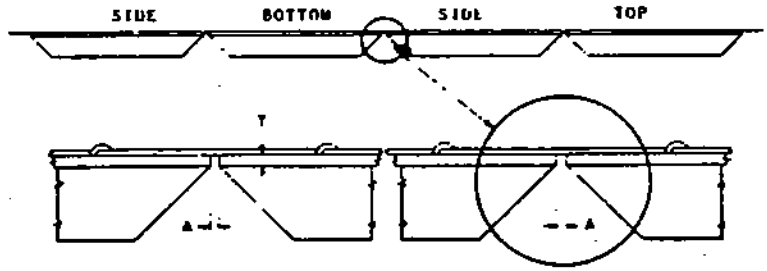
Top and Bottom Overlap on Boxes



T		F		A		O	
Faceboard Thickness (In.)	(mm.)	Distance Between Boards (In.)	(mm.)	Distance Between Cleats (In.)	(mm.)	Overlap (In.)	(mm.)
3/16	4.8	3/32	2.5	9/32	7.0	3/16	5.0
7/32	5.5	5/32	4.0	11/32	9.0	3/16	5.0
1/4	6.4	3/16	5.0	7/16	11.0	1/4	6.0
5/16	7.9	1/4	6.0	1/2	13.0	1/4	6.0
3/8	9.5	11/32	9.0	23/32	18.0	3/8	10.0
7/16	11.1	3/8	10.0	3/4	19.0	3/8	10.0

Tolerances: Distance between ends of Cleats (A) Cleats up to 30", (762 mm) long 1/16", (1.5 mm) plus or 0" minus cleats 30", (762 mm) or longer, 1/8", (3 mm) plus or 0" minus

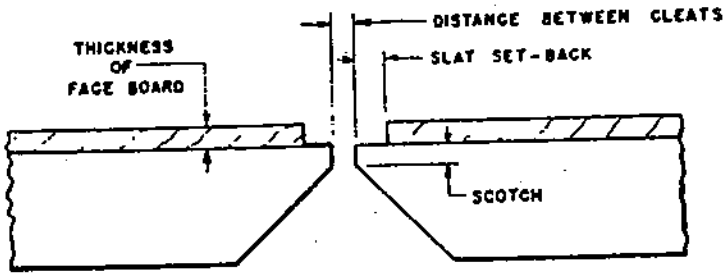
No Overlap



T. Face Board Thickness		A. Distance Between Cleats	
(In.)	(mm.)	(In.)	(mm.)
1/10	2.5	5/32	4.0
1/8	3.2	5/32	4.0
1/7	3.6	5/32	4.0
1/6	4.2	5/32	4.0
3/16	4.8	3/16	5.0
7/32	5.5	7/32	6.0
1/4	6.4	5/16	8.0
5/16	7.9	3/8	10.0
3/8	9.5	7/16	11.0
7/16	11.1	1/2	13.0

Tolerance: Distance between ends of cleats 1/16", (1.5 mm) plus or minus.

b) *Scotch Miter Cleats (slats set-back)*



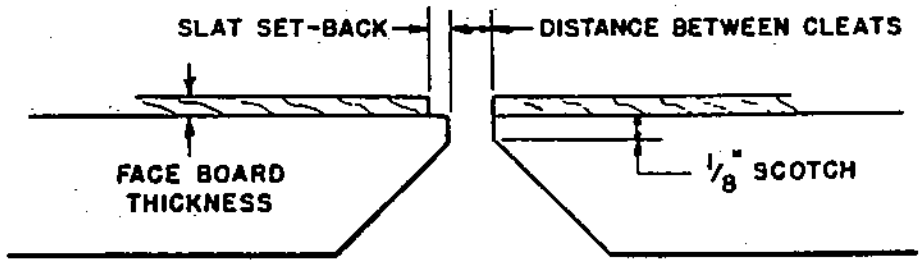
1/8" (3 mm) SCOTCH WITH EQUAL SET-BACK*

DISTANCE BETWEEN CLEATS TO NEAREST 32ND, or 1 mm									
Faceboard Thickness		Slat Set-Back (In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
(In.)	(mm.)	0	0	1/8	3	3/8	10	3/4	19
1/10-1/7	2.5-3.6	1/4	6	7/32	6	3/16	5	—	—
1/6-3/16	4.2-4.8	11/32	9	5/16	8	9/32	7	7/32	6
7/32	5.5	7/16	11	13/32	10	11/32	9	1/4	6
1/4	6.4	15/32	12	7/16	11	3/8	10	9/32	7
5/16	7.9	19/32	15	9/16	14	15/32	12	3/8	10
3/8	9.5	11/16	18	21/32	17	9/16	14	7/16	11
7/16	11.1	29/32	23	25/32	20	21/32	17	1/2	13
Tolerance: Distance between ends of cleats 1/16" (1.5 mm) plus or minus.									

1/4" (6 mm) SCOTCH WITH EQUAL SET-BACK*

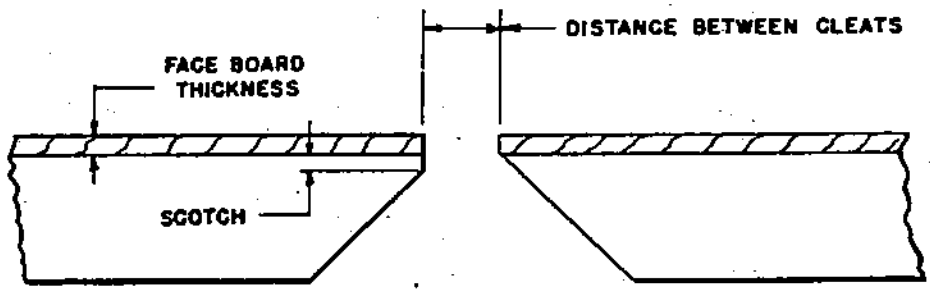
DISTANCE BETWEEN CLEATS TO NEAREST 32ND, or 1 mm									
Faceboard Thickness		Slat Set-Back (In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
(In.)	(mm.)	0	0	1/8	3	3/8	10	3/4	19
1/6-3/16	4.3-4.8	1/2	13	15/32	12	7/16	11	3/8	10
7/32	5.5	9/16	14	17/32	13	15/32	12	13/32	10
1/4	6.4	19/32	15	9/16	14	17/32	13	7/16	11
5/16	7.9	23/32	18	11/16	17	19/32	15	1/2	13
3/8	9.5	25/32	20	3/4	19	23/32	18	9/16	14
7/16	11.1	7/8	22	25/32	20	3/4	19	5/8	16
Tolerance: Distance between ends of cleats 1/16" (1.5 mm) plus or minus.									

** For other combinations interpolate for cleat distances.*



1 FACE SET-BACK – 1 FACE FLUSH

DISTANCE BETWEEN CLEATS TO NEAREST 32ND IN. OR 1 mm									
Faceboard Thickness		Slat Set-Back							
		(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
(In.)	(mm.)	1/8	3	1/4	6	3/8	10	1/2	13
1/8	3.2	1/4	6	1/4	6	1/4	6	1/4	6
1/6-3/16	4.2-4.8	3/8	10	11/32	9	5/16	8	9/32	7
7/32	5.5	7/16	11	13/32	10	3/8	10	11/32	9
1/4	6.4	15/32	12	7/16	11	13/32	10	3/8	10

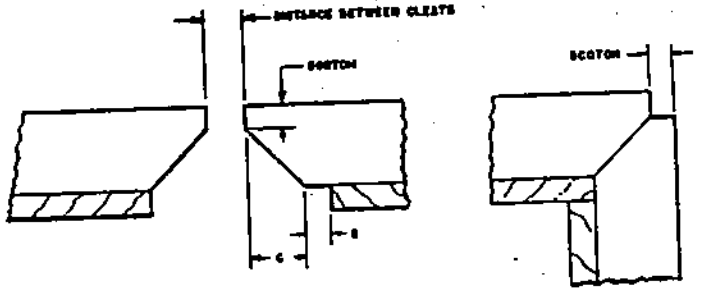


1 CLEAT 1/8" SCOTCH MITER – 1 CLEAT PLAIN MITER

DISTANCE BETWEEN CLEATS TO NEAREST 32ND IN. OR 1 mm							
Faceboard Thickness		Slat Set-back on S.M. Cleat Only					
		(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
(In.)	(mm.)	0	0	1/8	3	1/4	6
1/10	2.5	3/16	5	7/32	6	7/32	6
1/8	3.2	7/32	6	1/4	6	7/32	6

2. *Exterior Cleats*

a) *Scotch Miter*

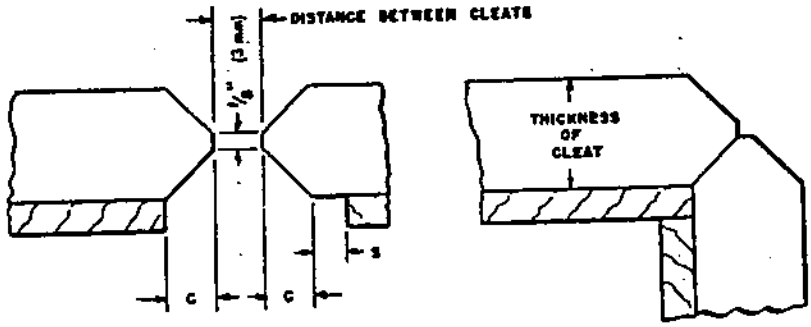


1/8" (3 mm) SCOTCH

Thickness of Cleat		"C" (See Note)		Distance Between Cleats	
(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
7/16	11	5/16	8	3/16	5
1/2	13	3/8	10	3/16	5
9/16	14	7/16	11	3/16	5
5/8	16	1/2	13	3/16	5
1/4" (6 mm) SCOTCH					
13/16	21	9/16	14	3/8	10
7/8	22	5/8	16	3/8	10

Tolerance: Distance between ends of cleats 1/16" (1.5mm) plus or minus
Note: Dimension C equals thickness of cleat minus scotch.
Dimension S equals nominal thickness of faceboard or slat plus 1/16" (1.5mm)

b) *Double Miter*



Thickness of Cleat		"C" (See Note)		Distance Between Cleats	
(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
13/16	21	11/32	9	3/8	10
7/8	22	3/8	10	3/8	10

Tolerance: Distance between ends of cleats 1/16" (1.5mm) plus or minus
Note: Dimension C equals one half thickness of cleat minus 1/16" (1.5 mm).
Dimension S equals nominal thickness of faceboard or slat plus 1/16" (1.5mm)

D. TWIST WIRE CLOSURE

The minimum lengths of closure wires on twist wire box blanks should be:

On Top Section: 2-3/8"

On Side Section: 2-1/8"

E. ATTACHING ALL-BOUND ENDS TO BLANK

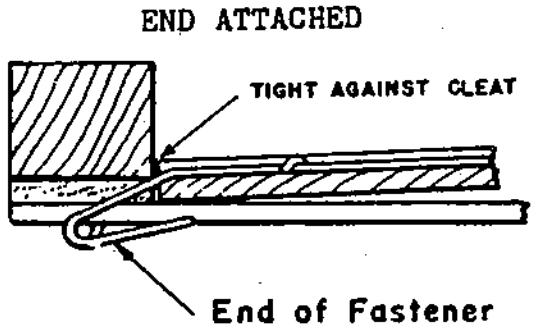
Usually one end should be attached to the right cleat on the front side of the box, and the other end to the left cleat on the rear side of the box, by means of the Rock Fasteners on the ends. (Right and left refer to position when facing front of box with top up.)

The Rock Fasteners should be bent around the binding wire or the side board on the blank and flattened against the side of the box.

Ends having greater than 1/4" thickness and ends with battens should not be attached to the blank. Such ends should be bundled separately.

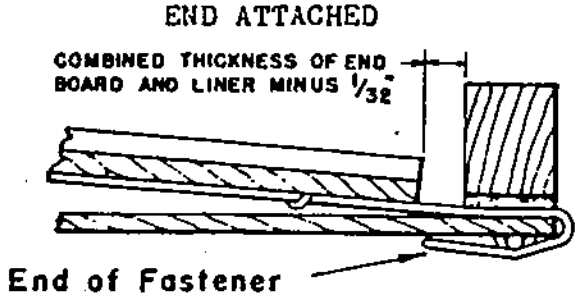
END WIRES ON OUTSIDE OF BOX

Each end should be tight against the inside of the cleat to which it is fastened.



END WIRES ON INSIDE OF BOX

Each end should be fastened to the cleat with the minimum clearance required for the end to fit tightly against the cleat when the box is made up.



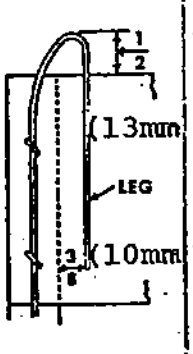
XI. DURABOXES

A. TOP CLOSURES

For Duraboxes with top closures, the side and end loops must be as shown below:

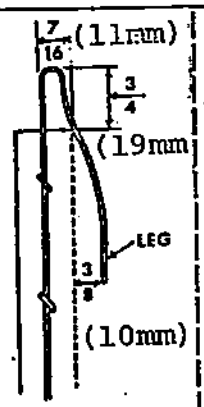
B. SIDE LOOP SIZE

B-SIDE LOOP SIZE

	Gage of Binding Wires	Length Side Loop		Type Loop	Spindle Size
		In.	mm.		
	All Gages	1/2	13	Durabox	Durabox

C. NARROW END LOOP SIZE

C-NARROW END LOOP SIZE

	Gage of Binding Wire	Length of End Loop		Spindle Size	
		In.	mm.	In.	mm.
	All Gages	3/4	19	3/16	4.7

D. LENGTH OF ROCK FASTENER

Length of Rock Fastener leg * on "Durabox Type" loops should be:

3" (76 mm) for Standard Clinch
4" (102 mm) for Setback Clinch

*** Length of leg to be measured from inside of loop to point of entry of prong into face board.**

E. ROCK FASTENER CLINCHES

Rock Fastener Clinches should be not more than 3/8" (10 mm) from cleats to keep prong away from contents.

F. LOCATION OF FIRST STAPLE

The location of the first staple in the end section and the adjacent side section is critical. The position of these staples must be in accordance with I. Staple Pattern (Page 34-A.)

G. INTERMEDIATE WIRES

Soft galvanized twist wire must be used on intermediate wires.

15-gage (18/10) must test 9 - 13 B pins on RWT

16-gage (12/10) must test 18 - 22 A pins on RWT

H. STAPLE LOCATION IN CLEATS

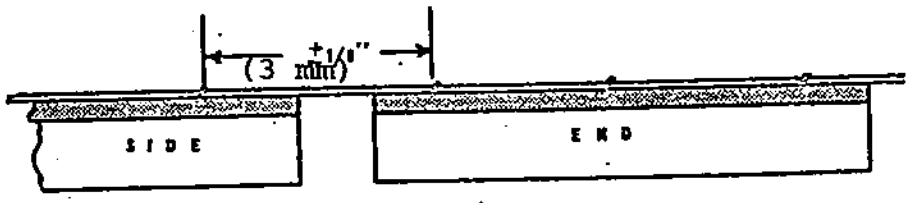
STAPLE LOCATION					
Length of Staple		Minimum Distance from End of Cleat			
		Miter End		Butt End	
In.	mm.	In.	mm.	In.	mm.
3/4	19.1	1	25	5/8	16
7/8	22.2	1-1/8	29	3/4	19
1 - 1-1/8	25.4.28.6	1-1/4	32	7/8	22
1-1/4	31.7	1-3/8	35	1	25
1-3/8	34.9	1-1/2	38	1-1/8	29
1-1/2	38.1	1-5/8	41	1-1/8	29

I. STAPLE PATTERN

1. Locate the first staples at optimum positions on adjoining ends of side and end cleats as indicated on the table, page 34-B.

2. Determine the distance between side and end cleats (section spacing) from same table - under the proper face board thickness.

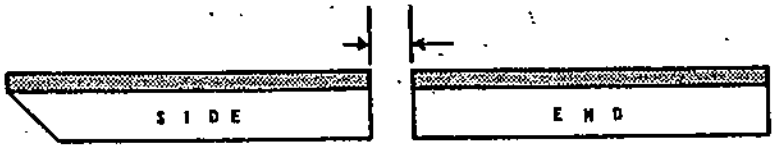
   The total distance between the two staples, including the section spacing, must be equal to the exact staple pattern or be greater than the minimum KO distance. A variation of $\pm$ 1/8" (3 mm) in the total distance will not adversely affect the section spacing.



3. If the staple pattern as determined above does not provide for an adequate number of staples per slat or for required openings between slats, or 5/8" (16 mm) clearance from edges of slats or minimum distance from ends of cleats, change the position of corner staples and repeat procedure 2.

4. Usually a chain travel of 1-1/2" to 1-7/8" (38 to 48 mm) will satisfy most requirements.

J. SPACING BETWEEN END AND SIDE CLEATS



Spacing between end and side cleats is affected by cleat width, face board thickness and the distance from the cleat ends to the first staple.

The tables below show the correct spacing for boxes which have side face boards flush with the top ends of the side cleats. In order to get the correct spacing, use the "average distance of first staples in end and adjacent side cleat" below.

If the side face boards are set back (not flush), the section spacing must be reduced to assure tight corners.

SPACING BETWEEN END AND SIDE CLEATS

Cleat Width				Faceboard Thickness							
				In.	mm.	In.	mm.	In.	mm.	In.	
In.	mm.	In.	mm.	3/16	4.8	7/32	5.5	1/4	6.4	5/16	
11/16	17	*5/8	16	3/8	9	7/16	11	1/2	13	---	
		3/4	19	3/8	9	13/32	10	15/32	12	---	
		**7/8	22	11/32	9	13/32	10	7/16	11	---	
		1	25	5/16	8	3/8	9	13/32	10	---	
13/16	20	*3/4	19	15/32	12	1/2	13	17/32	14	5/8	
		7/8	22	7/16	11	15/32	12	1/2	13	19/32	
		**1	25	13/32	10	15/32	12	1/2	13	9/16	
		1-1/8	29	13/32	10	7/16	11	15/32	12	9/16	
7/8	22	*7/8	22	15/32	12	17/32	13	9/16	14	5/8	
		1	25	7/16	11	1/2	13	17/32	14	19/32	
		** 1-1/8	29	13/32	10	15/32	12	1/2	13	9/16	
		1-1/4	32	13/32	10	7/16	11	15/32	12	17/32	

*Optimum location of staple from ends of end cleat.
**Optimum location of staples from ends of side cleats.

XII. PAPER LINERS

A. PAPER LINERS

When inside paper liners are used as cushioning material, it is imperative that the paper liners cover the edges of the face boards. In accomplishing this it is recommended that the die-cut or slotted ventilation holes be a minimum of 1/8" narrower than the openings between slats.

B. STAPLES IN END LINERS

When single face corrugated fiberboard or solid fiberboard liners are used, staples driven over end liners should be 1/2" — 20°.

XIII SUPPLEMENT

A. SPECIAL REQUIREMENTS FOR MANUFACTURE OF BUTT END "B" STYLE BOXES & CRATES

DISTANCE BETWEEN CLEATS

Faceboard Thickness		Distance Between Cleats	
(In.	(mm.)	(In.	(mm.)
1/8 to 1/6	3.2 to 4.2	3/8	10
3/16 to 1/4	4.8 to 6.4	7/16	12
5/16 to 7/16	7.9 to 11.1	11/16	17
No overlap or setback on any section			

DISTANCE OF STAPLES FROM ENDS OF CLEATS

Faceboard Thickness		Distance	
(In.)	(mm.)	(In.)	(mm.)
1/8 to 7/32	3.2 to 5.5	7/8	22
1/4 to 7/16	6.4 to 11.1	1	25

ROCK FASTENER LOOP LENGTHS WITH SETBACK CLINCH

Loop Width		Faceboard Thickness		Length	
(In.)	(mm.)	(In.)	(mm.)	(In.)	(mm.)
Wide—3/4	19.1	1/8 to 5/16	3.2 to 7.9	1-1/8	29
Wide—3/4	19.1	3/8 to 7/16	9.5 to 11.1	1-3/8	35
Narrow—3/8	9.5	All Thicknesses		1-3/8	35

NOTE: 1.) The above design data based on standard cleat square cross-sections.
2.) Wide cleats are to be mitered or special shiplapped.

B. SPECIAL REQUIREMENTS FOR MANUFACTURE OF MOST COMMON IRREGULAR SHAPE BOXES & CRATES

Cleat Angles Required For The Following Shapes

Shape	Sides	Angle	Shape	Sides	Angle
Square	4	45°	Octagon	8	67-1/2
Rectangle	4	45°	Nonagon	9	70°
Pentagon	5	54°	Decagon	10	72°
Hexagon	6	60°	Undecagon	11	73-1/2°
Heptagon	7	64°	Dodecagon	12	75°
			—	16	78°

Distance Between (Full Miter Cleats) For The Following Shapes

(Faceboards Flush With Ends of Cleats)

Shape	Faceboard Thickness		Distance Between Cleats		Faceboard Thickness		Distance Between Cleats		Faceboard Thickness		Distance Between Cleats	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
Pentagon	1/4	6.4	1/4	6.4	5/16	7.9	5/16	7.9	3/8	9.5	13/32	10.3
Hexagon	1/4	6.4	7/32	5.6	5/16	7.9	9/32	7.1	3/8	9.5	11/32	8.7
Heptagon	1/4	6.4	3/16	4.8	5/16	7.9	1/4	6.4	3/8	9.5	9/32	7.1
Octagon	1/4	6.4	5/32	4.0	5/16	7.9	3/16	4.8	3/8	9.5	1/4	6.4

Distance Between 1/8" (Scotch Miter Cleats) For The Following Shapes

(Faceboards Flush With Ends of Cleats)

Shape	Faceboard Thickness		Distance Between Cleats		Faceboard Thickness		Distance Between Cleats		Faceboard Thickness		Distance Between Cleats	
Pentagon	1/4	6.4	13/16	10.3	5/16	7.9	15/32	11.9	3/8	9.5	9/16	14.3
Hexagon	1/4	6.4	11/32	8.7	5/16	7.9	13/32	10.3	3/8	9.5	15/32	11.9
Heptagon	1/4	6.4	9/32	7.1	5/16	7.9	11/32	8.7	3/8	9.5	13/32	10.3
Octagon	1/4	6.4	1/4	6.4	5/16	7.9	9/32	7.1	3/8	9.5	11/32	8.7