

TECHNICAL NOTES

FOREST PRODUCTS LABORATORY

U. S. FOREST SERVICE

MADISON, WISCONSIN

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THE NAILING OF BOXES

Observations of packages which have failed in service and tests on packing boxes by the Forest Products Laboratory, Madison, Wis., have shown that the most common defect in box construction is inadequate nailing. Attempts to strengthen boxes by the use of thicker lumber without regard for nailing very often only waste material. The extra wood may not be needed so much as a few more nails.

As an aid in determining whether or not a box is adequately nailed, the laboratory offers the following information:

Box Woods Grouped According to Nail Holding Qualities And Other Properties

The woods commonly used in box construction may be divided according to nail-holding ability and other properties desirable in box woods, into four groups, as follows:

Group I

Alpine fir	Cottonwood	Redwood
Aspen	Cucumber	Spruce
Balsam fir	Cypress	Sugar pine
Basswood	Jack pine	Western yellow pine
Buckeye	Lodgepole pine	White fir
Butternut	Magnolia	White pine
Cedar	Noble fir	Willow
Chestnut	Norway pine	Yellow poplar

Group II

Douglas fir
Hemlock
Larch (tamarack)
So. yellow pine
Va. and Car. pine

Group III

Black ash
Black gum
Maple, soft or silver
Pumpkin ash
Red gum
Sycamore
Tupelo
White elm

Group IV

Beech
Birch
Hackberry
Hickory
Maple, hard
Oak
Rock elm
White ash

All the species in one group are used interchangeably as regards thickness of material, and size and spacing of nails.

Kind of Nails

Tests have shown that cement coated nails have a holding power from 10 to 30 per cent greater than that of uncoated nails. Smooth nails are more effective than barbed nails.

Size of Nails

The penny of nail to be used in any case is determined by the thickness and species of wood in which the point of the nail is held after driving. The following schedule is based upon standard cement-coated box nails. If the designated penny of nail is not available, use the next penny smaller and space nails proportionately closer.

Schedule of Nail Sizes

		Thickness of ends or cleats to which sides, tops and bottoms are nailed							
Species of wood hold- ing nails.	or less								
		3/8"				11/16"			
		7/16"	1/2"	9/16"	5/8"	3/4"	13/16"	7/8"	

Size of cement coated nails								
Group I.	4d	5d	5d	6d	7d	8d	8d	9d
Group II.	4d	4d	5d	5d	6d	7d	7d	8d
Group III.	3d	4d	4d	5d	5d	6d	7d	7d
Group IV.	3d	3d	4d	4d	4d	5d	6d	7d

Spacing of Nails

Space nails holding boards to end grain of end 1-3/4 inches apart and nails holding boards to side grain of end 2 inches apart, when nails are 6 penny or less. Increase spacing of nails 1/4 inch for each penny over 6. No board should have less than 2 nails at each nailing end. Space nails holding top and bottom to sides 6 inches or more apart, when nails are 6 penny or less, increasing the spacing 1 inch for each penny over 6.

While such spacing may appear to be too close, as a matter of fact, it calls for only about two-thirds of the number of nails which would cause excessive splitting of the ends, and only about two-thirds of the number required to balance the strength of the nailed joints with the strength of the box in other respects. With the spacing given above, the nailing is still the weakest point of the ordinary box.