TECHNICAL NOTE NUMBER 149
FOREST PRODUCTS LABORATORY UNITED STATES FOREST SERVICE
MADISON, WISCONSIN REVISED MAY 1945

STRENGTH OF SCREW FASTENINGS IN PLYWOOD

If the screw fastenings in plywood construction are to be as strong as the plywood itself, it is important to adapt the size of screw, spacing, and margin to the particular species and thickness of plywood used. Tests made at the Forest Products Laboratory have shown that the commonly-used plywood species may be divided into the following groups, all woods in any one group requiring the same screw fastening to develop maximum strength.

GROUP I Low Density	GROUP II Medium Density	GROUP III High Density
Baldcypress	Ash, black	Ash, white
Basswood	Ash, pumpkin	Beech
Cedar, Spanish	Elm, white	Birch
Cottonwood	Hackberry	Cherry, black
Douglas-fir	Magnolia	Elm, cork
Fir, true	Mahogany	Maple, hard
Hemlock	Maple, soft	
Pine, Eastern white	Sweetgum	
Pine, sugar	Sycamore	
Redwood	Tupelo, black	
Spruce, Sitka	Tupelo, water	
Yellow-poplar	Walnut, black	

The screw sizes, margin, and spacing for use with each species and plywood thickness will be found in the following table. The gauge is the smallest that can be used with the thickness specified and not cause failure through breaking of the screw when the full strength of the plywood is developed. The length of screw is the shortest which will prevent the screw from pulling out before the full plywood strength is reached. The margin is the smallest distance from edge of hole to edge of plywood which will insure against failure by shear. The spacing is the distance from center to center of screw holes which gave maximum strength per linear inch.

SIZE AND SPACING OF SCREWS FOR MAXIMUM STRENGTH IN PLYWOOD

Species in plywood	Plywood thickness in inches	Gauge of screw	Screw length (inches) Wood holding point		Margin in inches	Spacing in inches
			White ash	*Spruce*		
	3/30	4	1/2	5/8	1/2	3/8
	3/24	5	1/2	5/8	1/2	1/2
	3/20	6	5/8	3/4	1/2	1/2
Group I	3/16	7	5/8	3/4	1/2	1/2
	3/10	9	3/4	1	3/4	3/4
	3/8	11	1	1 1/4	3/4	3/4
	3/30	5	1/2	5/8	1/2	1/2
	3/24	6	5/8	3/4	1/2	1/2
	3/20	7	3/4	7/8	1/2	1/2
Group II	3/16	8	7/8	1	3/4	3/4
	3/10	10	1	1 1/4	3/4	3/4
	3/8	12	1 1/4	1 1/2	3/4	7/8
	3/30	6	5/8	3/4	1/2	1/2
	3/24	7	3/4	1	1/2	1/2
	3/20	8	1	1 1/4	1/2	3/4
Group III	3/16	9	1 1/4	1 1/2	3/4	7/8
	3/10	11	1 1/2	1 3/4	3/4	1
	3/8	13	1 3/4	2	3/4	1

About equally good results were obtained with flat-headed screws without washers and round-headed screws with washers. Round-headed screws without washers proved an inferior means of fastening. The spacing given in the table is for screws in a single row, but staggering is recommended wherever possible.

Designers must take particular care that the frame is not split or weakened through the use of the size of screw and the spacing necessary to make the fastening as strong as the plywood.