

## 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		GROUP II		GROUP III
<i>Low Density</i>		<i>Medium Density</i>		<i>High Density</i>
Basswood	Hemlock	Ash, black	Hackberry	Ash, white
Cedar, Spanish	Pine, sugar	Ash, pumpkin	Magnolia	Beech
Cottonwood	Pine, white	Elm, white	Mahogany	Birch
Cypress, bald	Poplar, yellow	Gum, black	Maple, soft	Cherry, black
Douglas fir	Redwood	Gum, cotton	Sycamore	Elm, cork
Fir, true	Spruce, Sitka	Gum, red	Walnut, black	Maple, hard

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)		Margin in inches	Spacing in inches
			Wood holding point White ash	Spruce		
Group I	3/30	4	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{5}{8}$
	3/24	5	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{1}{2}$
	3/20	6	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{2}$
	3/16	7	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{5}{8}$
	3/10	9	$\frac{3}{4}$	1	$\frac{3}{4}$	$\frac{3}{4}$
	3/8	11	1	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
Group II	3/30	5	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{1}{2}$
	3/24	6	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{2}$
	3/20	7	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{5}{8}$	$\frac{5}{8}$
	3/16	8	$\frac{7}{8}$	1	$\frac{5}{8}$	$\frac{3}{4}$
	3/10	10	1	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
	3/8	12	$1\frac{1}{4}$	$1\frac{1}{2}$	$\frac{3}{4}$	$\frac{7}{8}$
Group III	3/30	6	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$
	3/24	7	$\frac{3}{4}$	1	$\frac{5}{8}$	$\frac{5}{8}$
	3/20	8	1	$1\frac{1}{4}$	$\frac{5}{8}$	$\frac{3}{4}$
	3/16	9	$1\frac{1}{4}$	$1\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
	3/10	11	$1\frac{1}{2}$	$1\frac{3}{4}$	$\frac{3}{4}$	$\frac{7}{8}$
	3/8	13	$1\frac{3}{4}$	2	$\frac{3}{4}$	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.