

## NEVINS' SCANTLING RULES FOR WOODEN YACHTS

**General Clause.** The cube root of the displacement in cubic feet,  $\sqrt[3]{\text{Disp. cu. ft.}}$ , (with the yacht in load condition) is the basis upon which scantlings are calculated. (See table of functions of numbers in the back of this book for cube roots.)

**Keel**

Material: White Oak, Teak, or Mahogany.  
Molding: Not less than  $\sqrt[3]{\text{Disp. cu. ft.}}$  multiplied by .7.  
Siding: Not less than double the molding at the widest point of keel.

**Stem**

Material: White Oak, Teak, or Mahogany.  
Molding: Not less than siding.  
Siding: At head not less than four times the thickness of the planking. Below head the siding of stem and bow timber shall be gradually increased to siding of keel to provide proper back rabbet.

**Sternpost**

Material: White Oak, Teak, or Mahogany.  
Molding: Not less than siding.  
Siding: Not less than four times thickness of plank.

**Horn Timber**

Material: White Oak, Teak, or Mahogany.  
Molding: Not less than twice the thickness of plank.  
Siding: Not less than twice the molding.

**Frames**

Material: White Oak, steam-bent.  
Sectional Area: At heel in accordance with table sizes. May be straight-tapered to head to not less than 75% of the heel area. (See pp. 76, 77)

Where untapered frame is used, rule size shall be maintained for  $\frac{3}{4}$  of D.W.L. length. Fore and aft of the  $\frac{3}{4}$  length, the area may be gradually reduced to the ends of the yacht where it may be 15% less than amidships.

Where tapered frame is used, the rule shall be applied to the longest frame in the yacht, establishing thereby a standard taper for all other frames. The head size of the longest frame shall be maintained throughout the yacht, and the established taper applied therefrom to the heel, thereby decreasing the areas at the heel as the frames grow shorter fore and aft of the longest frame.

Spacing: To be in accordance with table. (See pp. 76, 77)  
Molding: Optional. Table dimensions are recommended. In no case less than is required to entirely bury the plank fastenings of the length specified for screws.  
Siding: Optional. Table dimensions recommended.

Where severe bends are encountered, making it impractical to use a solid frame, it is recommended that the frame be split, in a fore and aft direction, from the end to just beyond the point of extreme bend; or a double frame may be used, one member bent inside the other. In both instances, plank fastenings should extend through outer member well into inner member and the two be drawn tightly together.

If *saucen frames* are to be used, they shall be double, with the members adequately bolted or riveted together. *Sectional Area*—50% heavier than the table size of frames.

**Belt Frames**

Material: White Oak, steam-bent.  
Molding:  $\frac{3}{4}$  that of frames.  
Siding: Equal to frames.

Belt frames are to be applied to yachts which are ceiled and there must be at least four on each side. They shall be applied after ceiling is installed.

In the case of single-masted vessels and yawls, one set of belt frames are to be located immediately forward and one immediately aft of main mast, and are to be kned to heavy partner deck beams.

Belt frames should be used whenever possible, but, should they interfere with any unusual condition inside the yacht, may be omitted, provided the regular frame at that location is doubled in sectional area, or two frames of rule size placed alongside each other and bolted or riveted together. Yachts which are not ceiled are to be fitted with heavy frames having a sectional area of  $1\frac{3}{4}$  times the area of main frames and located in a like manner to the belt frames of ceiled yachts.

In the case of two-masted schooners or ketches, one set of belt frames are to be located immediately forward and one immediately aft of each mast and are to be kned to heavy partner deck beams.

In the case of three-masted yachts, there shall be 6 pairs of belt frames, one set located immediately forward and one immediately aft of each mast and kned to heavy partner deck beams.

**Planking**

Material: Teak, Mahogany, Long Leaf Yellow Pine, and Douglas Fir.  
Thickness: In accordance with table. (See pp. 76, 77)

Butts to be shifted so that no two butts shall come on same frame or in same frame space, except there be 3 clear planks between, and in no adjacent plank be nearer than 3 frame spaces.

If teak is used, thickness may be reduced 10%.

**Ceiling**

Material: Long Leaf Yellow Pine, Douglas Fir, or Spruce.  
Thickness: 40% of the table thickness of outside planking. No reduction allowed where teak planking is used.

Ceiling shall be fitted in all yachts having a  $\sqrt[3]{\text{Disp. cu. ft.}}$  of over 10, and shall extend for at least the water line length of the vessel and from cabin sole to underside of clamp.

#### Bilge Stringers

Material: Long Leaf Yellow Pine or Douglas Fir.

Sectional Area: Equal to 3 times the table area of frames for  $\frac{3}{4}$  of D.W.L. length.

Bilge stringers shall be used in all yachts which are not ceiled. There shall be one on each side, to extend from stem to stern wherever possible, and they may be straight-tapered to ends to not less than 50% of the area amidships.

#### Clamp and Shelf

Material: Long Leaf Yellow Pine or Douglas Fir.

Sectional Area:  $3\frac{1}{2}$  times the table area of frames for  $\frac{3}{4}$  of the water line length.

They shall extend the full length of the yacht but may be straight-tapered to the ends to not less than 50% of the area amidships.

A single clamp, or a clamp and shelf of required area, may be used.

#### Deck Beams

Material: Oak, Chestnut, Douglas Fir, Long Leaf Yellow Pine, Teak, Mahogany, and Ash.

Sectional Area: At center line of boat in accordance with table and may be reduced at ends to 75% of the sectional area at center.

Spacing: Same as table for frames.

Molding: Optional. May be reduced at ends to 75% of the molding at center.

Siding: Optional, but to be not more than 65% of the molded depth at center.

There shall be partner beams and hatch beams whose siding shall be  $1\frac{3}{4}$  times the siding of the main beams.

Half beams and beams beyond the ends of the D.W.L. may be reduced to 75% of the area of the main beams.

#### Decking

Material: White Pine, Cedar, Spruce, Cypress, or Douglas Fir.

Thickness: Same as outside planking

If teak is used, the thickness may be reduced 10%. If covered with canvas, thickness may be reduced  $\frac{1}{8}$ ".

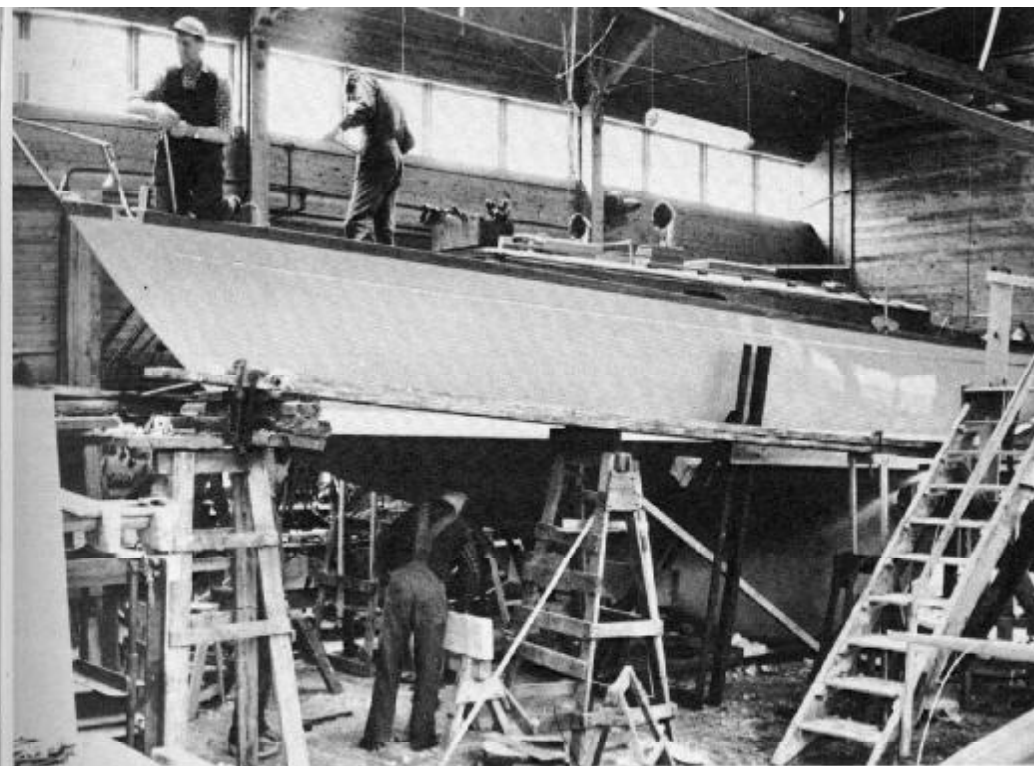
#### Floors

Material: White Oak, Teak, Mahogany.

Spacing: One to each pair of frames.

Molding: To be sufficient to allow at least 4 fastenings to heels of frames, whose spacing shall be not less than  $1\frac{1}{2}$  times siding of floor, but in no case shall the sectional area over the keel be less than 2 times the sectional area of frames.

In way of lead keel, siding of floors taking keel bolts shall be increased to



(Opposite page) PIPE DREAM Cruising Sloop, SOUTHERLY. (Top) Ready for launching; (bottom left) just before launching; builder, Oscar Schelin, and designer discuss location of draft marks; (bottom right) streamlined underbody.

regular siding, plus the diameter of the keel bolt. Molding to be same as regular floors.

There shall be no concave on top of any floor to show up cross grains at ends.

In any yacht where it is necessary to use the space occupied by wooden floors to install tanks or to meet any special conditions, metal floors—of approved design and of equal weight and strength to the wooden floors—may be used.

Siding: Not less than frame.

#### Hull Straps

Material: Bronze of not less than 60,000 pounds per square inch of tensile strength.

Width: Twice the planking thickness.

Thickness: .1 the plank thickness. (Other dimensions may be used but shall produce an equal cross-sectional area.)

There shall be 2 diagonal straps on each side at each mast, extending from underside of deck to keel between outside of frame and inside of planking.

Straps shall be fastened at each crossing of frame and between frames to the planking.

#### Deck Straps

Material, Width, Thickness: Same as hull straps.

Deck to be fitted with 2 diagonal straps at each mast, extending from gunwale to gunwale between top of deck beam and under side of deck and not cut by deck openings.

To be fastened at each beam crossing and between beams into deck.

#### Hanging Knees

Material: Wood, cast bronze, steel, or bronze plate flanged to frames or deck beams.

Length of Arms: 1.75 times table frame spacing.

Shall be fitted to all belt frames, all extra heavy frames, and partner beams.

#### Plank Fastenings





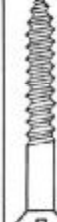


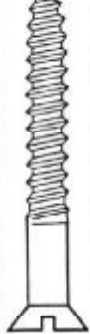

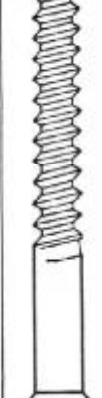
Material: Wood screws of noncorrosive metal. (See Figure 20)

Length: Twice the plank thickness from heel to turn of bilge; from turn of bilge to head may be shortened to suit molding of frame.

Size:

Plank Thickness	Gauge No.	Plank Thickness	Gauge No.
$\frac{5}{8}$ "	9	$1\frac{1}{2}$ "	20
$\frac{3}{4}$ "	10	$1\frac{3}{4}$ "	22
$\frac{7}{8}$ "	12	2"	24
1"	14	$2\frac{1}{4}$ "	26
$1\frac{1}{8}$ "	16	$2\frac{1}{2}$ "	28
$1\frac{1}{4}$ "	18		

Figure 20. (opposite page) Flat head wood screws for planking

PLANKING THICKNESS	LENGTH & GA. (1)	DIAM. (3)	LENGTH & GAUGE -- FULL SCALE	BODY DRILL (2)	LEAD DRILL (2)	BUNG DIAM.
$\frac{1}{4}$ "	$\frac{1}{2}$ " No. 6	.137"		$\frac{1}{8}$ "	No. 47	NONE
$\frac{3}{8}$ "	$\frac{3}{4}$ " No. 7	.150"		$\frac{9}{64}$ "	No. 44	NONE
$\frac{1}{2}$ "	1" No. 8	.163"		$\frac{5}{32}$ "	No. 40	NONE
$\frac{5}{8}$ "	$1\frac{1}{4}$ " No. 9	.176"		$\frac{11}{64}$ "	No. 37	$\frac{3}{8}$ "
$\frac{3}{4}$ "	$1\frac{1}{2}$ " No. 10	.189"		$\frac{3}{16}$ "	No. 33	$1\frac{1}{2}$ "
$\frac{7}{8}$ "	$1\frac{3}{4}$ " No. 12	.216		$\frac{13}{64}$ "	No. 30	$1\frac{1}{2}$ "
1"	2" No. 14	.242		$\frac{15}{64}$ "	No. 25	$1\frac{1}{2}$ "
$1\frac{1}{8}$ "	$2\frac{1}{4}$ " No. 16	.268		$\frac{17}{64}$ "	No. 18	$\frac{5}{8}$ "
$1\frac{1}{4}$ "	$2\frac{1}{2}$ " No. 18	.294		$\frac{9}{32}$ "	No. 13	$\frac{5}{8}$ "
$1\frac{1}{2}$ "	3" No. 20	.320		$\frac{5}{16}$ "	No. 4	$\frac{3}{4}$ "
$1\frac{3}{4}$ "	$3\frac{1}{2}$ " No. 22	.347	HEADS OF NO. 9 AND UNDER ARE USUALLY PUTTIED. SOAP CAN BE USED AS A DRIVING LUBRICANT. ALWAYS CHECK SIZE OF BIT WITH SIZE OF BUNG. TRY SMALLER LEAD HOLE FOR "PHILLIPS" HEAD SCREWS.			
2"	4" No. 24	.374				

GAUGE MAY BE REDUCED ONE SIZE FOR DECKING.

COMPILED FOR THE NUMBER

Should other type of fastening be used—such as bolts, rivets, or drift fastenings—they shall be of equal cross-sectional area to those in the table for wood screws, and of suitable length.

#### Lead Keel Bolts

Material: Bronze, having a tensile strength of not less than 60,000 pounds per square inch.

The number and size to be sufficient to give not less than 1 square inch of sectional area of bolt for 1500 pounds of outside ballast.

Nevins' Table for Size and Spacing of Frames, Deck Beams, and Planking

$\sqrt[3]{\text{Disp. cu. ft.}}$	Planking Thickness In.	FRAMES			Deck Beam Area Sq. In.
		Area Sq. In.	Siding and Molding In.	Spacing In.	
3.8	0.56	0.65	0.81	6.03	0.75
4.0	0.56	0.65	0.81	6.03	0.75
4.2	0.59	0.75	0.87	6.30	0.88
4.4	0.62	0.86	0.93	6.58	1.03
4.6	0.66	1.00	1.00	6.84	1.18
4.8	0.69	1.13	1.07	7.12	1.33
5.0	0.72	1.28	1.13	7.38	1.49
5.2	0.75	1.43	1.20	7.64	1.65
5.4	0.79	1.60	1.27	7.91	1.81
5.6	0.82	1.80	1.34	8.18	1.98
5.8	0.86	1.98	1.41	8.44	2.15
6.0	0.90	2.20	1.48	8.70	2.33
6.2	0.93	2.40	1.55	8.97	2.50
6.4	0.96	2.61	1.62	9.22	2.67
6.6	1.00	2.83	1.69	9.49	2.85
6.8	1.04	3.10	1.76	9.73	3.03
7.0	1.08	3.34	1.83	10.00	3.22
7.2	1.12	3.59	1.90	10.25	3.42
7.4	1.15	3.84	1.96	10.50	3.62
7.6	1.18	4.12	2.03	10.75	3.82
7.8	1.22	4.40	2.10	11.00	4.02
8.0	1.25	4.70	2.17	11.25	4.22
8.2	1.29	5.00	2.24	11.50	4.43
8.4	1.32	5.30	2.30	11.75	4.64
8.6	1.36	5.60	2.34	12.00	4.86
8.8	1.40	5.90	2.43	12.25	5.09
9.0	1.43	6.23	2.50	12.50	5.32
9.2	1.46	6.53	2.56	12.75	5.55
9.4	1.50	6.89	2.63	13.00	5.78
9.6	1.53	7.22	2.69	13.23	6.02
9.8	1.56	7.58	2.76	13.47	6.27
10.0	1.60	7.92	2.82	13.72	6.53

$\sqrt[3]{\text{Disp. cu. ft.}}$	Planking Thickness In.	FRAMES			Deck Beam Area Sq. In.
		Area Sq. In.	Siding and Molding In.	Spacing In.	
10.2	1.63	8.30	2.88	13.95	6.79
10.4	1.66	8.70	2.95	14.20	7.05
10.6	1.70	9.10	3.02	14.44	7.31
10.8	1.73	9.50	3.09	14.68	7.58
11.0	1.76	9.92	3.15	14.92	7.85
11.2	1.80	10.36	3.22	15.16	8.12
11.4	1.83	10.80	3.29	15.40	8.41
11.6	1.86	11.29	3.36	15.63	8.70
11.8	1.90	11.78	3.44	15.88	9.00
12.0	1.93	12.30	3.51	16.12	9.30
12.2	1.96	12.80	3.58	16.35	9.60
12.4	1.99	13.31	3.65	16.60	9.91
12.6	2.02	13.87	3.73	16.83	10.22
12.8	2.05	14.42	3.80	17.07	10.53
13.0	2.09	15.00	3.88	17.31	10.84
13.2	2.12	15.55	3.95	17.55	11.16
13.4	2.15	16.14	4.02	17.80	11.49
13.6	2.18	16.74	4.09	18.03	11.82
13.8	2.22	17.33	4.16	18.28	12.16
14.0	2.25	17.95	4.24	18.50	12.60
14.2	2.28	18.60	4.32	18.75	12.84
14.4	2.31	19.20	4.39	19.00	13.18
14.6	2.34	19.87	4.46	19.22	13.52
14.8	2.37	20.50	4.53	19.45	13.86
15.0	2.40	21.12	4.60	19.70	14.21
15.2	2.43	21.80	4.67	19.95	14.58
15.4	2.46	22.50	4.75	20.18	14.95
15.6	2.50	23.17	4.82	20.42	15.31
15.8	2.53	23.90	4.89	20.65	15.68
16.0	2.55	24.60	4.96	20.88	16.05
16.2	2.58	25.30	5.03	21.12	16.43
16.4	2.60	26.00	5.10	21.36	16.80