1. PLYWOOD

All plywood for exterior use is glued with the same phenolic glue. It carries the mark WBP = water boil proof.

The durability of plywood is entirely dependent on the species of wood used in the veneers. Often the manufacturer saves money by having a good but thin surface veneer, but species with low rot resistance in the core veneers.

The difference between "WBP Exterior" plywood and "Marine plywood" is in the species of timber accepted for the veneers and the thickness and number of layers. "Marine plywood" should have a minimum of 5 layers in plywood between 6 and 9 mm thickness. More layers give more equal strength along the sheet and across the sheet. The thickness of the layers should be :

Outer layers: Minimum 1.4 mm
Inner layers: Maximum 2.5 mm

Unless the veneers have been treated against rot at the factory, the durability of the plywood is dependent on the type of wood used. The following list of species for marine use has been prepared by Lloyds in England:

Common name	Natural durability
Agba	Durable
Gedu Nohor	Moderately durable
Guarea	Durable
Idigbo	Durable
African Mahogany	Moderately durable
Makore	Very durable
Omu	Moderately durable
Light Red Meranddi	Moderately durable
Light Red Seraya	Moderately durable
Sapele	Moderately durable
Utile	Durable

Douglas fir and Gaboon/Okoume are acceptable provided they are given preservative treatment at the factory. Gaboon/Okoume has very low natural durability.

In plywood construction it is important to seal all edges with epoxy glue. Especially where the deck overlaps the side there are problems of rot if the edge is not well sealed before fastening the sheer batten.

2. TIMBER

The timber for the plywood boat must first of all be suitable for gluing. Generally the heavier type A timber as described on page 18 does not give as good a glue bond as the lighter timber. An exception to this is Iroko and Kapur. Generally type B timber is therefore used in plywood boat construction. The keel and keel-shoe should preferably be of a heavier and harder timber.

3. GLUE

There are two types of glue with a proven record as waterproof glue: Epoxy and Phenol Resorcinol.

Epoxy has a better gap filling ability which means that less clamping pressure is required to achieve a good bond. However, epoxy presents a greater health risk. Contact with the skin should be avoided as some people develop a skin rash after having used epoxy over a period. The hardener powder of phenol resorcinol is toxic and should be handled with care.

The following rules are important for a good glue bond.

a) The correct measuring of quantities of resin and hardener and proper mixing is very important for a good bond. Use a postal scale if necessary and follow the instructions on the tin carefully. Glue is expensive so do not spoil the result by careless mixing.

b) The lids of the glue tins should be put on properly and the tins stored in a cool place 5-20 °C. Storage time will then be 1-2 years. In a hot climate the "shelf life" of the glue is much reduced.

c) Plane the timber to equal thickness with a machine planer. Although epoxy has a gap filling property, the surfaces should be fairly even.

d) Freshen up the wood surface. If time from planing is more than 48 hours before gluing, the wood should be freshened up with sandpaper followed by brushing off the dust. This gives fresh wood directly in contact with the glue.

e) Use timber of correct moisture content. Wet timber will not glue well and too dry timber puts high stress on the glueline when swelling takes place after the boat is put into service.

4. FASTENINGS

The purpose of the fastenings is to provide sufficient pressure until the glue sets. The fastening itself will take no load as long as the glueline is intact. Only in an emergency with glue failure might the fastening provide some additional safety. Use screws only where the bend in the plywood is too extreme.

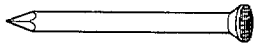
Nails

The best type of fastening is the annular ringed or barbed bronze nail. The nails also carry the name "Gripfast". For the 9 mm plywood used in these boats the following size is recommended: Diameter = 2 mm (14 SWG), Length = 25 mm (1 in).

If these nails are not available, hot dipped galvanized nails can be used. The nails should have a small head so that they can be countersunk below the surface of the plywood and the hole plugged with a filler to avoid any surface corrosion. For 9 mm plywood the dimension should be: Diameter = 2.65 (12 SWG), Length = 30 mm

The length of these nails means that they have to be set at an angle in the 25 mm battens to avoid splitting the inside surface.

Barbed bronze nail



Round wire nail, countersunk head hot dipped galvanized

50 PLYWOOD BOAT 5.2 M - TIMBER (including 25% waste)

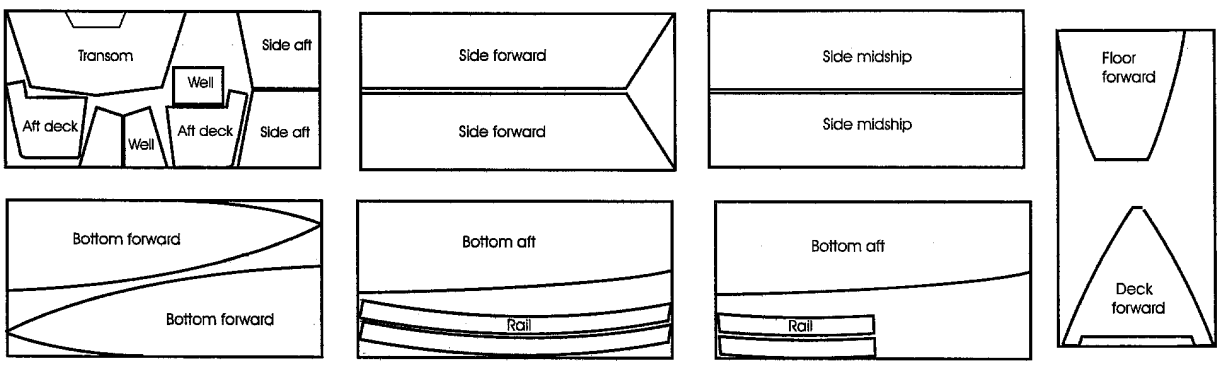
FOR THE OTHER BOATS MULTIPLY THE LENGTHS WITH THE FACTOR F :
6.3 M BOAT. F = 1.2. 7.4 M BOAT : F = 1.4. 8.5 M BOAT: F = 1.6.
NOTE: The keel for the 7.4 m and 8.5 m boats is 68 x 68 sawn from 75 x 150

TYPE OF TIMBER	DIMENSION FROM SAWMILL mm	TOTAL LENGTH m	SAWING INTO SMALLER SECTIONS mm	TOTAL LENGTH m	PLANED DIMENSION mm	ITEM LETTER
B Except where marked timber A	20 x 150	8	20 | 50 50 50	24	16 x 44	A
	25 x 150	15	25 | 150	15	20 x 143	B
		2 A	25 | 75 75	4	20 x 68	C
		1	25 | 50 50 50	3	20 x 44	D
		4.5	25 | 37 37 37 37	18	20 x 32	E
	38 x 150	9	38 | 150	9	32 x 143	F
		3	38 | 75 75	6	32 x 68	G
		4.6	38 | 50 50 50	14	32 x 44	H
	38 x 200	5	38 | 200	5	32 x 193	I
	50 x 150	3.2 A	50 | 75 75	6.4	44 x 68	J
		8	50 | 37 37 37 37	32	25 x 44	K
	75 x 150	2,5 A	75 | 150	2.5	68 x 143	L
		5	75 | 37 37 37 37	13	25 x 68	M
						N

Marine plywood 9 mm in sheets 1.2 m x 2.4 m

Total = 7 sheets
6.3 m Boat = 9 sheets
7.4 m Boat = 10 sheets
8.4 m Boat = 13 sheets

Optional floorboards not included except forward.



TIMBER (Including 25% waste)

TYPE OF TIMBER	DIMENSION FROM SAWMILL		TOTAL LENGTH OF TIMBER IN METRES			
	MM	INCH	5.2 M BOAT	6.3 M BOAT	7.4 M BOAT	8.4 M BOAT
A	25 x 150	1 x 6	2.0	3.5	5	6
	50 x 150	2 x 6	3.2	4		
	75 x 150	3 x 6	2.5	2.5	8	9
A m^3			0.06	0.07	0.09	0.12
B	20 x 150	¾ x 6	8	10	11	13
	25 x 150	1 x 6	21	22	23	24
	38 x 150	1 ½ x 6	17	20	24	27
	38 x 200	1 ½ x 8	5	6	7	8
	50 x 150	2 x 6	8	10	11	13
	75 x 150	3 x 6	5	6	7	8
B m^3			0.35	0.41	0.47	0.53
Total volume A + B in m^3			0.41	0.48	0.56	0.65
MARINE PLYWOOD , 9 mm, , sheet of 1.2 x 2.4 m			7 sheets	9 sheets	10 sheets	13 sheets

FASTENINGS AND MISCELLANEOUS

ITEM		QUANTITY			
		5.2 M BOAT	6.3 M BOAT	7.4 M BOAT	8.5 M BOAT
Bolt, hexagonal head, hot dip galvanized with nut. Alternative: Cup - square coach bolt, hot dip galvanized with nut	8 x 80	2	2	2	2
	8 x 90	5	6	2	2
	8 x 100	3	4		
	8 x 110			5	6
	8 x 120	4	4	4	4
	8 x 140	2	2	2	2
Barbed ringnail, flat head, bronze	2.0 x 25 (14 SWG x 1 in)	2.5 kg	3.0 kg	3.5 kg	4.0 kg
	3.2 x 32 (10 SWG x 1 ¼ in)	0.3 kg	0.4 kg	0.4 kg	0.5 kg
	3.2 x 45 (10 SWG x 1 ¾ in)	0.6 kg	0.7 kg	0.8 kg	1.0 kg
Alternative : Round wire nail, countersunk head, hot dip galvanized					
	2.6 x 30 (12 SWG x 1 ¼ in)	3.5 kg	4.0 kg	4.5 kg	5.0 kg
	3.2 x 45 (10 SWG x 1 ¾ in)	0.6 kg	0.7 kg	0.8 kg	1.0 kg
Woodscrew, AISI 316 Stainless steel					
	4.0 x 25 (8 Gauge x 1 in)	100	100	100	100
	5.0 x 50 (10Gauge x 2 in)	60	75	85	100
	5.0 x 63 (10 Gauge x 1 ½ in)	20	25	30	35
Epoxy glue including hardener		5.0 kg	6.0 kg	7.0 kg	8.0 kg
Filler for epoxy glue		1.0 kg	1.2 kg	1.4 kg	1.6 kg
Wood primer		5.0 kg	6.0 kg	7.0 kg	7.0 kg
Paint		6.0 kg	7.0 kg	8.0 kg	8.0 kg
Antifouling paint		1.0 kg	1.0 kg	1.5 kg	2.0 kg
Paint thinner		2 L	2 L	2 L	2 L
Buoyancy material, polyurethane, polystyrene, Emergency sail and rudder fittings, see drawing.		0.1 cub.m	0.1cub.m	0.1 cub.m	0.1 cub.m
Note: Two component polyurethane paint will give a much more durable finish than ordinary oil paints.					

DIMENSIONS OF FRAMES ARE SAME AS FOR PLANKED CONSTRUCTION

The bottom part of the frames forward of midship must be curved because of the natural bending of the plywood. The depth of the cutout for the batten must be determined in place as shown on page 41 and 56.

FRAME 3

Straight line from frame dimensions

20

Use flexible batten to draw curve

Remember that this distance is 12 mm lower than for planked construction except for the forward frame

FRAME 4

20

TRANSOM

Plywood pad on inside glued in place

Wood plate 20 x 193 bolted on outside same as for planked transom

100

H

32 x 44

N

Plw 9

Curve in aft deck determined after fixing sheer batten

Construction base

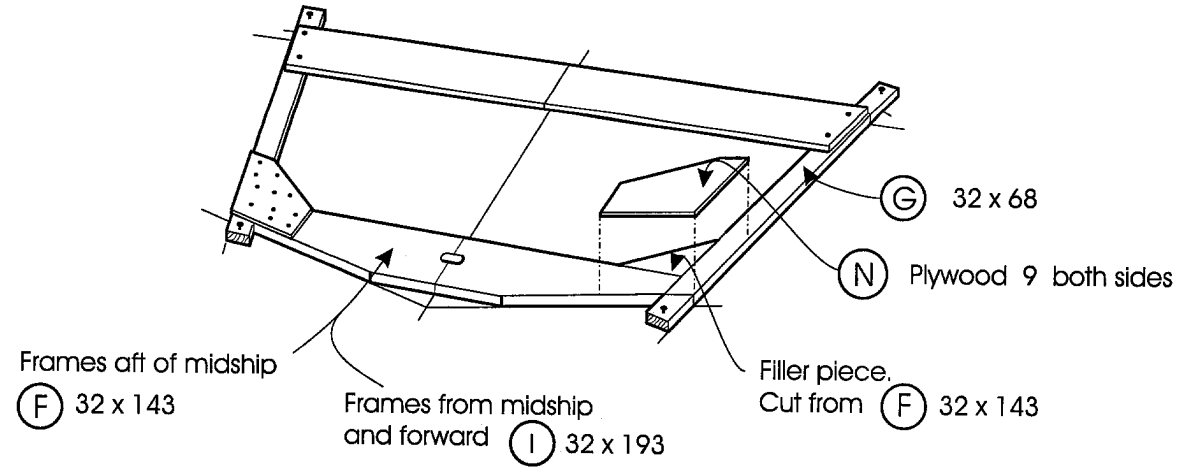
Cut from F 32 x 143

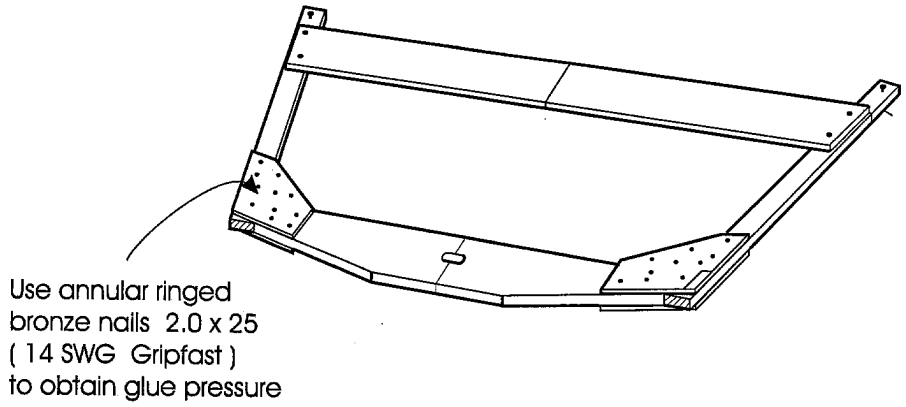
96

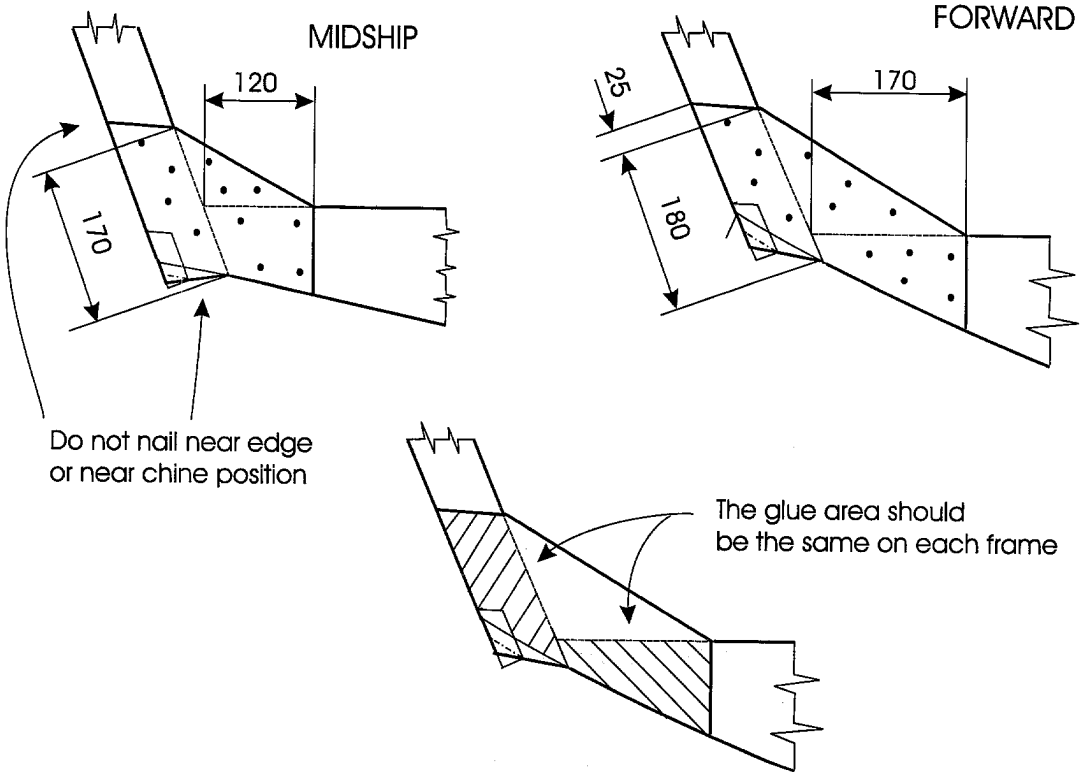
32

108

FRAME CONSTRUCTION IS SAME AS SHOWN FOR PLANKED CONSTRUCTION EXCEPT FOR GLUED GUSSET

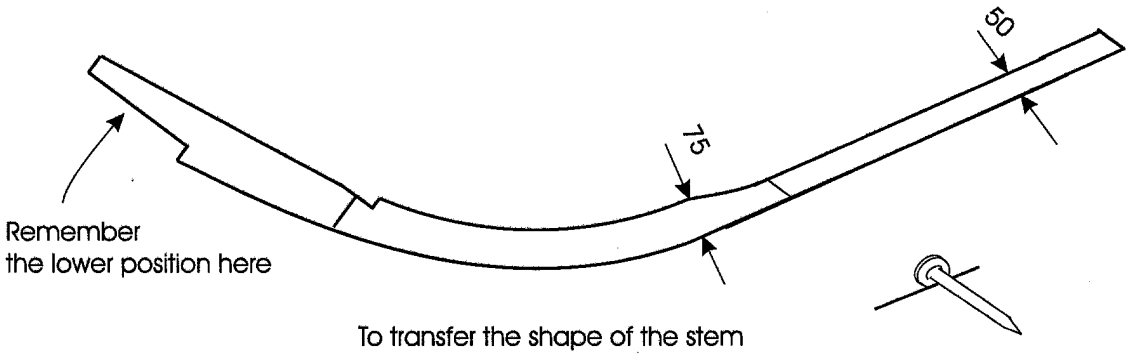






1

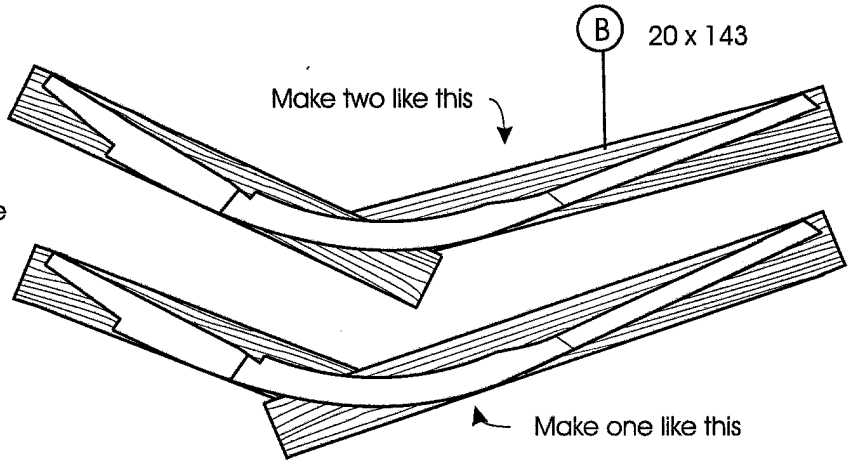
The forward side of the stem has the same shape as the planked boat. The width of the stem is modified as shown below:
Make a pattern of the stem out of 4 mm plywood.



To transfer the shape of the stem from the drawing on the plywood sheet, use transparent drawing paper or place the head of nails along the line, hammer the head so the nail does not roll and press the 4 mm sheet onto the nailheads to leave marks of the curve.

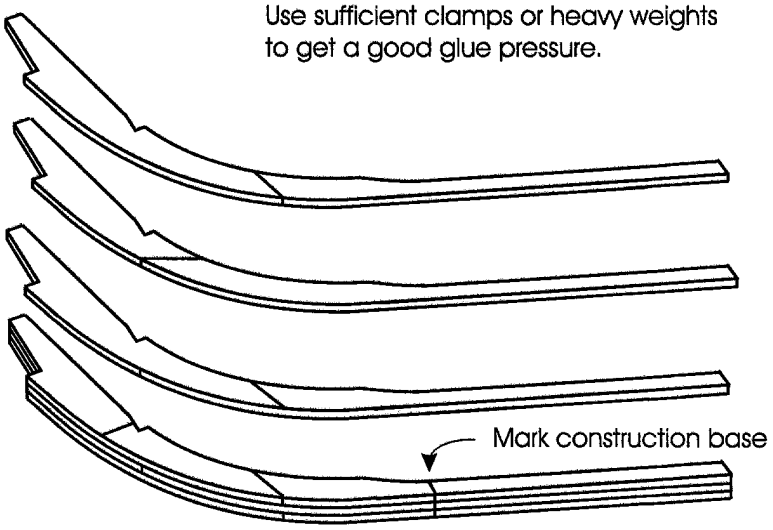
2

Cut the end of one board so that the pattern is inside the edges of the two boards. Trace the shape and cut.



3

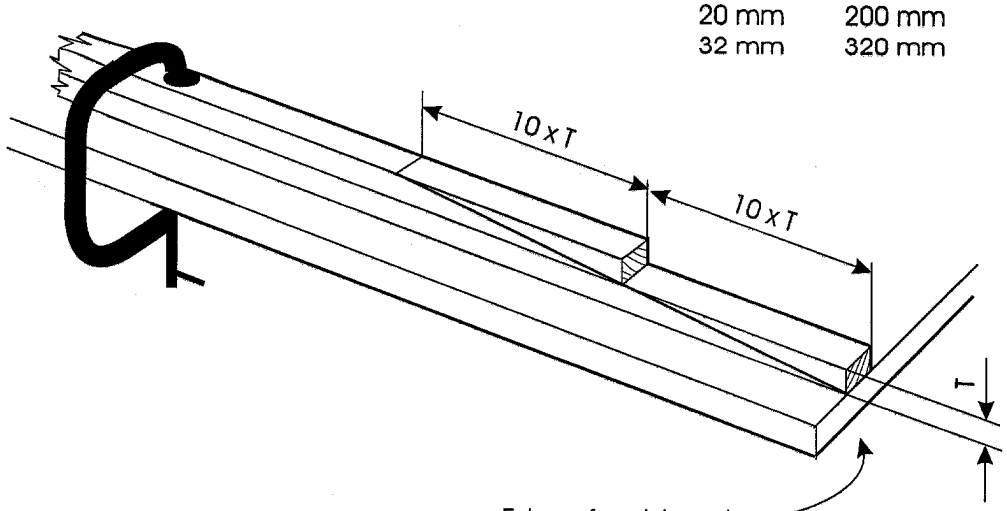
The three layers are laminated together. Use sufficient clamps or heavy weights to get a good glue pressure.



1

Plane the scarf in the two battens to be joined at the same time

T	SCARF LENGTH
20 mm	200 mm
32 mm	320 mm



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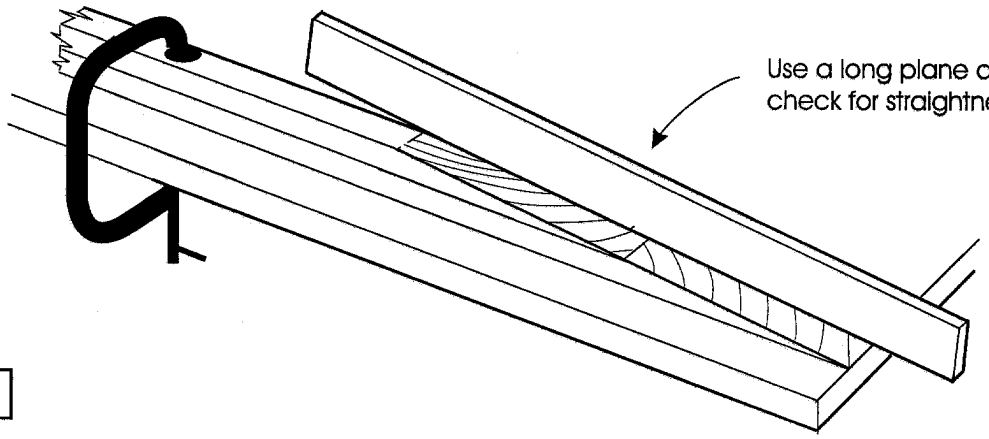

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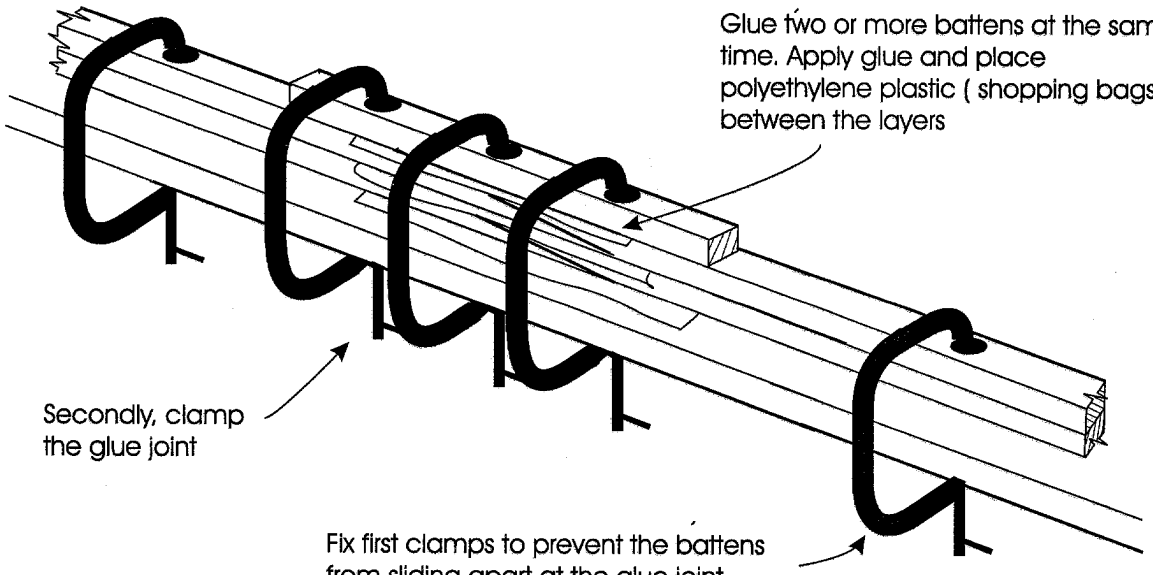
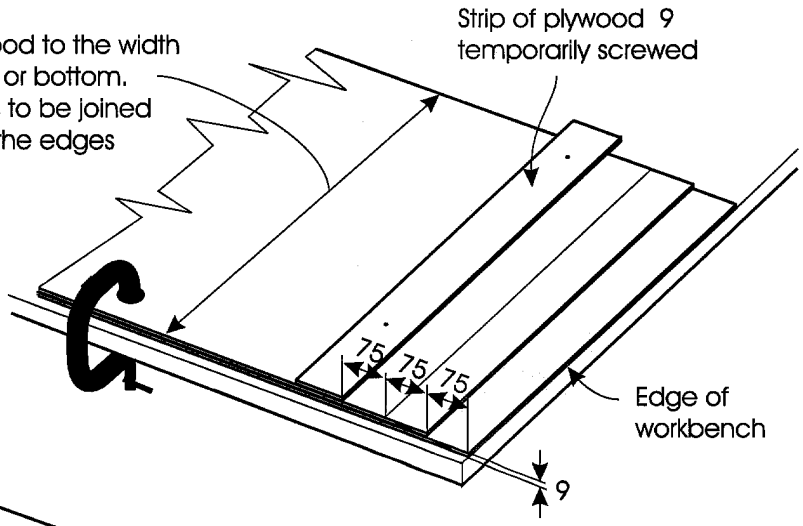


SCARFING PLYWOOD

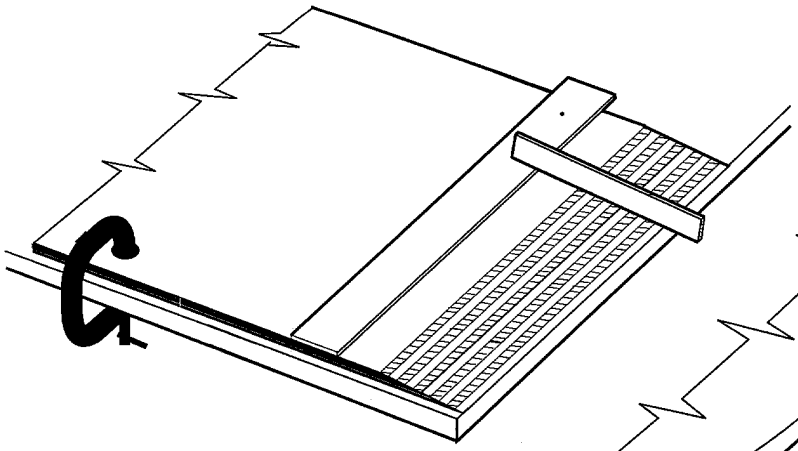
1

Cut the sheet of plywood to the width required to cover side or bottom. Clamp the two panels to be joined to the worktable with the edges staggered as shown.



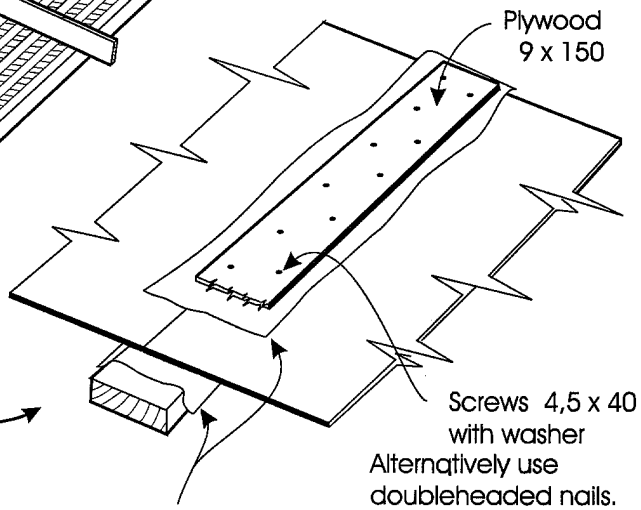
2

Plane the scarf with a long plane and check for straigtness

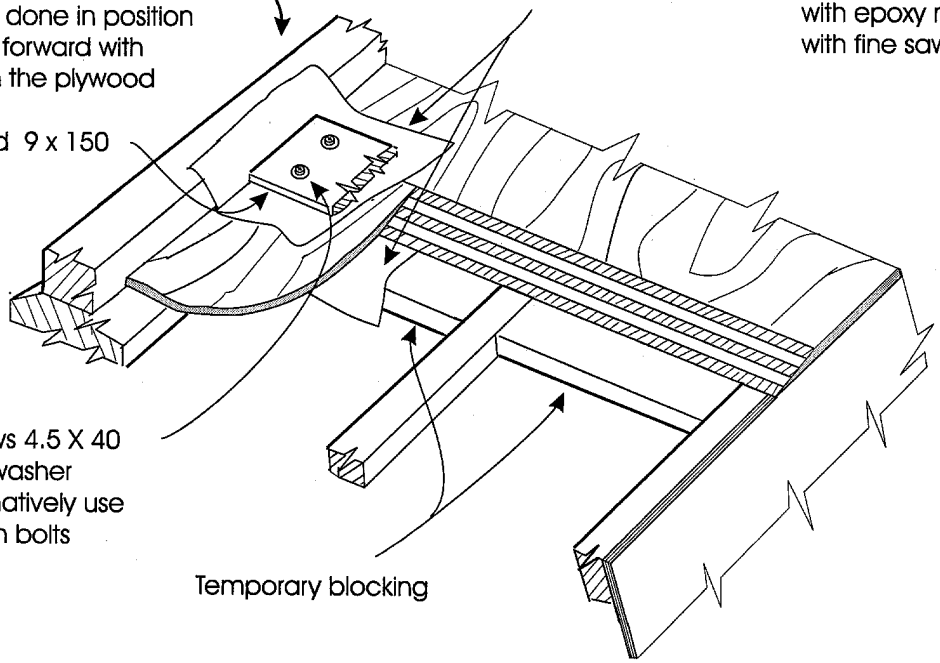


3

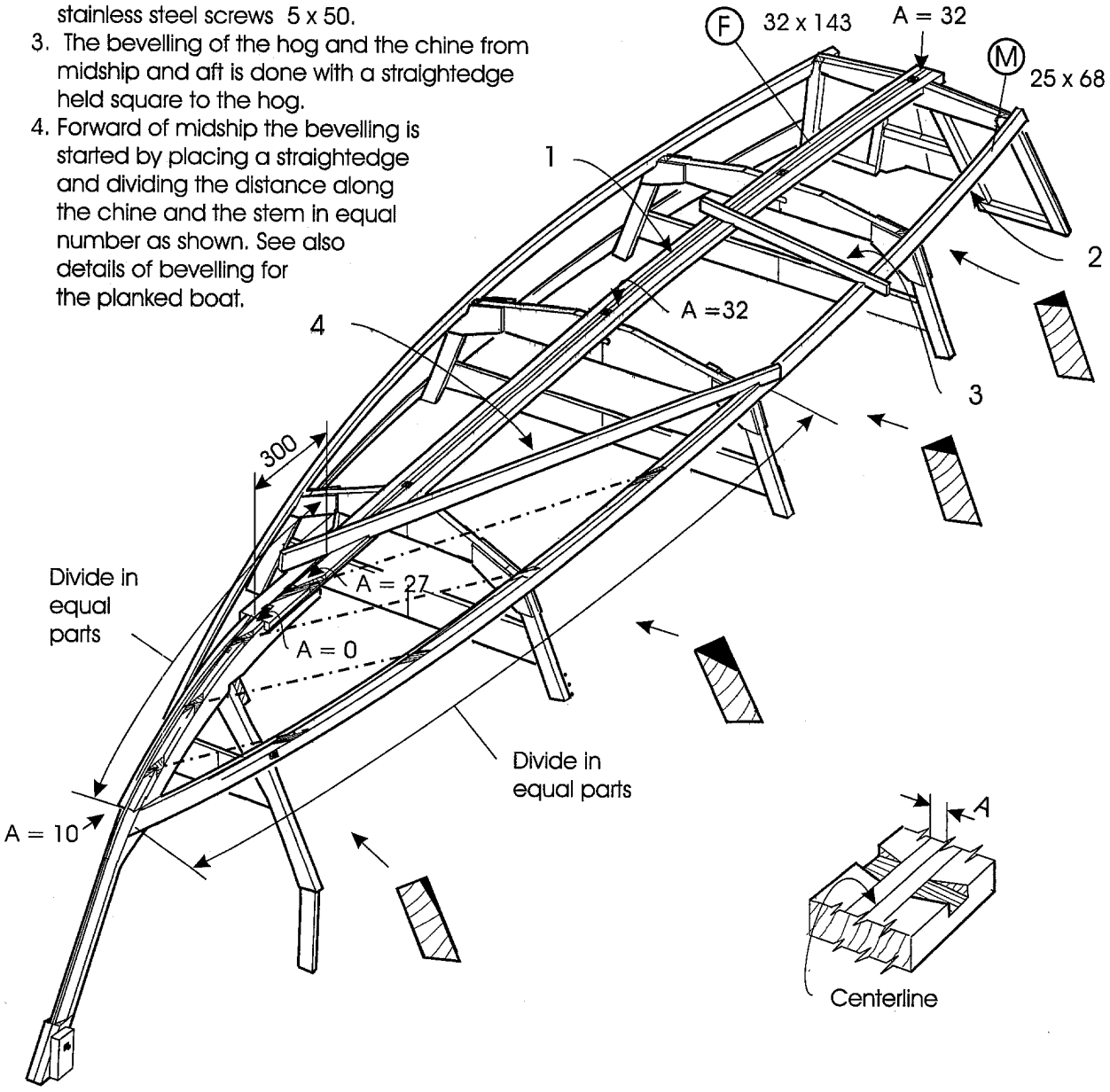
A Gluing can be done by supporting the panels on the floor and screwing into a wooden beam

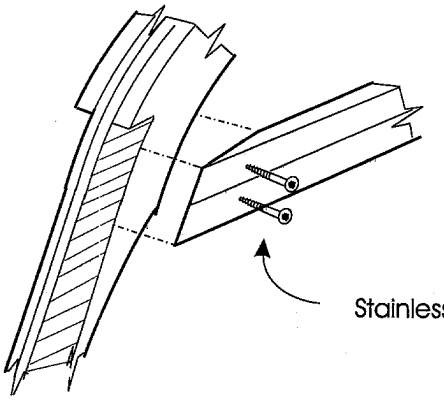


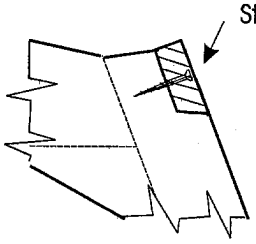
B On longer boats the gluing can be done in position but not forward with bend in the plywood



1. The hog is bolted to transom , frames and stem with 8 mm bolts, hot dip galvanized or stainless steel.
2. The position of the chine is determined in the same way as for the planked boat. The chine is fixed with stainless steel screws 5 x 50.
3. The bevelling of the hog and the chine from midship and aft is done with a straightedge held square to the hog.
4. Forward of midship the bevelling is started by placing a straightedge and dividing the distance along the chine and the stem in equal number as shown. See also details of bevelling for the planked boat.

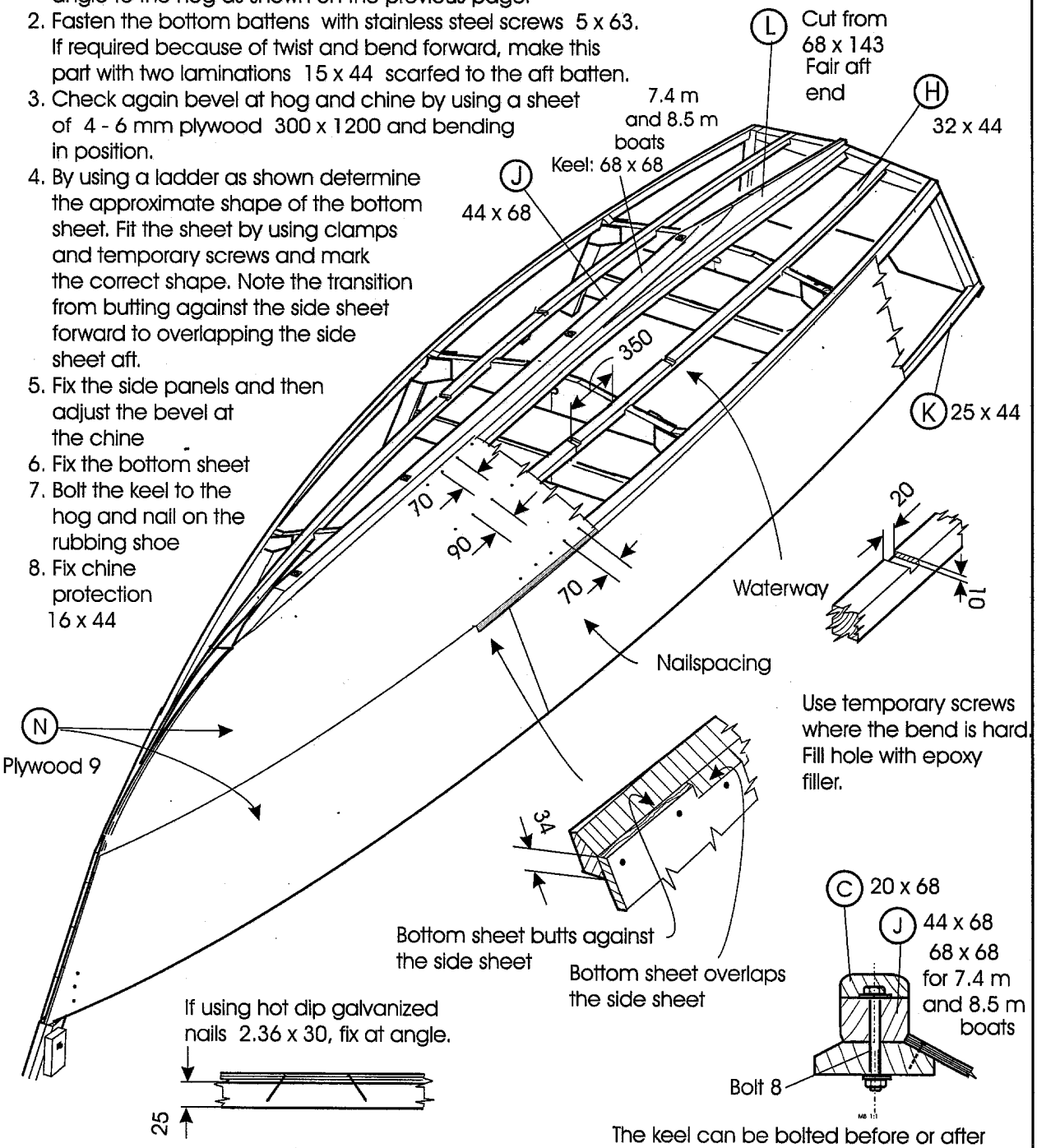




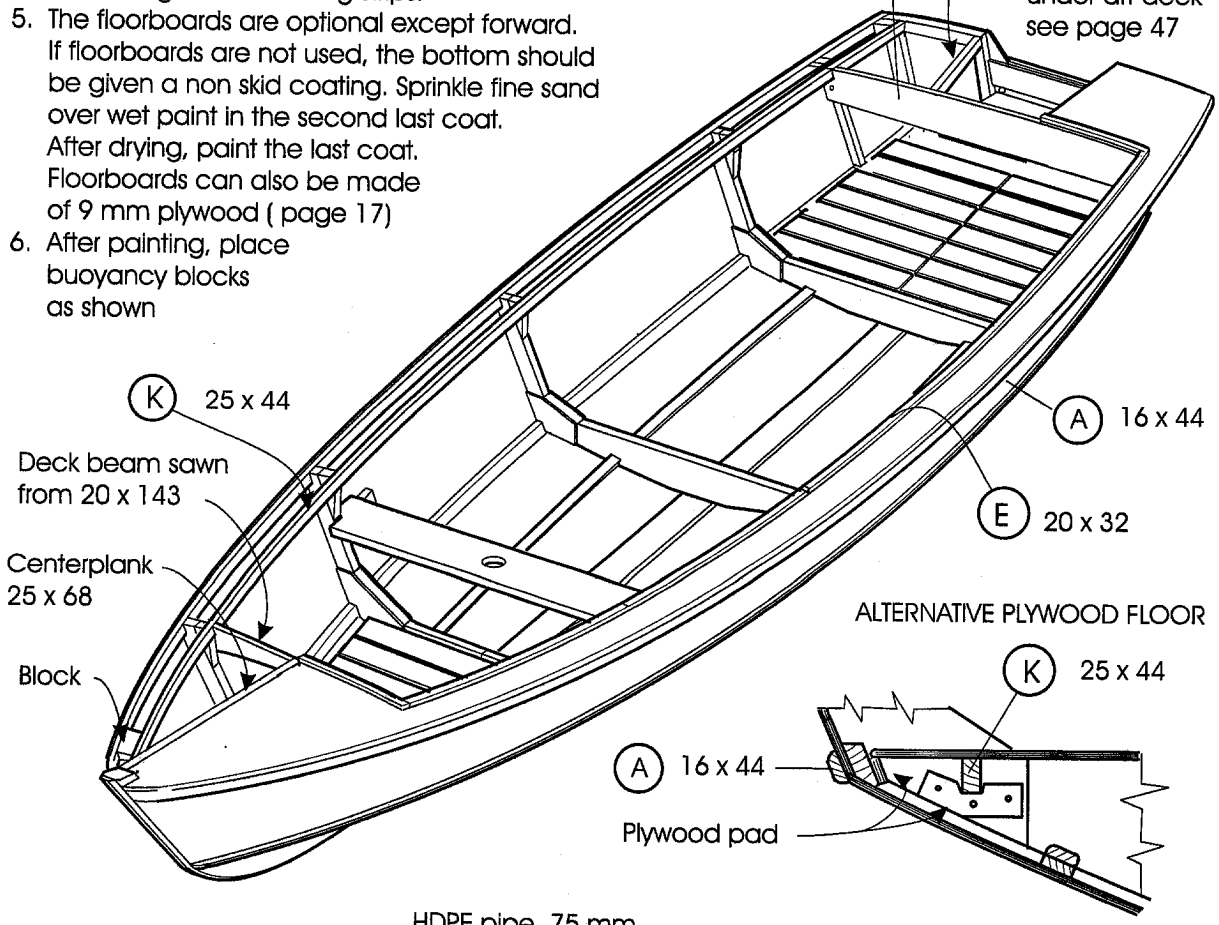


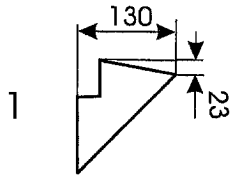
PLYWOOD - SIDE AND BOTTOM

1. Determine the depth of the cutout in the frames for the bottom battens in the same way as for planked construction, however it is very important that the straightedge is placed in the same angle to the hog as shown on the previous page.
2. Fasten the bottom battens with stainless steel screws 5 x 63. If required because of twist and bend forward, make this part with two laminations 15 x 44 scarfed to the aft batten.
3. Check again bevel at hog and chine by using a sheet of 4 - 6 mm plywood 300 x 1200 and bending in position.
4. By using a ladder as shown determine the approximate shape of the bottom sheet. Fit the sheet by using clamps and temporary screws and mark the correct shape. Note the transition from butting against the side sheet forward to overlapping the side sheet aft.
5. Fix the side panels and then adjust the bevel at the chine
6. Fix the bottom sheet
7. Bolt the keel to the hog and nail on the rubbing shoe
8. Fix chine protection 16 x 44



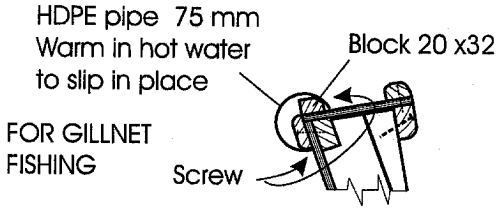
1. Glue and nail a piece to increase the width of the rail. By using a pattern draw the rail angle and cut below the sheer batten.
2. Screw the coaming batten to the frames and to blocks at the transom and the stem. Bevel the battens. Fix deck beams forward and aft, the center plank and the framing for the engine well.
3. Nail and glue the plywood in the engine well and the deck. Plane edges and seal with epoxy glue.
4. Nail and glue the rubbing strips.
5. The floorboards are optional except forward. If floorboards are not used, the bottom should be given a non skid coating. Sprinkle fine sand over wet paint in the second last coat. After drying, paint the last coat. Floorboards can also be made of 9 mm plywood (page 17)
6. After painting, place buoyancy blocks as shown

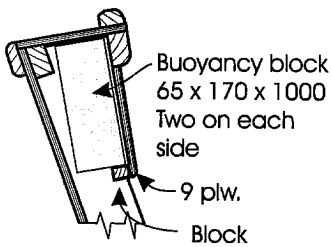


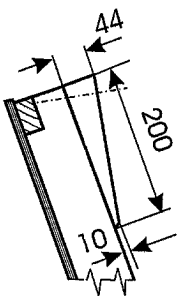


1

Plywood pattern for rail angle







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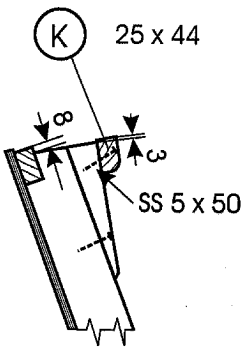

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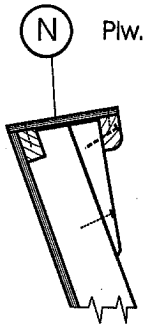

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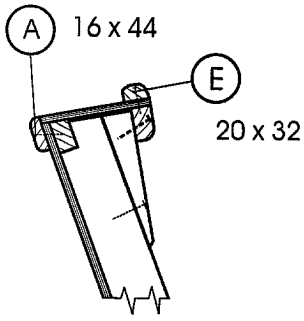

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