

PART 7

WOOD CONSTRUCTION

PART 7

WOOD CONSTRUCTION

SECTION	SUBJECT
7.1	General
7.2	Keel
7.3	Hog and keelson
7.4	Stem
7.5	Apron
7.6	Deadwood or foreknee
7.7	Stern post
7.8	After deadwood or knee
7.9	Outrigger or horntimber
7.10	Stopwaters
7.11	Transom
7.12	Bent frames - clinker construction
7.13	Laminated frames- clinker construction
7.14	Cant frames
7.15	Floors
7.16	Stringers and gunwales
7.17	Breasthooks
7.18	Quarter and transom knees
7.19	Frames
7.20	Lodging knees
7.21	Packing
7.22	Deck beams
7.23	Carlings
7.24	Hull planking (carvel)
7.25	Caulking
7.26	Clinker planking
7.27	Bulkheads
7.28	Decks
7.29	Bulwarks and hatches
7.30	Mast and spars
7.31	Hull protection
7.32	Engine seating
7.33	Stern tube
7.34	Miscellaneous

PART 7

WOOD CONSTRUCTION (continued)

SECTION	SUBJECT
7.35	<i>Tables</i>
7.35.1	Main structures
7.35.2	Planking (carvel) stringers and beam shelves
7.35.3	Sawn frames
7.35.4	Sawn and bent frames
7.35.5	Planking (clinker) risings, gunwales and cappings
7.35.6	Transoms
7.35.7	Steel deck beams
7.35.8	Carlings, beam knees and thwarts
7.35.9	Wooden beams (close spacing) double frame construction
7.35.10	Wooden beams (wide spacing) single frame construction
7.35.11	Bulwarks
7.35.12	Bulkheads
7.35.13	Bolts (minimum diameters)
7.35.14	The length of flats, spikes and dumps
7.35.15	Copper nail fastenings
7.35.16	Recommended timbers and uses
7.36	<i>Figures and illustrations</i>
7.36.1	Scantling numeral dimensions – wood vessels
7.36.2	Keel scarphs
7.36.3	Stringer scarphs
7.36.4	Breasthooks
7.36.5	Transom knees
7.36.6	Main frame construction
7.36.7	Alternative main frame construction
7.36.8	Transom arrangements
7.36.9	Transom construction
7.36.10	Engine seat construction
7.36.11	Steel engine seat construction – wood vessels
7.36.12	Midship section – wood vessels
7.36.13	Keel and hog section/cant frames
7.36.14	Wooden beams and beam shelf
7.36.15	Steel beams construction – wood vessels
7.36.16	Clinker construction
7.36.17	Deck and beam construction
7.36.18	Steel beam/carling connection

WOOD CONSTRUCTION

Section 7.1 - General

- 7.1.1 Hull construction may be either clinker, carvel, or chine.
- 7.1.2 The hull may be either conventional round bilge, single or multi-chine.
- 7.1.3 Care is to be taken when selecting timber that it is to be well seasoned, free from rot, sapwood, shakes, objectionable knots, or other defects. Timber is to be selected in accordance with Table 7.35.16.
- 7.1.4 Plywood is to conform to BS 1088/4079 (or equivalent) for marine use and be treated against fungi and attack from insects or marine borers. All edges are to be sealed against ingress of water. The use of gaboony plywood is not permitted for the construction of the hull.
- 7.1.5 Scantlings are to be in accordance with Tables 7.35.1 to 7.35.15 referred to in these Standards.
- 7.1.6 Where possible, the vessel should be built under cover and the workmanship is to be in accordance with the best marine practice.
- 7.1.7 Where laminated frames, stem or other sections of the vessel are to be utilised, the laminating procedure is to be carried out in a temperature controlled environment. Laminations are to be of kiln dried timber, bonded with resorcinol glues and properly cured before working.

Section 7.2 - Keel

- 7.2.1 The keel is to be constructed from an approved hardwood, and is to be sided and moulded in accordance with Table 7.35.1 and fitted in one length for vessels below 7m LOA. In vessels of 7m LOA and over, the keel may be fitted in two lengths.
- 7.2.2 Keel scarphs are to be of the lockfast type, with a length of not less than 5 times the moulded depth of the keel, as shown in 7.36.2. The scarp is to be through-bolted and be fitted with a softwood stopwater.
- 7.2.3 A galvanised steel keelband of adequate size is to be fitted to the underside of the keel, fastened with countersunk galvanised spikes or bronze screws. In the case of vessels of the beaching type, a false wood keel may be fitted in place of the keelband.

Section 7.3 - Hog and Keelson

- 7.3.1 The hog is to be moulded to the form of the vessel, and where possible should be fitted in one length. If scarphed, the length of the scarph is to be not less than 5 times the moulding and should be kept clear of the keel and keelson scarphs by not less than five frame spaces.

- 7.3.2 A centreline keelson of an approved hardwood or fabricated steel is to be fitted in all vessels with a Scantling Numeral of 340 and above. The keelson shall be fitted to the top of the frames or floors and is to extend from the forward deadwood or knee as far aft as is practicable
- 7.3.3 In vessels with a scantling number 340 to 440 two side keelsons may be fitted in place of the centre keelson
- 7.3.4 In vessels with a scantling numeral of 440 and over, side keelson are to be fitted in addition to the centre keelson. The engine seating may be extended in length and substituted for the side keelson

Section 7.4 – Stem

- 7.4.1 The stem is to be sided in accordance with Table 7.35.1 and moulded to suit the form of the vessel, scarphed, or mortise and tenon jointed to the keel and connected by a deadwood or heavy knee.

Section 7.5 - Apron

- 7.5.1 The apron is to be sided in accordance with Table 7.35.1, fitted in one length and moulded to suit the form of the vessel and through-bolted to stem with staggered fastenings.

Section 7.6 - Deadwood or foreknee

- 7.6.1 The deadwood or foreknee is to be sided to give a adequate faying surface of at least 3 times the plank thickness, lipped over the hog, scarphed to the apron, and through-bolted to the stem.

Section 7.7 – Stern post

- 7.7.1 The stern post is to be connected to the keel by mortise and tenon joints, and with a heavy steel skeg plate fitted on each side, through-bolted where necessary. The stern post may be swelled in way of stern tube, such that the thickness of the timber after the rabbet has been formed is not less than one quarter of the thickness of the siding of the stern post, as shown in Table 7.35.1.
- 7.7.2 When the stern post is not capped by the horn timber, the stern post is to be extended to the deck.

Section 7.8 - After deadwood or knee

- 7.8.1 The deadwood or knee is to be fitted to keel and stern post and lipped over the hog and swelled where necessary to take the stern tube.
- 7.8.2 The after deadwood is to be through bolted to the sternpost, keel and outrigger (if fitted), the use of gallery/pocket bolts is acceptable. See Figure 7.36.8.

Section 7.9 - Outrigger or horntimber

- 7.9.1 Where an outrigger or horntimber caps the stern post and deadwood, the cantilever should not exceed 60% of its length for a square stern vessel, or 67% of its length to the deck where there is no transom. Fashion pieces are to be fitted on each side of the horn timber to give a faying surface for plank ends, and should not be less than:-

Numeral	Fashion Piece mm
Up to 45	30
Over 45 up to 70	50
Over 70 to 170	75
Over 170 to 270	100
270 and above	130

- 7.9.2 Intermediate values are to be to next highest numeral.
- 7.9.3 Where the stern post continues to the deck, the outrigger is to be checked into the stern post and fitted with a knee or steel bracket.

Section 7.10 - Stopwaters

- 7.10.1 A stopwater of well seasoned fir is to be fitted at each intersection of the rabbet where two pieces are connected. This stopwater is to pass through the structure in the plane of the junction of these two pieces and out on each side in the part of the rabbet which is to be caulked.
- 7.10.2 Stopwaters should, in particular, be placed at the junction of the keel with the stern post, stem and forefoot, keel scarph, and connection of the counter with the stern post.

Section 7.11 - Transom

- 7.11.1 The transom is to be constructed of either single or double planking or plywood. Where double planking is used, a suitable membrane is to be fitted between the planks. The transom is to be suitably stiffened with timber stiffeners having scantlings as for main frames, or steel angle stiffeners of equivalent modulus. Vertical stiffeners are to be in line with bilge stringers for the fitting of knees or brackets.

Section 7.12 - Bent frames - clinker construction

- 7.12.1 In vessels of clinker construction, bent frames should be fitted in one piece, gunwale to gunwale as far as is practicable.
- 7.12.2 Frames are to be fastened to hog and keel and fastened through each plank landing with a copper boat nail of an adequate gauge. Copper nails should be clenched over copper roves on surface of frames.

- 7.12.3 Grown floor timbers should be fitted between frames and fastened through the keel with screw bolts and nuts.

Section 7.13 - Laminated frames - clinker construction

- 7.13.1 The timber layers forming the lamination are to be of similar timber and of even moisture content. The grain of the layers is to be approximately parallel to the length of the member. Where possible, the layers are to be continuous but, where this is not practicable, the layers may be scarphed with the slope of the scarph being not greater than 1 in 10. Scarphs are to be kept apart on alternate layers. The thickness of each layer is to be such that the layer will not be unduly stressed in forming, and that a satisfactory interlaminar bond can be achieved.

Section 7.14 - Cant frames

- 7.14.1 Cant frames are to be fitted at forward and aft ends of the vessel, where necessary. The cant frames are to be of the same scantling as normal frames.

Section 7.15 - Floors

- 7.15.1 Floors should be cut from timber having a suitable grain. Grown floors may be constructed from lower futtock clamps. Floors may be of laminated construction where required.
- 7.15.2 Floors are to be fastened to centreline structure with through-bolts. Limber holes of adequate size are to be provided in all floors.

Section 7.16 – Stringers and gunwales

- 7.16.1 Bilge and beam stringers in vessels above numeral 60 are to be fitted in accordance with Table 7.35.2.
- 7.16.2 Stringers are to run the full length of the vessel. Where the stringer is scarphed, the scarph should extend over a minimum of two frames and be staggered port and starboard. Stringers are to be through-bolted at each frame.
- 7.16.3 In all open type vessels, gunwales of approved timber are to be fitted. Gunwales are to be of the box type fitted to the face of the sawn or bent frames with through fastenings at each frame and a capping fitted to the top (see tables for scantling details). Where the framing is a combination of sawn and bent frames, filler pieces are to be fitted in way of the bent frames. A breasthook is to be fitted forward and either transom knees or a breasthook fitted aft.

Section 7.17 – Breasthooks

7.17.1 Breasthooks are to be of timber or steel construction, fitted to beams and stringers and through-bolted.

Section 7.18 - Quarter and transom knees

7.18.1 Knees may be of timber or steel and are to be fitted to beam stringers and bulwark rails on transom stern vessels. Transom knees are to be fitted between the outrigger and transom and may be a grown knee or of galvanised steel.

Section 7.19 - Frames

7.19.1 Timber for frames should be selected in accordance with Table 7.35.16 of these Standards and may be either sawn, steam bent, laminated, or a combination of these. Scantlings and spacing is to be in accordance with the Table 7.35.4.

7.19.2 Sawn frames may either be butted at the centre or fitted with floors, or the floors may be formed by the lower frame futtocks. Clamps are to be fitted at each futtock butt and are to be a minimum of 8 times frame siding in length. The clamps should be bolted through the frame with a minimum of three bolts on each side of the joint.

Section 7.20 - Lodging knees

7.20.1 Lodging knees of timber or galvanised steel are to be fitted to all main beams in areas subjected to local stress, i.e. gallows, winches, deckleads, etc.

Section 7.21 - Packing

7.21.1 Where packing is required to be fitted in way of knees, breasthook, or any structure, the material should be identical to that of the parent structure.

Section 7.22 - Deck beams

7.22.1 Deck beams of timber or steel are to be fitted in accordance with the Tables. All beams should have a camber of not less than 20mm per metre of length. Where a vessel is constructed with steel deck beams, a steel beam shelf and carling is to be fitted, with scantlings as for the main beam shown in Table 7.35.7.

7.22.2 Where wooden beams are fitted, tie rods are to be fitted to the carling in way of openings exceeding 2 meters in length.

7.22.3 Main beams as shown in Table 7.35.9 and 7.35.10 are to be fitted in way of deckhouse hatch openings, winches or areas subjected to local stress.

- 7.22.4 Steel half beams, where fitted, are to be in accordance with Table 7.35.7 and Figure 7.36.18. Timber half beams should be skewed/dovetailed into the beam stringer and carlings.
- 7.22.5 Steel deck casing and hatch coamings are to be connected to the inside of beams and carling, and fully welded top and bottom.

Section 7.23 - Carlings

- 7.23.1 Carlings may be of timber or steel. Timber carlings should be skewed dovetailed into main beam. Lodging knees or steel brackets are to be fitted at each corner. Scantlings are to be to Table 7.35.8.
- 7.23.2 All carlings are to have a maximum unsupported length of 2.5m. Support may be by a pillar or bulkhead.

Section 7.24 - Hull planking (carvel)

- 7.24.1 Planking for carvel hulls are to be in accordance with Table 7.35.2. Plank widths are not to exceed 4 times plank thickness, excepting the garboard and adjacent strake, and the three adjoining strakes to these at amidships which should not exceed 6 times their thickness.
- 7.24.2 Planking butts in adjacent strakes are to have a minimum spacing of four frame spaces with a minimum of three passing strakes between butts on the same frame.
- 7.24.3 Where planks cannot be butted on a frame, butt straps can be used. On vessels below a scantling numeral of 100, butt straps can be screw-fastened. Wood butt straps are to have bevel outer corners for drainage.
- 7.24.4 Butt straps can be of the same thickness wood as the planking. On vessels with a scantling numeral of 100 and above, butt straps must overlap the upper and lower planks. Butt straps are to be through-bolted, with tarred felt fitted between butt strap and planking.
- 7.24.5 Stealer planks may be fitted aft of midships and are not to be less in width at the fore end than 1.5 times the plank thickness to allow for fastening.
- 7.24.6 For planks not exceeding 150mm in width, hull planking is to be fastened by two flats, spikes or dumps or copper boat nail clenched over roves in each plank at each frame. Where planks exceed 150mm in width, there are to be three flats or dumps at each frame. All fastenings are to be staggered.

Through-fastenings (planking)

- 7.24.7 In all cases whatever the method of planking adopted, all through-fastenings in way of stringers shall pass through the planking and frame,

and on vessels with a scantling numeral of over 200, 20% of all hull fastenings shall be through-bolts or bolts clenched over roves or washers.

- 7.24.8 Rubbing strakes and bilge strakes, where fitted, are to be in accordance with Table 7.35.2.

Section 7.25 - Caulking

- 7.25.1 Carvel planked hull and decks should be caulked with oakum, and payed with a flexible marine glue or flexible waterproof filler.
- 7.25.2 On clinker vessels, the rabbet seams and decks should be caulked with oakum or boat cotton.
- 7.25.3 Where caulking cotton is used below the waterline, flexible marine glue is to be used as a sealant.

Section 7.26 - Clinker planking

- 7.26.1 Planking, where practicable, should be in one length, but where the plank requires joining, butt straps or scarphs may be utilised. Scarphs are not to be less than 6.5 times the plank thickness in length. Scarphs are to be feathered inside and stepped outside with the feather placed on a frame. The scarph is to be glued and fastened. Plank widths should not exceed 150mm with exception of garboard. Where plank widths differ from above on custom built vessels such as cobbles, etc., details are to be submitted for approval.
- 7.26.2 The lap or lands of the clinker planking are not to be less than the width given in Table 7.35.5. Plank landings should be completely tight, coated inside and outside with wood preservative, and fastened with copper boat nails clenched over copper roves.
- 7.26.3 Clinker hull planking is to be fastened by two clenched fastenings at each frame with two clenched copper fastenings in the plank land between each frame. Butt straps are to be fitted in way of all plank butts, or alternatively the planks may be scarphed together.
- 7.26.4 Plank ends at the stem are to be fastened at the rabbets by not less than four screws in each plank. In the case of a transom stern, the planks are to be fastened at the transom with not less than three screws in each plank and two screws in each plank in way of the transom fashion pieces.
- 7.26.5 In all open vessels, risings of an approved timber are to be fitted at the height of the thwarts and through-fastened at every frame. In vessels without thwarts, the risings are to be fitted no less than one-third of the moulded depth below the top of the gunwales.

- 7.26.6 Thwarts are to be connected to the risings by through fastenings, clenched over roves or washers and by thwart knees; these knees are to be fitted on aft side of the forward thwarts and on the forward side of the aft thwart. Thwart knees may be of wood, galvanised steel or other approved materials.

Section 7.27 - Bulkheads

- 7.27.1 Bulkheads may be constructed of wood, plywood or steel. Each bulkhead is to be mounted on a casing composed of a frame and beam, suitably arranged in the same plane.
- 7.27.2 Wooden watertight bulkheads are to be fitted as required by Section 3.10, (Part 3 'Hull Integrity and Arrangement') and are to be of double skin construction fitted with a suitable membrane between the layers.
- 7.27.3 Non-watertight bulkheads may be constructed with tongued and grooved boarding, marine plywood, or steel.
- 7.27.4 On decked vessels, bulkheads which separate machinery spaces from accommodation are to be faced with material capable of meeting B 15 Fire Standard, and are to be covered with a surface layer impermeable to oil.
- 7.27.5 On decked vessels where the machinery space is enclosed by a bulkhead, a portable section of equivalent strength to the parent bulkhead may be fitted in the appropriate bulkhead to facilitate removal of engine etc. Subject to the approval of the Surveyor.
- 7.27.6 The scantlings for watertight wood and steel bulkheads are to be obtained from Table 7.35.12.

Section 7.28 - Decks

- 7.28.1 Decks may be of timber planking or plywood. Timber planking should be quarter sawn and suitably treated with a preservative. Butts are to be spaced at least 1m apart and there should be a minimum of three passing strakes between butts on the same frame. Plank width should not exceed 125mm. Deck planking edges are to be bevelled to facilitate caulking and should be close fitted on the underside. Where decking is laid on steel beams, a suitable membrane of bituminous felt or equivalent is to be fitted between the beam and deck.
- 7.28.2 Plywood deck butts are to be arranged on beams, and seams should be arranged with a doubler. All joints are to be glued and fastened, and the end grain is to be suitably treated and sealed.

- 7.28.3 Partial decks are to be stiffened with a main beam securely fastened at the termination of the partial decks. Thwarts are to be fitted in open areas between partial decks to the Surveyor's satisfaction.

Section 7.29 - Bulwarks and hatches

- 7.29.1 On decked or partially decked vessels, the perimeter of the exposed deck is to be fitted with fixed bulwarks, guardrails or wires, or a combination of these. The height of the bulwark, guardrail, or wire is to be not less than 1m, excepting that where necessary for fishing operations, and where there is unreasonable interference with efficient operation of the vessel, this height for fixed bulwarks, rails and wires may be reduced and the required height of 1m maintained by the use of portable wires and stanchions. Solid bulwarks are to be in accordance with Table 7.35.11.
- 7.29.2 Weather deck hatch coamings are to be of hardwood, steel, or other approved material and fitted with all necessary covers and securing fittings to ensure weathertightness in accordance with Part 3, Section 3.1.
- 7.29.3 Where fishing operations involve the use of openings in bulwarks (e.g. in way of stern ramps etc.), details are to be submitted for approval prior to fitting.

Section 7.30 - Mast and spars

- 7.30.1 In view of the nature and diversity of masts and spars etc., proposed arrangements should be submitted for approval. All lifting equipment must meet the LOLER regulations, see Part 11, Paragraph 11.13.4.
- 7.30.2 In open and partially decked vessels without superstructure, means are to be provided to support fishing lights and shapes as required by statutory requirements.

Section 7.31 - Hull protection

- 7.31.1 Protective sheathing is to be fitted in way of trawl gallows, dredges, pot hauler, davits, etc., and may be of timber, steel or composite material. When fastening sheathing, care is to be taken to ensure that screws or fasteners do not penetrate through the hull planking.

Section 7.32 – Engine seating

- 7.32.1 Engine seats are to extend at least twice the distance between the engine gearbox output coupling and the forward engine holding down bolt centres. Wooden seats are to be of hardwood, reduced in depth clear of the engine as necessary, and checked over every frame or floor, but kept clear of the planking. The seats are to be stiffened with side brackets at every second frame and reinforced with not less than three cross-members. The side brackets and cross- members may be of wood

or steel and are to be connected to the engine seats by bolting to angle bars of suitable dimensions.

- 7.32.2 Wooden seats should be through-fastened at each frame before the hull planking is fitted. All bolts are to be fitted with plate washers, and provisions should be made to ensure that the bolts can be tightened during service. A steel plate, channel or angle bar is to be fitted to the tops of the engine seats extending over the length of the engine and gearbox. Engine seats are to terminate at a bulkhead or transverse floor, and be fitted with bracket stiffeners.
- 7.32.3 The engine holding down bolts are to pass through the full depth of the steel seats, or alternatively the angles or channels fitted to the engine seats. Engine seats of wood are to be fitted with gallery bolts.
- 7.32.4 The timber for wooden engine seats should be thoroughly seasoned to avoid excessive shrinkage during service.

The sidings of wooden engine seats are to be not less than the following:-

Maximum kW	Minimum siding of engine seats mm
Below 50	85
50 - 100	110

- 7.32.5 For engines rated in excess of 100kW, steel engine seats are to be fitted.
- 7.32.6 Where steel seats are fitted, the length is to be as for wooden seats, fabricated and fitted with side brackets on every second frame, and where space permits, not less than three intercostals.
- 7.32.7 Steel seats are to be connected to every frame by plates and brackets through-bolted to the frames. The sole plate is to be of adequate thickness for the type and size of engine to be installed, and to the engine Manufacturer's requirements. All welding is to be double continuous fillet. Provision is to be made to ensure that all bolts are accessible. Scantlings and method of construction are to be submitted for approval.

Section 7.33 - Stern tube

- 7.33.1 The installation of the stern tube and ancillary equipment is to be carried out according to the Manufacturer's requirements regarding deadwood bore, fitting of gland faces, shafts and propellers.
- 7.33.2 The stern post in the way of the propeller area should be faired to ensure an adequate flow of water to the propeller.

Section 7.34 – Miscellaneous

- 7.34.1 Flooring in fish rooms may be of either cement or timber. Where of cement, drain channels are to be fitted, draining to the bilge or slushwell.
- 7.34.2 All grounds and hull structure not easily accessible after completion of construction are to be treated with at least three coats of a non-toxic wood preservative.

Tables, figures, and illustrations

Where alternatives to the following Tables and Figures are proposed, details are to be submitted for consideration and approval prior to construction commencing.

7.35 Tables for wood construction

7.35.1 Table 1: Main structures

Scantling numeral	Keel		Stem	Apron face mm	Hog		Keelson	
	Face mm	Web mm	Face mm		Face mm	Web mm	Face mm	Web mm
10	90	125	90	65	25	150	-	-
15	90	150	90	65	30	150	-	-
20	100	150	100	75	40	165	-	-
25	100	170	100	75	45	165	-	-
30	115	175	115	90	50	190	-	-
45	125	180	125	90	50	190	-	-
60	125	180	125	90	65	205	-	-
70	125	180	125	90	75	215	-	-
85	140	205	140	90	75	240	-	-
100	150	230	150	100	90	270	-	-
115	150	230	150	100	100	270	-	-
140	180	255	180	100	115	280	-	-
170	180	255	180	100	125	290	-	-
200	190	280	200	125	125	290	-	-
235	190	280	190	125	140	300	-	-
270	215	305	215	125	150	305	-	-
315	215	305	215	125	165	320	150	205
340	215	305	215	140	165	340	150	205
370	215	305	215	140	165	350	150	205
415	240	320	240	150	180	365	205	230

Note:-

1. Stern post siding to be as keel, and swelled where required for stern tube housing in accordance with Paragraph 7.7.1.

7.35 Tables for wood construction

7.35.2 Table 2: Planking (carvel) stringers and beam shelves

Scantling numeral	Hull and deck planking mm	Thick strakes			Cross-section areas		
		Siding mm	Bilge no.	Rubbing no.	Stringers		Beam shelf cm ²
					Bilge cm ²	Beam cm ²	
10	20	35	1	1	20	-	-
15	20	35	1	1	20	-	-
20	20	50	1	1	25	-	-
25	25	50	1	1	30	-	-
30	25	50	1	1	30	-	-
45	30	55	1	1	35	-	-
60	30	55	1	1	40	50	50
70	30	60	1	1	50	65	65
85	35	60	1	1	50	75	65
100	40	60	1	2	65	90	65
115	40	65	1	2	75	95	65
140	40	65	2	2	95	115	80
170	45	65	2	2	95	130	80
200	45	70	2	3	120	165	95
235	45	70	2	3	145	170	100
270	50	75	2	3	190	230	110
315	50	75	2	3	190	230	135
340	50	75	2	4	250	275	135
370	55	80	2	4	275	305	150
415	55	80	2	4	300	310	150

7.35 Tables for wood construction

7.35.3 Table 3: Sawn frames

Scantling numeral	Siding single mm	Spacing centres mm	Siding double mm	Spacing centres mm	Moulded at			Clamps siding mm
					Floor mm	Bilge mm	Deck mm	
10	50	300	-	-	90	75	50	25
15	50	320	-	-	90	75	65	25
20	50	340	-	-	100	75	65	25
25	50	360	-	-	100	75	65	25
30	60	360	-	-	115	90	75	30
45	65	360	-	-	125	100	75	40
60	65	360	-	-	125	100	85	40
70	65	380	-	-	125	100	85	40
85	70	380	-	-	140	100	85	45
100	70	380	-	-	150	115	90	45
115	75	380	-	-	150	115	90	50
140	75	380	-	-	205	140	115	50
170	85	380	-	-	230	150	115	60
200	90	380	-	-	280	160	120	65
235	90	380	70	430	280	180	125	65
270	100	400	85	460	280	180	140	75
315	100	400	85	460	280	180	140	75
340	110	400	90	470	280	180	140	85
370	110	400	90	470	305	205	150	85
415	110	400	90	470	305	205	150	85

7.35 Tables for wood construction

7.35.4 Table 4: Sawn and bent frames

Scantling numeral	A						B			C		
	Sawn frames			Bent frames			Spacing of sawn frames with 1, 2 or 3 bent frames between			Bent frames only		
	Siding mm	Moulding		Siding mm	Moulded mm							
Floor mm	Bilge mm	Head mm	One centre mm	Two centres mm	Three centres mm	Siding mm	Moulded mm	Spacing centres mm				
10	50	90	75	50	20	30	—	510	660	20	30	150
15	50	90	75	65	20	35	—	540	710	20	30	165
20	50	100	75	65	20	40	400	585	760	20	40	180
25	50	100	90	75	20	45	430	620	810	20	45	190
30	60	115	90	75	25	45	465	665	875	25	45	205
45	65	125	100	75	30	45	465	725	875	30	45	205
60	65	125	100	75	30	45	510	725	925	—	—	—
70	65	125	100	75	30	50	510	725	925	—	—	—
85	70	140	100	75	35	50	510	725	925	—	—	—
100	70	140	100	75	35	60	510	725	925	—	—	—
115	75	150	115	100	40	60	530	760	990	—	—	—
140	75	180	140	100	40	60	530	760	990	—	—	—

A = Scantlings for a combination of sawn and bent frame construction.

B = Spacings for a combination of sawn and bent frame construction.

C = Scantlings and spacings for small vessels with bent frame construction only.

7.35 Tables for wood construction

7.35.5 Table 5: Planking (clinker) risings, gunwales and cappings

Scantling numeral	Hull planking mm	Deck planking mm	Width of land or lap mm	Risings		Gunwales		Cappings
				Siding mm	Moulded mm	Siding mm	Moulded mm	Siding mm
10	12.5	20	20	25	65	25	75	20
15	15	20	25	25	70	30	75	20
20	15	22.5	25	25	70	35	75	25
30	20	25	30	35	75	40	90	25
45	20	30	30	35	75	40	90	30
60	22.5	30	30	40	75	50	100	30
70	25	30	35	40	80	50	115	35

7.35 Tables for wood construction

7.35.6 Table 6: Transoms

Scantling numeral	Double skin construction thickness mm	Single planking thickness mm	Transom knee siding mm
10	2 x 10	30	75
20	2 x 15	40	85
25	2 x 20	45	100
30	2 x 20	45	110
45	2 x 20	45	110
60	2 x 20	50	115
70	2 x 20	50	115
85	2 x 25	55	125
100	2 x 25	55	125
115	2 x 25	60	140
140	2 x 25	60	150
170	2 x 25	60	150
200	2 x 25	60	165
235	2 x 30	65	165
270	2 x 30	65	165
315	2 x 30	65	165
340	2 x 30	65	190
370	2 x 35	70	190
415	2 x 35	70	190

Notes:-

1. Fashion piece siding is to equal siding for main frames.
2. Transoms on vessels for use with outboard engines are to have additional stiffening/thickness to the approval of the Surveyor.

7.35 Tables for wood construction

7.35.7 Table 7: Steel deck beams

Breadth of vessel	Dimensions of steel angle mm	Beam	Spacing
Below 3m	50 x 50 x 6	Ordinary	As for frames
	100 x 50 x 6	Main	
3 - 4.5m	75 x 50 x 8	Ordinary	
	150 x 50 x 8	Main	
Above 4.5 - 6.5m	80 x 60 x 8	Ordinary	
	160 x 60 x 8	Main	

Notes:-

1. Beams in way of deck openings and heavy deck equipment are to be main beams.
2. Where steel beam stringer plates are fitted, a reduction in wooden stringer scantlings may be considered.
3. All steel beams and stringer plates are to be shot-blasted and primed prior to installation.
4. Steel deck beams are to have a suitable membrane (e.g. tarred felt or similar) fitted between the beam and deck planking.

7.35 Tables for wood construction

7.35.8 Table 8: Carlings, beam knees and thwarts

Scantling numeral	Carlings		Beam knees siding mm	Thwarts siding mm	Thwart knees siding mm
	Moulded mm	Siding mm			
10	-	-	-	45	30
15	-	-	-	45	30
20	-	-	-	50	40
25	-	-	-	50	45
30	-	-	-	55	45
45	-	-	-	60	45
60	110	90	75	-	-
70	110	90	75	-	-
85	115	90	75	-	-
100	115	90	75	-	-
115	115	90	75	-	-
140	125	90	75	-	-
170	125	100	90	-	-
200	140	100	90	-	-
235	140	125	90	-	-
270	165	140	100	-	-
315	165	140	100	-	-
340	165	140	100	-	-
370	180	165	115	-	-
415	180	165	115	-	-

7.35 Tables for wood construction

7.35.9 Table 9: Wooden beams (close spacing) double frame construction

Scantling numeral	Main beams siding mm	Ordinary beams siding mm	Moulding at centre mm
10	65	30	75
20	70	40	90
25	75	45	100
30	75	50	100
45	90	50	110
60	90	60	110
70	90	60	115
85	90	65	125
100	95	65	125
115	95	65	125
140	100	70	140
170	100	70	140
200	115	75	150
235	125	85	150
270	140	90	180
315	140	95	180
340	150	95	180
370	165	100	190
415	165	100	190

Note:-

1. Spacing of beams is to be as frame spacing.

7.35 Tables for wood construction

7.35.10 Table 10: Wooden beams (wide spacing) single frame construction

Scantling numeral	Main beams siding mm	Ordinary beams siding mm	Moulding at centre mm	Spacing mm
70	100	75	125	500
85	100	75	135	500
100	100	75	135	500
115	100	75	135	500
140	115	90	150	500
170	115	90	150	500
200	125	100	165	500
235	130	100	170	500
270	140	115	190	500
315	150	125	190	550
370	150	125	200	550
415	150	125	200	550

7.35 Tables for wood construction

7.35.11 Table 11: Bulwarks

Scantling numeral	Stanchions siding mm	Planking siding mm	Top rails		Stringers	
			Siding mm	Moulded mm	Siding mm	Moulded mm
20	45	20	35	100	35	100
30	45	20	35	100	35	100
40	50	20	40	100	40	100
50	50	20	40	100	40	100
60	60	20	40	125	45	100
70	70	20	40	125	45	100
85	70	20	40	125	45	100
100	75	25	45	125	45	100
115	75	25	45	125	45	125
140	85	30	50	150	50	125
170	85	30	50	150	50	125
200	90	30	50	150	50	125
235	90	30	60	150	50	125
270	100	35	60	150	50	150
315	100	35	60	180	60	150
340	110	35	65	180	60	150
370	110	35	65	180	65	150
415	110	35	65	180	65	150

7.35 Tables for wood construction

7.35.12 Table 12: Bulkheads

Wood bulkheads (watertight)

Depth of bulkhead m	Planking		Plywood mm	Stiffeners		
	Single planked mm	Double planked mm		Spacing mm	Moulded mm	Sided mm
1	22	18	12	400	50	30
1.5	32	20	16	400	60	40
2	36	30	20	400	70	50
2.5	38	40	25	400	80	60
3	-	50	30	400	90	65
3.5	-	60	35	400	110	75
4	-	60	40	400	120	80

Steel bulkheads

Depth of bulkhead m	Plating mm	Stiffeners	
		Spacing	Scantling mm
0.75	3.5	-	-
1	4	460	40 x 5 FB
1.5	5	460	45 x 5 FB
2	6	460	40 x 40 x 5 angle
2.5	6	460	65 x 50 x 6 angle
3	6.5	460	65 x 50 x 6 angle
3.5	7	550	65 x 60 x 7 angle
4	7	550	80 x 60 x 7 angle

7.35 Tables for wood construction

7.35.13 Table 13: Bolts (minimum diameters)

Scantling numeral	Keel, apron, stem, stern, hog, keelson mm	Frame floors engine seats mm	Beams and beam shelf mm	Risings stringers gunwales mm	Frames clamps and futlocks mm	Planking mm
10	10	8	6	6	6	4
20	10	8	6	6	6	4
25	12	10	8	8	8	6
30	12	10	10	10	8	6
45	12	10	10	10	8	6
60	12	10	10	10	10	6
70	12	10	10	10	10	6
85	12	10	10	10	10	8
100	16	14	12	10	10	8
115	16	14	12	10	10	8
140	20	18	12	12	10	8
170	20	18	12	12	12	8
200	20	18	12	12	12	8
235	20	18	12	16	12	8
270	20	18	12	16	12	10
315	22	20	12	16	12	10
340	22	20	12	16	12	10
370	22	20	12	16	12	10
415	22	20	12	16	12	10

7.35 Tables for wood construction

7.35.14 Table 14 The length of flats, spikes and dumps

Thickness of Timber mm	Length of Flats, Spikes of Dumps mm
25	75
30	90
35	100
45	115
50	125
55	135
65	150
70	165
75	175
90	205
100	225

7.35 Tables for wood construction

7.35.15 Table 15 Copper nail fastenings

Thickness of Timber mm	Gauge of Nail mm
12	16
20	14
25	13
30	13
35	12
45	11
50	11
55	10
65	9
70	9
75	8
80	8
85	7
100	7

7.35 Tables for wood construction

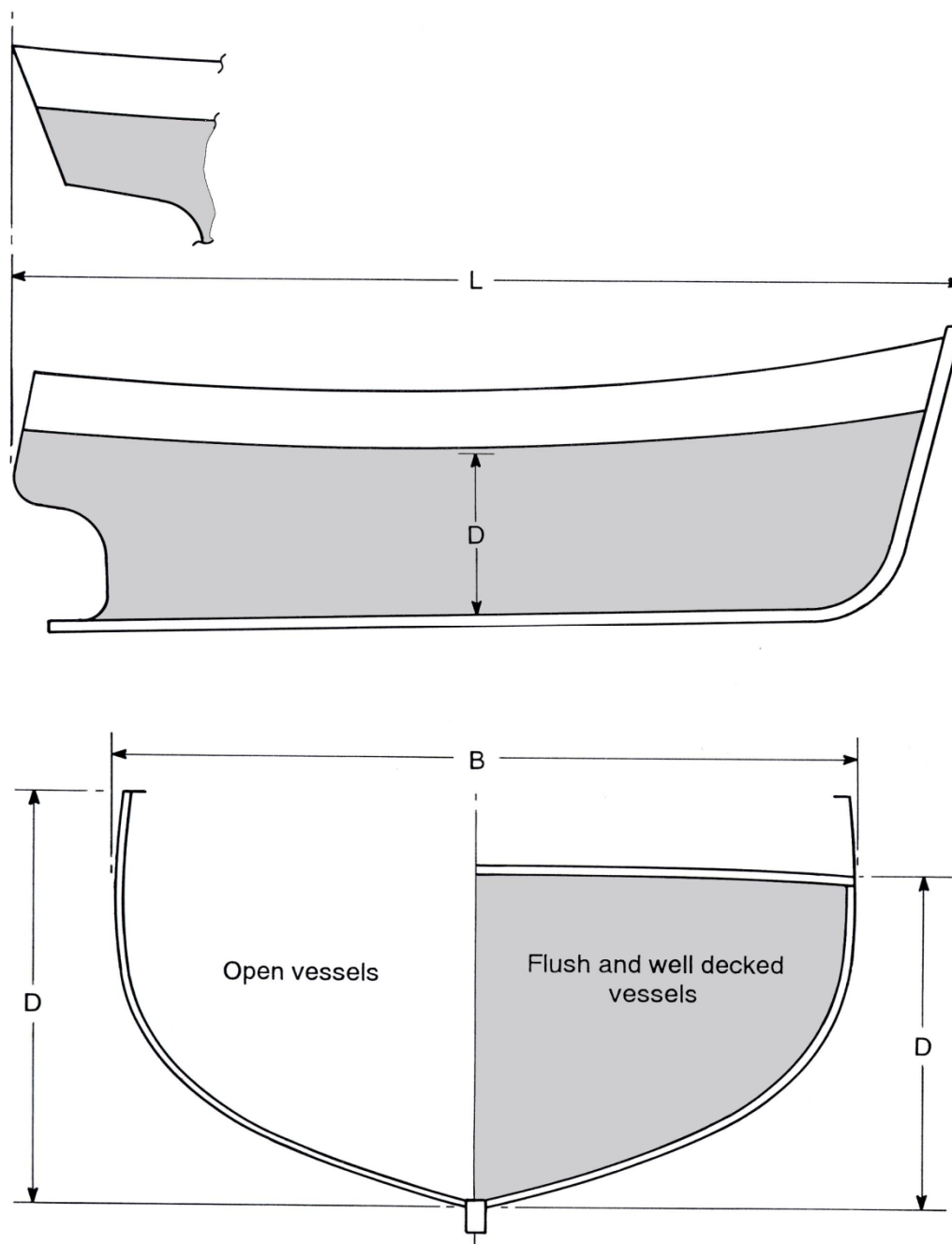
7.35.16: Recommended timbers and uses

Name of timber	Uses
Teak (<i>Tectona grandis</i>)	All purpose
Oak (European) (<i>Quercus</i> spp)	All purpose
Pitch Pine (<i>Pinus caribea</i>)	All purpose
Opepe (<i>Nauclea diderrichii</i>)	All purpose
Agba(<i>Gossweilerodendrom balsomiderum</i>)	Planking, laminated frames and joinery
Iroko (<i>Chlorophora excelsa</i>)	Deck planking, joinery and laminations
Garjun, Keruing (<i>Dipterocarpus</i> spp)	Decking (kiln dried)
Douglas Fir (<i>Pseudotsuga taxifolia</i>)	Decks, masts, thwarts and joinery
Elm, Dutch (<i>Ulmus thomasi</i>)	Steam bent frames
Larch, European (<i>Larix decidua</i>)	Planking, beams stringers, masts and thwarts
Mahogany, American (<i>Swietenia macrophylla</i>)	Planking, thwarts, joinery and laminations
Makore (<i>Tieghemella heckelii</i>)	Keels, planking, frames and laminations
Parana Pine (<i>Arancaria augustifolia</i>)	Soles and joinery
Redwood (<i>Pinus sylvertris</i>)	Soles, thwarts, joinery and planking for small boats
Sapele (<i>Entandrophragma cylindricum</i>)	Thwarts, joinery and planking for small boats
Utile (<i>Entandrophragma Utile</i>)	Keels, stems, sawn frames and thwarts
All plywood is to conform to BS 1088/4079 (or equivalent), for marine use and treated against attack by fungi, insects and marine borers. All edges are to be sealed against water ingress.	
Where alternative timbers to the above are proposed, details of the timber and proposed use are to be submitted before construction.	

7.36 Figures and illustrations

7.36.1 Scantling numeral dimensions – wood vessels

$L \times B \times D =$ Scantling numeral



Length L measured on a straight line from fore part of stem at top to aft side of outrigger or transom.

Breadth B the greatest breadth of the vessel measured to the outside of the hull planking.

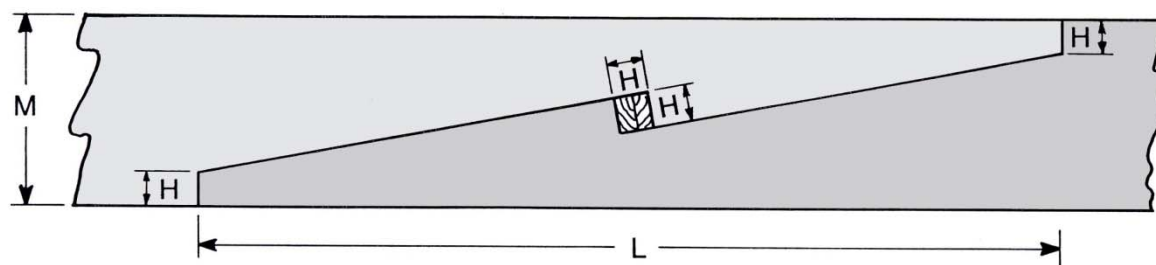
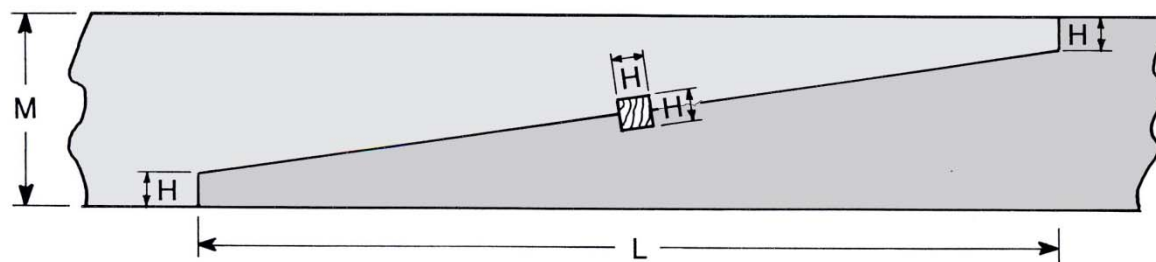
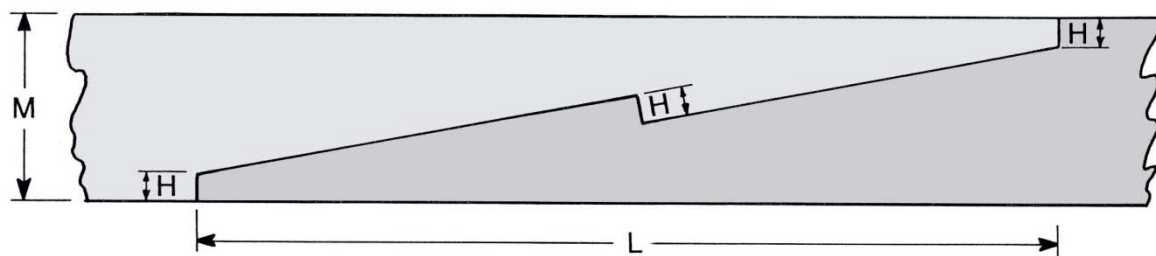
Depth D measured at amidships from the outside of planking at the keel rabbet to top of deck beam at side on flush and well decked vessels.

On open type vessels D to be measured from the outside of planking at the keel rabbet to the top of gunwale

7.36 Figures and illustrations

7.36.2 Keel scarphs

Hooked scarphs

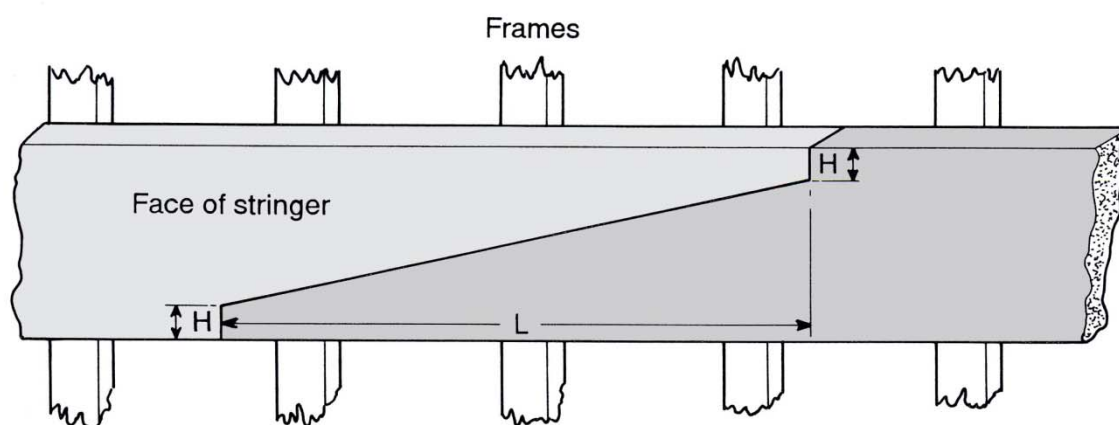


M = Keel moulding
L = Length of scarph = 5 x M
H = 0.15 x M

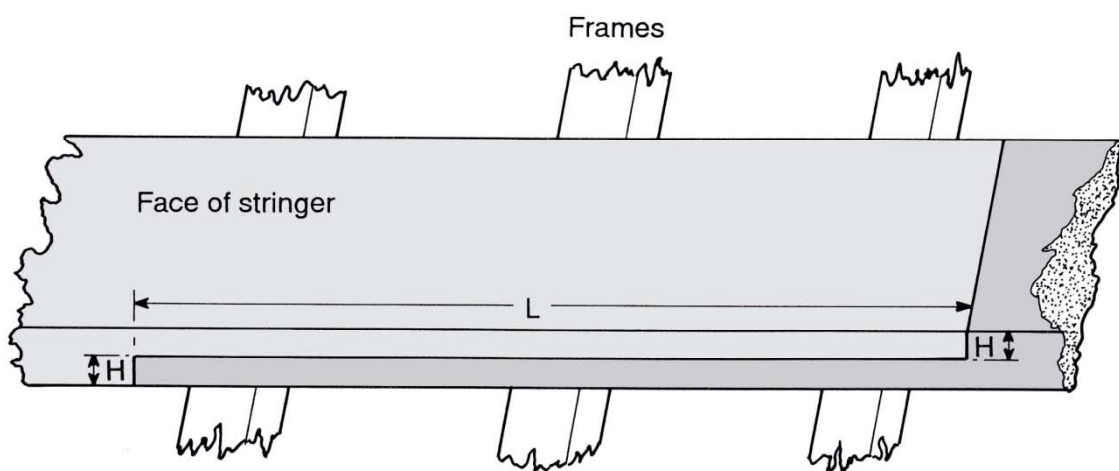
7.36 Figures and illustrations

7.36.3 Stringer scarphs

BEAM STRINGER SCARPHS



BILGE STRINGER SCARPHS

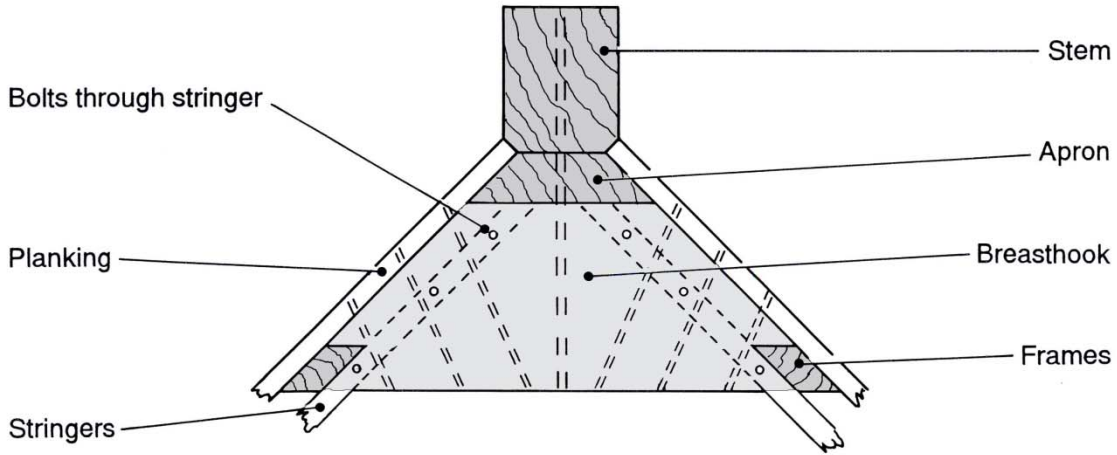


- L shall not be less than two frame spaces.
- H shall not be less than 0.15 x the moulding for beam stringers.
- H shall not be more than 0.15 x siding for bilge stringers.

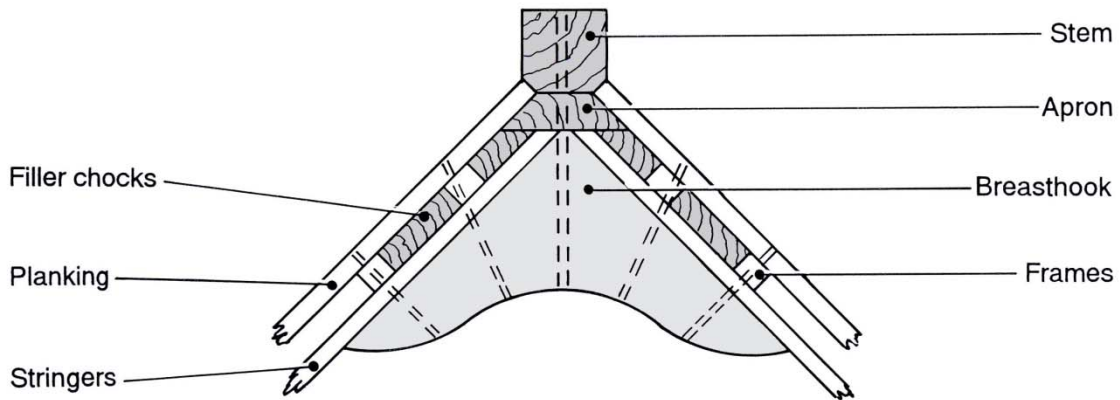
7.36 Figures and illustrations

7.36.4 Breasthooks

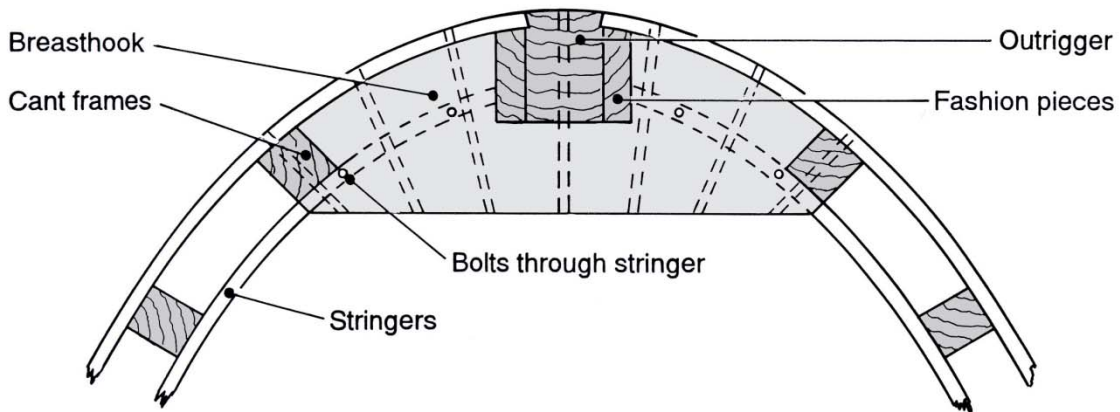
FORWARD BREASTHOOK WITH SAWN FRAMES



FORWARD BREASTHOOK WITH BENT FRAMES



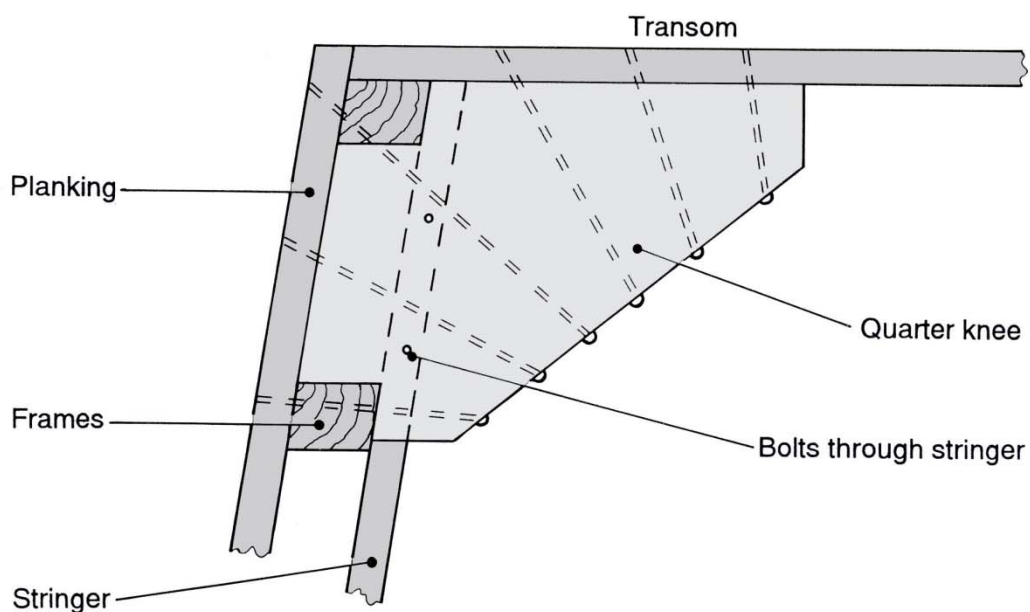
AFT BREASTHOOK WITH SAWN FRAMES



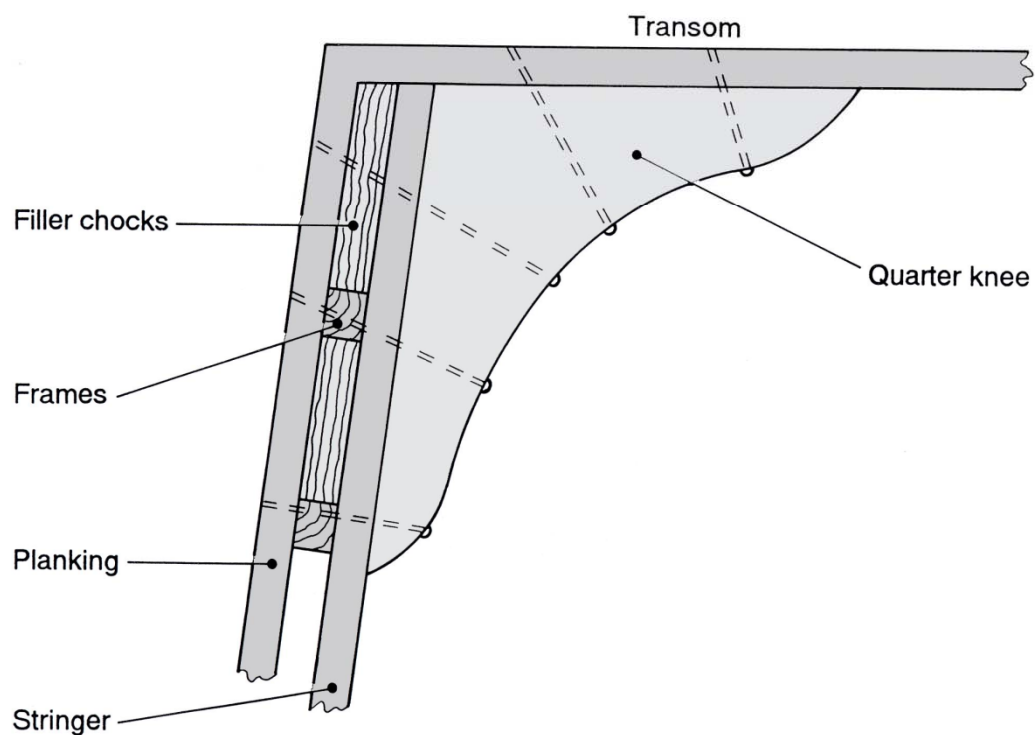
7.36 Figures and illustrations

7.36.5 Transom knees

TRANSOM QUARTER KNEE WITH SAWN FRAMES

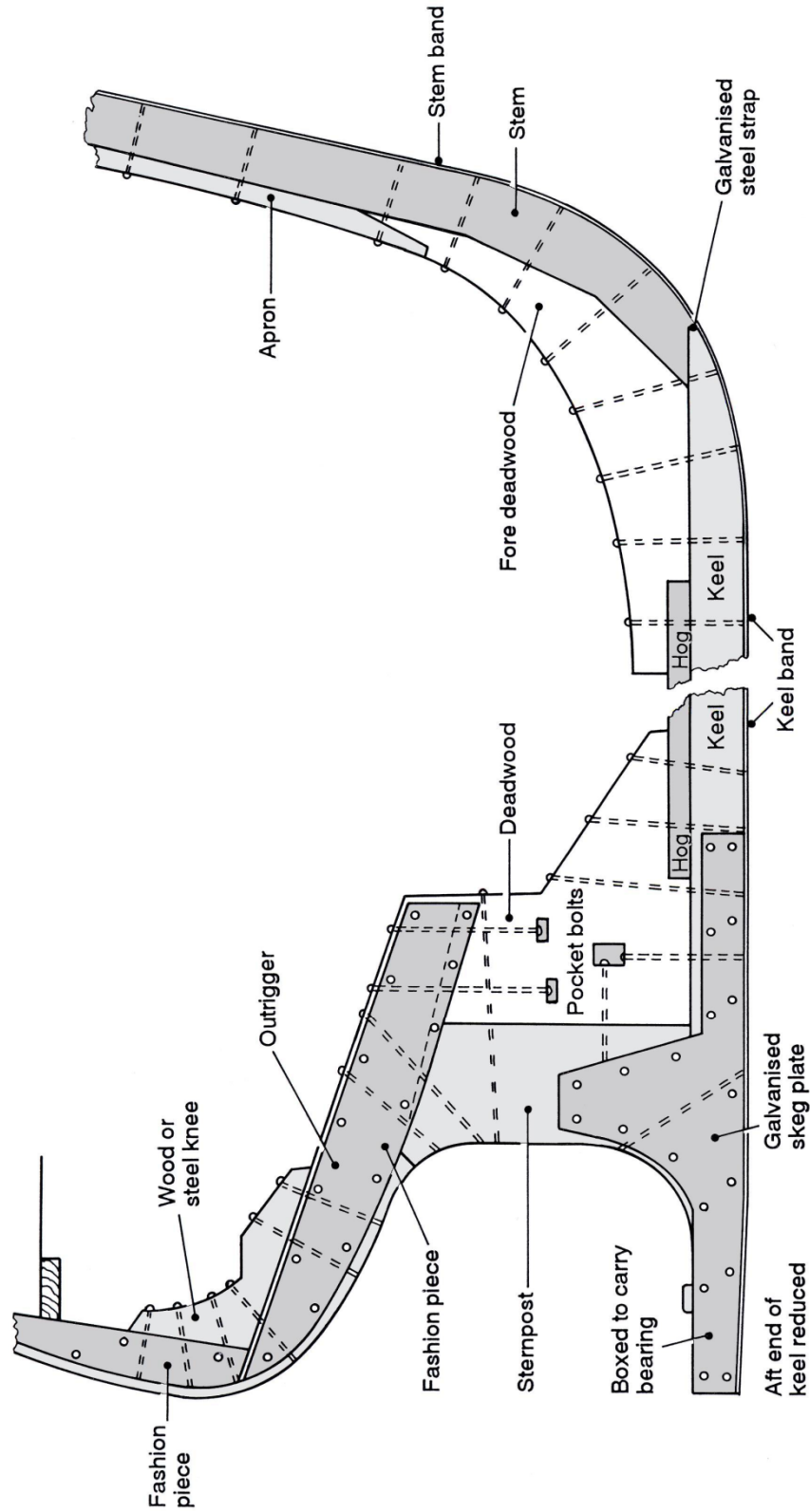


TRANSOM QUARTER KNEE WITH BENT FRAMES



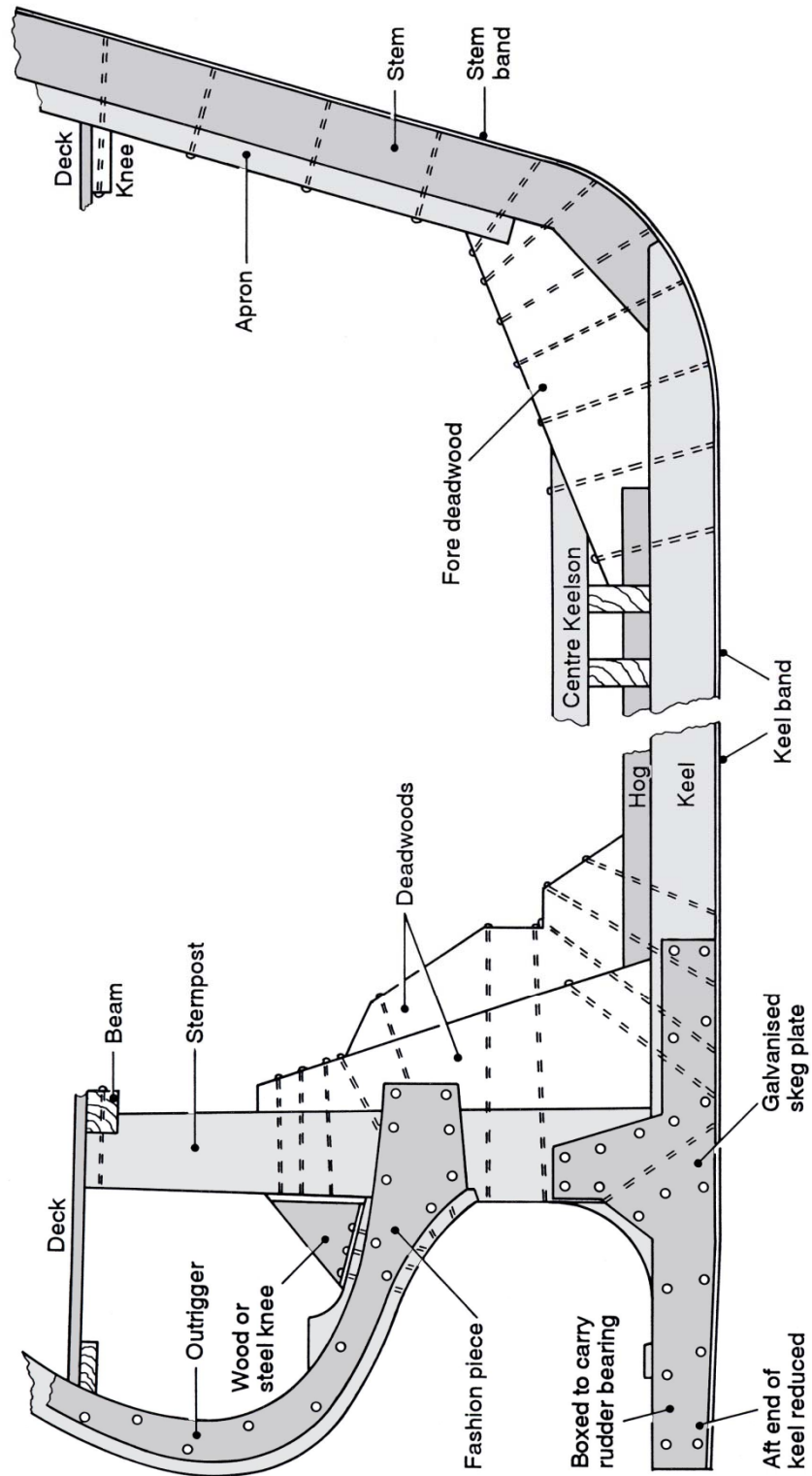
7.36 Figures and illustrations

7.36.6 Main frame construction



7.36 Figures and illustrations

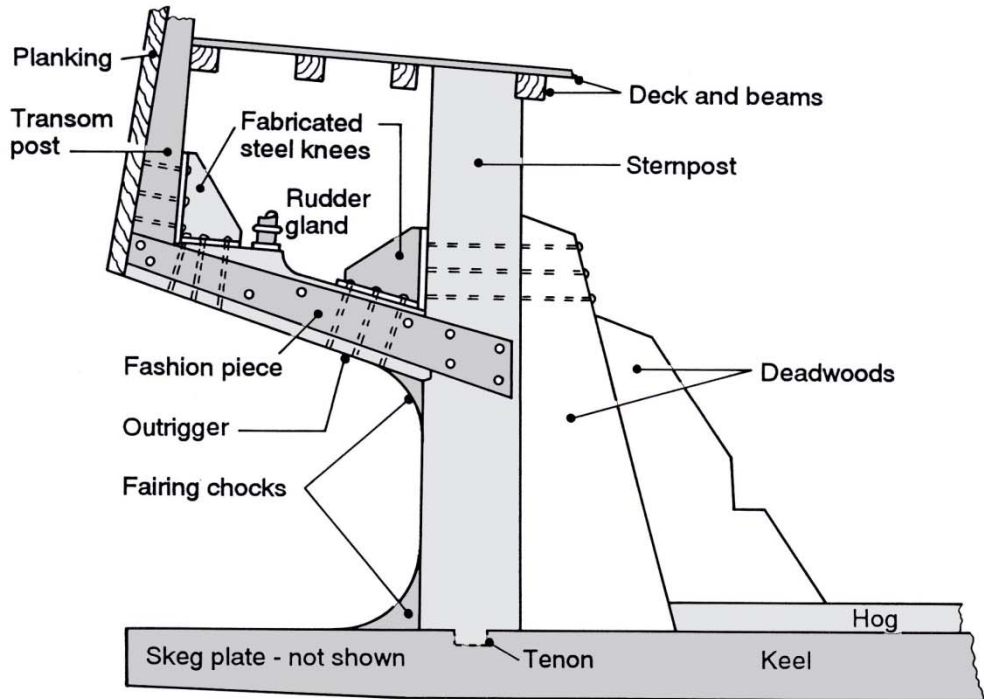
7.36.7 Alternative main frame construction



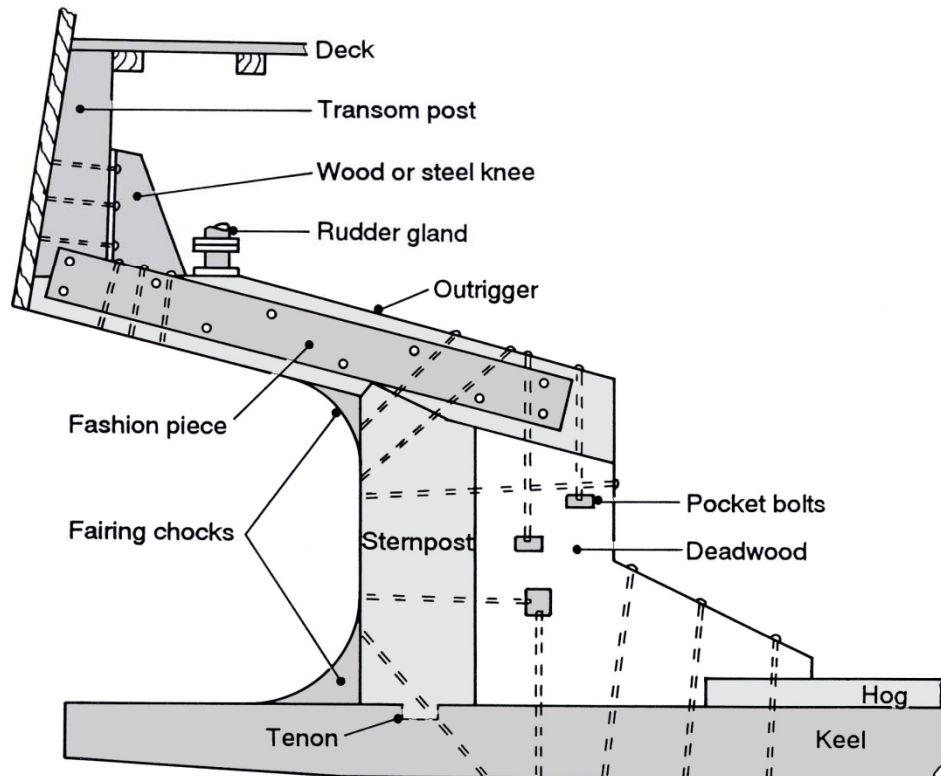
7.36 Figures and illustrations

7.36.8 Transom arrangements

AFT SECTION SHOWING TRANSOM ARRANGEMENT WITH THROUGH STERNPOST

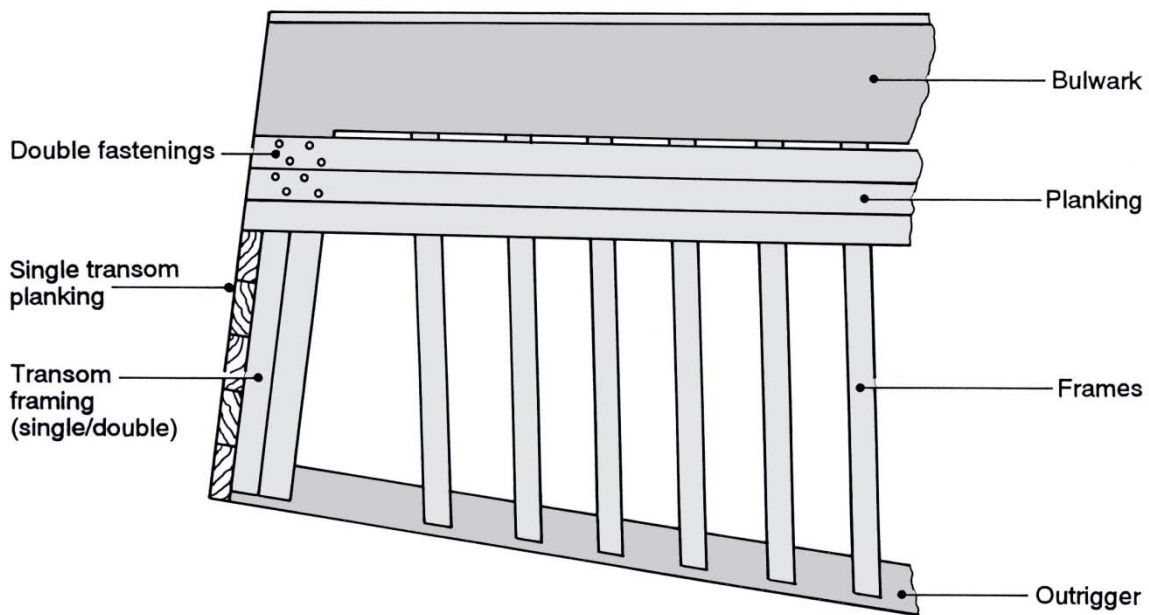
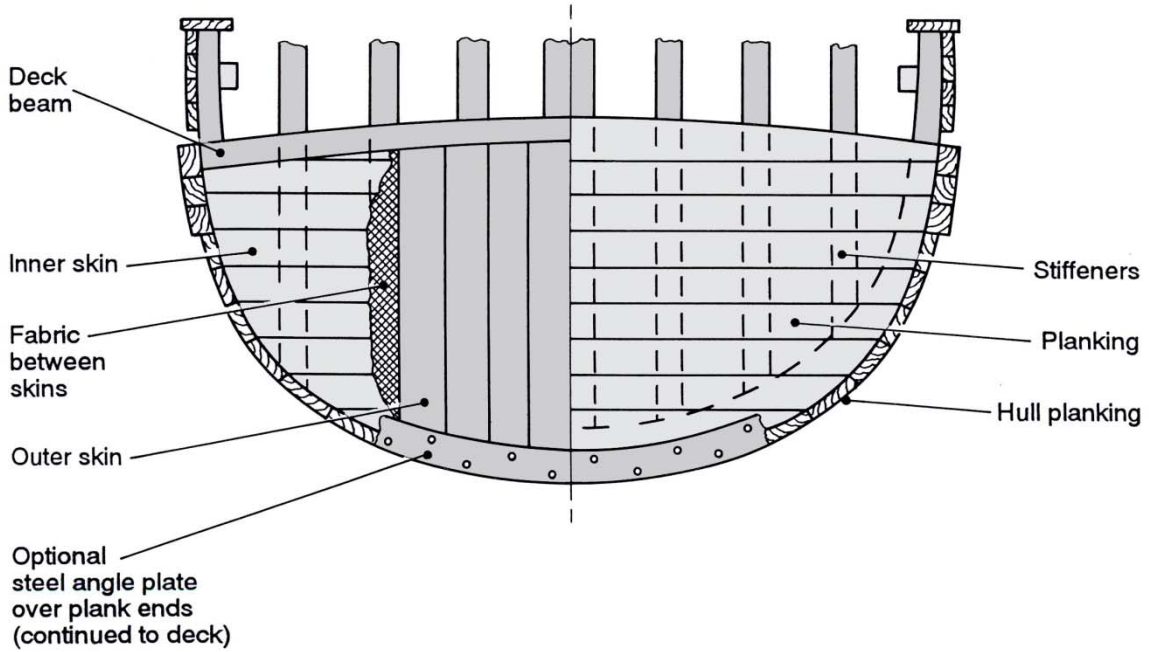


AFT SECTION SHOWING TRANSOM ARRANGEMENT WITH SHORT STERNPOST



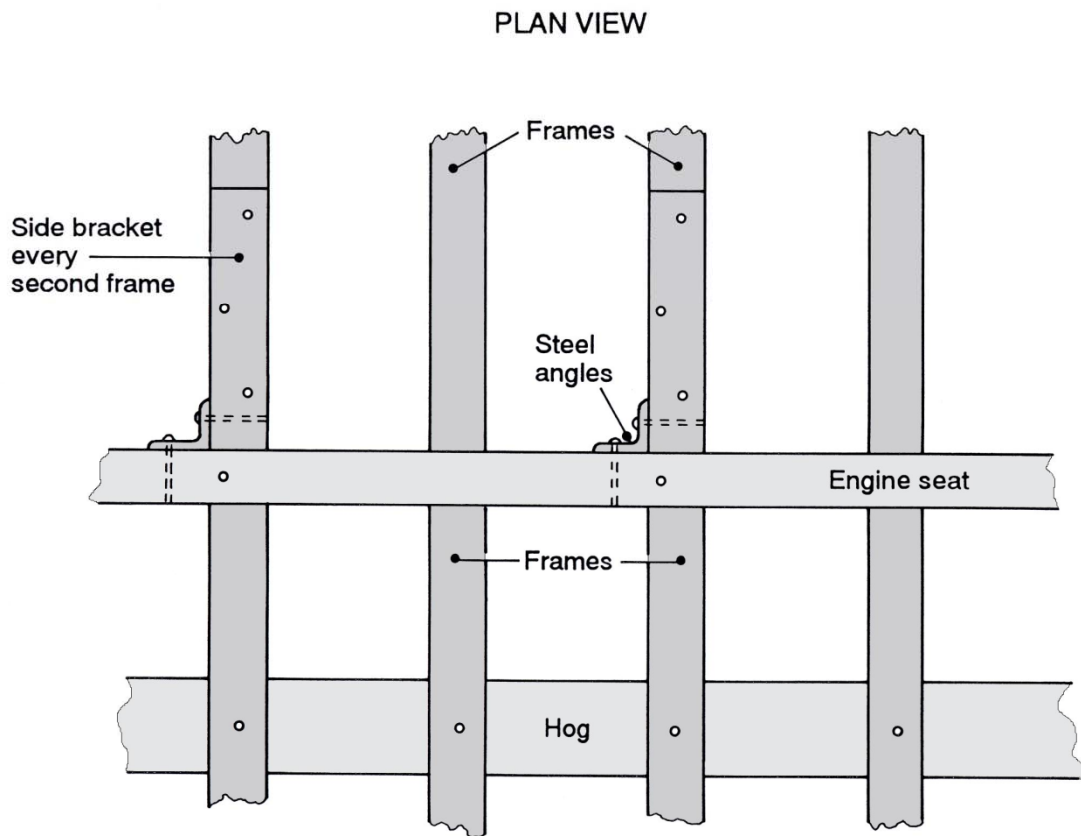
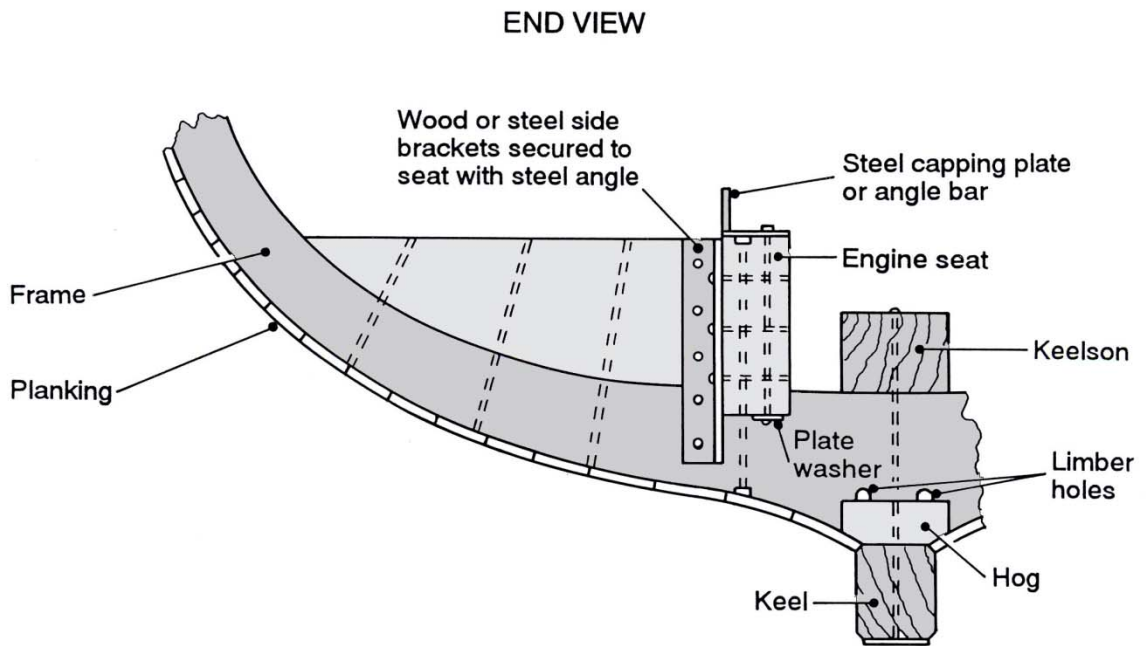
7.36 Figures and illustrations

7.36.9 Transom construction



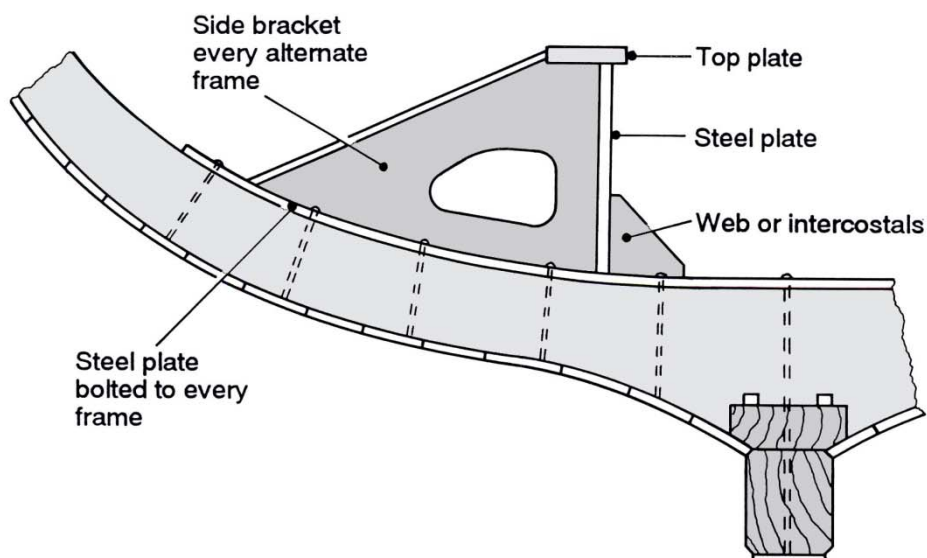
7.36 Figures and illustrations

7.36.10 Engine seat construction

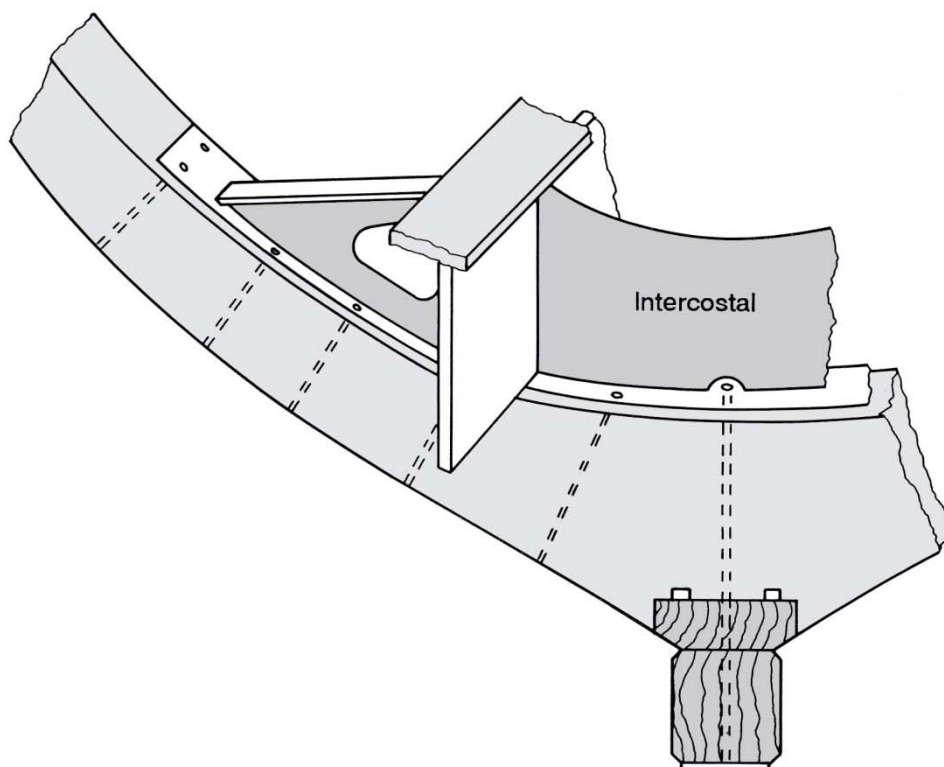


7.36 Figures and illustrations

7.36.11 Steel engine seat construction – wood vessels

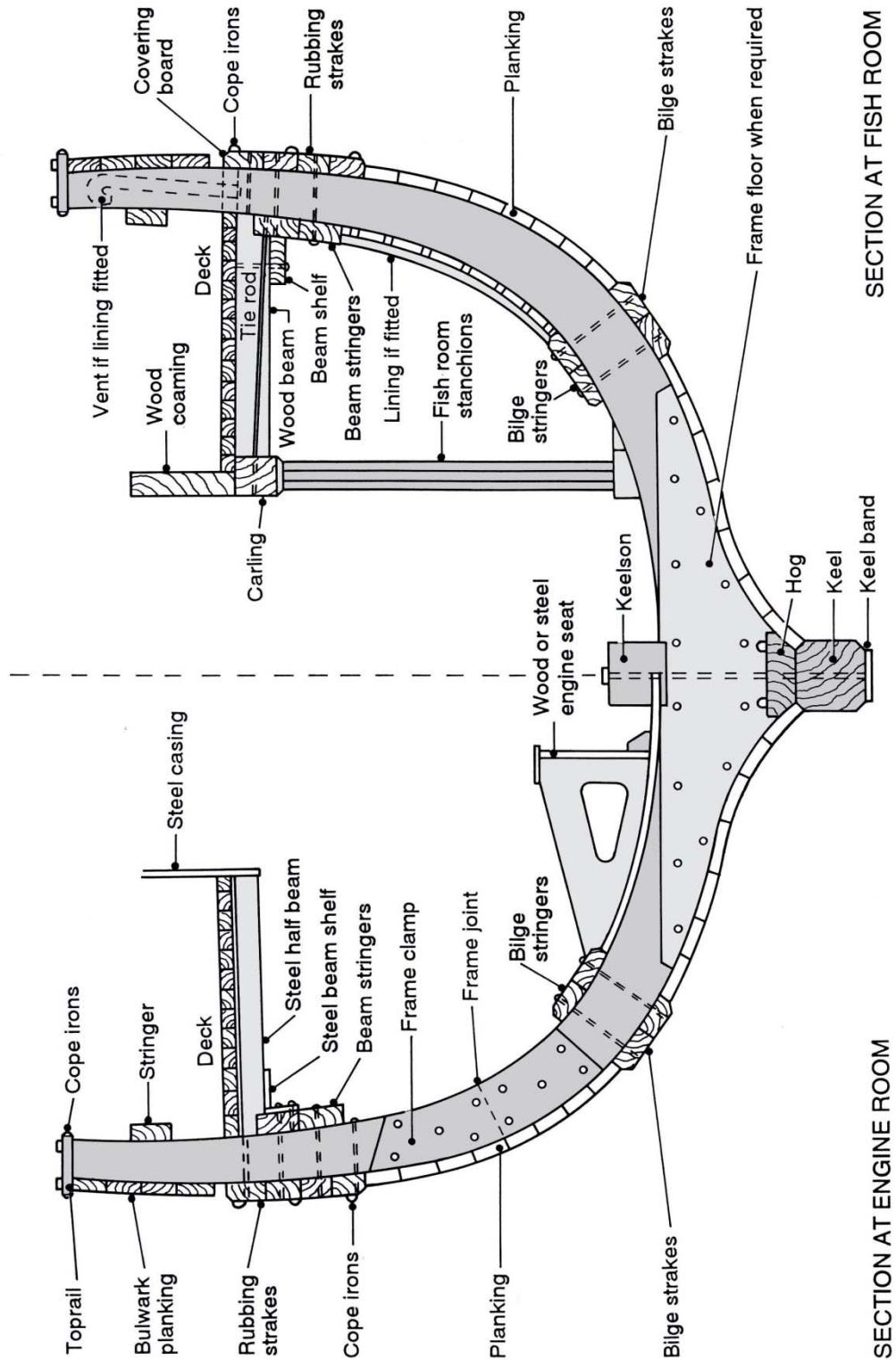


ISOMETRIC VIEW OF TOP DIAGRAM
BUT SHOWING INTERCOSTAL



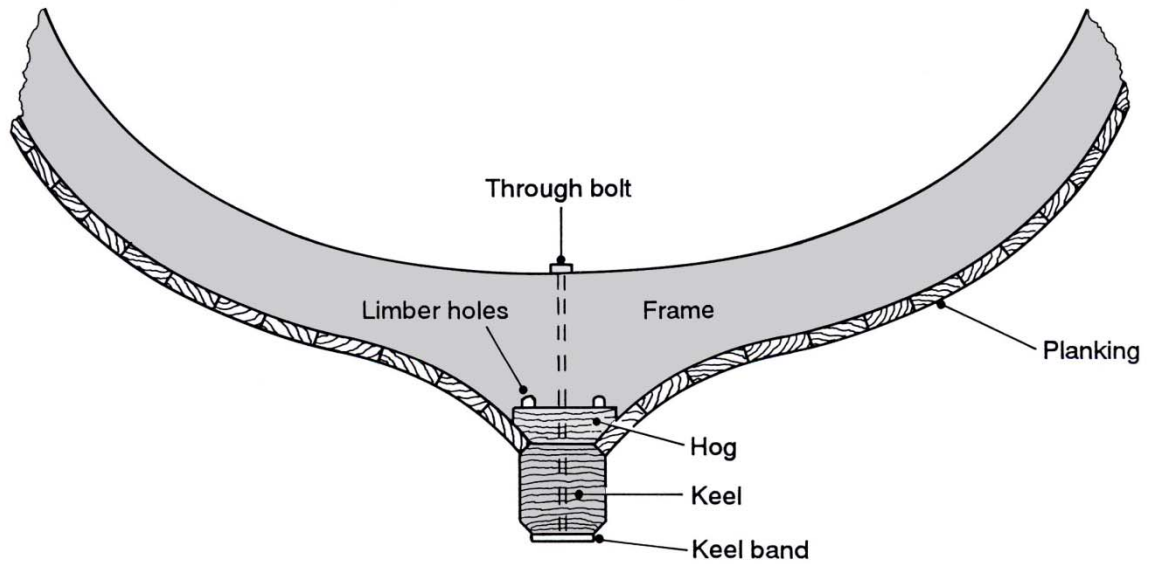
7.36 Figures and illustrations

7.36.12 Midship section – wood vessels

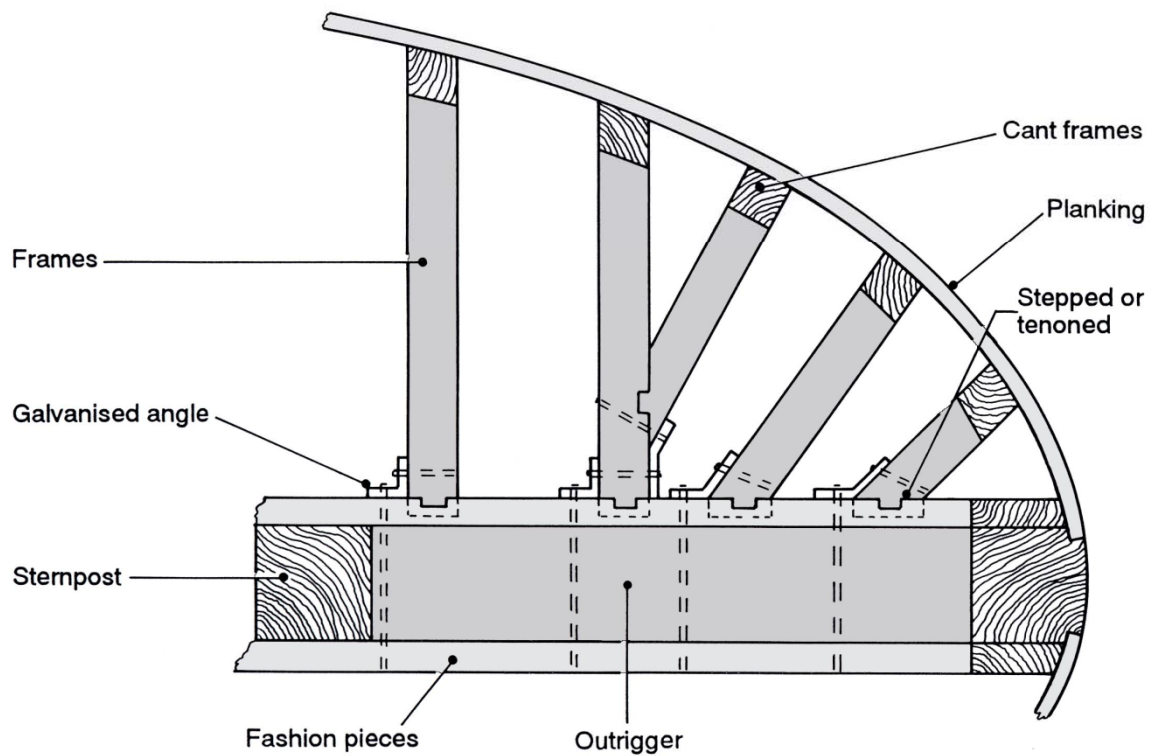


7.36 Figures and illustrations

7.36.13 Keel and hog section/cant frames

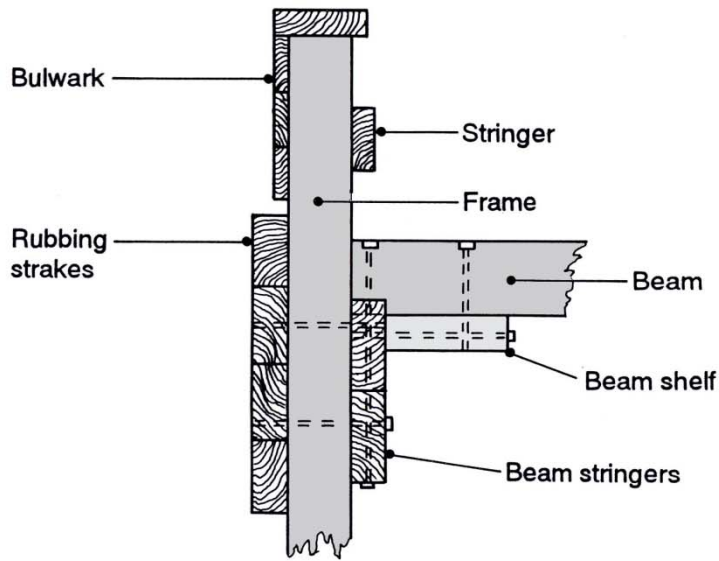


CANT FRAMES CRUISER TYPE STERN

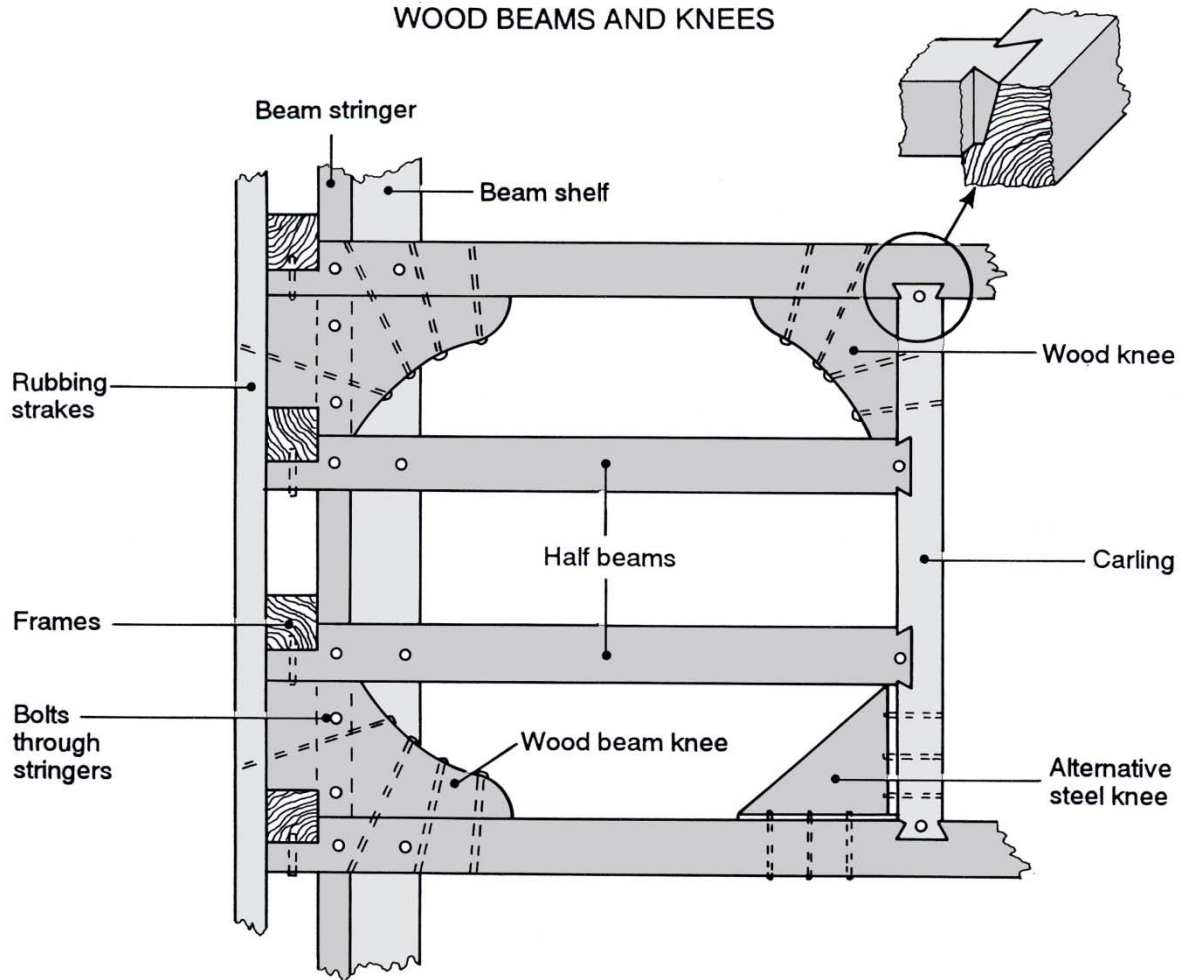


7.36 Figures and illustrations

7.36.14 Wooden beams and beam shelf

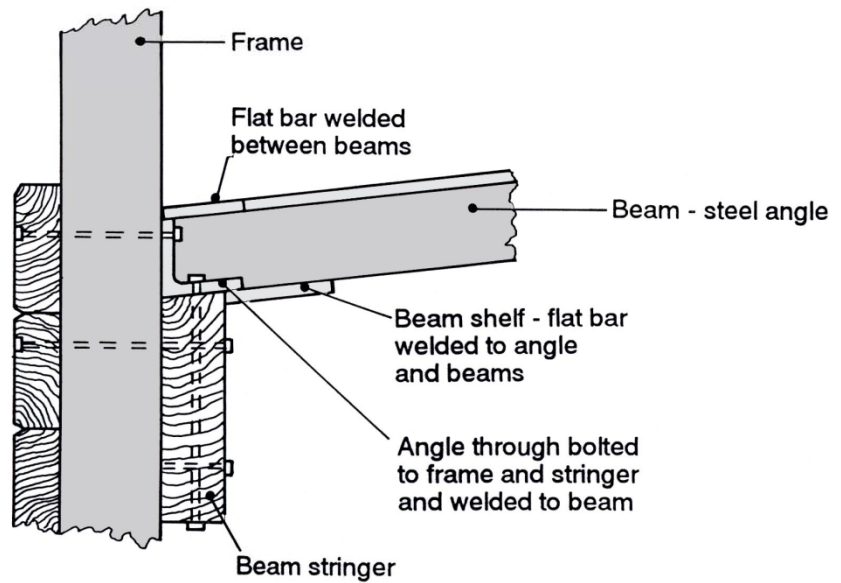
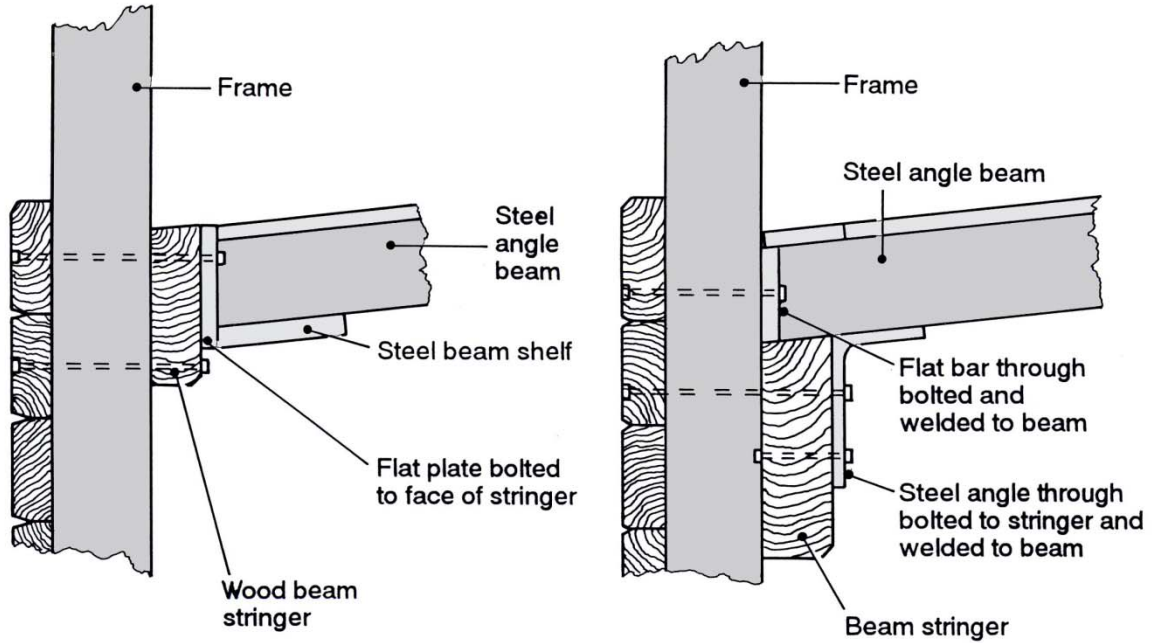


WOOD BEAMS AND KNEES



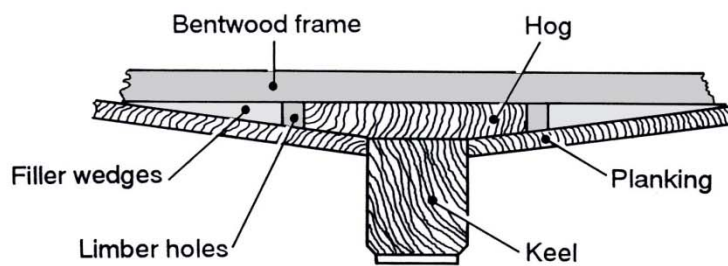
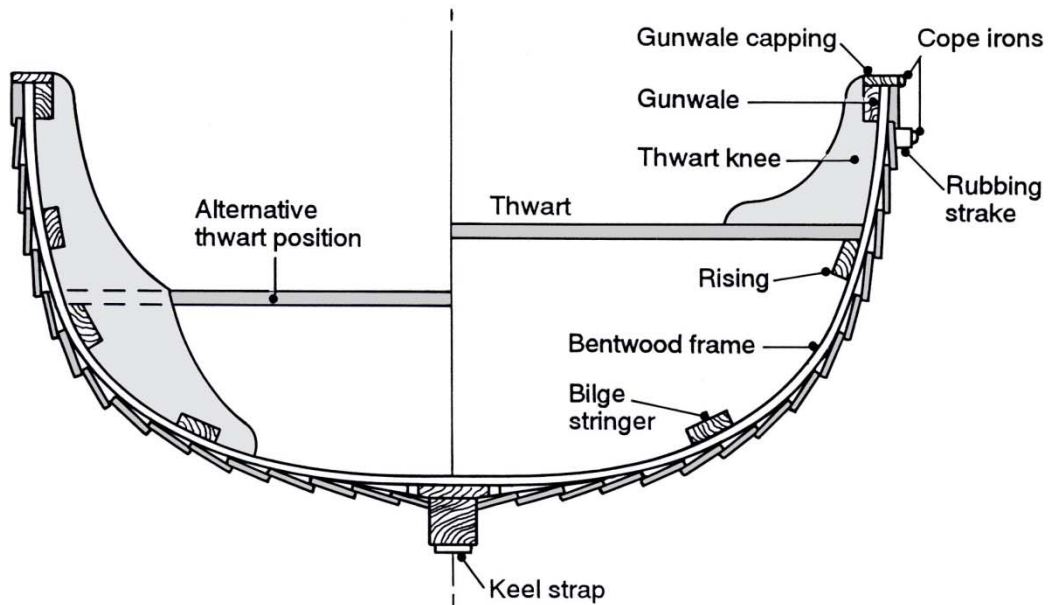
7.36 Figures and illustrations

7.36.15 Steel beams construction – wood vessels



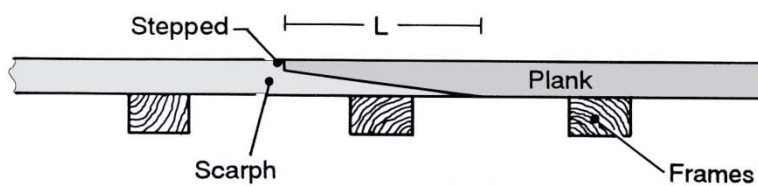
7.36 Figures and illustrations

7.36.16 Clinker construction



SECTION AT KEEL

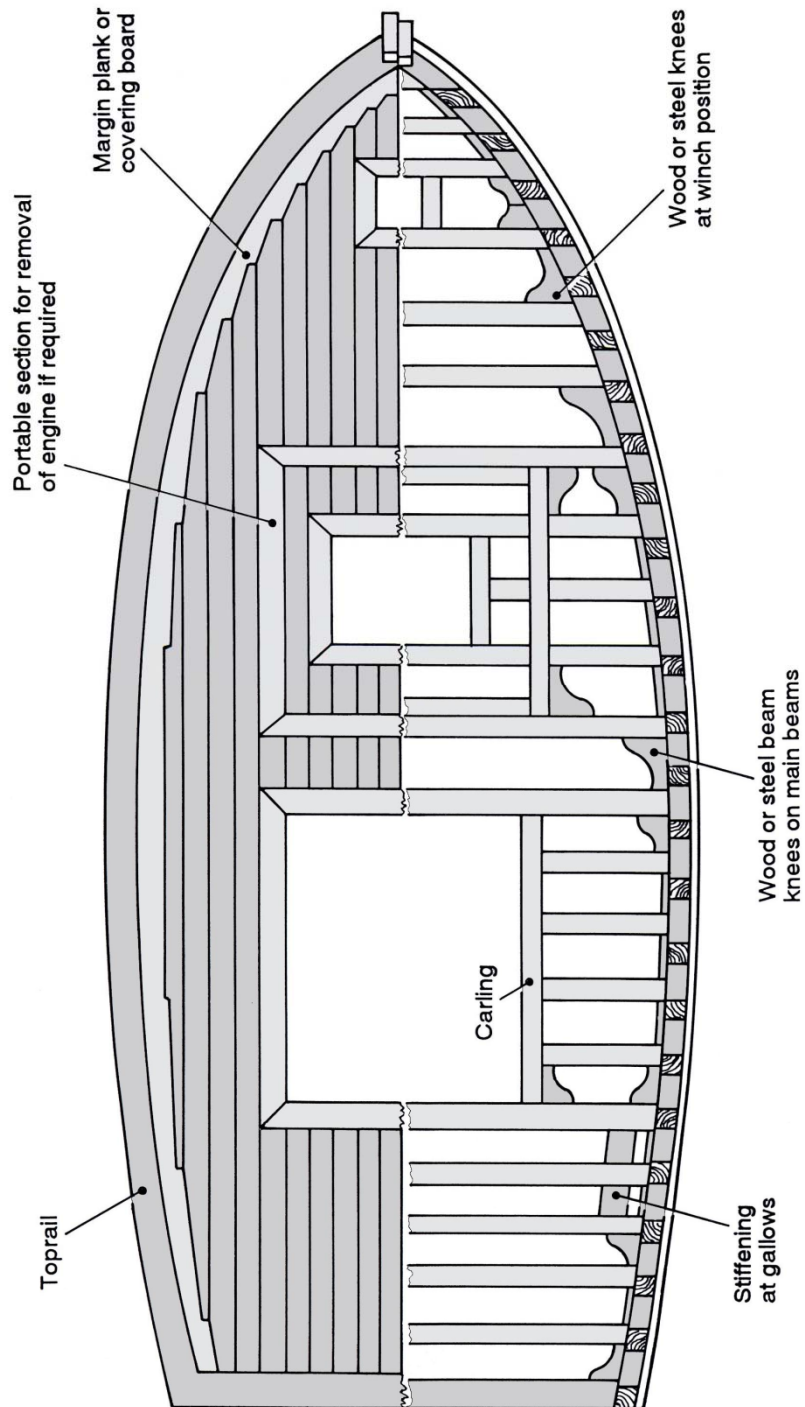
PLANK SCARP



Length L = 6.5 plank thickness

7.36 Figures and illustrations

7.36.17 Deck and beam construction



7.36 Figures and illustrations

7.36.18 Steel beam/carling connection

