Fishing Vessel Construction and Outfit Standards

Less than 15m LOA

IMPORTANT NOTE

These Construction Standards define minimum Fishing Vessel Construction standards for the construction, inspection and certification of the hull, and outfit of small commercial fishing vessels. Particular attention is drawn to Part 1 of these Standards with regard to the definition and scope of MCA certification of any new vessel.

In addition, Designers, Builders, Operators and Owners should ensure that they comply with the relevant Code of Practice for the Safety of Small Fishing Vessels of less than 15 Metres in Length and also such International Convention requirements as may be applicable.

Introduction

These Construction Standards can be used as guidance to anyone wishing to build a new vessel, but only MCA or a Fishing Vessel Certifying Authority can certify a new vessel to these Standards.

All Plan and Drawing Approvals are conducted by the MCA. See Section 23 Drawings, Markings and Trials. Furthermore, only MCA can survey vessels of 12m Registered Length and over.

Fishing vessels of less than 12m Registered Length can be surveyed by a Fishing Vessel Certifying Authority which has a signed and valid a Fishing Vessel Certifying Authority Agreement with the MCA.

These Standards were originally developed by the Marine Survey Department of the Sea Fish Industry Authority (Seafish) through close consultation between the MCA, (Maritime and Coastguard Agency, an Executive Agency of the Department of Transport), Specialist Marine Equipment Manufacturers, Fishing Vessel Builders, and Fishing Industry Representatives, under the direction of a Standards Review Committee on which the following organisations were represented:-

Shipbuilders and Shiprepairers Association
Maritime and Coastguard Agency
National Federation of Fishermen's Organisations
Northern Ireland Fishermen's Federation
Scottish Fishermen's Federation

These Standards will now be reviewed by the Fishing Vessel Construction Standards Working Group at intervals not exceeding five years to take into account experience gained in their application, and any new statutory requirements will be applied to new vessels as applicable to these Standards.

Where new standards are developed and finalised by the Maritime and Coastguard Agency (MCA), European Union (EU), the International Maritime Organisation (IMO), International Standards Organisation (ISO) or British Standards (BS) which impact upon the requirements of these Standards, amendment may be considered immediately and implemented by means of a Marine Information Note (MIN).

How you can contact us

Plan Approval Process

Before building a vessel, drawing approval is required for the vessel intended to be built. If you are building a one-off vessel an Application for Survey and Inspection of Ships and Fishing Vessels (form MSF 5100) and Additional Information (form MSF 1356) should be submitted to the Marine Office closest to where the vessel is to be built. A list of Marine Offices can be found on the following link:

https://www.gov.uk/government/organisations/maritime-and-coastguard-agency/about/access-and-opening

If you would like the drawing approval to be dealt with separately, such as when multiple boats are to be built from the same set of drawings, then please clearly indicate this on the Additional Information form MSF 1356. The application should then be sent to:

MCA Plan Approval Unit
Albex House
1 Marchfield Drive
Paisley
Renfrewshire
PA3 2RB

Alternatively, applications and drawings can be submitted electronically to: stability.unit@mcga.gov.uk

On receipt of the Application and additional information a lead surveyor will be nominated by the Marine Office or Plan Approval Unit. Once nominated, an estimate of fees will be provided.

Construction Process

Addresses, telephone numbers (including those with twenty-four hour answering machines) and emails for all our Marine Survey offices are given below.

Marine and fishing survey offices

Aberdeen fishing survey office

Marine House
Blaikies Quay
Aberdeen
AB11 5EZ

Fishing survey office phone 020 381 72001
Fishing survey office fax 01224 573 725
Email: MOAberdeen@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Belfast fishing survey office

Bregenz House
Quay Street
Bangor
BT20 5ED

Fishing survey office phone: 020 381 72012
Email: MOBelfast@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Cardiff marine office

Anchor Court
Keen Road
Cardiff
CF24 5JW

Marine office phone: 020 390 85220
Marine office fax: 02920 448 820
Email: MOCardiff@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Colchester marine office

Iceni Way
Colchester
Essex
CO2 9BY

Email MOColchester@mcga.gov.uk
Marine office phone: 020 390 85165

Public Counter Services:
Monday to Thursday: 09:00 – 16:00
Friday: 09:00 – 15:30
Telephone Queries:
Monday to Thursday: 09:00 – 17:00
Friday: 09:00 – 16:30

Dover marine office

Eastern Region
Langdon Battery
Swingate
Dover
Kent
CT15 5NA

Marine office phone: 020 381 72789
Email: MODover@mcga.gov.uk

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Falmouth marine office

Pendennis Point
Castle Drive
Falmouth
Cornwall
TR11 4WZ

Marine office phone: 020 381 72652
Email: MOFalmouth@mcga.gov.uk

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Glasgow fishing survey office

1st Floor, West Point
West Point Business Park
1 Marchfield Drive
Paisley, PA3 2RB

Fishing survey office phone: 020 381 72011
Fishing survey office fax: 0141 842 1258
Email: MOGlasgow@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Hull fishing office

Crosskill House
Mill Lane
Beverley
North Humberside
HU17 9JB

Fishing survey office phone: 020 381 72018
Fishing survey office fax: 01482 869 989
Email: MOBeverley@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Liverpool fishing survey office

Hall Road West
Crosby
Liverpool
Merseyside
L23 8SY

Fishing survey office phone: 020 390 85110
Fishing survey office fax: 0151 931 6615
Email: MOLiverpool@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Milford Haven marine office

Gorsewood Drive
Hakin
Milford Haven
Pembrokeshire
SA73 3HB

Marine office phone: 020 381 72007
Marine office fax: 01646 699 606
Email: MOMilfordhaven@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Plymouth Marine Office

Suite 5
Endeavour House
Oceansgate
Vivid Approach
Plymouth
PL1 4RW

Emailmcaplymouthadmin@mcga.gov.uk
Marine office phone: 020 390 85245

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Southampton marine office

Spring Place
105 Commercial Road
Southampton
SO15 1EG

Marine office phone: 020 381 72210
Marine office fax: 02380 329 351
Email: MOSouthampton@mcga.gov.uk

Counter services:
Monday to Thursday – 09:00 – 16:00
Friday – 09:00 – 15:30

Telephone query time:
Monday – Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Tyne Marine Office

Exam Centre

MCA North East Exam Centre
C/o South Tyneside College
St Georges Avenue
South Shields
NE34 6ET

Exam centre phone: 0203 81 72016
Email: MOTyne@mcga.gov.uk

Telephone query time:
Monday-Thursday 09:00 – 17:00
Friday 09:00 – 16:30

Complaints

If you have a complaint then please see

https://www.gov.uk/government/organisations/maritime-and-coastguard-agency/about/complaints-procedure

CONSTRUCTION STANDARDS for new fishing vessels less than 15 metres length overall

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PART 1

GENERAL REQUIREMENTS

PART 1

GENERAL REQUIREMENTS

SECTION SUBJECT

GENERAL REQUIREMENTS

Section 1.1 - Standards

1.1.1 These Construction Standards, hereinafter called **"Fishing Vessel Construction Standards"** or **"Standards"**, apply to the construction of any new commercial fishing vessel of less than 15m length overall (LOA), for which certification of compliance with the Standards is required.

1.1.2 Tables found in Parts 4, 6 and 7 are for the construction of hulls of a displacement design. For fast planing and high speed hulls, details are to be submitted for consideration.

1.1.3 Where building yards have developed and produced standard designs of vessels, alternative scantlings, and/or working practices, these may be specially considered in relation to these Standards, upon submission of full details.

1.1.4 Vessels are to conform to these Standards, and be completed in accordance with the specification. Any variations to the arrangement, scantlings, materials, or equipment used in the construction of the vessel that may alter the content of the original undertaking, are to be notified to MCA and Fishing Vessel Certifying Authority (FVCA) for consideration and shall be at least equivalent to the requirements, prior to the proposed variation being carried out. Approval must be obtained using MSF 1261.

1.1.5 It is the responsibility of the Builder, main Contractor or, (in case of Owner completion) the Owner for the quality of workmanship throughout the vessel, which should be in accordance with best practice and to good marine standards.

1.1.6 The Surveyor is to confirm and approve compliance with these Standards. Quality control procedures are the responsibility of the Builder/Owner.

1.1.7 The Builder of any new vessel is to ensure that the completed structure, machinery, equipment, and outfit, will provide the strength and service for the safe operation of the vessel in all operating conditions likely to be met in the vessel's area of operation.

1.1.8 Fishing vessels of unusual form and dimensions or those that may be designed as high speed planing hulls require further details to be submitted for approval.

1.1.9 Compliance with these Standards does not relieve the Designer or Builder of a vessel of their responsibilities to the Owner for the specification requirements or performance of the completed vessel.

1.1.10 The Builder is to allow the Surveyor full access to facilities during normal working hours to carry out their duties in surveying for compliance with these Standards.

1.1.11 These Construction Standards may be used for guidance during the repair of fishing vessels.

1.1.12 MCA or the FVCA may refuse the inspection and survey of any vessel that is considered to be not suitably covered by the scope of these Standards. **The MCA will not supply a service until application and requested funds have been received.**

1.1.13 A unique MCA CM file reference number (for tracking of correspondence) will be provided along with the estimate of fees. This number must be used in all correspondence.

1.1.14 Where an Owner undertakes the completion and fit out of a new vessel, the Owner will be considered as assuming full responsibility for this work. This responsibility also includes the work and design by any Subcontractors that may be appointed to assist in completing the vessel. In such cases it is the Owner's responsibility to ensure that all parties involved are familiar with the requirements of these Standards and any other mandatory requirements that are necessary to complete the vessel.

Section 1.2: Applicable Rules

1.2.1 All vessels are to fully comply with any statutory requirements, current at the time of their construction and with MCA code of practice relevant to the size and type of vessel.

1.2.2 For a vessel in a series of identical vessels under construction to the class of, or of a design previously approved by another administration or classification society, MCA may accept the design approved by that organisation provided a review by MCA has demonstrated that the design in principle meets the safety and reliability level of MCA's rule requirements.

1.2.3 Where requirements from international maritime conventions have been adopted in MCA's rules, compliance with these requirements is

Section 1.3 - Compliance procedures and certification

1.3.1 It is the responsibility of the Builder/Owner of a new vessel to be constructed to these Standards to inform the MCA and in the case of vessels of less than 12m RL, a designated FVCA of the intention to build and register the vessel.

1.3.2 Builders and owners must ensure they are aware of the structure to be included in the length overall. It is advised liaising with the Lead Surveyor if you have any doubts. Of particular note, pods and brackets for the attachment of outboard engines are usually included. A copy of MCA guidance can be found :

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/652359/MSIS27_Chapter_1_Annex_3_Rev_1017.pdf

1.3.3 Where a vessel is to be constructed and certified to these Standards, the Builder/Owner is to inform MCA, and in the case of vessels of less than 12m RL, an FVCA, of the intention to build a new vessel, and is to provide the following information after application for survey:-

(i) Dimensions and power;
(ii) Intended use (method of fishing);
(iii) Number of crew;
(iv) Construction material;
(v) Estimated design speed;
(vi) Area of operation;
(vii) Place of build (hull);
(viii) Place of outfit (where differing from build location);
(ix) Proposed date of commencement of construction;
(x) Proposed date of completion of vessel.
(See also Part 2, Paragraph 2.1.1)

Wood and Composite Materials

1.3.4 The following documentation from the builder or designer (workshop and yard) and from subcontractors shall be submitted when requested by MCA or FVCA (for vessels of less than 12m RL):

- information related to the builder’s or designer’s quality control and quality management system
- information related to the builder's procedures for managing materials that are excluded from use on board by statutory and/ or class requirements

All Vessels

1.3.5 For all vessels, the following documentation is also required:

- an “Asbestos Free Declaration”, including structures and equipment on board (required for Steel vessels aswell)
- list of relevant subcontractors to the building yard
- list of relevant subcontractors to the manufacturer of systems and components to be delivered for the product, if applicable.

1.3.6 To assess compliance with the rules MCA may require additional documentation.

1.3.7 Documents to submit upon completion of the vessel by the builder:

1. MCA environment/material data sheets (MSF 1361) – GRP Vessels only

2. MCA, or other tank pressure testing certificate[1] (MSF 1364) – All vessels 7m LOA and over

3. MCA electrical completion certificate (MSF 1363) – All vessels 7m LOA and over

4. Gas certificate, supplied and signed off by a marine certified gas technician – All vessels 7m LOA and over (where applicable)

5. MCA Declaration of Welding Operators Competency form (MSF 1362) (steel and aluminium vessels)

6. Mill certificates for hull plating and main structural members – Steel and aluminium vessels only

7. MCA Hydraulic Completion Certificate (MSF1369) – Al vessels over 7m LOA and over

1.3.8 Documents 1 to 5 in 1.3.7 above will not be accepted unless signed and dated by the relevant person.

1.3.9 All the above documents are to be submitted to the lead surveyor.

[1] At the discretion of MCA, where tanks are stamped by the manufacturer to a recognised standard (CE/ISO) then this may be acceptable in lieu of a test certificate.

1.3.10 Upon completion of a vessel built and surveyed in compliance with these Standards, MCA or the FVCA will issue a certificate in accordance with Paragraph 1.3.12.

1.3.11 Construction standard compliance certification will not be issued where the Surveyor has not inspected the vessel to their satisfaction during the construction period, or if fees and documents are still outstanding.

1.3.12 Categories of certification

Vessel length	Certification requirement
0 to <7m LOA	Hull Construction (MSF1367)
7m LOA to <12m RL[2]	Hull Construction (MSF1367) & Outfit Compliance (MSF1368)
12m RL to <15m LOA	Partial Declaration (MSF1326)

1.3.13 Certificates attesting the vessel has been constructed to meet with the requirements contained in these Standards, including all documentation to facilitate registration of the vessel will be issued upon completion.

Section 1.4 - Registration

1.4.1 The Owner should take all steps necessary to effect registration of the vessel by contacting the Registry of Shipping and Seamen.

Section 1.5 - Building premises

1.5.1 Building premises are to be suitable for the particular construction material proposed, and are to be in accordance with the requirements of these Standards, where applicable.

1.5.2 Separate locations may be approved for the construction of the hull and the fitting out of the vessel. When a hull is to be transported for fitting out and completion elsewhere, the construction is to be progressed to a stage commensurate with the method of transport to be used. When a partially completed vessel is to be towed or propelled afloat, the Builders should ensure that the vessel's stability and weathertightness is adequate prior to removal from the Builder's yard. Advice is to be sought by the Builder/Owner from the MCA when towing by sea.

[2] RL – Registered Length

1.5.3 For a hull of GRP construction, hull certification will only be issued where the Moulders of the hull also fit the internal framing and stiffeners to bare hull assemblies to ensure correct bonding and maintenance of adequate rigidity and shape for onward transportation. Certification of mono-hulls without decks fitted will only be considered on the basis as described above. Catamarans must be completed with the bridge deck structure completed by the Moulders.

1.6 Survey During Construction

1.6.1 Attending surveyors will verify:

- that the construction and scantlings comply with the Construction Standard requirements and the approved plans, and that the required materials are being used,
- that the materials, components and systems have been certified in accordance with the Construction Standards (or an alternative as agreed prior to construction with MCA)
- that the work is carried out in compliance with the Construction Standards.
- that satisfactory tests are carried out to the extent and in the manner prescribed by the Construction Standards.

1.6.2 MCA or FVCA (for vessels of less than 12m RL) may increase the scope based on observed quality during construction.

1.6.3 MCA or FVCA (for vessels of less than 12m RL) may base its verification methods on the quality system (such as ISO 9001 etc.) as implemented in the builder's fabrication processes and as accepted by MCA or FVCA (for vessels of less than 12m RL). The surveys at the builder's premises may consist of a combination of visual inspection, tests, measurements and review of records.

1.6.4 Two weeks' notice should be given to the lead surveyor by the builder/outfitter during construction, in order to ensure that a surveyor is available to attend. A notice period less than two weeks may not guarantee a surveyor is available to attend.

1.6.5 It is the builder's responsibility to inform the lead surveyor when the vessel is ready for an inspection. If the vessel is found to be not at the required stage, then a further inspection may be required with associated additional costs. Any vessel found to be beyond the early

framing stage or other agreed stage for the first inspection (vessels 7m LOA and over) may result in refusal of certification.

Section 1.7 - Testing of structures

1.7.1 Where applicable, weathertight and watertight structures including sub-divisions are to be tested in accordance with these Standards and to any other statutory requirements.

1.7.2 Freshwater, ballast, oil fuel, and other tanks, void spaces and collision bulkheads should be either water or air pressure tested at the discretion of MCA or the Fishing Vessel Certifying Authority.

1.7.3 Where water tested, the head in integral tanks is to be not less than 2.4m above the tank top or to the overflow point whichever is the greater.

1.7.4 Where tested by air pressure, the test pressure is to be no greater than 0.2kg/cm^2 (2.85 psi).

1.7.5 Fish stowage tanks and vivier tanks are to be tested by filling with water to overflow level.

1.7.6 Radiographic or ultrasonic examination may be required for welded structures or components. Where other means of non-destructive testing are being considered, details are to be submitted to the Surveyor for prior approval.

1.7.7 Weathertight/watertight hatches, doors and windows should be hose tested on completion.

Section 1.8 - Materials

1.8.1 All materials used in the construction of a new vessel are to be in accordance with the approved specification.

1.8.2 The specification of steel, aluminium, wood and GRP materials is to be in accordance with the requirements of the appropriate sections of these Standards.

1.8.3 When selecting materials and equipment to be used in the vessel construction, Designers and Builders of new vessels will need to pay special regard to the working conditions to which the vessel will be subjected, and should take all measures to ensure that any material or appliance fitted in accordance with the requirements of these Standards is suitable for the purpose intended, having regard to its

location in the vessel, the area of operation, and the weather conditions which may be encountered by the vessel.

1.8.4 The Commission of the European Union's general mutual recognition clause should be noted. The clause states:-

Any requirement for goods or materials to comply with a specified standard shall be satisfied by compliance with

(i) a relevant standard or code of practice of a national standards body or equivalent body of a Member State of the European Community; or

(ii) any relevant international standard or code of practice of a national standards body or equivalent body of a Member State of the European Community; or

(iii) a relevant specification acknowledged for use as a standard by a public authority of any Member State of the European Community; or

(iv) traditional procedures of manufacture of a Member State of the European Community where these are the subject of a written technical description sufficiently detailed to permit the assessment of the goods or materials for the use specified; or

(v) a specification sufficiently detailed to permit assessment for goods or materials of an innovative nature (or subject to innovative processes of a manufacture such that they cannot comply with a recognised standard or specification) and which fulfil the purpose provided by the specified standard.

provided that the proposed standard, code of practice, specification or technical description provides, in use, equivalent levels of safety, suitability and fitness for purpose.

1.8.5 Where the phrase "or equivalent" is used in these Standards, details of the standard applied are to be advised to MCA.

Section 1.9 - Stability general

1.9.1 It is the responsibility of Owners and Skippers under safety legislation to use all reasonable means to ensure fishing vessels go to sea in a seaworthy state. Adequate stability and freeboard contribute greatly to a vessel's seaworthiness and survival capabilities in extreme conditions.

1.9.2 Information gathered from casualties to small fishing vessels shows that, in many cases, insufficient attention has been given to matters of

stability and freeboard, and this can be avoided if care is taken to ensure that a vessel is suitable for its intended mode of fishing and the area in which it will operate.

1.9.3 For any new vessel, stability should be properly assessed by a person having appropriate professional experience. Alterations of more than a minor nature should not be made to fishing gear, structure or ballast without first checking to confirm that the vessel's stability characteristics and freeboard are not reduced below acceptable standards.

1.9.4 It is the Builder and/or Owners responsibility that any statutory stability criteria and associated requirements have been complied with for the completed vessel.

Section 1.10 - Definitions

In these Standards the following expressions have the following meanings:-

1.10.1 **"Accommodation space"** means corridors and lobbies, stairways, lavatories, cabin offices, crew spaces, pantries not containing cooking appliances, and spaces similar to any of the foregoing and trunks to such spaces.

1.10.2 **"Amidships"** is the mid-length of "Length" as defined in Statutory Instrument 1998 No. 1916 The Merchant Shipping (Tonnage) (Fishing Vessels) (Amendment) Regulations 1998

1.10.3 **" 'B' Class division"** means those divisions formed by bulkheads, decks, ceilings or linings which:-

(i) Are so constructed as to be capable of preventing the passage of flame to the end of the first thirty minutes of the standard fire test;

(ii) Have an insulation value such that during the standard fire test the average temperature of the unexposed side will not rise more than 140°C above its initial temperature. Nor will its temperature at any one point, including any joint, rise more than 225°C above its initial temperature within the time listed below:-

B-30 Standard ..... 30 minutes

B-15 Standard ..... 15 minutes
B- 0 Standard ..... 0 minutes

(ii) Are constructed of suitable non-combustible materials and their supporting members or structures are also constructed of non-combustible materials.

1.10.4 **"Breadth (B)"** is the maximum breadth of the vessel, measured amidships to the moulded line of the frame in a vessel with a metal hull and to the outer surface of the hull or normal planking in a vessel with a hull of any other material.

1.10.5 **"Code"** means the Maritime and Coastguard Agency (MCA) Code of Practice for the applicable vessels size and category.

1.10.6 **"Control station"** are those spaces in which the ships radio or main navigation equipment or the emergency source of power is located, or where the fire recording or fire control equipment is centralised.

1.10.7 **"Dead ship condition"** means the condition in which the main and auxiliary machinery is not operational due to the due to the absence of starting power

1.10.8 **"Deckhouse"** means see "Superstructure" as defined in section 1.9.33.

1.10.9 **"Decked vessel"** means a vessel with a continuous watertight weather deck that extends from stem to stern and has positive freeboard throughout, in any condition of loading the vessel.

1.10.10 **"Deep beams"** means those beams increased in scantlings and fitted in way of openings and those areas of deck on which masts, winch and superstructures are fitted.

1.10.11 **"Depth of vessel (D)"** means the scantling depth as defined for respective materials of construction.

1.10.12 **"Draught"** means the vertical distance from the moulded base line amid-ships to the operating waterline of a vessel.

1.10.13 **"Enclosed superstructure"** means a superstructure with:-

(i) Enclosing bulkheads of efficient construction.

(ii) Access openings, if any, in those bulkheads fitted with permanently attached weathertight doors of a strength

equivalent to the unpierced structure that can be operated from either side.

(iii) Other openings in sides or ends of the superstructure fitted with efficient weathertight means of closing;

(iv) a bridge or poop should not be regarded as enclosed unless access is provided for the crew to reach machinery and other working spaces inside those superstructures by alternative means which are available at all times when bulkhead openings are close.

1.10.14 **"Fishing vessel"** has the same meaning as in Section 313 of the Merchant Shipping Act 1995.

1.10.15 ***"Freeboard"*** means the distance measured vertically downwards from the upper edge of the freeboard deck to the waterline.

1.10.15 **"Hull extension"** is a separately constructed intact section which is full breadth and depth of the area it is permanently fitted to, and follows the design lines of the vessel; this section is included in the length overall of the vessel.

1.10.16 **"Length Between Perpendiculars" (LBP)** is the ITC '69 definition which means 96% of the total length on a waterline of a vessel at 85% of the least moulded depth measured from the top of the keel, or the length from the fore-side of the stem to the axis of the rudder stock on that waterline, if that be greater. In vessels designed with a rake of keel the waterline on which this is measured shall be parallel to the designed waterline. The forward perpendicular and the after perpendicular are positioned at the forward and after ends of LBP respectively.

1.10.17 **"Length" (L)** unless otherwise specified shall refer to the scantling length "L" as defined for respective materials of construction.

1.10.18 **"Length overall" (LOA)** means the overall length measured from the foreside of the foremost permanent fixed structure to the aft side of the aftermost permanent fixed structure of the vessel.

1.10.19 **"Length registered" (RL)** means has the same meaning as length in the Tonnage Regulations {SI 1997 No. 1510 - The Merchant Shipping (Tonnage) Regulations} which has the meaning as "Length between perpendiculars" (LBP);.

1.10.20 **"MCA"** is an abbreviation for Maritime and Coastguard Agency, an Executive Agency of the Department of Transport.

1.10.21 **"Main deck"** means the lowest continuous weathertight deck.

1.10.22 **"Main frames"** are those frames extended from the top of floors or double bottom to the lowest continuous deck abaft of the collision bulkhead and forward of the after peak bulkhead.

1.10.23 **"Moulded depth"** means

(a) the vertical distance measured from the top of the keel to the underside of the upper deck at side. In wood and composite ships the distance is to be measured from the lower edge of the keel rabbet. Where the form at the lower part of the midship section is of a hollow character, or where thick garboards are fitted, the distance is to be measured from the point where the line of the flat of the bottom continued inwards cuts the side of the keel;

(b) in ships having rounded gunwales, the moulded depth shall be measured to the point of intersection of the moulded lines of the deck and side shell plating, the lines extending as though the gunwales were of angular design;

(c) where the upper deck is stepped and the raised part of the deck extends over the point at which the moulded depth is to be determined, the moulded depth shall be measured to a line of reference extending from the lower part of the deck along a line parallel with the raised part;

and for the purposes of this definition,

(i) "upper deck" means the uppermost complete deck exposed to weather and sea, which has permanent means of weather tight closing of all openings in the weather part thereof and below which all openings in the sides of the ship are fitted with permanent means of watertight closing. In a ship having a stepped upper deck, the lowest line of the exposed deck and the continuation of that line parallel to the upper part of the deck is taken as the upper deck; and

(ii) "weather tight" means that in any sea conditions water will not penetrate into the ship

1.10.24 **"Multi-hull vessel"** means any vessel which in any normally achievable operating trim or heel angle, has a rigid hull structure which penetrates the surface of the sea over more than one separate or discrete area.

1.10.25 **"Navigable speed"** means the minimum ahead speed at which the vessel can be effectively steered.

1.10.26 **"Non-combustible material"** means material that neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to a temperature of 750°C, this being determined in accordance with the IMO Fire Test Procedures Code. Any other material is a combustible material;.

1.10.27 **"Open type vessel"** means a vessel where water coming onto the vessel normally drains to the bilge.

1.10.28 **"Pod/Outboard Bracket"** is a fitted hull appendage which is not full breadth or depth of the area it is connected to, and does not follow the design lines of the vessel; but is included in length overall when it is required to be fitted for the normal operation of the vessel.

1.10.29 **"Sea"** means all waters outside a safe haven and "safe haven" means a harbour or shelter of any kind which affords entry, subject to prudence in the weather conditions prevailing, and protection from the forces of weather. Details of categorised waters can be found in MSN 1837 or any superseding MSN;.

1.10.30 **"Shelter deck"** means a superstructure deck above the level of the main weathertight deck and which is exposed to the weather.

1.10.31 **"Sole"** is the flooring in open vessels.

1.10.32 **"Spacing"** means the distance apart of members such as frames, stringers and stiffeners, as defined in the Tables.

1.10.33 ***"Superstructure"*** means the decked structure on the working deck extending from side to side of the vessel or with the side plating not being inboard of the shell plating more than 0.04B

1.10.34 **"Superstructure deck"** means the complete or partial deck or the top of a superstructure, deckhouse or other erection situated at a height of more than 1.8m above the freeboard deck. Where this height is less than 1.8 metres, the top of such deckhouses or other erections shall be treated in the same way as the working deck

1.10.35 **"Surveyor"** refers to either a Surveyor employed by the Maritime and Coastguard Agency (MCA) or by a Fishing Vessel Certifying Authority acting under a signed Agreement with the MCA to undertake specific work on its behalf.

1.10.36 **"Watertight"** in relation to structures and/or fittings means capable of preventing the passage of water through it in either direction, under a head of water for which the surrounding structure is designed.

1.10.37 **"Weather deck"** means deck that is exposed to the elements.

1.10.38 **"Weathertight"** in relation to structures and/or fittings means it is designed to prevent the passage of water into the vessel in any sea condition.

1.10.39 **"Working deck" or "Freeboard deck"** means the lowest complete deck above the deepest operating waterline from which fishing is undertaken. In vessels fitted with two or more complete decks, the lower deck may be accepted as the freeboard deck provided that the deck is situated above the deepest operating waterline.

PART 2

DRAWINGS, MARKINGS AND TRIALS

PART 2

DRAWINGS, MARKINGS AND TRIALS

SECTION SUBJECT

DRAWINGS, MARKINGS AND TRIALS

Section 2.1 - Drawings and specification

2.1.1 Before building a vessel, drawing approval is required for the vessel intended to be built. If you are building a one-off vessel an MSF1356 Notice of Intention to Build should be submitted to the Marine Office closest to where the vessel is to be built. A list of Marine Offices can be found on the following link: https://www.gov.uk/government/organisations/maritime-and-coastguard-agency/about/access-and-opening

2.1.2 When the build has been agreed, a CM Number and estimate, along with a request for payment will be provided and MSF5100 Application for Survey and Inspection of Ships and Fishing Vessels should then be submitted to the Marine Office.

2.1.3 If you would like the drawing approval to be dealt with separately, such as when multiple boats are to be built from the same set of drawings, then please clearly indicate this on the Additional Information form (MSF 1356). The address is –

MCA Stability and Plan Approval Unit
Albex House
1 Marchfield Drive
Paisley
Renfrewshire
PA3 2RB

2.1.4 Alternatively, applications and drawings can be submitted electronically to stability.unit@mcga.gov.uk

2.1.5 On receipt of the Application and additional information a lead surveyor will be nominated by the Marine Office or Stability and Plan Approval Unit. Once nominated, an estimate of fees will be provided.

2.1.6 All The following additional details are to be submitted to MCA for review/approval prior to the commencement of the relevant work:-

2.1.7 The following drawings are required at minimum.

Vessels less than 7m length overall :

- General Arrangement
- Hull Construction drawings
- Welding details (for steel and aluminium vessels)
- GRP laminate schedule, evidence of humidity and temperature control
- corresponding technical descriptions, calculations and data, including material specifications
- outline specification for the vessel

Vessels 7 to 15m Length Overall length :

- General Arrangement
- Lines Plans
- Hull construction drawings, transverse sections and bulkheads
- Superstructure construction drawings, including the wheelhouse
- Welding details (for steel and aluminium vessels)
- Crew accommodation layout
- Water freeing arrangements
- Steering gear and rudder
- Propeller, shaft and bearings
- Bilge pumping
- Electrical layout
- corresponding technical descriptions, calculations and data, including material specifications
- outline specification for the vessel

2.1.8 Drawings may be submitted by post in hard copy format or by email in pdf or AutoCAD dwg format. If sent by post, these should be sent to the nominated Lead Surveyor.

2.1.8 The issue of any certificate of compliance may be affected in the absence of any of the required information, or delay in provision of technical details.

Section 2.2 - Markings

2.2.1 New vessels of 12m RL to 15m LOA should have scales of draft marks permanently and clearly marked in metric units on each side of the vessel at the bow and where they can be easily read at the stern.

2.2.2 Any new vessel constructed and certified to these Standards is to be marked with a CM number assigned by MCA, in accordance with the MCA CM number form.

2.2.3 It is the responsibility of the builder to mark the CM number on the vessel in a plain typeface, clearly legible, with a letter height of at least 10mm. It must be permanently marked by the builder in a clean and visible position to the satisfaction of the attending surveyor.

2.2.4 The number may be:

a. Engraved on a metal plaque with fixings drilled to prevent removal;
b. Moulded to the hull;
c. Carved into part of the structure; or
d. Welded to the structure; or fixed in some similar manner to the approval of the attending surveyor

2.2.5 The attending surveyor will check the marked number as part of the survey process. Certification will not be granted if the number of not marked in the correct manner.

2.2.6 Where a vessel gains MCA or FVCA Certification, the Certificate of Construction will have the same CM number clearly printed on it to identify the vessel and a copy of the Certificate will be supplied to the Owner (as well as RSS where applicable)

2.2.7 Where a vessel does not gain certification, but a number has been issued, records will be kept by MCA to show that the vessel with that CM Number does not have certification. If the vessel has been marked, it will be the builder's responsibility to remove the marking from the boat.

2.2.8 The CM number is provided as a mean of identifying the vessel with corresponding MCA records. It is not an indication the vessel has been certified.

2.2.9 Vessels with operating restrictions as detailed in Part 3, Section 3.9 are to be fitted with a notice visible at the helm position stating the limited area of operation.

Section 2.3 – Trials and Testing

2.3.1 Systems and equipment to be installed on new buildings and that serves as a part of the main functions shall in general be new[1].

2.3.2 Upon completion and where appropriate to the size of the vessel A test programme for harbour and sea trials shall be prepared by the builder and customer and accepted by MCA or FVCA to ensure systems function correctly. The programme shall specify systems and components to be tested, and the testing procedure. MCA or FVCA may, in order to verify compliance, request additional tests and/or data to be recorded.

2.3.3 The trials should include a period of not less than two hours with the propulsion machinery running under continuous load, with the inclusion of a short full load test.

2.3.4 Where specified by the Construction Standards, testing shall be carried out in the presence of a surveyor, and related requirements for test programmes shall be observed.

[1] If second-hand equipment complies with applicable rules for the newbuilding, it may upon special consideration be installed on new buildings, provided the owner has given a written acceptance.

2.3.5 The tests shall give evidence as to satisfactory operation and performance in accordance with the Construction Standards. When testing control and safety systems, failure modes shall be simulated as realistically as possible.

2.3.6 Safety equipment is to be installed as per the requirements of the relevant code of practice.

PART 3

WATERTIGHT AND WEATHERTIGHT INTEGRITY

PART 3

WATERTIGHT AND WEATHERTIGHT

INTEGRITY

SECTION SUBJECT

WATERTIGHT AND WEATHERTIGHT INTEGRITY

Section 3.1 - Doors, hatchways, and coamings

3.1.1 All openings through which water may enter and endanger the vessel should be kept to a minimum and be provided with effective closing arrangements.

3.1.2 Weathertight doors and hatch covers should be of efficient construction, adequately framed, and fitted with gaskets and securing arrangements.

3.1.3 Entrance doors to deckhouses and other superstructures giving access to openings in the working deck should be constructed weathertight.

3.1.4 Doorways giving direct access to spaces located below the working deck are to be fitted with a permanent coaming 300mm in height above the deck. Doorways should be located as close as practicable to the centreline of the vessel, hinged out or forward against the weather and to be operable from both sides. Where a sliding door is proposed, details are to be submitted for approval.

3.1.5 Hatchways should be fitted with substantial coamings, complete with all necessary fittings and covers to ensure weathertight closure. Hatch covers and coamings are to be of strength equivalent to that of the surrounding deck or structure.

3.1.6 To prevent seizure, hinge pins, bushes, screw clips and securing nuts of doors, hatch covers, ventilator and air pipe closures, should be of stainless steel or other corrosion-resistant material and fitted with adequate lubricating points, where applicable.

3.1.7 The height of hatch coamings above the working deck is not to be less than 300mm, excepting that where essential for fishing operations, such as warp leads to winches, etc., and for safe working on restricted decks, the coamings may be reduced in height or omitted, subject to the requirements for flush deck hatches and to the approval of the Surveyor.

3.1.8 Main access hatches should normally be 600mm x 600mm clear opening. Where space is restricted, hatches may have a minimum clear opening of 500mm x 500mm at the discretion of MCA or Fishing Vessel Certifying Authority. See Section 11.11 for escape arrangements.

3.1.9 For vessels less than 10m LOA, access hatches to unmanned spaces other than engine spaces may be of a reduced size, but in no case less than 500mm x 380mm, providing access is not required for any essential operation e.g. valve closure.

3.1.10 Hatch covers should preferably be secured by hinges on the forward side or otherwise permanently attached to the structure of the vessel by means of wire or chain.

3.1.11 Flush deck hatches are to be rigid in construction and secured by positive means such as recessed dog clips. A permanent notice is to be fitted on the hatch or in a visible location in close proximity stating **"HATCH TO BE KEPT CLOSED AT SEA"**.

3.1.12 Flush type hatches and ice scuttles are to have the covers permanently attached to the hull structure by means of hinges, wire or chain and are to be capable of being closed weathertight.

3.1.13 Where drain pipes are fitted from recessed channels of flush hatches to discharge at ship sides, shut-off valves should be fitted at the hull side and must be accessible. The requirement for a non-return valve shall not apply to such drains.

3.1.14 The shut-off valve may be omitted if the hatch drain discharge pipe is located above the design waterline, and the drain pipe is of equivalent material and thickness to that of the hull, and permanently moulded, or welded in place without separable joints.

3.1.15 It is recommended that access, loading, and discharge hatches on the working deck that are likely to be opened at sea, should be positioned on the centreline where practicable.

3.1.16 Propeller inspection tubes are to meet the freeboard requirements for the vessel, and are to be fitted with a permanent attached means of watertight closure.

Section 3.2 - Air pipes

3.2.1 The lowest point at which water might gain access through an air pipe should be not less than 760mm above the exposed freeboard deck or less than 450mm above the exposed superstructure deck. The exposed portion of the air pipes should be of substantial construction.

3.2.2 A reduced height may be accepted if it can be shown that the rule air pipe height would interfere with essential operations and provided that an adequate height above the deck is maintained.

3.2.3 Air pipes should be provided with an efficient means of watertight closure and provision should be made to prevent overpressure or vacuum occurring when the tanks are filled or emptied.

3.2.4 On vessels of metal construction all air pipe/deck connections are to be by a welded through socket or welded pad of adequate thickness.

3.2.5 The open ends of tank air pipes are to be provided with a proprietary type ball float fitting or a gooseneck fitted with an automatic means of closure. Where the pipe internal diameter is 25mm or less, alternative arrangements may be considered.

Section 3.3 - Ventilators (decked vessels)

3.3.1 Ventilators should be of substantial and efficient construction and be provided with a permanently attached means of weathertight closure.

3.3.2 For all monohulls, the height above deck of each ventilator should not be less than 760mm to the lowest point where water might gain access. For catamarans between 10m to 15m LOA, the height above deck should not be less than 600mm to the lowest point where water may gain access, catamarans less than 10m LOA, the height should be as high as practical but in no case less than 450mm.

3.3.3 Ventilators which must be kept open, e.g. for the supply of air to machinery or for the discharge of noxious or flammable gases, should be specially considered with respect to its location and height above deck.

3.3.4 Engine rooms are to be adequately ventilated to meet the engine Manufacturer's recommendations for engine air supply and exhaust requirements. Where auxiliary engines are fitted, extra ventilation is to be provided to ensure sufficient total air capacity for both engines. Where electric ventilation fans are provided to the engine space, a means of stopping the fans, operable from outside the engine space, must be provided.

Section 3.4 - Portlights

3.4.1 All portlights where fitted to superstructures, deckhouses and other weathertight structures, are to be fitted with hinged deadlights capable of being closed weathertight. Any port lights and deadlights fitted are to be equivalent in strength to the surrounding structure.

3.4.2 Portlights should not be fitted in the hull below the working (freeboard) deck, nor in engine casings.

3.4.3 Portlights fitted within an enclosed superstructure are to be fitted at a minimum height of 1m to the centre above the working deck, except those used for escape which may be lower subject to Surveyor's approval.

3.4.4 Any opening portlight should not exceed 250mm diameter or equivalent area, except where the portlight has been approved as a means of escape.

3.4.5 Glazing thicknesses should meet the requirements of ISO 12216 or other equivalent Standard.

Section 3.5 - Skylights

3.5.1 Skylights leading to spaces below the working deck are to be of substantial construction and capable of being closed weathertight, operable from both sides, positioned clear of deck working areas, and fitted on or as near to the centreline as possible, and are to be mounted on substantial coamings of equivalent strength to the surrounding deck and as high as practicable.

3.5.2 Skylight glazing should meet the requirements of ISO 12216 or an equivalent standard.

3.5.3 Glass inserts, where fitted, are to have the framing material and fastenings of equivalent strength to the surrounding structure, and are to be protected against damage from warps and gear.

3.5.4 Skylights should not be fitted in machinery spaces perimeters, working decks or other vulnerable positions. Where skylights are provided as a means of escape, they should be positioned clear of obstructions to enable rapid and easy access and be clearly marked **"EMERGENCY EXIT"**.

Section 3.6 - Windows

3.6.1 Windows are not to be fitted in the hull of any vessel.

3.6.2 Windows fitted in superstructures of decked or partially decked vessels of 7m LOA and over, are to be to ISO 12216 or other equivalent standard and fitted in metal frames, or frames of equivalent strength to that of surrounding material, rubber framed windows are not permitted. Where windows are bonded to the surrounding structure of GRP vessels, the fixing method is to be compliant with ISO 12216 or other equivalent standard.

3.6.3 Where the wheelhouse entrance does not open to the outside deck, at least one window fitted in the wheelhouse is to be of the opening type arranged to permit a means of escape, as described in Part 11, Section 11.11.

3.6.4 Opening windows may be hinged, vertically or horizontally sliding types, provided that the window can be readily and efficiently secured in the closed position.

3.6.5 Vertical sliding windows are to be fitted with adequate drainage arrangements discharging to the open deck, where practicable.

3.6.6 Polarised or tinted glass or glazing material susceptible to scratching must not be fitted at the helm or control position, where required for navigational visibility.

Section 3.7 - Exhaust outlets (through hull)

3.7.1 Exhaust pipes that penetrate the hull below the freeboard deck are to be fitted with a non-return valve, device, or flap to prevent the ingress of water at the outlet position.

3.7.2 The lower edge of the discharge is to be a minimum of 100mm above the design load waterline. Alternative arrangements are to be submitted for approval prior to installation.

3.7.3 The non-return device referred to in Paragraph 3.7.1 may be a proprietary fitting, water trap, built in valve, or an inverted “U” bend, fitted in the exhaust line.

3.7.4 Materials for exhaust systems see Part 8, Paragraphs 8.1.9 & 8.1.10.

Section 3.8 - Sea inlets and discharges

3.8.1 All sea inlets and overboard discharges penetrating the hull below the working or freeboard deck are to be provided with a shut-off valve or cock. Those fitted within machinery spaces or below the design waterline are to be of metal or other approved type. If valves are used other than metal, a certificate attesting to their classification must be supplied from a recognised body.

3.8.2 In open vessels, discharges are to be no less than 300mm above the design waterline.

3.8.3 In addition to the requirements of Paragraph 3.8.1, overboard discharges - other than toilet discharges - located below the weathertight or freeboard deck, are to be fitted with a non-return valve, which may be incorporated within the shut-off valve. Discharges located 300mm above the waterline and are <40mm inside diameter, are to be fitted with either a shut-off valve or non-return valve.

3.8.4 Valves and cocks fitted in metal hulls are to be connected to substantial pads welded to the hull plating, or to a welded-in short distance piece, to clear side or bottom stiffeners. Distance pieces, where fitted, are to have a wall thickness of at least the thickness of the connecting hull plating.

3.8.5 Valves and cocks in wood or GRP hulls are to be fitted and spigoted into a suitable pad and secured with an external non-corrodible ring under the bolts. Fittings up to 50mm diameter may be attached with threaded spigot pieces having an external collar and internal nut, provided that suitable hull reinforcement is provided where necessary. Those fitted within machinery spaces are to be of metal or other approved type.

3.8.6 Sea inlet and discharge valves are to be accessible for operation at all times, if necessary, by extended spindles or wire pulls to above the floor plating or above deck. See Part 9, Section 9.1.

3.8.7 Sea inlet and overboard discharge valves are to be clearly labelled, indicating function, and open and closed position.

3.8.8 Water feeds to stern glands are to be fitted with a shut-off valve at the gland.

Section 3.9 - Freeboard

3.9.1 Open vessels are to have a minimum freeboard measured down from the lowest point of gunwale top to the design waterline. Freeboard measurements are to be not less than 400mm for a vessel of 7m LOA or less and 700mm for a vessel of 15m LOA. For a vessel of intermediate length the clear height should be determined by linear interpolation.

3.9.2 All vessels less than 7m LOA and open vessels are to be limited in their area of operation, to 20 miles from a safe haven and in favourable weather conditions.

3.9.3 All vessels less than 7m LOA and open vessels are to be fitted with a notice visible at the helm position stating the limited area of operation.

3.9.4 Decked vessels with a continuous watertight weatherdeck are to have a minimum freeboard from the design waterline of not less than 300mm. Freeboard is to be measured from the waterline to the lowest point of the deck at side.

3.9.5 Decked vessels with freeboard less than 300mm are to be limited in their area of operation to 20 miles from a safe haven and in favourable weather conditions and to be fitted with a visible notice as per Paragraph 3.9.3.

Section 3.10 - Water freeing arrangements

Open Vessels

3.10.1 The following provisions should apply:-

3.10.2 The height of any door sill above the fixed sole level in open type vessels should be as high as practical, but no less than 200mm. If hinged, the door should open outwards.

3.10.3 Sole drainage on open vessels is to be given careful consideration. The level of the floor should not be positioned at such a height that it would have an adverse effect on the stability of the vessel, the following shall apply:-

(i) There should be effective drain openings fitted on each side of the sole to enable any water to drain directly to the bottom of the vessel. In the case of a vessel with a sealed sole, an aft sump is to be fitted, extending from the keel to sole;

(ii) It is recommended that the drainage area be at least 2% of the total bulwark area above the sole;

(iii) Open vessels are not to be fitted with freeing ports;

(iv) Any barrier or coaming which may be fitted to the sole to prevent the entry of rain water to the bottom of the vessel should not be at a height any greater than 25mm above the level of the sole;

(v) The bilge pumping intake should be at a readily accessible position;

(vi) Sole support structures that form buoyancy spaces are to be sealed, and surfaces that may come into contact with water are to be sealed with gel coat or similar.

3.10.4 Open type vessels are to be fitted with bilge pumps as required by Section 9.3 of these Standards.

Decked vessels

3.10.5 On decked vessels, where the fixed bulwarks, ends or sides of superstructures etc., form enclosed wells, means to clear entrapped water are to be provided and may comprise any, or any combination, of the following:-

(i) Freeing ports with an attached means of closing (see Paragraph 3.10.14 regarding restrictions to this arrangement);

(ii) Permanent openings in the bulwarks such as slots;

(iii) Apertures in and under bulwark or stern ramp doors;

(iv) Deck scuppers where the discharge is above the load waterline.

3.10.6 The minimum area for freeing ports on each side of the well or deck is to be not less than 3% of the total bulwark area each side. Where monohull length/breadth ratios are greater than 2.5 then an additional 1% is required in freeing port area each side

3.10.7 Where vessels are fitted with full or partial shelters which are left open at the stern, and where the passage of water forward is not restricted by watertight bulkheads, the freeing port area is to be increased by 1% over the requirement stated in Paragraph 3.10.6.

3.10.8 Freeing ports are to be arranged throughout the length of the bulwark or well to provide maximum drainage under all normal conditions. At the discretion of the attending Surveyor, up to one third of the freeing port area required at each side may be located in the transom bulwark, with the vessel centreline dividing the port and starboard side allocation. Where the freeing port area in the transom bulwark is greater than the maximum one third allowance per side, the excess area shall not be included in the total freeing port area provided.

3.10.9 The means of clearing water must not provide easy access for water to enter the enclosed deck space.

3.10.10 Any freeing port or slot in the bulwark is to have the bottom edge as close to the deck as possible. Freeing ports greater than 230mm in depth and wider than 350mm are to be fitted with bars.

3.10.11 Where freeing ports are fitted with hinged flaps or shutters, sufficient clearance to prevent jamming is to be provided and hinges are to be fitted with pins of non-corrodible material. Greasing points or nipples are to be provided where practicable.

3.10.12 Freeing ports are to be arranged throughout the length of the bulwark or well to provide maximum drainage under all normal conditions of trim.

3.10.13 Care is to be taken that deck pounds, machinery and net or gear stowage will not impede the free flow of trapped water to the freeing ports or slots.

3.10.14 Lift-up closing appliances should not be fitted to freeing ports, or locking devices fitted to freeing port flaps, if they reduce the total freeing port area along either side of the vessel below the freeing port requirement. They will only be considered acceptable where the remaining open freeing port area meets the requirement when the appliances are closed.

Section 3.11 - Watertight subdivision

3.11.1 All vessels below 7m LOA are to be fitted with at least one watertight bulkhead positioned according to the vessel's arrangement where it will be most effective to prevent flooding when in a damaged condition. Those fitted with sealed decks are to comply with Part 9, Paragraph 9.3.17.

3.11.2 All vessels between 7m and 10m LOA are to be fitted with at least two watertight bulkheads. A collision bulkhead is to be positioned forward at a point no less than 0.5m and no greater than 1m from the stem, measured at the design waterline. A second bulkhead is to be positioned to separate the machinery space from the fish hold or accommodation spaces.

3.11.3 All vessels between 10m and 15m LOA are to be fitted with at least three watertight bulkheads. A collision bulkhead is to be positioned forward at a point no less than 0.75m and no greater than 2m from the stem, measured at the design waterline. The second and third watertight bulkheads should be positioned at each end of the engine room. Vessels with engines mounted forward where the collision bulkhead is the forward engine room bulkhead, should have a bulkhead positioned aft of the engine space and aft of the fish hold (aft peak bulkhead).

3.11.4 Where a vessel is of a catamaran design, a longitudinal watertight bulkhead is to be fitted between hulls to separate main engine compartments.

3.11.5 Where it is intended for a bulkhead to be fitted outside the stipulated parameters, details should be submitted for approval prior to construction.

3.11.6 In decked vessels, the collision bulkhead should extend from the keel or forefoot to the first weathertight deck, or to a flat located no lower than 300mm above the estimated deepest operational waterline (collision tank). Bulkheads in other positions should extend full height from the keel to the deck.

3.11.7 Vessels fitted with collision tanks as detailed in Paragraph 3.11.6 with accommodation fitted forward of the vertical bulkhead, will be restricted to 24 hours at sea with no crew permitted to be living on board in port.

3.11.8 Access to the compartment forward of the collision bulkhead may be by a bolted watertight cover or watertight hatch normally closed at sea.

3.11.9 Doors should not normally be fitted in watertight bulkheads, but where these are necessary for the safe operation of the vessel, the doors are to be permanently attached to the bulkhead and are to be of equivalent strength to the unpierced bulkhead. Doors are to be watertight and capable of operation from both sides, and fitted with signs stating **"TO BE KEPT CLOSED AT SEA"**.

3.11.10 Where pipes and electrical cables are carried through a watertight bulkhead, the method of penetration must maintain the watertight integrity of the bulkhead.

3.11.11 For vessels 7m LOA and greater, where it is intended that a watertight compartment is to be sealed to omit the need for bilge pumping, Part 9, Paragraph 9.3.17 should be consulted.

PART 4

STEEL AND ALUMINIUM CONSTRUCTION

PART 4

STEEL AND ALUMINIUM CONSTRUCTION

PART 4

STEEL AND ALUMINIUM CONSTRUCTION (continued)

SECTION SUBJECT

STEEL AND ALUMINIUM CONSTRUCTION

Section 4.1 - Materials

Steel plate and sections

4.1.1 Steel is to be manufactured by an approved process in accordance with Lloyds requirements for shipbuilding quality mild steel, or similar Standards.

4.1.2 Scantlings are based on mild steel with the following properties:-

Yield strength (min)	235 N/mm^2
Tensile strength	400-490 N/mm^2
Modulus of elasticity	200 x 10^3 N/mm^2

4.1.3 Documentation in the form of mill test certificates is to be provided for all structural steel materials.

4.1.4 Steel plate and sections should be stored so that distortion does not occur and immersion in water is avoided.

Aluminium plate and sections

4.1.5 Aluminium plates and sheets for use with these Standards are to be of marine grade to the requirements of BS 5083/DIN 1725 (or equivalent), with consumables to BS 5356 (or equivalent).

4.1.6 Aluminium sections, where not available to the Standard in Paragraph 4.1.5 may be to BS 6082 (or equivalent), with consumables to BS 4043 (or equivalent).

4.1.7 Scantlings are based on marine grade aluminium with the following properties:-

0.2% proof stress (min)	170 N/mm^2
Tensile strength (min)	260 N/mm^2
Modulus of elasticity	69 x 10^3 N/mm^2

4.1.8 Plates should be of annealed (flanging quality) material.

4.1.9 Documentation in the form of mill test certificates is to be provided for all structural aluminium materials.

4.1.10 Aluminium materials are to be stored under cover in clean, dry conditions and in such a manner that distortion is prevented. The storage area is to be separate from storage of other metals.

Steel construction

4.1.11 Construction should be carried out in a designated area and where practicable, protected from adverse wind and weather conditions.

4.1.12 Steel plate and section may be cut by profile burning, mechanical saw, mechanical shears/guillotine, or other approved process. Cut edges are to be straight and free of scoring, swarf, and burrs. Plate edge preparation is to be carried out prior to erection where possible.

4.1.13 Plate edges are to be carefully aligned to avoid distortion on welding.

4.1.14 Scantlings are to be obtained from the associated Tables shown in Section 4.20.

Aluminium construction

4.1.15 Fabrication and erection of aluminium structures is to be carried out under cover, screened from wind and weather and where practicable, is to be separate from steel fabricating areas.

4.1.16 Plate, sheet, and sections may be cut by plasma process, mechanical saws, or mechanical shear/guillotine. Such tools are to be free from contamination by other materials. Where plate is to be flanged for pre-forming structural sections, the inside radius is to be a minimum of 1.5 times plate thickness.

4.1.17 All plate edges, and areas to be connected by welding are to be de-greased with a de-greasing agent, and scratch brushed to remove oxides.

4.1.18 Care is to be taken when connecting together of steel and aluminium structures or components. Welded connections may be by bi-metallic bar ('Kelocouple' or equivalent) or by bolting. Bolted joints are to be insulated between the metals. Bolts are to be stainless steel or plated, and insulated from bi-metallic contact.

Section 4.2 - Main hull construction

4.2.1 Minor details of construction based on existing designs, shipyard standards, and normal practices proposed as an alternative to the following standards, will be considered upon submission of details for consideration.

4.2.2 Where construction is proposed by means of pre-formed or pre-fabricated kit, drawings showing scantlings and connection assembly procedures are to be submitted for consideration prior to commencing of cutting of kit.

4.2.3 Construction of the hull may be of the round bilge, single, or multi-chine form.

4.2.4 Scantlings are to be in accordance with the appropriate Section or Table reference.

4.2.5 Care is to be taken to avoid abrupt changes in the structure of the vessel (e.g. alignment of engine girders to side girders, tank sides, etc.), but where such changes are unavoidable, adequate compensation is to be incorporated, to the approval of the Surveyor.

4.2.6 Scantlings shown in the Tables are based on transverse framing construction.

4.2.7 Generally frames, beams, and other stiffeners should be of flat bar, bulb, or angle section and are to be toe welded. Alternative sections to those specified in the Tables together with modulus calculations confirming equivalent strength to Table requirements, should be submitted for approval.

4.2.8 Longitudinal stiffeners may include stringers, engine seatings, and chines, subject to approval.

4.2.9 On longitudinally framed vessels, there is to be a full transverse ring frame fitted with spacings not exceeding 1.5m, made up of the transverse floor, side frame and deck beam requirements. The scantlings of these sections are to be determined from the relevant Tables with the section moduli increased in direct proportion to the ring frame spacings.

4.2.10 Particular attention is to be given to the stiffening at the ends of the vessel, and especially in way of areas which may be subjected to slamming.

4.2.11 Adequate access should be arranged to double bottom areas and in way of tank boundaries to facilitate inspection and testing.

Section 4.3 - Centre and side girders (bottom construction)

4.3.1 The centre girder in vessels with a plate keel is to extend over the whole of the length of the keel, except that in way of the main engine, the side girders forming the engine seatings may be accepted in lieu of the centre girder, subject to the approval of the Surveyor, and provided continuity of strength is maintained. The thickness of vertical plate girders forming engine seats should be at least that required for the centre girder.

4.3.2 The centre girder and the engine seatings are to overlap by at least one frame space, and are to be tapered to avoid abrupt changes in structure.

4.3.3 When it is proposed to fit side girders in lieu of a centre girder, e.g. in order to form a duct for the propeller shaft in vessels with a forward engine room, the thickness of the side girders is to be at least that of the adjoining floor.

4.3.4 Where it is proposed that a box keel be fitted, details are to be submitted for consideration and approval.

4.3.5 Fabricated ballast keels constructed with heavy bars will be specially considered after submission of section and welding details prior to construction. See also Figure 4.21.9.

4.3.6 Vessel engine girders are to be extended fore and aft, over two frame spaces where practicable, and may be tapered down to half the height of the adjoining floor at ends and welded to the adjoining floor. Transverse floors between girders may be reduced in height to suit deep sumps etc., provided substantial fully welded face bars are fitted.

Section 4.4 - Bottom construction (floors)

4.4.1 Plate floors in accordance with Table 4.20.4 are to be fitted at every transverse frame, and weld connected to the side frames and shell.

4.4.2 Where the rise of floor is excessive, the tops of transverse floors may be maintained parallel to the height of the centre girder, and the side frames continued at the bottom shell to connect to the floor plates. See Figure 4.21.6.

(i) All floors are to be flanged or fitted with a face bar;

(ii) All floors are to be welded in accordance with Part 5 of these Standards.

4.4.3 The depth of floors at the centreline is to be not less than that specified in Table 4.20.4. Where there is a rise of floor, the depth of the floors is to be increased in order that the depth at 25% of the distance between the centreline and the outboard extremity of the floor, is not less that 75% of the required depth of floor at the centreline.

4.4.4 Where twin propulsion engines are to be fitted, details of the proposed engine seating arrangement are to be submitted for consideration and approval.

4.4.5 In general, engine seatings are to be formed with longitudinal girders, fully welded to shell plating and transverse floors, and fitted with fully welded substantial top plates. The cross-sectional area of the top plates and vertical girders are to be suitable for the maximum power of the propulsion engine, and are to be approved by the engine Manufacturer/Supplier.

4.4.6 Top plates are to be tapered off at ends, clear of engine and gearbox holding down bolts over a minimum of one frame space. Abrupt changes in section are to be avoided by tapering the heavier member.

4.4.7 Access holes in girders and floors are to have face bars fitted, where the distance from shell plate is less than 150mm or the access hole is greater than 300mm x 450mm.

Section 4.5 - Integral tanks

4.5.1 For integral tanks in single bottom vessels, other than deep tanks, the thickness of the tank top plating is to be not less than that required for tank top plating as shown in Table 4.20.7.

4.5.2 The thickness of other plating forming the boundaries of such tanks should not be less than that required for the connecting shell plating.

4.5.3 Integral tanks are to be fitted with lightened plate stiffeners which may form baffles or wash plates at every alternate frame, and are to be of a thickness not less than that required for adjacent plate floors.

4.5.4 Side frames should be connected to tank tops by brackets as for tank top plating.

4.5.5 Access manholes are to comply with the requirements shown in Part 9, Paragraph 9.2.12.

4.5.6 Where the depth of the floor exceeds 1m, vertical stiffeners are to be fitted to plate floors at a spacing not exceeding 1m.

4.5.7 All tanks to be pressure tested to conform fully to Section 1.5.

Section 4.6 - Stem, stern frame and keels

4.6.1 The stem may be either of the bar or plate type, or a combination of both.

4.6.2 Stern frames are to be fabricated in accordance with scantling Table 4.20.2 and efficiently attached to the hull structure.

4.6.3 Bar and plate stems should be in accordance with the scantlings given in Table 4.20.1, and horizontal web plates (breast plates) should be fitted to bar stems at ends of longitudinals, stringers, and bulwark rails.

4.6.4 Sole pieces with an unsupported span of over 1m should have a heavy centreline web fitted on the top side suitably integrated with the radiused section where the sole piece meets the stern post.

4.6.5 The keel may be of bar, plate, box type, or of fabricated sections.

4.6.6 The dimensions of bar and plate type keels are to be in accordance with Table 4.20.1, and should be fitted in association with a centre girder, conforming to Table 4.20.5 for vessels of single bottom construction.

Section 4.7 - Bulbous bows and nozzles

4.7.1 Where bulbous bows are to be fitted, adequate provisions are to be made to ensure access for welding/moulding procedures.

4.7.2 Where bulbous bows are to be utilised as ballast or fresh water tanks, they are to meet the criteria of Sections 11.7 and 11.10 respectively of these Standards.

4.7.3 Where a nozzle is to be fitted, details of the hull connection and internal stiffening are to be submitted for approval. See Section 8.4.

Section 4.8 - Side framing

4.8.1 Transverse main frames are to be in accordance with Table 4.20.6.

4.8.2 Deep web frames fitted to carry heavy deck loads in association with deep beams should have a depth and thickness of at least twice the depth of ordinary frames. Deep beams are to be fitted with a continuously welded face bar. Web frames are to be fabricated plate, angle bar or bulb flat.

4.8.3 Deep web frames may also be required in way of other highly stressed areas, to the approval of the Surveyor.

4.8.4 Frames are to be bracketed to deck beams, inner bottoms and tank tops in accordance with Figure 4.21.5. Ring frame construction details are to be submitted to the Surveyor for approval.

4.8.5 Where the Depth ‘h’ (Figure 4.21.5) in relation to side frames is greater than 2.5m, a longitudinal stringer of equal dimension to that required for side frames is to be fitted midway between the deck and floor/tank top connection.

4.8.6 End brackets of deep web frames where connected to longitudinal bulkheads or coamings, are to be as those required for deck girders.

4.8.7 At the fore and aft ends of the hull where frames are fitted normal to the centreline, frames may be canted to provide welding access, with suitable connections to floors and beams.

Section 4.9 - Shell plating

4.9.1 The thickness of shell plating is to be in accordance with Table 4.20.3.

4.9.2 The thickness of the sheerstrake plating is to be increased in accordance with the Tables in way of areas where excessive wear may occur due to fishing operations. Alternatively, solid section half round bar or convex may be fully welded to the shell plating at these positions.

4.9.3 Chine bars, where fitted, are to be solid round, and of diameter as shown in Table 4.20.15.

4.9.4 Where the thickness of the shell is to be increased by the use of an insert, plates are to have a minimum radius of 50mm, or 10 times the plate thickness, whichever is the greater.

4.9.5 Rubbing bars, where fitted, should be of solid section and are to be continuously welded to the shell plating.

4.9.6 Butts in shell plating are to be so arranged as to provide a maximum distance of 150mm from vertical framing and structural connections.

4.9.7 Upon completion of fabrication, all weld marks from clips, dogs or other devices utilised in the fabrication of the vessel including weld spatter are to be removed and repaired where necessary.

Section 4.10 - Deck plating

4.10.1 The thickness of deck plating is to be in accordance with Table 4.20.8.

4.10.2 All openings in deck plating are to be adequately framed and their corners radiused to a minimum of 50mm, or 10 times the plate thickness, whichever is the greater. A radius of 25mm may be permitted providing additional support is fitted, such as coamings, stiffening.

4.10.3 Deck plating in way of masts, machinery, gantries, and deck loads, etc., subject to areas of stress, is to be strengthened, to the approval of the Surveyor.

4.10.4 Plating butts are to be arranged to provide a maximum distance of 150mm from beam, girder, and bulkhead connections.

4.10.5 Where deck thicknesses are to be increased, deck inserts are to be used and are to have radius corners with a minimum radius of 50mm, or 10 times plate thickness, whichever is the greater.

Section 4.11 - Wood deck sheathing

4.11.1 Wood sheathing, where fitted to the steel deck, is to be of an approved timber and fitted up to flat bar margins in way of all deck fittings and waterways. The thicknesses of margin bars are to be at least 15% greater than that required for the deck plating. Margin bars are to be welded with a continuous sealing run on one side to prevent water ingress under the sheathing. The fastening of sheathing should not affect integrity or strength of the deck plating, (e.g. not through-fastened).

4.11.2 All wood deck sheathing is to be installed over a suitable bedding compound to the Surveyor’s approval.

Section 4.12 - Deck beams

4.12.1 Deck beams are to be in accordance with Table 4.20.9, fitted and bracketed to each transverse frame. Brackets and beam knees are to be in accordance with Figure 4.21.3 or equivalent.

4.12.2 Beams in way of large deck openings (i.e. greater than 0.2B), and heavy deck equipment, should be increased in depth by not less than twice the depth of the ordinary beams, as for web frames.

Section 4.13 - Deck girders

4.13.1 Girders are to be in accordance with Table 4.20.11, and end brackets in accordance with Figure 4.21.4.

4.13.2 Girders are to extend over the full length of the deck, excepting where a longitudinal bulkhead is fitted at a similar position.

4.13.3 Where deck girders are scalloped for the passage of continuous deck beams, the depth of the girder is to be twice that of the beam except where welded collars are fitted over beam/girder penetrations. See Figure 4.21.10.

4.13.4 Tripping brackets from beam to girder are to be fitted in way of pillars, and at every third frame space clear of pillars. See Figure 4.21.10.

4.13.5 Where a connection between girders of dissimilar metals is made, an insulating material is to be fitted between the girders and connected with bolts of compatible material or fitted with insulating ferrules/washers. Alternatively, the joint may be transitioned using a bi-metallic welding strip connection.

Section 4.14 - Pillars

4.14.1 When the unsupported span of deck girders exceeds 4m, pillars, in accordance with Table 4.20.12, are to be fitted.

4.14.2 Where pillars are to be omitted, deep web beams and side frames are to be fitted in accordance with Table 4.20.10 and associated notes.

4.14.3 In way of the fish hold, the hold pound stanchions may be accepted as meeting the requirements of pillars, subject to these being of equivalent section modulus and inertia, and that they are permanently attached to the hull and deck structures.

4.14.4 Details of pillars fitted in way of areas of local stress and heavy deck equipment, are to be submitted for consideration.

4.14.5 Pillars may be of tubular or hollow square section.

4.14.6 Pillars are to be fitted with brackets and pads to the approval of the Surveyor.

4.14.7 Pillars should be positioned, whenever practicable, at the intersection of floors and longitudinal structural members at the bottom, and at the intersection of longitudinal deck girders and beams at the top. Where this is not practicable, or where positioned over floor or girder manholes, additional local stiffening is to be fitted to the approval of the Surveyor.

Section 4.15 - Bulkheads

4.15.1 Watertight bulkheads are to be fitted in all vessels as required by Part 3, Section 3.11.

4.15.2 The thickness, spacing, and section modulus of stiffeners for watertight bulkheads are shown in Table 4.20.13.

4.15.3 Where a bulkhead forms a fore peak or collision bulkhead, the thickness of the bulkhead plating is to that of the adjoining shell plate.

4.15.4 Watertight bulkheads in decked vessels are to extend to the lowest continuous deck above the deepest operational waterline.

4.15.5 Pipe or drain penetrations in the collision or fore peak bulkhead are to be fitted with a valve or cock on the after side, fitted directly to the bulkhead, and arranged to be accessible at all times or fitted with an extended operating spindle to the deck.

4.15.6 Non-watertight bulkheads are to have scantlings as required for watertight bulkheads.

Section 4.16 - Bulwarks

4.16.1 On decked or partially decked vessels, the perimeter of the exposed deck is to be fitted with fixed bulwarks, guard rails or wires, or a combination of these.

4.16.2 The height of the bulwark, guard rail, or wire is to be not less than 1m, 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. See Section 11.12 and Figure 11.20.1.

4.16.3 Plate bulwarks are to be fitted with a substantial top rail of flat bar, angle, bulb flat, or other approved section.

4.16.4 Bulwark stays of flat bar or flanged plate are to be fitted at alternate frames. Thickness of the stays are to be not less than the bulwark plating. Mild steel stays should be continuously welded to prevent corrosion. The connection of the stay to the deck are to be over deck beams, but where this is not practicable, the stay may be landed to a welded pad on the deck plating.

4.16.5 Additional bulwark stays are to be fitted in way of gantries or gallows to the satisfaction of the Surveyor.

4.16.6 Plate thickness of fixed bulwarks is to be determined from Table 4.20.14.

4.16.7 Where tubular guard rails or wires are fitted, the lower course of rails or wire is to have a clearance of not more than 230mm above the deck, with remaining courses evenly spaced.

4.16.8 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 4.17 - Bilge keels and bow fins

4.17.1 Bilge keels and bow fins are to be of plate, flat bar, or bulb flat, suitably stiffened, radiused or tapered at ends, and arranged to terminate over an internal frame or stiffener. Bilge keels should not extend beyond the projected vertical line of the side plating at waterline level.

4.17.2 The hull plating is to be reinforced in way of the bilge keel or bow fins by a welded flat bar with a thickness of not less than the adjoining shell plate thickness and with a minimum width of 12 times thickness. The flat bar is to be secured to the hull with full continuous fillet weld. Welding of the bilge keel to the flat bar is to be by light continuous fillet. See Figure 4.21.7.

4.17.3 Bilge keels of an unusual design will be specially considered for approval prior to fitting.

Section 4.18 - Deckhouses and superstructures

4.18.1 In open decked vessels where a raised poop, engine box or casing is fitted over an engine space, it may be constructed of GRP, timber, steel, or aluminium.

4.18.2 On decked vessels where the wheelhouse and deckhouse is constructed of steel or aluminium, the thickness of the superstructure plating and stiffening is to be as per the requirements in Tables 4.20.16 to 4.20.20. Alternative structural designs are to be submitted for approval.

4.18.3 The joints of aluminium superstructures to steel structures are to be made by means of continuously welded bi-metallic strip, or by bolting as detailed in Paragraph 4.1.18.

4.18.4 Where openings to spaces below the main deck are contained within a superstructure, the superstructure is to be constructed weathertight, unless such openings are fitted with weathertight closures.

4.18.5 Windows and portlights are to comply with the requirements of Part 3 'Hull Integrity and Arrangement'.

Section 4.19 - Shelter decks

4.19.1 On vessels fitted with steel or aluminium weathertight, non-weathertight, decks above the main or freeboard deck, the shelter deck plating sides, and associated stiffeners, are to be determined from Tables 4.20.16 to 4.20.20.

4.19.2 The shelter height is to be sufficient to provide adequate headroom but must not obscure all round vision from the steering/navigation position.

4.19.3 Full shelters are defined as those structures whose length extends from the stem to the stern and whose width extends across the breadth of the vessel, rail to rail.

4.19.4 The joints of aluminium superstructures to steel structures are to be made by means of continuously welded bi-metallic strip, or by bolting as detailed in Paragraph 4.1.18.

4.19.5 Where the shelter is to be included in the vessel's intact stability, it is to be constructed weathertight (WT) as an enclosed superstructure, fitted with approved weathertight doors, hatches, and a means of draining the enclosed deck space. Such drains are to incorporate suitable non-return arrangements if draining directly overboard.

4.19.6 Non-weathertight (NWT) shelters (which may extend full breadth over part or the whole of a vessel's length) are to be fitted with freeing ports as defined in Section 3.10, and may be left open at either end. It is recommended that closing doors be fitted in way of openings.

4.19.7 Decks and shelter tops in way of masts, derricks, machinery and other areas of additional deck loading, are to be strengthened with web frames or deep beams and pillars to the approval of the Surveyor.

4.19.8 Pillars are to be fitted such that the unsupported span of the shelter deck girder does not exceed 4m. Pillars or equivalent support is to be fitted in way of other areas subjected to additional loading.

4.19.9 Rails and stanchions should be fitted to the tops of shelters and in way of all loading hatches. The top rail is to be 1m above the deck, with the lower rail not more than 230mm above the deck, and mid rail equally spaced between upper and lower rail.

4.19.10 Gutting hatches or ports, and offal chutes fitted in weathertight shelter sides should have a minimum inboard opening height of 1m and fitted with suitable closing arrangements.

4.19.11 The shelter top is to have a non-slip surface.

4.19.12 In the case of vessels fitted with an enclosed shelter, an additional access from within to the shelter top should be fitted to facilitate escape in an emergency.

Section 4.20 - Scantlings tables

Throughout the Tables the letters L, B, and D represent the measurements as shown in Figures 4.21.1, and 4.21.2.

The scantling numeral is the product obtained by multiplying the length ‘L’, by breadth ‘B’, by depth ‘D’, as shown in the Figure.

In determining scantlings from the Tables in respect of intermediate lengths, breadths and depths, the scantling applicable is to be that given for the next lower dimension, unless stated otherwise in the Table notes.

Where these Tables indicate plate thicknesses and scantlings of sections which are not commercially available, the next higher available thickness or scantling is to apply. In such cases the increased section modulus may be considered in determination of main scantlings.

All applicable scantling requirements for a monohull are to be those required for a catamaran, unless otherwise stated within the notes below scantling tables.

Details of any alternative sections proposed are to be submitted for consideration.

Section 4.21 - Figures and illustrations

Illustrations shown in Figures 4.21.3 through to 4.21.11 are for guidance only. Alternative proposals to those shown may be accepted to the approval of the Surveyor.

4.20 Tables for steel and aluminium construction

4.20.1 Table 1: Keel and stem

Steel

Length L M	Bar		Plate		
	Keel mm	Stem Mm	Keel		Stem mm
			Width mm	Thickness mm	
5	75 x 10	75 x 10	250	4.5	4
6	75 x 12	75 x 10	250	5	4
7	90 x 12	75 x 12	300	6	4
8	100 x 12	90 x 12	300	6	5
9	100 x 15	90 x 15	350	6	5
10	110 x 15	90 x 15	350	6	5
11	100 x 20	90 x 20	375	7	6
12	110 x 20	90 x 20	400	7	6
13	110 x 25	90 x 25	400	7	6
14	110 x 25	90 x 25	450	7	6
15	110 x 25	110 x 20	450	8	7

Refer to Notes after aluminium table on following page.

4.20 Tables for steel and aluminium construction

4.20.1 Table 1: Keel and stem *(continued)*

Aluminium

Length L m	Bar		Plate		
	Keel mm	Stem mm	Keel		Stem mm
			Width mm	Thickness mm	
5	88.9 x 12.7	88.9 x 12.7	250	6	5
6	101.6 x 15.9	80 x 15.9	250	6	5
7	101.6 x 19.1	80 x 19.1	300	8	5
8	101.6 x 25.4	90 x 25.4	300	8	6
9	101.6 x 25.4	95 x 25.4	350	8	6
10	152.4 x 19.1	110 x 19.1	350	8	6
11	152.4 x 25.4	110 x 25.4	375	10	8
12	152.4 x 25.4	110 x 25.4	400	10	8
13	152.4 x 25.4	120 x 25.4	400	10	8
14	152.4 x 25.4	120 x 25.4	450	10	8
15	152.4 x 25.4	130 x 25.4	450	10	8

Notes:-

1. Bar keels should be continued to include the fore foot, and the reduction in scantling from the keel to the stem is to be tapered over a length of not less than 500mm.
2. Where stems are constructed of a combination of bar and plate, the stem bar may be continued at a reduced cross-section to the stem-head. The reduction in section should be tapered as in Note 1 above.
3. The minimum width of plate keels shown in the Table are at amidships and may be tapered at ends to suit the stem plate or bar, and stern skeg.
4. Details of fabricated ballast and box type keels are to be submitted for consideration and approval prior to construction.

Catamaran hulls

5. A minimum factor of 0.70 may be applied to the section modulus requirement for the keel and stem components (plate requirements are to be as those stated).

   Note: items 1 – 4 inclusive remain applicable for these types of vessels.

4.20 Tables for steel and aluminium construction

4.20.2 Table 2: Stern frame

Steel

Length L M	Stern post		Stern bar		Sole piece
	Minimum sectional area cm^2	Minimum thickness mm	Minimum sectional area cm^2	Minimum thickness mm	Minimum sectional area cm^2
7	14	15	6	8	12
8	16	18	9	12	19
9	20	20	12	15	25
10	25	25	15	18	31
11	30	30	20	20	37
12	40	35	25	20	43
13	48	40	30	20	45
14	56	40	32	25	56
15	64	50	38	25	65

Aluminium

Length L M	Stern post		Stern bar		Sole piece
	Minimum sectional area cm^2	Minimum thickness mm	Minimum sectional area cm^2	Minimum thickness mm	Minimum sectional area cm^2
7	24	19.1	11	10	21
8	28	25	16	15	33
9	34	25	21	19.1	43
10	43	38.1	26	25	53
11	51	38.1	34	25	63
12	68	44.5	43	25	74
13	82	50.8	51	25	77
14	96	50.8	55	38.1	96
15	109	63.5	65	38.1	111

Refer to Notes on following page.

4.20 Tables for steel and aluminium construction

4.20.2 Table 2: Stern frame *(continued)*

Notes:-

1. The scantlings relate to a stern frame supported by plating on both sides. Where a single plate skeg is fitted, the minimum sectional area and thickness of the stern post is to be increased by 50%.
2. The sole piece may be of solid square, rectangular or T section.
3. The stern frame should be suitably radiused or bracketed where the stern post meets the sole piece.
4. The stern tube housing boss is to have a finished thickness of metal around the bore of at least 30% of the propeller shaft diameter.
5. For vessels with a length scantling L below 7m, details of the stern construction are to be submitted for approval.
6. Solid round sections, where used, are to be of equivalent cross-sectional area to those shown in the Table.

4.20 Tables for steel and aluminium construction

4.20.3 Table 3: Shell plating

Length L m	Shell thickness mm	
	Steel	Aluminium
5	3.5	5
6	3.5	5
7	4	5
8	4.5	6
9	5	6
10	5	6
11	6	8
12	6	8
13	6	8
14	6	8
15	6	8

Notes:-

1. The plate thickness in the above Table are based on a transverse frame spacing of 500mm for 0.7L amidships. Where the actual frame spacing differs, the thickness of the shell plating is to be increased at the rate of 0.5mm per 50mm of increase in the spacing, unless otherwise approved by the Surveyor.
2. The transom plating of stern fishing vessels is to be increased by at least 1mm above the Table thicknesses shown, unless coping irons are fitted.
3. Side plating in way of gantries and gallows is to be locally reinforced to the Surveyor's satisfaction.
4. The minimum thickness requirement for wetdeck plating on catamarans is to be that as required for the main hull.

4.20 Tables for steel and aluminium construction

4.20.4 Table 4: Transverse floors

Steel

Depth D m	Floors	Face bars mm
	Minimum depth at centreline and thickness mm	
0.75	150 x 4.5	35 x 4.5
1	160 x 5	35 x 5
1.25	180 x 5	40 x 5
1.5	200 x 5	45 x 5
1.75	230 x 5	50 x 5
2	250 x 6	50 x 6
2.25	280 x 6	50 x 6
2.5	310 x 7	50 x 8
2.75	340 x 7	65 x 8
3	380 x 7	75 x 8
3.25	400 x 8	75 x 8
3.5	440 x 8	75 x 8
3.75	470 x 8	80 x 8
4	500 x 8	80 x 8

Refer to Notes after aluminium table on following page.

4.20 Tables for steel and aluminium construction

4.20.4 Table 4: Transverse floors *(continued)*

Aluminium

Depth D m	Floors	Face bars mm
	Minimum depth at centreline and thickness mm	
0.75	165 x 6	50.8 x 6.4
1	185 x 6	50.8 x 6.4
1.25	210 x 6	50.8 x 6.4
1.5	230 x 6	63.5 x 6.4
1.75	265 x 6	63.5 x 6.4
2	275 x 8	63.5 x 9.5
2.25	310 x 8	63.5 x 9.5
2.5	355 x 10	63.5 x 9.5
2.75	375 x 10	101.6 x 9.5
3	425 x 10	101.6 x 9.5
3.25	450 x 10	101.6 x 12.7
3.5	495 x 10	101.6 x 12.7
3.75	535 x 10	101.6 x 12.7
4	570 x 10	101.6 x 12.7

4.20 Tables for steel and aluminium construction

4.20.4 Table 4: Transverse floors *(continued)*

Notes:-

1. For depths 'D' below 2m, flanged plate floors may be substituted for welded webs and face bars.
2. Where the floor spacing exceeds the frame spacing of 500mm, the thickness of floors is to be increased by not less than 0.5mm per 50mm difference in spacing.
3. The depth of floor is to be maintained over as great a distance fore and aft as is practicable. Where there is a significant reduction in hull depth (e.g. aft accommodation), 'D' may be taken at that position.
4. The thickness of plate floors in the engine room is to be increased by 1mm above the Table value, except that where additional structure (such as side tanks, flats, etc., are fitted) the additional strength provided may be taken into consideration to avoid this increase.
5. Where the rise of the floor makes it necessary, the depth of the floors at the centreline should be increased in order that the depth of floor, 0.25 times the distance from the centreline to the outboard end of the floor, is not less than 0.75 times the depth at the centreline.
6. Alternative sections to those shown within the Table may be considered providing they meet the same section modulus. In such cases the centre girder is to be adjusted accordingly, details are to be submitted for consideration.

Catamaran hulls

7. A minimum factor of 0.70 may be applied to the section modulus requirements of sections stated (sections are based on having 500mm of required plate thickness attached). Where spacings exceed 500mm then the section modulus requirement is to be increased in direct proportion. Spacings are not to exceed 1.5m.
8. In addition to item 7 above, where spacings are greater than 500mm then additional bottom stiffening is to fitted as per the below requirement:-

    i. Longitudinals (max. spacing of 300mm) – The relevant section moduli stated in Table 4.20.6 is to taken as found (no reducing factor used) with Length 'h' being the span of stiffener, and depth 'D' taken as stated.

    Note: Requirements 1 through to 6 above remain applicable for these types of vessels.

4.20 Tables for steel and aluminium construction

4.20.5 Table 5: Centre girders

Steel

Length L m	Thickness of girder Mm		Face bar mm
	With plate keel	With bar keel	
5	4.5	-	50 x 5
6	4.5	-	50 x 5
7	5	-	65 x 5
8	6	-	75 x 6
9	6	5	80 x 6
10	7	5	80 x 6
11	7	6	80 x 8
12	7	6	90 x 8
13	7	6	100 x 8
14	7	6	100 x 8
15	10	7	130 x 8

Refer to Notes after aluminium table on following page.

4.20 Tables for steel and aluminium construction

4.20.5 Table 5: Centre girders *(continued)*

Aluminium

Length L m	Thickness of girder mm		Face bar mm
	With plate keel	With bar keel	
5	6	-	63.5 x 6.4
6	6	-	63.5 x 6.4
7	6	-	76.2 x 6.4
8	8	-	101.6 x 9.5
9	8	6	101.6 x 9.5
10	10	6	101.6 x 9.5
11	10	8	101.6 x 12.7
12	10	8	101.6 x 12.7
13	10	8	127 x 12.7
14	10	8	127 x 12.7
15	12	10	152.4 x 12.7

4.20 Tables for steel and aluminium construction

4.20.5 Table 5: Centre girders *(continued)*

Notes:-

1. The depth of the centre girder is to be a minimum of the depth required for the floors at the centreline. See Table 4.20.4.
2. In the engine room the vertical plates of the engine seats will be accepted as an alternative to the centre girder provided that the continuity of longitudinal strength is maintained by an overlap at the ends of the centre girder and the engine seats. See Paragraph 4.3.2.
3. The thickness of the centre girder and the cross-sectional area of the face bars should in no circumstances be less than that of floors. If necessary the Table values for the centre girders are to be increased to meet this requirement.
4. The face bar may be formed of channel where required for drainage purposes. The dimensions of the channel web is to be a minimum of that required for the equivalent face bar.

Catamaran hulls

5. A minimum factor of 0.70 may be applied to the section modulus requirements of sections stated.

   Note: Requirements 1 through to 4 above remain applicable for these types of vessels.

4.20 Tables for steel and aluminium construction

4.20.6 Table 6: Transverse main frames

Steel

Depth D in metres	Length h in metres									
	0.75	**1**	**1.25**	**1.5**	**1.75**	**2**	**2.25**	**2.5**	**2.75**	**3**
0.75	- 50 x 5 FB (4.5) I/Y 4.0	Angle Flat Bar (Shell thickness) I/Y								
1	- 50 x 5 FB (4.5) I/Y 4.2	- 60 x 5 FB (5) I/Y 6.2								
1.5	- 60 x 5 FB (5) I/Y 4.9	- 65 x 5 FB (5) I/Y 7.1	- 75 x 6 FB (5) I/Y 9.3	50 x 40 x 5 70 x 8 FB (5) I/Y 11.9						
2	40 x 40 x 4 60 x 5 FB (5) I/Y 5.6	40 x 40 x 4 65 x 6 FB (5) I/Y 8.0	40 x 40 x 6 75 x 6 FB (5) I/Y 10.6	60 x 30 x 5 75 x 8 FB (6) I/Y 13.6	50 x 50 x 6 80 x 8 FB (6) I/Y 16.7	60 x 50 x 6 90 x 8 FB (7) I/Y 20.2				
2.5			50 x 40 x 5 70 x 8 FB (6) I/Y 11.8	60 x 30 x 6 75 x 8 FB (6) I/Y 15.2	50 x 50 x 8 90 x 8 FB (7) I/Y 18.7	65 x 50 x 6 100 x 8 FB (7) I/Y 22.8	75 x 50 x 6 100 x 10 FB (7) I/Y 27.6	60 x 60 x 8 100 x 10 FB (8) I/Y 33.2		
3			50 x 40 x 5 70 x 8 FB (6) I/Y 12.8	50 x 50 x 6 80 x 8 FB (6) I/Y 16.7	60 x 50 x 6 90 x 8 FB (7) I/Y 20.6	60 x 50 x 6 100 x 8 FB (7) I/Y 25.2	75 x 50 x 6 100 x 10 FB (7) I/Y 30.6	75 x 50 x 8 110 x 10 FB (8) I/Y 36.8	70 x 70 x 8 120 x 10 FB (8) I/Y 43.8	75 x 75 x 8 120 x 12 FB (8) I/Y 51.6
3.5			50 x 40 x 6 75 x 8 FB (7) I/Y 13.9	50 x 50 x 6 90 x 8 FB (7) I/Y 18.1	65 x 50 x 6 100 x 8 FB (7) I/Y 22.4	75 x 50 x 6 100 x 10 FB (7) I/Y 27.6	60 x 60 x 8 100 x 10 FB (8) I/Y 33.4	75 x 75 x 6 110 x 10 FB (8) I/Y 40.2	80 x 60 x 6 110 x 12 FB (8) I/Y 48.0	100 x 50 x 8 120 x 12 FB (8) I/Y 56.4
4			50 x 40 x 6 75 x 8 FB (7) I/Y 14.8	50 x 50 x 8 90 x 8 FB (7) I/Y 19.4	65 x 50 x 6 100 x 8 FB (8) I/Y 24.2	75 x 50 x 6 100 x 10 FB (8) I/Y 29.8	80 x 60 x 6 110 x 10 FB (8) I/Y 36.0	80 x 60 x 6 120 x 10 FB (8) I/Y 43.4	75 x 75 x 8 130 x 12 FB (8) I/Y 51.1	100 x 65 x 7 130 x 12 FB (8) I/Y 60.7

4.20 Tables for steel and aluminium construction

4.20.6 Table 6: Transverse main frames *(continued)*

Aluminium

Depth D in metres	Length h in metres									
	0.75	**1**	**1.25**	**1.5**	**1.75**	**2**	**2.25**	**2.5**	**2.75**	**3**
0.75	- 63.5 x 6.4 FB (6) I/Y 6.8	Angle Flat Bar (Shell thickness) I/Y								
1	- 63.5 x 6.4 FB (6) I/Y 7.2	- 76.2 x 6.4 FB (6.4) I/Y 10.6								
1.5	- 63.5 x 6.4 FB (6.4) I/Y 8.4	- 76.2 x 6.4 FB (6.4) I/Y 12.1	- 76.2 x 9.5 FB (6.4) I/Y 15.9	63.5 x 38.1 x 6.4 76.2 x 12.7 FB (6.4) I/Y 20.3						
2	- 76.2 x 6.4 FB (6.4) I/Y 9.6	- 76.2 x 9.5 FB (6.4) I/Y 13.6	63.5 x 38.1 x 6.4 76.2 x 9.5 FB (6.4) I/Y 18.1	63.5 x 50.8 x 6.4 76.2 x 12.7 FB (8.0) I/Y 23.2	76.2 x 50.8 x 6.4 101.6 x 9.5 FB (8) I/Y 28.4	76.2 x 50.8 x 6.4 88.9 x 12.7 FB (9.5) I/Y 34.4				
2.5			63.5 x 38.1 x 6.4 76.2 x 12.7 FB (8) I/Y 20.1	76.2 x 50.8 x 6.4 101.6 x 9.5 FB (8) I/Y 25.9	76.2 x 50.8 x 6.4 101.6 x 9.5 FB (9.5) I/Y 31.8	76.2 x 76.2 x 6.4 101.6 x 12.7 FB (9.5) I/Y 38.8	101.6 x 50.8 x 6.4 101.6 x 15.9 FB (9.5) I/Y 47.0	101.6 x 76.2 x 6.4 - (10) I/Y 56.5		
3			63.5 x 50.8 x 6.4 76.2 x 12.7 FB (8) I/Y 21.8	76.2 x 50.8 x 6.4 101.6 x 9.5 FB (8) I/Y 28.4	76.2 x 76.2 x 6.4 88.9 x 12.7 FB (9.5) I/Y 35.1	76.2 x 76.2 x 6.4 101.6 x 12.7 FB (9.5) I/Y 42.9	101.6 x 76.2 x 6.4 101.6 x 15.9 FB (9.5) I/Y 52.1	101.6 x 76.2 x 6.4 - (10) I/Y 62.6	101.6 x101.6 x 6.4 - (10) I/Y 74.5	88.9 x 88.9 x 9.5 - (10) I/Y 87.8
3.5			63.5 x 50.8 x 6.4 76.2 x 12.7 FB (9.5) I/Y 23.7	76.2 x 50.8 x 6.4 101.6 x 9.5 FB (9.5) I/Y 30.8	76.2 x 76.2 x 6.4 101.6 x 12.7 FB (9.5) I/Y 38.1	101.6 x 50.8 x 6.4 101.6 x 15.9 FB (9.5) I/Y 47.0	101.6 x 76.2 x 6.4 - (10) I/Y 56.8	101.6 x101.6 x 6.4 - (10) I/Y 68.4	101.6 x101.6 x 6.4 - (10) I/Y 81.6	101.6 x101.6 x 9.5 - (10) I/Y 95.9
4			63.5 x 50.8 x 6.4 76.2 x 12.7 FB (9.5) I/Y 25.2	76.2 x 50.8 x 6.4 88.9 x 12.7 FB (9.5) I/Y 33.0	76.2 x 76.2 x 6.4 - (10) I/Y 41.2	101.6 x 50.8 x 6.4 - (10) I/Y 50.7	101.6 x 76.2 x 6.4 - (10) I/Y 61.2	101.6 x101.6 x 6.4 - (10) I/Y 73.8	88.9 x 88.9 x 9.5 - (10) I/Y 86.9	101.6 x101.6 x 9.5 - (10) I/Y 103.2

4.20 Tables for steel and aluminium construction

4.20.6 Table 6: Transverse main frames *(continued)*

Notes:-

1. Sections stated are those stock sizes produced equivalent to or greater than the section moduli given.
2. Section dimensions are in mm and section moduli are in cm^3.
3. The section sizes in the Table may be varied provided the relevant section modulus is not reduced.
4. The section moduli are calculated with attached shell plating of thicknesses given in brackets immediately following the section dimension and a frame spacing of 500mm. Where the actual spacing is varied, the section modulus is to be increased or decreased in direct proportion, but in no circumstances should the frame spacing exceed 650mm.
5. Length 'h' in the Table is vertical depth of the frame measured from the top of the frame floor or inner bottom to the top of the deck beam at side as shown in Figure 4.21.2.

Catamaran hulls

6. A minimum factor of 0.70 may be applied to the section modulus requirements stated. Where spacings exceed 500mm then the section modulus requirement is to be increased in direct proportion.
7. In addition to item 6 above, where spacings are greater than 500mm then additional side stiffening is to fitted as per the below requirement:-

    i. Longitudinals (max. spacing of 300mm) – A minimum factor of 0.70 may be applied to the required section moduli stated in Table 4.20.6 with length 'h' being the span of stiffener, and depth 'D' taken as stated.

    Note: Requirements 1 through to 3 & 5 above remain applicable for these types of vessels.

4.20 Tables for steel and aluminium construction

4.20.7 Table 7: Tank top plating

Steel

Length L m	Plating thickness	
	50% L at amidships mm	At ends mm
8	4.5	4.5
9	5	4.5
10	5	5
11	5.5	5
12	6	5
13	6	6
14	6	6
15	6	6

Aluminium

Length L m	Plating thickness	
	50% L at amidships mm	At ends mm
8	6	6
9	6	6
10	6	6
11	8	6
12	8	6
13	8	8
14	8	8
15	8	8

Note:-

1. Where vessels carrying bulk fish are likely to be discharged by mechanical grabs, the tank top plating is to be increased in thickness by 1mm in way of the main loading/unloading hatch. This requirement may be waived where the fishroom floor is sheathed with timber or other approved material.

4.20 Tables for steel and aluminium construction

4.20.8 Table 8: Main deck plating

Steel

Length L m	Thickness of deck	
	Sheathed mm	Unsheathed mm
6	3	3.5
8	4	4.5
10	4.5	5
12	5	6
14	5	6
15	5	6

Aluminium

Length L m	Thickness of deck	
	Sheathed mm	Unsheathed mm
6	4	5
8	5	6
10	6	6
12	6	8
14	6	8
15	6	8

Notes:-

1. Main deck means the lowest continuous weathertight deck.
2. Where the spacing of the deck beams exceeds 500mm, the thickness of the deck plating is to be increased by 0.5mm per 100mm increase in spacing.

4.20 Tables for steel and aluminium construction

4.20.9 Table 9: Deck beams

Steel

Breadth B m	Beam section	
	Flat bar mm	Angle mm
2	50 x 4.5	35 x 35 x 4
	I/Y 4	
2.5	50 x 5	35 x 35 x 4.5
	I/Y 4.2	
3	65 x 6	40 x 40 x 5
	I/Y 8.6	
3.5	75 x 6	40 x 40 x 6
	I/Y 10.2	
4	80 x 6	50 x 40 x 5
	I/Y 12.1	
4.5	80 x 8	50 x 40 x 6
	I/Y 14.3	
5	90 x 8	50 x 50 x 6
	I/Y 17	
5.5	90 x 8	65 x 50 x 5
	I/Y 20.5	
6	100 x 8	65 x 50 x 6
	I/Y 24.6	
6.5	100 x 10	75 x 50 x 6
	I/Y 29	
7	100 x 12	75 x 60 x 6
	I/Y 34	

Refer to Notes after aluminium table on following page.

4.20 Tables for steel and aluminium construction

4.20.9 Table 9: Deck beams *(continued)*

Aluminium

Breadth B m	Beam section	
	Flat bar mm	Angle mm
2	63.5 x 6.4	-
	I/Y 6.8	
2.5	63.5 x 6.4	-
	I/Y 7.2	
3	76.2 x 9.5	-
	I/Y 14.7	
3.5	76.2 x 9.5	63.5 x 38.1 x 6.4
	I/Y 17.4	
4	101.6 x 9.5	63.5 x 38.1 x 6.4
	I/Y 20.6	
4.5	101.6 x 9.5	76.2 x 50.8 x 6.4
	I/Y 24.4	
5	101.6 x 9.5	76.2 x 50.8 x 6.4
	I/Y 28.9	
5.5	101.6 x 12.7	76.2 x 76.2 x 6.4
	I/Y 34.9	
6	101.6 x 12.7	76.2 x 76.2 x 6.4
	I/Y 41.9	
6.5	-	101.6 x 76.2 x 6.4
	I/Y 49.3	
7	-	101.6 x 76.2 x 6.4
	I/Y 57.8	

Refer to Notes on following page.

4.20 Tables for steel and aluminium construction

4.20.9 Table 9: Deck beams *(continued)*

Notes:-

1. Deck beams are to be fitted at every frame and should be connected to the frames by brackets in accordance with Figure 4.21.3.
2. Deck beams should be fitted in association with longitudinal girders, deep web beams and, where necessary, pillars (see Tables 4.20.10, 4.20.11 and 4.20.12).
3. The dimensions of the sections given in the Table may be modified provided the section modulus is not reduced.
4. The Table section moduli are based on a beam spacing of 500mm. Where the spacing is varied the moduli should also be increased in direct proportion.
5. Beams supporting heavy deck loads are to be increased in depth by twice the depth of the ordinary beam.
6. Where alternative flat bar or fabricated frames are proposed in place of rolled section, details are to be submitted for approval prior to utilisation in construction.

Catamaran hulls

7. Deck beam requirements are those as stated however, the breadth is to be that of the individual hull, not breadth overall of the vessel. breadth ‘B’ is to be the span taken from the outboard hull side to a longitudinal primary stiffener at the inboard hull side e.g. longitudinal wetdeck bulkhead or girder.
8. If deck girders are not fitted as per Table 4.20.11 then the individual breadth of hull is to be doubled for the requirements of the Table e.g. a 1m breadth hull is to be taken at the 2m requirements of the Table.

   Note: Requirements 1 through to 6 above remain applicable for these types of vessels.

9. In addition to item 7 above, if the spacings are greater than 500mm, then additional deck stiffening is to fitted as per the below requirement:-

   i. Longitudinals (max. spacing of 300mm) – The section to be a minimum section modulus of stiffener stated with the breadth taken as span of stiffener.

4.20 Tables for steel and aluminium construction

4.20.10 Table 10: Deep web beams

Steel

Breadth B m	Deep web beam spacing (m)				
	2	**2.5**	**3**	**3.5**	**4**
2	I/Y 42	I/Y 52	I/Y 63	I/Y 73	I/Y 83
2.5	I/Y 65	I/Y 82	I/Y 98	I/Y 114	I/Y 130
3	I/Y 94	I/Y 117	I/Y 141	I/Y 164	I/Y 188
3.5	I/Y 128	I/Y 160	I/Y 192	I/Y 224	I/Y 256
4	I/Y 167	I/Y 209	I/Y 250	I/Y 292	I/Y 334
4.5	I/Y 211	I/Y 264	I/Y 317	I/Y 370	I/Y 423
5	I/Y 256	I/Y 320	I/Y 384	I/Y 448	I/Y 512
5.5	I/Y 315	I/Y 394	I/Y 473	I/Y 552	I/Y 631
6	I/Y 389	I/Y 486	I/Y 584	I/Y 681	I/Y 778
6.5	I/Y 473	I/Y 591	I/Y 709	I/Y 827	I/Y 945
7	I/Y 576	I/Y 720	I/Y 864	I/Y 1008	I/Y 1152

Aluminium

Breadth B m	Deep web beam spacing (m)				
	2	**2.5**	**3**	**3.5**	**4**
2	I/Y 57.7	I/Y 72.1	I/Y 86.5	I/Y 101	I/Y 115.4
2.5	I/Y 90.1	I/Y 112.7	I/Y 135.2	I/Y 157.7	I/Y 180.3
3	I/Y 129.8	I/Y 162.2	I/Y 194.7	I/Y 227.1	I/Y 259.6
3.5	I/Y 176.7	I/Y 220.8	I/Y 265	I/Y 309.2	I/Y 353.3
4	I/Y 230.7	I/Y 288.4	I/Y 346.1	I/Y 403.8	I/Y 461.5
4.5	I/Y 292	I/Y 365	I/Y 438.1	I/Y 511.1	I/Y 584.1
5	I/Y 353.9	I/Y 442.3	I/Y 530.8	I/Y 619.3	I/Y 707.8
5.5	I/Y 435.4	I/Y 544.6	I/Y 653.8	I/Y 763	I/Y 872.3
6	I/Y 537.7	I/Y 671.8	I/Y 807.3	I/Y 941.4	I/Y 1075.5
6.5	I/Y 653.8	I/Y 817	I/Y 980.1	I/Y 1143.2	I/Y 1306.3
7	I/Y 796.2	I/Y 995.3	I/Y 1194.3	I/Y 1393.4	I/Y 1592.5

Refer to Notes on following page

4.20 Tables for steel and aluminium construction

4.20.10 Table 10: Deep web beams (continued)

Notes:-

1. The deep beam web Table provides the section modulus requirements for transverse beam sections being fitted in lieu of pillars.

2. The section modulus of deep web side frames in way of deep web beams are to be at least 4 times that required for ordinary frames.

3. Web corner connections are to be bracketed in accordance with Figure 4.21.4.

4. The Table moduli are based on a beam spacing of 500mm.

4.20 Tables for steel and aluminium construction

4.20.11 Table 11: Deck girders

Steel

Breadth B m	Girder Span m				
	2	2.5	3	3.5	4
2	I/Y 19	I/Y 29	I/Y 42	I/Y 57	I/Y 75
3	I/Y 28	I/Y 43	I/Y 63	I/Y 85	I/Y 111
4	I/Y 37	I/Y 58	I/Y 83	I/Y 113	I/Y 148
5	I/Y 46	I/Y 73	I/Y 105	I/Y 142	I/Y 186
6	I/Y 56	I/Y 87	I/Y 125	I/Y 170	I/Y 222
7	I/Y 65	I/Y 101	I/Y 146	I/Y 199	I/Y 259

Aluminium

Breadth B m	Girder Span m				
	2	2.5	3	3.5	4
2	I/Y 26.3	I/Y 40	I/Y 58	I/Y 78.8	I/Y 103.7
3	I/Y 38.7	I/Y 59.4	I/Y 87	I/Y 117.5	I/Y 153.4
4	I/Y 51.1	I/Y 80.2	I/Y 114.7	I/Y 156.2	I/Y 204.6
5	I/Y 63.6	I/Y 100.9	I/Y 145.1	I/Y 196.3	I/Y 257.1
6	I/Y 77.4	I/Y 120.3	I/Y 172.8	I/Y 235	I/Y 306.9
7	I/Y 89.8	I/Y 139.6	I/Y 201.8	I/Y 275	I/Y 358

Refer to Notes on following page.

4.20 Tables for steel and aluminium construction

4.20.11 Table 11: Deck girders *(continued)*

Notes:-

1. Maximum spacing of girders should not exceed B/3; consideration may be given to the fitting of additional girders to those required in the Tables, or surrounding structures providing equal support to that of pillars; in such cases a reduced section may be permitted.
2. The unsupported span of girders is not to exceed 4m.
3. The Table moduli are based on a beam spacing of 500mm. Where the beam spacing is varied, the section modulus of the girder is to be varied in direct proportion.
4. Where the girder web is notched over the deck beams, the depth of the girder web should be not less than 20mm greater than that of the beams. Girders fitted in association with flat bar beams are to be welded to the beams.
5. Girders are to be fitted with brackets at the transom and bulkheads. The depth and length of the brackets are to be as shown in Figure 4.21.4.
6. Moduli for intermediate spans are to be obtained by interpolation.

4.20 Tables for steel and aluminium construction

4.20.12 Table 12: Pillars

Steel – Solid Round

Factor N		Length of pillar (m)				
		1.5	2	2.5	3	3.5
3	Diameter in mm	45	50	60	60	60
4		50	50	60	65	65
6		50	60	60	70	70
8		50	60	65	75	75
10		50	65	60	80	80

Steel – Square Hollow Section

Factor N		Length of pillar (m)				
		1.5	2	2.5	3	3.5
3	Section size in mm	63.5 x 6.4	63.5 x 6.4	63.5 x 6.4	63.5 x 6.4	63.5 x 6.4
4		63.5 x 6.4	63.5 x 6.4	63.5 x 6.4	76.2 x 6.4	76.2 x 6.4
6		63.5 x 6.4	63.5 x 6.4	63.5 x 6.4	76.2 x 6.4	76.2 x 6.4
8		63.5 x 6.4	63.5 x 6.4	76.2 x 6.4	80 x 6.4	80 x 6.4
10		63.5 x 6.4	76.2 x 6.4	76.2 x 6.4	90 x 6.4	90 x 6.4

Aluminium – Solid Round

Factor N		Length of pillar (m)				
		1.5	2	2.5	3	3.5
3	Diameter in mm	60.4	66.7	82.6	82.6	82.6
4		66.7	66.7	82.6	88.9	88.9
6		66.7	82.6	82.6	95.3	95.3
8		66.7	82.6	88.9	101.6	101.6
10		66.7	88.9	95.3	108	108

Refer to Notes on following page.

4.20.12 Table 12: Pillars *(continued)*

Aluminium – Round Tube

Factor N		Length of pillar (m)				
		1.5	**2**	**2.5**	**3**	**3.5**
3	o/d and wall thickness in mm	76.2 x 6.4	88.9 x 6.4	114.3 x 6.4	114.3 x 6.4	114.3 x 6.4
4		88.9 x 6.4	88.9 x 6.4	114.3 x 6.4	127 x 6.4	127 x 6.4
6		88.9 x 6.4	114.3 x 6.4	114.3 x 6.4	152.4 x 6.4	152.4 x 6.4
8		88.9 x 6.4	114.3 x 6.4	127 x 6.4	165.1 x 6.4	165.1 x 6.4
10		88.9 x 6.4	127 x 6.4	152.4 x 6.4	-	-

Notes:-

1. Factor ‘N’ for pillar supporting main deck = 1.4 ιb

   where ι = mean length of deck supported by pillar
   b = mean breadth of deck supported by pillar

2. Factor ‘N’ for pillar supporting superstructure deck = 1.07 ιb

3. Where pillars of built-up or tubular section or aluminium are used, they are to be of equivalent strength to those shown in the Table.

4.20 Tables for steel and aluminium construction

4.20.13 Table 13: Watertight bulkheads

Steel

Depth of bulkhead at centreline m	Thickness of plating mm	Section modulus of stiffeners (I/Y cm^3)	Stiffener sections meeting modulus required	
			Angle mm	Flat Bar mm
0.75	3.5	4	-	50 x 4.5
1	4	4.4	-	50 x 5
1.25	4.5	6.2	-	60 x 5
1.5	5	7.5	-	60 x 6
1.75	5	9.1	40 x 40 x 5	70 x 6
2	6	12	45 x 45 x 5	70 x 8
2.25	6	15	50 x 40 x 6	75 x 8
2.5	6	17.7	50 x 50 x 6	75 x 10
2.75	6	21.3	65 x 50 x 5	80 x 10
3	6.5	26	60 x 60 x 6	90 x 10
3.25	6.5	30.6	75 x 50 x 6	100 x 10
3.5	6.5	35	70 x 70 x 6	100 x 12
3.75	6.5	41	75 x 75 x 6	110 x 12
4.0	8	48	80 x 60 x 8	110 x 12

Refer to Notes after aluminium table on following page.

4.20 Tables for steel and aluminium construction

4.20.13 Table 13: Watertight bulkheads *(continued)*

Aluminium

Depth of bulkhead at centreline m	Thickness of plating mm	Section modulus of stiffeners (I/Y cm^3)	Stiffener sections meeting modulus required	
			Angle mm	Flat Bar mm
0.75	5	6.8	-	63.5 x 6.4
1	5	7.5	-	63.5 x 6.4
1.25	6	10.6	-	76.2 x 6.4
1.5	6	12.8	44.5 x 44.5 x 6.4	76.2 x 6.4
1.75	6	15.5	50.8 x 50.8 x 6.4	76.2 x 9.5
2	8	20.4	63.5 x 38.1 x 6.4	76.2 x 12.7
2.25	8	25.5	76.2 x 50.8 x 6.4	76.2 x 12.7
2.5	8	30.1	76.2 x 50.8 x 6.4	101.6 x 9.5
2.75	8	36.3	76.2 x 76.2 x 6.4	101.6 x 12.7
3	8	44.2	76.2 x 76.2 x 6.4	127 x 12.7
3.25	8	52.1	101.6 x 76.2 x 6.4	127 x 12.7
3.5	8	59.5	101.6 x 76.2 x 6.4	127 x 12.7
3.75	8	69.7	101.6 x 101.6 x 6.4	152.4 x 12.7
4.0	10	81.6	101.6 x 101.6 x 6.4	152.4 x 12.7

4.20 Tables for steel and aluminium construction

4.22.13 Table 13: Watertight bulkheads *(continued)*

Notes:-

1. Watertight bulkheads are to extend from the keel to the lowest continuous deck/flat above the deepest operational waterline.
2. The moduli of stiffeners in the Table are based on a stiffener spacing of 500mm. Where the spacing is varied the modulus should be varied in direct proportion.
3. The stiffener sections given in the Table may be varied provided the section moduli are not reduced.
4. Where the depth of the bulkhead at any stiffener is less than 2.5m, brackets or other end connections may be omitted, unless connected to deck girders or longitudinals.
5. Where longitudinal bulkheads, decks, tank tops, etc. butt to bulkhead plating, these connections may be taken into consideration when determining stiffener and plating scantlings.
6. For details of bracket connections see Figures 4.21.3 and 4.21.4.

Catamaran hulls

7. A minimum factor of 0.70 may be applied to the section modulus of stiffeners only, plate thicknesses are to be as those stated.

   Note: Requirements 1 through to 6 above remain applicable for these types of vessels.

4.20 Tables for steel and aluminium construction

4.20.14 Table 14: Bulwark plating and bulwark stays

Steel

Length L m	Thickness of bulwark plating mm	
	In way of gallows and transom	Elsewhere
5	5	4
6	5	4.5
8	6	5
10	6.5	5
12	7	6
14	7.5	6
15	8	6

Aluminium

Length L m	Thickness of bulwark plating mm	
	In way of gallows and transom	Elsewhere
5	6	5
6	6	5
8	8	6
10	8	6
12	9.5	8
14	9.5	8
15	10	8

Refer to Notes on following page.

4.20 Tables for steel and aluminium construction

4.20.14 Table 14: Bulwark plating and bulwark stays *(continued)*

Notes:-

1. Where stays consist of a flanged flat plate, the flange width is to be not less than 50mm, and the plate thickness not less than that of the bulwark plating locally. Where an alternative thickness is proposed, details are to be submitted for consideration.
2. Only that section of the bulwark stay which is welded to the deck is to be used when determining the modulus of the stay.
3. Where length ‘L’ is between those shown in the Table, the thickness is to be that shown for the nearest length.
4. Where the shell plating is extended to bulwark height, the bulwark thickness may be that required for the shell plating except in way of gallows, and subject to the approval of the Surveyor.

4.20 Tables for steel and aluminium construction

4.20.15 Table 15: Chine bars

Steel

Length L m	Diameter mm
5	15
6	15
8	18
10	22
12	25
14	32
15	35

Aluminium

Length L m	Diameter mm
5	19
6	19
8	22.3
10	28.6
12	31.8
14	41.3
15	44.5

Notes:-

1. When the length 'L' falls between those given in the Table, the diameter of the bars should be to the nearest length.
2. Diameters shown are for solid round section. Proposals for the use of alternative sections are to be submitted for consideration and approval.

4.20 Tables for steel and aluminium construction

4.20.16 Table 16: Shelter deck beams

Steel

Breadth B m	(Modulus cm^3) - Recommended scantling			Frame spacing mm
	Weathertight (WT)	Non-weathertight	Wheelhouse	
3	(5.2) 65 x 5 FB	(4.8) 50 x 5 FB	(3.2) 50 x 5 FB	500
3.5	(6.4) 65 x 5 FB	(5.2) 65 x 5 FB	(3.8) 50 x 5 FB	500
4	(7.4) 65 x 6 FB	(5.9) 65 x 5 FB	(4.4) 50 x 5 FB	500
4.5	(8.3) 65 x 6 FB	(6.6) 65 x 5 FB	(4.9) 50 x 6 FB	500
5	(9.2) 75 x 6 FB	(7.4) 65 x 6 FB	(5.5) 65 x 5 FB	500
5.5	(10.1) 75 x 6 FB	(8.2) 65 x 6 FB	(6) 65 x 5 FB	500
6	(13.2) 75 x 10 FB	(10.5) 75 x 6 FB	(7.9) 65 x 6 FB	500
6.5	(17.5) 75 x 10 FB	(14) 75 x 10 FB	(10.5) 75 x 6 FB	500
7	(21.8) 65 x 50 x 6 OA	(17.5) 75 x 10 FB	(13) 75 x 10 FB	500

Aluminium

Breadth B m	(Modulus cm^3) - Recommended scantling			Frame spacing mm
	Weathertight (WT)	Non-weathertight	Wheelhouse	
3.5	(10.9) 75 x 6.4 FB	(8.7) 63 x 6.4 FB	(6.6) 63 x 6.4 FB	500
4	(12.5) 75 X 6.4 FB	(10) 75 x 6.4 FB	(7.5) 63 x 6.4 FB	500
4.5	(14) 75 x 9.5 FB	(11.2) 75 x 6.4 FB	(8.4) 63 x 6.4 FB	500
5	(15.6) 76.2 x 9.5 FB	(12.5) 76.2 x 6.4 FB	(9.4) 63 x 6.4 FB	500
5.5	(20.6) 63.5 x 38 x 6 OA	(13.8) 76.2 x 9.5 FB	(10.3) 76.2 x 6.4 FB	500
6	(22.4 63.5 x 50 x 6 OA	(20.6) 63.5 x 38 x 6 OA	(13.4) 76.2 x 6.4 FB	500
6.5	(29.6) 76.2 x 50.8 x 6.4	(23.7) 63.5 x 50.8 x 6.4	(20.6) 63.5 x 38.1 x 6.4	500
7	(37) 76.2 x 76.2 x 6.4	(29.6) 63.5 x 50.8 x 6.4	(22.2) 63.5 x 50.8 x 6.4	500

Refer to Notes on following page.

4.20 Tables for steel and aluminium construction

4.20.16 Table 16: Shelter deck beams *(continued)*

Notes:-

1. The moduli shown are based on girders spaced B/3 apart. If the unsupported span of beams is greater, the following correction is to be applied:-

   New modulus = $\frac{Table\ modulus\ x\ S^2}{(B/3)^2}\ cm^3$

   Where *B* = Breadth of vessel; *S* = unsupported span of beam.

2. Where frame spacing is greater than that shown, the moduli is to be increased by 10% for each 50mm increase in spacing.
3. Alternative sections giving equal moduli may be used.
4. B/3 or S, unsupported span of beam, should not be less than 1.83m.
5. Wheelhouses and island deckhouses may take breadth ‘B’ as the actual breadth of the structure.

4.20 Tables for steel and aluminium construction

4.20.17 Table 17: Shelter deck side plating and stiffeners

Side stiffeners

Depth D	Steel		Aluminium	
	Modulus	Section	Modulus	Section
1.5	(6.3)	65 x 5 FB	(10.7)	75 x 6.4 FB
2	(8.4)	65 x 6 FB	(14.2)	65 x 38 x 6.4 OA 76.2 x 9.5 FB
2.5	(10.5)	75 x 6 FB	(17.8)	65 x 38 x 6.4 OA 76.2 x 9.5 FB
3	(12.6)	75 x 10 FB	(21.4)	65 x 65 x 6.4 OA 76.2 x 12.7 FB
3.5	(14.7)	65 x 38 x 6 OA 75 x 10 FB	(25)	65 x 65 x 6.4 OA 101.6 x 9.5 FB
4	(16.8)	65 x 38 x 6 OA 75 x 10 FB	(28.5)	65 x 65 x 6.4 OA 101.6 x 9.5 FB

Shelter side plating

Length L	Weathertight		Non-weathertight		Wheelhouse	
	Steel	Aluminium	Steel	Aluminium	Steel	Aluminium
10m and below	4	5	4	5	4	5
Over 10m	5	6	5	6	4	5

Notes:-

1. Sizes are based on frame spacing of 500mm. Where the spacing is greater, the plating thickness is to be increased at the rate of 0.5mm per 50mm spacing difference.
2. Alternative sections giving equal moduli may be fitted. The next greater standard aluminium section is to be utilised when stated sections are not available.

4.20 Tables for steel and aluminium construction

4.20.18 Table 18: Shelter deck plating

Length L	Weathertight		Non-weathertight		Wheelhouse	
	Steel	Aluminium	Steel	Aluminium	Steel	Aluminium
10m and below	4	5	4	5	4	5
Over 10m	5	6	5	6	5	5

Note:-

1. Sizes are based on frame spacing of 500mm. Where the spacing is greater, the plating thickness is to be increased at the rate of 0.5mm per 50mm spacing difference.

4.20 Tables for steel and aluminium construction

4.20.19 Table 19: Shelter deck girders

Steel

Weathertight					
Girder spacing m	**Distance between supports (m)**				
	2	2.5	3	3.5	4
	Modulus (cm^3) - recommended section (angle)				
1.5	(43) 100 x 50 x 6	(67) 100 x 100 x 6	(96) 150 x 75 x 10	(132)	(172.4)
2	(57) 100 x 75 x 6	(89) 100 x 100 x 6	(129) 150 x 75 x 10	(175)	(229.9)
Non-weathertight					
1.5	(25.8) 65 x 50 x 6	(40.2) 100 x 50 x 6	(57.6) 100 x 75 x 6	(79.2)	(103.2)
2	(34.2) 100 x 50 x 6	(53.4) 100 x 75 x 6	(77.4) 100 x 100 x 6	(105)	(137.6)
Wheelhouse					
1.5	(19.3) 65 x 50 x 6	(30.1) 75 x 50 x 6	(43.3) 100 x 50 x 6	(59)	(77.1)
2	(25.7) 65 x 50 x 6	(40.1) 100 x 50 x 6	(57.8) 100 x 75 x 6	(78.6)	(102.8)

Aluminium

Weathertight					
1.5	(73) 100 x 100 x 6.5	(114) 150 x 75 x 9.5	(163) 200 x 75 x 9.5	(224)	(292.6)
2	(97) 150 x 75 x 9.5	(151) 150 x 75 x 9.5	(219) 200 x 100 x 9.5	(298)	(390.2)
Non-weathertight					
1.5	(43.9) 100 x 50 x 6.4	(68.4) 100 x 100 x 6.4	(98) 150 x 75 x 9.5	(134.7)	(175.7)
2	(58.2) 100 x 75 x 6.4	(90.5) 150 x 75 x 9.4	(131.6) 150 x 75 x 9.5	(178.5)	(234.2)
Wheelhouse					
1.5	(25.7) 65 x 50 x 6.4	(40.1) 100 x 50 x 6.4	(57.7) 100 x 75 x 6.4	(78.6)	(102.7)
2	(34.2) 75 x 50 x 6.4	(53.5) 100 x 75 x 6.4	(77) 100 x 100 x 6.4	(104.7)	(137)

4.20 Tables for steel and aluminium construction

4.20.19 Table 19: Shelter deck girders (continued)

Notes:-

1. Maximum spacing of girders is not to exceed B/3.
2. The fitting of a single centreline girder may be considered in vessels where ‘B’ is less than 4m.
3. The unsupported span of girders is not to exceed 4m.
4. Pillars supporting girders are to comply with Table 4.20.12.
5. Where the girder web is cut over deck beams, the depth of the web is not to be less than 25mm greater than the beam web.
6. Ends of girders are to be bracketed to the satisfaction of the Surveyor.
7. Scantlings for aluminium sections shown may be substituted by the next greater standard section.
8. Moduli for intermediate spans are to be obtained by interpolation.

4.20 Tables for steel and aluminium construction

4.20.20 Table 20: Shelter deck deep web beams

Steel

Weathertight – Modulus (cm³)					
Breadth of unsupported shelterdeck (m)	**Deep web beam spacing (m)**				
	2	**2.5**	**3**	**3.5**	**4**
2	I/Y 42	I/Y 52	I/Y 63	I/Y 73	I/Y 83
2.5	I/Y 65	I/Y 82	I/Y 98	I/Y 114	I/Y 130
3	I/Y 94	I/Y 117	I/Y 141	I/Y 164	I/Y 188
3.5	I/Y 128	I/Y 160	I/Y 192	I/Y 224	I/Y 256
4	I/Y 167	I/Y 209	I/Y 250	I/Y 292	I/Y 334
4.5	I/Y 211	I/Y 264	I/Y 317	I/Y 370	I/Y 423
5	I/Y 256	I/Y 320	I/Y 384	I/Y 448	I/Y 512
5.5	I/Y 315	I/Y 394	I/Y 473	I/Y 552	I/Y 631
6	I/Y 389	I/Y 486	I/Y 584	I/Y 681	I/Y 778
6.5	I/Y 473	I/Y 591	I/Y 709	I/Y 827	I/Y 945
7	I/Y 576	I/Y 720	I/Y 864	I/Y 1008	I/Y 1152

Aluminium

Weathertight – Modulus (cm³)					
Breadth of unsupported shelterdeck (m)	**Deep web beam spacing (m)**				
	2	**2.5**	**3**	**3.5**	**4**
2	I/Y 57.7	I/Y 72.1	I/Y 86.5	I/Y 101	I/Y 115.4
2.5	I/Y 90.1	I/Y 112.7	I/Y 135.2	I/Y 157.7	I/Y 180.3
3	I/Y 129.8	I/Y 162.2	I/Y 194.7	I/Y 227.1	I/Y 259.6
3.5	I/Y 176.7	I/Y 220.8	I/Y 265	I/Y 309.2	I/Y 353.3
4	I/Y 230.7	I/Y 288.4	I/Y 346.1	I/Y 403.8	I/Y 461.5
4.5	I/Y 292	I/Y 365	I/Y 438.1	I/Y 511.1	I/Y 584.1
5	I/Y 353.9	I/Y 442.3	I/Y 530.8	I/Y 619.3	I/Y 707.8
5.5	I/Y 435.4	I/Y 544.6	I/Y 653.8	I/Y 763	I/Y 872.3
6	I/Y 537.7	I/Y 671.8	I/Y 807.3	I/Y 941.4	I/Y 1075.5
6.5	I/Y 653.8	I/Y 817	I/Y 980.1	I/Y 1143.2	I/Y 1306.3
7	I/Y 796.2	I/Y 995.3	I/Y 1194.3	I/Y 1393.4	I/Y 1592.5

4.20 Tables for steel and aluminium construction

4.20.20 Table 20: Shelter deck deep web beams *(continued)*

Steel

Non-weathertight – Modulus (cm³)					
Breadth of unsupported shelterdeck (m)	**Deep web beam spacing (m)**				
	2	**2.5**	**3**	**3.5**	**4**
2	I/Y 33	I/Y 41	I/Y 50	I/Y 58	I/Y 67
2.5	I/Y 52	I/Y 65	I/Y 78	I/Y 91	I/Y 104
3	I/Y 75	I/Y 94	I/Y 113	I/Y 131	I/Y 150
3.5	I/Y 102	I/Y 128	I/Y 153	I/Y 179	I/Y 204
4	I/Y 133	I/Y 167	I/Y 200	I/Y 234	I/Y 267
4.5	I/Y 169	I/Y 211	I/Y 254	I/Y 296	I/Y 338
5	I/Y 208	I/Y 261	I/Y 313	I/Y 365	I/Y 417
5.5	I/Y 252	I/Y 316	I/Y 379	I/Y 442	I/Y 505
6	I/Y 300	I/Y 376	I/Y 451	I/Y 526	I/Y 601
6.5	I/Y 353	I/Y 441	I/Y 529	I/Y 617	I/Y 705
7	I/Y 409	I/Y 511	I/Y 613	I/Y 716	I/Y 818

Aluminium

Non-weathertight – Modulus (cm³)					
Breadth of unsupported shelterdeck (m)	**Deep web beam spacing (m)**				
	2	**2.5**	**3**	**3.5**	**4**
2	I/Y 45.6	I/Y 56.7	I/Y 69.1	I/Y 80.2	I/Y 92.6
2.5	I/Y 71.9	I/Y 89.9	I/Y 107.8	I/Y 125.8	I/Y 143.8
3	I/Y 103.7	I/Y 129.9	I/Y 156.2	I/Y 181.1	I/Y 207.4
3.5	I/Y 141.0	I/Y 176.9	I/Y 211.5	I/Y 247.4	I/Y 282.0
4	I/Y 183.9	I/Y 230.9	I/Y 276.5	I/Y 323.5	I/Y 369.1
4.5	I/Y 233.6	I/Y 291.7	I/Y 351.1	I/Y 409.2	I/Y 467.2
5	I/Y 287.5	I/Y 360.8	I/Y 432.7	I/Y 504.6	I/Y 576.4
5.5	I/Y 348.4	I/Y 436.8	I/Y 523.9	I/Y 611.0	I/Y 698.1
6	I/Y 414.7	I/Y 519.8	I/Y 623.4	I/Y 727.1	I/Y 830.8
6.5	I/Y 488.0	I/Y 609.6	I/Y 731.3	I/Y 852.9	I/Y 974.6
7	I/Y 565.4	I/Y 706.4	I/Y 847.4	I/Y 989.8	I/Y 1130.8

Refer to Notes on following page

4.20 Tables for steel and aluminium construction

4.20.20 Table 20: Shelter deck deep web beams *(continued)*

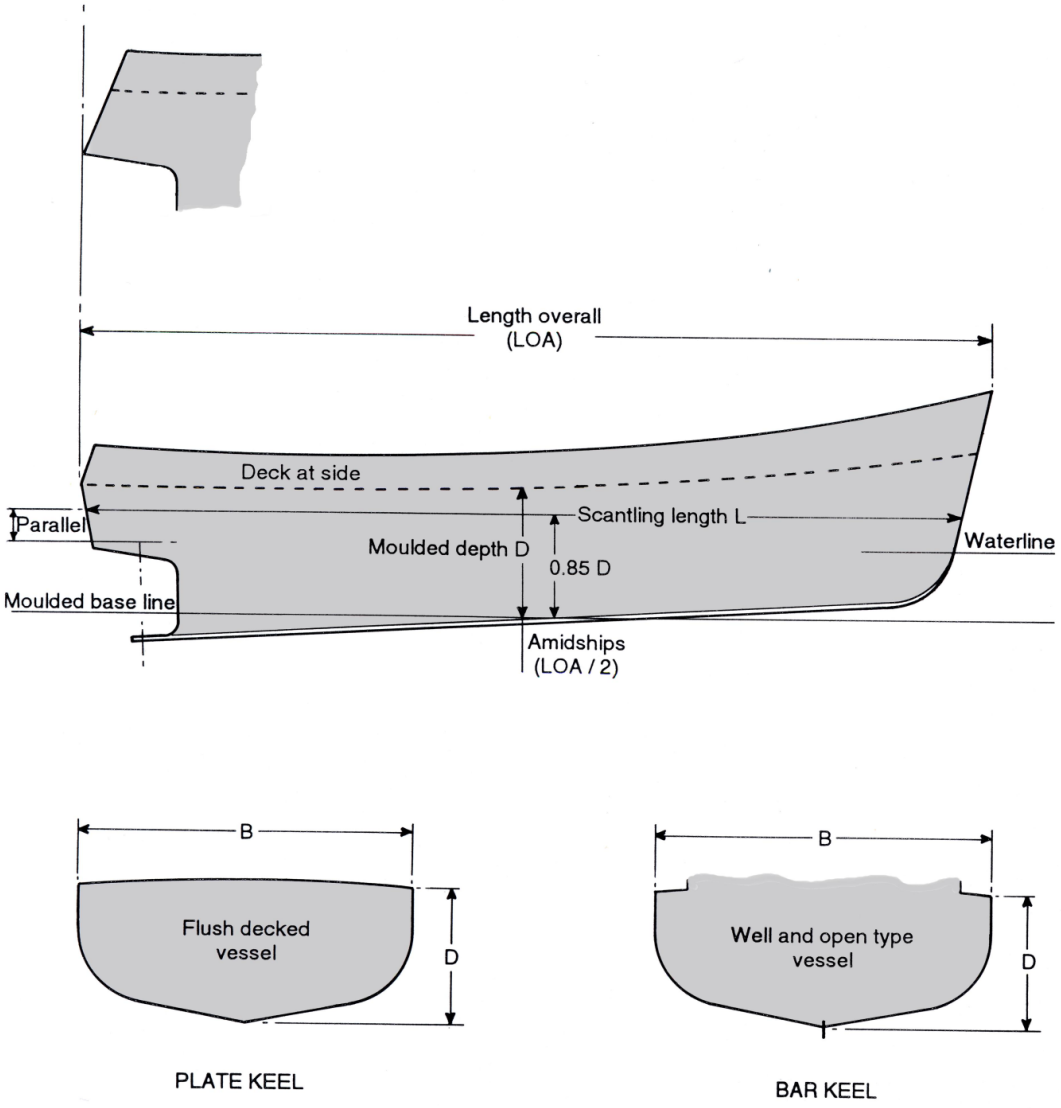
Notes:-

1. The deep beam web Table provides the section modulus requirements for transverse beam sections being fitted in lieu of pillars.
2. The section modulus of deep web side frames in way of deep web beams are to be at least 4 times that required for ordinary frames.
3. Web corner connections are to be bracketed in accordance with Figure 4.21.4.
4. The Table moduli are based on a beam spacing of 500mm.
5. Moduli for intermediate spans are to be obtained by interpolation.

4.21 Figures & illustrations

4.21.1 Scantling numeral dimensions – steel and aluminium vessels

L x B x D = Scantling numeral



Length overall measured in a straight line from the fore side of stem at top to after side of stern / transom or fore side of the bulbous bow to after side of stern / transom if that be greater.

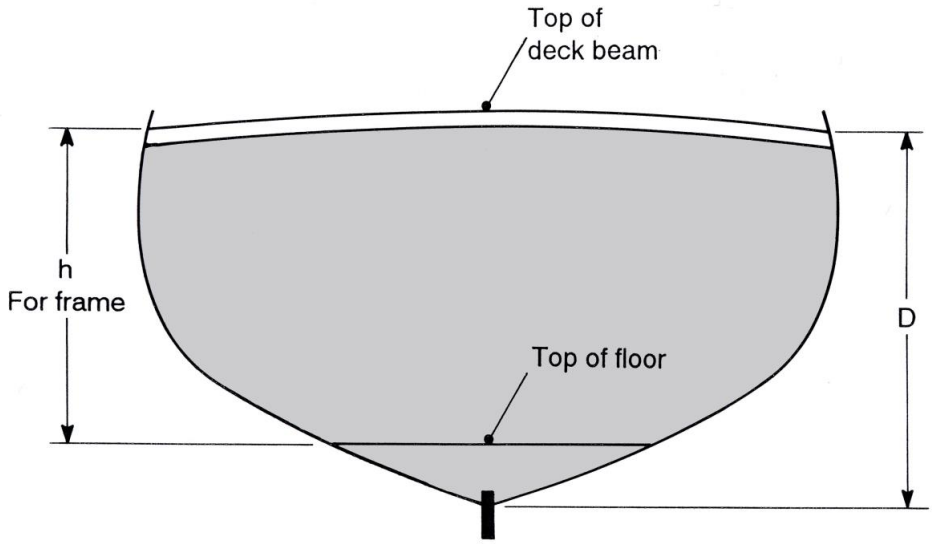
Scantling length ‘L’ measured in a straight line parallel to an assumed waterline at 0.85 x moulded depth, above top of keel amidships.

Breadth ‘B’ measured to outside of plating at the greatest breadth of the vessel, but excluding fenders or rub rails.

Depth ‘D’ measured amidships from top of plate keel or the line of intersection of the inside of the shell plating at keel to top of deck beam at side. See Figure 4.12.2, Fig. 1a.

4.21 Figures and illustrations

4.21.2 Scantling numeral dimensions – steel and aluminium vessels



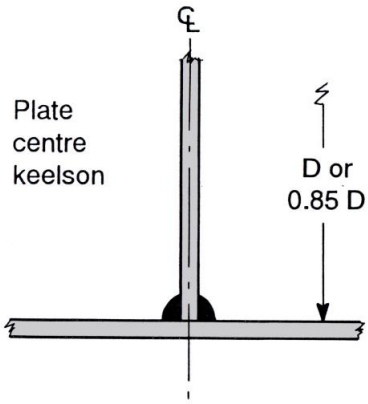
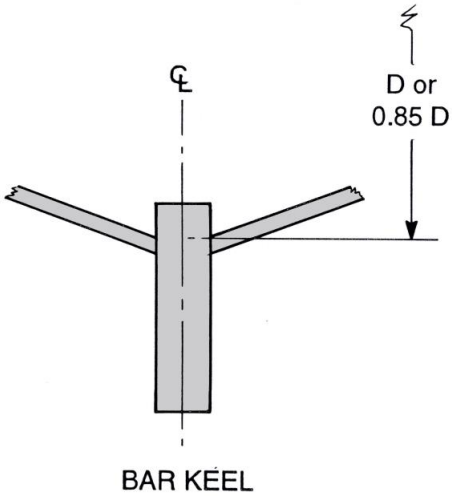


PLATE KEEL

Fig.1a

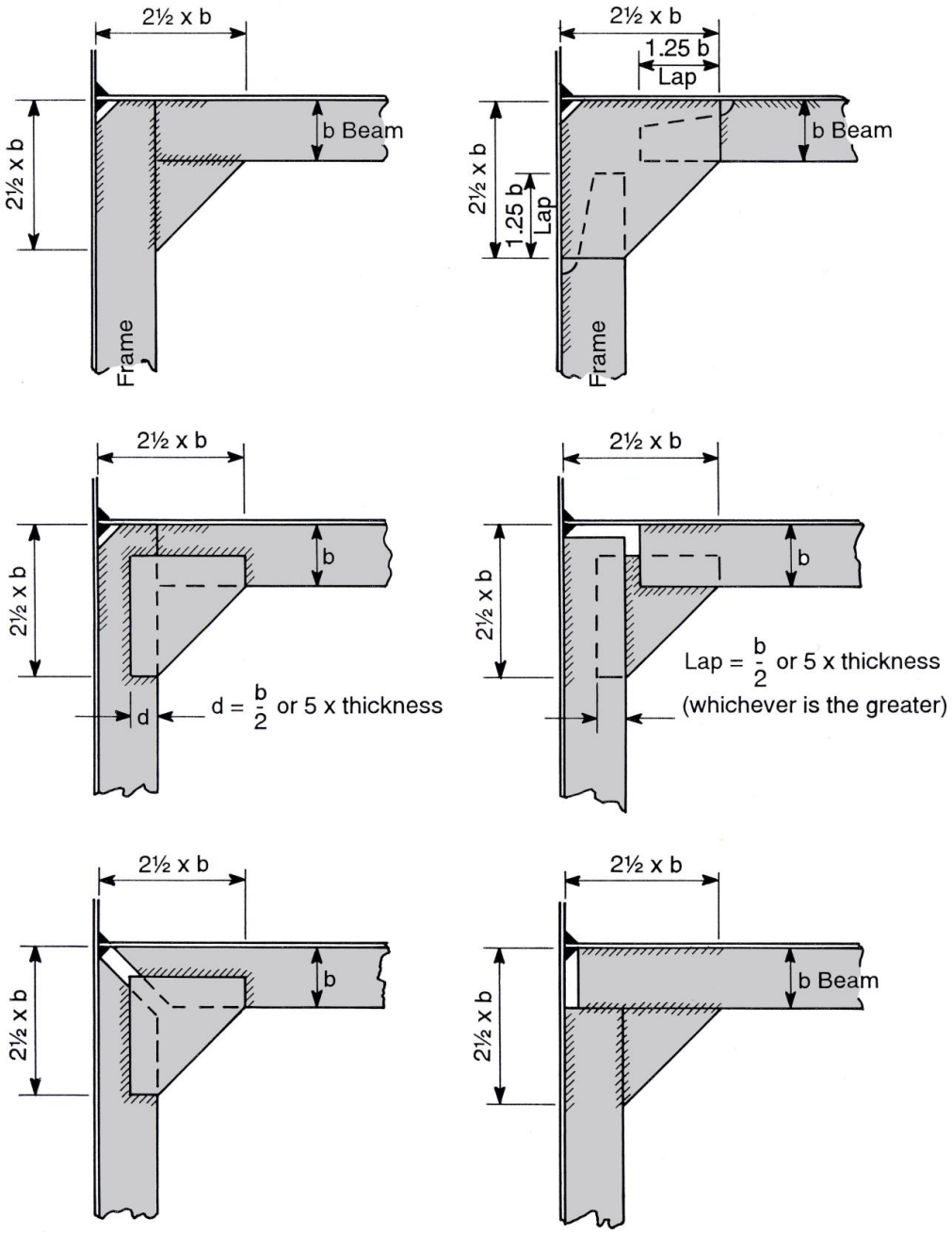


BAR KEEL

Length = h
Depth = D

4.21 Figures and illustrations

4.21.3 Beam knees and longitudinal brackets



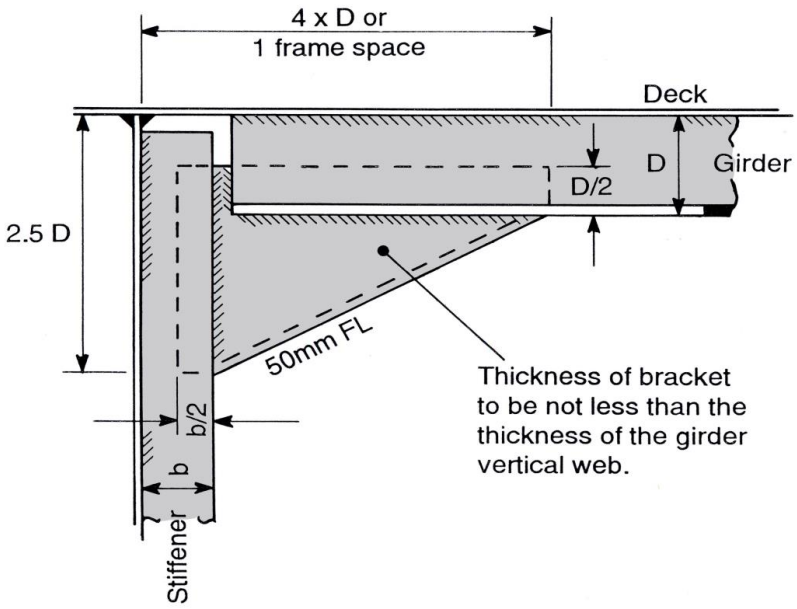
i) Where beam and frame scantlings are greater than required by the associated tables, the beam knee may be omitted where the beam is directly connected to the frame to the approval of the surveyor.

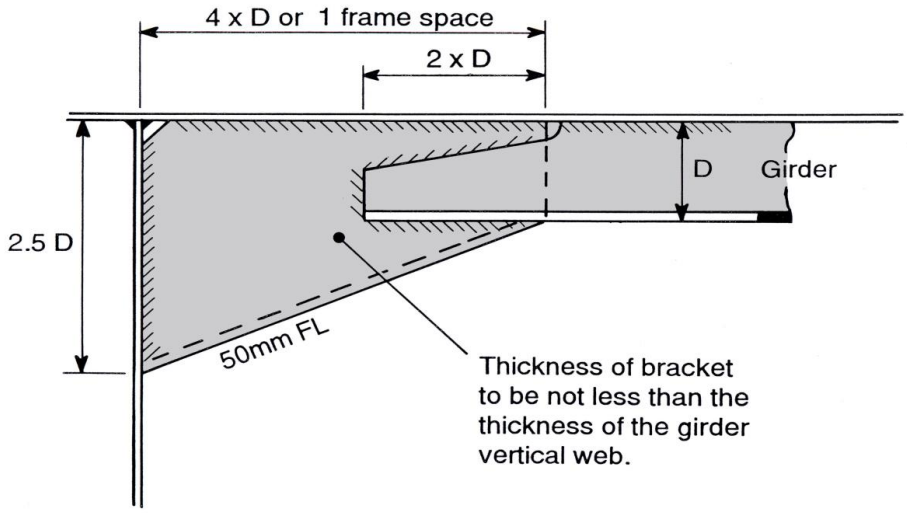
ii) The thickness of unflanged brackets should not be less than the table thickness of the stiffener.

iii) Where the bracket length / thickness ratio exceeds 32 the bracket is to be flanged.

4.21 Figures and illustrations

4.21.4 Longitudinal girder brackets

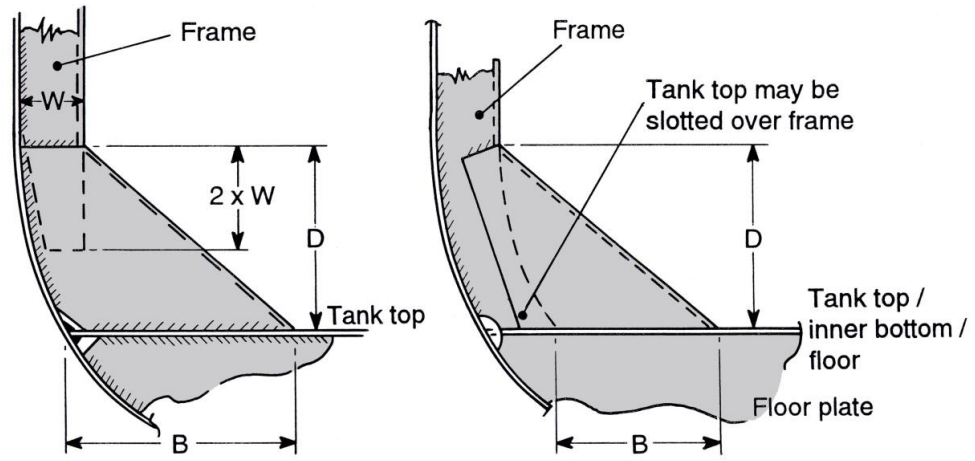




Transverse deck beams in way of bracket ends are to be collared where passing through the deck girder.

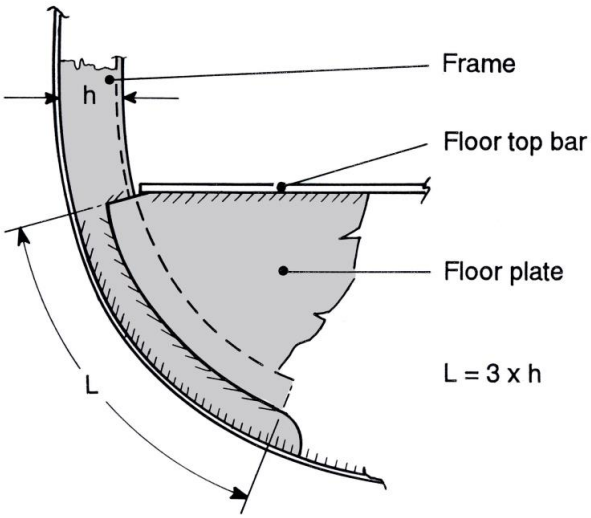
4.21 Figures and illustrations

4.21.5 Side frame bottom brackets



Notes:

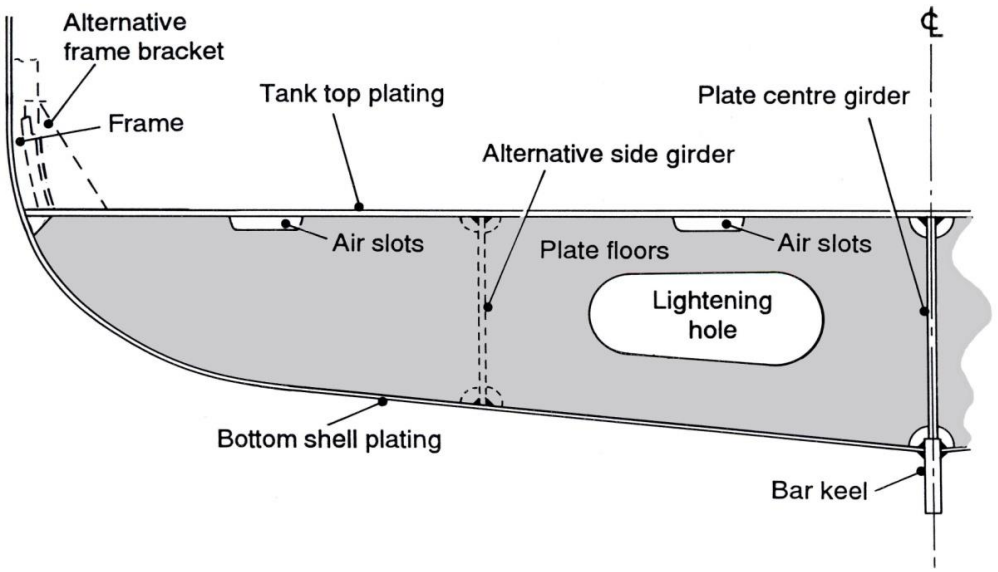
1. D is to be not less than 0.1 x the unsupported span of the side frame.
2. B is to be not less than 1.5 x the depth of the side frame.
3. The thickness of the bracket is to be not less than that of the floors locally.
4. All brackets are to be flanged or fitted with a welded face bar. Minimum width of flange is to be 50 millimetres.



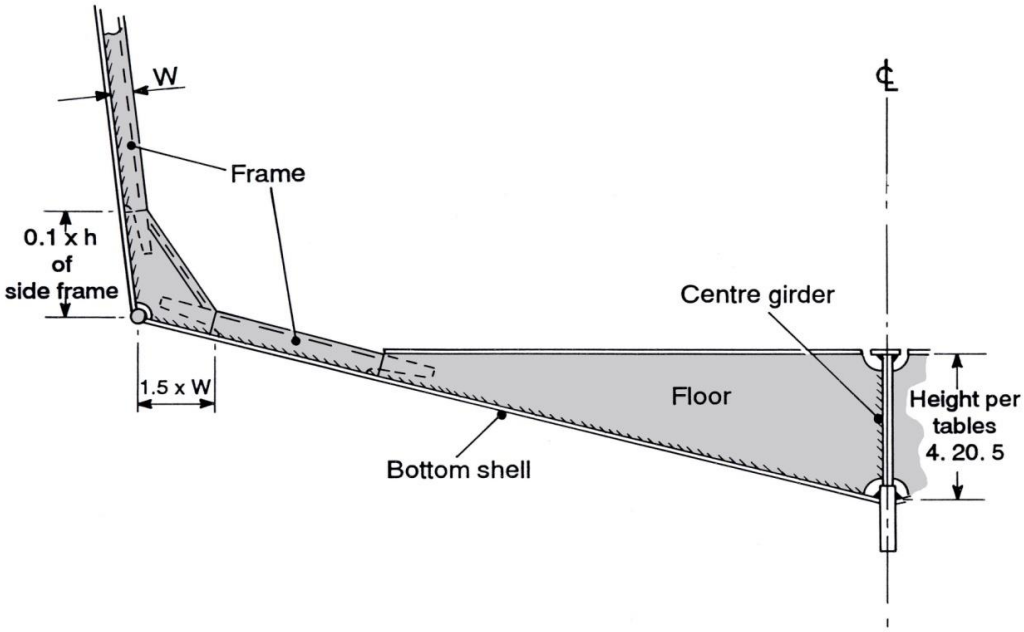
FRAME TO FLOOR LAP CONNECTION

4.21 Figures and illustrations

4.21.6 Bottom construction



TYPICAL BOTTOM INTEGRAL TANK CONSTRUCTION

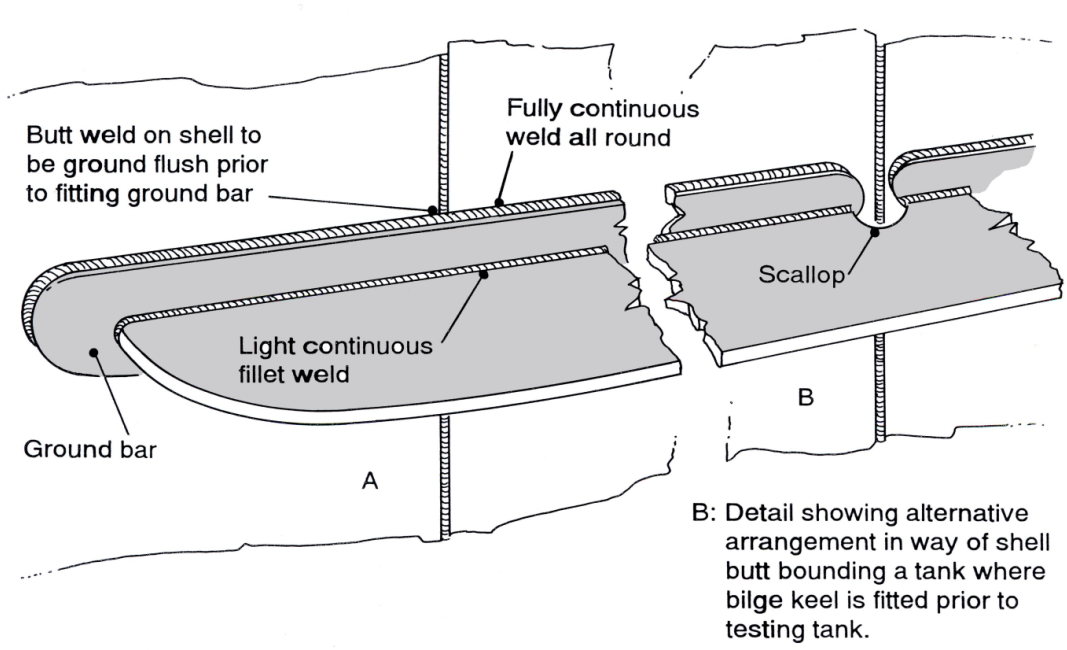


TYPICAL SINGLE BOTTOM CONSTRUCTION

For integral tanks see Section 4.5

4.21 Figures and illustrations

4.21.7 Bilge keel details

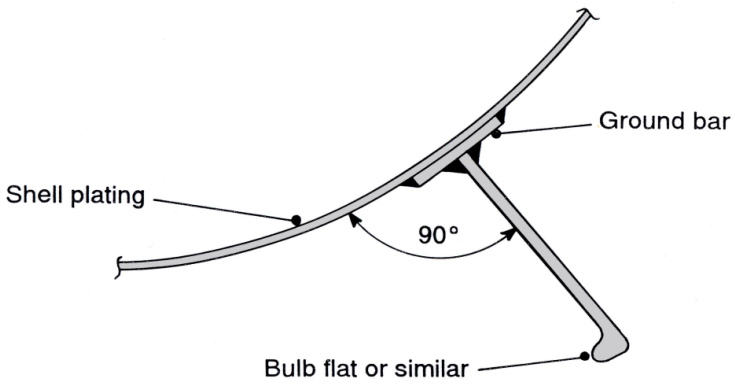


B: Detail showing alternative arrangement in way of shell butt bounding a tank where bilge keel is fitted prior to testing tank.

Notes:

1. Butts in ground bar and bilge keel should be well staggered from shell butts and from each other.

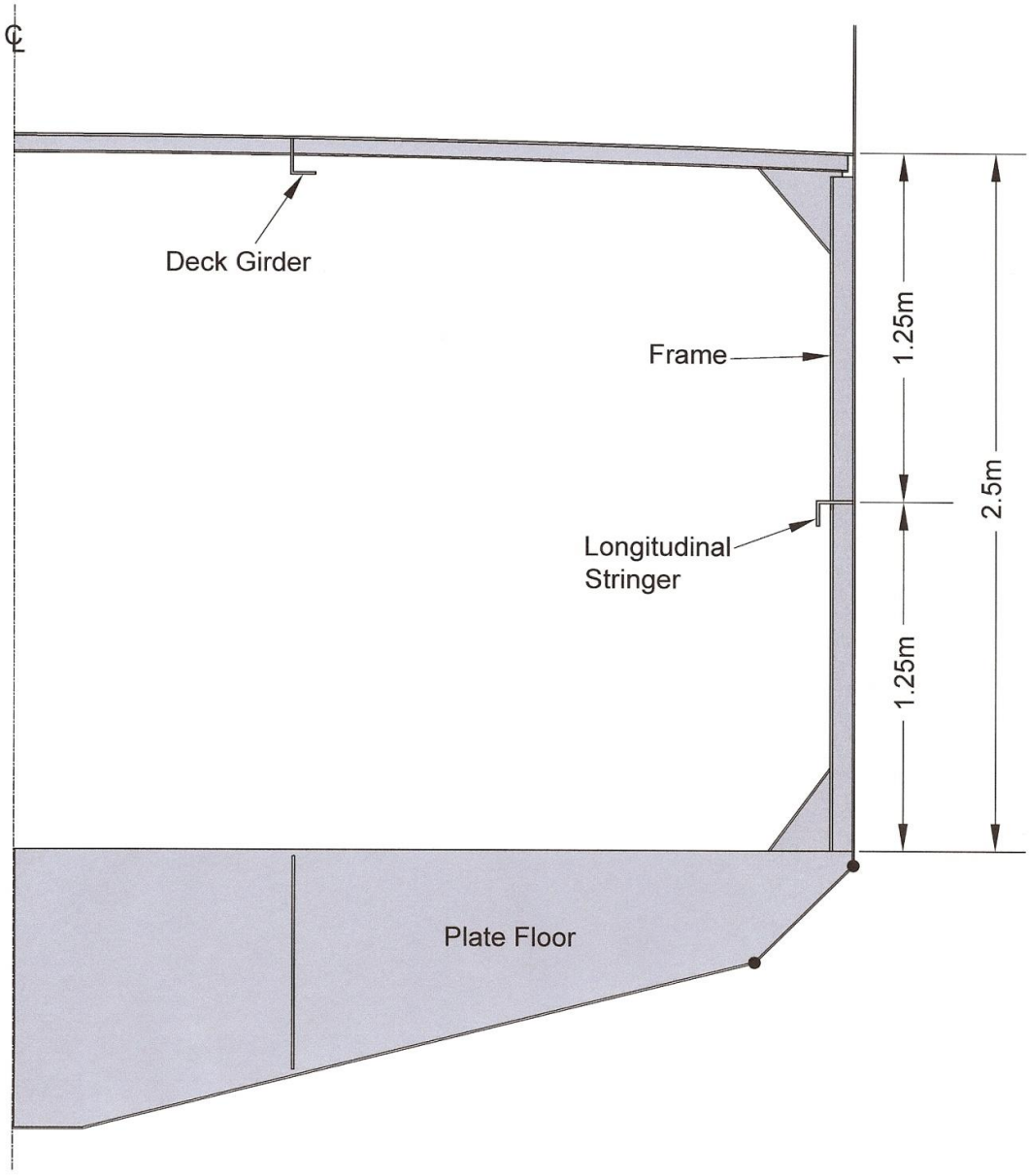
2. The arrangement shown above involving the grinding flat of shell plating butt welds before fitting the ground bar for the bilge keel, should not be used in way of fuel and other tanks unless the tanks have been pressure-tested after grinding the shell butt weld and before fitting the bilge keel.



See Section 4.17

4.21 Figures and illustrations

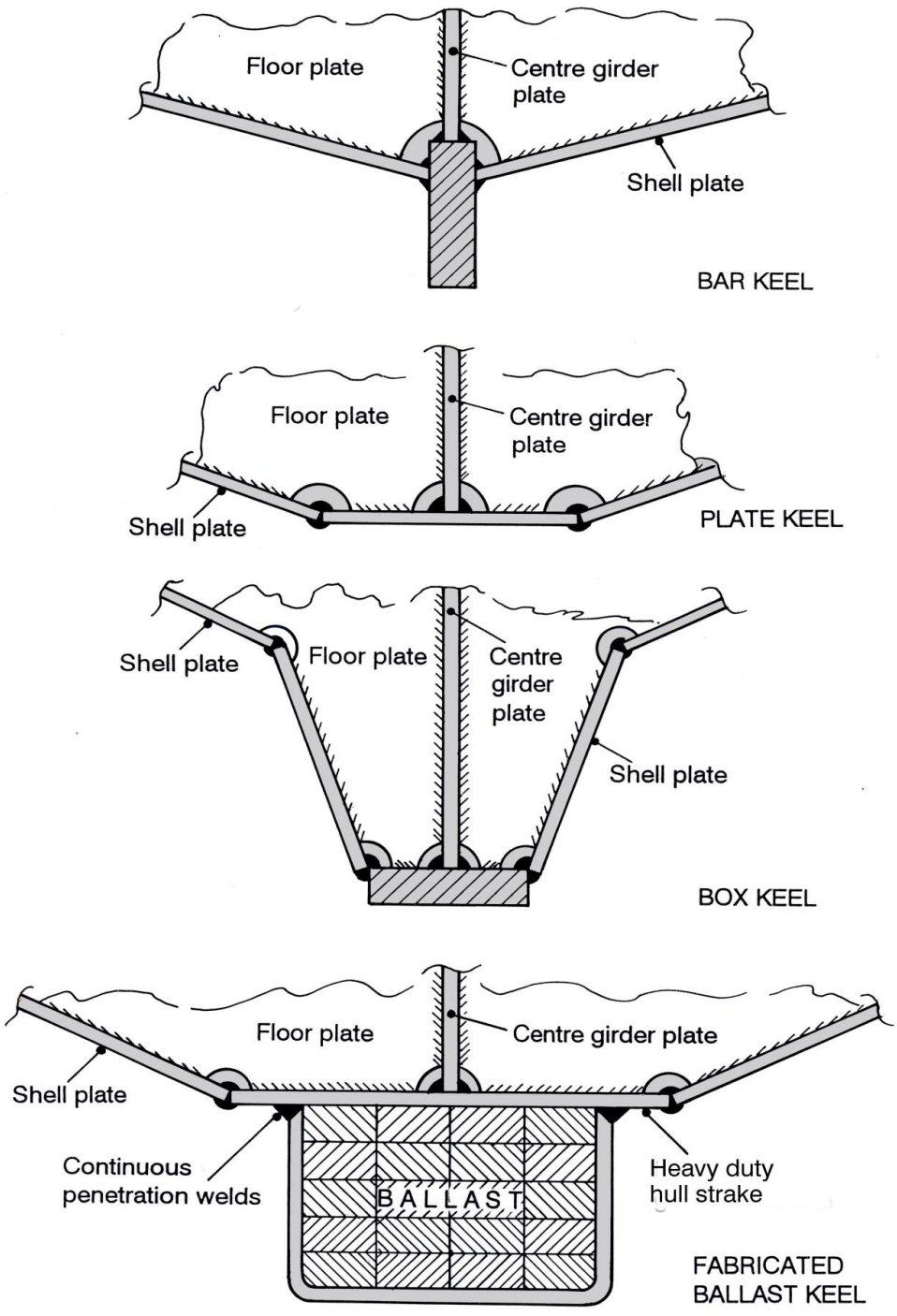
4.21.8 Longitudinal shell plate stringer position



See Section 4.8

4.21 Figures and illustrations

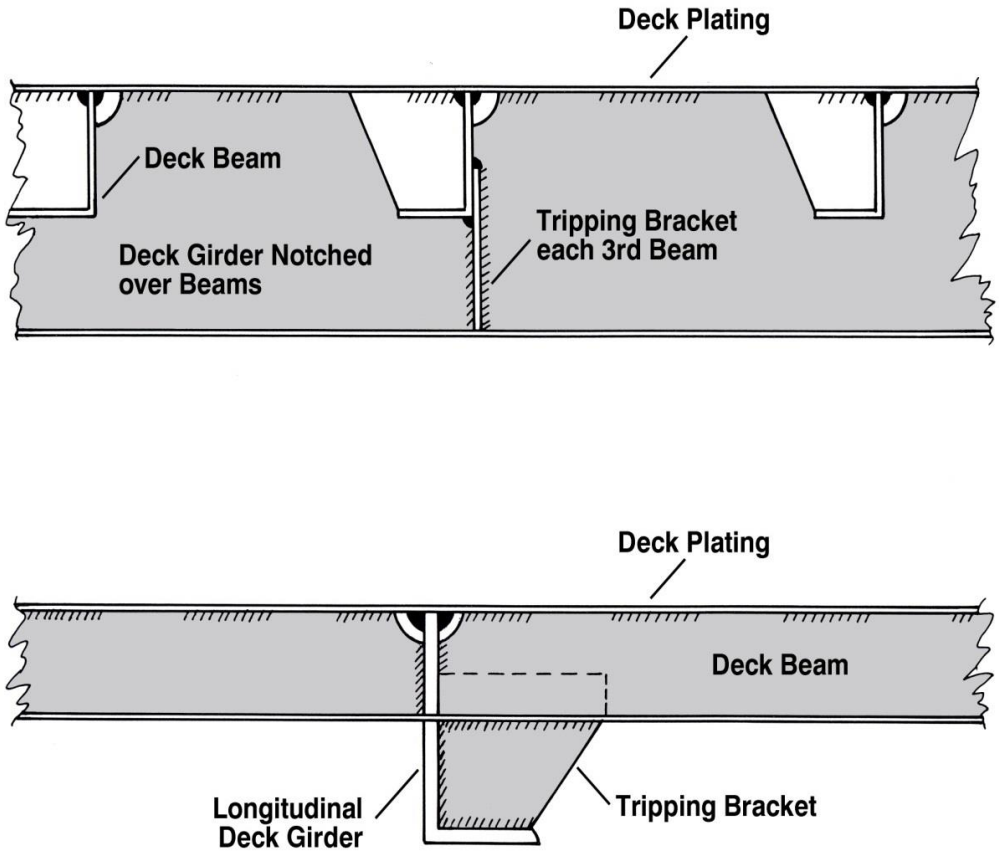
4.21.9 Typical keel arrangement



See Section 4.6 & Table 4.20.1

4.21 Figures and illustrations

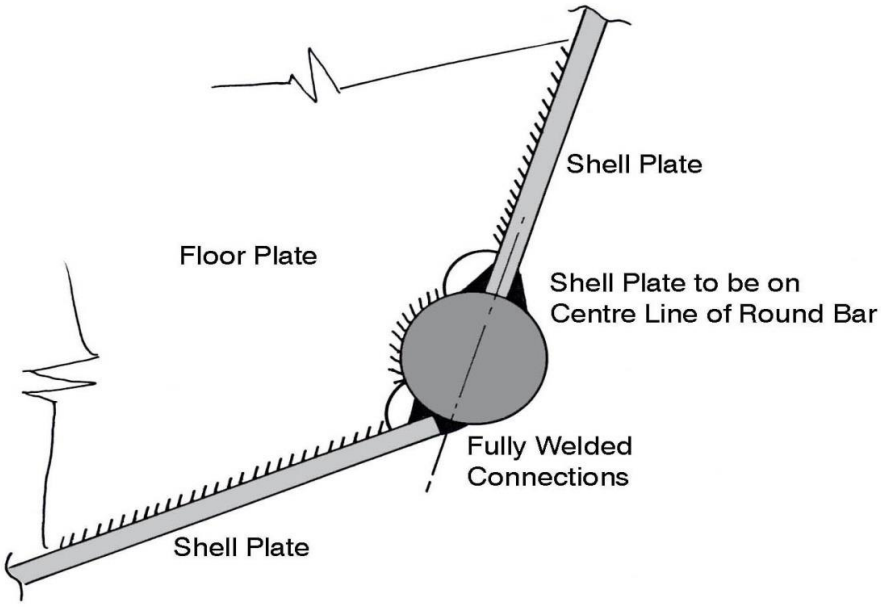
4.21.10 Deck girder arrangements

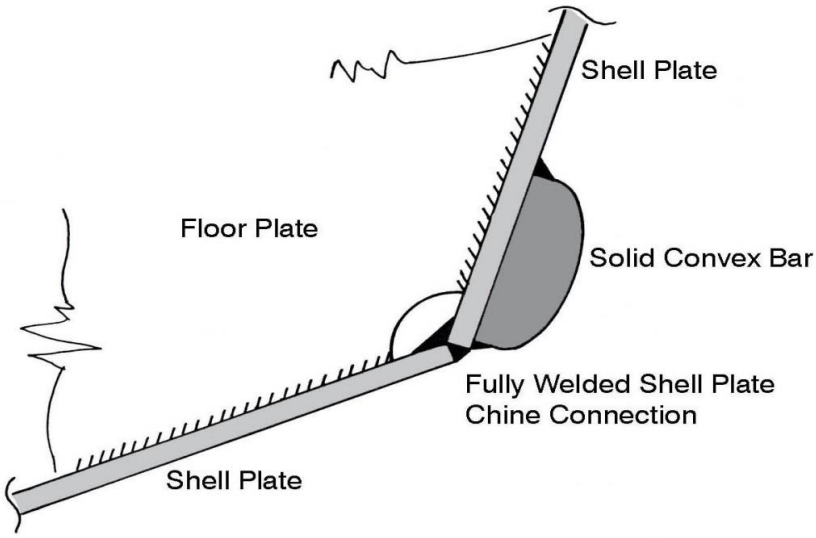


See Sections 4.12, 4.13 & Tables 4.20.9, 4.20.11

4.21 Figures and illustrations

4.21.11 Chine bar





See Table 4.20.15

PART 5

WELDING

PART 5

WELDING

SECTION SUBJECT

WELDING

Section 5.1 - General

5.1.1 Welding of structures and fabrications will generally be for mild steel and of either manual metal arc (MMA) or metal inert gas MIG/CO_2 types.

5.1.2 Proposed alternative methods of welding should be submitted for the consideration and approval of the Surveyor.

5.1.3 Details of the welding of main structural members are to be included for approval on structural drawings and should indicate the type and dimensions of weld. Alternatively, the Builder's standard welding table may be submitted for approval. Details are to be provided of the proposed sequence of fabrication and welding.

5.1.4 Welding operators should be qualified or coded to an approved standard and proficient for the type of work undertaken. A declaration to verify these competences shall be requested from the Builder. In addition the Surveyor may require the Builder to provide sample weld test pieces, fabricated under similar conditions to the proposed construction.

5.1.5 If there is, or considered to be, restricted access within the crossdeck structures on catamarans, then a full construction and weld method plan is to be submitted for review prior to construction.

5.1.6 All welding is to be carried out in accordance with the best practice. Full consideration should be given to the access of welds and their locations.

5.1.7 Where welds are not suitably detailed on drawings, symbols will be required, as shown in Section 5.7.

5.1.8 Care is to be taken when removing welded temporary fittings in order to avoid damage to the hull material. Bridges and dogs should not be hammered off. Tack welds, where utilised, should be of a quality equal to the finished weld.

Section 5.2 - Preparation

5.2.1 Generally, plate edges and weld preparations may be produced by any of the established methods. Plate edges are to be properly prepared, and a back sealing run is to be applied after suitable back seam gouging to all seams where the main welding is carried out from one side only. Plates are to be properly aligned and excessive force should not be used in fairing and closing. Where excessive gaps exist, the correction is to be to the Surveyor's approval.

5.2.2 Special care should be taken to ensure cleanliness of edges and faces prior to welding. All edges are to be cleaned free of oil, rust, paint, zinc coatings and other contaminants.

5.2.3 When welding components with large cross-sectional areas, the sections are to be pre and post-heated, to provide good weld fusion and prevention of cold cracking in the heat affected zones (HAZ).

Section 5.3 - Dimensions

5.3.1 The dimensions of fillet welds for structural connections are to be in accordance with Section 5.6. The length of intermittent welds is to be measured over the length of the correctly proportioned fillet. Intermittent welds are to be doubled at the ends and continued around ends of brackets etc.

5.3.2 At the design stage, consideration is to be given to the stress capabilities of the different types of welds.

5.3.3 Care must be taken to ensure thorough penetration and fusion. Finished welds should be sound, uniform, and free from slag inclusions, porosity, undercutting or other defects.

5.3.4 Plug and slot welds are not to be used except where access to both sides of a joint is not possible. Such plug welds are to be 75mm maximum length and spacing is to be in accordance with the requirements for intermittent welding as given in the Standards. Width of slot is not to be less than twice plate thickness and the ends of the slot are to be radiused.

5.3.5 Stiffening members which pass over an uncompleted weld are to be scalloped in way of same. Scallops are to have a minimum radius of 25mm.

Section 5.4 - Materials

5.4.1 Electrodes and filler wires should be stored under approved conditions to Manufacturer's requirements to avoid deterioration. Special consideration is to be given to the storage of low hydrogen electrodes.

5.4.2 All welding consumables are to be compliant with current BS EN ISO Standards (or equivalent).

5.4.3 The testing of welds is to be at the discretion of the Surveyor and will generally be of the non-destructive type. Visual inspections may be augmented by a system of radiograph, ultrasonic, magnetic particle, or dye penetrant examination. Welds which are found to be defective are to be cut out and re-welded to the satisfaction of the Surveyor, and subject to re-testing.

Section 5.5 - Aluminium

5.5.1 Aluminium should be welded by either the gas tungsten arc (TIG) or gas metal arc (MIG) or other approved processes. Generally the welding of connections shall be as for steel. Where chain or intermittent welding is employed, the minimum length of the length 'W' is to be not less than that required for steel measured clear of end craters.

5.5.2 Plate edges and weld preparations may be by either of the following methods:-

(i) Plasma arc cutting;
(ii) Tungsten arc;
(iii) Mechanical means (saw or shear).

5.5.3 All weld edges are to be prepared smooth and free from cutting tool scores and moisture. Fusion faces of weld joints should be cleaned free of all foreign matter, i.e. grease, dirt, oxide film and moisture.

5.5.4 Where cutting by mechanical means are used, care is to be taken to ensure that the tools used are not contaminated by other metals. Plates may be sheared provided this does not cause distortion of the plate edges.

5.5.5 Operatives, material, and structures, should be protected at all times to effectively prevent draughts destroying the gas shield. All welds are to be made on clean dry surfaces and carried out under cover.

Section 5.6 - Welding details

5.6.1 Connections of structural members

Type of weld connection		
Plating-bottom shell	Bar keel, stem bar Centre girder to bar keel and floors Side girders and machinery seatings Floors in machinery spaces Floors, and girders in fuel, fresh water and ballast tanks Tank tops and ends Watertight and oil-tight bulkheads	Full strength fillet (continuous)
	Frames and floors outside machinery spaces	Staggered intermittent or chain
Plating-side shell	Frames Longitudinals Stringers Non watertight bulkheads	Staggered intermittent or chain
	Frames and stringers in fuel, fresh water and ballast tanks	Full strength fillet (continuous)
Plating-deck	Deck to shell plating Pillars Hatch coamings Bulwarks and stays to deck plating Beams and girders under machinery, bollards, masts and gallows Beams, girders and webs in fuel, fresh water and ballast tanks	Full strength fillet (continuous)
	Beams Longitudinals Deck girders	Staggered intermittent or chain

Note: All seams and butts in shell, deck, and weathertight deckhouses and superstructures are to be square butt or single vee butt, continuous welded both sides.

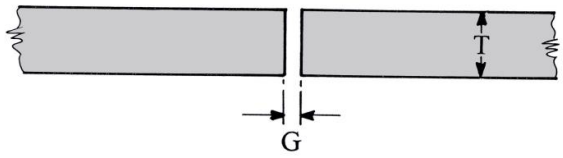
5.6.1 Connections of structural members *(continued)*

Type of weld connection - *continued*		
Bulkheads	Watertight and oil-tight bulkheads to shell plating Wash bulkheads to shell, bulkhead and deck plating Brackets on longitudinals Tank sides and ends, to bulkhead plating	Full strength fillet (continuous)
	Stiffeners	Staggered intermittent or chain
Side plating of engine room casings, deckhouses, wheelhouses and shelters	Side plating to deck Side plating to rail	Full strength fillet (continuous)
	Stiffeners	Staggered intermittent or chain
Steering compartments	All connecting bottom stiffening to rudder tables (including face flats), terminating at side girders or adjacent primary structure	Full strength fillet (continuous)

5.6.2 Details of weld connections

(i) *Square butt joint*

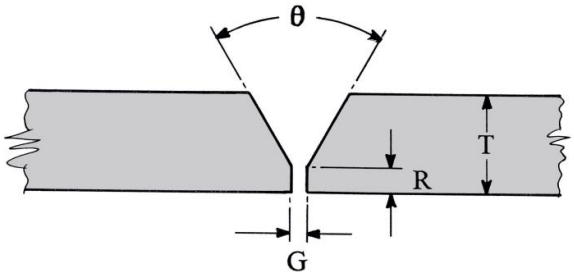
Recommended for use up to and including 6 mm plate - this method is economical in preparation and welding. A gap of more than that shown is not permitted



Up to 6 mm plate:

$G = \frac{T}{2}$

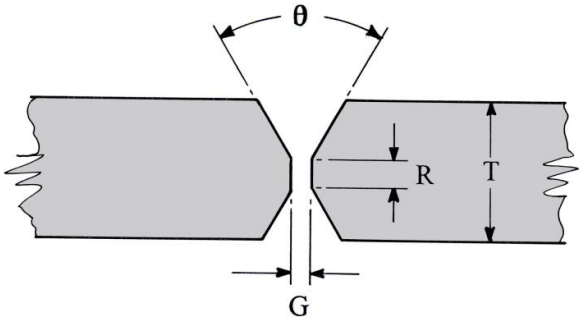
(ii) *Single V butt*



Over 6 mm up to 16 mm plate:

G = 0-3 mm
R = 1.5 mm - 3 mm
θ = 60°- 70°

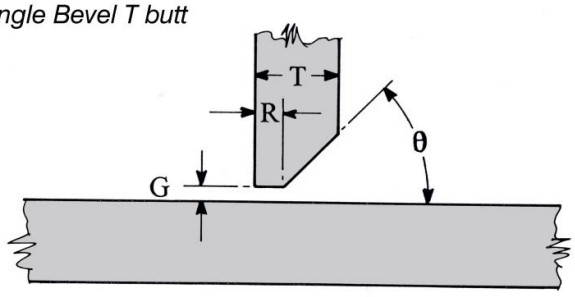
(iii) *Double V butt*



Over 16 mm plate:

G = 0-3 mm
R = 1.5 mm - 3 mm
θ = 60°- 70°

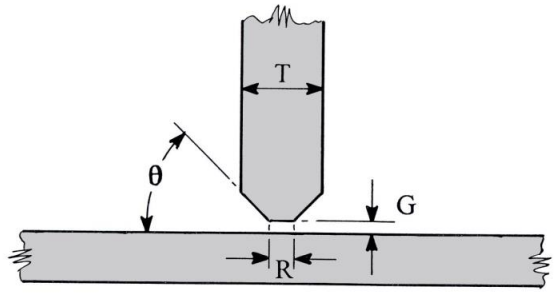
(iv) *Single Bevel T butt*



Over 6 mm up to 19 mm plate:

G = 0 - 1.5 mm
R = 1.5 mm - 3 mm
θ = 45° minimum

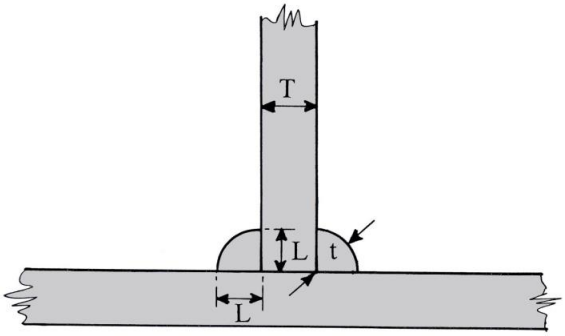
(v) *Double bevel T butt*



Over 19 mm up to 38 mm plate:

G = 0 - 1.5 mm
R = 0 - 5 mm
θ = 45° mm

(vi) *Full strength (continuous) fillet weld*

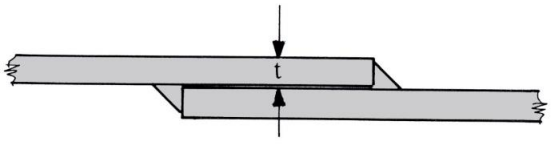


12.5 mm plate and above:

T = thickness of thinner part.
L = leg length = 0.7T approx.
t = throat thickness = 0.75L where plates are at right angles but is not to exceed 0.9L.
For plates under 12.5 mm leg length is given in table 5.6.4.

(vii) *Fillet welded lap joint*
(Recommended only for work of minor structural importance)

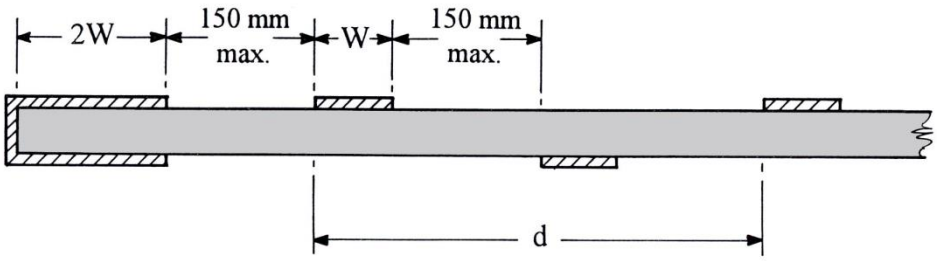
Length of overlap minimum 3t
maximum 4t



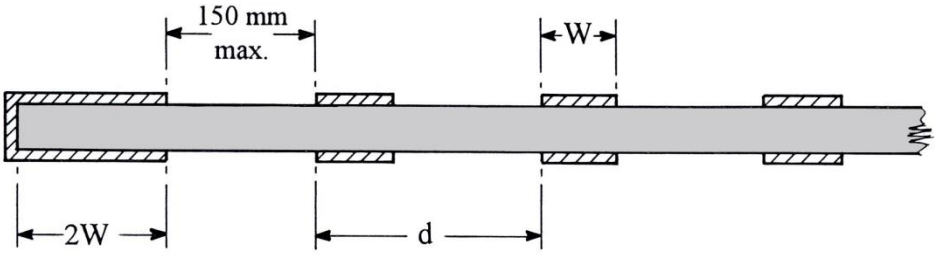
(viii) *Intermittent welds*

The minimum length of weld W is to be 10 x plate thickness or 75 mm whichever is the lesser. For values of 'd' in relation to W see Paragraph 5.6.3.

Staggered intermittent



Chain intermittent



Note:

Intermittent welds are to be doubled at the ends of all structural members and the welding to be carried round the ends.

5.6.3 Fillet welding

Maximum value of ‘d’ in relation to minimum ‘W’ values for staggered intermittent and chain intermittent welds.

Plate thickness in mm	Minimum ‘W’ length in mm	Maximum ‘d’ in mm	
		Staggered intermittent	Chain intermittent
3	30	360	180
4	40	380	190
5	50	400	200
6	60	420	210
7	70	440	220
8	75	450	225
↕	75	450	225
16	75	450	225

5.6.4 Dimensions of fillet welds for light plate

Plate thickness in mm	Weld type - double continuous leg length in mm
3	3.5
4	4
5	4.5
6	5
8	6
10	7

5.6.5 Throat thickness

(i) The minimum and maximum limits of throat thickness are to be as follows

(a) Intermittent (staggered or chain) fillets

Minimum throat thickness	=	'T' x 0.25
Maximum throat thickness	=	'T' x 0.45

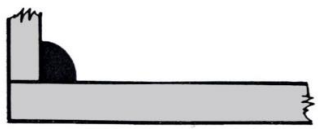
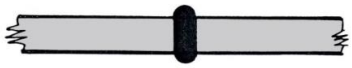
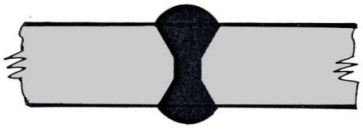
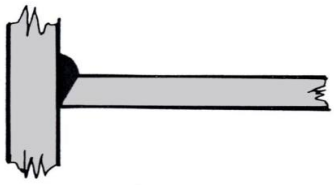
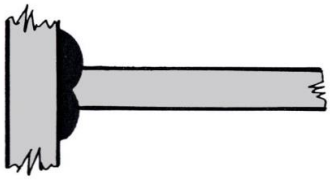
(b) Double continuous fillets

Minimum throat thickness	=	'T' x 0.20
Maximum throat thickness	=	'T' x 0.45

subject to a minimum throat thickness of 3mm for intermittent fillets, and a minimum of 2.5mm for continuous fillets;

(ii) 'T' = plate thickness of thinner member where this is less than 8mm. The minimum throat thickness of fillet welds for plates 8mm thickness and over is to be increased by 10% of the values shown above.

Section 5.7 - Symbols

FORM OF WELD	SECTION REPRESENTATION	SYMBOL
Fillet		
Square butt		
Single V butt		
Double V butt		
Single bevel butt		
Double bevel butt		
Sealing run		

PART 6

GRP CONSTRUCTION

PART 6

GRP CONSTRUCTION

GRP CONSTRUCTION

Section 6.1 - General requirements

6.1.1 The Builder is to comply with the requirements and recommendations given by the raw material Manufacturer throughout the moulding and construction of the vessel.

6.1.2 The Surveyor will make checks and inspections as appropriate during the moulding of the hull and construction of the vessel in accordance with these Standards.

6.1.3 Completion of main hull framing by Owners and other Subcontractors is not allowed, and bare shell hulls without the main framing and stiffeners fitted by the original Moulders will not be accepted.

6.1.4 It may be acceptable for some GRP hulls to be supplied for others to complete parts of the main structure, such as decks, watertight bulkheads, or engine seatings, however catamaran bridge deck structures are to be completed by the original Moulders.

6.1.5 Acceptance will be conditional on the assurance that this remaining structural work will be completed by competent and experienced personnel. The work should be done in suitable conditions, strictly in accordance with the Designer's/Builder's instructions for completion and with the use of equivalent and good quality marine materials.

6.1.6 The Designer's acceptance and approval must be sought to complete any such work that may alter the original design concept or affect the safety of the vessel. In such cases full responsibility for the completion of those remaining items must be borne by the Owner or his Subcontractors.

6.1.7 In such circumstances as described above, further inspection(s) will be required, and hull certification may only then be issued after compliance and final completion of the 'intact' hull structure, as envisaged by the vessel Designer or Builder.

6.1.8 Hulls are to be inspected prior to any antifoul preparation (sanding) or antifoul being applied.

Section 6.2 - Definitions

In these Standards the following expressions have the following meanings:-

6.2.1 "***Accelerator***" means additive to the resin to speed the curing at workshop temperature.

6.2.2 **"Activated resin"** means resin with catalyst added.

6.2.3 **"Catalyst"** means an additive to the resin to induce curing with heat or with an accelerator at workshop temperature.

6.2.4 **"Colour pigment"** means colourant added to give colour to the gel coat resin.

6.2.5 **"Fire-resistant additive"** means antimony trioxide and chlorinated organic compound mixed with resin or any other Manufacturer approved additive.

6.2.6 **"Foam"** means closed cell polyurethane or rigid PVC foam.

6.2.7 **"Former"** means material used for the purpose of forming, reinforcing and stiffening members.

6.2.8 **"Gelation"** means the curing process of the resin liquid to a jelly-like state.

6.2.9 **"Gel coat"** means the outer protective and cosmetic resin coat of the hull, applied to the female mould prior to the lay-up process.

6.2.10 **"Gel time"** means the period from addition of the accelerator to the setting of the resin to a soft gel.

6.2.11 **"Glass reinforcement"** means fabric, chopped strand mat (CSM), woven rovings (WR), or combination materials stitched together and used in the lay-up for reinforcement of the laminate.

6.2.12 **"Green stage"** means in a soft rubbery state.

6.2.13 **"Hardening time"** means the time from the setting of the resin to a point when the resin is hard enough for removal from the mould.

6.2.14 **"Intumescent paint"** means a resin paint, which has resistance to direct flame by creating carbonaceous foam from which the inert gases formed insulate the main structure of the laminate.

6.2.15 **"Kiln dried timber"** means timber which has been heat treated to reduce moisture content.

6.2.16 **"Laminate"** means alternative layers of glass reinforcement and resin forming a moulding, applied by hand.

6.2.17 **"Laminate spray"** means the application of the resin and glass reinforcement by a mechanical spray method.

6.2.18 **"Powder bonded mat"** means a glass fibre reinforcement impregnated with high solubility polyester powder.

6.2.19 **"Pre-accelerated resin"** means a resin to which an accelerator has been previously added.

6.2.20 **"Resin"** means unsaturated polyester synthetic resin.

6.2.21 **"Sandwich construction"** means a method of construction comprising two laminates enclosing a core of foam, timber or other approved material.

6.2.22 **"Spacing"** means the distance apart of members such as stringers, frames or beams as defined in the scantling Tables.

6.2.23 **"Woven roving"** means a glass fibre reinforcement comprising a loose evenly woven cloth as distinct from the random woven chopped strand mat cloth.

Section 6.3 - Moulding premises

6.3.1 The moulding premises are to be separated from the outfit factory and are to be dust, damp, and draught free, to enable a uniform temperature and humidity to be maintained during the moulding process.

6.3.2 The air temperature in the moulding premises is not to be lower than 15°C, and the temperature during the moulding process should not vary by more than 10°C. The relative humidity should not exceed 70%.

6.3.3 The moulding premises are to be insulated or built in such a way that the indoor temperature is not significantly affected by the outdoor temperature or direct heat from the sun.

6.3.4 Windows enabling the mixing or moulding area to be subjected to direct radiation from sunlight should be screened or painted.

6.3.5 The moulding premises are to be adequately heated and ventilated, with good headroom and sufficient lighting positioned well above the mouldings.

6.3.6 Resins and curing agents should be stored away from the working area in a cool place, and the necessary precautions for flammable liquids and the special hazards associated with organic peroxides should be strictly observed.

6.3.7 Glass fibre should be stored and tailored under dry conditions.

6.3.8 All premises intended to be used for a new vessel construction according to these Standards will be inspected and approved by the Surveyor prior to commencement of building the vessel.

Section 6.4 - Moulding shop practice

Scope

6.4.1 This procedure describes the standard practices to be applied in the moulding premises. The workmanship is to be in accordance with the best marine practice and to the approval of the Surveyor.

Responsibilities

6.4.2 It is the responsibility of the Builders to ensure that the requirements of this procedure are complied with.

Moulding conditions

6.4.3 Cleanliness - cleanliness is important both for the health of the operators and for preventing contamination of resin and reinforcement. Special care is necessary for handling peroxide catalysts which can ignite spontaneously when in contact with some materials. Contaminated waste material should be removed and destroyed immediately. It is the responsibility of the Moulders to ensure that their working area is free from accumulations of foreign matter which may be transferred to the moulding surfaces. Suitable protective sheets are to be laid on the working areas of shop floors and changed at regular intervals. Cutting of mouldings by saws is only permitted in the designated assembly areas to avoid the spreading of dust to mouldings surfaces.

6.4.4 Humidity and temperature control - the recommended humidity and temperature ranges within which laminating is allowed are as follows:-

Temperature	15°C up to 25°C
Humidity	70%

6.4.5 Should the workshop atmosphere move outside these limits, then action should be taken to resolve the situation. Should the conditions continue to deteriorate, the moulding process is to cease when the following limits are reached:-

Temperature	below 13°C or above 32°C
Humidity	80%

Note: When the humidity rises above 80% there is a danger of dew precipitating on the moulding surfaces. When the temperature rises above 25°C it is necessary to reduce the amount of catalyst used. When the temperature falls below 13°C the resin cannot be worked correctly and any reduction in catalyst may result in undercure.

Humidity and temperature recorders are to be located in the moulding shop. It is the responsibility of the Builders to ensure that the equipment is monitored, and continuous and accurate records are kept for future reference. The workshop humidity and temperature should be hand recorded on at least an hourly basis or on a continuous chart and be capable of cross-referencing against moulding operations.

Laminate curing

6.4.6 No hull, deck or wheelhouse mouldings is to be taken outside the moulding shop environment until after seven days have elapsed from the commencement of the main lay-up procedure. If mouldings must be moved outside prior to their assembly, they should be protected against precipitation on the laminate face by the use of protective sheeting or tarpaulins.

6.4.7 The outer gel coat surface of hull mouldings is to reach a minimum state of cure with a Barcol hardness test reading of 30 before being transferred to the fitting out berth or yard, and should be rigidly supported to preserve hull shape until the installation of gunwales, bulkheads and decking. Any hull moulding failing to meet a minimum surface hardness test reading of 30 may be rejected. (Barcol readings stated are by use of Barcol Impressor Model GYZJ 934-1).

Catalyst use procedure

6.4.8 The addition of catalyst to polyester products is to be strictly controlled within the limits of 1% to 3% by weight. To enable the operators to comply with these limits, it is necessary that they know the weight of the material they are about to catalyse.

6.4.9 Standard catalyst percentage charts are to be provided in the workshop. The weight of resin and the volume (measured in cubic centimetres (cc)) of the catalyst to be used, is to be ascertained from the chart. Should a container be part filled only, it should be weighed in order to ascertain the correct volume of catalyst required. The catalyst level used is to be recorded on the building materials reference list.

6.4.10 The Moulder is responsible for ensuring that the catalyst is thoroughly dispersed in the polyester material.

Recording of materials being used

6.4.11 Resins and lay-up materials are supplied with batch numbers, which are to be checked against order requirements. The Builder is to maintain a record of resin and reinforcement type, batch number, quality and date received, for the particular hull under construction. These records are to be kept for future reference and to enable completion of such certification and record

of weights and content of each hull moulding, as required by the inspecting Surveyor.

Section 6.5 - Materials

6.5.1 The Builder is to use materials approved for marine use or alternatives permitted by MCA or Fishing Vessel Certifying Authority. Details and certification for the moulding materials are to be submitted to the inspecting Surveyor for prior consideration.

6.5.2 Resins are to be suitable for marine use and be in accordance with the Manufacturer's type and code number as stated in the approved specification. The mixing and use of resin is to be in accordance with the Manufacturer's recommendations, and the catalyst and accelerator should permit a maximum setting time of one hour without the use of localised heating.

6.5.3 Colour pigment may be added to the gel coat and initial internal finishing coat, sufficient to give a satisfactory depth of colour. The quantity of pigment paste to be added is to be strictly within the amount recommended by the resin Manufacturer. No pigment should be used in the lay-up resin of the main hull laminates. Consideration may be given to pigment being added to the first layer from the gelcoat subject to MCA or Fishing Vessel Certifying Authority approval.

6.5.4 It is recommended that the hull bottom below the designed load waterline should be a clear unpigmented finish for all vessels of 10m LOA and over. For vessels less than this length, pigmented finish may be used below the waterline subject to MCA or Fishing Vessel Certifying Authority approval.

6.5.5 Glass reinforcement is to be of the best marine quality and may be in the form of fabric, woven rovings, chopped strand mat, powder bound mat, combination mats or other approved materials.

6.5.6 Formers used for stiffening may be of rigid foam, timber, metal, or other approved materials. Where timber is used, it is to be kiln dried to a moisture content of not more than 15% and treated with a wood preservative of a type suitable for use with polyester resins.

6.5.7 Structural plywood is to be of marine standard or alternatively approved by MCA or Fishing Vessel Certifying Authority. All exposed edges are to be sealed and the plywood treated with approved preservative.

6.5.8 Builders are to comply with Manufacturer's recommendations concerning the storage and use dates of materials supplied.

6.5.9 Additives other than those required to enable the necessary thixotropic property to be achieved should not be used in resin systems.

6.5.10 Continuing research may produce new resin compositions and reinforcement materials, and whilst their acceptance is not discouraged, new products should be tested and proved prior to their general acceptance and recommendation for use in new vessel building according to these Standards.

Section 6.6 - Laminate lay-up

6.6.1 The outside surface of all laminates should have a layer of gel coat of uniform thickness, or be coated with an equivalent surface protection after completion of the moulding process.

6.6.2 It is recommended that the first lay-ups of the hull have at least one layer of a powder bound mat moulded by isophthalic resin next to the gel coat.

6.6.3 Woven rovings or heavy chopped strand mat should not be applied directly to the gel coat. It is recommended that the first layer should consist of a light mat of 300g/m² (1oz), but in no instances should this exceed 450g/m² (1½oz). The reinforcement lay-up of the laminate should then be applied in the approved sequence.

6.6.4 It is recommended that a suitable top coat be applied on the inside laminate surface in the keel and in bilge wells where it can be assumed water will accumulate.

6.6.5 A standard GRP hull will be considered to be of “single skin”, i.e. a solid laminate of glass reinforcement in resin, laid up to a glass weight as determined by Table 6.11.1.

6.6.6 Where the hull is of sandwich construction built on a male plug, the outer surface of the hull is to be given a coat of resin or resin-based compound prior to final painting.

6.6.7 The hull laminate is to be locally increased in thickness in way of fittings for rudder stocks, propeller brackets, bilge keels, etc. The increased laminate weight is to be gradually reduced to the normal laminate weight.

6.6.8 The exposed edges of any openings cut in the hull laminate are to be sealed with resin.

6.6.9 Voids are not to extend through more than one ply of laminate. The maximum size of a single void is not to exceed 15mm diameter. In any single ply of 300mm x 300mm area, the loss of area due to voids is not to exceed 260mm².

e.g.: 8 x 6mm diameter
or 12 x 5mm diameter
or 36 x 3mm diameter

Linked voids shall be assessed as a single void.

Section 6.7 - Hand lay-up method

6.7.1 The hull mould should be thoroughly cleaned, dried, wax polished and allowed to be conditioned to the workshop temperature prior to being treated with a suitable release agent system.

6.7.2 Release agents should have non-inhibiting effect on the gel coat system, and are to be properly applied over the entire surface and be allowed to dry thoroughly prior to application of the gel coat.

6.7.3 The gel coat may be applied by hand or by spray. Gel coats are not to be left exposed longer than necessary before the application of the first lay-ups.

6.7.4 The lay-up process is to be commenced within not more than 24 hours of the gelation of the gel coat. The laminations should be applied at regular intervals until completion of the total shell laminate.

6.7.5 The overlap of mat or woven roving is to be at least 50mm, and the shift of reinforcement overlaps is to be at least 100mm.

6.7.6 Reinforcement layers are to be in the approved sequence and direction, carefully positioned, and then thoroughly impregnated and consolidated to give the required glass content. The resin should be applied uniformly on each layer.

6.7.7 Laminates should be worked such that they are free from blisters, air gaps, delamination, excessive resin drainage and resin starved areas.

6.7.8 The interval between each layer of reinforcement is to be carefully timed to enable proper completion of each total laminate or complex.

6.7.9 The time lapse between completion of the final shell laminate and the forming and bonding of frames, stiffeners and structural members is to be kept within the limits as recommended by the resin Manufacturer, to ensure full bonding strength throughout the hull.

6.7.10 During rolling out over sharp edges, corners, etc., it should be ensured that the amount and thickness of the reinforcement will not be less than specified in these areas.

Section 6.8 - Spray lamination method

6.8.1 Due to the potential problems that could arise using this method of construction, the use of spray lay-up is limited to such parts of the structure to which access of the spray can be obtained to ensure satisfactory laminating. The Moulder is required to demonstrate the equipment and the competency of the Operator to the Surveyor’s approval.

6.8.2 Any hull manufactured using this system of lay-up is to have at least one layer of woven roving in the laminate.

6.8.3 When hand lay-up adjoins spray lay-up, care should be taken to ensure continuity of strength.

6.8.4 Stiffeners are to be matted to the shell in accordance with Table 6.11.3 as specified for hand lay-up over laminate.

6.8.5 The resin control device is to be adjusted to give a resin to glass ratio of not less than 1.75 to 1, and a uniform distribution of glass and resin. The glass cutter of the spraying equipment is to be adjusted to give a minimum fibre length of at least 30mm.

6.8.6 The spray operator should distribute the material uniformly over the laminate surface and if necessary the glass roving is to include a colour indicator to ensure laminate thickness control. The calibration of spray equipment is to be checked periodically during operation.

6.8.7 The initial laminate thickness after the first rolling-out is not to be greater than 1.5mm.

6.8.8 Subsequent hand rolling-outs should be performed so that there is not more than a 2.5mm thickness increase between each rolling.

Section 6.9 - Hull construction

6.9.1 Keel and sheerstrake areas are to be laminated in accordance with Table 6.11.1 and are to have reinforcement progressively lapped to avoid any sudden change in thickness.

6.9.2 Hulls are to have stiffening fitted in accordance with the Tables, which may be longitudinal or transverse or a combination of both. Vessels, which have longitudinal stiffening only, should have at least two stringers on each side, in addition to the deck connection joint line or gunwale and to be to the Surveyor's approval.

6.9.3 Where a longitudinal stiffening system is used, partial bulkheads or frames and engine bed cross-webs are to be fitted, each in one piece from side to side. Longitudinals should extend for the whole length of the vessel and be joined at the vessel's centreline or connected to a transverse stiffening section at each end.

6.9.4 Transverse frames, spacing and stiffening scantlings are given in Table 6.11.3. Transverse frames are to fitted from keel to gunwale top throughout the length of the hull and bonded as specified.

6.9.5 Where a weathertight deck is fitted above waterline and the main shell moulding forms the bulwark, frame stiffeners are to be fitted above deck to

the bulwark rail at every second frame position. Additional stiffeners may be required depending on the fishing method proposed.

6.9.6 Where through-bolting connections are required (e.g. for gunwales or beam stringers), an approved timber former is to be used. All bolt fastenings are to be of corrosion-resistant metal, galvanised or coated as required, to ensure compatibility with adjoining materials. The edges of the laminate and the fastening holes are to be sealed.

6.9.7 In general the framing and stiffening sections are to be built up layer by layer on to the laminate while it is still in the uncured state. Where the bonding laminate of these sections intersect, particular attention is to be given to ensure continuity of strength.

6.9.8 The hull surface gel coat is to be adequately protected in way of all fishing gear hauling positions by GRP sheathing, metal, hard rubber or plastic to prevent damage. Cope irons are to be fitted to the face of timber sheathing, and bulwark top rails positioned to suit each mode of fishing.

6.9.9 Discontinuities and hard points in the structure are to be avoided. Where the strength of a stiffener may be impaired by attachment of fittings, openings, etc., adequate compensation is to be provided.

6.9.10 In bonded joints, polyester or epoxy resin may be used provided that the joint is so designed that the connection is in shear. The contact area is to be as large as practicable and the surfaces are to be adequately prepared.

6.9.11 Where backing or insert pads are fitted in way of the attachment of fittings, the contact area is to be suitably prepared and free of contamination.

6.9.12 In vessels below 7m LOA where a combination of bonding of internal furniture and hull form provides adequate stiffening, the framing may be omitted at that position provided the bonding is continuous and full strength, subject to the approval of the Surveyor.

6.9.13 In open boats the bottom stiffening may be provided wholly or partly by the bonded-in flooring arrangement, subject to the approval of the Surveyor.

6.9.14 Transoms not subjected to loads from outboard engines, water-jet units or steering arrangements, etc., are to have scantlings as required for the normal shell laminate. The joint of transom and hull shell is to be increased by 100% in weight in the form of reinforcement laminates. The reinforcement should be lapped 50mm per 600g/m^2 weight and stiffened to the approval of the Surveyor.

6.9.15 Transoms which are to be used for the mounting of outboard engines, outboard pods or brackets should be constructed to the minimum requirements as indicated in Table 6.11.5. A GRP outboard pod is to be constructed with the minimum laminate equal to the hull laminate and to the

requirements of Table 6.11.5. The outboard pod fixing details are to be submitted for approval.

6.9.16 Where the hull shell is laid up in separate half moulds, the laminate is to be stepped back 50mm per laminate on each half. The two halves of the split mouldings are to be clamped together within 48 hours of completion of the laying-up process and the two sections bonded together. With this method, the keel lay-up weight is to be increased by 20% above the weight determined from Table 6.11.1. The stiffened keel area is to extend from the transom to the stem.

6.9.17 The stem is to be moulded to enable a gradual reduction from the keel weight to that required for the sheer. The lay-up should be in 50mm steps per 600g/m^2 from the fore foot, up to 100mm per 600g/m^2 at the sheer position. When moulding is in two halves, the weights in way of the joint area are to be increased by 20% above the weight obtained from the Tables.

6.9.18 The centre of the hull aft of the keel to the transom is to be stiffened by lay-ups as required for the keel section.

6.9.19 Size of frames are to be as obtained from Table 6.11.3 and constructed by moulding over formers which should be bonded to the inside hull laminate while it is still in an uncured state. Frame formers may be of top hat or rectangular section and their spacings should not be less than the minimum distance given in the Table. Where tops of frames have gunwales or bulwark stringers through-bolted, the core of the frames is to be of an approved timber.

6.9.20 Stringers, where fitted, are to be matted to the hull shell with spacing and scantling size obtained from Table 6.11.4. They may form a combination of other longitudinal structural members to the approval of the Surveyor.

6.9.21 Bilge keels, may be moulded as part of the hull, or a separate GRP moulding bonded and bolted to the hull, or of a solid hardwood or fabricated steel structure. Suitable bedding is to be fitted between the connection surfaces and bolts to be through a suitable hardwood stringer. Bolt connections to be well sealed and glassed over to prevent leakage.

6.9.22 Where fitted, rubbing strakes may be of hardwood, patent rubber or plastic section; securing bolts are to be non-corrodible and sealed to prevent leakage.

6.9.23 The height of the bulwark, guardrail, or wire is to be not less than 1m, 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. See Section 11.12 and Figure 11.20.1.

6.9.24 Engine seatings are to be continuous and should be of low density or foam core, GRP sheathed, or of fabricated steel construction. Where space permits, the seating is to extend at least twice the length of the engine, i.e. from the forward holding down bolt to the face of the gearbox coupling. The seatings are to be matted to the hull and stiffened transversely with floor sections and side support brackets. A continuous flat steel plate of adequate thickness and width is to be fitted to the top of the seating in way of the engine, gearbox and front end drive arrangement, and the whole keyed and "matted in". A typical section is shown in the Figure 6.12.8.

6.9.25 Hatch coamings may be separate GRP mouldings, integrally moulded as part of the deck, or of an approved timber or steel construction and fitted with weathertight covers with clips, hinges and gaskets. See Part 3 'Hull Integrity and Arrangement'.

6.9.26 Watertight bulkheads may be of GRP, steel, timber, plywood or other approved materials, suitably stiffened and fitted in accordance with Part 3, Section 3.11 'Watertight subdivision'.

6.9.27 It is recommended that bulkheads are formed and fitted to a rigid type foam core seating or frame section. When not practical to fit on a frame position, the bulkhead should be matted to the shell with double angles to a weight not less than specified in Table 6.11.10.

6.9.28 Watertight glands and fittings are to be fitted where bulkheads are pierced for pipework and wiring arrangements. Doors or hatches fitted in watertight bulkheads are to be of watertight construction to British Standards or equivalent requirements, and be of equivalent strength as the bulkhead.

Section 6.10 - Deck construction

6.10.1 Decks are to be in accordance with Tables 6.11.7 and 6.11.8, and may be either marine ply sheathed with GRP, or GRP sandwich construction with a structural core. Special consideration will be given to the construction of decks which may be GRP laminated but which must be adequately stiffened to the Surveyor's approval. Where pre-fabricated GRP section or composite deck structures are proposed, details are to be submitted for approval.

6.10.2 A beam shelf or stringer arrangement is to be bonded to the hull shell to support the deck beams. A system combining through-bolting and bonding is recommended, but alternative methods, where proposed, are to be submitted for approval.

6.10.3 Deck beams are to be as stated in Table 6.11.7 and 6.11.8, with longitudinal stiffening provided by hatches and carlings as required.

6.10.4 Decks in way of gallows, warp leads, deck machinery and heavy work positions are to have additional stiffening and pillars to the approval of the Surveyor.

6.10.5 Main beams in accordance with Table 6.11.7 and 6.11.8 are to be fitted in way of all deck openings, machinery and deckhouse casings, and in way of masts and heavy deck machinery.

6.10.6 Special consideration may be given to the fitting of a steel deck beam arrangement in way of engine rooms for vessels above 10m LOA, and if required by the Owners.

6.10.7 Deck beams of timber, where fitted, are to be in accordance with the following:-

(i) All main beams and beams fitted in fishrooms should be of hardwood or approved timber treated with preservative.

(ii) Beams should be moulded, sided and spaced in accordance with Table 6.11.8, and may be moulded 25mm less at the ends.

(iii) All deck beams should have a round of beam (camber) of not less than 20mm per metre of breadth unless otherwise agreed with the Surveyor.

(iv) Decks without camber are to be fitted with extra stiffening.

6.10.8 Where decks and deck beams are of GRP construction, openings in the deck may be stiffened by forming continuously moulded flanges, the weight of which should be 25% greater than the laid-up deck laminate weight. Deck openings over 500mm in length should be fitted with longitudinal stiffening comprising of wood, GRP or steel carlings or girders.

6.10.9 Where applicable plywood decks are to be of scantlings obtained from Table 6.11.8 and are to be bolted and bonded to the GRP/plywood beamshelf and bonded to the hull. The complete deck area is to then be sheathed with a GRP laminate. Special attention should be paid to the sheathing in way of working areas which may require extra protection.

Section 6.11 & 6.12 - 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.

In determining scantlings from the Tables in respect of intermediate values, the scantling applicable is to be that given for the nearest dimension/numeral, unless otherwise stated in the Table notes.

6.11 Tables for GRP construction

6.11.1 Table 1: Hull laminate (single skin construction)

Scantling numeral	Shell	Keel		Sheer	
	Weight g/m²	Width mm	Weight g/m²	Width mm	Weight g/m²
10	3000	400	5400	250	3000
15	3300	450	5700	300	3600
20	3600	500	6000	350	3900
25	3900	500	6300	350	4200
30	3900	550	6600	400	4200
45	4200	550	6900	400	4500
60	4500	600	7200	450	4800
80	4500	600	7500	450	4800
100	4800	650	7800	500	5400
150	4800	700	8100	550	5400
200	5100	750	8400	600	5700
250	5400	800	9000	650	6000
300	6300	1000	9300	700	6900
350	6600	1000	9600	750	7200
400	6900	1100	9900	800	7500
450	7200	1100	10200	850	7500

Notes:-

1. Weights indicated are based on CSM at 600g/m^2.
2. For vessels whose design incorporates live fish wells or vivier tanks and with a scantling numeral above 45, the laminate weight of the shell is to be increased by 10%, the keel by 20%, and the sheer laminate by 10%. Details to be submitted for approval prior to commencement of moulding.

6.11 Tables for GRP construction

6.11.2 Table 2: Hull laminate (sandwich construction)

Scantling numeral	Core Thickness							
	10mm		15mm		20mm		25mm	
	Shell laminates weight g/m²		Shell laminates weight g/m²		Shell laminates weight g/m²		Shell laminates weight g/m²	
	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner
25	3150	2550	2850	2400	-	-	-	-
30	3300	2700	3000	2550	-	-	-	-
45	3450	2850	3150	2550	-	-	-	-
60	3600	3000	3300	2700	-	-	-	-
80	3750	3150	3450	2850	3150	2550	-	-
100	3900	3300	3600	3000	3300	2700	-	-
150	3900	3300	3600	3000	3300	2700	3150	2550
200	4200	3450	3900	3300	3600	3000	3300	2700
250	4500	3600	4200	3450	3750	3150	3450	2850
300	-	-	4200	3450	4050	3300	3600	3000
350	-	-	4350	3600	4050	3300	3750	3150
400	-	-	4500	3600	4200	3450	3900	3300
450	-	-	4500	3750	4200	3600	4050	3450

Notes:-

1. Weights indicated are based on CSM at 600g/m². The shell outer and inner laminates are to be faired into the keel laminate to a weight not less than that given in Table 6.11.1.

6.11 Tables for GRP construction

6.11.3 Table 3: Transverse hull framing

Scantling numeral	Frame spacing mm	Frame section		Face & web weight g/m^2
		Face Mm	Web Mm	
10	1000	60	50	1200
15	1000	65	55	1500
20	900	70	60	1500
25	800	75	70	1800
30	700	85	80	1800
45	600	95	85	1800
60	500	100	95	1800
80	510	105	100	1800
100	520	115	105	2100
150	530	130	115	2100
200	540	140	120	2400
250	550	150	125	2400
300	600	160	140	3000
350	630	165	150	3000
400	650	170	155	3300
450	700	175	160	3300

Notes:-

1. Frame spacing is centre to centre.
2. Weight is based on CSM. Where the frame spacing is required to exceed that given above, the frame scantlings are to be increased by direct proportion. Where the frame lay-up weight exceeds 1800g/m^2, the bonding of frame to hull is to be increased in width by 40mm per layer of 600g weight of CSM.
3. The frame spacing requirements above are based on a conventional round bilge hull form for displacement vessels. Where the hull moulding incorporates longitudinal rigidity in the form of ribs, chines or knuckles, special consideration may be given to increase the transverse frame spacings up to a maximum of 1m apart, provided that the panel modulus is equivalent to that given in this Table and increased by direct proportion where necessary.
4. Longitudinal framing will be accepted providing the modulus is equivalent to the above Table for transverse framing, and that some transverse framing is provided. Details are to be submitted and approved prior to commencement of moulding operation.

6.11 Tables for GRP construction

6.11.4 Table 4: Longitudinal hull stiffeners

Scantling numeral	Longitudinal stringers (1.5m maximum spacing)					
	Beam		Bilge		Intermediate	
	Section mm	Weight g/m²	Section Mm	Weight g/m²	Section mm	Weight g/m²
10	-	-	-	-	-	-
15	-	-	-	-	-	-
20	-	-	75 x 60	1800	75 x 60	1800
25	-	-	80 x 70	1800	80 x 70	1800
30	100 x 80	1800	100 x 80	1800	100 x 80	1800
45	100 x 85	1800	100 x 85	1800	100 x 85	1800
60	125 x 95	1800	125 x 95	1800	125 x 95	1800
80	125 x 100	2100	125 x 100	2100	125 x 100	2100
100	150 x 105	2100	150 x 105	2100	125 x 105	2100
150	175 x 115	2400	175 x 115	2400	125 x 115	2400
200	175 x 120	2400	175 x 120	2400	125 x 120	2400
250	175 x 125	2400	175 x 125	2400	150 x 125	2400
300	200 x 140	3000	175 x 140	3000	150 x 140	2400
350	200 x 150	3000	175 x 150	3000	160 x 150	3000
400	200 x 155	3000	175 x 155	3000	175 x 155	3000
450	200 x 165	3000	175 x 165	3000	175 x 165	3000

Notes:-

1. The Table scantlings are based on CSM and with a hull transversely framed with spacings as indicated in Table 6.11.3. The spacing of longitudinal stiffeners is not to exceed 1.5m, and may form a combination with other longitudinal structural members, such as beam shelf and engine girders at the discretion of the Surveyor. For vessels with a scantling numeral of less than 100, the stringers may be omitted providing they are substituted by other longitudinal hull stiffening either by way of hull form, chines, ribs or bondings to the inside of the hull.

2. Where the over laminate weight exceeds 1800g/m², the bonding of stiffener to hull is to be increased in width by 40mm per layer of 600g/m² of CSM. See Figure 6.12.5.

6.11 Tables for GRP construction

6.11.5 Table 5: Transom construction (outboard engine mounting)

Engine power		Plywood core	Minimum thickness	Weight outer laminate	Weight inner laminate
Max HP	**Max kW**	**mm**	**mm**	**g/m²**	**g/m²**
5	4	20 - 25	30	3000	1500
20	15	25 - 30	35	3600	1800
50	37	30 - 35	40	4200	2400
100	75	30 - 35	45	4800	3000
150	112	35 - 40	50	5400	3600
200	150	40 - 45	60	6000	4200

Notes:-

1. The inner laminate is not to be less than 60% of that required for the sheer strake lay-up, and the outer laminate is not to be less than 60% of that required for the keel area lay-ups as specified in Table 6.11.1 for the hull laminate.
2. The inner laminate is to extend to the sides and bottom of the hull moulding and be gradually tapered as required for corner reinforcements in this area.
3. Transoms not subject to loads from outboard engines or outdrive leg units are to be laid up to the same weight as required for the hull laminate, and constructed generally as detailed in Paragraph 6.9.14 and with stiffeners spaced as for frames.
4. For vessels where the scantling numeral is greater than 200, details of transom construction to be submitted for approval.

6.11 Tables for GRP construction

6.11.6 Table 6: Flanged top rails

Scantling numeral	Top rail width mm	Total flange weight g/m^2	Depth of flange at shell mm
10	70	3000	90
15	75	3300	100
20	80	3600	120
25	90	3900	140
30	100	3900	150
45	110	4200	160
60	120	4500	170
80	125	4500	180
100	130	4800	190
150	135	4800	200
200	140	5100	210
250	150	5400	220
300	160	6300	230
350	165	6600	240
400	170	6900	250
450	175	7200	260

Notes:-

1. Weight is based on CSM at 600g/m^2.
2. The width of top rail, laminate, and depth of flange as shown in the Table, are recommendations if the design of hull moulding enables and requires an integral flanged top rail.
3. Single piece mouldings and those with no flanged top rail are to be fitted with longitudinal stiffening for the full length of the vessel by the use of a timber gunwale and capping arrangement or deck moulding connection and rubbing bar.

6.11 Tables for GRP construction

6.11.7 Table 7: Main decks (GRP beams and sandwich core construction)

Scantling numeral	GRP beams				Sandwich				Beam shelf	
	Beam face mm	Beam web mm	Beam laminate g/m²	Beam to hull g/m²	Inner laminate weight g/m²	Outer laminate weight g/m²	Minimum core thickness mm	Deck to hull g/m²	Cored beam shelf (CSA) cm²	Beam shelf GRP laminate g/m²
10	50	75	1500	1200	900	1200	15	1200	10	1200
15	75	100	1800	1800	900	1200	15	1800	15	1800
20	75	125	1800	1800	1200	1500	15	1800	20	1800
25	100	125	1800	1800	1200	1500	15	1800	25	1800
30	100	125	1800	2400	1200	1500	15	2400	30	2400
45	100	125	2400	2400	1200	1500	15	2400	35	2400
60	100	125	2400	2400	1200	1800	15	2400	35	2400
80	100	125	3000	2400	1200	1800	15	2400	40	2400
100	100	150	3000	3000	1500	1800	15	3000	40	3000
150	100	175	3000	3000	1800	2100	20	3000	45	3000
200	100	175	3000	3000	1800	2100	20	3000	50	3000
250	100	200	3000	3000	1800	2100	20	3000	55	3000
300	100	200	3000	3000	1800	2100	20	3000	60	3000
350	100	225	3000	3000	1800	2100	20	3000	65	3600
400	100	250	3000	3600	1800	2100	20	3600	70	3600
450	150	250	3300	3600	1800	2400	20	3600	75	3600

Refer to Notes on following page.

6.11 Tables for GRP construction

6.11.7 Table 7: Main decks (GRP beam and sandwich core construction) *(continued)*

Notes:-

1. Scantlings for deck beams are based on a spacing of 500mm centre to centre. Where the spacing exceeds 500mm, the scantlings are to be increased by direct proportion.
2. The table is based on a PVC Cross cut H Type core. The core may be any structural core material with similar sheer properties such as foam, balsa or honeycomb panels, details of which should be submitted for consideration. The core thickness should be no less than that as stated in the Tables.
3. Laminate weights are based on CSM.
4. Where surrounding structural components permit, the beam shelf may be replaced with beam knees, details of which are to be submitted for consideration.
5. The beam sections stated will be used for deep beams, ordinary beams and carlings. Where alternative beam sections are proposed, details are to be submitted for consideration.
6. Additional over-bonding may be necessary to achieve suitable impact resistance depending on the operation of the vessel.

6.11 Tables for GRP construction

6.11.8 Table 8: Main decks (sheathed plywood construction)

Scantling numeral	Deep beams face mm	Ordinary beams face mm	Web at centre mm	Plywood thickness mm	GRP sheathing g/m^2	Plywood beam shelf (CSA) cm^2	Beam shelf GRP laminate g/m^2
10	65	35	80	9	1200	10	1200
15	70	35	85	12	1200	15	1800
20	70	40	85	15	1200	20	1800
25	70	45	95	15	1800	25	1800
30	75	50	100	18	1800	30	2400
45	85	55	110	18	1800	35	2400
60	95	65	120	18	1800	35	2400
80	100	75	130	20	1800	40	2400
100	110	85	140	20	1800	40	3000
150	120	95	150	20	2400	45	3000
200	135	110	165	25	2400	50	3000
250	150	120	180	25	2400	55	3000
300	160	125	200	25	2400	60	3000
350	170	140	200	25	2400	65	3600
400	180	150	210	30	3000	70	3600
450	180	150	210	30	3000	75	3600

Note:-

1. Scantlings for deck beams are based on a spacing of 500mm centre to centre and with a camber of 20mm per metre length of beam. Where the spacing exceeds the 500mm, the scantlings are to be increased by direct proportion.

6.11 Tables for GRP construction

6.11.9 Table 9: Sandwich construction watertight bulkheads

Depth of bulkhead m	Bulkhead core thickness mm					Vertical stiffeners			Horizontal stiffeners		
	10	15	20	25	30	Section		Face & web weight g/m²	Section		Face & web weight g/m²
	Bulkhead laminate weight g/m²	Bulkhead laminate weight g/m²	Bulkhead laminate weight g/m²	Bulkhead laminate weight g/m²	Bulkhead laminate weight g/m²	Face mm	Web mm		Face mm	Web mm	
1.2	1800	1800	–	–	–	40	40	1200	–	–	–
1.5	2100	1800	1800	–	–	50	40	1200	–	–	–
1.8	2100	2100	1800	–	–	50	50	1500	50	50	1500
2.1	2400	2100	2100	–	–	60	60	1800	60	60	1800
2.4	–	2400	2100	2100	–	65	60	2100	65	60	2100
2.7	–	–	2400	2100	2100	65	65	2400	65	65	2400
3.0	–	–	2700	2400	2100	75	70	2700	75	70	2700
3.3	–	–	2700	2700	2400	85	75	3000	85	75	3000
3.6	–	–	3000	2700	2700	90	85	3300	90	85	3300
3.9	–	–	3300	3000	2700	95	90	3300	95	90	3300
4.2	–	–	3600	3300	3300	115	100	3600	115	100	3600
4.6	–	–	3900	3600	3300	120	115	3600	120	115	3600

Refer to Notes on following page.

6.11 Tables for GRP construction

6.11.9 Table 9: Sandwich construction watertight bulkheads *(continued)*

Notes:-

1. Depth of bulkhead is measured from top of floor/frames to underside of deck at centreline. Where depth of bulkhead is less than 2.4m, floor bearers or attached joinery connections may be incorporated as stiffeners.
2. Bulkhead scantlings are based on a stiffener spacing of 900mm. Where the spacing of stiffeners differs from 900mm the bulkhead laminate weight is to be modified at the rate of 5% per 50mm spacing difference, but in no case shall the laminates be less than 1800g/m^2.
3. Bulkheads with depth of 1.8m and above, are to be further strengthened by the addition of horizontal stiffeners.
4. All bulkheads are to be bonded to the shell laminate with double angles as detailed at Figure 6.12.6.
5. Non-watertight bulkheads are to have scantlings as required for watertight bulkheads.

6.11 Tables for GRP construction

6.11.10 Table 10: Plywood construction watertight bulkheads

Depth of bulkhead m	Plywood thickness mm	Vertical stiffener section		Shell bonding laminate g/m²	Stiffener spacing mm	Horizontal stiffener section	
		Face mm	Web mm			Face mm	Web mm
0.5	9	–	–	1200	–	–	–
0.7	9	–	–	1200	–	–	–
0.9	12	–	–	1800	–	–	–
1.2	15	50	40	1800	500	–	–
1.5	18	50	40	1800	500	–	–
1.8	18	50	50	2400	500	–	–
2.1	18	60	50	2400	500	75	50
2.4	22	65	50	2400	500	75	50
2.7	22	70	50	2400	500	80	50
3	25	75	50	3000	500	85	50
3.3	25	75	50	3000	500	90	50
3.6	25	80	50	3000	500	90	50
3.9	25	85	50	3000	500	100	50
4.2	30	90	50	3600	500	100	50

Notes:-

1. Depth of bulkhead is measured from top of floor/frames to underside of deck at centreline. Where depth of bulkhead is less than 2.4m, floor bearers or attached joinery connections may be incorporated as stiffeners.
2. Bulkheads with depth of 2.1m and above, are to be further strengthened by the addition of horizontal stiffeners.
3. All bulkheads are to be bonded to the shell laminate with double angles as detailed at Figure 6.12.6.
4. Non-watertight bulkheads are to have scantlings as required for watertight bulkheads.
5. Vertical and horizontal stiffeners are to be wooden sections screw and glued in position.

6.11 Tables for GRP construction

6.11.11 Table 11: Deckhouse construction

Size of vessel	Plywood thickness (1088 WBP) mm	Single skin GRP g/m²	Foam cored construction		
			Outer skin g/m²	Core mm	Inner skin g/m²
0 – 7m	10	2700	1500	10	1200
7 – 9m	12	3900	2100	12	1200
9 – 12m	18	5700	2100	12	1800
12 – 15m	25	6900	2700	15	2400

Notes:-

1. Wheelhouse and deckhouses may be of plywood with painted only finish. Plywood is to be BS 1088 WBP grade (or equivalent) and stiffeners spaced 500mm apart. If GRP sheathed, the plywood may be of B/BB quality with exterior sheathing of two layers of 600 CSM gelcoat or paint finished.

1. In deckhouses of single skin GRP construction the lay up is to be as specified above with gelcoat exterior finish.

2. In deckhouses of cored construction, the GRP inner and outer skins are to be as specified in the above Table with gelcoat or paint exterior finish.

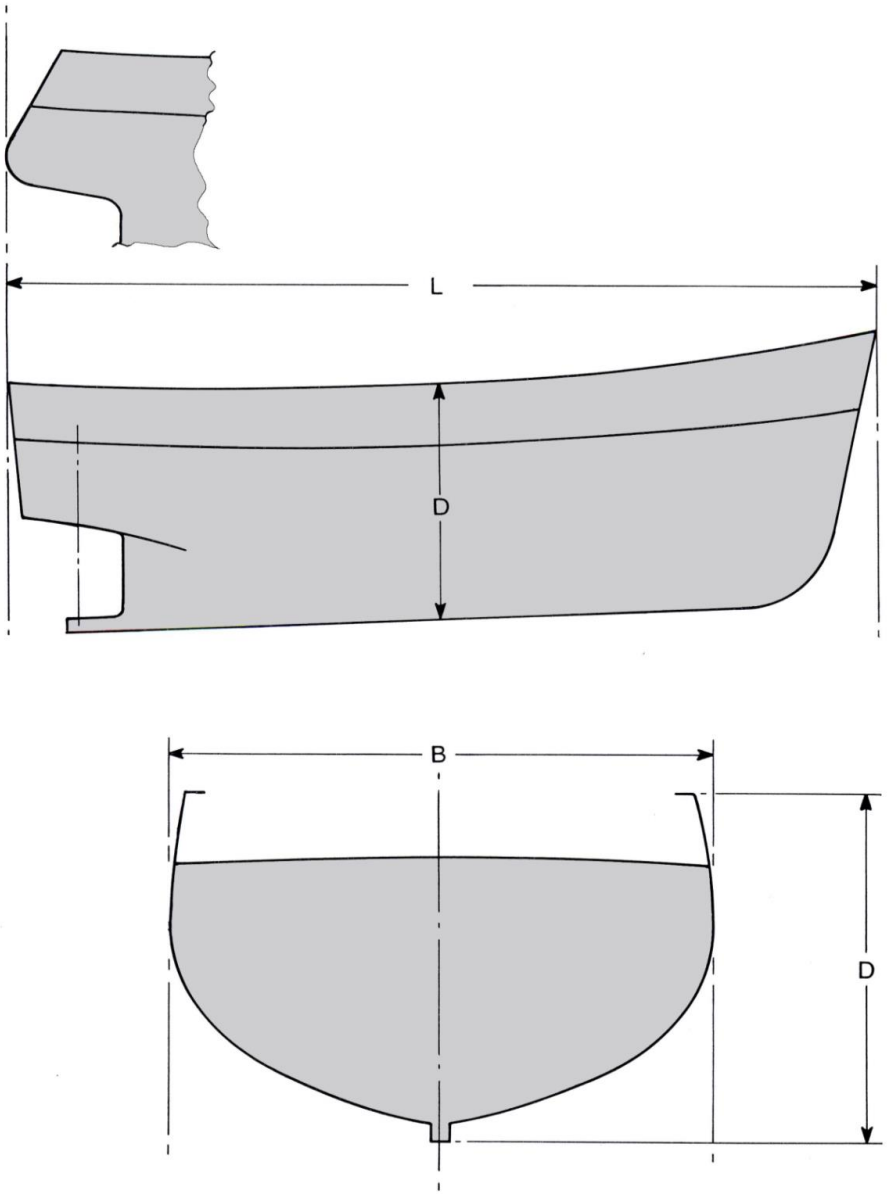
3. This Table is for the construction of normal sized wheelhouses relevant to the size of vessel stated, for larger structures and shelter decks refer to Table 4.20.18 aluminium structures or equivalent.

4. Wheelhouses of alternative construction may be considered upon the submission of details.

6.12 Figures and illustrations

6.12.1 Scantling numeral dimensions – mono-hull

L x B x D = Scantling numeral



Length overall measured in a straight line from the fore side of stem at top to after side of stern/transom or fore side of the bulbous bow to after side of stern/transom if that be greater.

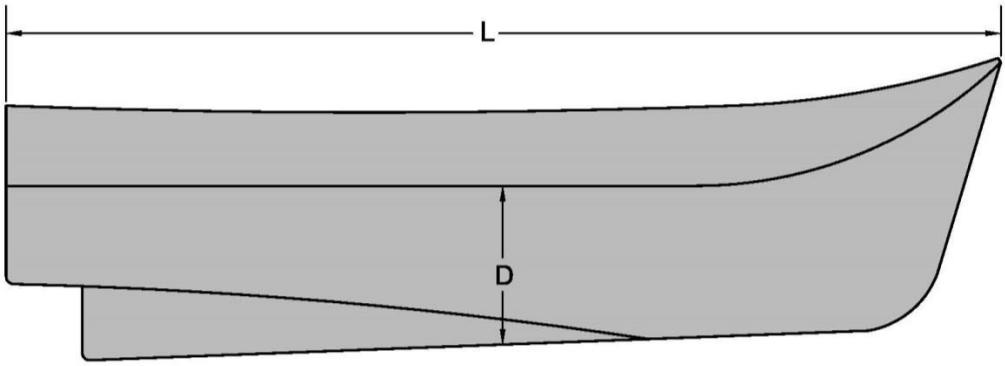
Breadth ‘B’ the greatest breadth of the vessel outside of the shell moulding.

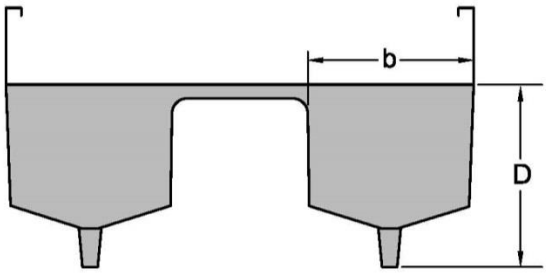
Depth ‘D’ measured at amidships from underside of keel to top of shell moulding or gunwale.

6.12 Figures and illustrations

6.12.2 Scantling numeral dimensions – multi-hull

2 (L x b x D) = Scantling numeral





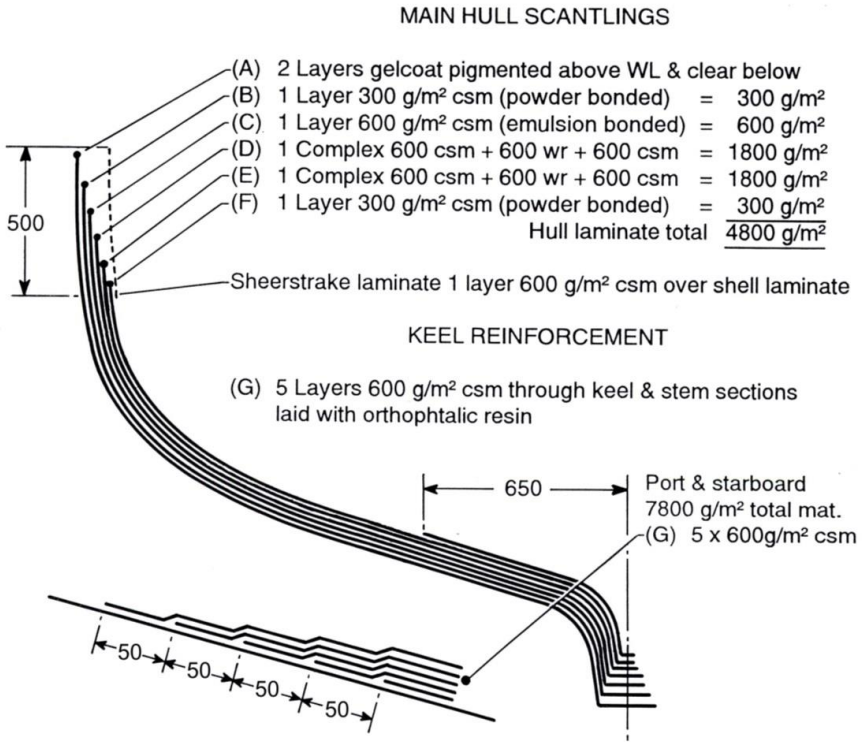
Length overall measured in a straight line from the fore side of stem at top to after side of stern/transom or fore side of the bulbous bow to after side of stern/transom if that be greater.

Breadth ‘b’ the greatest breadth of each hull at crossdeck level outside of the shell moulding.

Depth ‘D’ measured at amidships from underside of keel to underside of deck.

6.12 Figures and illustrations

6.12.3 Specimen lay-up diagram



TYPICAL HULL LAMINATE SCANTLINGS - USING SCANTLING NUMERAL 100

NOTES ON LAY UP PROCEDURE

(A) Crystic 65 pa* isophtalic gelcoat laid with mohair roller. Pigmented above datum waterline to owners colour choice and clear unpigmented below.

(B) One layer of chopped strand mat (csm) to be powder bonded and impregnated with isophtalic crystic resin No.489 pa* (csm 300 g/m² [1oz / ft²]).

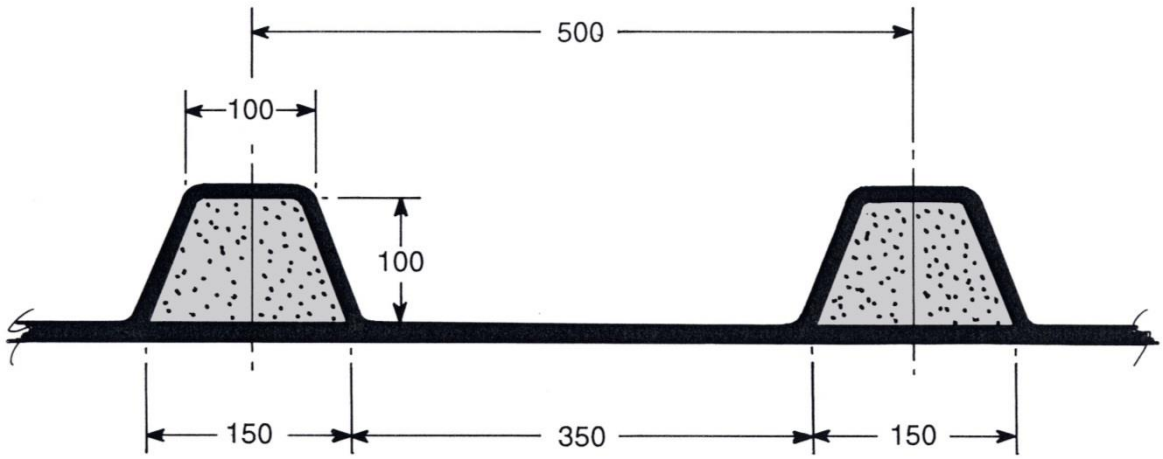
(C) One layer of chopped strand mat (csm) to be emulsion bonded, laid vertically and overlapped at least 50mm. CSM to be impregnated with crystic orthophtalic resin No.414 pa*. Resin to be clear unpigmented.

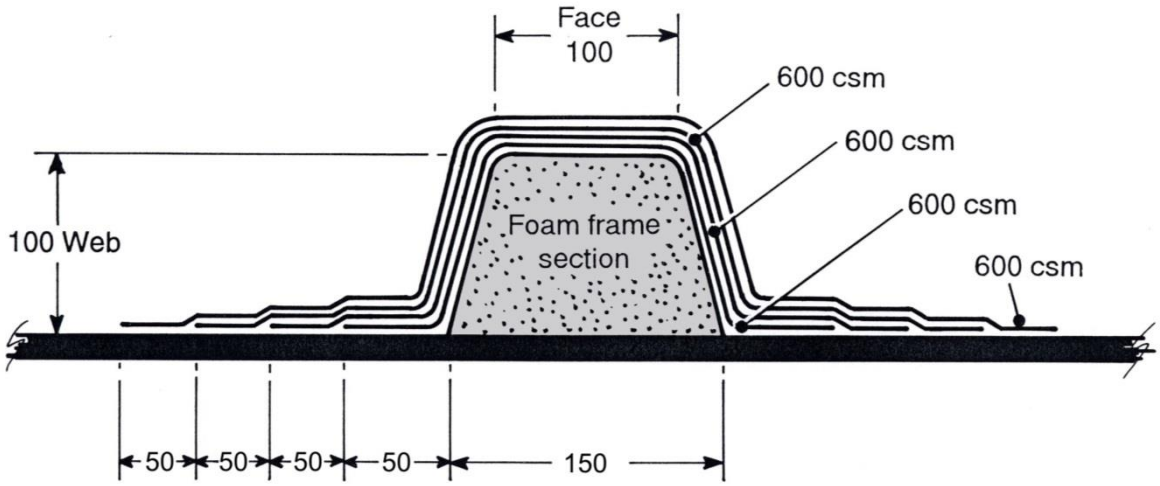
(D) Complex of csm + wr + csm to be laid with orthophtalic resin No.414 pa* and be overlapped at least 50mm. Overlap around transom corners and stem to be 200mm min. (* or other approved resins).

Frames to be 115mm x 105mm low density closed cell polyurethane rigid foam section spaced 520mm apart centre to centre and bonded to hull laminate with 3 layers of 600 g/m² csm & 1 layer of 300 g/m² csm. The frame bonding laminate is to be increased in width by 50mm each side per layer. Frame sections to be continuously installed and over laminated prior to longitudinal stringers.

6.12 Figures and illustrations

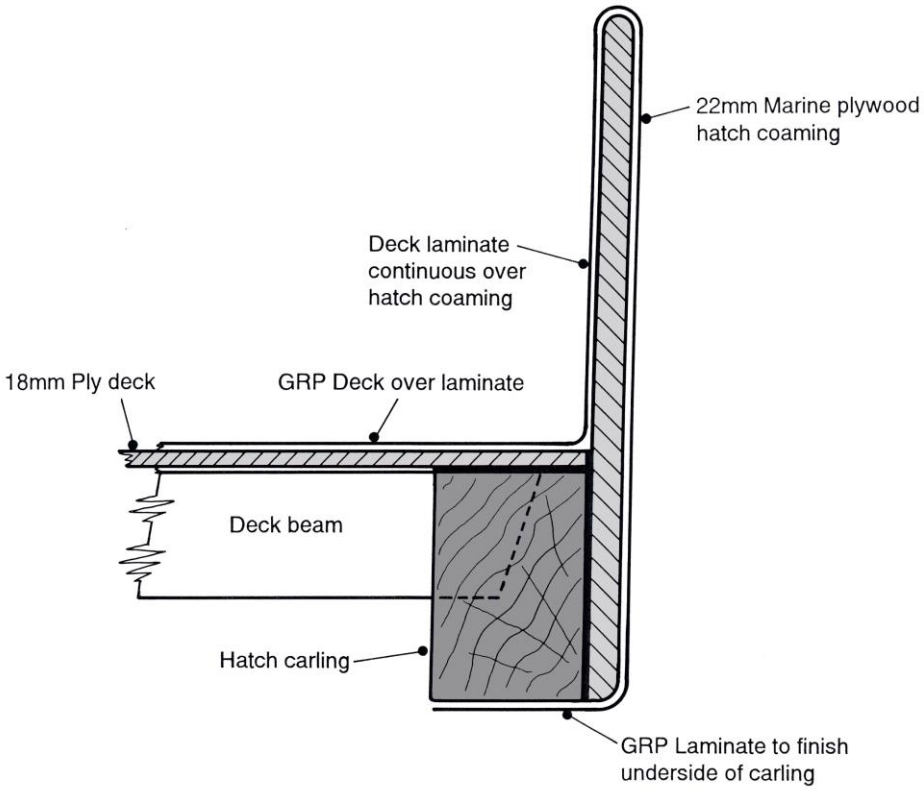
6.12.4 Framing details

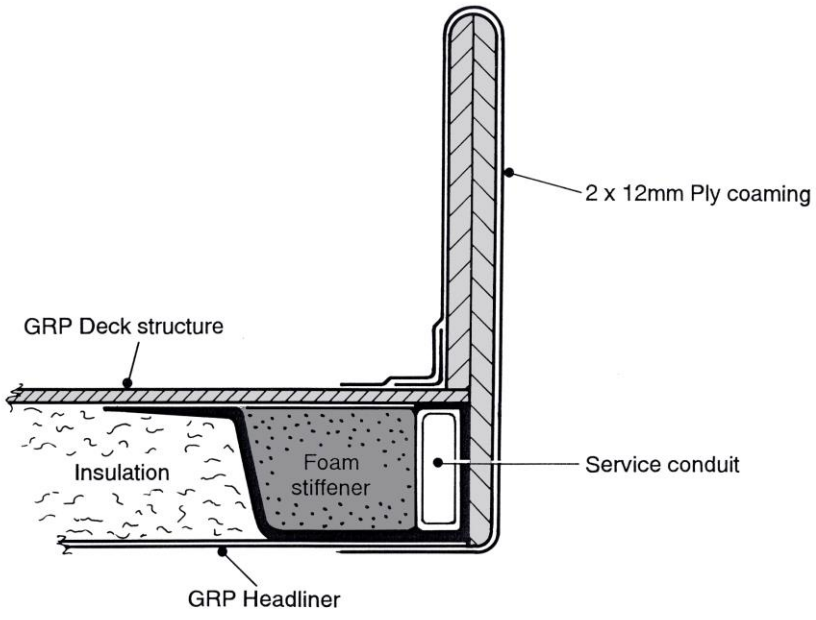




6.12 Figures and illustrations

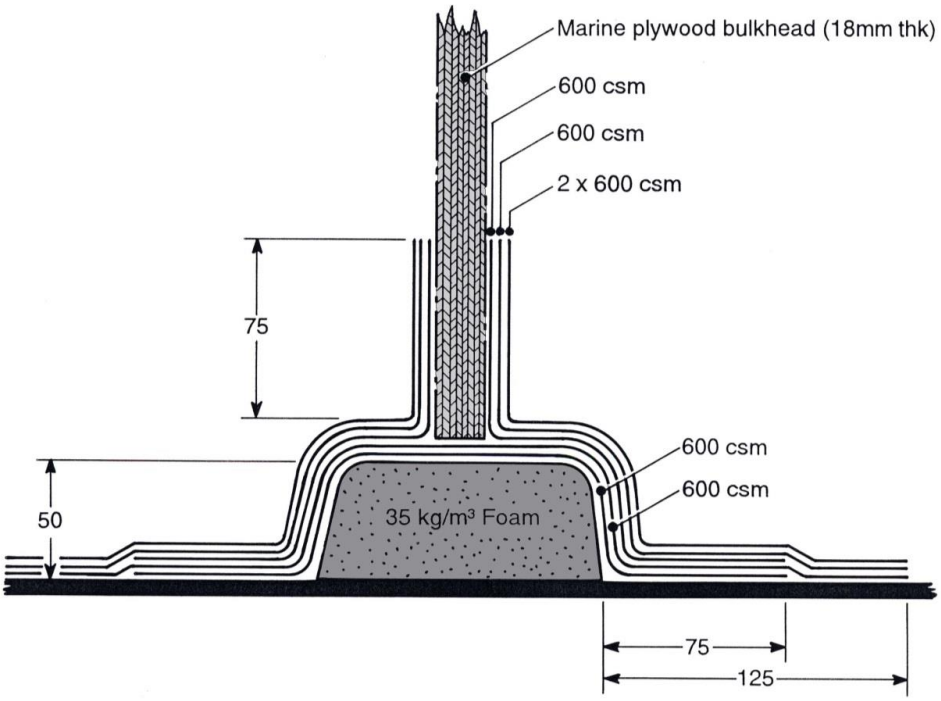
6.12.5 Hatch coamings

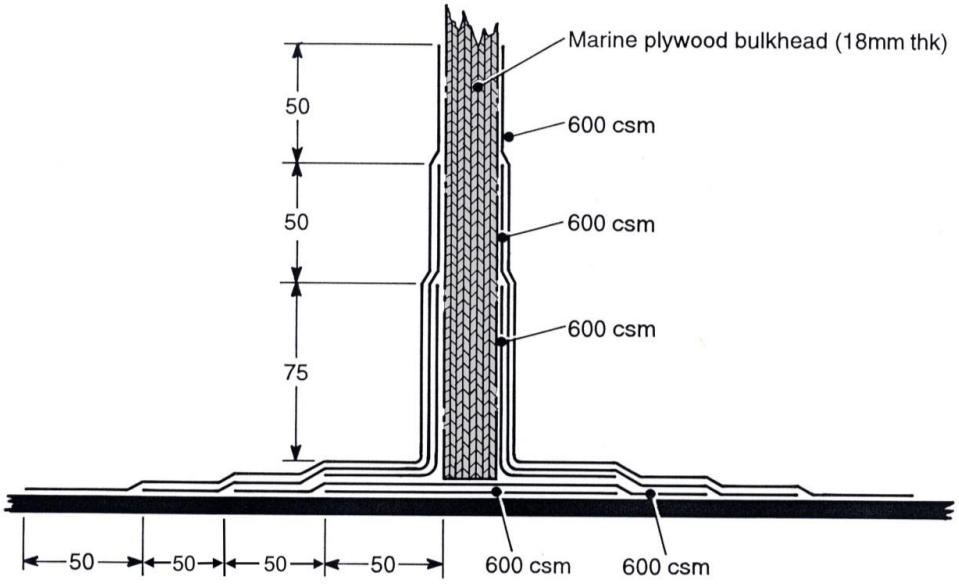




6.12 Figures and illustrations

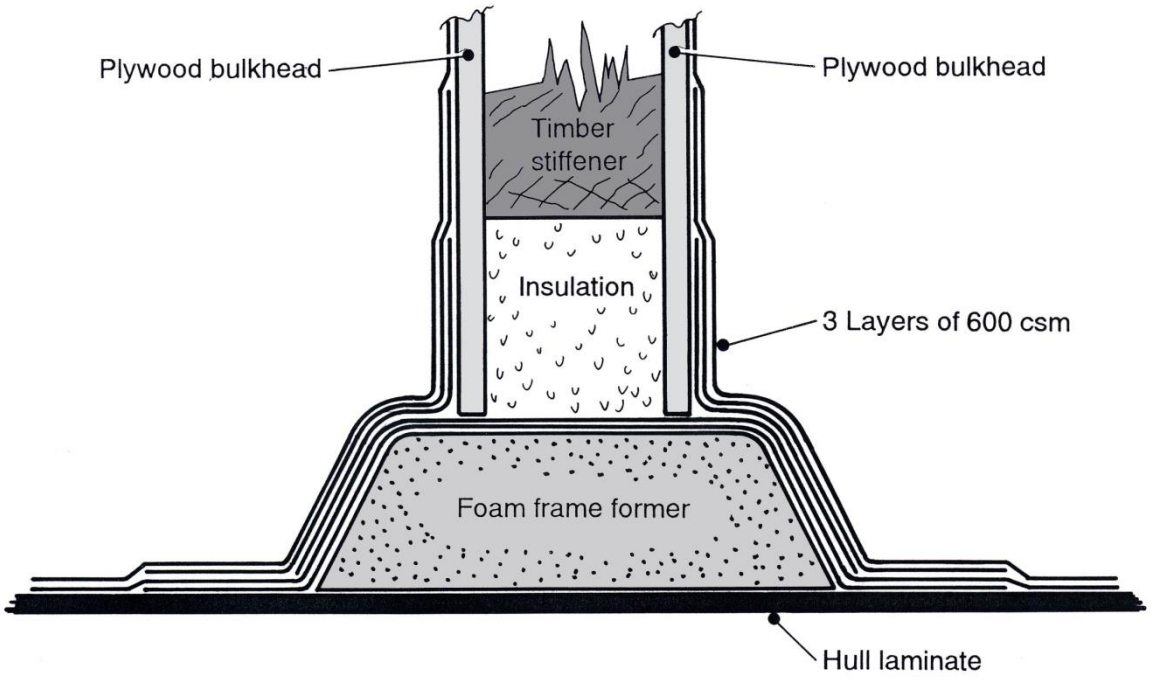
6.12.6 Bulkhead attachments





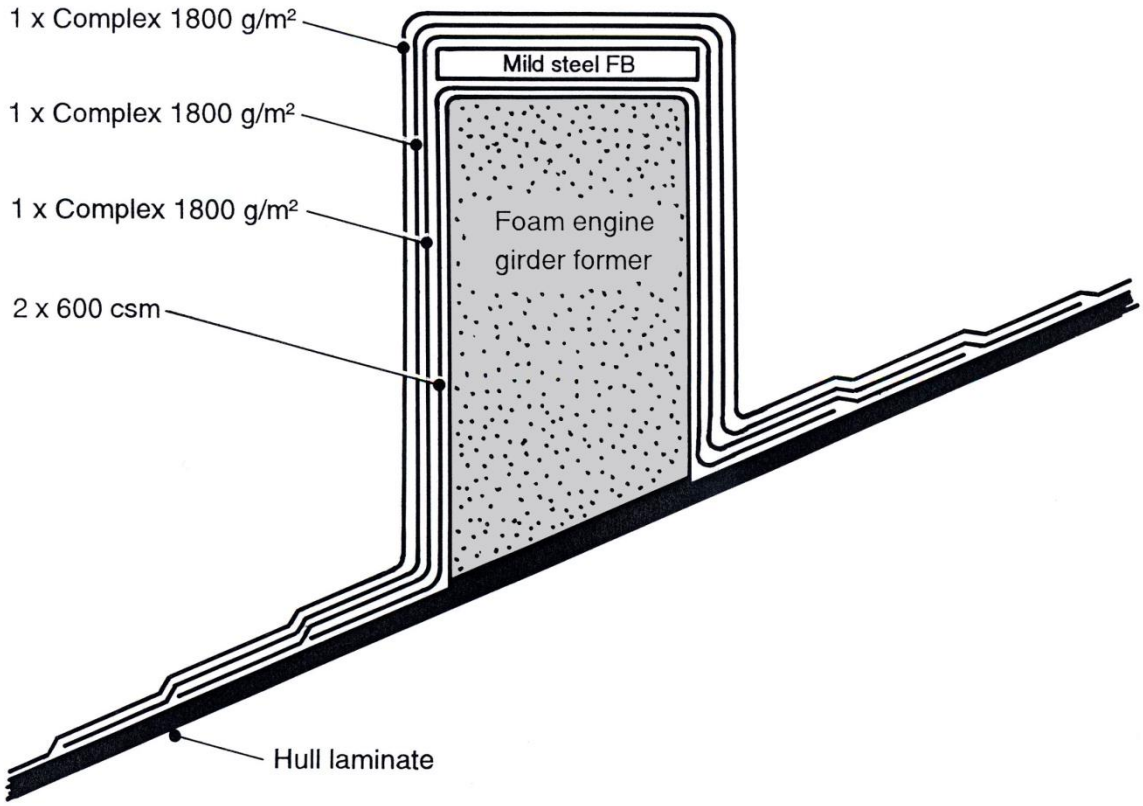
6.12 Figures and illustrations

6.12.7 Foam core bulkhead connection



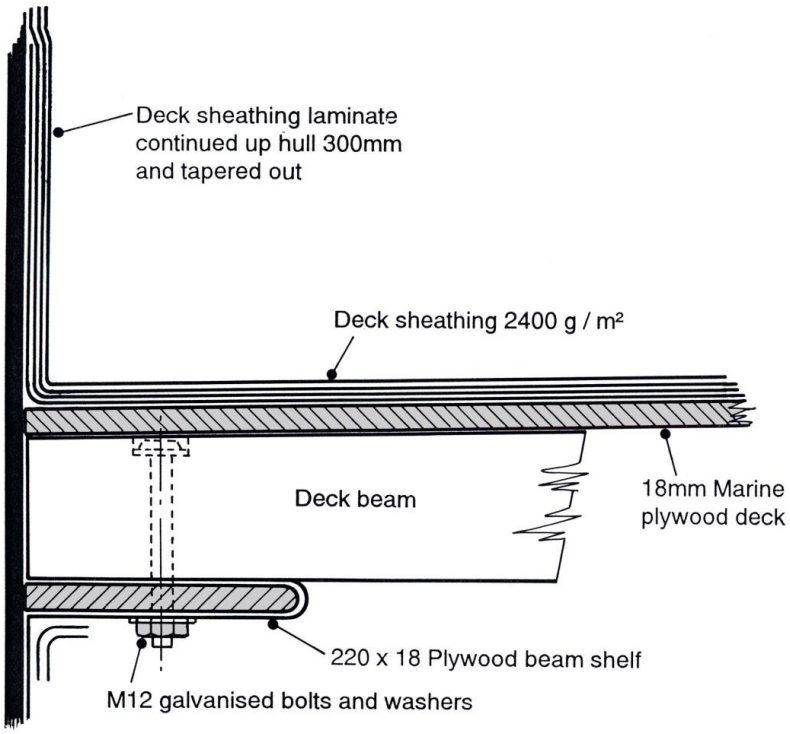
6.12 Figures and illustrations

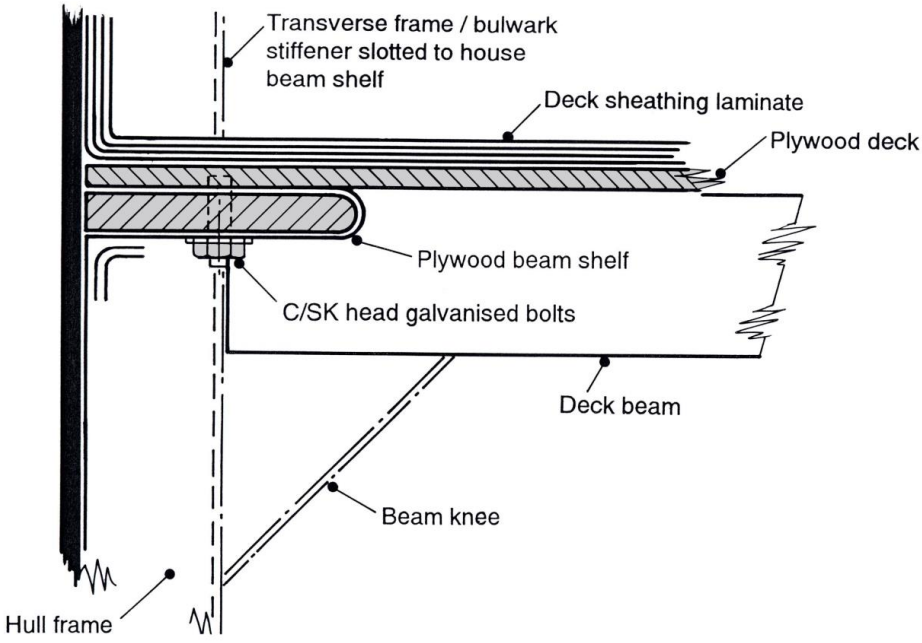
6.12.8 Engine seats



6.12 Figures and illustrations

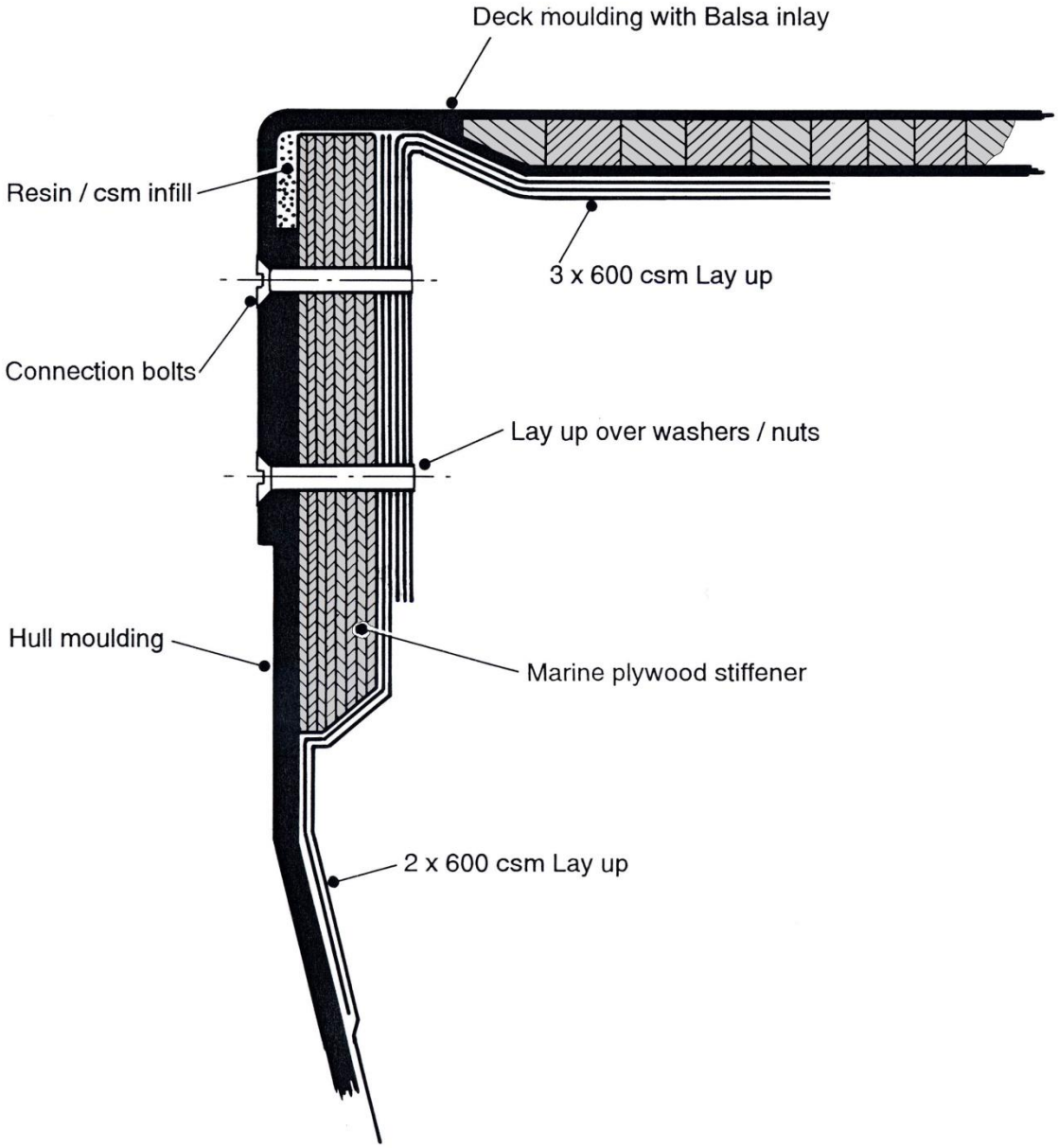
6.12.9 Deck/beam/shelf connections





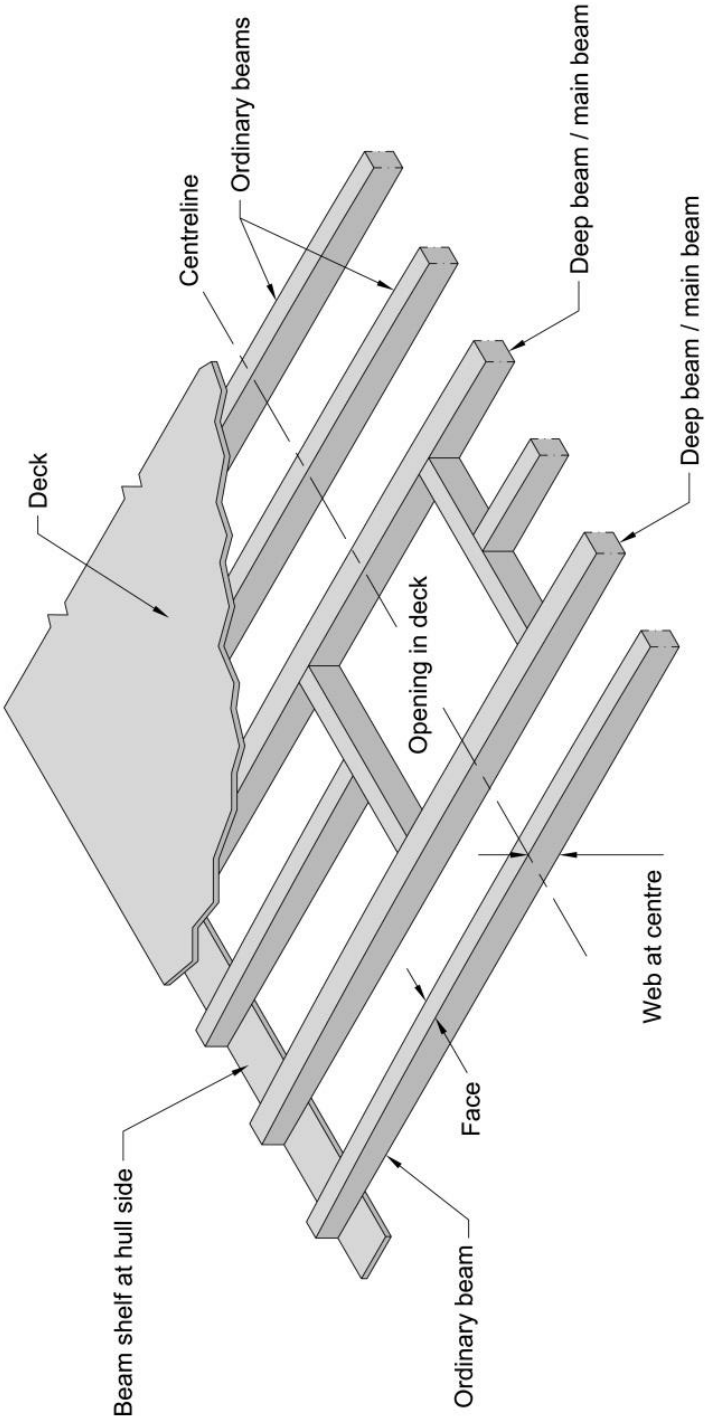
6.12 Figures and illustrations

6.12.10 Deck moulding to hull joint



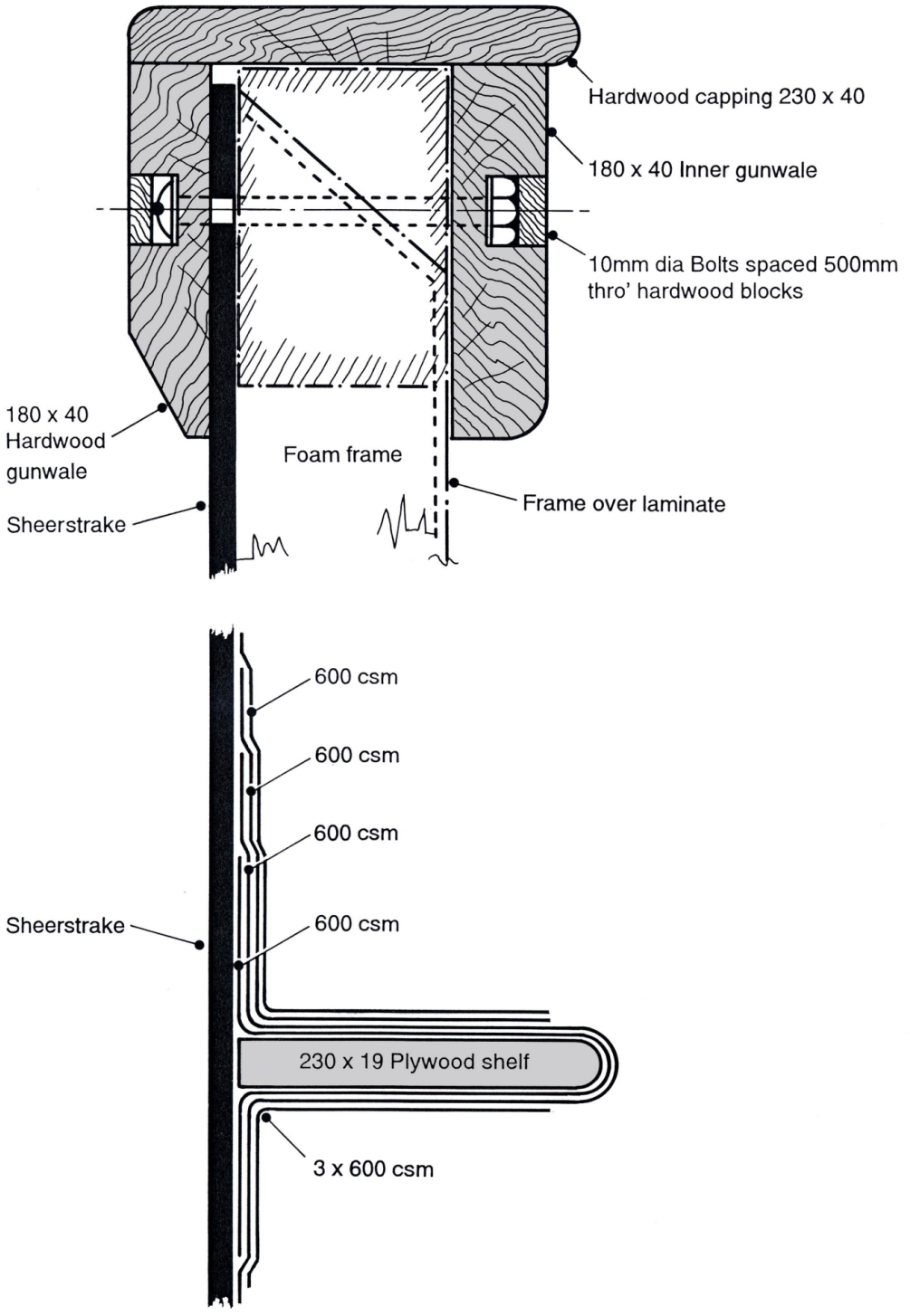
6.12 Figures and illustrations

6.12.11 Deck structure



6.12 Figures and illustrations

6.12.12 Section at bulwark and beam shelf



PART 7

WOOD CONSTRUCTION

PART 7

WOOD CONSTRUCTION

PART 7

WOOD CONSTRUCTION (continued)

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 gaboon 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 Figure 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 metres 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 cobles, 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 3.11, 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 B15 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, guard rails or wires, or a combination of these. The height of the bulwark, guard rail, 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 11.14.2.

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 fishrooms 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.

Section 7.35 & 7.36 - 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.

In determining scantlings from the Tables in respect of intermediate values, the scantling applicable is to be that given for the nearest dimension/numeral, unless otherwise stated in the Table notes.

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	150	25	-	-
15	90	150	90	65	150	30	-	-
20	100	150	100	75	165	40	-	-
25	100	170	100	75	165	45	-	-
30	115	175	115	90	190	50	-	-
45	125	180	125	90	190	50	-	-
60	125	180	125	90	205	65	-	-
70	125	180	125	90	215	75	-	-
85	140	205	140	90	240	75	-	-
100	150	230	150	100	270	90	-	-
115	150	230	150	100	270	100	-	-
140	180	255	180	100	280	115	-	-
170	180	255	180	100	290	125	-	-
200	190	280	200	125	290	125	-	-
235	190	280	190	125	300	140	-	-
270	215	305	215	125	305	150	-	-
315	215	305	215	125	320	165	150	205
340	215	305	215	140	340	165	150	205
370	215	305	215	140	350	165	150	205
415	240	320	240	150	365	180	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		
					Stringers		Beam shelf cm^2
		Siding mm	Bilge no.	Rubbing no.	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

	A						B			C		
Scantling numeral	Sawn frames with bent frames between						Spacing of sawn frames with 1, 2 or 3 bent frames between			Bent frames only		
	Sawn frames				Bent frames							
	Siding mm	Moulding			Siding mm	Moulded mm	One centre mm	Two centres mm	Three centres mm	Siding mm	Moulded mm	Spacing centres mm
		Floor mm	Bilge mm	Head 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 be 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			Stiffeners		
	Single planked mm	Double planked Mm	Plywood 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 futtocks 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

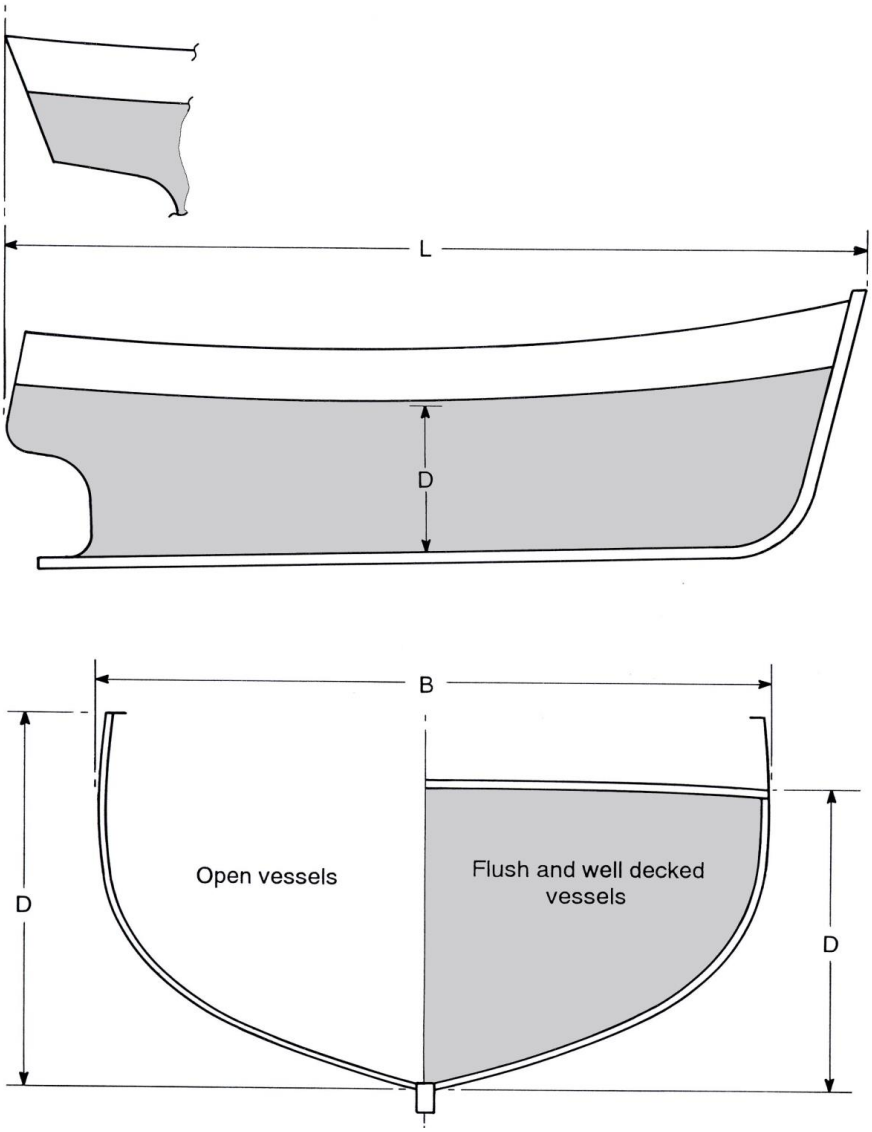
7.35.16: Recommended timbers and uses

Name of timber	Uses
Teak (Tectona grandis)	All purpose
Oak (European) (Quercus spp)	All purpose
Pitch Pine (Pinus caribea)	All purpose
Opepe (Nauclea diderrichii)	All purpose
Agba (Gossweilerodendrom balsomiderum)	Planking, laminated frames and joinery
Iroko (Chlorophora excelsa)	Deck planking, joinery and laminations
Garjun, Keruing (Dipterocarpus spp)	Decking (kiln dried)
Douglas Fir (Pseudotsuga taxifolia)	Decks, masts, thwarts and joinery
Elm, Dutch (Ulmus thomasi)	Steam bent frames
Larch, European (Larix decidua)	Planking, beams stringers, masts and thwarts
Mahogany, American (Swietenia macrophylla)	Planking, thwarts, joinery and laminations
Makore (Tieghemella heckelii)	Keels, planking, frames and laminations
Parana Pine (Arancaria augustifolia)	Soles and joinery
Redwood (Pinus sylvertris)	Soles, thwarts, joinery and planking for small boats
Sapele (Entandrophragma cylindricum)	Thwarts, joinery and planking for small boats
Utile (Entandrophragma Utile)	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 x B x 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.

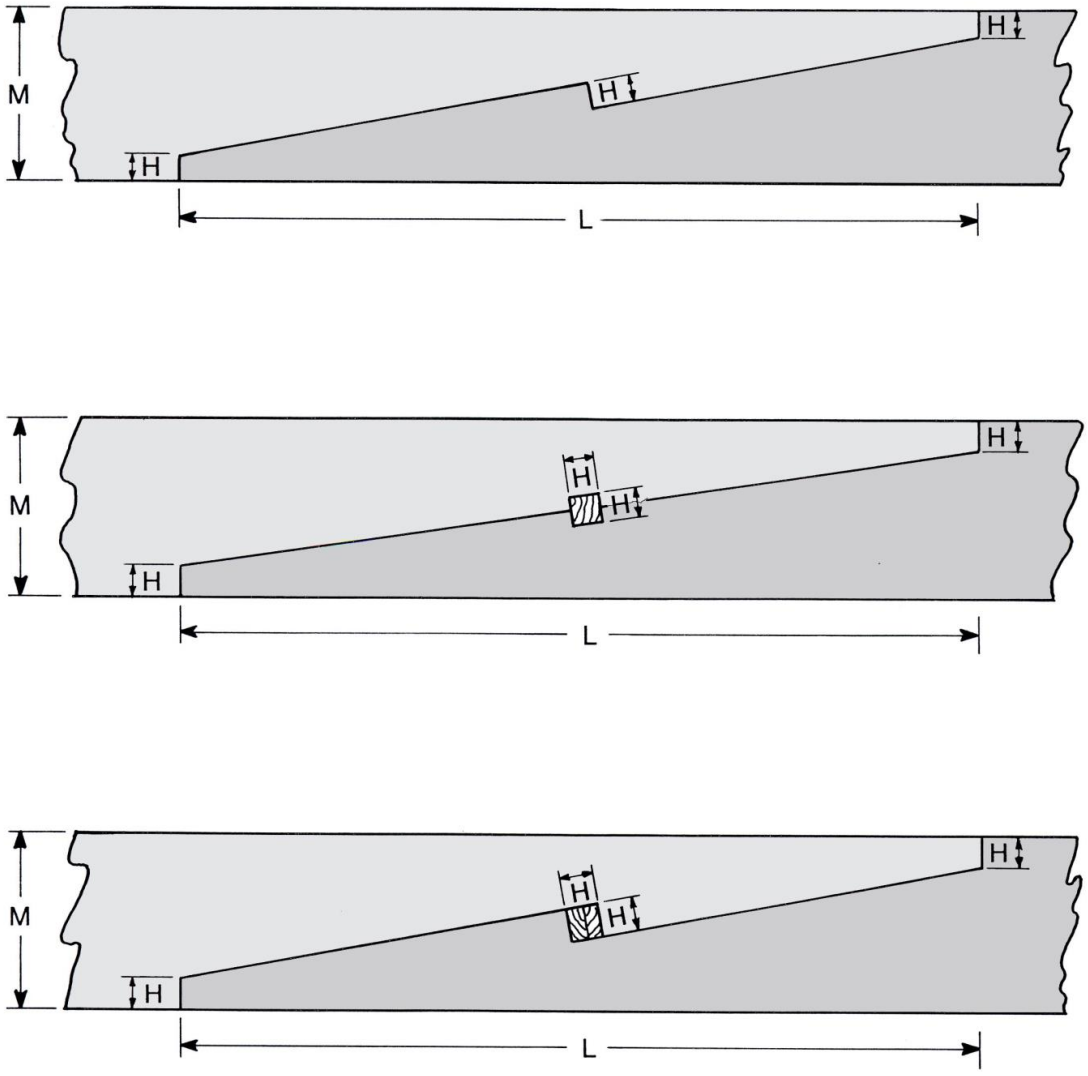
Depth ‘D’ measured at amidships from the outside of planking at the keel rabbet to top of deck beam at side on flush and well decked vessels.

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

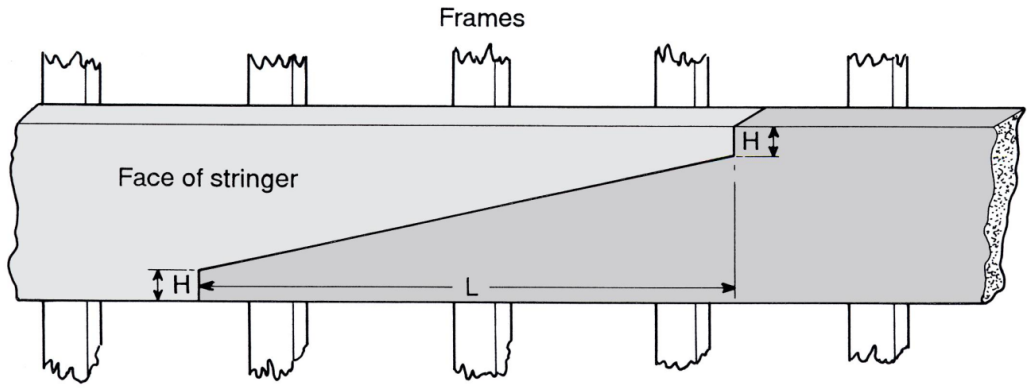


M = Keel moulding
L = Length of scarph = 5 x M
H = 0.15 x M

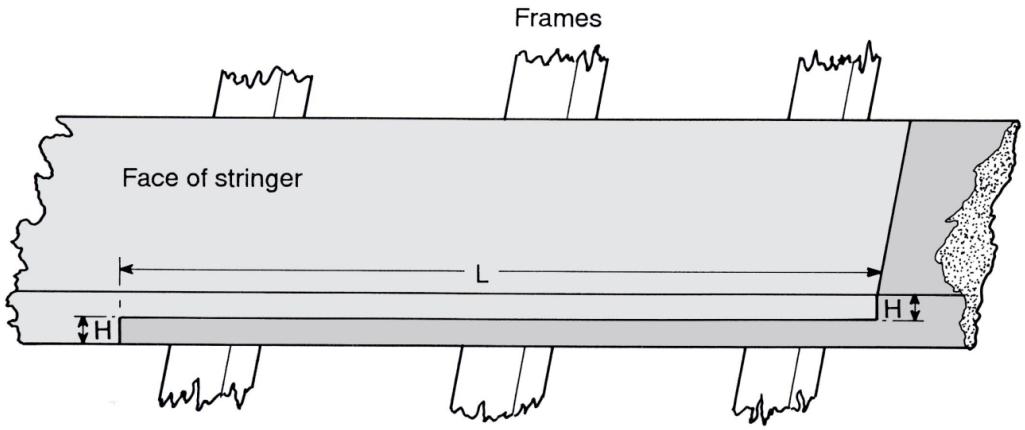
7.36 Figures and illustrations

7.36.3 Stringer scarphs

BEAM STRINGER SCARPHS



BILGE STRINGER SCARPHS

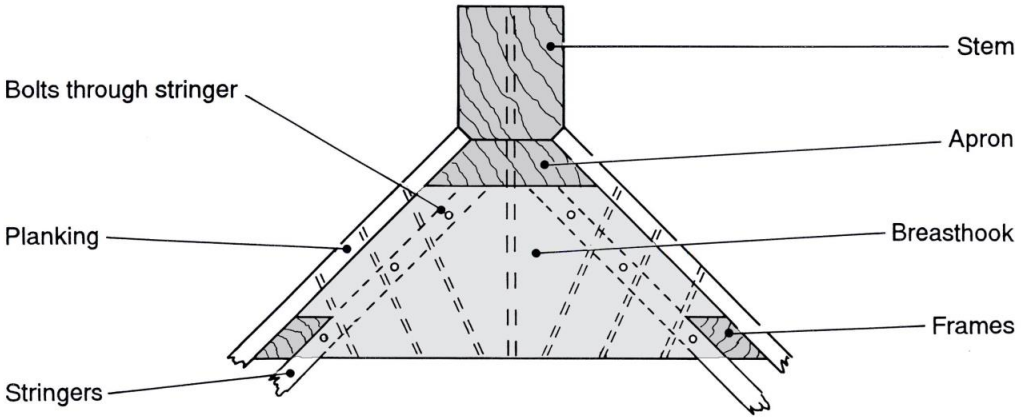


L shall not be less than two frame spaces.
H shall not be less than 0.15 x the moulding for beam stringers.
H shall not be more than 0.15 x siding for bilge stringers.

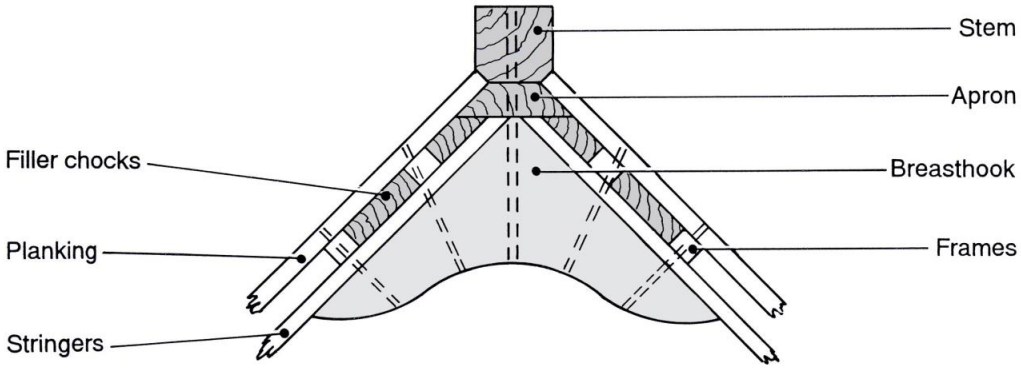
7.36 Figures and illustrations

7.36.4 Breasthooks

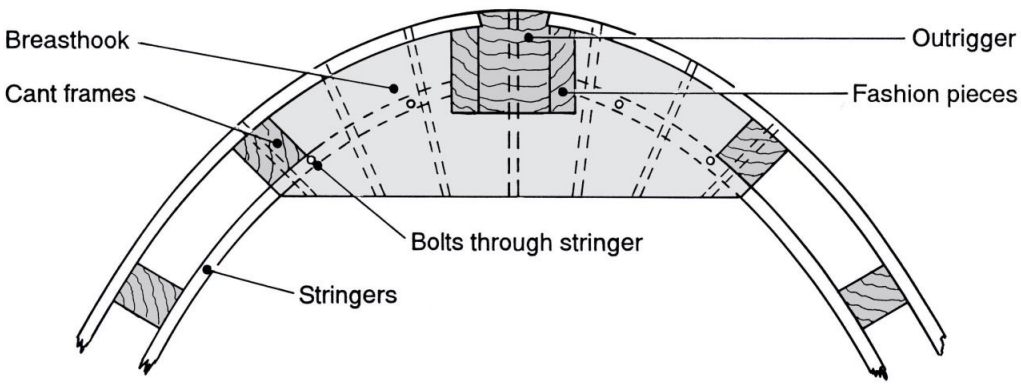
FORWARD BREASTHOOK WITH SAWN FRAMES



FORWARD BREASTHOOK WITH BENT FRAMES



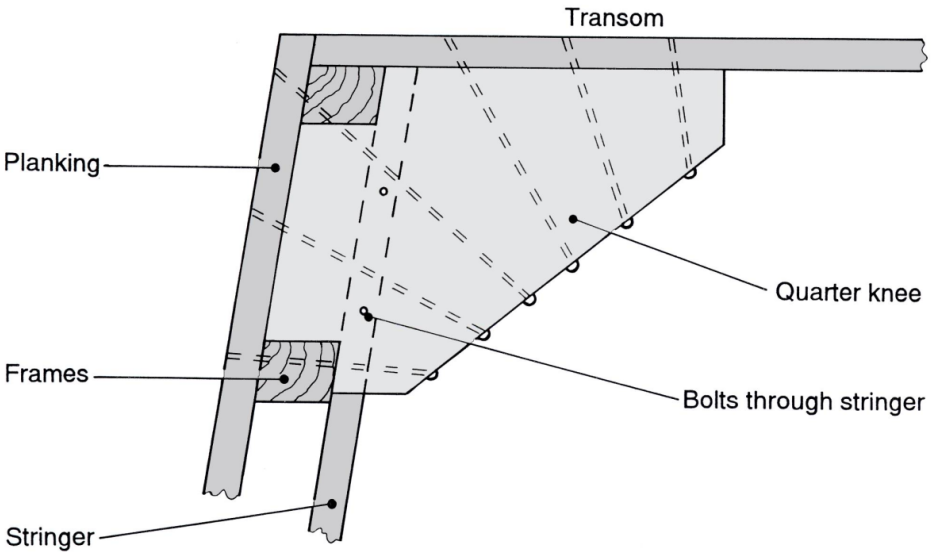
AFT BREASTHOOK WITH SAWN FRAMES



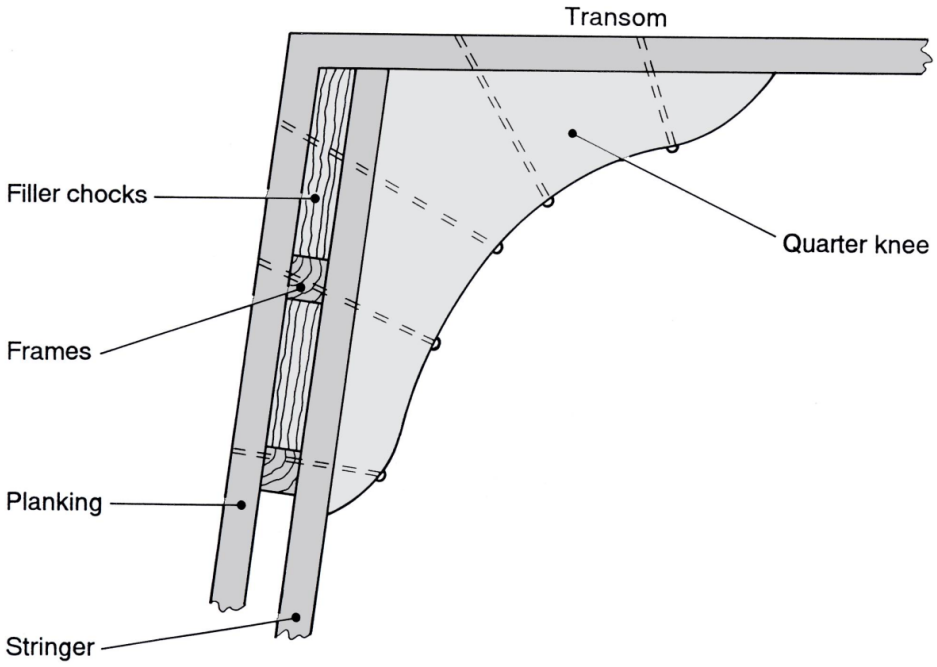
7.36 Figures and illustrations

7.36.5 Transom knees

TRANSOM QUARTER KNEE WITH SAWN FRAMES

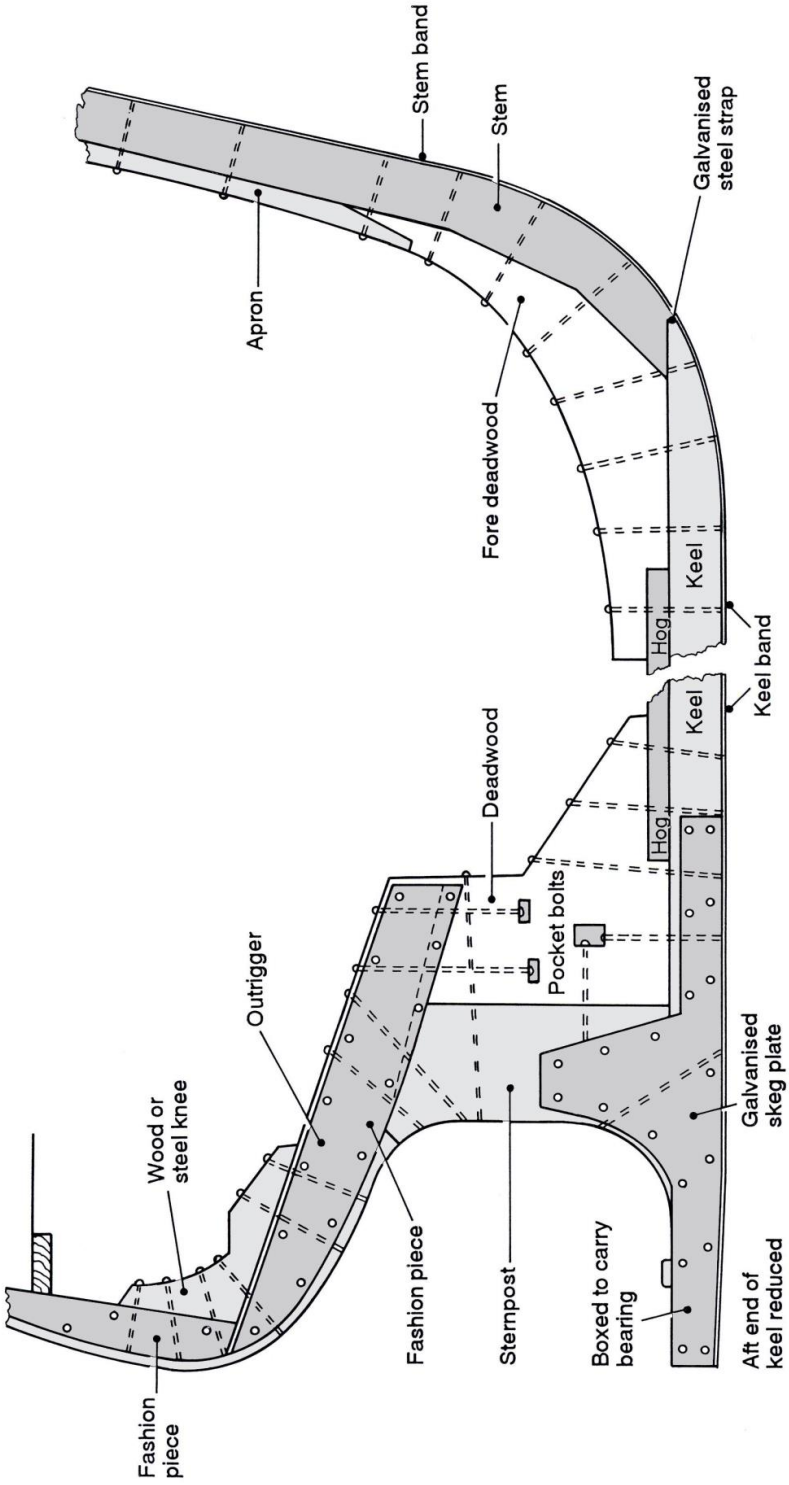


TRANSOM QUARTER KNEE WITH BENT FRAMES



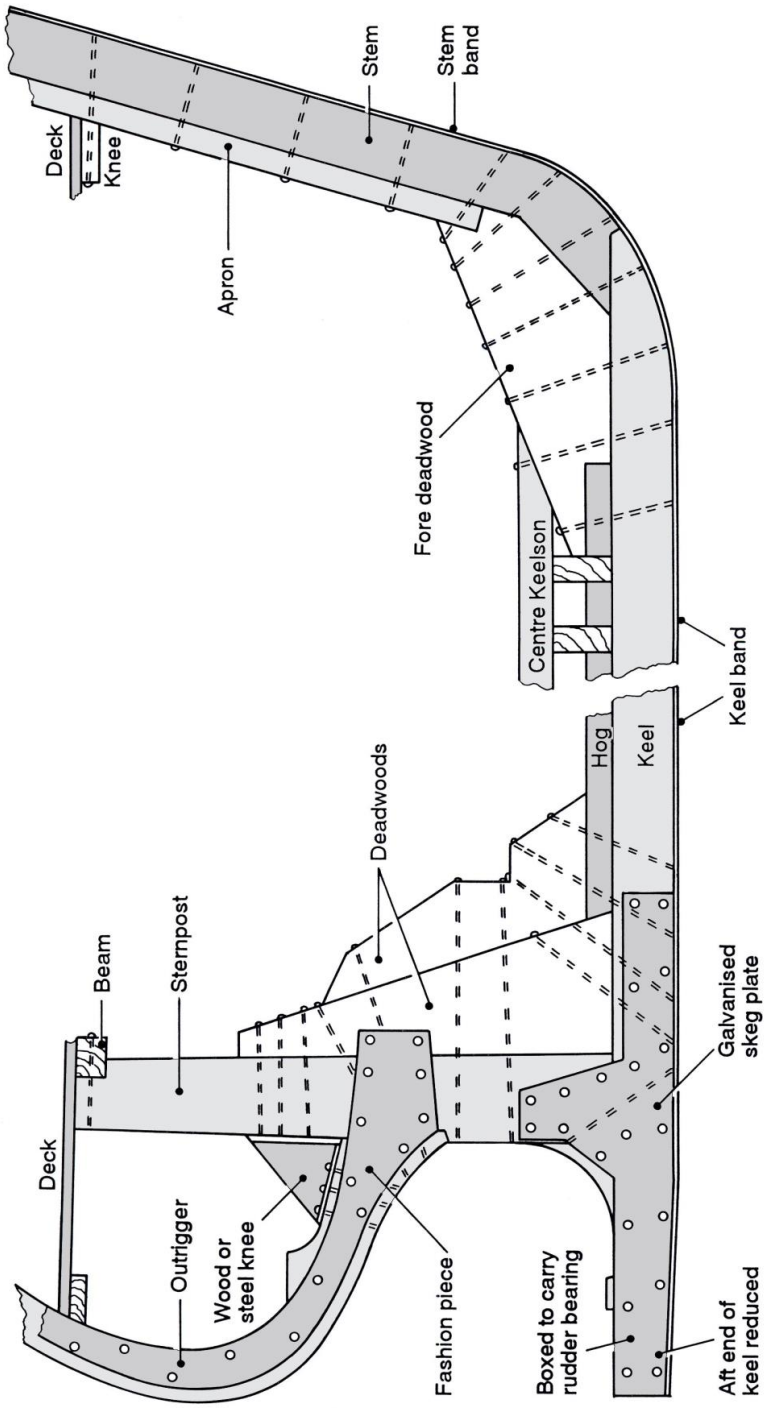
7.36 Figures and illustrations

7.36.6 Main frame construction



7.36 Figures and illustrations

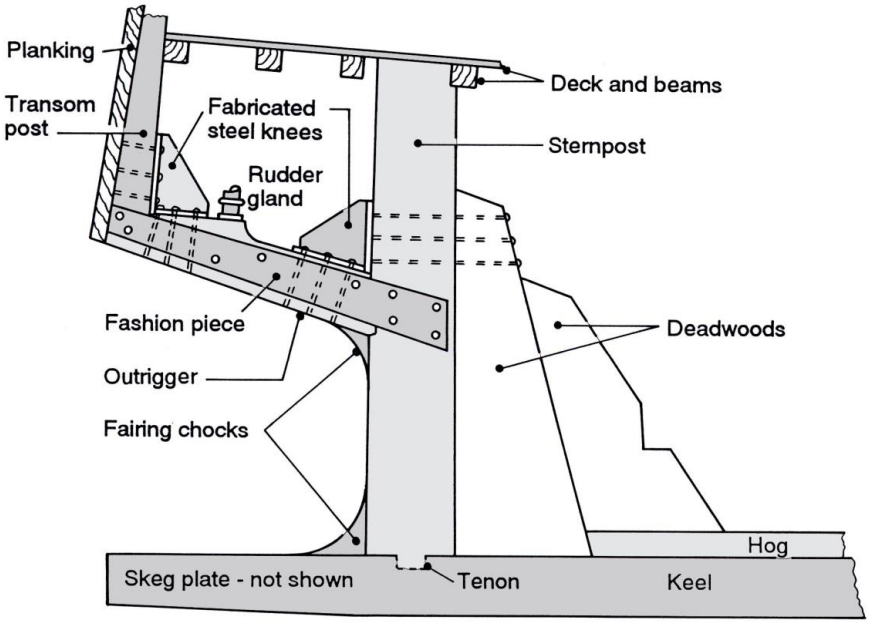
7.36.7 Alternative main frame construction



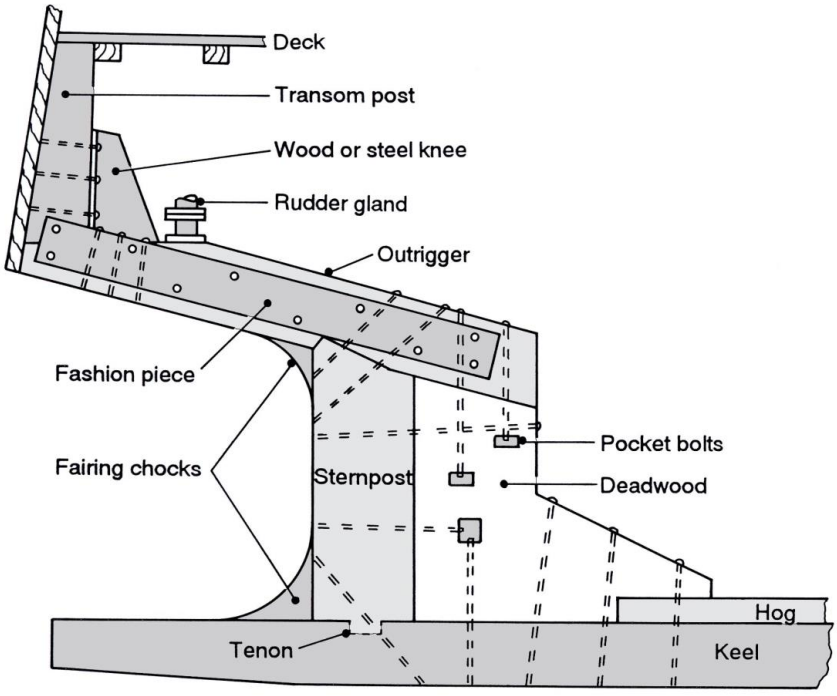
7.36 Figures and illustrations

7.36.8 Transom arrangements

AFT SECTION SHOWING TRANSOM ARRANGEMENT WITH THROUGH STERNPOST

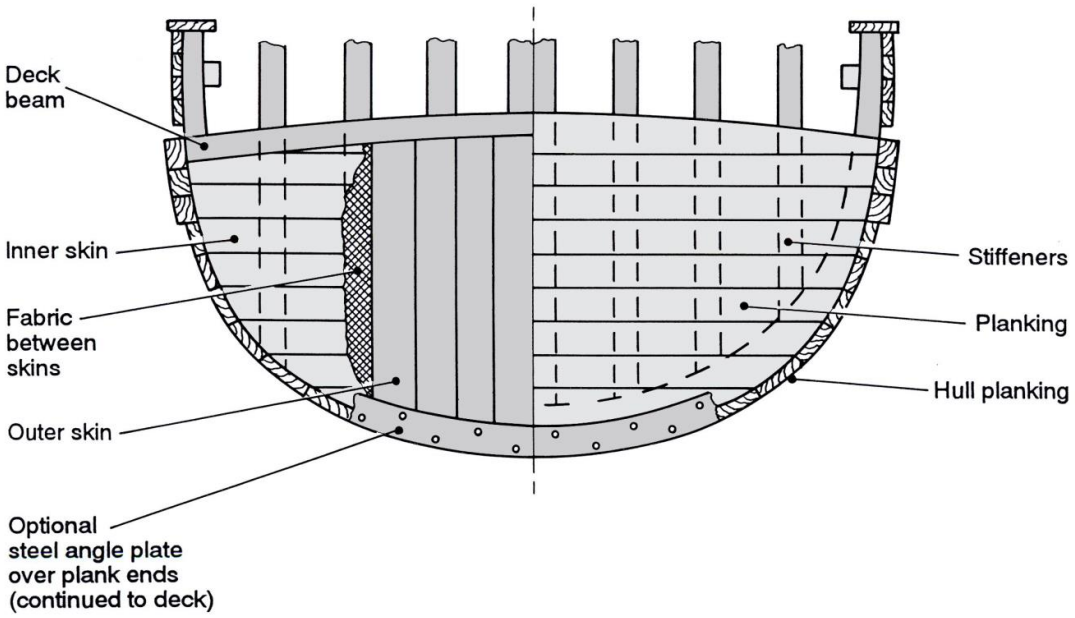


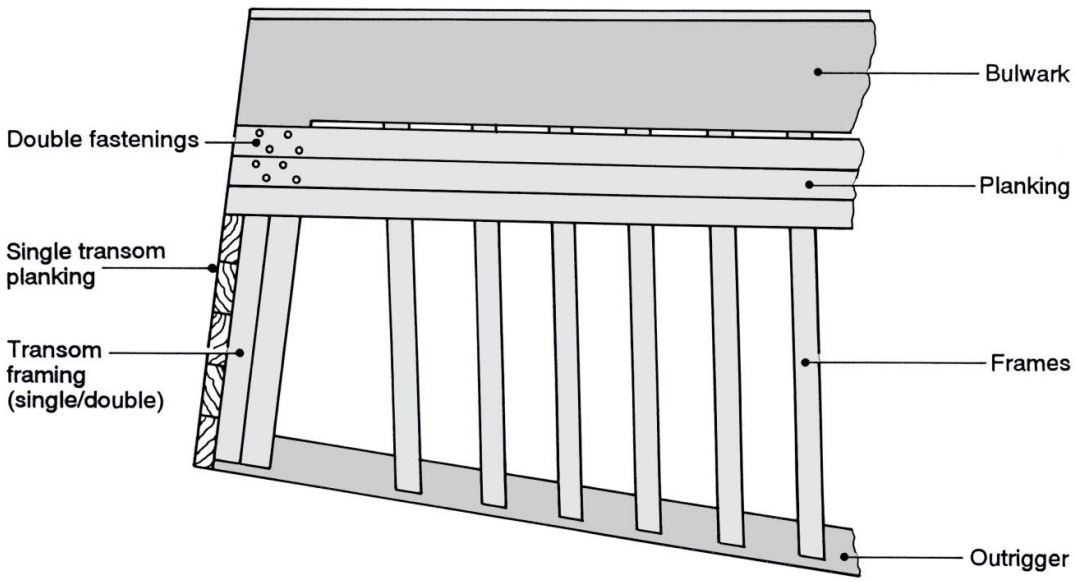
AFT SECTION SHOWING TRANSOM ARRANGEMENT WITH SHORT STERNPOST



7.36 Figures and illustrations

7.36.9 Transom construction

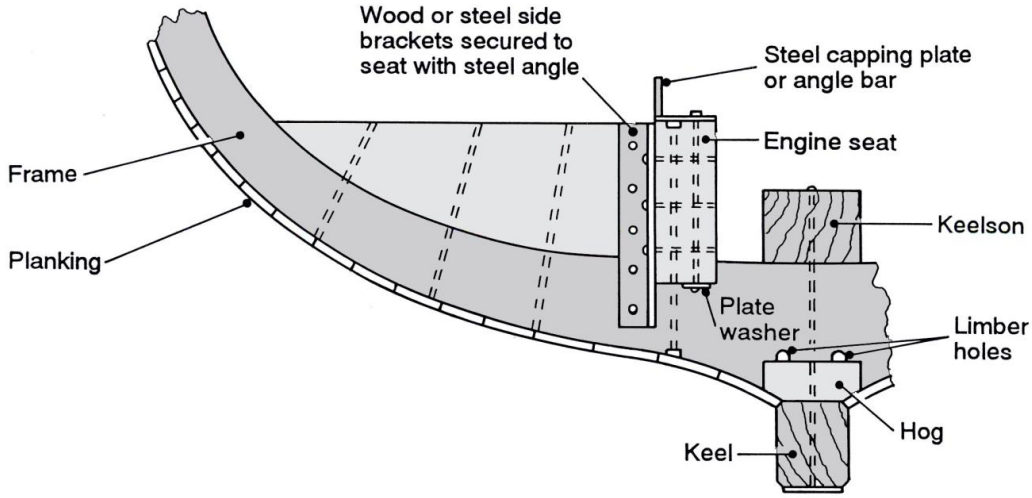




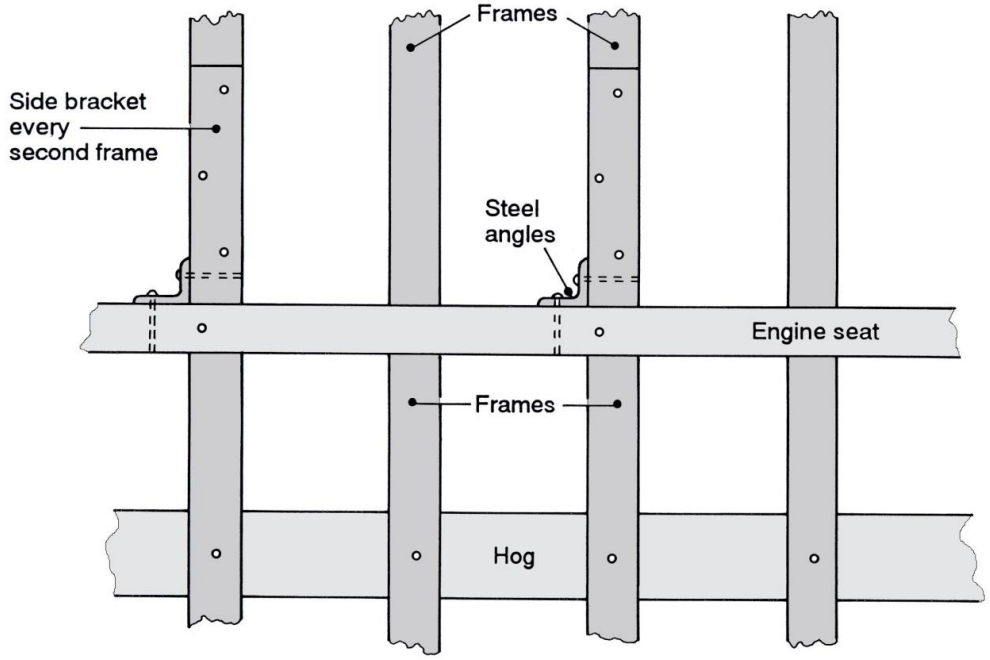
7.36 Figures and illustrations

7.36.10 Engine seat construction

END VIEW

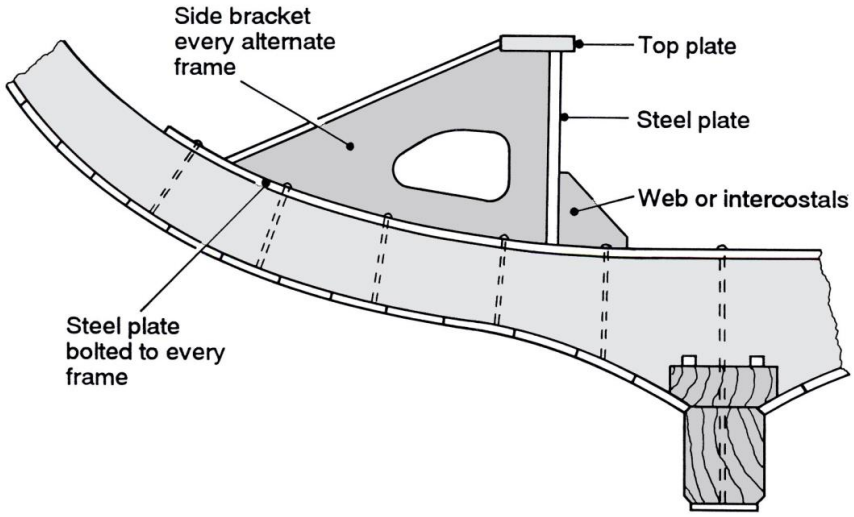


PLAN VIEW

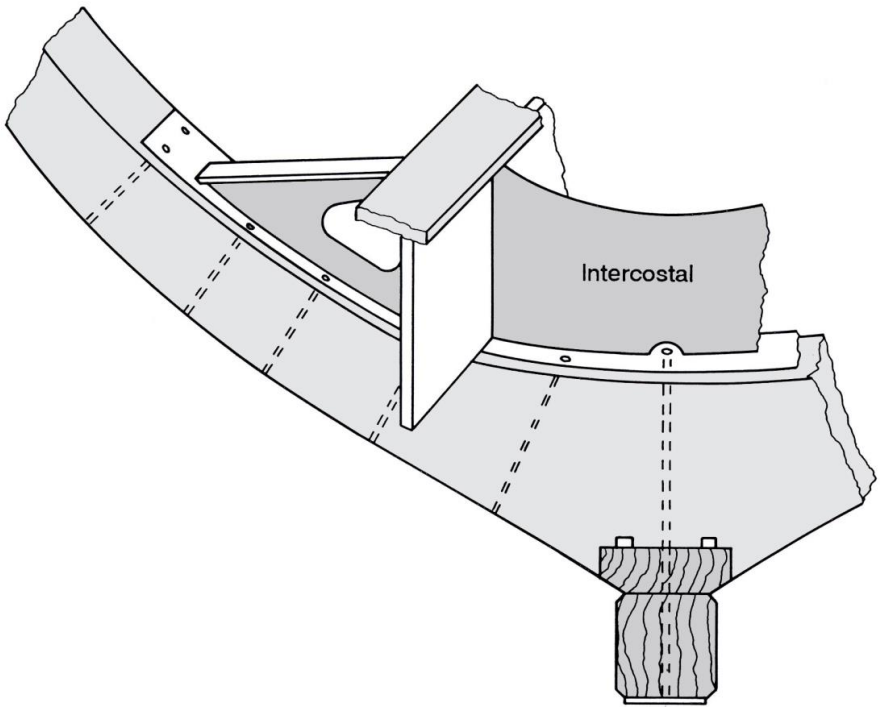


7.36 Figures and illustrations

7.36.11 Steel engine seat construction – wood vessels

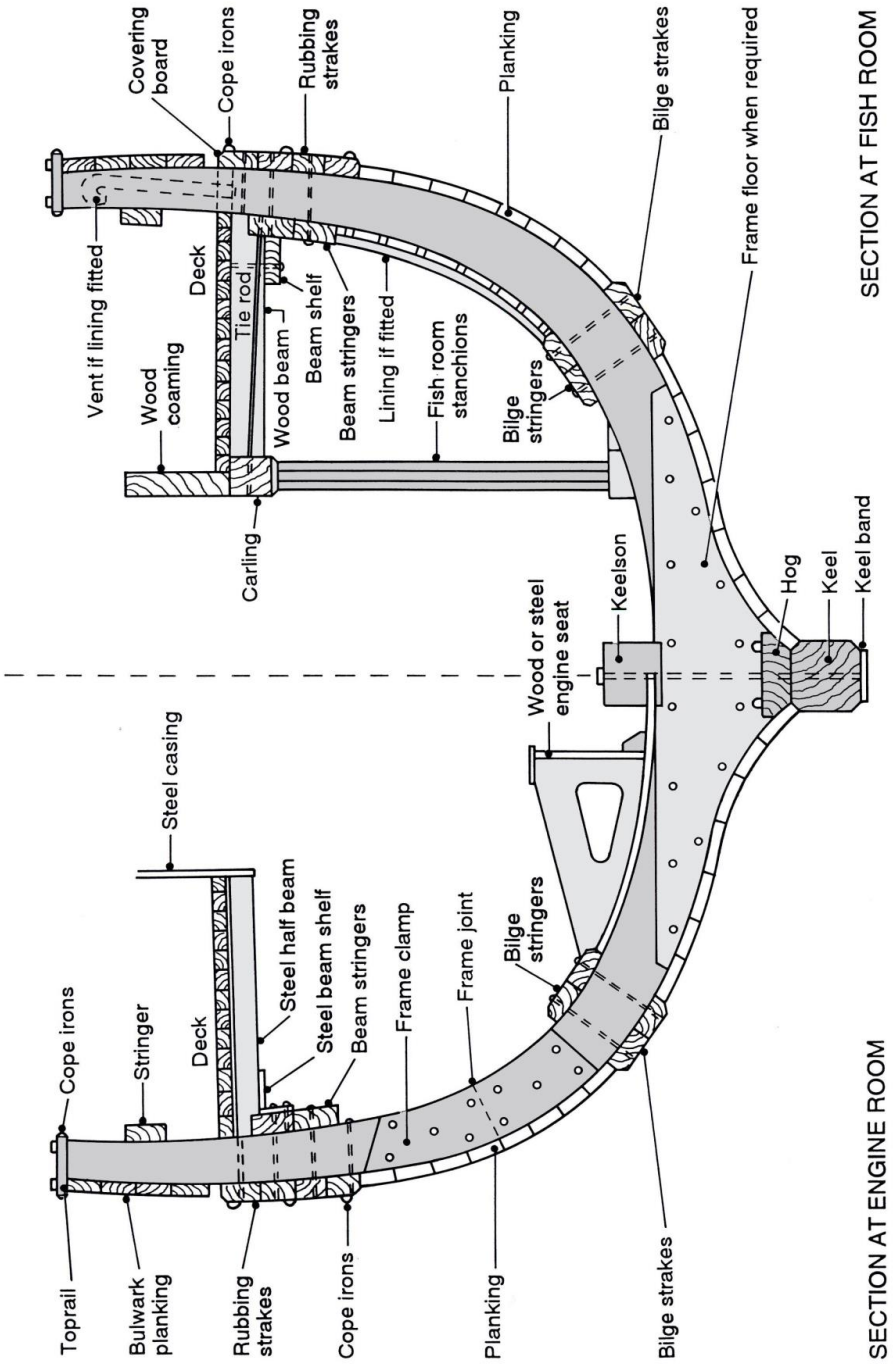


ISOMETRIC VIEW OF TOP DIAGRAM
BUT SHOWING INTERCOSTAL



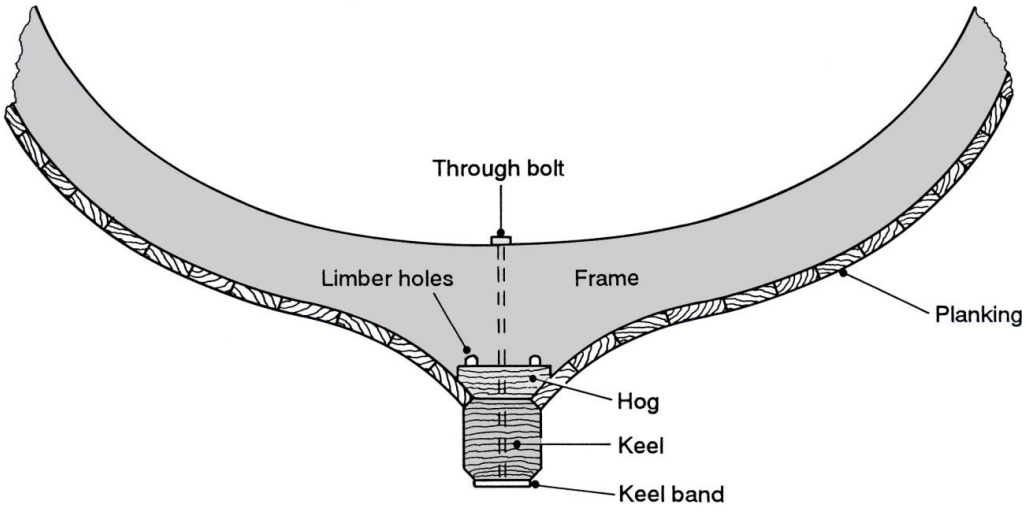
7.36 Figures and illustrations

7.36.12 Midship section – wood vessels

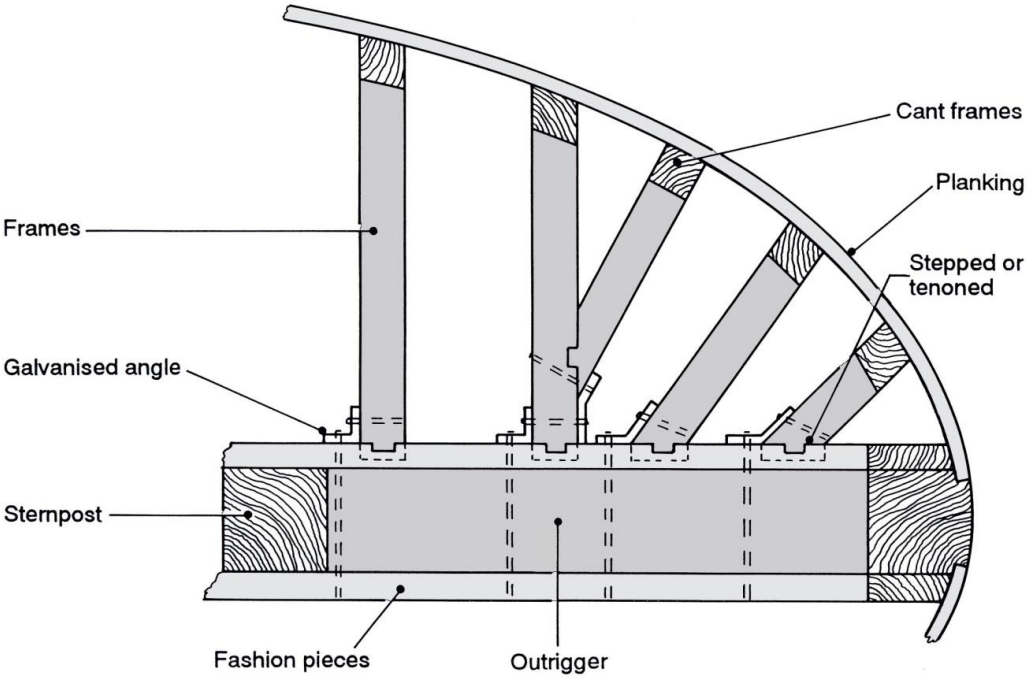


7.36 Figures and illustrations

7.36.13 Keel and hog section/cant frames

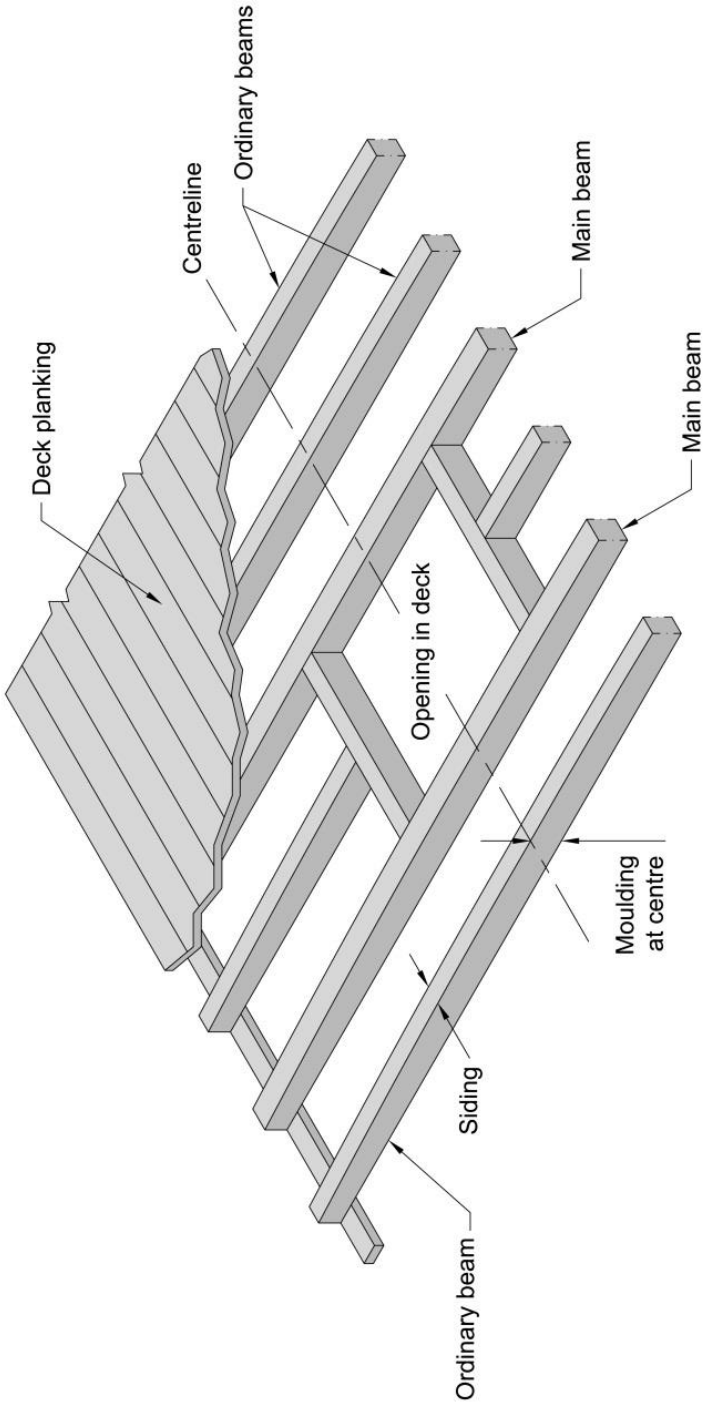


CANT FRAMES CRUISER TYPE STERN



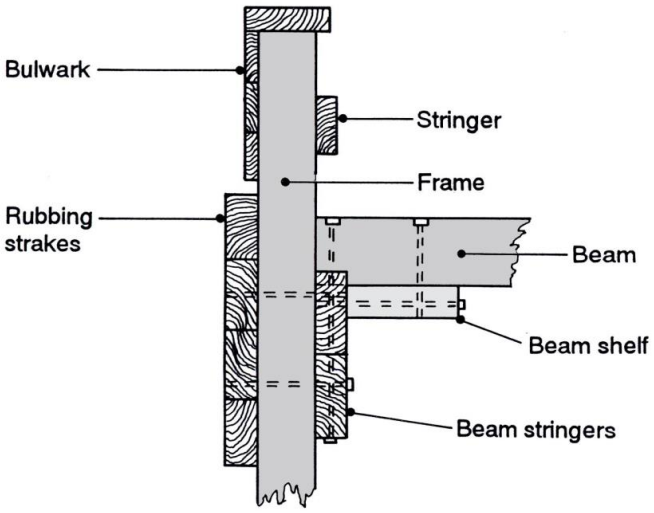
7.36 Figures and illustrations

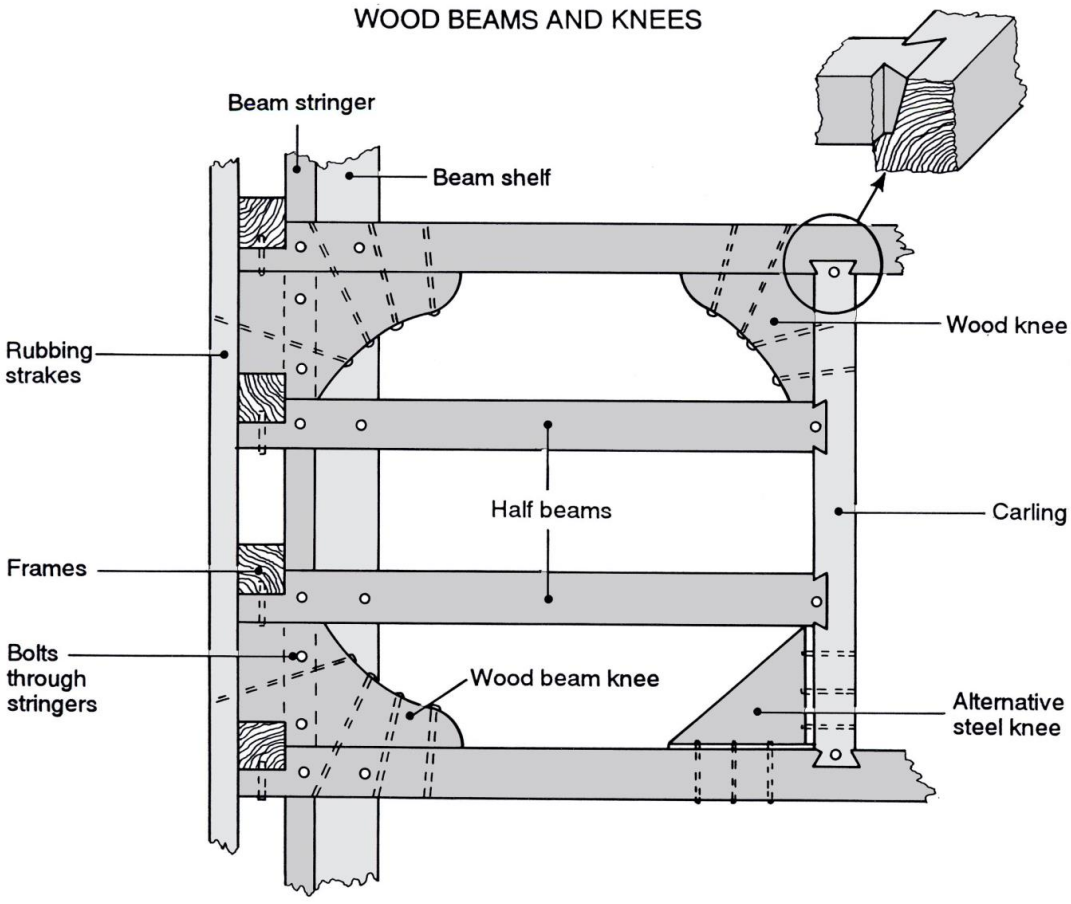
7.36.14 Deck structure



7.36 Figures and illustrations

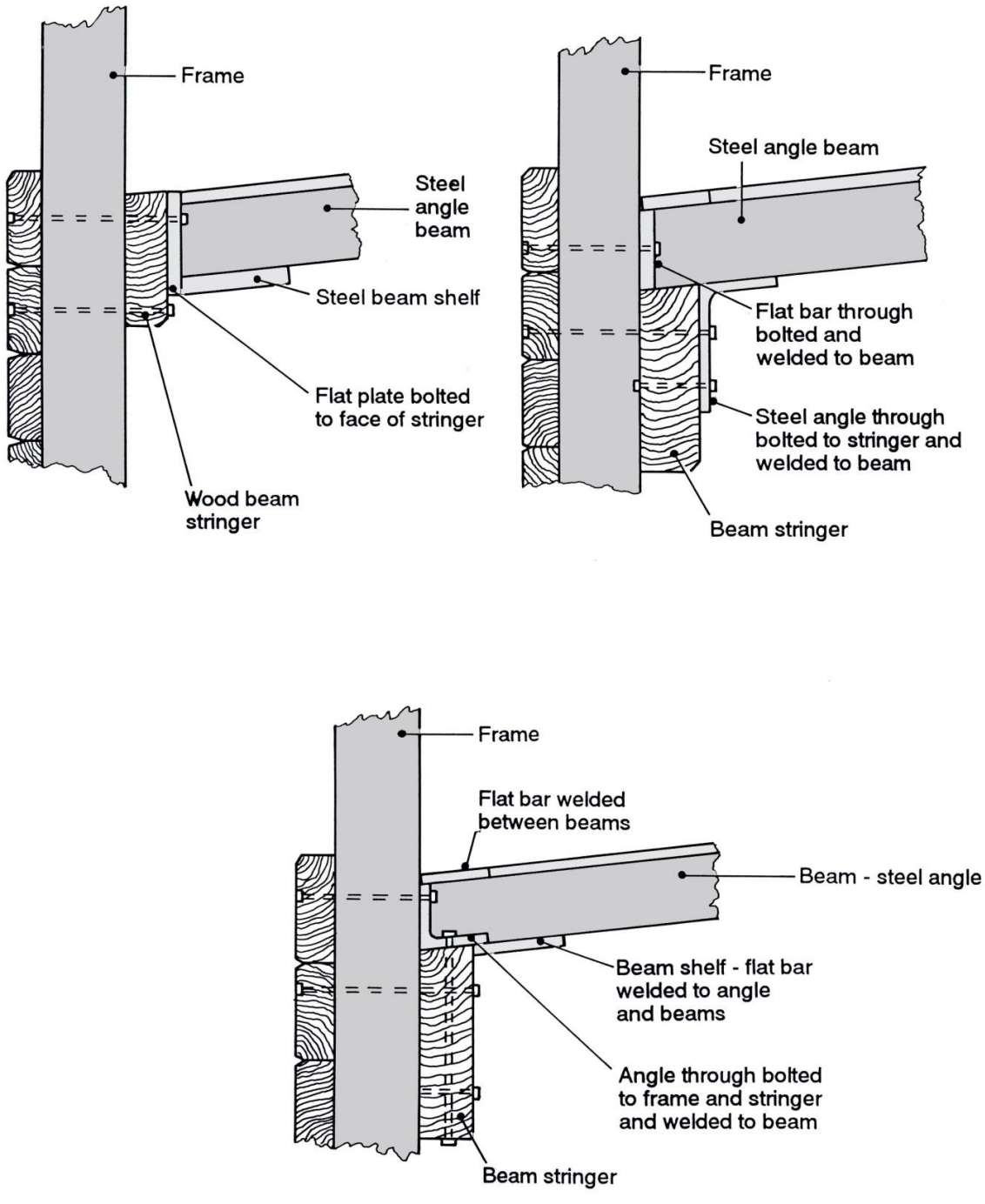
7.36.15 Wooden beams and beam shelf





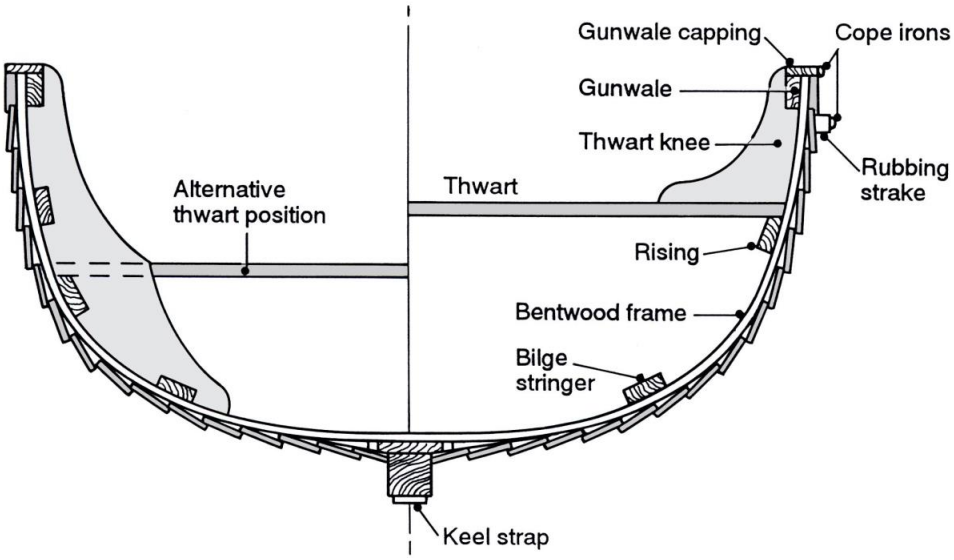
7.36 Figures and illustrations

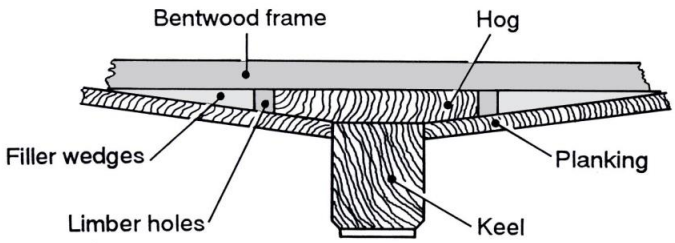
7.36.16 Steel beams construction – wood vessels



7.36 Figures and illustrations

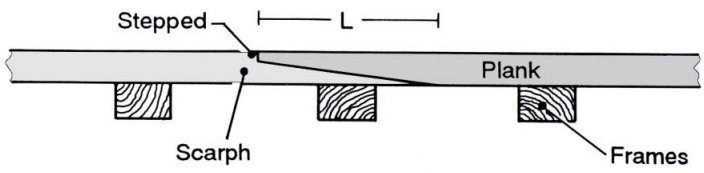
7.36.17 Clinker construction





SECTION AT KEEL

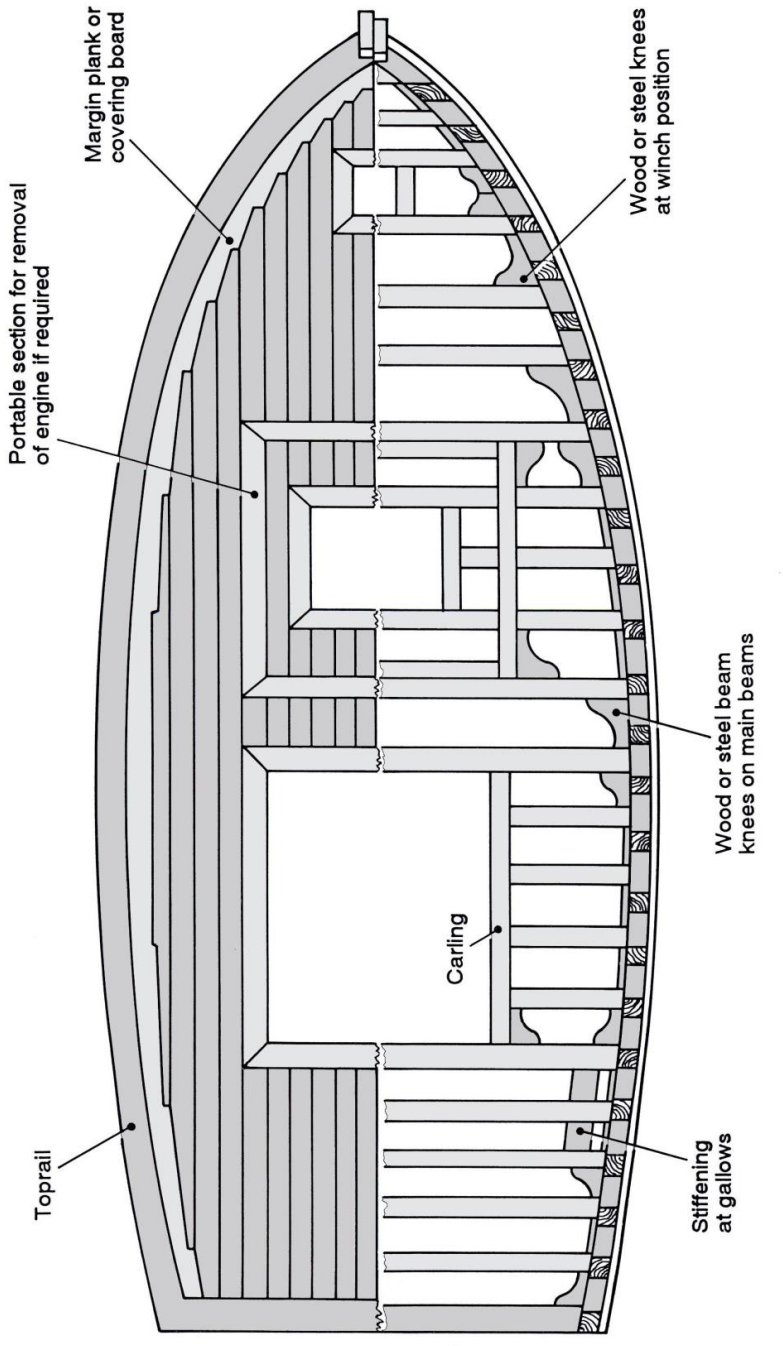
PLANK SCARPH



Length L = 6.5 plank thickness

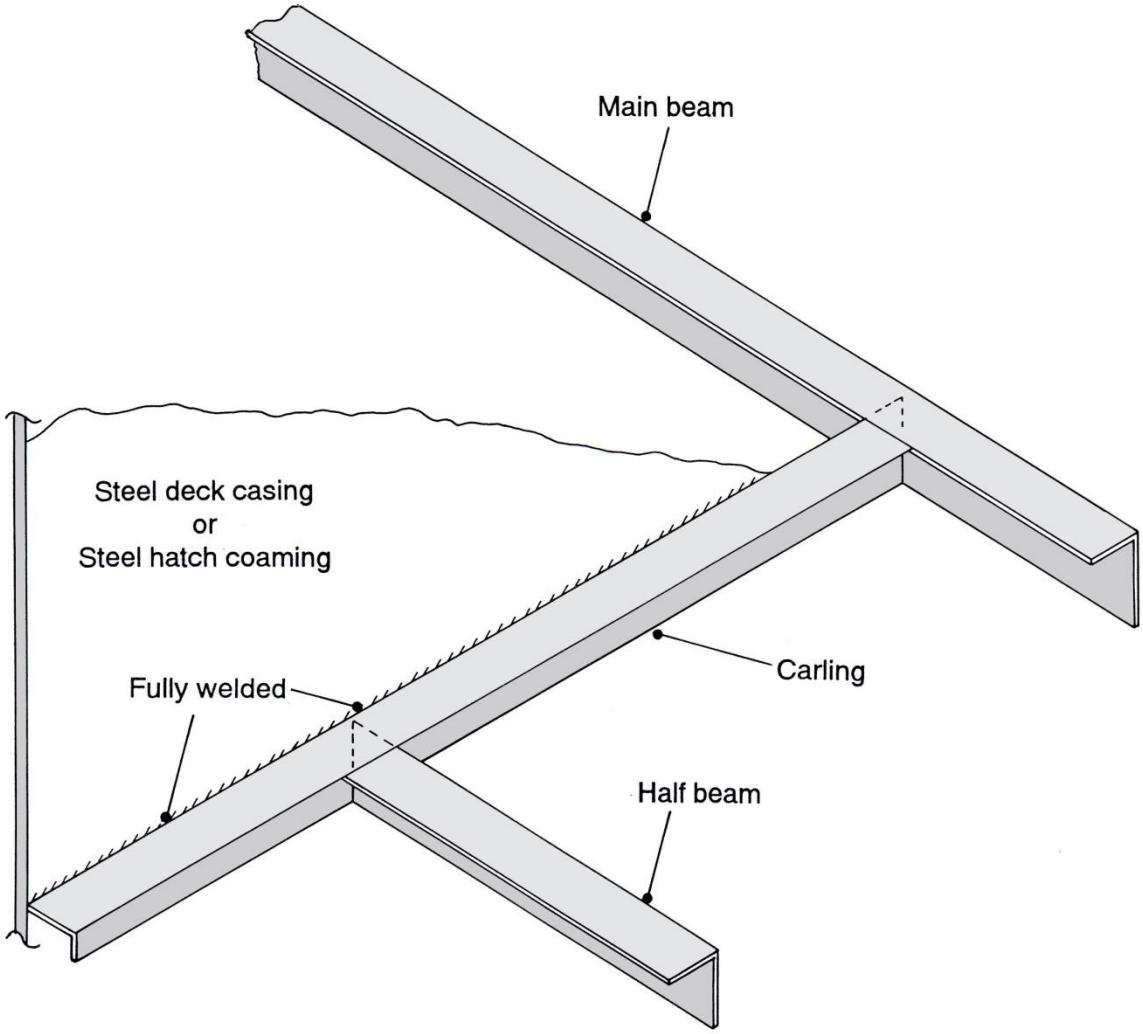
7.36 Figures and illustrations

7.36.18 Deck and beam construction



7.36 Figures and illustrations

7.36.19 Steel beam/carling connection



PART 8

MACHINERY INSTALLATIONS

PART 8

MACHINERY INSTALLATIONS

MACHINERY INSTALLATIONS

Section 8.1 - General

8.1.1 Propulsion machinery is to be of a type and power suitable for the method of fishing, and for the design and dimensions of the vessel. The machinery is to be installed in accordance with the best current marine engineering practice, these Standards, and to the engine Manufacturer's requirements. In all cases, engine power is to be to the Manufacturer's continuous rating to ISO/DIN Standards. Where engines are de-rated, ventilation inlet areas, shaft line scantlings, etc. are to be determined without the effect of de-rating being taken into consideration. Every vessel should have adequate power for astern manoeuvring and to maintain proper control in all foreseeable service conditions.

8.1.2 Propulsion and auxiliary machinery installed below deck/sole is to be suitable for use with diesel fuel, and is to be of an accepted marine type or, where based on an industrial engine, be marinised to the Manufacturer's approved Standards. Emission controls are to comply with current statutory requirements.

8.1.3 Where the engine is installed on flexible mountings, a flexible coupling is to be fitted between the engine/gearbox and the propeller shafting. The exhaust, water and oil pipes, should have a short length of approved fire-resistant flexible piping fitted for connection to the engine. Auxiliary engines are to be installed to the same standard as the propulsion machinery. Earth bonding cables are to be fitted in way of flexible couplings and hose connections on piping.

8.1.4 Where power take-offs are fitted to the main engine for auxiliary drives, the power to be taken off should not exceed the engine Manufacturer's permitted limits, and a flexible coupling is to be fitted between the engine and the forward drive, except where it is integral with the engine. Power take-off drives fitted to flexibly mounted engines should also be flexibly mounted, and on seatings integral with the engine. Where clutches are fitted to drives, they are to be of adequate capacity for the purpose intended.

8.1.5 It is recommended that all single handed operated vessels are fitted with an emergency kill system for the main engine, in case of a man overboard situation.

8.1.6 Where a lay-shaft is driven by a pulley and belt, the driven shaft is to be fitted with bearings on each side of the pulley. Drives to side layshafts are to comply with the engine Manufacturer's requirements for permissible side loads.

8.1.7 Auxiliary pumps driven by the main engine and not continuously running, are to be fitted with a clutch with local or remote control.

8.1.8 Belt drives are to be arranged with a method of adjusting the belt tension, and special attention is to be given to providing separate tensioning for each driven item. Belt and chain drives, exposed shafting, clutches, moving parts, etc., are to be fitted with suitable guards to the satisfaction of the Surveyor.

8.1.9 Metal exhausts serving the engine(s) are to be lagged with an approved material, fitted with the minimum number of bends, and are to be of a diameter as required by the engine Manufacturer. All exhaust piping joints are to be gas tight, and the pipe supported by hangers or brackets designed to allow for expansion and contraction of the exhaust pipe. The connection to the engine should be with a metal bellow piece. Care is to be taken to provide an efficient barrier to prevent damage from the hot exhaust. Exhausts are to be adequately ventilated and guards are to be fitted over hot surfaces. See Figure 8.9.1.

8.1.10 Where a water injected exhaust system is fitted and is discharging at side or transom below the weather deck, sea water from the engine cooling system is to be introduced into the exhaust pipe near to the manifold. A 'U' bend or water trap should be incorporated in the exhaust system to avoid flow back of water into the engine. An approved type of flexible heat/acid resistant rubber exhaust hose may be fitted. The requirements of Part 3, Section 3.7 are to be incorporated.

8.1.11 Vessels with a total main engine power exceeding 200kW should carry the following equipment and instruments as a minimum:-

- Engine revolution counter
- Engine lubricating oil pressure gauge
- Engine water temperature gauge
- Gearbox oil pressure gauge (where applicable)
- Ammeter or battery charge indicator (for service batteries)
- Ahead/astern control
- Engine stop
- Engine start (if electric start)
- Audible and visual alarm for high water temperature
- Audible and visual alarm for low lubricating oil pressure
- Visual alarm or battery charge indicator for starting batteries, (if separate from service batteries).

8.1.12 In vessels with main engine power below 200kW, the following minimum requirements are to apply:-

- Engine revolution counter
- Engine stop
- Lubricating oil pressure gauge and alarm
- Engine water temperature gauge and alarm
- Battery charge warning light.

8.1.13 The instruments/gauges are to be marked to indicate abnormal conditions and fitted with adjustable illumination.

8.1.14 In all installations, electric starting, charging, and alarm systems, are to comply with the requirements of Part 10 of these Standards.

8.1.15 In open boats, where the propulsion engine is housed within an enclosed box, the controls and instruments are to be mounted in a protected area, at, or visible from, the steering or control position.

8.1.16 Proposals for unorthodox machinery installations and propulsion transmissions are to be submitted for consideration.

8.1.17 In vessels 10m LOA and over with an enclosed machinery space, at least two means of escape from the engine room should be provided, separated as far apart as practicable, except that, where the size of the machinery space renders this impracticable, one escape may be fitted, subject to approval.

8.1.18 The machinery space is to be designed to give safe and free access to all parts of the engine(s) for normal servicing and maintenance. All parts are to have adequate lighting. Ladders are to be of steel and adequately secured.

8.1.19 The machinery space is to be adequately ventilated to meet engine Manufacturer's requirements for the engine maximum continuous rating. Where air supply fans are fitted, the fan controls are to be located outside the machinery space.

8.1.20 In case of fire and to prevent the excessive ingress of water, all ventilators are to be fitted with a method of closure to the acceptance of the Surveyor, operable from outside the machinery space. A permanent notice is to be fitted on the hatch lid or in a visible location in close proximity stating **"TO BE CLOSED IN THE EVENT OF FIRE"**.

8.1.21 All floor plates and floor areas are to be of non-slip material or finish. Floor plates are to be securely fastened in position.

8.1.22 Where outboard engines are fitted, it is recommended the transom is to be fitted with a securely attached plate on both sides as reinforcement for the engine fastening bolts. Outboard motor wells are to be adequately drained,

and the well should be of such size that the motor can be easily manoeuvred and tilted. Holes carrying control cables, fuel pipes, etc. through the transom are to be located as high as practicable to prevent water ingress, and protected against chafe. This may be by means of a gaiter/gland fitting, or other approved method.

8.1.23 All propulsion engines are to be fitted with a secondary means of starting.

8.1.24 Where sea water is used for the cooling of inboard mounted engines, an efficient strainer is to be fitted between the sea inlet valve and the pump. The strainer is to be accessible and capable of being cleared from inside the vessel. Vessels of 10m LOA and over should be fitted with a permanent alternative means for providing sea water cooling to the propulsion engine, which can be operable without tools in the event of failure or blockage of the main inlet.

8.1.25 Seawater strainer located within the machinery space are to be of metal construction or fire rated to a recognised Standard. Glass topped strainers are not to be used.

Section 8.2 - Auxiliary engines

8.2.1 In any vessel where an auxiliary engine is provided, it is to be installed to best marine practice and to the approval of the Surveyor.

8.2.2 A separate fuel supply with approved filters is to be provided for each engine.

8.2.3 Each such engine is to have a separate exhaust system which should be installed as for the main engine.

8.2.4 Where the auxiliary engine is flexibly mounted, exhaust, fuel, and water pipes should have a length of approved flexible fire-resistant piping fitted for connection to the engine.

8.2.5 Equipment which is belt driven from the auxiliary engine is to have suitable devices fitted to enable belt tension adjustment for each individual item of driven equipment.

8.2.6 Exposed moving parts and drives are to be fitted with guards to the approval of the Surveyor.

Section 8.3 - Stern gear

8.3.1 Propeller shaft and intermediate shafts are to be that recommended by the stern gear and engine Manufacturer.

8.3.2 Stern tube is to be carefully aligned. Stern tube and shaft bracket bearings are to be of an approved type, and are to be of the shaft and engine Suppliers' requirements.

8.3.3 The distance between the shaft bearings must not be greater than that specified in the following formula:-

$$S = 0.142 \times \sqrt[3]{d^2}$$

where '*S*' = distance between bearing centres in metres
'*d*' = diameter of shaft in millimetres.

8.3.4 Where a shaft penetrates a watertight bulkhead, the watertight integrity and strength of the bulkhead is to be maintained.

8.3.5 The propeller is to be designed to permit the engine to run at its continuous rating without overload, and with tip clearance to Manufacturer's requirements.

8.3.6 Suitable arrangements are to be provided for safe access to the stern gland and bearings. Adequate provision is to be made for renewal of stern gland packing (where applicable).

8.3.7 Header tanks for oil-filled stern tubes are to be located in an accessible position, and be complete with level indication or contents gauge.

Section 8.4 - Propeller and nozzles

8.4.1 The connection of propulsion nozzle/propeller and alignment is to be as directed by Manufacturer's guidelines, with the propeller fitted to ensure correct tip clearances prior to final welding. Substantial headbox connected to shell plate with adequate internal stiffening to ensure continuity of strength. See Section 4.7.

Section 8.5 - Rudders

8.5.1 Rudders may be of steel, stainless steel, aluminium, GRP or timber construction, and of a design strength and area compatible with the size and power of the vessel.

8.5.2 Rudders of metal may be either single or, double plate type. Blade thickness is to be as determined in accordance with Table 8.8.1. Double plate rudders are to be constructed watertight and fitted with a drain plug. Such rudders may be filled with an approved internal coating or filling. The side plating of double plate rudders are each to be a minimum of 6mm.

8.5.3 Double plate rudders of welded steel or aluminium construction in excess of 600mm deep, are to be fitted with an internal web plate welded to the stock, and welded to each side plate by means of slot or plug welds. The thickness of the web plate is to be that required for single plate rudders.

8.5.4 Steel rudder stocks are to be in accordance with Table 8.8.1 and are to be fitted with welded and keyed or spigoted coupling flanges. The stock is to be continuous from the coupling to the lower pintle.

8.5.5 Table 8.8.1 is for balanced and semi-balanced rudders supported with a lower (pintle) bearing in the skeg or stern frame extension, and with an upper bearing fitted at the hull position.

8.5.6 The upper or hull bearing is to be fitted with an accessible and adjustable watertight gland, fitted above the waterline where practicable.

8.5.7 Rudder bearings are to be fitted with a sleeve and bush of compatible materials, and bearings are to be securely locked in place. Means are to be provided for removal of bearings.

8.5.8 Where the weight of the rudder is supported at the top by a carrier, the seating for the carrier bearing is to be stiffened locally to the approval of the Surveyor.

8.5.9 Rudders of timber construction are to be attached to the stock by welded forks of a thickness equal to the thickness of steel blades, and with bolt fastenings equal to the diameter of the coupling bolts. Thickness of blade is to be in accordance with Table 8.8.1.

8.5.10 Single blade rudders of GRP construction are to have steel reinforcing bars welded to the stock.

8.5.11 Rudder coupling bolts are to be of the fitted type, and are to be provided with locking arrangements. For dimensions of coupling flanges and bolts see Table 8.8.1.

8.5.12 Where the arrangement of the rudder and stock allows an excessive vertical movement, a removable jumping collar is to be fitted above the rudder coupling flange to prevent the stock lifting out of the pintle bearing, and to avoid contact with the shell by the upper edge of the rudder or coupling.

8.5.13 Proposals for active/semi-active rudders are to be submitted for consideration.

Section 8.6 - Steering gear

8.6.1 The steering gear is to be suitable for the size and power of the vessel.

8.6.2 Where a power operated system is used, the system is to incorporate arrangements for hand operation in the event of power failure.

8.6.3 In all vessels where the steering is remotely controlled from a helm or control position, an emergency steering system is to be provided which is capable of operation at navigable speeds. The emergency steering may

consist of a drop-on tiller arm to the top of the rudder stock via a deckplate in the deck over the rudder stock, but may be operated from below deck providing efficient communication can be maintained between the emergency steering position and the helm or control position. Where it can be demonstrated that a twin propulsion system will provide an adequate secondary means of steering then this may be accepted as the emergency steering system. Twin installations are to be fitted with a bypass valve to enable the rudder blades or outboard motors to be centralised in an emergency.

8.6.4 Single line hydraulic systems (flow and return) are to be provided with an accessible bypass valve between the flow and return pipes in order that pressure can be relieved when operating emergency gear.

8.6.5 Mechanical parts of steering systems are to be installed such that they are accessible for lubrication and maintenance. All moving parts are to be protected against contact with loosely stowed items such as fishing gear, etc.

8.6.6 All remotely operated steering gears are to be provided with rudder stops at the limiting angle of the steering gear each side. Alternative arrangements are to be submitted for approval prior to installation.

8.6.7 Steering gear for vessels of greater numeral than 300 is to be hand hydraulic or power assisted.

8.6.8 Where steering is proposed by other means (e.g. steerable nozzle, multiple rudders, etc.) details are to be submitted for consideration.

8.7 Tables

8.7.1 Table 1: Rudders and steering

Scantling numeral	Stock	Blade thickness	
	Steel diameter mm	Steel mm	Wood mm
10	30	6	25
15	30	8	40
20	30	8	45
25	40	8	50
30	40	8	60
45	40	10	65
60	45	10	65
80	45	10	70
100	45	10	75
150	50	10	85
200	65	12	90
250	70	12	100
300	75	12	100
400	85	12	100
500	90	12	110

Table below is for mild steel plate and bar.

Where stainless steel is to be used the grade is to be 316L or a higher grade.

Notes:-

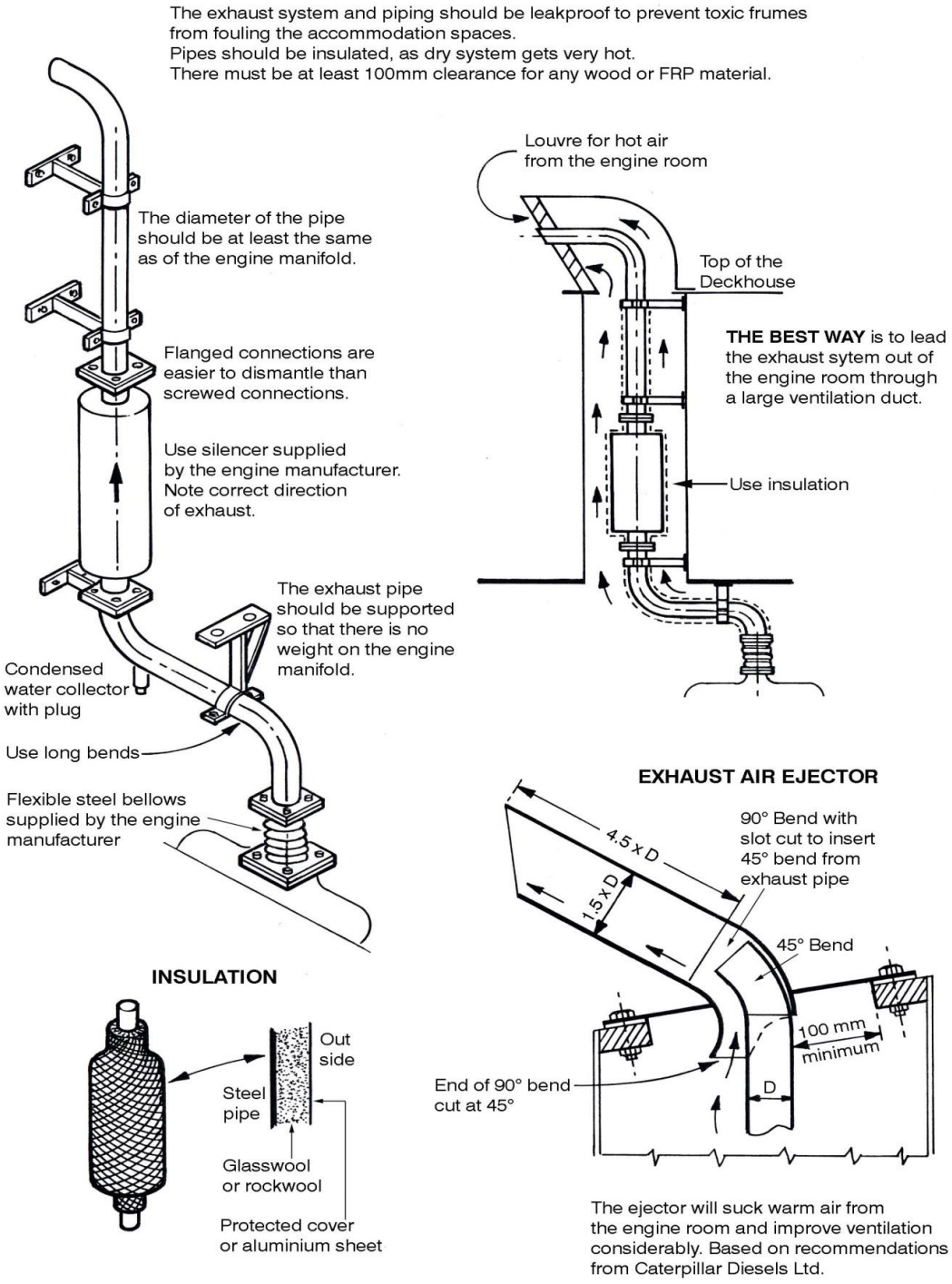
1. The diameter of rudder coupling bolts must not be less than $d = 0.65\ x\ \frac{ds}{\sqrt{n}}$

   where '*d*' = bolt dia.; '*ds*' = dia. of stock; '*n*' = no. of bolts (minimum of 4).

2. The pitch circle diameter of rudder coupling bolts is to be a minimum of 2 times diameter of stock.
3. The coupling flange thickness is to be not less than 0.25 times upper stock diameter.
4. Where higher tensile steels are proposed for rudder stocks of reduced diameter, details are to be submitted for approval.
5. Locking arrangements are to be incorporated in rudder coupling bolts.

8.8 Figures and illustrations

8.8.1 Dry exhaust system



PART 9

PUMPING AND PIPING SYSTEMS

PART 9

PUMPING AND PIPING SYSTEMS

PUMPING AND PIPING SYSTEMS

Section 9.1 - (i) Sea water piping

9.1.1 All engine cooling sea water piping and fittings are to be to the engine Manufacturer's requirements, and may be of aluminium bronze, cupro-nickel or similar recommended corrosion-resistant material. Mild steel piping, where used, is to be schedule 80 and is to be **fully galvanised after fabrication**. Valves, strainers, and other fittings are to be of compatible material to avoid electrolytic action. Bends should have as long a radius as practicable.

9.1.2 All flexible sea water inlet piping hose within the engine space is to be of a fire-resistant Standard as detailed in Paragraph 9.1.10, or alternatively marine exhaust hose approved to a recognised Standard.

9.1.3 Solid pipe connections may be flanged and bolted, welded, or brazed as appropriate, but must not be connected by soft soldered joints or non fire-resistant materials within the engine compartment. Screwed mild steel joints and malleable iron fittings are not to be used. Short flexible connections to pumps and other machinery may be fitted, see Paragraphs 9.1.2 and 9.1.10, to the Surveyor's approval. Piping joints should be arranged in order that sections may be easily removed for service/replacement.

9.1.4 All seacocks, filters, valves, and piping, are to be readily accessible, and braced and supported against vibration. Seacocks and valves are to be clearly marked, indicating the direction of turn to open or close. Valve chests are to be clearly labelled with regard to the function and position of each valve. Arrangements to prevent back-flooding are to be incorporated in all systems.

9.1.5 Piping or valves attached to the hull are to be fitted as described in Part 3, Section 3.8.

Section 9.1 - (ii) Oil fuel piping

9.1.6 Pipes used to convey fuel oil, lubricating oil, cooling oil or hydraulic oil, should be of solid drawn black seamless steel or other approved material, and is to be installed to best marine practice. Flanged joints in fuel and oil pipe systems are to have jointing gaskets which are impervious to oil.

9.1.7 Fuel return pipes are to be led back to the fuel tank, and care is to be taken that where tanks can be isolated, the fuel should be returned to the emptying tank except where a service tank is incorporated in the system.

9.1.8 Dual filters are to be fitted in the main and auxiliary engine fuel lines on all vessels over 10m, and should be so arranged that they can be changed over and cleaned without the need to stop the relevant machinery.

Section 9.1 - (iii) General

9.1.9 Flexible piping and associated fittings will be considered with regard to the intended service and the properties of the material proposed, and are to be of robust construction complying with established Standards. In enclosed engine rooms, plastic piping is not to be used for the fuel supply to the engine or fuel tanks.

9.1.10 Fire-resistant hoses should comply with one of the following British Standards (BS) or their equivalent ISO Standards:-

BS EN 853 Rubber covered wire braided reinforced hydraulic type
BS EN 856 Rubber covered spiral wire reinforced hydraulic type
ISO 7840 Fire-resistant flexible oil fuel hose.

9.1.11 All pipes should be colour coded to indicate service and direction of flow. Colour codes are shown in Table 9.5.1. Simple pipe work systems on vessels of less than 12m RL need not be colour coded providing the valves are clearly labelled.

9.1.12 All valves are to be labelled indicating service and function.

9.1.13 Keel cooling systems, where fitted, are to be of substantial construction and are to meet the requirements of engine Manufacturer.

9.1.14 The connection between keel coolers and the vessel hull is to be approved by MCA or Fishing Vessel Certifying Authority prior to installation.

Section 9.2 - Tanks

9.2.1 Fuel tanks are to be constructed of approved material suitable for the fuel type, with non-metallic tanks complying with ISO 21487 or an equivalent Standard. Tanks may be integral with the hull structure or independently mounted within the vessel. Tanks are to be fitted with baffles and all necessary valves, cocks, filling pipes, vents and filters. Tanks which are not integral with the hull structure are to be mounted on seats and secured to the main structure of the hull.

9.2.2 In vessels with an enclosed engine room, and where oil fuel tanks are sited in the engine space, the fuel tanks shall be fire-resistant to a B15 Standard.

9.2.3 Where tanks are connected by common lines such as suction, filling, or levelling pipes, etc., particular care is to be taken to avoid situations where transferring of liquids will be detrimental to the stability of the vessel.

9.2.4 Steel plate and sections used for the construction of fuel tanks are to be thoroughly de-scaled and cleaned.

9.2.5 Adequate save-alls are to be fitted to integral and non-integral tanks to the approval of the Surveyor, in order to prevent oil spillage to the bilges or on to hot surfaces. Save-alls should be fitted under all drain or draw-off cocks.

9.2.6 Fuel filler pipes are to be led up to the main deck terminating below the height of the venting pipe, and fitted with watertight covers marked "**Fuel**". Pipes should be of adequate sectional area. Alternative proposals are to be submitted for approval prior to installation.

9.2.7 Tank air pipes are to be led outside of the engine room or tank space, terminating to outside atmosphere above main deck level at a height according to Part 3, Section 3.2 of the Standards. The open end of fuel, hydraulic and lubricating oil tank vent pipes are to be fitted with a gooseneck with a removable flame screen and an automatic means of closure, or similar approved device at the Surveyor's discretion.

9.2.8 In general, tank air pipes are to be 1.25 times the cross-sectional area of the tank filling pipes. For fuel tanks less than 1000 litres capacity, the internal diameter of the air pipe may be reduced in size but should be no less than 16mm. In such cases, a notice is to be fitted next to the fuel filling pipe opening stating "**Closed fuel filling systems are not to be used**".

9.2.9 Consideration is to be given to the total combined cross-sectional area of the supply lines from the tank, which should not be more than the cross-sectional area of the air pipe.

9.2.10 Levelling pipes between tanks should have a cross-sectional area proportional to the size of the tank. Isolating valves are to be fitted at each tank so that the levelling pipes can be isolated in case of rupture or leakage, and to reduce free surface effects.

9.2.11 In non-integral tanks, where practicable, a sediment sump of suitable dimensions should be provided, complete with self-locking ball valve. Adequate provision is to be made to prevent sediment etc. being pumped from integral tanks into the fuel system. Integral tanks are to be fitted with a drain-off cock for drawing water.

9.2.12 All permanently fitted tanks are to be provided with access for cleaning. Where accesses are fitted at the tank side, save-alls are to be fitted below to collect any leakage or spillage.

9.2.13 In vessels with an enclosed engine room, and where oil fuel tanks are sited in the engine space, shut-off valves capable of being remotely closed from outside the engine room are to be fitted to all fuel tank outlets used for supply of fuel oil. All shut-off valves are to be accessible.

9.2.14 Sight glasses, contents gauges or sounding pipe arrangements are to be fitted to all fuel tanks. Sight glasses are to be adequately guarded and fitted with spring loaded isolating valves or other approved positive shut-off

device, so that in the event of a breakage, only the contents of the glass can spill.

9.2.15 Non-integral fresh water tanks should be constructed of steel or other approved material, and should be complete with all necessary baffles, inspection covers, cocks, vents, filling pipes, contents indicator, etc., and are to be securely mounted to the hull structure.

9.2.16 All tanks are to be tested in accordance with Part 1, Section 1.5 'Testing of structures' unless stamped to an approved Standard.

Permanently fitted petrol tanks above deck

9.2.17 Petrol tanks greater than 27 litres in capacity are to be permanently and securely mounted above deck whereby tooling is required for removal e.g. bolted metal straps.

9.2.18 Petrol tanks are to be non-integral to the vessel's structure and arranged so that they are separated and protected from the engine(s) and working deck by bulkheads, one of which may be the well deck perimeter structure.

9.2.19 Petrol tanks are to be raised from the deck by a minimum of 25mm.

9.2.20 Petrol tanks are to be provided with means of protection in their stowage location, which prevents damage from fishing activities.

9.2.21 Where petrol fuel tanks are fitted within stowage boxes/lockers, the following will apply:-

(i) Each box/locker is to be provided with ventilation. This may be by means of a 25mm diameter or greater opening(s) at the base. Where ventilation pipes are proposed to be fitted atop of the box/locker, these are to have a minimum inside diameter of 35mm and extend to the lower one third of the compartment, and consist of a supply pipe and exhaust pipe located at opposite sides of the box/locker;

(ii) Tank supports are not to inhibit the free flow of air around the base e.g. side to side transverse or longitudinal bearers. Support tables may be considered for plastic petrol tanks providing they are perforated;

(iii) The base of every box/locker will require a drain cock to allow drainage should water enter, or spillages occur.

9.2.22 Refuelling arrangements are to ensure that any accidental spillages do not enter the vessel below deck/sole level.

9.2.23 In vessels with open bilges (unsealed sole), petrol tanks are to be stowed in sealed boxes which are vented in accordance with Paragraph 9.2.21

above. The vent exhaust is to expel any vapour overboard, to prevent any vapour build up in the bottom of the vessel.

9.2.24 Petrol tanks are to be constructed, tested and marked in accordance with ISO 21487. Other fabricated tanks may be acceptable providing they are tested and certificated in accordance with Part 1, Section 1.5.

9.2.25 The inside diameter of the fuel fill is to be no less than 38mm. Where fuel fills are extended, the hose is to be double clamped at the tank spigot and at the fuel fill cap fitting.

9.2.26 Fuel fill caps are to be provided with a positive means of watertight closure and labelled "**PETROL**".

9.2.27 The inside diameter of a petrol tank air pipe is to be no less than 11mm. It is to be noted that the inside diameter of each petrol tank air pipe is to be greater than any fuel supply, or combined area of supplies from that tank.

9.2.28 The open ends of petrol tank air pipes are to be provided with both a gooseneck and flame arresting breather head. An alternative arrangement may be considered upon full details being submitted to MCA or Fishing Vessel Certifying Authority.

9.2.29 Petrol fuel tank filler height is to be lower than the height of the air pipe. Where the air pipe is adjacent to the filler and visible during filling then the filler may terminate at an equal level of the air pipe.

9.2.30 All flexible hoses are to be fire-resistant and meet ISO 7840 A1 or A2, or an equivalent.

9.2.31 Petrol tanks are to be independent from each other i.e. no balancing pipes.

9.2.32 Fuel supply to be provided with fuel/water separating filters. All relevant components within the system should be approved and fitted in accordance with ISO 10088 or an equivalent Standard and securely fixed to the vessel's structure.

9.2.33 A means is to be provided to determine the fuel contents of the tanks. Tanks fitted with fuel gauge sender units are to be fully compliant with the current ISO 8846 Standard or an equivalent. The means of dipping the tank for gauging contents is not permitted.

9.2.34 A fuel shut-off valve is to be provided and positioned on the tank with a clear visible label fitted in close proximity stating "**FUEL SHUT-OFF**" along with location of valve if not openly visible. Where the fuel shut-off cannot be positioned directly at the tank then details of an alternative arrangement are to be submitted for consideration prior to fitting/installation.

9.2.35 All gaskets and associated fittings are to be suitable for the use with petrol. Metallic fittings are to be protected against galvanic corrosion from other connecting differing metals.

9.2.36 Metallic tanks and any directly adjoining metallic components are to be grounded independently; all connections are to have a resistance of less than 1Ω. The only electrical supply to the tank shall be the sender for the fuel gauge and is to be no greater than 24 volts. No other electrical supply shall go to the tank or stowage box/locker (where applicable), and no other electrical devices on board the vessel are to share any petrol tank grounding connection.

Portable Petrol tanks fitted above deck

9.2.37 Where a portable fuel tank is provided, it is to be no greater in capacity than 27 litres. The tank is to be fitted on the open deck and arranged such that it can be easily and securely fitted in place, and can be quickly jettisoned in an emergency (quick release hose fittings).

9.2.38 Portable petrol tanks are acceptable providing they are in compliance with ISO 13591 with associated markings, and/or CE marked.

Petrol tanks general

9.2.39 Petrol engines and petrol tanks are not permitted below decks, or within recessed weathertight deck lockers.

9.2.40 Petrol tanks are not to be sited within a 500mm radius of any internal combustion engine or other source of ignition.

9.2.41 Petrol tanks are not to share spaces containing batteries or other electrical equipment.

9.2.42 Small petrol tank arrangements fitted to hydraulic power packs by engine Manufacturers will be accepted providing the capacity does not exceed 5 litres.

Risk Control

9.2.43 Suitable safety signage is also required to be affixed to the vessel in the relevant areas detailing the carriage of petrol and safety rules to be complied with.

9.2.44 There shall be an emergency plan permanently affixed to the vessel. All crew are to familiarise themselves with this plan in the possible event of failure of any risk control measures set out above. This plan should be used as the basis for the provision of suitable emergency and fire equipment.

Section 9.3 - Bilge pumping systems

9.3.1 An approved means of draining any compartment (other than integral bait and vivier tanks), is to be provided in accordance with the following:-

(i) Where a vessel is divided into watertight compartments, the bilge suctions and means of drainage are to be so arranged that any water entering any main watertight compartments can be pumped out through at least one bilge suction situated in that compartment;

(ii) Where peak compartments are incorporated in a vessel's design and are not for ballasting purposes, an accessible drain cock may be fitted in the bulkhead or vertical floor, providing that any drainage from the drain cock will flow naturally to an adjacent bilge suction.

9.3.2 Bilge pumps are to be fitted in accordance with the following requirements:-

Vessel size (LOA)	**Total no. of pumps**	**Number and type of pump**		**Minimum capacity of power pumps L/Min.**	**Minimum capacity of hand pumps L/Min**
		Hand	**Power**		
Below 7m	1	1	-	-	65
7m – Below 10m	2	1	1	65	65
10m – Below 15m	2	1	1	125	65

9.3.3 The Table above primarily relates to bilge pumping systems where the pumps are capable of drawing from any compartment. Where individual pumps are installed, such as submersible pumps, the requirements shall apply to each compartment.

9.3.4 The hand operated pump may be omitted in favour of a second power pump providing the two pumps draw power from independent power sources, in such cases the second power pump should have the minimum capacity equal to the hand pump requirement.

Systems incorporating a bilge main

9.3.5 Where two pumps are required, the system should be so arranged that either pump can draw from any compartment via a suitable changeover system. The changeover system is to be clearly and permanently labelled with direction and operation.

9.3.6 The power pump may be either the washdeck or general service pump, providing that the sea water suction is isolated from the bilge system by means of a positive accessible changeover valve, or interlocking valve arrangement to ensure only one system may be used at any time, and to prevent sea water draining to the bilge system. The positive changeover valve or cock is to be arranged to avoid the possibility of leak-back or seepage from the sea water system into the bilge pumping system.

9.3.7 To prevent any leakage from compartment to compartment, bilge pumping systems are to have non-return valves fitted in all suction lines.

9.3.8 The diameter of the bilge main and branch sections are to be accordance with the system designed capacities.

Individual power pumps

9.3.9 Where an individual power pump is installed to provide bilge suction for a single compartment, then an additional means of pumping out the compartment is to be provided in the form of a hand operated pump of a capacity not less than the minimum hand pump capacity stated in the Table for the relevant size of vessel.

9.3.10 Discharge pipes should be of an inside diameter to suit the pump, in accordance with the Manufacturer's instructions, to maintain the stipulated pumping capacity.

9.3.11 The total capacity of power pumps providing suction in any one compartment shall not be less that the minimum power pump capacity stated in the Table for the relevant size of vessel.

9.3.12 Where used, submersible pumps must be fixed in place and have suitable strainers fitted that do not restrict the capacity of the pump.

Additional requirements

9.3.13 Shut-off valves and non-return valves are to be fitted on all discharges below the weathertight or freeboard deck, placed directly on the vessel's sides in an accessible position, and sited above the maximum load waterline, see Part 3, Section 3.8 for full details.

9.3.14 All bilge suctions should be fitted with readily accessible strainers. The total area of the perforation in the strainer should be not less than twice the cross-sectional area of the bilge pipe (for submersible pumps, see Paragraph 9.3.12).

9.3.15 Complex bilge systems and valves are to be clearly labelled with regard to compartment served and position of valve. Simple bilge systems are to be labelled at the discretion of the attending Surveyor.

9.3.16 Small compartments may be drained by individual portable hand pump. Such compartments should be no greater in volume than one cubic metre and should not contain any sea inlets or any machinery crucial to the operation of the vessel. The minimum capacity of the hand pump shall be no less than 70 L/min for spaces with a volume of one cubic metre and 35 L/min for spaces with a volume of half a cubic metre or less.

9.3.17 Where a watertight compartment that contributes to buoyancy is to be completely sealed and is void of any piping, then a means of bilge drainage

may be omitted providing the volume of the compartment is no greater than volume Vm in m^3 (determined using the formula below) or filled with an approved closed-cell foam. In any such cases, details should be submitted for approval.

$Vm = L \times B \times D \times 0.14$

Where L = length of hull (m)
B = breadth of hull (m)
D = moulded depth of hull (m)

For catamarans L, B & D are for each hull.

9.3.18 Piping used in bilge systems is to be of an approved metal or non-collapsible tubing, and in machinery spaces piping/tubing is to be of fire-resistant material.

9.3.19 Metals for piping and valves or fittings are to be compatible in order to avoid electrolytic action and wasting. Mild steel piping is to be galvanised after fabrication. Malleable iron fittings are not to be used in bilge systems.

9.3.20 In decked vessels, hand operated bilge pumps, where fitted, are to be capable of operation from above the deck with the hatches and doors closed.

9.3.21 In all vessels, a bilge alarm system is to be fitted in the wheelhouse with audible and visible indication at helm/control position. Bilge level sensors are to be fitted in the machinery space and fishroom/hold. Sensors should also be fitted in any compartment which has a bilge suction if the level of bilge water cannot be readily checked visually without entering the compartment.

9.3.22 Where bilge spaces are to be filled with cement or solid ballast, drain holes are to be fitted to ensure adequate drainage when the cement or ballast is not fitted flush with the top of the vertical floor plates, permitting drainage to the bilge suction well or space under all normal conditions of trim.

9.3.23 Provision is to be made for drainage or approved overboard discharges from both port and starboard sides of any weathertight deck shelter.

9.3.24 All bilge pipework is to be colour coded for immediate identification. Simple bilge pipework systems on vessels of less than 12m RL need not be colour coded providing the valves are clearly labelled.

Section 9.4 - Hydraulic installations

9.4.1 Hydraulic equipment should be installed in accordance with the best marine and hydraulic engineering practices, these Standards, and to the Manufacturer's requirements. Installers should take all necessary precautions to avoid contamination, and all systems are to be flushed and cleansed prior to commissioning.

9.4.2 All equipment is to be designed to produce the specified performance when operating at or below the maximum design pressure and flow rate.

9.4.3 Hydraulic pumps are to be capable of safe operation with the prime mover running at its maximum design speed. All motors, pumps and valves should be capable of accepting the oil flow under the stipulated conditions and within the Manufacturer's recommendations.

9.4.4 All hydraulic piping, except for pump suction pipes, is to be of cold drawn mild steel or reinforced rubber hose to BS EN 853 1997 or BS EN 856 1997 (or equivalent), or other approved material, and is to conform with current statutory requirements. The following guidance is provided:-

(i) All tubing or flexible hose end terminations must be compatible with the tube or flexible hose;
(ii) All the components that form part of the termination must be from a single Manufacturer and compatible;
(iii) All tube or flexible hose assemblies must have a safe working pressure greater than the maximum designed working pressure and have at least a 4:1 burst safety factor;
(iv) Oil velocities within all tube or flexible hose should not exceed 4.6 m/sec in pressure and return lines, and not greater than 1.2 m/sec in pump suction lines;
(v) All tube and hose assemblies should be suitable and adequately clamped, protected and supported.

9.4.5 All pump suction piping, return, and relief valve drain piping, is to be capable of accepting the full flow under maximum operating conditions, and within industry Standards and the equipment Manufacturer's recommendations.

9.4.6 All pump and motor case drain piping is to be capable of accepting flows of twice the Manufacturer's stated leakage flow rate, and the bore size of the piping should be no less than the bore size in the pump or motor pipe connection.

9.4.7 If no leakage flow rate is available, a value of 15% of the input flow rate should be assumed. Drain piping is to be rated to withstand pressures of not less than 10 Bar.

9.4.8 The drain pipes must be connected directly to the oil tank and not connected into any other return flow pipes and the normal working pressure within these lines should not exceed the Manufacturer's recommendations.

9.4.9 All hydraulic piping should be connected by means of approved high pressure couplings and adaptors rated to withstand operating pressures of not less than 120% of the normal maximum working pressure, and should be pressure tested to 1.5 times the maximum designed working pressure prior to commissioning. Re-usable hose fittings of the screw threaded inner type are not to be used.

9.4.10 Oil reservoirs should, unless formed as an integral unit with the pump, be sited to provide an effective static head of oil in accordance with the requirements of the pump Manufacturer. Oil supply piping from the reservoirs to the pump is to be arranged to provide a continuous fall to the pump suction. Small radius bends or elbows fittings are not to be fitted unless supplied as the pump Manufacturer's standard fitting.

9.4.11 Long length suction pipes and lines should be avoided; if they cannot be avoided the suction pipe internal bore should be increased to counteract any increased oil flow resistance.

9.4.12 Reservoir tanks may be free-standing or built-in, and are to be fitted with an oil level indicator which is easily visible. Where tanks are built-in, to avoid condensation contamination of the oil, it is recommended that the shell plating of the vessel should not form a tank boundary.

The general tank design should take into consideration the following points:-

(i) Oil capacity based on the application, circuit, and the systems maximum flows;
(ii) Inspection plates and internal cleaning, after it's been fabricated;
(iii) Safe isolation of the pump suction feed line;
(iv) Oil circulation and the natural cooling effect of the oil within the tank;
(v) Possible baffle plates;
(vi) Oil filling points;
(vii) Oil tank breather;
(viii) Visual oil level gauge with an integral temperature thermometer;
(vix) All return lines to be terminated below the oil level.

9.4.13 Where the reservoir capacity is greater than 75 litres, the filling system is to incorporate a manual or powered pump delivering to the reservoir through a filter of not more than 25 Micron.

9.4.14 Circulation filtration is to be provided in accordance with the following requirements:-

(i) High pressure, not more than 10 Microns;
(ii) Low pressure, not more than 25 Microns;

(iii) The pump suction strainer or filter should be capable of accepting at least twice the maximum rated pump flow;
(iv) A magnetic drain plug should be fitted in the reservoir, or some such similar device shall be incorporated in the system.

9.4.15 Filters should be sited so as to permit easy access for cleaning and replacement of their elements. Dirty filter indicators should be clearly visible. All filters should include bypass safety check valves within the filter assembly.

9.4.16 All piping is to be installed clear of all sources of extreme heat. Where practical, the use of flexible pipes is to be avoided in the engine rooms, but when fitted, should not be run over engines or adjacent to heat sources, or exceed a maximum length of 1.50m. Installations of flexible pipe systems in small vessels will be specially considered on submission of details.

9.4.17 Where piping is routed through fish rooms areas above the fish storage levels, the use of pipe couplings is to be avoided and arrangements should be incorporated to protect the catch from accidental oil leakage.

9.4.18 An oil temperature gauge is to be provided on the return side of the system, or other suitable provisions made for monitoring the oil temperature within the oil reservoir.

9.4.19 A range of pressure test points should be installed in all hydraulic systems to check and monitor maximum working pressures in the high pressure and the low pressure lines of the system. If pressure gauges are permanently fixed they should include safe isolation valves.

9.4.20 The type and viscosity of the hydraulic oil should be clearly displayed at the oil reservoir or other convenient prominent location.

9.4.21 Where oil coolers are sea water cooled, the sea water inlet, discharge valves and piping are to be as required for engine cooling systems.

9.4.22 All hydraulic systems should be protected by an individual and independent system safety relief valve.

9.4.23 An emergency stop facility is to be fitted at the helm position for all hydraulically operated deck equipment, and in addition a local emergency stop device is to be fitted at the winch or hauler. See Part 11, Paragraph 11.14.4 and 11.14.5.

9.5 Tables

9.5.1 Table 1: Colour codes for piping

Pipe contents	Ground colour		Colour band	
	Colour	**BS colour no.**	**Colour**	**BS colour no.**
Water				
Cooling (primary)	Sea green	217	-	-
Drinking	Aircraft blue	108	-	-
Treated	Aircraft grey/blue	283	-	-
Central heating below 60°C	French blue	166	-	-
Central heating 60°C to 100°C	French blue	166	Post Office red	538
Central heating above 100°C	Crimson	540	French blue	166
Cold water domestic service	Brilliant green	221	-	-
Domestic hot water supply	Eau-de-Nil	216	-	-
Sea, river, untreated	Grass green	218	-	-
Air				
Compressed up to 14g/cm^2	White	-	-	-
Compressed over 14g/cm^2	White	-	Post Office red	538
Vacuum	White	-	Black	-
Drainage/bilge	Black	-	-	-
Electrical service	Light orange	557	-	-
Oils				
Diesel fuel	Light brown	410	-	-
Lubricating	Salmon pink	447	-	-
Hydraulic power	Salmon pink	447	Sea green	217
Transformer	Salmon pink	447	Light orange	557
Fire installations	Signal red	537	-	-

Notes:-

1. The above Table is for guidance only. For any colour coding systems which are used, a clear and visible legend is to be placed within the machinery space(s).

PART 10

ELECTRICAL INSTALLATIONS

PART 10

ELECTRICAL INSTALLATIONS

SECTION SUBJECT

ELECTRICAL INSTALLATIONS

Section 10.1 - General

10.1.1 Electrical equipment is to be designed to operate in a marine environment and the likely conditions pertaining to such an installation such as vibration, shock, temperature extremes, sea and salt spray. Equipment designed for use onshore may be used provided it meets the criteria for the on board environment.

10.1.2 For all installations a certificate of compliance with the requirements of these Standards or alternative approved marine Standard utilised for the electrical installation on the vessel, is to be provided on completion by the Builder or electrical Installer. For electrical systems of less than 50 volts the certificate may be signed by the Builder. For all systems greater than 50 volts the certificate must be signed by an Electrician registered with a recognised UK regulatory body covering marine or industrial installations.

10.1.3 Electrical equipment must operate correctly under the following voltage and frequency fluctuations:-

(i) Rated system AC and DC voltage, permanent, -10% and +6%. Transient +20%, -15%, recovery 1.5 seconds;

(ii) Rated system frequency, permanent +/-5%, transient +/-10%, recovery 5 seconds.

10.1.4 Generators' voltage regulators and governors must ensure the above are not exceeded.

10.1.5 All electrical equipment is to be designed and installed to the latest requirements to minimise interference caused by electromagnetic emissions.

10.1.6 Consideration should be given to access for maintenance/repair when positioning equipment.

10.1.7 Vessels fitted with both AC and DC systems are to have these voltages supplied from separate panel boards. Equipment such as sockets are to be clearly marked with the voltage; and plugs of different voltage are not to be interchangeable.

10.1.8 Wiring diagrams are to be included in all switchboards and distribution boards with each circuit, component and conductor identified.

10.1.9 Electrical equipment installed in compartments containing explosive gases are to be ignition protected in accordance with ISO 8846.

Section 10.2 - Cables

10.2.1 Cables rated in accordance with Tables 1-4 shown in this section, are to be used on all installations except where specifically exempted in these Standards.

10.2.2 Screens, where used, are to be of braided tinned copper wires or of metal/polyester; in the latter, a tinned copper drain wire is to be included. The screens are to be insulated overall.

10.2.3 Conductors are to be capable of carrying the maximum rated current, taking into consideration the ambient temperature and bunching factors.

10.2.4 Conductor cross-sectional areas are to be sufficient to ensure that voltage drops do not exceed 6% of nominal when carrying maximum rated current in any circuit.

10.2.5 In all cases conductors are to be tinned stranded copper.

10.2.6 All cables are to be of the correct voltage grade for their application.

10.2.7 Cable types, as detailed in Tables 1-4, should be used excepting that:-

(i) Cables installed on deck in positions liable to damage, are to run in heavy duty galvanised conduit or pipe;

(ii) Cables for radio, electronic aids, alarms, communications and equipment requiring special cables, are to be to the relevant Manufacturer's requirements;

(iii) PVC cables are not to be installed in refrigeration spaces;

(iv) Compliance with IEC publication 331, Fire characteristics of electric cables (or equivalent), will be required in circuits supplying systems which maintain services during a fire (e.g. CO_2 release systems);

(v) In systems not exceeding 50 volts, PVC insulated, PVC sheathed cable manufactured to BS 6004 (or equivalent), and PVC cables for vehicles manufactured to BS 6862 (Part 1 flame-retardant) (or equivalent) are acceptable.

10.2.8 AC wiring should be carried out, as far as is reasonably practical, in twin or multi-core cables. Where it is necessary to use single-core cables in AC circuits, special precautions may be necessary.

10.2.9 The voltage rating of any cable is to be not less than the nominal voltage of the circuit for which it is used.

10.2.10 The rated operating temperatures of the cables should be at least 10°C higher than the maximum ambient temperatures likely to exist, or to be produced in the space where the cable is installed.

10.2.11 Every conductor must be capable of carrying the maximum current which will normally flow through it, without exceeding the appropriate current rating. The conductor size is to be calculated to take account of rating and diversity factors.

10.2.12 Cables and wiring should, so far as is practical, be routed clear of heat sources and high fire risk areas, except for supply to equipment in those spaces.

10.2.13 In situations where there could be a risk of mechanical damage, cables should be enclosed in suitable metal conduits or casings, unless the cable covering (for example, armour or sheath) provides adequate protection. Where metal conduit is used it should be installed in such a way as to permit the drainage of water. The casings of metal conduits, trunking, etc., should be earthed and electrically continuous along its length.

10.2.14 The cable supports and accessories should be robust and constructed from corrosion-resistant material or suitably treated to resist corrosion. Low melting point metals or alloys, e.g. aluminium, should not be used.

10.2.15 With the exception of cables for portable appliances, cables are to be fixed by means of clips, saddles or straps and arranged so that the cables remain tight without their coverings being damaged.

10.2.16 The distances between supports should be chosen according to the type of cable and the probability of vibration, and recommended not to exceed 400mm. For a horizontal cable run, fixings should be provided to restrain the cable movement.

10.2.17 Cable clips or straps made from a material such as polyamide, PVC, etc. may be used, however, additional metal straps are to be used on vertical runs, and where cables are run on the underside of horizontal cable ways, such straps are to be installed a maximum of 500mm apart. All cable clips in engine spaces are to be of metal.

10.2.18 Cables are not to be bonded into a GRP structure, and are not to be fastened direct to oil or water pipes, fuel tanks, etc.

10.2.19 Cables passing through watertight bulkheads, exposed decks or into watertight equipment, are to be fitted with watertight glands. Glanding or penetrations is to maintain the fire and watertight integrity of the bulkhead or equipment. Cables may pass through bushed holes in non-watertight bulkheads. Where cables are exposed to sharp edges, such edges are to be bushed.

10.2.20 Cables entering electrical equipment are to be glanded. The use of flame-retarding plastic type glands is permissible provided the requirements of Paragraph 10.2.19 are maintained.

10.2.21 Cables supplying winches, cranes, windlasses and capstans are to be suitably rated for their duty. Unless their duty is such as to require a longer time rating, cables for winch or crane motors may be half hour rated on the basis of 50% of the motors kW rating. Cables for windlasses and capstan motors should not be less than one hour rated based on one hour kW rating of the motor. In all cases the voltage drop rating is to be within specified limits.

Recommended cables - Types and ratings
Cables: Continuous ratings

Table 1 - Butyl rubber insulated cable

Nominal cross-section area mm^2	Current rating On average 45°C ambient		
	Single core amps	Twin core amps	3 - 4 core amps
1	15	13	11
1.5	19	16	13
2.5	26	22	18
4	35	30	25
6	45	38	32
10	63	54	44
16	84	71	59
25	110	94	77
35	140	120	98
50	165	140	115
70	215	185	150
95	260	220	180

For Notes see Table 4

Recommended cables - Types and ratings
Cables: Continuous ratings

Table 2 - Ethylene propylene rubber insulated cable (EPR)

Nominal cross-section area mm^2	Current rating On average 45°C ambient		
	Single core amps	Twin core amps	3 - 4 core amps
1	16	14	11
1.5	20	17	14
2.5	28	24	20
4	38	32	27
6	48	41	34
10	67	57	47
16	90	77	63
25	120	102	84
35	145	123	102
50	180	153	126
70	225	191	158
95	275	234	193

For Notes see Table 4

Recommended cables - Types and ratings
Cables: Continuous ratings

Table 3 - Silicon rubber insulated cable

Nominal cross-section area mm^2	Current rating On average 95°C ambient		
	Single core amps	Twin core amps	3 - 4 core amps
1	17	17	14
1.5	21	20	17
2.5	30	27	22
4	40	36	29
6	51	47	39
10	71	64	53
16	95	85	70
25	125	115	95
35	155	140	116
50	190	175	140
70	240	217	179
95	290	264	217

For Notes see Table 4

Recommended cables - Types and ratings
Cables: Continuous ratings

Table 4 - PVC/A insulated cable

Nominal cross-section area mm²	Current rating On average 45°C ambient		
	Single core amps	Twin core amps	3 - 4 core amps
1	8	7	6
1.5	12	10	8
2.5	17	14	12
4	22	19	15
6	29	25	20
10	40	34	28
16	54	46	38
25	71	60	50
35	87	74	61
50	105	89	74
70	135	115	95
95	165	140	116

Notes:-

1. These tables assume a maximum bunching factor of 6 cables: In excess of this requires a correction factor of 0.85.

2. For non-continuous ratings the following multiplying factors may be applied:-

With metallic sheath			Without metallic sheath
Half hour ratings	factor =1.0 factor =1.1 factor =1.15 factor =1.2	1-20mm² 20-35mm² 50mm² 70-95mm²	1-70mm² 95mm²
One hour ratings	factor =1.0 factor =1.2	10-50mm² 70-95mm²	1-95mm²

Note for information:-

Detailed cable ratings and factors are contained in IEE Regulations for Ships.

Section 10.3 - DC systems

10.3.1 The following forms of DC generation and distribution are acceptable:-

(i) 2 wire insulated;
(ii) 12 volts, 24 volts, 110 volts, 220 volts.

10.3.2 Proposals to use other voltages are to be submitted for consideration.

10.3.3 Electrical systems are to be wired as insulated return systems; i.e. using two insulated conductors. The hull is not to be used as a current carrying conductor.

10.3.4 For voltages between poles of 110 volts DC and above, switchboards are to be of the dead front or metal clad type, in accordance with Paragraph 10.12.1.

10.3.5 Switchboards for systems of 110 volts or greater are to be fitted with a voltmeter and an ammeter on each main supply. For parallel operation of generators a voltmeter is to be fitted for each generator. Battery charging systems are to be fitted with a charge/discharge meter. Main sub-distribution boards in the wheelhouse are to be fitted with a voltmeter.

10.3.6 Insulating materials used in the construction of switchboards or mains distribution points are to be mechanically strong, flame-retarding, and moisture-resistant. The surface finish should be anti-tracking.

10.3.7 Double pole switches should be used, except in a final sub-circuit where the use of single pole switches is acceptable.

10.3.8 At least one pair of spare fuses is to be fitted to all distribution boxes to allow for additional circuits. They should be equal in size to the largest sizes fitted in the distribution box.

10.3.9 Fuse boards in working and service areas, the wheelhouse and in alleyways are to be constructed of corrosion-protected sheet metal, and should be enclosed in accordance with Paragraph 10.12.1. In engine spaces they are to be of fire-resistant material.

10.3.10 Fuses are to be of the high rupture capacity type. Miniature or moulded case circuit breakers may be used as circuit protection.

10.3.11 Terminations are to be of screwed or bolted types, spring-loaded types are not permissible on main supply cables.

10.3.12 Where combined switch fuses are used, they are to be of the “on load” type complying with BS 3185 (or equivalent).

10.3.13 Attention is to be given to the layout of wiring, switchboard, batteries and control boards in order to avoid excessive cable runs.

10.3.14 Cables are to be sized to avoid overheating and all connections shall be vibration proof.

Section 10.4 - Batteries

10.4.1 The total required battery capacity is to be calculated and adequate charging facilities provided.

10.4.2 The batteries are to be capable of being isolated when not in use, preferably by means of a double pole switch however, a single pole switch may be used on the positive conductor. Where it is proposed that a changeover battery switch is to be fitted then these are to be provided with an OFF position. All switches are to be located in an accessible position.

10.4.3 Batteries should be firmly secured to avoid movement due to vessel's motion and must be provided with stowage trays or boxes. The trays or boxes should be protected against corrosion caused by acid or alkaline. Batteries are to be capable of inclination of up to 45° without spillage of electrolyte.

10.4.4 Alkaline batteries and lead acid batteries of the vented type are not to be installed in the same battery box or container.

10.4.5 Batteries in an enclosed space are to be contained in a battery box ventilated by an independent ventilating system.

10.4.6 Where batteries are located in a dedicated compartment solely for battery stowage the battery box may be omitted in favour of a tray providing that the compartment has adequate ventilation.

10.4.7 Natural ventilation may be employed if a duct can be run directly from the top of the box to the open air. If natural ventilation is impracticable, mechanical ventilation is to be provided. Interior surfaces of ducts and fans are to be painted with corrosion-resistant paint. Fan motors for battery ventilation are to be spark-proof and are not to be located in the air stream.

10.4.8 Switches, fuses, and other electrical equipment liable to cause an arc are not to be installed in or near battery boxes.

10.4.9 Where batteries are used for starting the main engine, the capacity is to be capable of meeting 1.25 times the starting and consumer needs, or to provide at least six engine starts. All propulsion engines are to be provided with an additional starting battery, which may be the battery supplied for the domestic/navigation systems.

10.4.10 There should be arrangements for charging the batteries continuously when underway, a facility should be provided to enable a charging system to be connected to either, or both.

10.4.11 Batteries must be accessible for topping up and the electrolyte level maintained.

10.4.12 All circuits, except as follows, are to be provided with short-circuit and overload protection. Exceptions are:-

(i) The cables from a battery to the starter motor which are to be as short as possible and double insulated;

(ii) The cables to steering gear motors which are to have short-circuit protection equal to twice the rated motor current.

Section 10.5 - AC systems

10.5.1 The following forms of generation and distribution are acceptable:-

(i) 3 phase 3 wire insulated;
(ii) 3 phase 4 wire with neutral earthed at power source (generator; transformer; converter);
(iii) Single phase 2 wire;
(iv) 400 volts rms. 50 Hz;
(v) 115 volts rms. 50 Hz;
(vi) 230 volts rms. 50 Hz.

10.5.2 The number and rating of generators or converters are to be sufficient to ensure that when one power source is out of action, the operation of essential services and the starting of the largest motor can be achieved by the remaining power source(s) without causing failure in any part of the system.

10.5.3 Power sources are to be capable of continuous full rated output duty at maximum specified cooling air and water temperatures for an unlimited period.

10.5.4 Non self-regulating alternators are to be provided with automatic voltage regulation.

10.5.5 Alternators may be run in parallel provided synchronising and power sharing devices are fitted; reverse power protection is to be fitted in such a system.

10.5.6 The primary windings of transformers are to be protected against short-circuits by circuit breakers or fuses. Such protective devices are to be capable of withstanding current surges.

10.5.7 Transformers arranged to operate in parallel are to be provided with secondary isolation.

10.5.8 Switchboards and distribution boards are to be of the dead front type and shall not permit access to live parts. Enclosures are to be in accordance with Paragraph 10.12.1.

10.5.9 Each alternator section of a switchboard is to have a voltmeter, a frequency meter, and an ammeter with a switch to enable the current to be read in each phase. Above 50kW, a wattmeter is to be fitted. Sub-distribution boards fitted in the wheelhouse are to have a voltmeter and mains isolator switch.

10.5.10 Free-standing switchboards are to be fitted with an insulated hand rail on the front, and an insulated mat fitted on the floor to run the length of the switchboard.

10.5.11 The requirements of Section 10.3, Paragraphs 10.3.6 and 10.3.8 to 10.3.14 apply to AC systems.

Section 10.6 - Earthing and bonding

10.6.1 All electrical installations and equipment are to be bonded to earth.

10.6.2 The basic requirement of earth bonding is to provide a low impedance path from the unit to the earth.

10.6.3 Earth bonding points are to be accessible.

10.6.4 Earth bonding leads are to be as short as possible and are to be identified by green with yellow stripe insulation or un-insulated. Conductors with green or green/yellow insulation are not to be used as current carrying conductors.

10.6.5 It is recommended on vessels over 10m a system of earth indicator lamps is to be fitted. Such lamps are to be of the metal filament type not exceeding 30 watts, of clear glass, and sited not more than 150mm apart. The lamps should not be powered except for “testing” or in the event of an earth fault. To prevent corrosion damage, earth faults should be immediately located and cleared.

10.6.6 An earthing point used for radio, radar and other navigational equipment, should not be used for other electrical equipment and should be as short as possible.

10.6.7 Exposed non-conducting metal parts of equipment are to be bonded to earth through the use of a suitable copper conductor, and in a steel vessel this may be a part of the structure in contact with the main hull. In wood and composite vessels, an unpainted copper earth plate is to be fitted

which is to be outside the hull below the waterline, immersed under all sea conditions and shall have an area of at least 0.25m^2.

10.6.8 An earth bar is to be fitted in a suitable position and connected to the plate by a copper conductor of at least 64mm^2. Equipment should be connected to the earth bar by means of suitable copper conductors. Lightning protection is to be connected directly to the earth plate by means of a separate welded joint connector.

10.6.9 Equipment need not be earthed where it is of the double insulated type, or at a voltage not exceeding 55 volts DC or 55 volts rms between conductors (auto transformer supplied voltages are excluded), or from a safety transformer rated not more than 230 volts and supplying one consumer device only.

10.6.10 Where a flexible non-conducting coupling is fitted between engine gearbox and propeller shafting, it is to be bridged by a braided copper strip across the coupling.

Section 10.7 - Motor control

10.7.1 Every electric motor is to be provided with efficient means of starting and stopping, so placed as to be easily operated by the person controlling the motor. Every motor above 0.5kW is to be provided with control apparatus.

10.7.2 Means to prevent undesired restarting after a stoppage due to low volts or complete loss of volts are to be provided. This does not apply to motors where a dangerous condition might result from the failure to restart automatically, e.g. steering gear motor.

10.7.3 Efficient means of isolation are to be provided so that all voltage may be cut off from the motor, and any associated apparatus including any automatic circuit breaker.

10.7.4 Where the primary means of isolation (that provided at the switchboard, section board or distribution board) is remote from a motor, one of the following is to be provided:-

(i) An additional means of isolation fitted adjacent to the motor;

(ii) Provision made for locking the primary means of isolation in the OFF position;

(iii) Provision made so that the fuses in each line can be readily removed and retained by authorised personnel.

10.7.5 Means for automatic disconnection of the supply in the event of excess current due to mechanical overloading of the motor are to be provided.

10.7.6 When motor control gear is being selected, the maximum current of a motor is to be taken as the full load rated current of the motor.

Section 10.8 - Lighting

10.8.1 A final sub-circuit of rating exceeding 16A is not to supply more than one point. The number of lighting points supplied by a final sub-circuit of rating 16A or less is not to exceed the following

- 24 volt circuits 10
- 110 volt circuits 14
- 230 volt circuits 18

except that in final sub-circuits where lampholders are closely grouped, or are of LED type, the number of points supplied is unrestricted provided the maximum operating current in the sub-circuit does not exceed 10A.

10.8.2 Lighting circuits are to be supplied by final sub-circuits separate from those for heating and power.

10.8.3 Lighting for machinery spaces, control stations and work spaces should be supplied from at least two final sub-circuits in such a way that failure of any one of the circuits does not leave the space in darkness.

10.8.4 Lighting of unattended spaces such as fishrooms and net stores, is to be controlled by a switch situated outside the space.

Section 10.9 - Remote stops

10.9.1 Means of stopping all electric ventilation fans are to be provided outside the spaces being served at positions which will not readily be cut off in the event of a fire. The provisions for machinery spaces are to be independent of those for other spaces.

10.9.2 Electric fans, independently driven pumps delivering oil to main propulsion machinery for lubrication, oil fuel transfer pumps, oil fuel unit pumps and other similar fuel pumps are to be fitted with remote controls situated outside the space concerned, so that they may be stopped in the event of fire arising in the space in which they are located.

Section 10.10 - Emergency electrical systems

10.10.1 Batteries shall be positioned so as not to short-circuit if their compartment is flooded up to the load waterline, and be capable of operating the following services simultaneously for a period of at least one hour:-

(i) The vessel’s lights which are sited at stairways and exits, engine room, wheelhouse, sleeping accommodation, mess room, boarding ladder position, and at the liferaft storage position;

(ii) Emergency communications, navigation lights and signal equipment if they are operated from the vessel’s main source of power;

(iii) The daylight signalling lamp if it is operated by the vessel's main source of electric power;

(iv) Other equipment as required by the Code of Safe Practice.

Section 10.11 - Testing

10.11.1 A certificate of compliance of conformity with the requirements of the foregoing Standards or alternative Standards utilised for the electrical installation on the vessel, is to be provided on completion.

10.11.2 It is to be demonstrated that the Standards have been complied with in respect of the following:-

(i) Satisfactory commutation and performance of each generator throughout a run at full rated load;

(ii) Temperatures of joints, connections, circuit breakers and fuses;

(iii) The operation of generator engine governors, synchronising devices, overspeed trips, reverse current, reverse power, over current trips and any other safety devices fitted;

(iv) Voltage regulation of every generator when full rated load is suddenly thrown off;

(v) For alternating current and direct current generators, satisfactory parallel operation and kW load sharing of all generators capable of being operated in parallel at all loads up to normal working load. For alternating current generators, satisfactory parallel operation and electrical load sharing of all generators capable of being operated in parallel at all loads up to normal working load.

10.11.3 All essential motors and other important equipment are to be operated under service conditions, though not necessarily at full load, or simultaneously, for a sufficient length of time to demonstrate satisfactory performance.

10.11.4 Insulation readings should be taken on all new installations, with a meter, rated and operated so as to not cause damage. On voltages 50 volts and below, such readings should be not less than 0.3 megohms, and not less than 1 megohm on voltages above 50 volts.

Section 10.12 - Enclosures

10.12.1 Switchboards, panel boards and electrical equipment are to be enclosed as follows:-

(i)	Exposed to short term immersion or to heavy seas	IP66;
(ii)	Exposed to jets of water	IP65;
(iii)	Exposed to splashing water	IP54;
(iv)	Located within the vessel in a protected area	IP54.

10.12.2 Sockets and plug inlets subject to conditions as shown in Paragraph 10.12.1(i), (ii) and (iii) are to be protected when in use to the same IP rating.

Section 10.13 - Shore supply

10.13.1 Vessels arranged to have a supply from a shore or other external supply, are to be fitted with a suitable connection box having an inlet socket or terminals suitably rated for the supply.

10.13.2 The connection box is to be fitted in a position as close as possible to the source of supply to minimise the length of flexible supply cable. The flexible cable should not be run into the main switchboard, unless the board is the nearest point, in which case, it is to be connected via a suitable isolating device and be incapable of being paralleled with the vessel's own supply.

10.13.3 A permanent cable is to be run from the connection box to the main switchboard and connected via a suitable isolating device.

10.13.4 On three phase AC systems, a meter or lamps is to be fitted at the shore inlet termination point to indicate the correct phase sequence and, on a DC system, the correct polarity.

10.13.5 An earth terminal is to be fitted to connect the vessel's hull (or in the case of non-metallic hull, the main earth plate) to permit interconnection to the incoming supply earth.

10.13.6 An indicator is to be fitted at the main switchboard to show when the shore supply is live.

10.13.7 Shore connection boxes are to be fitted with a label detailing the supply requirement of the vessel and the method of connection.

10.13.8 Shore supply connections are to be capable of powering all emergency systems including but not limited to: smoke alarms, fire alarms, bilge alarms, emergency lighting, source of radio communication and fire suppression systems where fitted. The vessel is also to be fitted with a power dropout alarm in case of shore power disruption.

Section 10.14 - Reference standards

10.14.1 The following is a list of reference Standards applicable. Where the reference Standard requirements supersedes any of the foregoing requirements, the reference Standard requirement is to be used:-

(i) *The Institution of Electrical Engineers Regulations for the Electrical and Electronic Equipment of Ships with Recommended Practice for their Implementation, (latest edition);*

(ii) *BS 6883 (1999), Specification for elastomer insulated cables for fixed wiring in vessels. (Suitable for lighting, power, control, instrumentation and propulsion circuits);*

(iii) *IEC 600 92-350, Low voltage shipboard power cables. (General construction and test requirements for shipboard cables with copper conductors intended for low voltage power systems at voltages up to and including 0.6/1kV);*

(iv) *ISO 10133, Small Craft – Electrical systems – Extra low voltage DC installations;*

(v) *ISO 13297, Small Craft – Electrical systems – Alternating current installations;*

(vi) *BS EN 28846, Small Craft – Electrical devices – Protection against ignition of surrounding flammable gases.*

PART 11

OUTFIT AND FIRE PROTECTION

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Section 11.1 - Paintwork

Painting general

11.1.1 All paints, varnishes, anti-fouling and bitumen based compositions are to be of an approved marine commercial standard and quality, and of adequate film thickness in accordance with the paint Manufacturer's specification, and be fully compatible with previously coated surfaces.

11.1.2 Anti-fouling paints, where used, are to comply with current statutory and environmental regulations.

11.1.3 All working deck surfaces are to be provided with non-slip coating/coverings.

11.1.4 All tanks, pipework and fittings except where they are of non-ferrous material or galvanised, are to be painted externally with at least three coats of anti-corrosive paint.

11.1.5 All engine room pipework systems should be colour coded in accordance with Part 9, Table 9.5.1, or identified by a painted or taped band on each side of every joint.

11.1.6 When painting aluminium structures, care should be taken that the paint Manufacturer's procedures are strictly adhered to. All surfaces should be thoroughly degreased, etc. primed and coated with an appropriate primer prior to applying undercoats and finishing coats. The paints used for aluminium structures should not contain lead, mercury, copper, or other metals which would lead to degradation of the aluminium surfaces.

Painting steel vessels

11.1.7 Whenever possible, all steel plate and sections should be shot-blasted and primed prior to delivery to the Builder's yard. Alternatively, the steel may be shot-blasted and metal sprayed or coated with an epoxy resin based, or other high duty steel primer at the Builder's yard, prior to or during construction.

11.1.8 During construction, all weld damaged paint areas, cut edges or other breaks in previously primed surfaces are to be thoroughly cleansed and re-coated with a compatible primer. Paint should not be applied to continuously welded connections subject to air pressure or water testing until inspection and testing is completed.

11.1.9 On completion of construction, the hull is to be thoroughly cleaned and painted in accordance with the selected paint specification. Steelwork behind linings and in way of bilge areas may be painted with an approved

bitumen based composition, subject to compliance with these Standards and statutory requirements concerning flamespread characteristics.

11.1.10 Steelwork that is neither galvanised or shot-blasted is to be thoroughly cleaned of all rust and scale, and painted in accordance with paint Manufacturer's specification.

Painting GRP vessels

11.1.11 In all GRP vessels, paints used internally in the engine room and accommodation spaces are to be of low flame spread characteristics.

11.1.12 Where the painting of a GRP hull may be considered necessary, painting should not be carried out until the moulding has completely cured. Prior to the application of paint, the gelcoat surface should be treated with approved solvent to remove any residue of release agent or wax, and then washed. The GRP surface should then be lightly abraded prior to being coated with etching primer and final paint system to Manufacturer's specification.

Painting wood vessels

11.1.13 Before the application of paint, all timber fitted in positions liable to rot, which has not been previously pressure impregnated with preservative, is to receive not less than three coats of preservative. All straight lengths of timber such as decking, bulkhead timbers, floors and ceilings, etc., should, where practical, be pressure treated with preservative before fitting.

11.1.14 On completion of construction, the external and internal surfaces of the hull are to be painted in accordance with the paint Manufacturer's specification.

Section 11.2 - Fire protection

11.2.1 All decked vessels between 10m and 15m LOA are to have an approved fixed fire extinguisher system fitted in the machinery space.

11.2.2 Where the machinery space boundaries are constructed of steel or aluminium, the interior surface finish of the engine room and surfaces directly on the opposite side which are used as accommodation or control spaces, are to be coated with a Class 1 surface spread of flame rating paint.

11.2.3 The engine space boundaries of decked GRP vessels and decked wood vessels are to be capable of meeting a B15 Standard of fire protection. This level of protection is to apply to the deckhead and bulkheads in their entirety, and hull boundaries from 300mm below the waterline to the deckhead. Alternatively, where the total installed power does not exceed 400kW, a fixed fire extinguisher system will be accepted in lieu of B15 fire protection.

11.2.4 For aluminium vessels where the total installed power exceeds 400kW, a B15 standard of fire protection is to be supplied in the machinery space as described in Paragraph 11.2.3. This level of protection is in addition to the installation of a fixed fire extinguisher system.

11.2.5 Where a fixed fire extinguisher system is fitted in the engine space, it must of the type that can be manually operated from outside the space. An automatic discharge system is not permitted.

11.2.6 For machinery spaces that can be occupied, the fixed fire extinguisher system shall also incorporate an advance warning system with audible and visual alarms fitted within the space. Such spaces shall also be capable of being enclosed gas-tight.

11.2.7 Insulation materials in engine rooms are to be covered by a surface layer impermeable to oil.

11.2.8 The structure above and surrounding the galley/cooker area is to be effectively insulated with non-combustible materials or sheathing.

11.2.9 Fabrics used for curtains, upholstery and bunk mattresses, etc. are to be fire-retardant.

11.2.10 Exhaust pipes and ducts which are liable to become hot, are to be adequately insulated and positioned clear of combustible surfaces. Unprotected combustible materials are not to be fitted within 300mm of any exhaust pipe, cooker, heater or duct.

11.2.11 Interior lining materials fitted to the hull or superstructure are to be of marine grade plywood, composite plastic faced boards or other approved material.

11.2.12 Ventilators serving machinery and accommodation spaces are to be fitted with a manual closure outside the compartment for use in the case of fire. A permanent notice is to be fitted on the means of closure, or in a visible location in close proximity, stating **“TO BE CLOSED IN THE EVENT OF FIRE”**.

11.2.13 Where engine and accommodation doors are situated within a designated escape route, the door is to be A30 fire rated, and fitted with a means of self-closure.

Fire detection

11.2.14 Sleeping accommodation, galley, machinery space, and any spaces containing open flame devices are to be fitted with efficient fire/smoke detectors to give an audible warning in the space they are protecting and at the helm position.

Section 11.3 - Oil fired and LPG installations

11.3.1 Where oil-fired appliances are fitted, the supply tank is to be sited outside the compartment containing the appliance(s) together with a means of closing the oil supply to the appliance. Such means is to require manual re-setting in order to restore the oil supply. Appliances using fuel oil having a flash point of less than 60°C (closed test) are not to be fitted.

11.3.2 Oil-fired cookers and heaters are to have a melt valve or fusible link weighted lever valve adjacent to the appliance to isolate the fuel supply in the event of fire.

11.3.3 The installation of liquid petroleum gas type appliances is not permitted.

Carbon monoxide detection

11.3.4 An efficient carbon monoxide (CO) detector with audible and visible alarm is to be fitted in the following spaces:-

(i) Every enclosed space that contains a fuel burning appliance, with the exception of unmanned machinery spaces. Fuel burning appliances include any appliance that burns gas, liquid or solid fuel;

(ii) Manned compartments, including wheelhouse and accommodation spaces, through which an exhaust from a fuel burning appliance runs.

11.3.5 CO alarms should be of the lithium battery type and installed in accordance with the Manufacturer's guidance.

Section 11.4 - Accommodation arrangements

11.4.1 All accommodation spaces are to have adequate headroom. It is recommended that at least 2m clear height be provided, but in no case should it be less than 1.9m.

11.4.2 Where possible, sleeping accommodation is to be located so as to minimize the effects of motion and acceleration but shall in no case be located forward of the collision bulkhead. See Part 3, Paragraph 3.11.7 regarding collision tanks.

11.4.3 The number of persons to be accommodated in a sleeping room is not to exceed six. The maximum number of persons to be accommodated in any sleeping room is to be clearly and permanently marked in a visible location within the room.

11.4.4 Where sleeping accommodation is installed, a separate sleeping room or sleeping rooms shall be provided for officers, if practicable.

11.4.5 Sleeping rooms are to be arranged and equipped to ensure reasonable comfort for the occupants and to facilitate tidiness. Adequate space and floor area shall be provided in each room to comfortably accommodate the number of occupants, taking into account the service of the vessel. Equipment provided shall include berths of appropriate dimensions, individual lockers sufficient for clothing and other personal effects, and a suitable writing surface.

11.4.6 Vessels with crew accommodation are to be provided with mess room accommodation suitable for their service and of sufficient size for the number of persons likely to use it at any one time.

11.4.7 Mess rooms shall be situated as close as possible to the galley, but in no case shall they be located forward of the collision bulkhead. Where practicable, mess room accommodation shall be separate from sleeping quarters.

11.4.8 Where a collision tank is fitted in lieu of a full height collision bulkhead, the mess room or sleeping accommodation may be located in the adjacent space in which the tank is located, but in such cases the vessel will be restricted to a maximum period of 24 hours at sea at any one time, and crew will not be permitted to sleep on board whilst the vessel is in port.

11.4.9 Direct openings into sleeping rooms from fishrooms and machinery spaces are not permitted, except for the purpose of emergency escape. Where practicable, direct openings into sleeping rooms from galleys, storerooms, drying rooms and communal sanitary areas are to also be avoided.

11.4.10 Where practicable, a place for hanging foul-weather gear and other personal protective equipment is to be provided outside of, but convenient to, sleeping rooms.

11.4.11 Accommodation spaces are to be adequately insulated. The materials used to construct internal divisions, panelling, and floors and joinings are to be suitable for the purpose and conducive to ensuing a healthy environment. For additional requirements relating to fire protection, refer to Section 11.2.

11.4.12 Where crew accommodation is installed on board a vessel, cooking facilities are to be provided. These should be fitted, where practicable, in a separate galley. The galley, or cooking area where a separate galley is not provided, is to be of adequate size to suit the intended purpose. In addition, a suitable place for provisions is to be provided which can be kept dry, cool and ventilated. Refrigerators or other low-temperature storage facilities should be provided where possible.

Section 11.5 - Toilets and sanitation

11.5.1 Where crew accommodation is to be installed, sanitary facilities, which include toilets, washbasins, and tubs or showers, are to be provided for all persons on board, as appropriate for the service of the vessel. These

facilities shall meet at least minimum standards of health and hygiene and reasonable standards of quality.

11.5.2 The sanitary facilities shall allow for reasonable privacy and are to be arranged such as to eliminate contamination of other spaces as far as practicable.

11.5.3 On vessels with crew accommodation, amenities for washing and drying of clothes are to be provided as necessary, taking into account the service of the vessel.

11.5.4 All surfaces in sanitary accommodation are to be such as to facilitate easy and effective cleaning. Floors are to have a non-slip deck covering.

Section 11.6 - Ventilation

11.6.1 An effective means of ventilation is to be provided to all enclosed accommodation spaces, and service spaces which under normal operating conditions may be entered by persons on board. All ventilators are to meet the requirements stated at Part 3, Section 3.3 for hull integrity and arrangement, and the means of ventilation should supply air in satisfactory condition.

11.6.2 Engine rooms are to be adequately ventilated to meet the engine Manufacturer's recommendations for engine air supply and exhaust requirements. Where auxiliary engines are fitted, extra ventilation is to be provided to ensure sufficient total air capacity for both engines. Where electric ventilation fans are provided to the engine space, a means of stopping the fans, operable from outside the engine space, must be provided.

11.6.3 Toilet and shower/washroom spaces are to be fitted with separate exhaust ventilation direct to open air, independent of any other part of the accommodation.

11.6.4 Galleys, and any similar such cooking areas, are to have sufficient ventilation, taking into account the size and nature of the compartment.

Section 11.7 - Water services

11.7.1 Where the number of crew and duration and nature of voyage are such that facilities for cold fresh drinking water are to be installed, the facilities shall be capable of supplying a sufficient quantity of cold fresh water to meet the requirements of the number of crew on board.

11.7.2 Where sanitation, galleys or mess rooms are provided, facilities are to be installed to provide cold fresh water and hot fresh water in sufficient quantities to allow for proper hygiene.

11.7.3 Freshwater tanks may be integral with the hull or separate tanks securely fitted in position. The tanks are to be constructed complete with baffles, access manholes for cleaning and all necessary valves, air pipes and fillers. Built-in tanks in GRP vessels are to be coated internally with a non-toxic approved composition or paint to prevent styrene contamination and to seal the GRP hull laminate. Steel fabricated tanks are to be continuously welded inside and out. Internal coatings are to be non-toxic and suitable for use with potable water.

Section 11.8 - Lighting

11.8.1 An electric lighting system is to be provided and installed to the requirements of Part 10 of these Standards 'Electrical Installations'. The lighting system must be capable of supplying adequate light to all enclosed accommodation spaces and, where possible, to working spaces, escape routes and life-saving appliance stowage positions. Galleys, and any similar such cooking areas, are to be well-lit.

11.8.2 Wherever practicable, accommodation spaces shall be lit with natural light in addition to artificial light, taking into account the requirements stated in Part 3 relating to portlights, windows and skylights.

11.8.3 11.9.2 Adequate reading light shall be provided for every berth in addition to the normal lighting of the sleeping accommodation.

11.8.4 Emergency lighting is to be provided in sleeping accommodation spaces, installed in accordance with Part 10 of these Standards. Where a vessel is not fitted with emergency lighting in mess rooms, passageways and any other spaces that may be used for emergency escape, permanent night lighting shall be provided in such spaces.

Section 11.9 - Temperature

11.9.1 Where practicable, the temperature within accommodation spaces and enclosed work areas is to be kept within a comfortable range, having regard to the physical demands placed on the crew, and the actual or potential weather conditions in the area in which the vessel is designed to operate.

Section 11.10 - Ballast

11.10.1 Loose ballast is to be firmly secured to prevent movement. Due consideration is to be given to the possibility of corrosion at the ballast position, and suitable preventative measures such as painting or sealing should be carried out, to ensure interior hull protection. Where concrete ballast is fitted, care should be taken to ensure the drainage of bilge water remains effective.

Section 11.11 - Escape arrangements

11.11.1 On all vessels of 10m LOA and above, where practicable, emergency escape routes are to be provided from the wheelhouse and sleeping accommodation.

11.11.2 In vessels 10m LOA and over with an enclosed machinery space, at least two means of escape from the engine room should be provided, separated as far apart as practicable, except that, where the size of the machinery space renders this impracticable, one escape may be fitted, subject to approval.

11.11.3 In the case of vessels fitted with an enclosed shelter, an additional access from within to the shelter top is to be fitted to facilitate escape in an emergency. The position of the escape is to be agreed with the Surveyor and dimensions are to be not less than 600mm x 600mm.

11.11.4 Escape routes are defined as a means of exit which is unobstructed, easily accessible and leads out as directly as possible to an open deck. An escape may be through any hatch, door, or skylight which has a minimum clear opening of not less than 500mm x 500mm, and in the case of portlights, 400mm minimum diameter. Where windows are to be utilised as escapes, the minimum opening should be no less than 500mm x 380mm. Where the arrangement of the vessel or compartment renders a secondary escape impractical, details are to be submitted for approval.

11.11.5 Emergency escape hatches or doors must be capable of easy opening from both sides, without the use of special keys or tools, and must not be fitted with padlocks or locked closed when the vessel is occupied. Escape routes and exits must be indicated by permanent signs.

11.11.6 All spaces must be fitted with sufficient ladders, steps, hand rails and grips as deemed necessary to facilitate easy access and escape. Ladders are normally to be of steel construction.

Section 11.12 - Hand rails, hand holds and grab rails

11.12.1 On decked or partially decked vessels, the perimeter of the exposed deck is to be fitted with fixed bulwarks, guard rails or wires, or a combination of these. The height of the bulwark, guard rail, or wire is to be not less than 1m, 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. See Figure 11.20.1. The maximum recommended distance between stanchions is 1.5m.

11.12.2 Where tubular guard rails or wires are fitted, the lower course of rails or wire is to have a clearance of not more than 230mm above the deck, with

remaining courses evenly spaced at a distance not more than 400mm apart.

11.12.3 Where an exposed raised deck is not to be accessed for any reason whilst at sea, then hand rails may be omitted around this area. In such cases, access to the raised deck from the working deck should be prevented by use of rails, wires or chains fitted in accordance with the Standards to maintain a top rail height of 1000mm above the working deck (or step if fitted), and notices should be fitted at the adjoining boundary stating "**No access beyond this point**". If any form of hatch, skylight or door provides access to the exposed raised deck, then hand rails must be fitted around the raised deck in accordance with the Standards.

11.12.4 Where an exposed raised deck is not to be accessed for any reason whilst at sea except for anchor release and retrieval, then hand rails may be omitted from the perimeter of this area and a suitable rail system fitted to allow the use of a safety harness and tether. In such cases, access to the raised deck from the working deck should be restricted using removable wires or chains fitted in accordance with the Standards to maintain a height of 1000mm above the working deck (or step if fitted), and notices should be fitted at the adjoining boundary stating "**Safety harness must be worn beyond this poin**t". If any form of hatch, skylight or door provides access to the exposed raised deck then hand rails must be fitted around the raised deck in accordance with the Standards.

11.12.5 Sufficient hand holds and grab rails must be provided to allow safe movement around the accommodation and working spaces. Storm rails and hand holds are to be fitted in the outside of deckhouses and casings to enable the safe movement of the crew on all working deck areas when the vessel is in a seaway.

11.12.6 All vessels are to be fitted with a permanently mounted re-boarding ladder that can be deployed from a man overboard position (i.e. it must be possible to deploy the ladder from in the water). The ladder is to be capable of extending from the gunwale/bulwark top to 600mm below the waterline.

11.12.7 The re-boarding ladder should be of firm construction and fit for purpose. Rope and webbing ladders may be accepted as re-boarding ladders, details are to be submitted to MCA or Fishing Vessel Certifying Authority for consideration. All ladders are required to be permanently fixed to the vessel.

11.12.8 The re-boarding ladder may be made up of more than one construction type to achieve the full extension required for boarding. For example, an extending ladder may be fitted in conjunction with fixed rungs or hand holds in the bulwark. In all cases, the ladder must enable a person to board the vessel from a man overboard position.

11.12.9 Safe access by means of steps, ladders and hand holds/rails is to be provided to wheelhouses and deckhouse top areas which are to have a non-slip finish.

11.12.10 It is recommended that all single handed operated vessels are fitted with an emergency kill system for the main engine, in case of a man overboard situation.

Section 11.13 - Securement of heavy items

11.13.1 All heavy items of equipment such as batteries, gas bottles, cooking appliances and spare gear must be securely fastened in position to prevent movement when the vessel is at sea. All lockers and stowage cupboards containing heavy items must have a lid or doors with secure fastening arrangements.

Section 11.14 - Fishing equipment

11.14.1 Masts, derricks and lifting equipment may be of suitable timber, steel or other approved material and securely fastened to the vessel's structure. The maximum safe working load and maximum radius of operation of all derricks and lifting equipment is to be stated in the building specification or approved constructional drawings, and are the responsibility of the vessel Builder.

11.14.2 The associated ropes, wires and guys, eyeplates, shackles and blocks are to be designed to meet these loads. Derricks should be tested as rigged for services to not less than the appropriate British Standards or equivalent requirement, and the maximum safe working load is to be permanently indicated on the derrick. In all cases the LOLER and PUWER regulation referenced in Paragraph 11.14.9 shall apply.

11.14.3 Where practical, warp rollers and leads are to be fitted with guards and be positioned to enable safe passage by crew members. All deck machinery is to be of a good marine standard and be suitable for the size of vessel and type of fishing to be prosecuted. The controls of all equipment are to be arranged adjacent to the Operator's position to enable a clear view of the gear being hauled. Controls should not be positioned in such a way that the Operator has to reach over the moving equipment.

11.14.4 An emergency stop facility is to be provided at the helm position for all hydraulically operated deck equipment and in addition a local emergency stop device is to be fitted at the winch or hauler.

11.14.5 The emergency stop facility at the helm and the local emergency stop device shall be of the typical push-to-stop button type and shall be fitted in addition to the normal operating controls of the equipment.

11.14.6 All winches and haulers are required to have a local emergency stop device. Consideration should be given to the positioning of the local

emergency stop to maximise the chance of operation in the event of an accident. In general, it should be located within a reaching distance of approximately one metre from the actual piece of equipment it is intended to stop (this may not necessarily be the control position), and should be positioned so that it will be visible and readily accessible at all times. The device should not be fitted in a position where other parts of the vessel will cause obstruction to either its visibility or operation.

11.14.7 A local emergency stop device may cover more than one piece of hydraulically operated deck equipment providing its location in relation to each piece of equipment complies with the requirements of Paragraph 11.14.6.

11.14.8 Emergency stop facilities/devices for hydraulic deck equipment are not to interfere with the running of any propulsion engine, or any other item of machinery used to control the vessel.

11.14.9 It is the responsibility of the Builder/Designer and Owner to ensure that all equipment necessary for the operation and use of the vessel meets the requirements as laid out in PUWER: Provision and Use of Work Equipment Regulations and LOLER: Lifting Operations and Lifting Equipment Requirements. These regulations cover any equipment that is used in the course of the work aboard the vessel, including all equipment used in any way for lifting operations including attachments for anchoring, fixing or supporting structures and equipment used in conjunction with the operation of the vessel.

Section 11.15 - Cathodic protection

11.15.1 An approved method of cathodic protection is to be fitted to all vessels to eliminate or reduce corrosion. The anodes should be of the correct surface area as recommended by the Manufacturer, bonded with correctly sized wires. Continuity bridges are to be fitted at flexible pipe positions, engines, stern gear, rudder and seacocks.

Section 11.16 - Galvanic action

11.16.1 Where connections of dissimilar metals are made, special consideration is to be given to hull fittings and penetrations, bulkhead and deck penetrations and attachment of equipment, in order to prevent any galvanic corrosion.

Section 11.17 - Steel/wood connections

11.17.1 Wood connections directly to steel structure and vice versa are to be protected against corrosion. The wood is to be primed and painted or the surface connecting to the steel structure or fitting is to be coated with a compatible non-hardening sealant.

Section 11.18 - Anchors and cables

11.18.1 Every vessel should be equipped with anchors, chain cables and or rope sufficient in weight and strength, having regard to the vessel's size and intended service.

11.18.2 The requirements shown in the Anchors and Cables Table below are for a vessel of displacement hull form, which may be expected to ride out storms whilst at anchor and when seabed conditions are favourable. The anchor sizes shown in the Table are for high holding power types. Where a fisherman type anchor is provided, the weight given in the Table is to be increased by 25%, but the diameter of the anchor cable need not be increased.

11.18.3 Wire rope of suitable strength and positioned in a suitable location (e.g. trawl warps) may be substituted for chain cable provided that a length of chain cable is attached between the wire rope and the anchor, as specified in Table 11.20.1.

11.18.4 The length of the chain cable should not be less than the LOA of the vessel.

11.18.5 The main anchor must be rigged, ready for use in a position where it may be safely and reliably deployed from a dead ship condition and is to be provided with a means of retrieval.

11.18.6 Where a vessel has an unusual hull form and an unusually high windage area, due to high freeboard or large superstructure, the weight of the anchor is to be increased to take account of the increase in wind loading. For vessels with partial shelters the anchor weight is to be 1.3 times and for full shelters the anchor weight is to be 1.6 times the anchor requirement. The increased anchors are to have chain and rope for their designated weights, as specified in Table 11.20.1.

11.18.7 The length of anchor cable attached to an anchor is to be appropriate to the holding ground and depth of water in the area of the operation of the vessel, but in no case less than that shown in Table 11.20.1. It is recommended the total anchor cable length is a minimum of 10 times the intended depth of water at anchorage.

11.18.8 All vessels must be provided with a means of being towed.

11.19 Tables

11.19.1 Table 1: Anchors and cables – requirements

Anchor numeral L x B x D	Total weight of anchor/s kg	Number of anchors	Length of cable (m)		Diameter of chain mm	Diameter of rope mm
			Minimum chain m	Minimum length M		
10	9	1	4	25	6	10
15	14	1	5	30	6	12
20	16	1	6	30	6	15
25	18	1	7	35	6	15
35	22	1 or 2	8	35	8	18
50	27	1 or 2	9	40	8	18
70	34	1 or 2	10	45	8	20
90	41	1 or 2	12	50	10	20
110	48	1 or 2	15	55	10	25
150	62	1 or 2	15	60	10	25
200	80	1 or 2	15	70	12	30
250	98	1 or 2	15	82.5	12	35
300	115	1 or 2	15	82.5	12	40
350	133	1 or 2	15	82.5	12	40

Notes:-

1. Anchor numeral L x B x D is obtained from the following:-

   L = Overall length in metres
   B = Overall beam in metres (maximum - outside planking or plating)
   D = Depth in metres (maximum - deck at side to top of keel amidships).

2. Requirements for vessels with intermediate anchor numeral value are to be obtained by interpolation.

3. Chain cable diameter is given for short link chain. Chain cable should be sized in accordance with EN 24/565:1989 (ISO 4565:1986 and BS 7160:1990 - Anchor Chains for Small Craft) or equivalent.

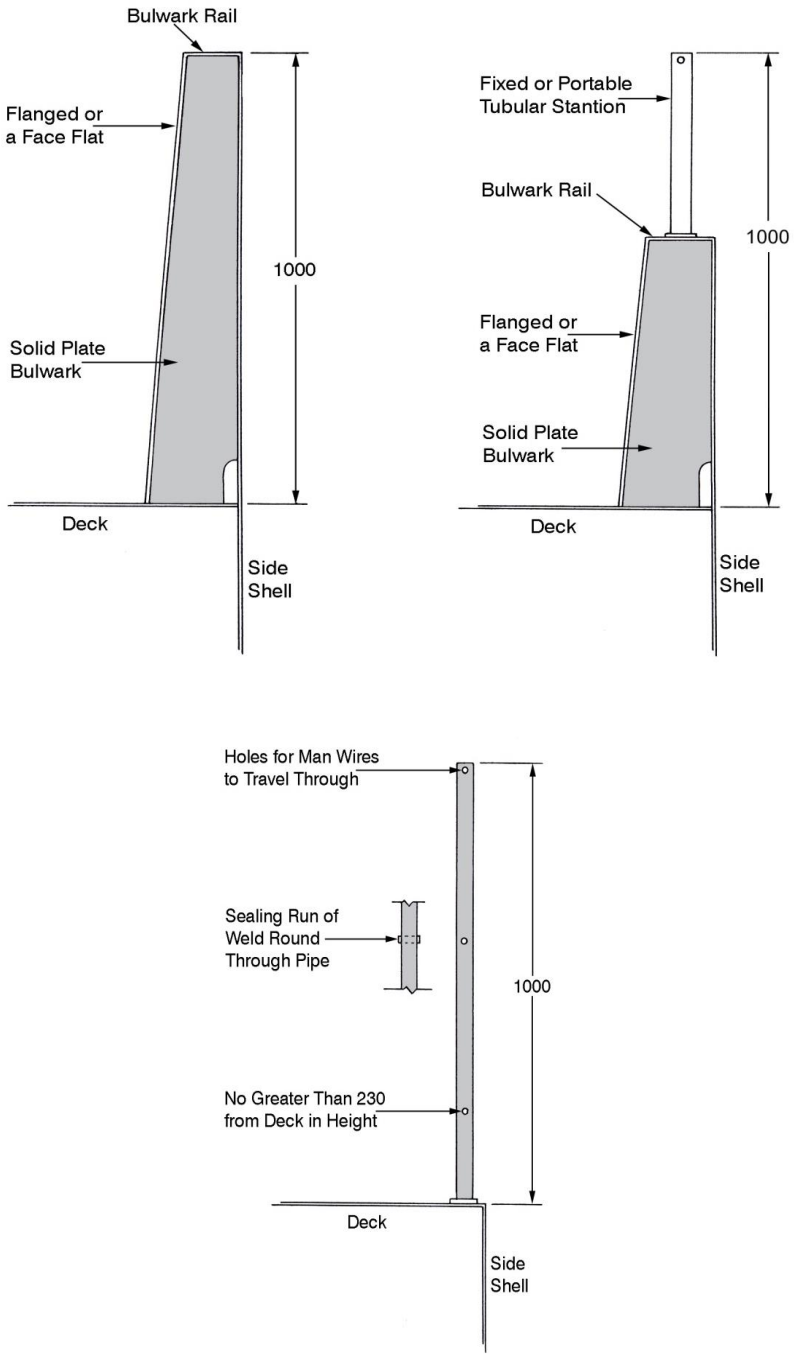
4. The rope diameter given is for nylon construction. Where rope of differing construction is provided, the breaking load should not be less than that of the diameter of nylon rope specified in the Table.

5. Where stud link chain cable is used, the diameter may be 1.5mm less than the tabular diameter stated.

6. Two anchors are permitted on vessels with an anchor numeral 35>. The weight of the main anchor is to be at least 66% of the total weight for the anchors given in the table. The main and kedge anchors are to be rigged with chain and rope for their designated weight.

11.20 Figures and illustrations

11.20.1 Hand rail arrangements



See Section 11.12