BOBP/REP/112

SAFETY GUIDE
FOR
SMALL FISHING BOATS

BOBP Sida

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FOR

SMALL FISHING BOATS

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FOREWORD

One can broadly say that fishing boats engaged in the small-scale sector account for the bulk of marine fish landings in south Asia. Yet, this sizeable fleet of fishing vessels is ignored when it is a matter of compliance with safety standards, since such standards do not exist in the region for fishing vessels less than 24m in length. More often than not, fishing vessels are built by boat yards that: do not meet minimum standards of quality; do not pay heed to minimum safety requirements and; do not have the benefit of professional inputs in terms of design, construction and specification.

While traditionally built boats have stood the test of time, the advent of motorization and newer boat-building materials like FRP have changed many variables of operation. Traditional fishers used to near shore operations are now fishing in distant waters requiring a new set of safety norms.

Fishery management interventions have generally been on conflict-resolution and resource management. Any interventions at improving safety at sea have been knee-jerk reactions consequent to a major natural disaster such as the December 2004 Asian Tsunami.

The Fishing Technology Service (FIIT) at the FAO Fisheries and Aquaculture Department, is developing various safety guidelines for small fishing vessels. One of the expected outputs of the global FAO project **Safety at sea for small scale fisheries in developing countries**, GCP/GLO/200/MUL, with activities in West Africa and South Asia, is to assist in the development of rules and regulations for the design, construction and equipment of fishing vessels in the small-scale fisheries sector, adapted and amended from the FAO/ILO/IMO Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels, 2005; the draft FAO/ILO/IMO Safety recommendations for decked fishing vessels of less than 12 metres in length and undecked fishing vessels; relevant sections of Part A of the FAO/ILO/IMO Code of Safety for Fishermen and Fishing Vessels, 2005; and other international standards for fishing vessels of less than 24 metres in length.

A Safety Guide for Small Offshore Fishing Boats, BOBP/MAG/16 produced by the Bay of Bengal Programme in 1993 was very popular and received tremendous response not only from the Bay of Bengal region, but worldwide. Explaining safety standards using sketches and diagrams and presenting technical data in an easy-to-understand format was the key to its success. The present publication is an updated version of the 1993 Safety Guide taking into account work done in this field internationally in the past decade. We are sure that it is a very important step to emerging fishery management regimes that treat safety-at-sea as an integral part, in developing countries in general and south Asia in particular.

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INTRODUCTION

Fishing is a very dangerous occupation with a high accident risk. Experience has shown that it is often when a fishery develops from traditional sail-powered craft and near shore fishing to motorized craft venturing further out to sea and with new fishing methods that accidents happen. In many developing countries, fibreglass reinforced plastic (FRP) boats are replacing traditional wooden boats and this new construction material requires new thinking when it comes to strength, stability and the ability to keep afloat when swamped. It is often difficult to do something about boats already in operation, but significant safety measures can be incorporated at relatively low cost in boats yet to be built. Close cooperation between the government departments responsible for safety legislation and the boatyards is required.

The purpose of this safety guide is to present simple measures to ensure that new boats will satisfy internationally accepted safety standards. The target group consists of boat designers, boatbuilders, boat owners, skippers and government officials responsible for drafting new regulations and for safety supervision. This safety guide is not intended to be comprehensive and deal with all kinds of safety issues, but it will highlight the main problems and indicate what practical measures can be taken to avoid them. The guide mainly deals with small boats of less than 15 m in length, which, from experience are most prone to accidents.

The Food and Agriculture Organization of the United Nations (FAO), the International Labour Organization (ILO) and the International Maritime Organization (IMO) are working together to draft new safety recommendations for decked fishing boats of less than 12 m and undecked fishing boats of any length. This work is expected to be finalized by 2010.

The present guide is a revision of BOBP/MAG/16: *A safety guide for small offshore fishing vessels* issued by the Bay of Bengal Programme (BOBP) in 1993. The main change is that this publication not only focuses on small offshore fishing boats in the 10-13 m range, but also includes smaller coastal boats. The revision has benefited from recent work regarding the safety of small craft as given below.

- IMO document SLF 51/5: *Safety of small fishing vessels* - Consolidated text of the draft Safety recommendations for decked fishing vessels of less than 12 m in length and undecked fishing vessels.
- *FAO/ILO/IMO Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels 2005*.
- Det Norske Veritas: Standard for certification No 2.21. Craft, 2008.
- International Organization for Standardization:
  ISO 8666 Small craft-Principal data.
  ISO 11812 Watertight cockpits and quick-draining cockpits.
  ISO 12215-5 Design pressures, design stresses, scantling determination.
  ISO 12217-1 Small craft Stability and buoyancy assessment and categorization-Part 1: Non-sailing boats of length of hull greater than or equal to 6 m.

  ISO 12217-3 Small craft-Stability and buoyancy assessment and categorization-Part 3: Boats of hull length less than 6 m.
- Transport Canada

The terms for boat dimensions in this publication follow the ISO 8666, except for the definition of Depth moulded of the hull = D_M.

Some guidelines may not be in keeping with recommendations made by FAO/ILO/IMO or other international agencies for similar boats. The intent is to make them as simple as possible while ensuring an acceptable standard. It must be stressed that this publication is open for comment. It is expected that further revisions will be required in the future, in the light of discussions and general experience gained regarding the safety of small fishing boats.

This safety guide has been prepared and issued under the Joint IMO-FAO Tsunami Reconstruction and Rehabilitation in the Bay of Bengal Region with a focus on small fishing vessel safety - TC/0124, a sub-project of the FAO - Safety at Sea for small-scale fisheries project - GCP/GLO/200/MUL.

ACCIDENTS

CAPSIZING

Poor stability
Heavy loads on deck
Water trapped on deck

SINKING

Bad construction
Bad maintenance

DRIFTING

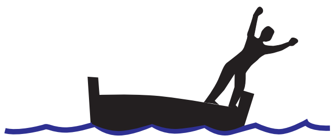
Bad engine installation
Bad engine maintenance
Lack of fuel
Lack of troubleshooting experience

COLLISION

Lack of navigation lights
Tired crew

FIRE

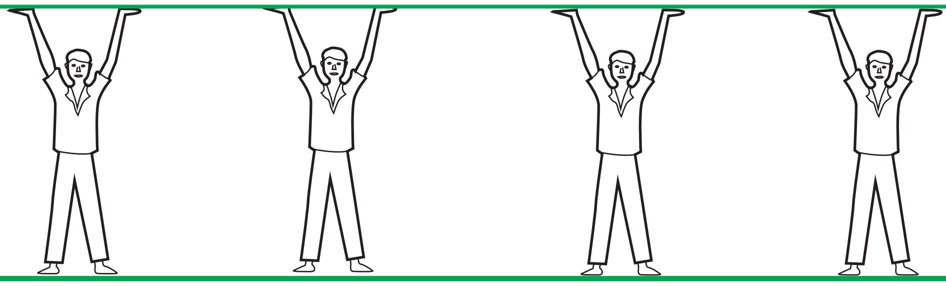
Bad engine installation
Bad installation of cooking stove



WORK ACCIDENTS

Slippery decks
Unprotected machinery
Tired crew

THESE PEOPLE MUST COOPERATE TOGETHER TO AVOID ACCIDENTS



AUTHORITY

Safety regulations
Safety information
Enforcement of regulations

BOATBUILDER

High quality in construction and equipment

BOAT OWNER

Caring for the safety of the crew
Maintenance of boat and equipment

BOAT CREW

Safe operation
Good maintenance

DESIGN CATEGORIES

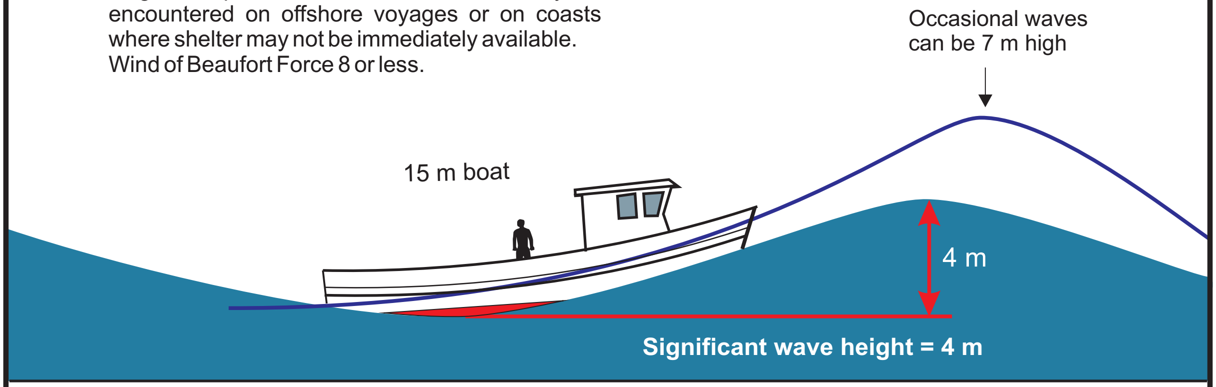
Boats meet different sea conditions. The International Organization for Standardization ISO 12215-5 standard for boats under 24 m use four different design categories to characterize the maximum waveheight and wind speed for which a boat should be suitable for. It uses the term, "significant wave height" which is the average of the 1/3 highest waves. However, some occasional waves may sometimes be almost twice as high as the "significant wave height".

Design category A - "Ocean"

Boats suitable for seas higher than 4 m with a significant wave height of more than 4 m. These conditions may be encountered on extended voyages, for example, across oceans, or inshore when unsheltered from winds and waves.

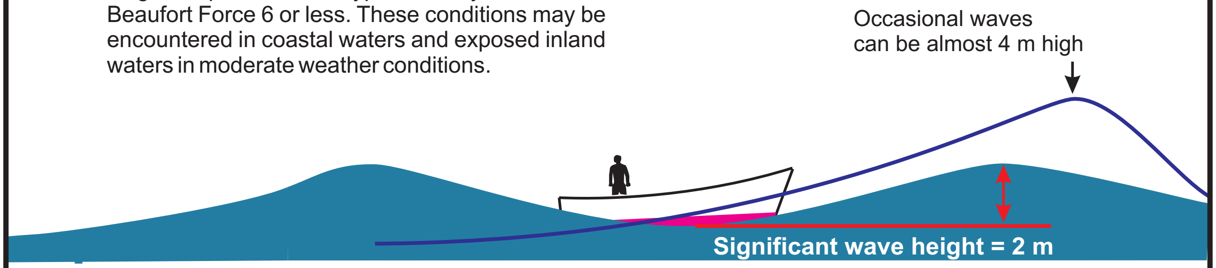
Design category B - "Offshore"

Boats suitable for seas with a significant wave height of up to 4 m. These conditions may be encountered on offshore voyages or on coasts where shelter may not be immediately available. Wind of Beaufort Force 8 or less.



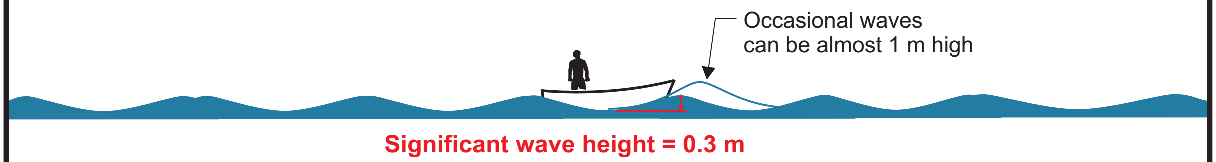
Design category C - "Inshore"

Boats suitable for seas with a significant wave height of up to 2 m and a typical steady windforce of Beaufort Force 6 or less. These conditions may be encountered in coastal waters and exposed inland waters in moderate weather conditions.

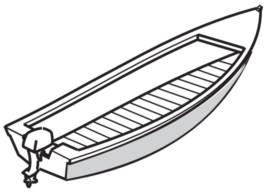


Design category D - "Sheltered water"

Boats suitable for seas with a significant wave height up to 0.3 m. Such conditions may be encountered on sheltered coastal and inland waters in fine weather.

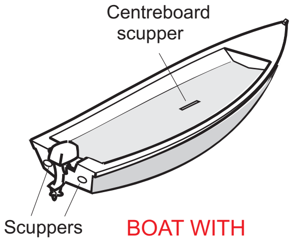


TYPES OF BOATS



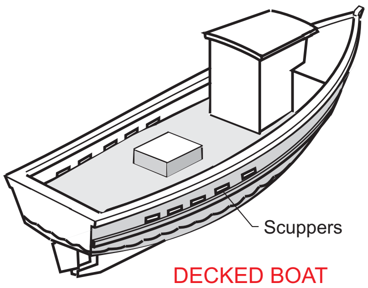
OPEN BOAT

Rainwater will stay inside the boat.



BOAT WITH QUICK DRAINING COCKPIT

Rainwater will drain overboard through scuppers.

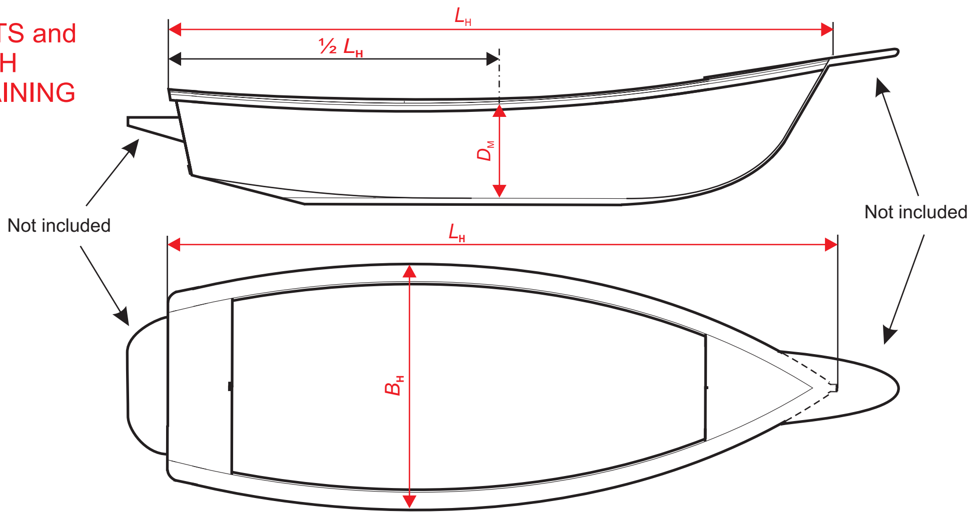


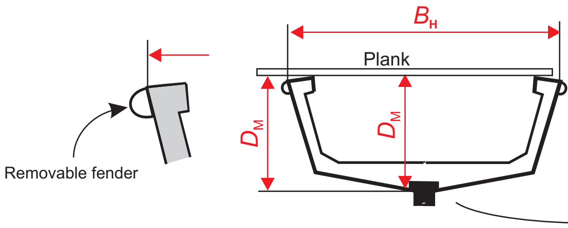
DECKED BOAT

Rainwater will drain overboard through scuppers.

MEASURING THE MAIN DIMENSIONS

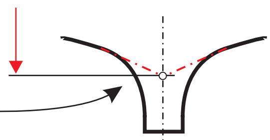
OPEN BOATS and BOATS WITH QUICK DRAINING COCKPITS





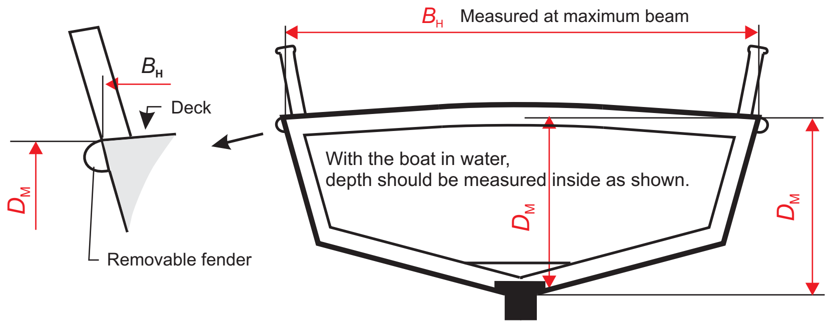
Measuring the depth D_M

The depth should be measured at 1/2 length L_H. If the boat is in water, depth should be measured inside the boat as shown.



DECKED BOATS

Length L_H measured in the same way as for open boats.



OPEN BOATS – DOWNFLOODING HEIGHT

To prevent waves from flooding into the boat in rough weather and with a full load, the downflooding height must be sufficient to prevent the boat from being swamped.

1. **Determine maximum load**

Maximum load = 90 x *CUNO* kg

$CUNO = L_H \times B_H \times D_M$ m^3

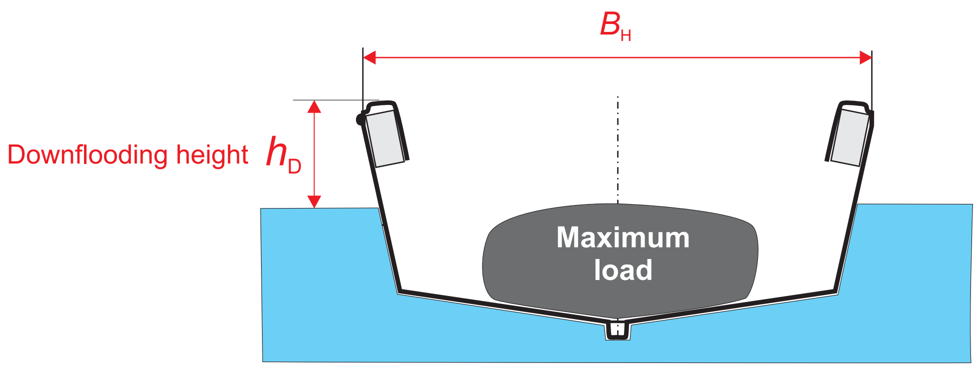
2. **Load the boat with the maximum load**

Use drums of known capacity filled with water or use a number of people necessary to represent the maximum load. Use bathroom scales to determine the weight. People must stand still in the boat so that it does not heel.

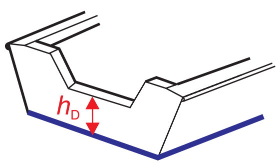
3. **Measure the minimum downflooding height h_D on both sides or aft**

Check whether the minimim downflooding height satisfies the following criterion.

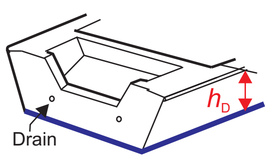
For open boats with built-in buoyancy, minimum downflooding height at maximum load: $h_D = 0.2 \times B_H$



If the measured downflooding height is less than the minimum calculated value, the maximum allowed load must be reduced.



For boats without a well for the outboard engine, the height is measured at the cut down in the transom.



For boats with a well for the outboard engine, the height should be measured at the lowest point along the rail.

OPEN BOATS – SWAMPED BUOYANCY TEST

The main safety criterion for an open boat is that it will float level when it is swamped.

FAO-designed 4.5 m (15 ft) boat being tested in the Maldives

This picture shows that the boat has ample reserve buoyancy.
The people should however stand up in the boat during the test.

Buoyancy test

This should be carried out on all open FRP boats of a new model not previously tested.

During the test, the boat should be in calm water, in the light craft condition and equipped as follows.

1. Outboard engines can be replaced with an equivalent weight in steel or cast iron. Alternatively, a defunct engine can be used.
2. Portable fueltanks should be removed.
3. Inboard engines can be replaced with an equivalent weight in steel or cast iron representing 75 percent of the weight of the engine.
4. Replacement weights must be placed in the same position as the real weights.
5. Equipment such as anchors, and fishing gear such as sinkers on fishing nets, or their equivalent weights should be on board in the correct position.
6. Empty compartments that are part of the boat's structure and have not been pressure tested for airtightness should be left open so that they too can be flooded with water.
7. People are represented with a total weight in kg as shown in the table below (check with a bathroom scale). They should not be immersed above their knees. Alternatively, iron weights can be used, placed in the centre of the boat to represent the crew.
8. Fill the boat with water and wait for five minutes.
9. The boat should float level with approximately two thirds of the length of the top of the rail above water.

Equivalent person weight in kg

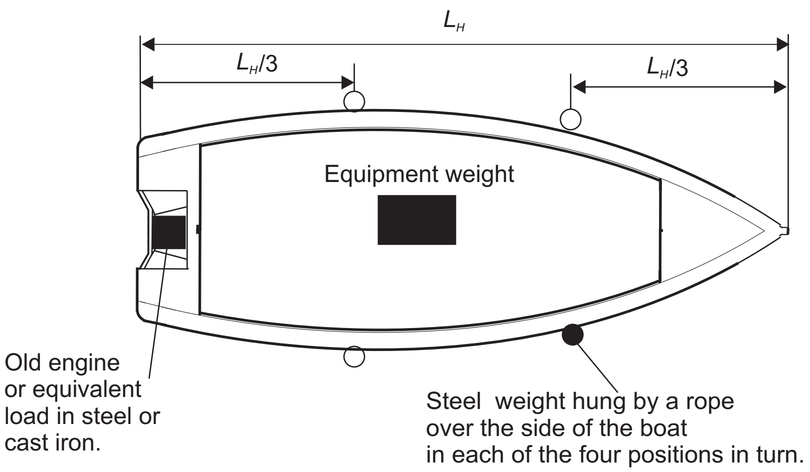
Maximum number of crew	1	2	3	4	5	6	7	8	9	10
Design category D (kg)	70	80	90	100	110	120	135	145	155	165
Design category C (kg)	85	100	120	140	150	170	185	200	215	230

OPEN BOATS – SWAMPED STABILITY TEST

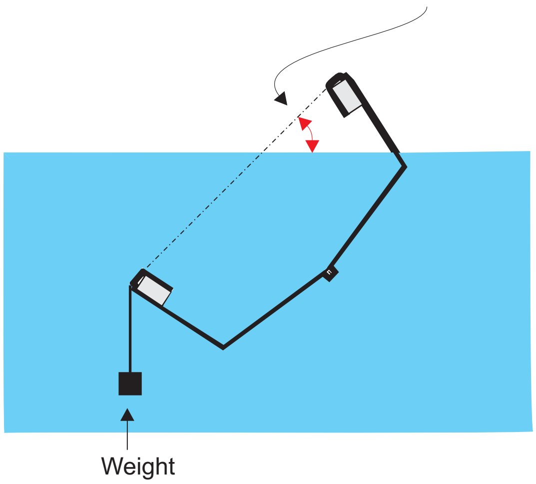
1. Prepare a steel test weight with weight in kg = 7 x maximum crew number.
   Tie a rope to the steel piece (or pieces).

2. Keep the same weights on board as specified in the swamped buoyancy test, but without the people (point 7).

3. Suspend the weights over the side at each of the positions indicated below. After applying the weight, wait until the water inside and outside the boat has equalized.



The boat should not heel more than 45º during this test



OPEN BOATS – CALCULATING REQUIRED BUOYANCY

All materials weigh less when submerged in water which is why buoyancy to support the boat when it is filled with water is always less than the weight in air. Materials such as wood weigh less than water; therefore they float and contribute to the buoyancy. To calculate the submerged weight of different materials the buoyancy factor is used.

Buoyancy factor: $f_B = \frac{\text{Submerged weight}}{\text{Weight in air}}$

Positive buoyancy: +
Negative weight: -

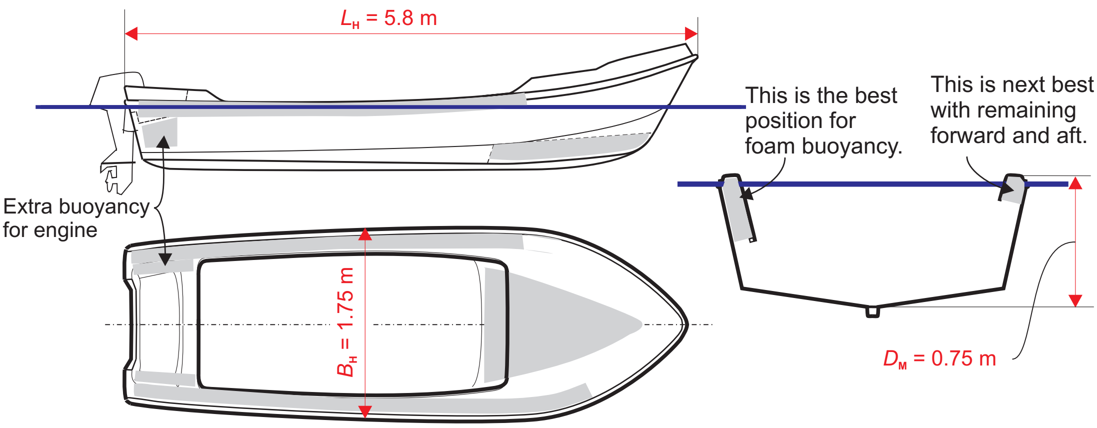
Material	Buoyancy factor f_B
Wood	+0.25
Fibreglass	- 0.33
Steel	- 0.88
Aluminium	- 0.63
Lead	- 0.92
Concrete	- 0.50
Engines	- 0.75
People	- 0.1

To find the submerged weight, the weight in air has to be multiplied with the corresponding buoyancy factor.

EXAMPLE 1. 5.8 m (19 ft) FRP boat from Sri Lanka

The weight of an FRP open boat without engine can be estimated at 60 x *CUNO* kg

In this case: *CUNO* = $L_H \times B_H \times D_M$ = 5.8 x 1.75 x 0.75 = 7.6 m^3 Hull weight = 60 x 7.6 = 460 kg



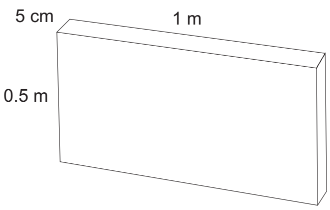
Besides the weight of the crew, the load on a fishing boat is mostly fishing nets and fish. The weight of the fishing nets is in the sinkers and this has to be estimated. The net and the floats will not have any submerged weight, and nor will the fish.

Item	Weight in air (kg)	Buoyancy factor (f_B)	Weight submerged (kg)
Hull above water (10 percent)	46		- 46
Hull submerged	414	- 0.33	- 136
Sinkers of fishing nets, concrete	50	- 0.50	- 25
Anchors	20	- 0.88	- 18
People - 4 x 75 kg	300	- 0.1	- 30
Total required buoyancy, distributed			- 255
Engine concentrated	60	- 0.75	- 45

Continued

OPEN BOATS – REQUIRED BUOYANCY *(Continued)*

Required buoyancy distributed to support the flooded boat = 255 kg. This is equivalent to 0.28 m^3 of buoyancy blocks or 0.14 m^3 on each side of the boat. The buoyancy material should preferably be placed high up along the sides. Over a length of 4.5 m on each side, this means 0.14/4.5 = 0.04 m^2 cross area. If the block is 10 cm thick it means a height of 40 cm. In this case, there is not sufficient space under the rail, so some must be placed forward and some aft. Foam inside the hollow transverse frames can also contribute to the buoyancy. For the engine, a total buoyancy of 45 kg is required and this must be placed along the sides where the engine is located.



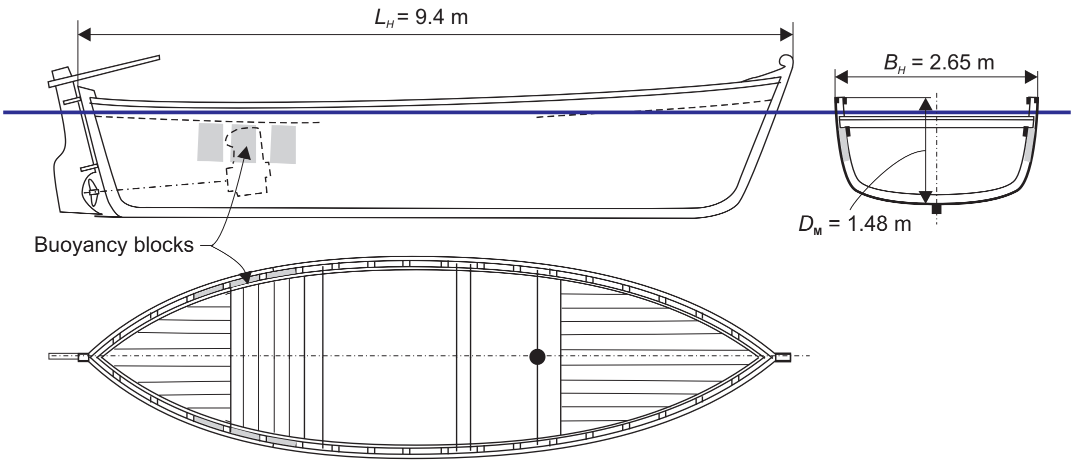
A polystyrene sheet of 5 cm thickness and 0.5 x 1 m will have a buoyancy of 24 kg. To support the boat, a total of of 255 /24kg = 11 sheets are required. To support the engine a total of 45 /24 kg = 2 sheets are required.

Buoyancy material is commonly polystyrene or polyurethane. The polystyrene should be of the expanded, closed cell type that will not become waterlogged. To check the buoyancy material, it can be kept under water for eight days. The water absorbtion should not exceed 8 percent of the volume.

NOTE: POLYSTYRENE MUST BE PROTECTED AGAINST PETROL, DIESEL AND RAW POLYESTER RESIN.

Polystyrene must be protected by a polyetethylene plastic sheet before it can be given a protective layer of FRP.

EXAMPLE 2. 9.4 m (31 ft) wooden boat from Tuticorin, India



The weight of the hull can be estimated by using the cubic number:
CUNO = L_H x B_H x D_M = 9.4 x 2.65 x 1.48 = 37 m^3

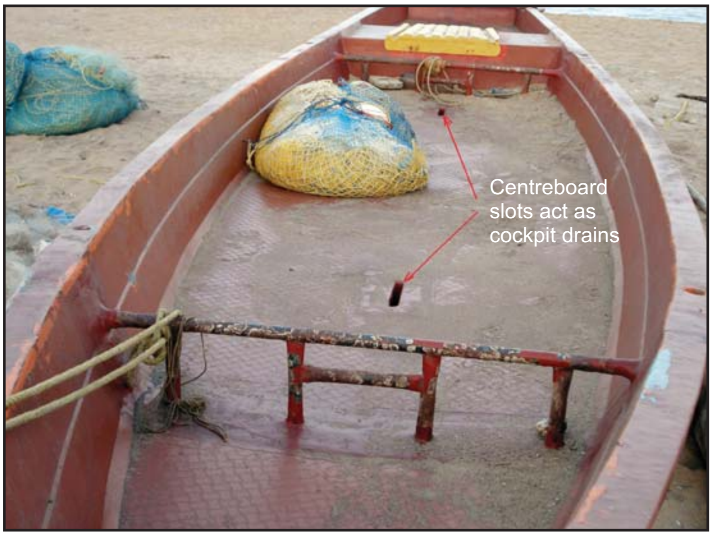
A strongly built wooden boat would have a hull weight = 75 x CUNO = 75 x 37 =2800 kg

Item	Weight in air (kg)	Buoyancy factor (f_B)	Weight submerged (kg)
Hull above water (10 percent)	300		- 300
Hull submerged	2500	+ 0.25	+625
Sinkers of fishing nets, concrete	50	- 0.5	- 25
Anchors	20	- 0.88	- 18
People - 4 x 75 kg	300	- 0.1	- 30
Total positive buoyancy			+ 252
Engine. concentrated	450	- 0.75	-138

* Boat without engine will not sink.

Extra concentrated buoyancy required for the engine = 138 kg. Number of polystyrene sheets as shown above: 138/ 24 kg = 6 sheets. These must be placed along the sides of the hull between the frames and protected against diesel and oil.

COCKPIT DRAINS



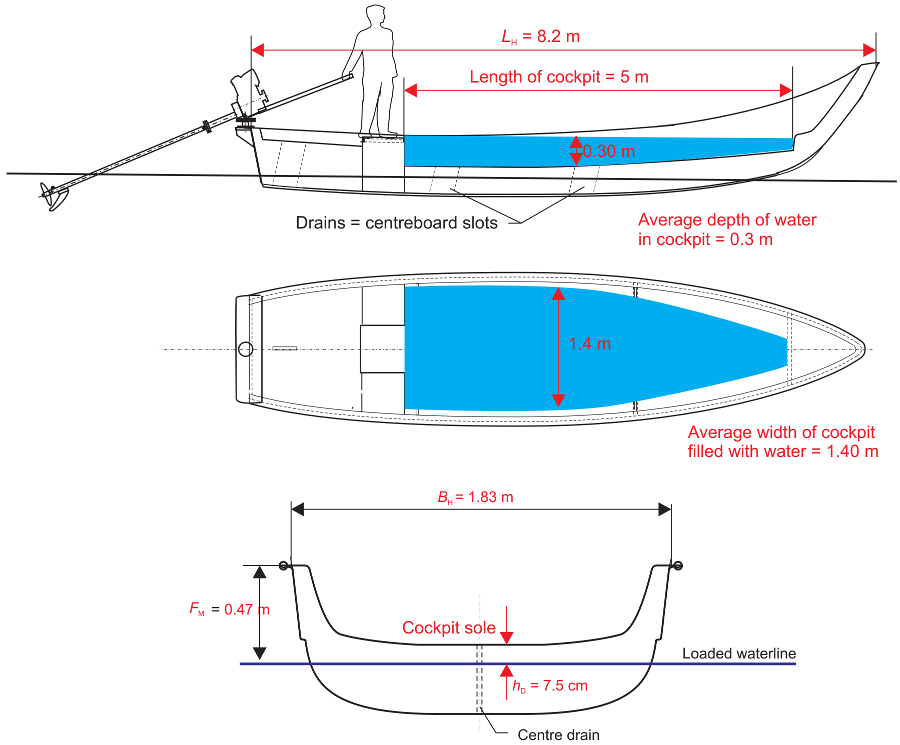
Slots for centreboards also drain water on deck but...

...blocked drains, heavy catch and cockpit filled with water can capsize the boat.

To ensure safety, drains must be large enough to drain the water on deck quickly. Drains should be placed port and starboard and should not be obstructed at any time, to ensure adequate and quick drainage even when the boat has heeled.

BOATS WITH QUICK DRAINING COCKPITS

EXAMPLE 3. 8.2 m (27 ft) FRP fishing boat from Tamil Nadu, India



1. Minimum downflooding height, fully loaded: h_D = 7.5 cm for category C
2. Cockpit volume: V_c = length x average width x depth = 5 x 1.4 x 0.3 = 2.1 m^3
3. Cockpit volume in relation to remaining buoyancy:

$$\text{Cockpit volume coefficient} = k_c = \frac{V_C}{L_H \times B_H \times F_M} = \frac{2.1}{8.2 \times 1.83 \times 0.47} = \underline{0.3}$$

4. Maximum draining time of cockpit: $t_c = 0.6/k_c$ = 0.6/ 0.3 = <u>2 minutes</u>
5. Practical test to find the maximum load.

   To determine the maximum load, the boat should be in calm water and people distributed onboard until the minimum downflooding height is reached (measured in the cockpit drain). Measure the weight of the people with bathroom scales. This is the maximum load.

6. Practical test to find the draining time.

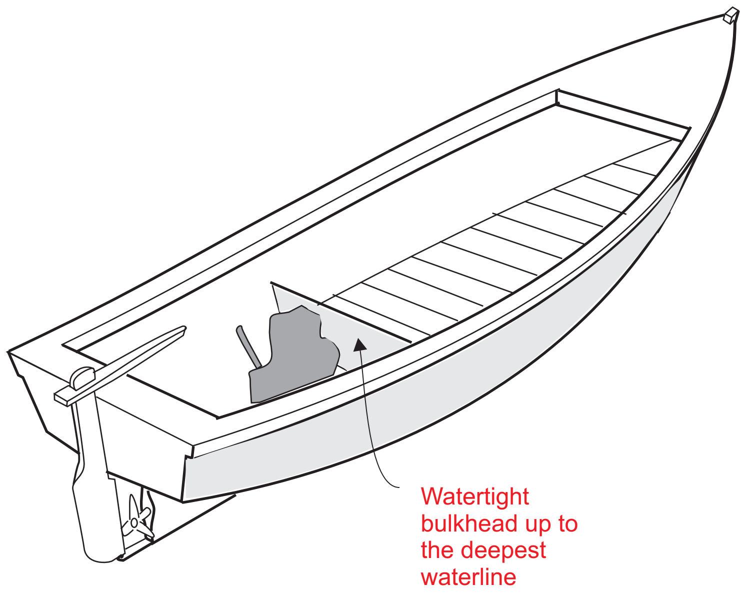
- The boat should be in calm water.
- Block the cockpit drains with plugs.
- Load the boat with weights equivalent to the engine weight at the correct positions (or use a defunct engine).
- Use people of known weight to obtain the maximum load when loaded to minimum downflooding height.
- Fill the cockpit with water up to the top.
- Measure the time it takes to remove all the plugs until there is 10 cm water left in the cockpit. This is t_c = the draining time for the cockpit. In this case it should be less than 2 minutes.

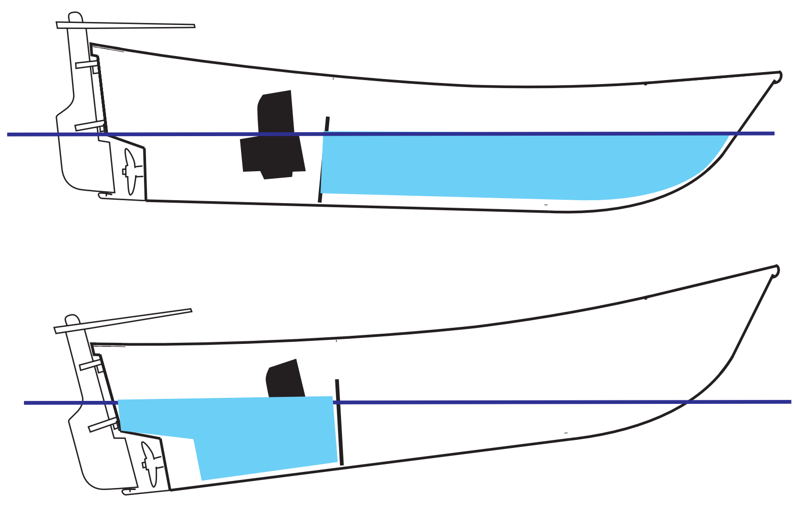
If there are two drain openings, one to port and one to starboard with a total area of =0,05 x V_c = 0,05 x 2.1 = 0,11 m^2, no drainage time test is required. This means that each drain will have an area of 23 x 23 cm.

The boat above was tested for draining time which was more than two minutes. Therefore, the boat does not satisfy draining time criterion.

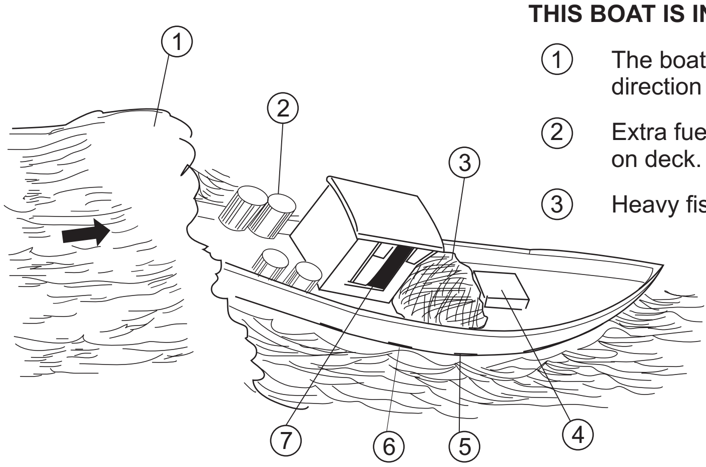
OPEN BOATS – WATERTIGHT BULKHEAD

With an inboard engine, safety against sudden leaks is much improved by having a bulkhead in front of the engine. In this way, it is possible to gain time in bailing out the boat.





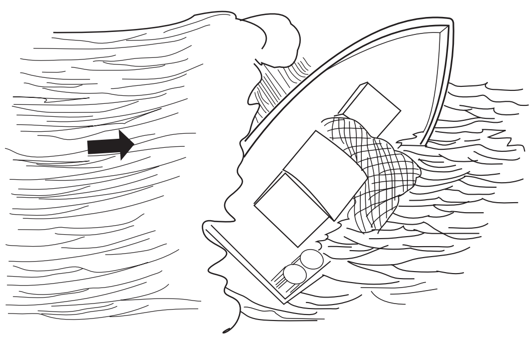
DECKED BOATS – CAUSES OF CAPSIZING



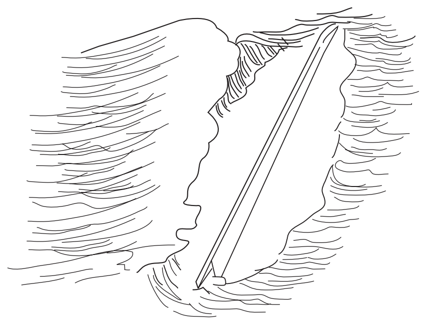
THIS BOAT IS IN DANGER OF CAPSIZING

1. The boat is going full speed in the same direction as the waves.
2. Extra fuel and fresh water are in drums on deck.
3. Heavy fishing gear is on deck.
4. Hatch covers are not lashed down.
5. Freeing ports are small.
6. Freeboard is low.
7. Deckhouse door is open.

The boat is likely to be thrown broadside to the waves and the fishing gear and drums are likely to slide over the bulwark.

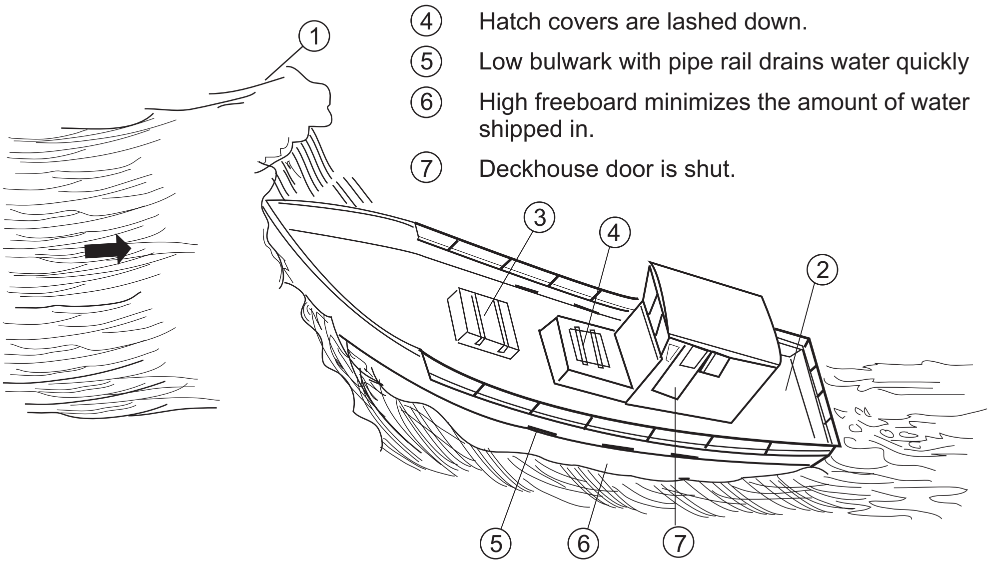


The boat is then likely to capsize with the next large wave.



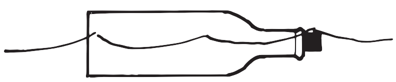
THIS BOAT IS BETTER PREPARED AGAINST CAPSIZING

1. The boat is going slowly against the waves.
2. All fuel and freshwater are in tanks under the deck.
3. Fishing gear is under the deck in bad weather.
4. Hatch covers are lashed down.
5. Low bulwark with pipe rail drains water quickly
6. High freeboard minimizes the amount of water shipped in.
7. Deckhouse door is shut.

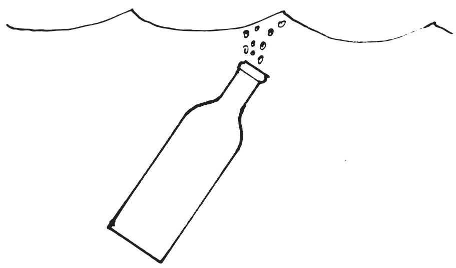


DECKED BOATS – WEATHERTIGHT HATCHES

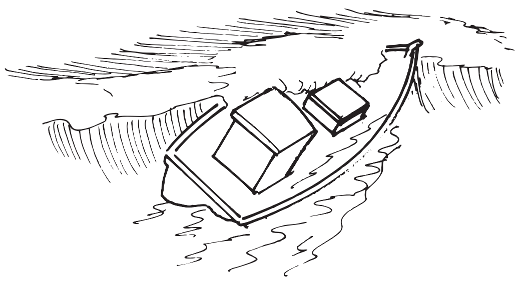
A corked empty bottle will float as long as its cork is in place.



Take the cork out and it will sink.

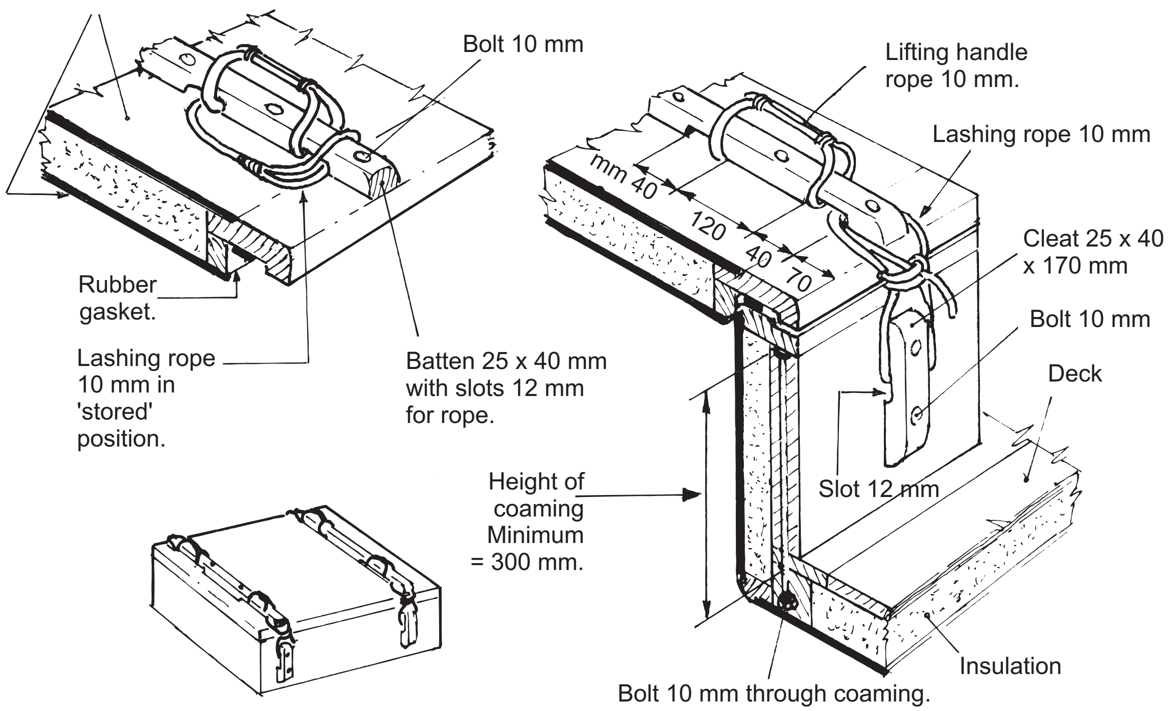


A boat will float as long as its deckhouse is strong and weather tight and the hatch cover is lashed down.



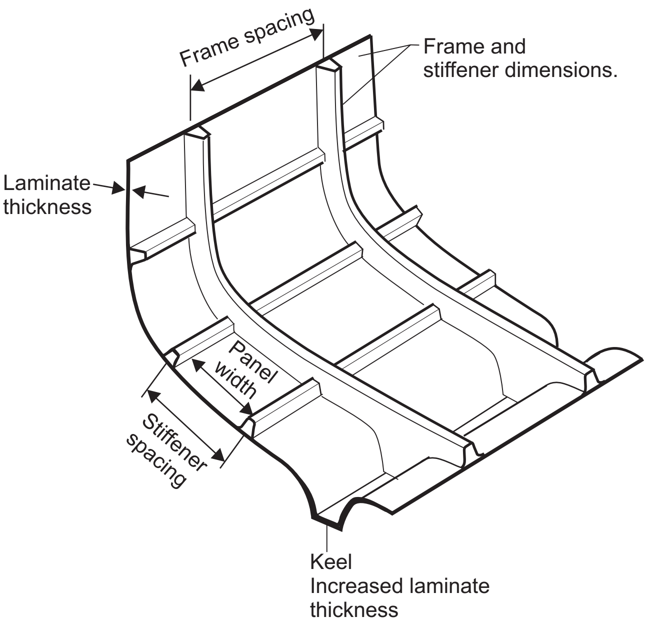
If the hatch covers are not secured, the boat will fill with water and sink.

AN EXAMPLE OF A HATCH COVER LASHING FOR AN INSULATED FISH HOLD THAT WILL NOT SNAG FISHING GEAR



CONSTRUCTION

FIBREGLASS REINFORCED PLASTIC (FRP)



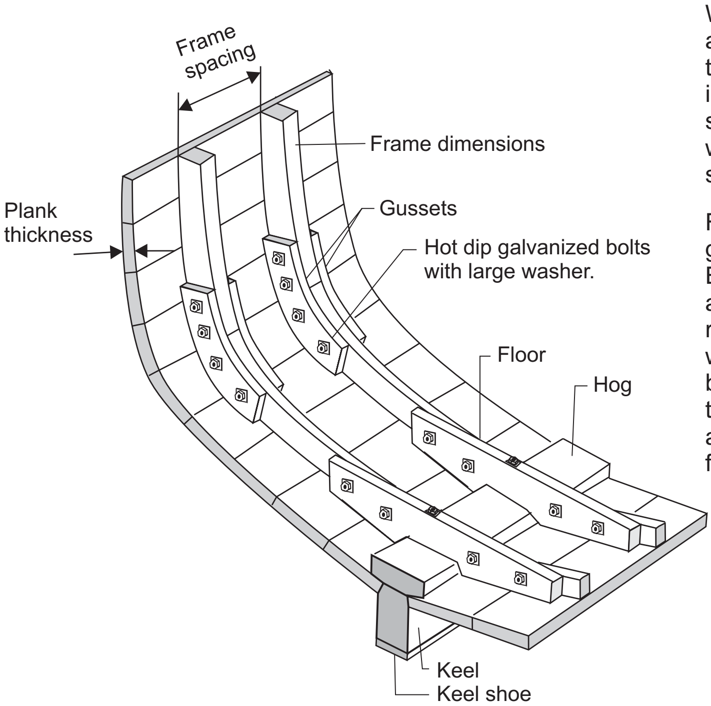
Fibreglass reinforced plastic (FRP) boats should be built up to a standard and not down to a price, which would cost fishermen more money in the long-term because of repairs and short service life.

FRP boats must be made under cover with protection against rain and sun. Properly trained workers are necessary to ensure quality.

The laminate thickness must be sufficient to withstand the local impact that a fishing boat will experience. Added thickness is required for boats operating from beaches with surf.

The skin thickness and the stiffener dimensions must be according to a recognized international standard.

WOOD



Wooden boats should be made according to the best local tradition or according to an international standard. Only well-seasoned boatbuilding timber without bark and crossgrain should be used.

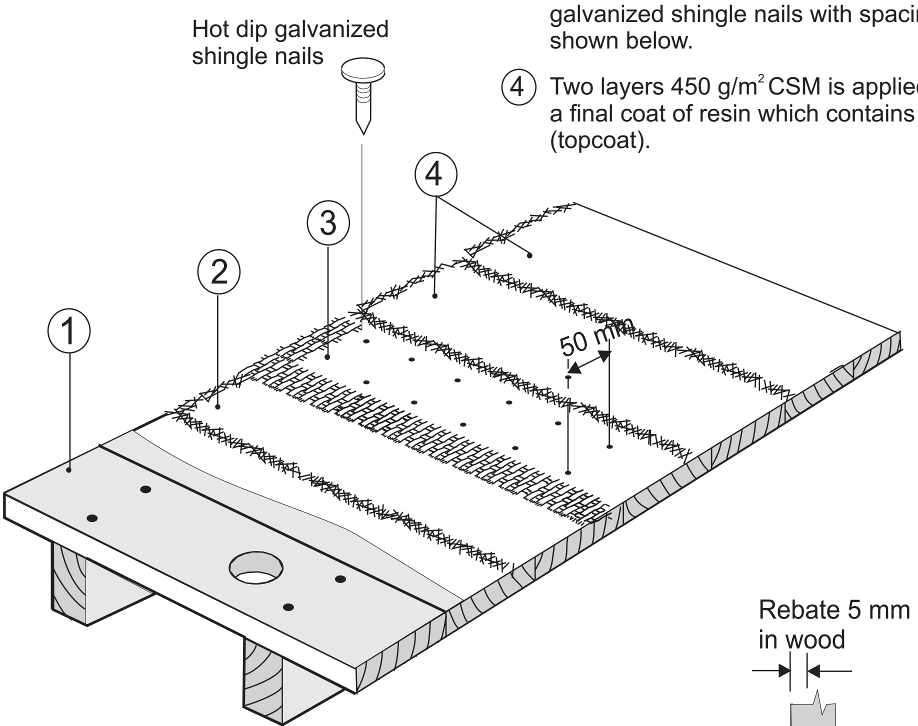
Fastenings should be hot dip galvanized nails and bolts. Electroplated fastenings look nice and shiny, but have low corrosion resistance. Large size galvanized washers must be used under the bolts to prevent crushing the timber. A more expensive alternative is to use copper fastenings.

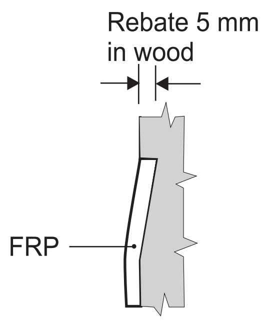
FRP SHEATHING OF WOODEN BOATS

This picture shows the result of poor application of FRP sheathing. The sheathing is too thin and not fastened with nails. It will come loose from the wood, sudden leaks will develop and this will result in the boat sinking. Using the method below will result in a long-lasting sheathing.

Sheathing of wooden hulls with FRP

1. Nail heads are countersunk and covered with polyester filler. Skin fittings are removed. If the wood is very dry it must be wetted to swell it before caulking and applying the sheathing. There is need to remove firm paint.
2. First coat of polyester resin. When the resin is tacky apply a layer of 450 g/m^2 chopped strand mat (CSM) thoroughly wetted.
3. 600 g/m^2 woven roving is then applied before the resin has hardened. Fix with 16 mm galvanized staples or hot dip galvanized shingle nails with spacing as shown below.
4. Two layers 450 g/m^2 CSM is applied and a final coat of resin which contains wax (topcoat).

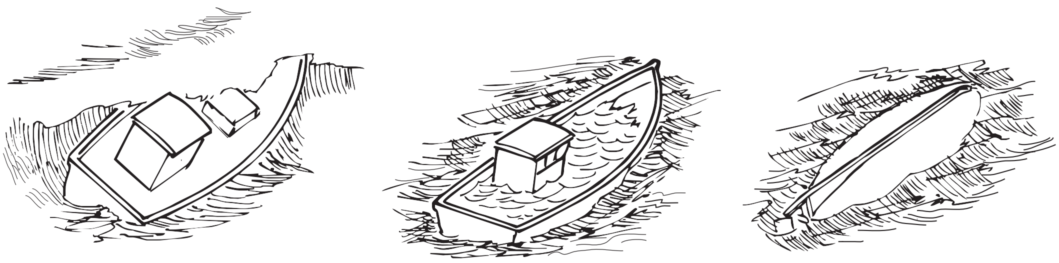




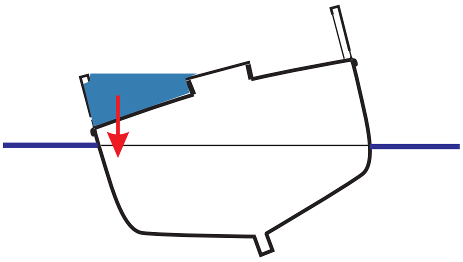
Method approved by United States Coast Guard. For details see book: "*Covering wooden boats with fiberglass*" by A Vaitses.

Correct termination of FRP sheathing.

DECKED BOATS – FREEING PORTS (SCUPPERS)

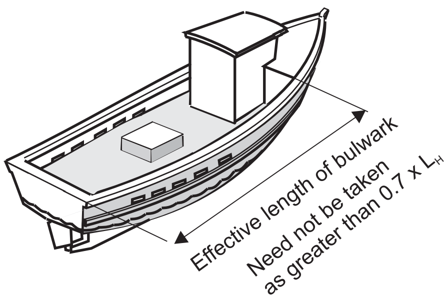


When a large wave fills up the deck, the bulwarks will trap the water unless it is quickly drained away. This heavy load high up is very dangerous for stability and can lead to rapid capsizing.



Water trapped inside the bulwark is dangerous

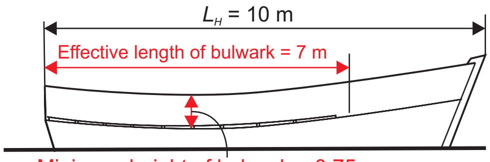
A low bulwark will reduce the risk of trapping water but increase the risk of people falling overboard.
The minimum height of the bulwark should be 0.75 m.



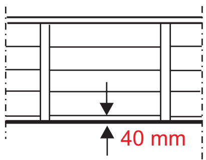
Area of bulwark = effective length x height (m^2)

Required area of freeing ports on each side:
Category A and B = 0.05 x area of bulwark (m^2)
Category C and D = 0.03 x area of bulwark (m^2)

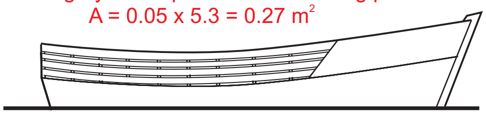
EXAMPLE 4. 10 m (33 ft) Boat

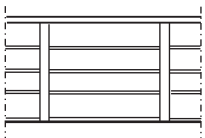


Minimum height of bulwark = 0.75 m
Area of bulwark = 0.75 x 7 = 5.3 m^2
Category B: Required area of freeing ports:
A = 0.05 x 5.3 = 0.27 m^2

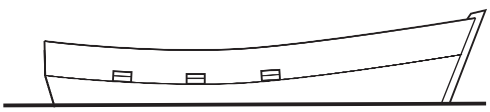


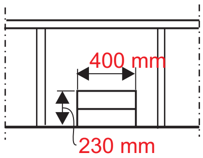
A gap of 40 mm along the effective length of the bulwark along the deck will give sufficient freeing port area (0.04 x 7 = 0.28 m^2).



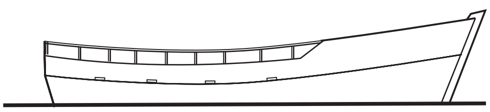


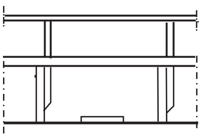
A good way of providing freeing ports is to have a gap of 15 mm between the bulwark planks.





Three large freeing ports of the dimension shown will give sufficient area. There must be a grid with maximum 150 mm spacing in the opening.

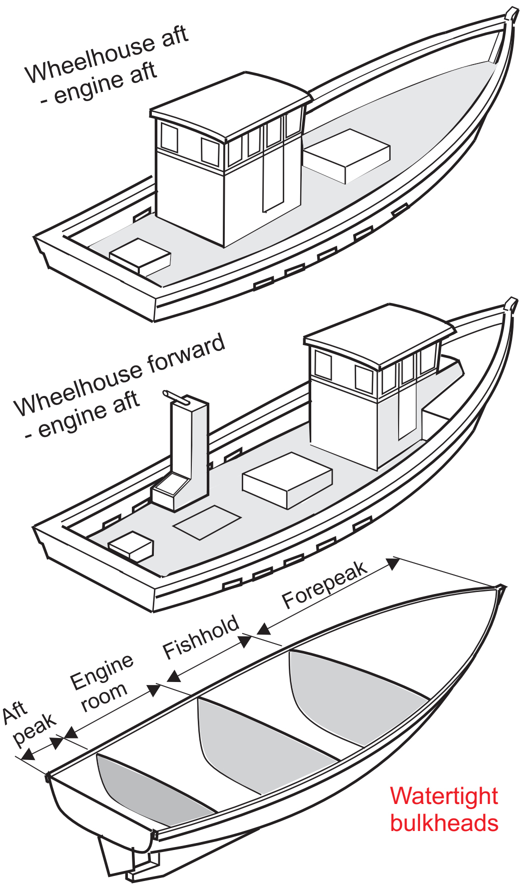




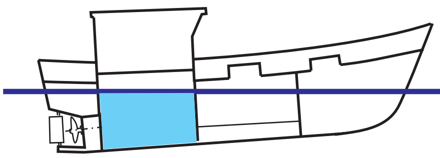
A good system is to have a low bulwark with a pipe rail above giving a good handgrip.

Note: FAO/ILO/IMO Standards recommend a minimum height of 1 m for bulwarks.

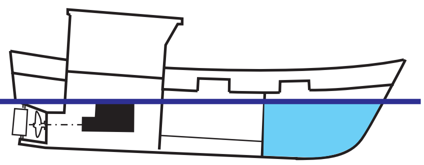
DECKED BOATS – WATERTIGHT BULKHEADS

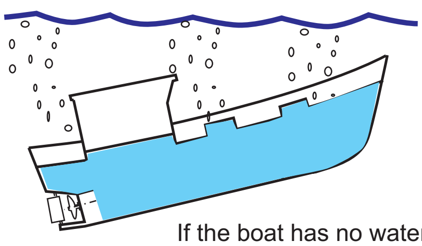


A leak in the engine room is often caused by a corroded seacock, damaged seawater hoses, faulty installation of a wet exhaust pipe or a leaking propeller shaft stuffing box. If the buoyancy of the aft peak is sufficient, the boat will float.



Running aground could lead to the boat flooding. A forward watertight bulkhead will prevent the whole boat from flooding.





If the boat has no watertight bulkheads and if the bilge pump cannot cope with the leak, the boat will certainly sink.

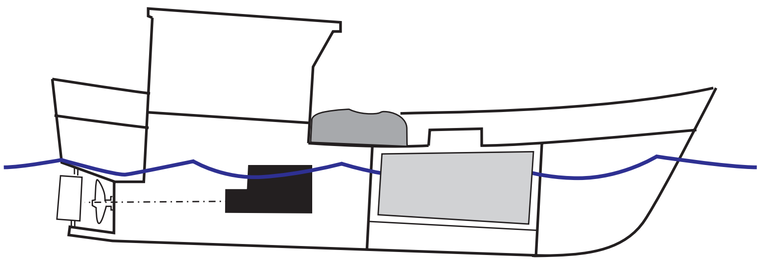
It is relatively easy to make watertight bulkheads in FRP, steel or aluminium boats.

With the use of plywood bulkheads and care in construction it is also possible in wooden boats.

Watertight bulkheads are easier to achieve with engine aft because there is no need for watertight glands where the propeller shaft penetrates the bulkheads. Engine aft can also be combined with wheelhouse forward.

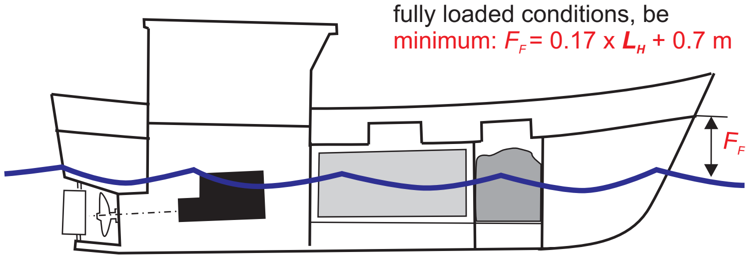
DECKED BOATS – GENERAL ARRANGEMENT

EXAMPLE 5. 10-12 m (33-40 ft) Fishing boat doing large mesh driftnetting

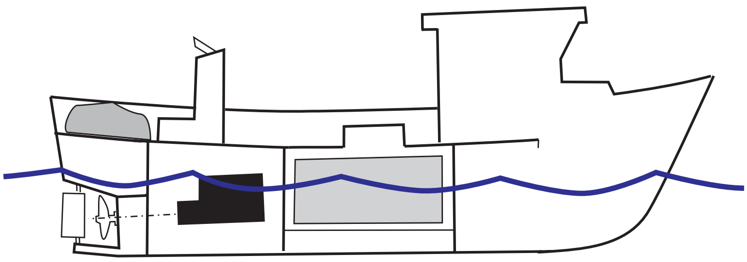


The fish-hold is too far forward. Boat is trimming by the bow when the fuel tanks are nearly empty and the fishhold is full when arriving in port. The boat will be difficult to steer. This can be dangerous in heavy waves where good rudder response is important. Bow freeboard is low which increases the risk of waves breaking over the bow.

For acceptable safety, the freeboard forward should, under fully loaded conditions, be minimum: $F_F = 0.17 \times \boldsymbol{L_H} + 0.7$ m

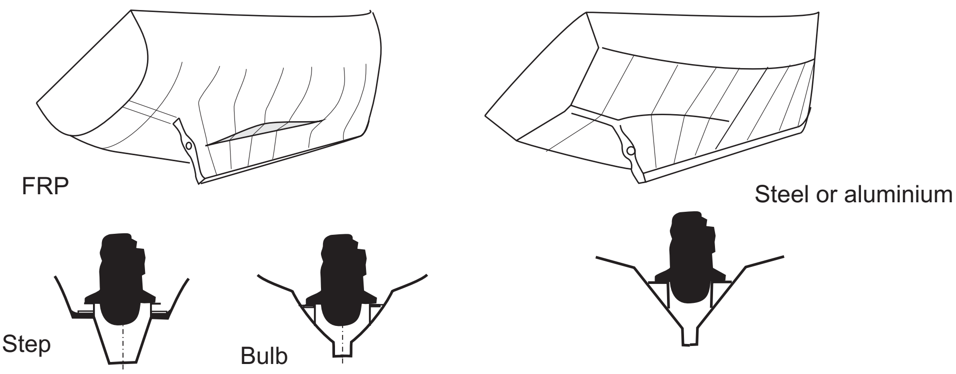


The engine is placed further aft which makes it possible to have the fishhold midship. The fishing net can be kept in a nethold during bad weather. The trim of the boat is much improved.



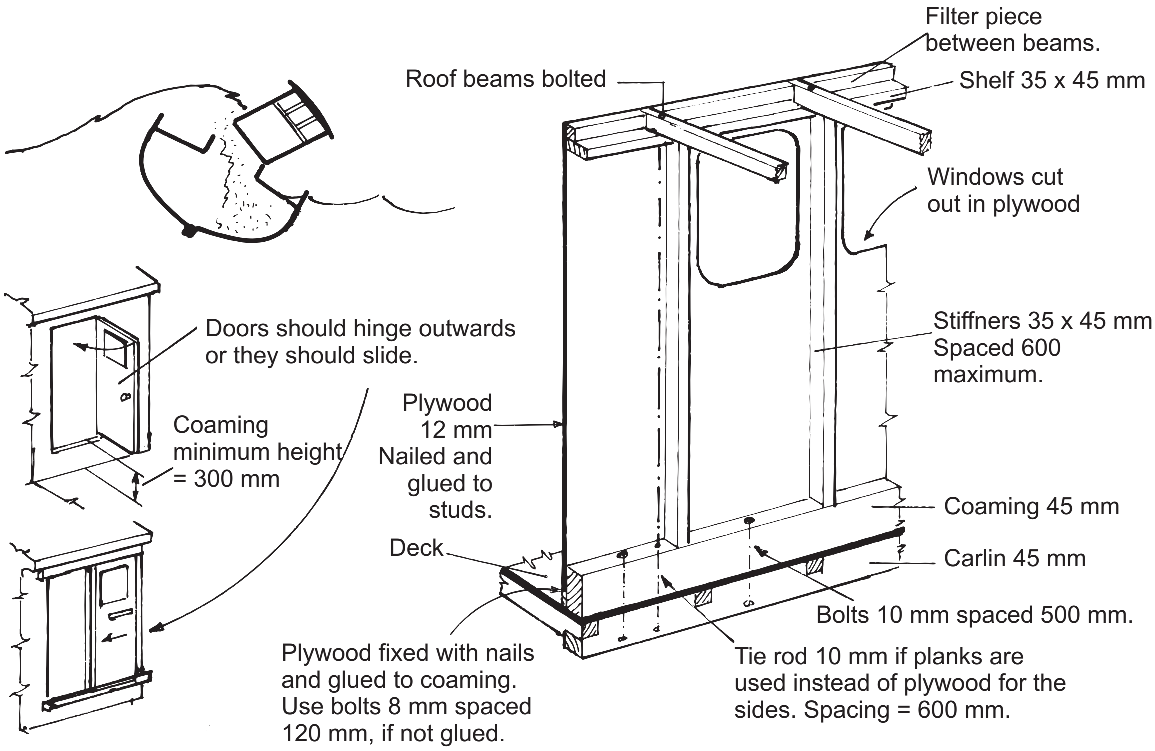
The deckhouse is forward. Access to the engine is through a hatch with high coaming placed towards the side of the boat. The engine can be removed through a flush hatch bolted watertight to the deck.

Possible change in hull shape in the afterbody to permit moving the engine further aft.



DECKHOUSE CONSTRUCTION

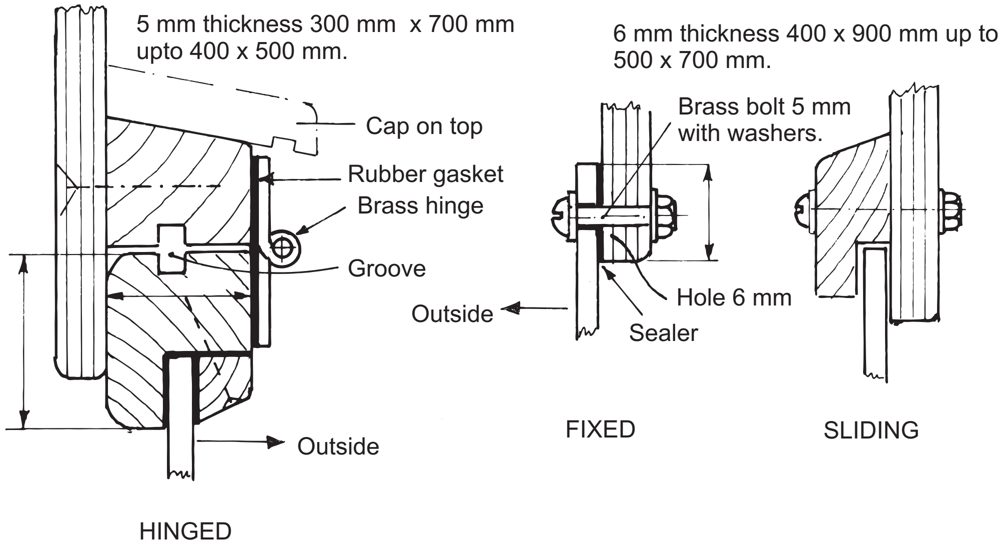
The deckhouse is often the weakest part of a boat.
One large wave might knock it overboard and fill the boat.



WINDOWS

Windows should be fixed outside the plywood for adequate strength. Window panes should be made of safety glass, as used in cars, in acrylic (Perspex) or polycarbonate.

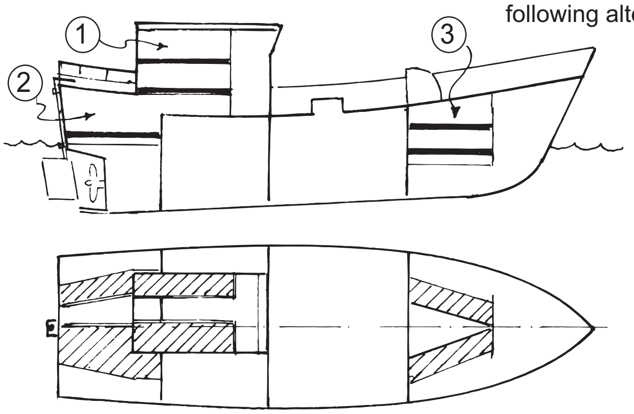
The thickness should be according to window size (mm).



CREW ACCOMODATION

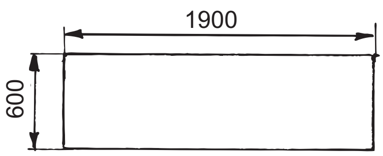
RESTED CREW MAKE FEWER MISTAKES

The number of berths should be at least the number of crew less one person who will be on duty.

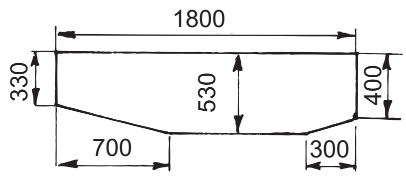


In a boat with an aft deckhouse, there are the following alternatives (listed in order of priority):

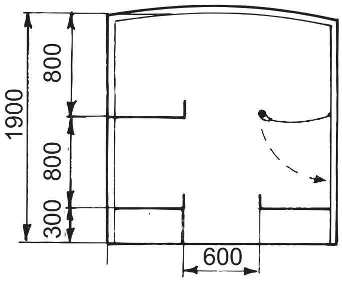
1. Deckhouse. Good ventilation.
2. Aft peak. Difficult to get good ventilation. Double berth necessary to utilize space. Note that an outside rudder saves a lot of space. Raised aft-deck may be needed.
3. Fore peak. Difficult to get good ventilation (except with deckhouse forward). Uncomfortable when the boat is pitching.

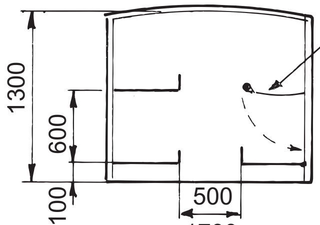


This is the normal size of a berth and should be preferred.

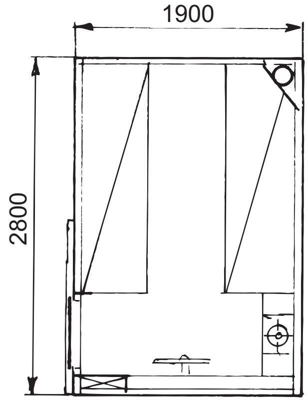


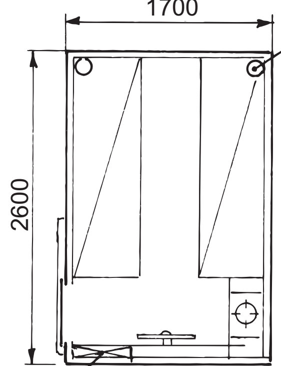
This is the minimum size of a berth.
Use foam mattresses that are covered with a material that does not easily catch fire.





Pipe berth folds down during the day.





Engine room ventilation duct.

Engine room ventilation duct.

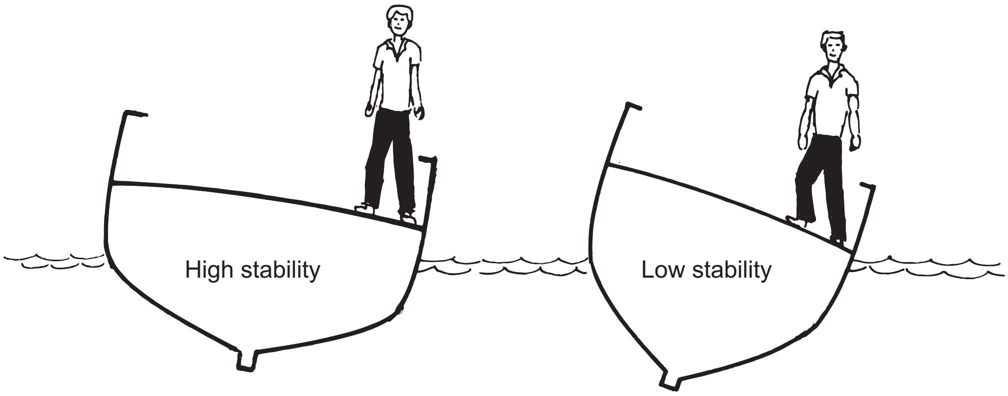
Normal space requirement in deckhouse.

Minimum space requirement.

All dimensions are in mm

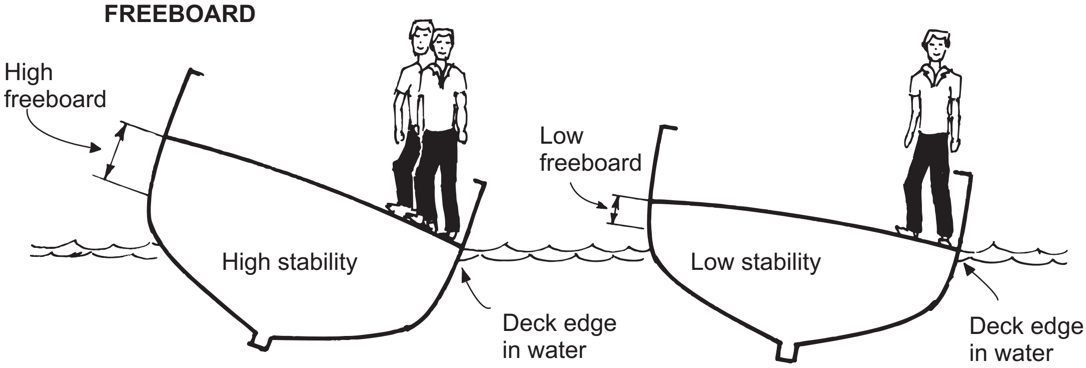
DECKED BOATS – STABILITY

BEAM

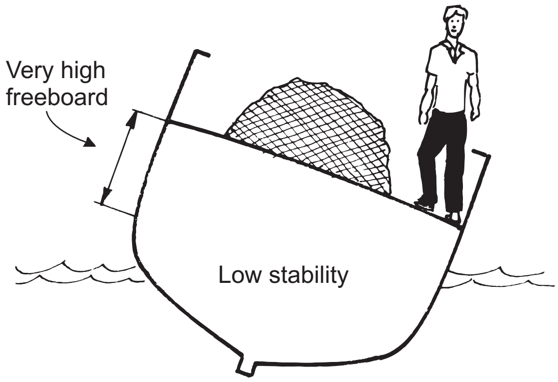


When a person walks to one side of a broad-beamed boat, it will not heel over as much as a narrow boat. A beamier boat has more stability.

FREEBOARD



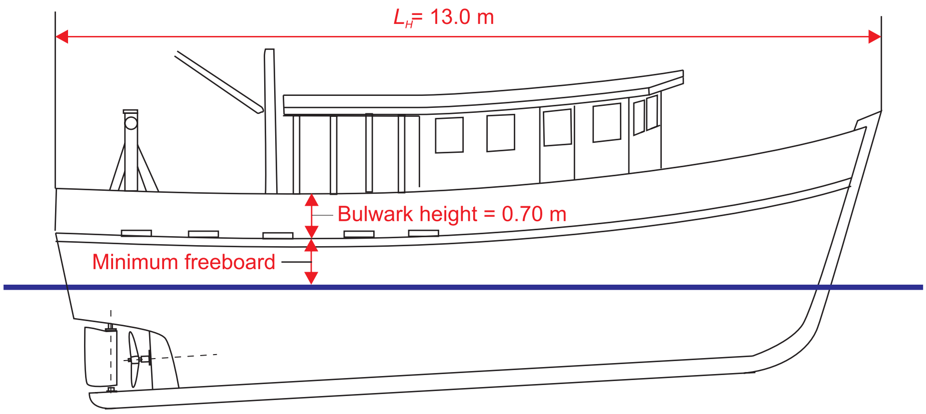
Comparing two boats with the same beam but different freeboards, the one with the higher freeboard has more stability and is able to take more people at the deck edge before the deck touches the water.

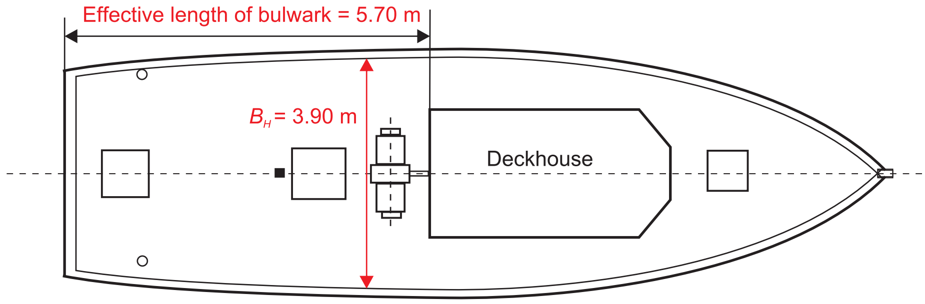


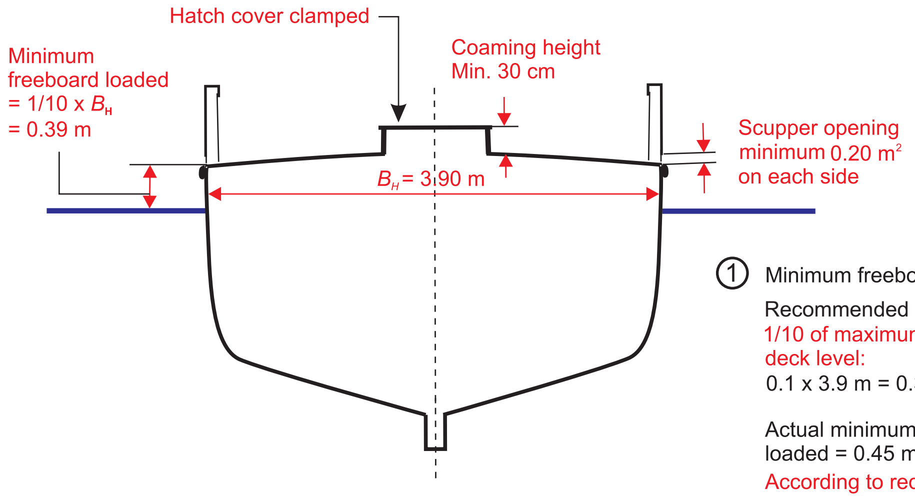
The freeboard is, thus, very important for the safety of a fishing boat. However, if it is increased too much, the boat will lose stability more quickly than a boat with less freeboard. This will happen if heavy fishing gear is put on deck. So, a compromise has to be found to select the optimum freeboard.

DECKED BOATS UNDER 15 m – SAFETY CHECK

EXAMPLE 6. 13 m (43 ft) Shrimp trawler from Visakhapatnam in India







(1) Minimum freeboard, loaded.

Recommended minimum freeboard: 1/10 of maximum beam at deck level:
0.1 x 3.9 m = 0.39 m.

Actual minimum freeboard, loaded = 0.45 m.
According to requirement

(2) Minimum area of scuppers on each side of the boat:
= 0.05 x Bulwark area for category B

Bulwark effective length covering the main deckarea up to the wheelhouse = 5.70 m. Bulwark height = 0.70 m

Bulwark area = 0.70 x 5.70 = 4.0 m^2

Minimum area of scuppers on each side = 0.05 x 4.0 = 0.20 m^2

This correspond to an opening along lower edge of the bulwark with the height.
: 0.20/ 5.70 = 0.035 m = 3.5 cm

Actual area of the scuppers = 0.10 m^2 $<$ 0.20 m^2
Not according to requirement.

(3) Hatch coaming
Minimum height of the hatch coaming and coamings to deck house = 300 mm
Actual height of the coamings = 200 mm
Not according to requirement

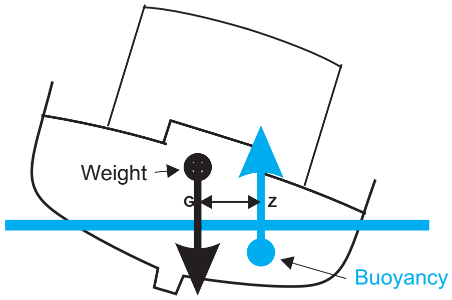
(4) Hatch cover clamped in place when not fishing.
Actual: Hatch cover is loose.
No method of clamping.
Not according to requirement.

DECKED BOATS UNDER 15 m – OVERLOADING PRECAUTION

HEAVY FISH CATCH ON DECK AND OVERLOADING ON DECKHOUSE
SHOULD BE AVOIDED

STABILITY OF BOATS IN CATEGORY A AND B

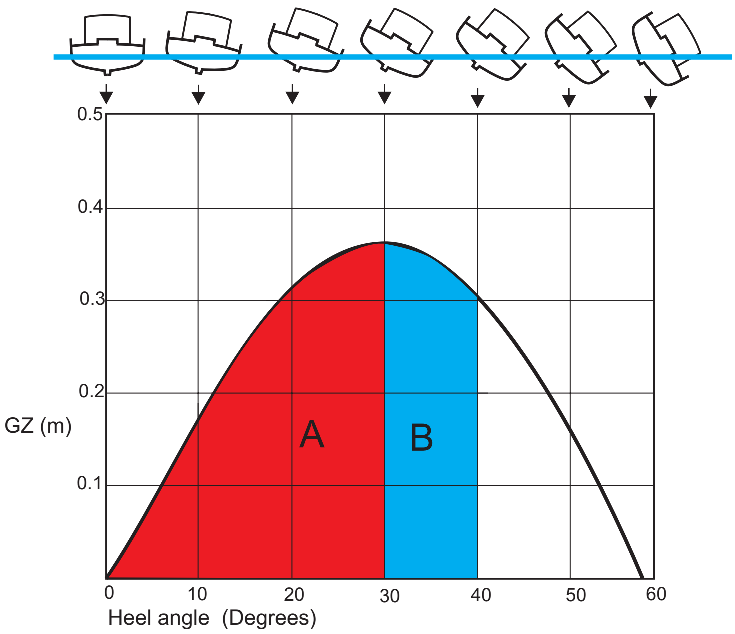
Boats in category A and B should have a complete stability check by calculating the GZ curve in various operating conditions and verifying the height of the centre of gravity with an inclining test after the boat has been launched.



The righting lever G Z is calculated at various angles of heel

Operating conditions for which G-Z is calculated

1. Departure for fishing grounds with full fuel, provision, ice, fishing gear, etc.
2. Departure from the fishing grounds with full catch, 30 percent provision, fuel, etc.
3. Arrival at port with full catch and 10 percent provision, fuel, etc.
4. Arrival at port with 10 percent stores, fuel and minimum catch, which should normally be 20 percent of full catch.



GZ curve

Stability criteria for decked vessels of design category A and B

1. The area A under the righting lever curve (GZ curve) should not be less than 0.055 m-rad up to 30° angle of heel and not less than 0.09 m-rad up to 40° or the angle of flooding θ_f if this angle is less than 40°. Additionally, the area under the righting lever curve between the angles of heel of 30° and 40° (B) or between 30° and θ_f, if this angle is less than 40°, should not be less than 0.03 m-rad. θ_f is the angle of heel at which openings in the hull, superstructures and deckhouses, that cannot be rapidly shut watertight, begin to immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

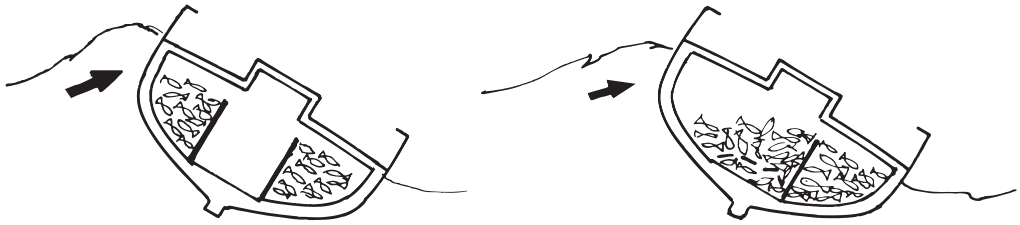
2. The righting lever GZ should be at least 200 mm at an angle of heel equal to or greater than 30°. The righting lever GZ may be reduced to the satisfaction of the competent authority but in no case by more than 2(24 - L_H) percent.

3. The maximum righting lever GZ should occur at an angle of heel preferably exceeding 30° but not less than 25°.

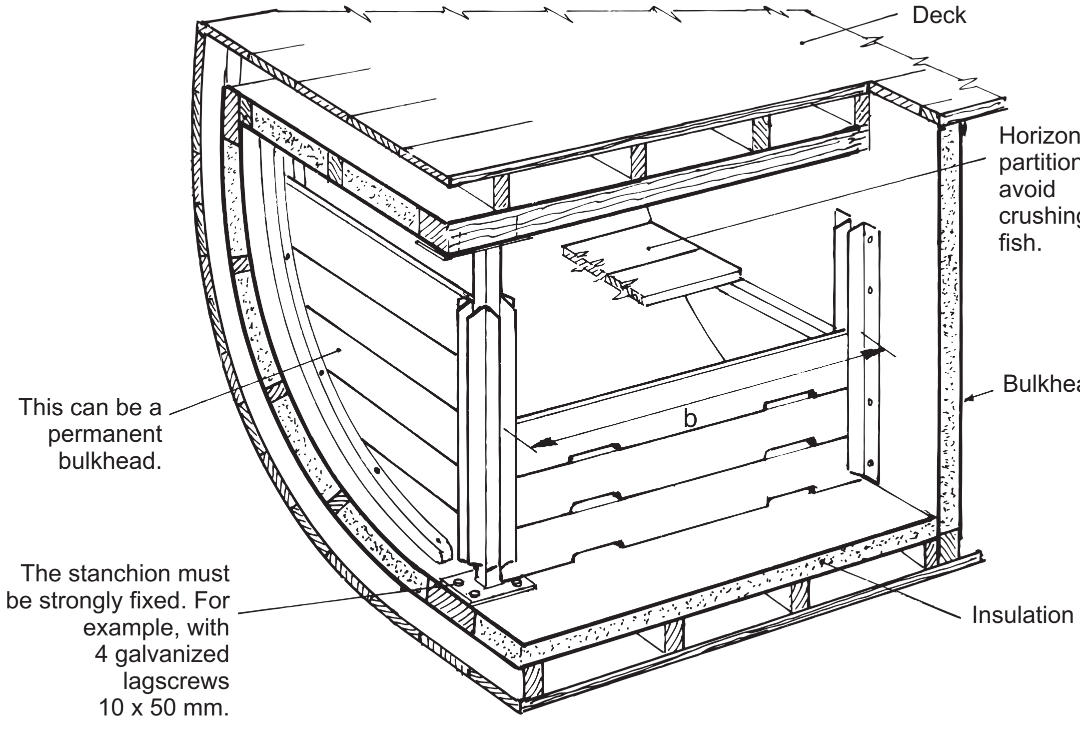
4. The initial metacentric height GM_0 should be not less than 350 mm.

DECKED BOATS – FISH HOLD – PENBOARDS

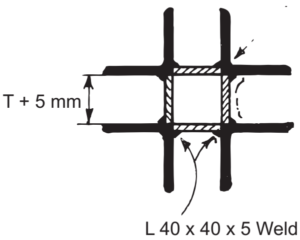
The penboards and penboard stanchions must be strong enough to prevent the fish and ice sliding to one side when the boat is hit by wave.

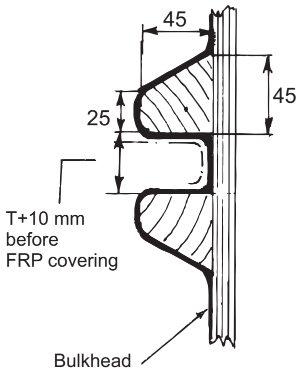


The boat could capsize



It is best to make the stanchions for the penboards of extruded aluminium or of welded and galvanized steel.
Hard wood can also be used.

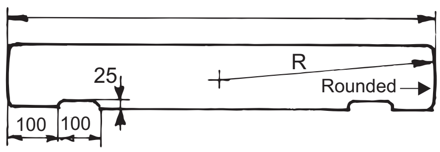




The thickness of the penboard depends on the span b:

Span b (cm)	80	90	100	110
Thickness (mm)	20	21	22	23

Distance between stanchions less 1000 mm



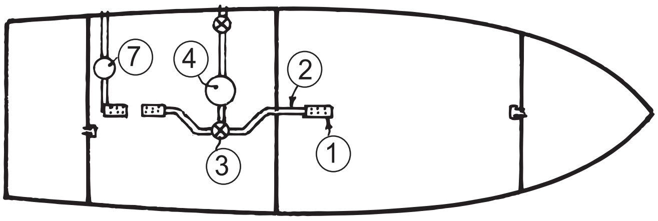
Wooden penboard

Aluminium penboards are best because they are easy to keep clean.

All dimensions are in mm

DECKED BOATS – BILGE PUMP SYSTEM

All decked boats should have two pumps; an engine-driven one and a manual driven one to pump out water. The following system is suitable for a boat where the engine room and the fish-hold have watertight bulkheads: (1) Strainer easily accessible and connected with a flexible pipe so that it can be lifted out and cleaned. (2) Pipes must be oil-resistant and reinforced so that they do not collapse under suction. Diameter must be al least the same as the pump inlet. (3) Three-way valve, alternatively two valves of stainless steel or bronze. Ball valves are preferable to gate valves because “on” and “off” positions are easily seen. (4) Engine-driven pump, self-priming of the following capacity:



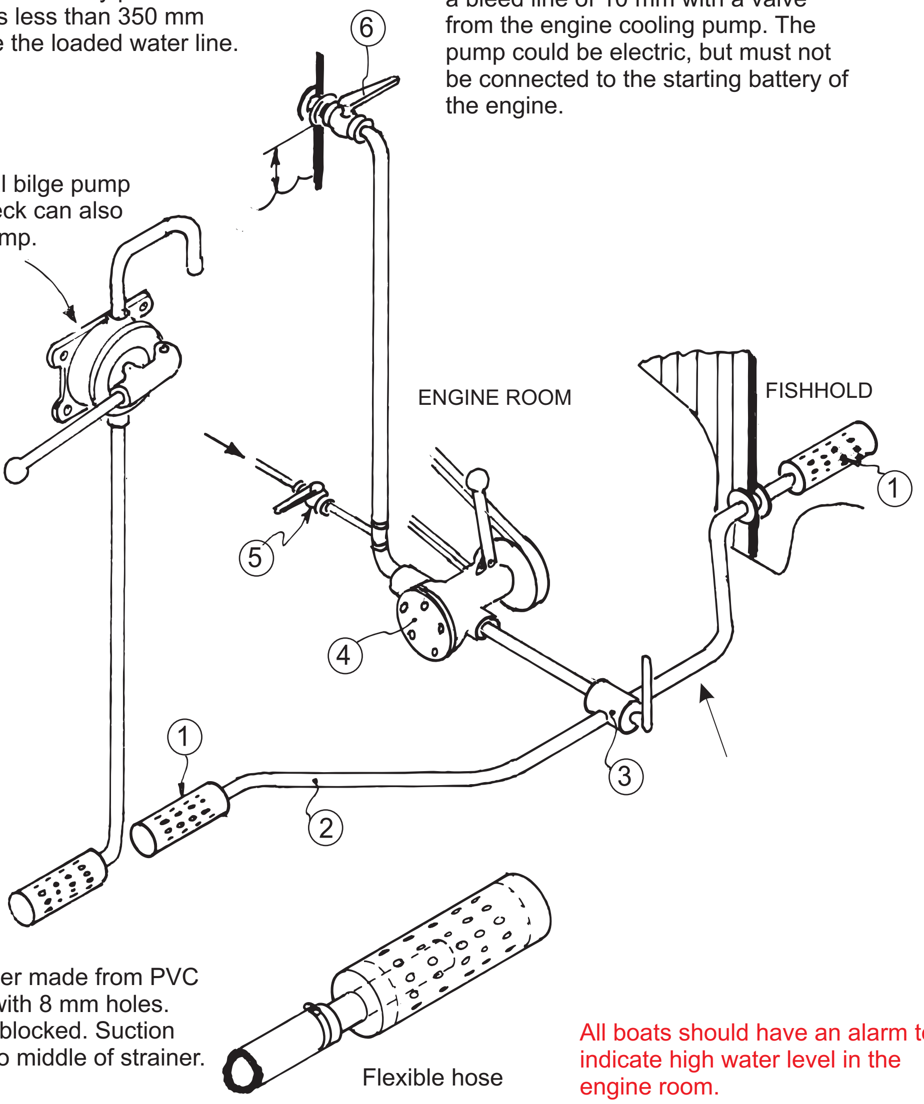
Boats < 6 m: Bucket or hand operated pump with 70 litre /min capacity.

Boats 6 - 15 m: One hand operated and one power driven pump of minimum 70 litre/min. Total capacity = 140 litre/min

(6) A valve must be used if the outlet or any part of the pipe is less than 350 mm above the loaded water line.

(5) A rubber impeller pump must have a bleed line of 10 mm with a valve from the engine cooling pump. The pump could be electric, but must not be connected to the starting battery of the engine.

(7) The manual bilge pump fixed above deck can also be a piston pump.

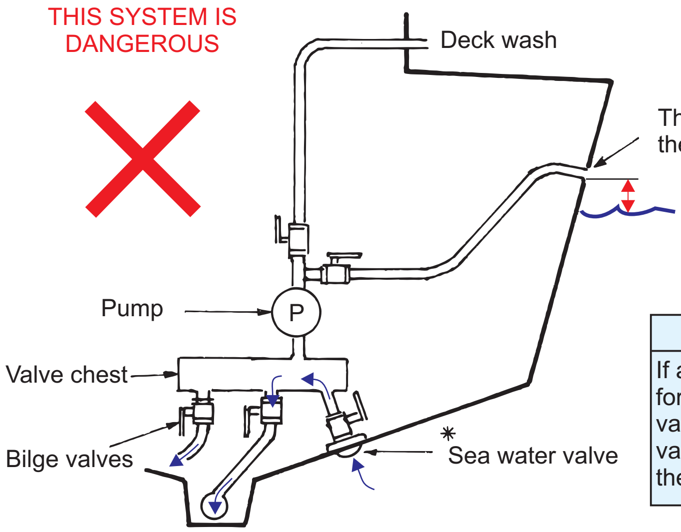


Strainer made from PVC pipe with 8 mm holes. Ends blocked. Suction pipe to middle of strainer.

All boats should have an alarm to indicate high water level in the engine room.

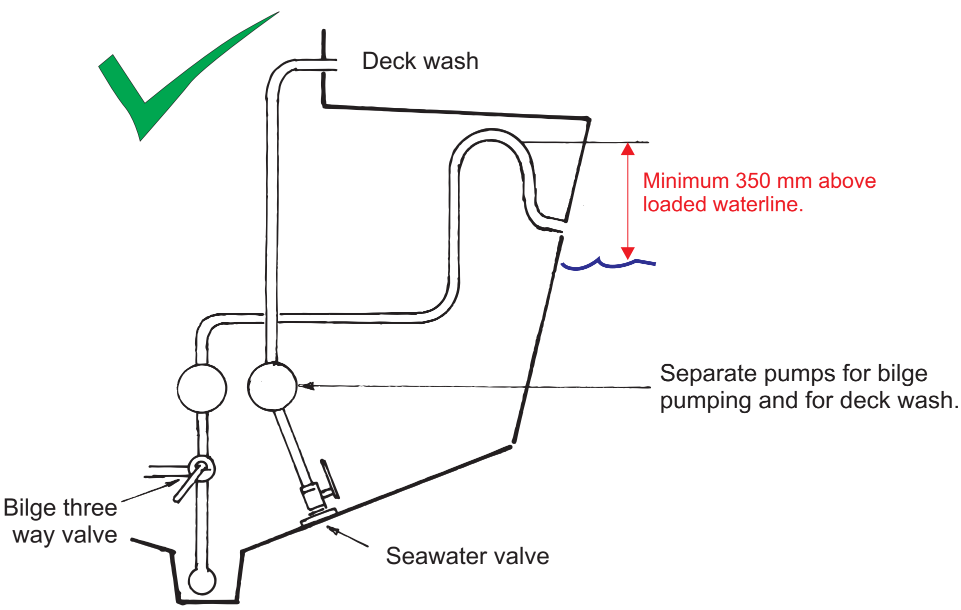
BILGE PUMP – DECK WASH SYSTEM

A seawater outlet on the deck that can be used for cleaning fish as well as washing the deck and fish-hold is very convenient. On some boats, the bilge pump is used for this purpose, but experience has shown that this has, in many cases, resulted in seawater accidentally entering the bilges and the boat sinking.

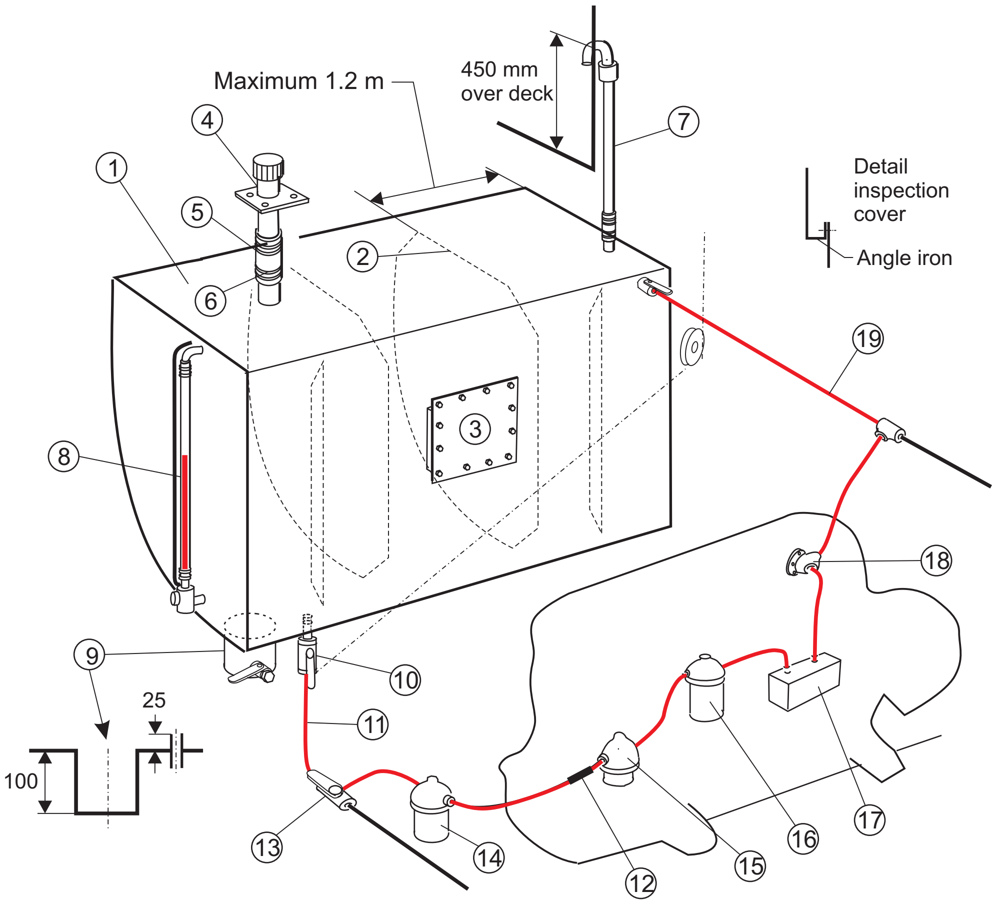


WARNING
If a negligent crew member forgets to close the seawater valve, when opening the bilge valves, seawater will flood into the bilges when the pump stops.

THIS IS A BETTER SYSTEM



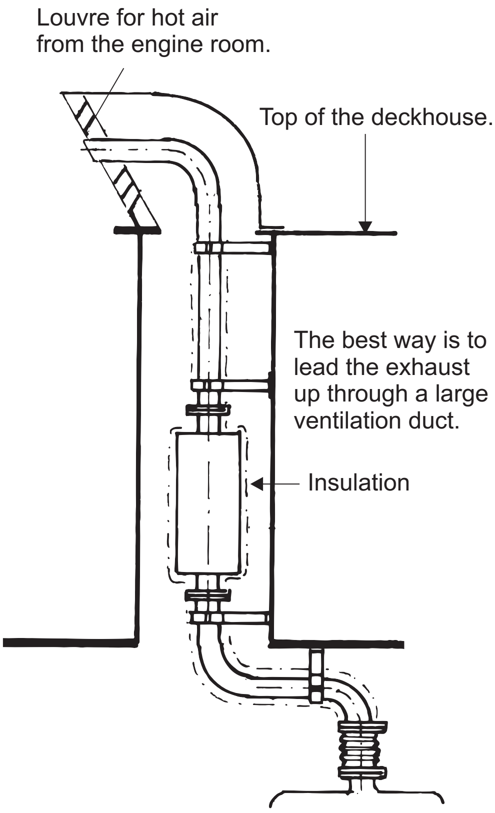
FUEL SYSTEM



Poor installation and dirty fuel are frequent causes of engine breakdown.

1. Tank welded from steel plate. 4 mm plate up to 400 litre, 5 mm plate up to 4 500 litre. Stiffeners are required for panels larger than 0.4 m^2 for 4 mm plate and 0.55 m^2 for 5 mm plate. Use anti corrosive paint.The tank must be leak tested before use and must be strongly fixed to the boat structure.
2. Tanks with more than 1.2 m in one direction need baffles of the same thickness as the tank.
3. Inspection cover for cleaning the tank, minimum 200 x 200 mm, bolted and with oil resistant gasket.
4. Filler pipe of minimum inner diameter = 38 mm with screw cap above deck.
5. Short flexible and diesel resistant hose.
6. All hoseclips to be of stainless steel doubled up.
7. Ventilation pipe of minimum 12 mm inner diameter leading to outside.
8. Fuel gauge with self closing shut off valve at the bottom. Protected against damage. Alternatively, check fuel level with stick through filler pipe.
9. Sump with drain valve blanketed with a plug.
10. Stop valve with possibility of shutting off from outside the engine room by use of a wire in case of fire.
11. Seamless annealed copper pipe with wall thickness of atleast 0.8 mm fixed in place with clamps.
12. Short length of fire resistant flexible metal braided fuel hose close to engine to resist vibrations.
13. Three way valve to connect the two fuel tanks.
14. Primary fuel filter and water separator.
15. Fuel pump.
16. Engine fuel filter.
17. Injector pump.
18. Injector.
19. Fuel return pipe, seamless annealed copper.

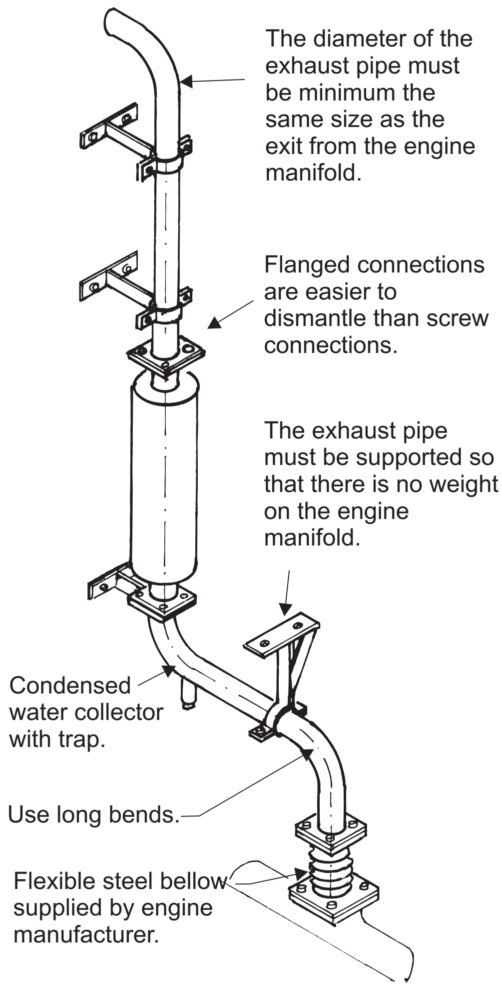
DRY EXHAUST SYSTEM



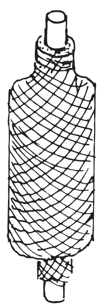
Dry exhaust systems should be leakproof to prevent toxic fumes.

Pipes gets very hot and must be insulated.

There must be a minimum clearance of 100 mm from wood or FRP.

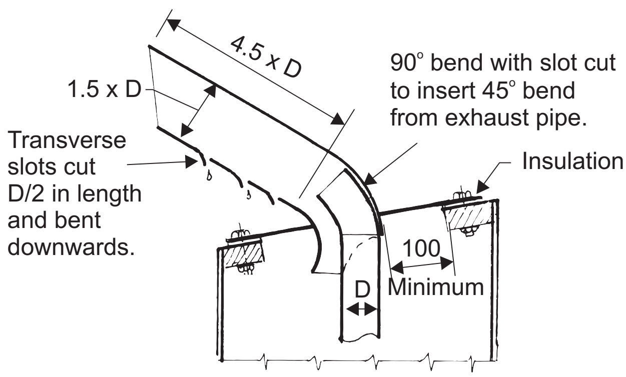


INSULATION



The exhaust pipe and silencer must be covered with glasswool or rockwool insulation and protected by a suitable cover such as a thin aluminium sheet.

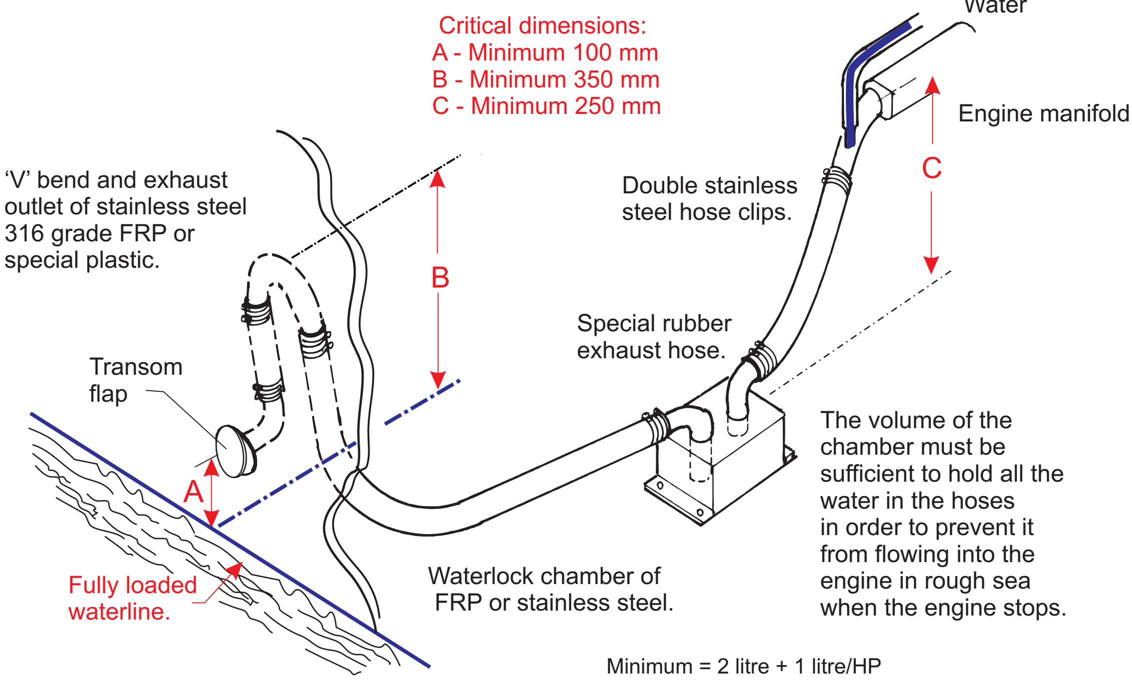
EXHAUST AIR EJECTOR

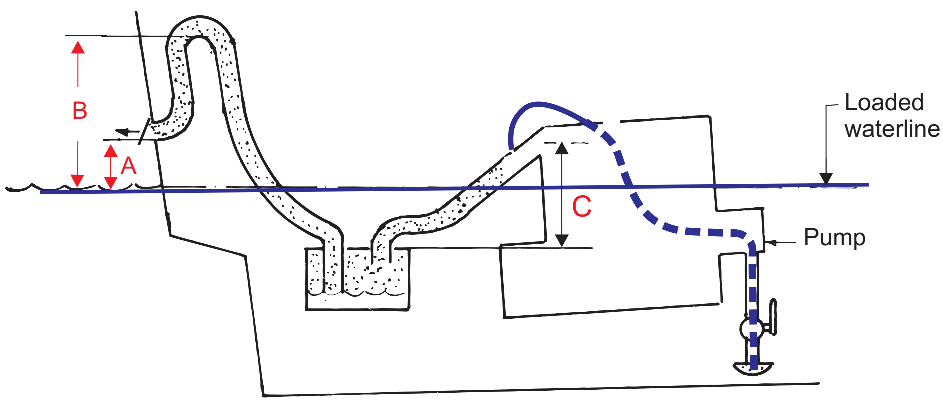


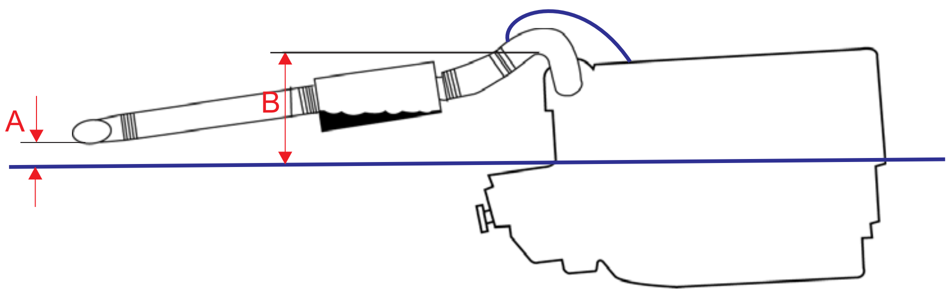
The ejector will suck warm air from the engine room and improve ventilation considerably. Based on recommendation from Caterpillar Diesels Ltd.

WET EXHAUST SYSTEM – ENGINE MANIFOLD ABOVE LOADED WATERLINE

If the wet exhaust system is not correctly installed, water can enter into the cylinders through the exhaust. This will happen in rough seas and when the engine stops.





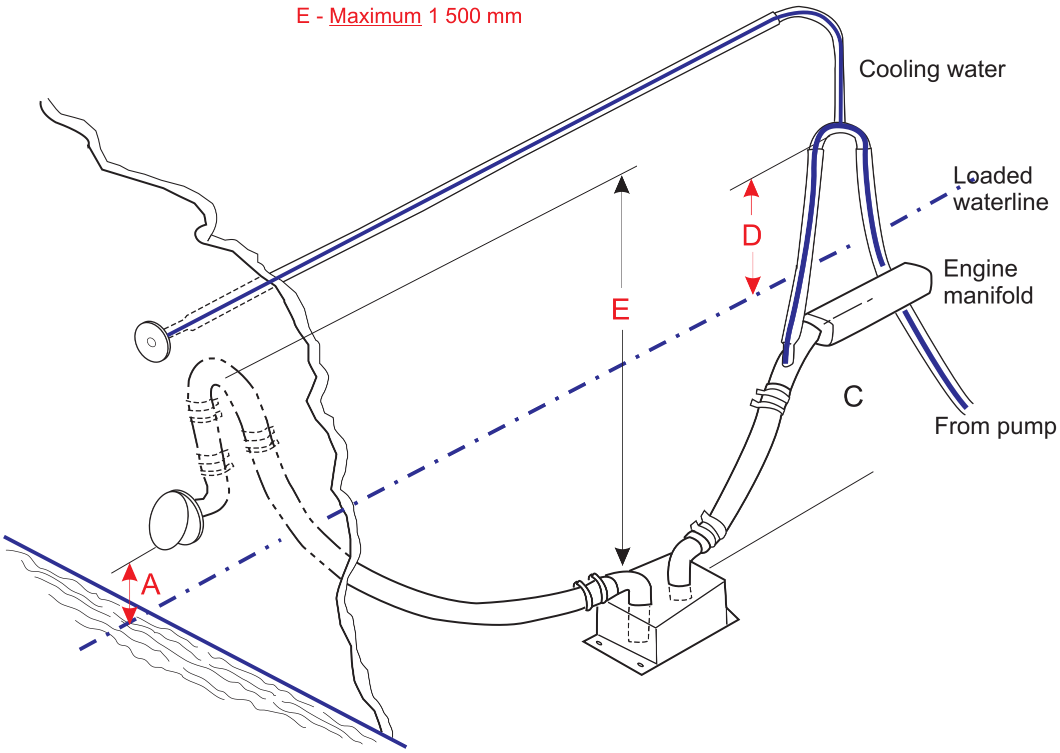


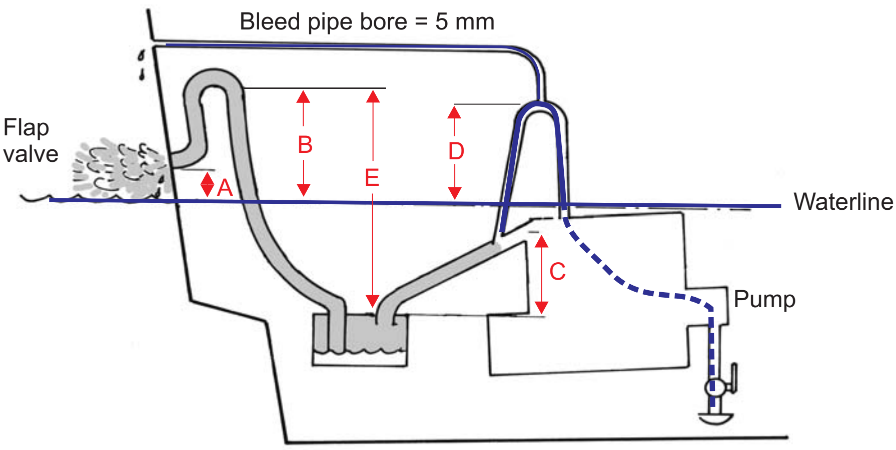
WET EXHAUST SYSTEM – ENGINE MANIFOLD BELOW LOADED WATERLINE

When the engine stops, water will siphon in through the waterpump, fill the exhaust system and enter the cylinders. An anti-siphoning bleed pipe of inner diameter = 5 mm must be connected to the highest point of the cooling water pipe and discharge overboard. It can be made of clear plastic tube and led through the wheelhouse to indicate whether cooling water is circulating.

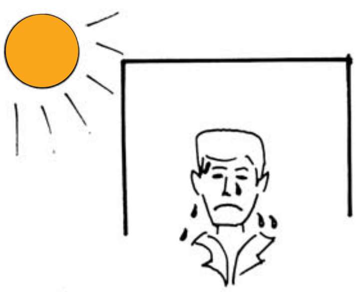
Critical dimensions:

A - Minimum 100 mm
B - Minimum 350 mm
C - Minimum 250 mm
D - Minimum 300 mm
E - Maximum 1 500 mm





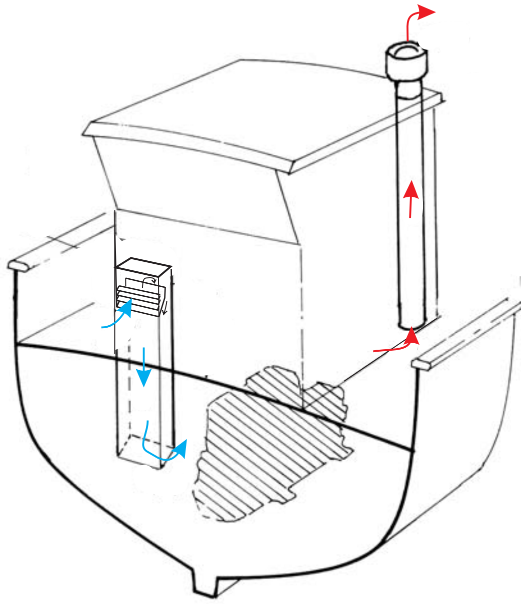
ENGINE ROOM VENTILATION



Would you like to be in a room without ventilation on a hot day?

Your engine does not like it either. It needs plenty of fresh air for combustion. If the air in the engine room gets too hot, it will produce less power.

In a home, there is often a fan over the stove that sucks warm air out of the room. If warm air is drawn out, fresh air will automatically replace it if there are openings from the outside. The same principle must be used on a boat. How to get rid of hot air is the first question. The next question is how to supply fresh air from the outside.

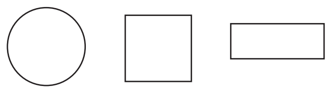


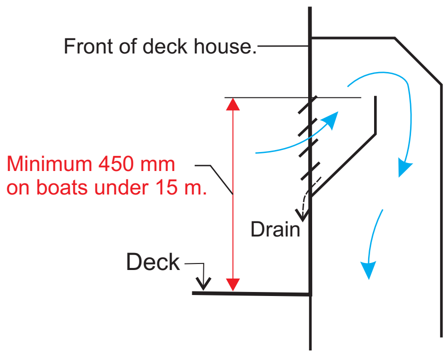
The intake in the engine room for the hot air duct should be located high up and away from the cool air outlet. For larger engines there must be an electric fan sucking the air out. Follow the engine manufacture's instructions.

If the engine has a dry exhaust system it is possible to place the exhaust pipe in the outlet ventilation duct and get an effective ejector action as shown under the dry exhaust system.

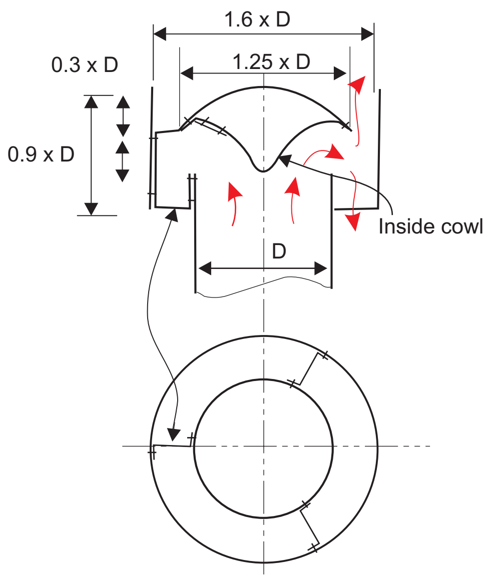
For tropical countries the cross sectional area of the air ducts should be 10 cm^2 per kW engine power (8 cm^2 per HP).

The air ducts can have different sections as long as the cross-sectional area is the same.



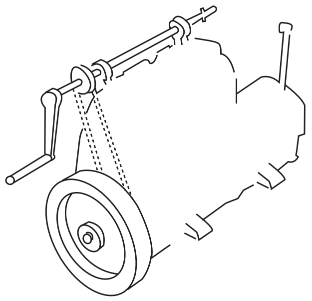


TYPICAL AIR INTAKE
with louvres



EFFICIENT AIR OUTLET COWL

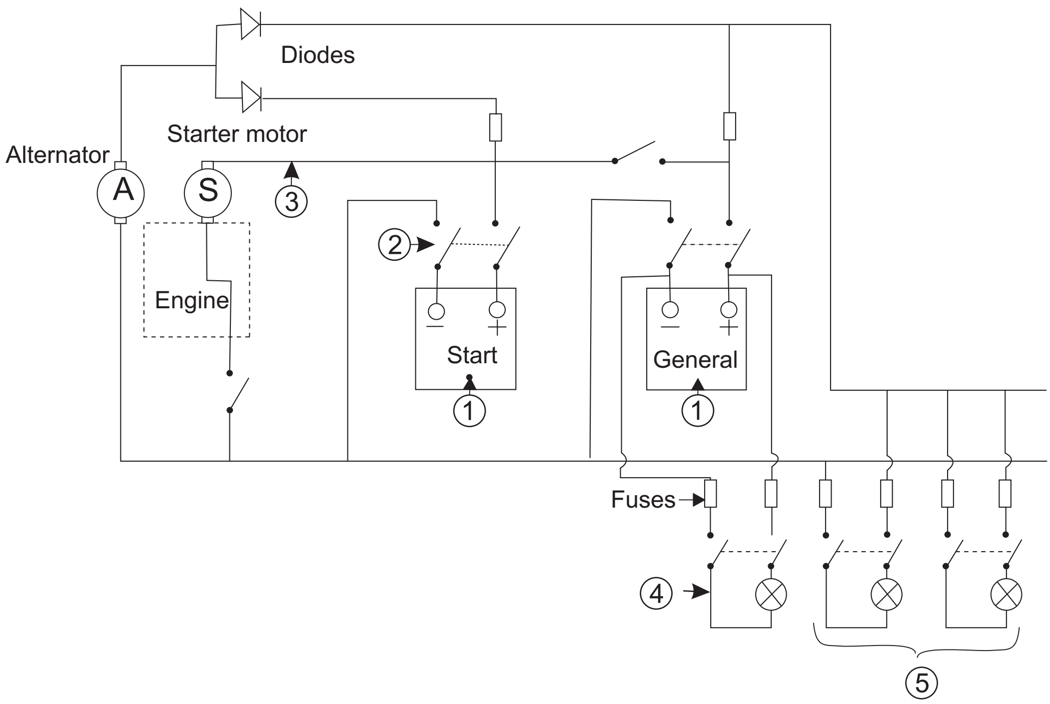
ELECTRICAL SYSTEM



Hand starting is the most dependable starting method in the tropics. Preferably choose an engine with hand starting even if it is fitted with an electric starting system.

REMEMBER that space is required in front or aft of the engine for one or two men to exert full force whilst starting the engine.

Electrical systems are vulnerable in the tropics. A correct installation of the electrical system is therefore very important. A good system is shown below.



1. Two separate batteries, which can be used to start the engines individually or together. The battery for starting the engine should never be used for general service.

2. Two wires, two pole switches (the engine is used as a conductor during starting). Main switches to be located as near to the batteries as possible.

3. Batteries should be placed as near to the starter motor as possible. Use the wire size recommended by the engine manufacturer.

4. All user points to be disconnected when the main switches are off, with the exception of the bilge water-level alarm and any automatic bilge pumps.

5. General switchboard. Navigation lights to have separate fuses. All switches and fuses have to be clearly marked.

Batteries
For general service, use a deep cycle battery, such as the double separation type, with sufficient capacity in Ah so that the battery is never discharged more than 60 percent (approximately 0.6 x daily consumption).

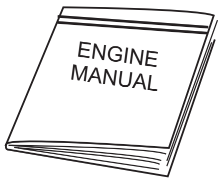
The starting battery can be of the automotive type and should have a capacity 50 percent greater than specified for engine starting.

A voltage measuring instrument is essential to ensure that the general service battery is never discharged more than 60 Percent (12 V).

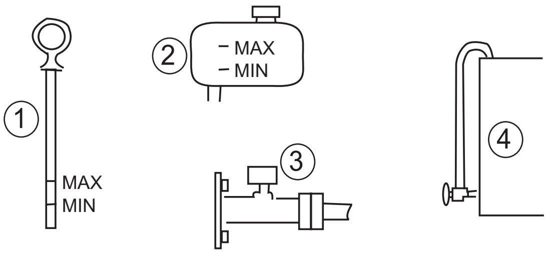
Batteries should be secured firmly in the engine room or any other well-ventilated place (in a box or a locker). Where the maximum charging output is greater than 5 KW, the batteries must be placed in a box with ventilation to the outside.

ENGINE MAINTENANCE

REGULAR MAINTENANCE IS THE BEST WAY TO PREVENT BREAKDOWNS

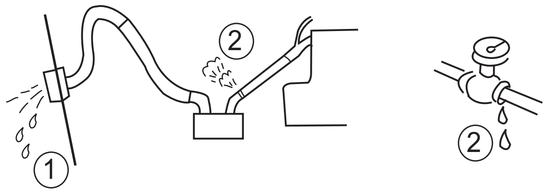


The engine manufacturer knows best how to take care of the engine. Read the manual carefully and follow the instructions regarding maintenance, regular checks and periodic overhauling.



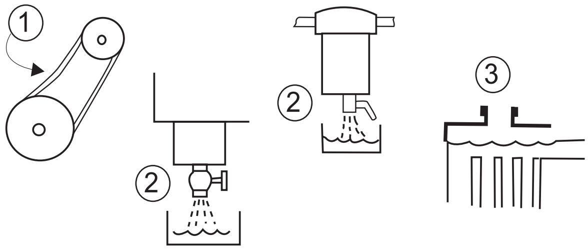
CHECK DAILY, BEFORE STARTING

1. Oil level of engine.
2. Water level, if the engine has fresh water cooling.
3. One turn on the stern tube greasing cup?
4. Sufficient fuel for the trip.



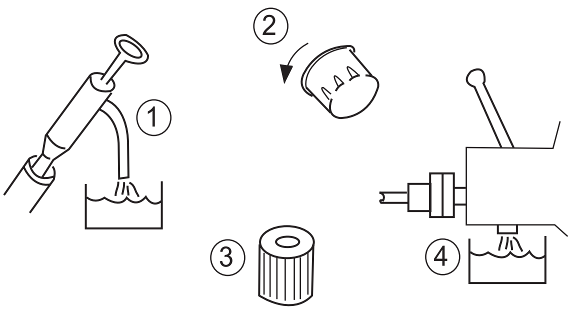
CHECK DAILY, AFTER STARTING

1. Whether engine cooling water is flowing
2. The water pipes, exhaust pipe, fuel pipes and oil pipes – for leaks.
3. Oil pressure gauge.
4. Battery-charging gauge.



CHECK EVERY 14 DAYS

1. Belt tension on alternator belt. With proper tension, it should be possible to push belt down 5-10 mm.
2. Dirt and water in fuel tank sump and primary filter. Drain off.
3. Battery level. Fill with distilled water as necessary.
4. Whether bolts of engine mount and propeller shaft coupling are tight.
5. Gland packing of stuffing box. Replace packing as necessary.

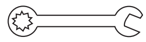
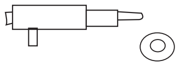
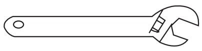
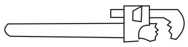
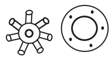
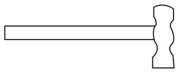
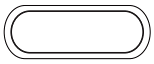
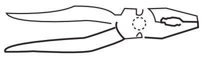
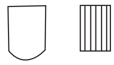
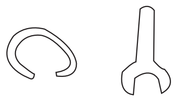
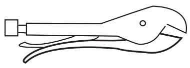
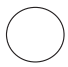
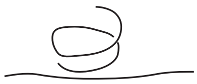
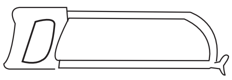
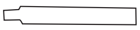
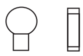
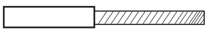
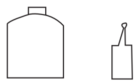
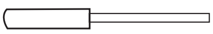
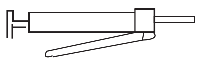
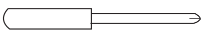
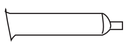
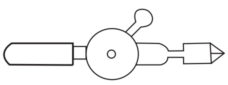
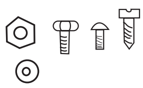
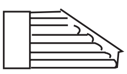
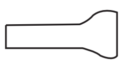


EVERY 100-150 ENGINE HOURS

Follow the engine-manufactures recommendation on:

1. change of engine oil.
2. change of oil filter.
3. change of fuel filter.
4. change of gear oil.

TOOLS AND SPARE PARTS TO BE CARRIED ON BOARD

	Combination spanners set 8 – 24 mm.		Fuel injector with sealing washer.
	Adjustable spanners 6” and 10”.		Fuel injection pipe with end fittings.
	Pipe wrench 18”.		1 set spare parts for engine waterpump.
	Ball pen hammer 0.5 kg.		V-belts for alternator, waterpump, etc.
	Combination pliers 6”.		Cartridges for fuel and lub-oil filters.
	Pump pliers 12”.		Gland packing for stern tube with special spanner.
	Vice grip 10”.		Spare parts for manual pump.
	Diagonal cutting plier, 6”.		Coil of copper wire, stiff steel wire.
	Hacksaw, with spare blades.		Insulating tape, tape for pipe threads.
	Cold chisel.		Spare bulbs and fuses.
	Flat single-cut file, fine.		Engine oil 2-5 litres, oil squirt can.
	Flat screwdrivers 3mm, 6 mm, 10 mm.		Grease gun.
	Pozdrive screwdrivers nos 2 and 3. Philips, type 1.		Gasket cement, epoxy glue.
	Hand drill.		Assorted bolts, nuts, wasters, screws, hoseclips.
	One set of different drill sizes high speed 3 -10 mm.		Waterproof torch.

COOKER AND GAS CYLINDER INSTALLATION

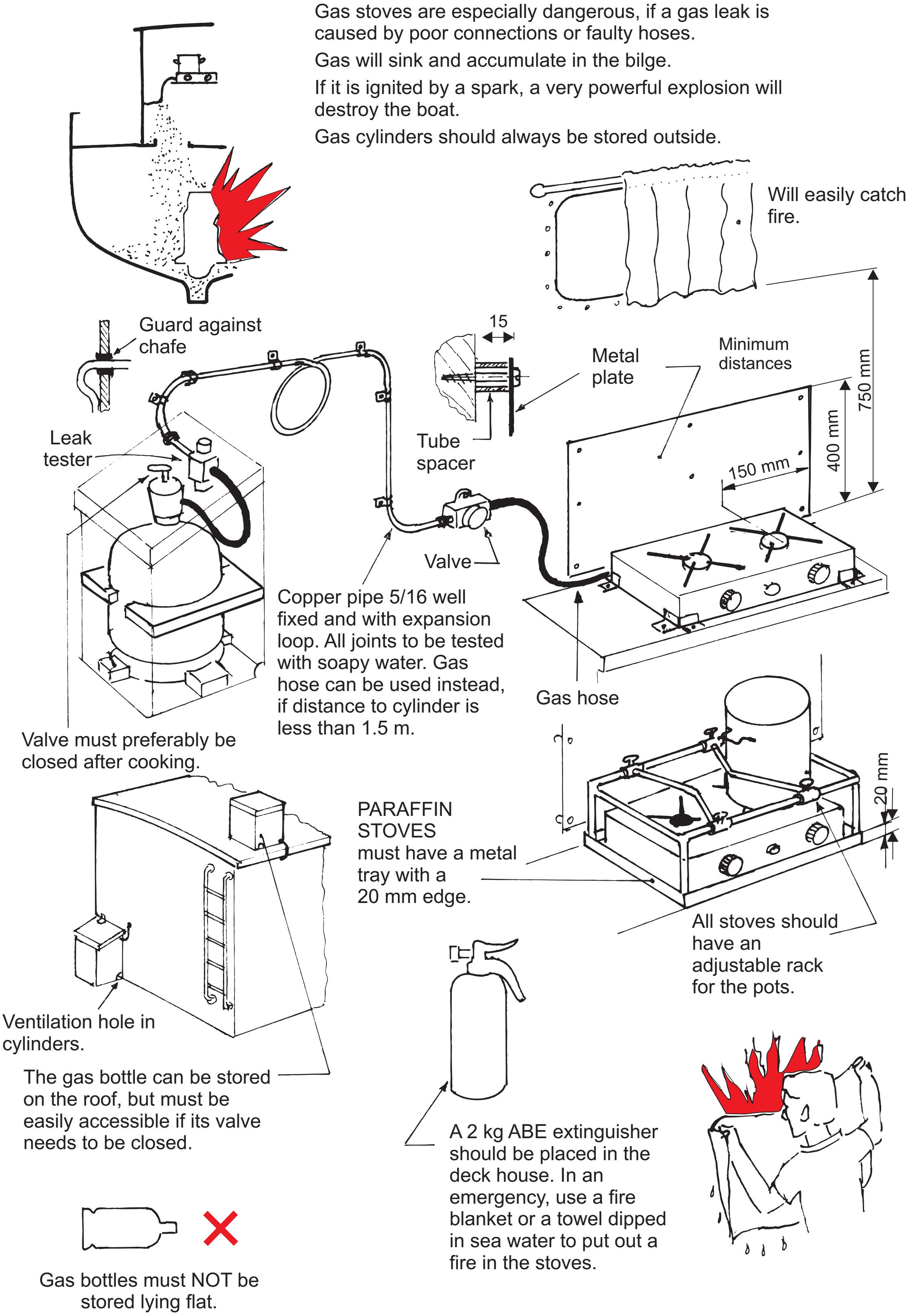
Many fires are caused by poor installation or maintenance of cooking stoves.

Gas stoves are especially dangerous, if a gas leak is caused by poor connections or faulty hoses.

Gas will sink and accumulate in the bilge.

If it is ignited by a spark, a very powerful explosion will destroy the boat.

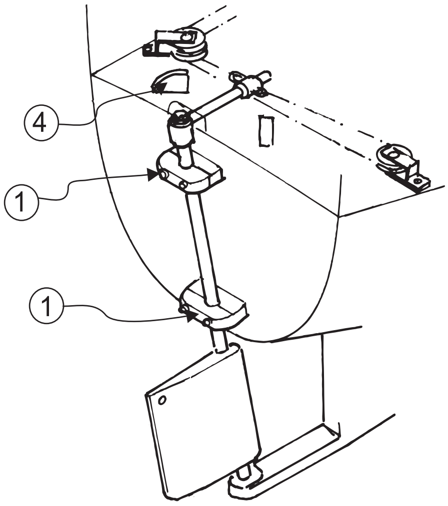
Gas cylinders should always be stored outside.



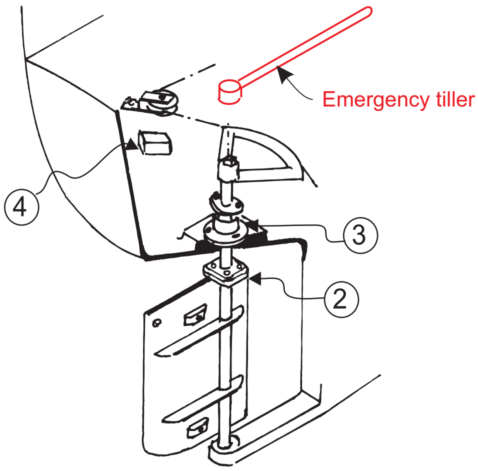
STEERING SYSTEM

There must be an emergency tiller or a separate steering system in case of failure in transmission between steering wheel and rudder.

TRANSOM-MOUNTED RUDDER



UNDERHUNG RUDDER

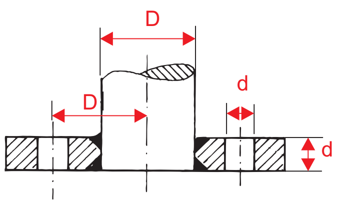


A rudder mounted on the transom is the most reliable system and should be chosen if it does not obstruct the fishing operation. The two bearings (1) of heavy wood are bolted through the transom. The under hung rudder usually requires a coupling (2) and a bronze bearing with a gland (3).

Rudder stoppers (4) are required to limit swing to 40°.

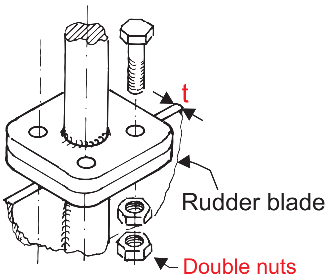
The rudder stock diameter – D – should be selected according to classification societies' rules, but the following dimensions may be used as a guide:

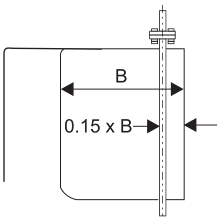
CUNO = $L_H \times B_H \times D_H$ (m^3)



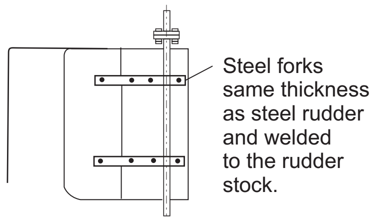
Machine after welding

CUNO (m^3)	Rudder stock diameter D (mm)	Bolt diameter d (mm)	Steel plate thickness t (mm)	Timber thickness (mm)
10	25	8	6	25
15	25	8	6	25
20	30	10	8	30
30	40	10	10	40
60	45	12	10	45
80	45	14	10	45
100	45	14	10	45
150	50	16	10	50
250	56	16	10	56





Rudder balance

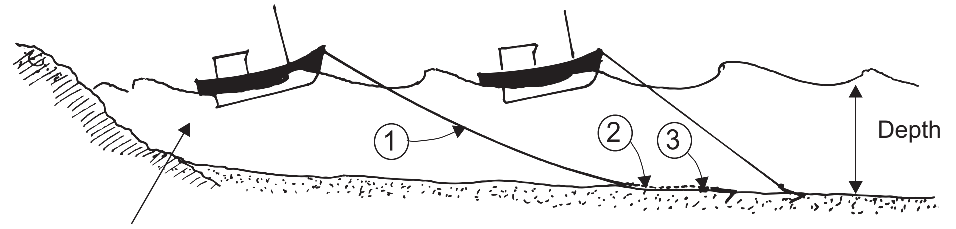


Wooden rudder

ANCHOR EQUIPMENT

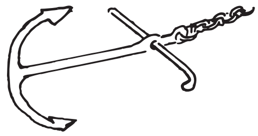
In this situation an anchor that holds well is needed.

Which boat is safest?

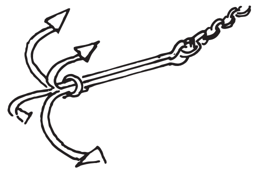


This boat is safest because it has the following: 1 An anchor rope of sufficient diameter and length. The length of the anchor rope should be seven times the depth. 2 A galvanized chain of minimum 8 mm and length 5 m attached to the anchor. 3 An anchor of high holding power. The type of anchor depends on the bottom condition:

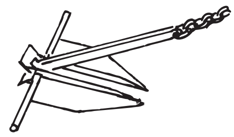
Fisher's anchor and grapnel can be used in rocky areas, but only a high holding power anchor, such as Danforth, will hold well in mud or sand.



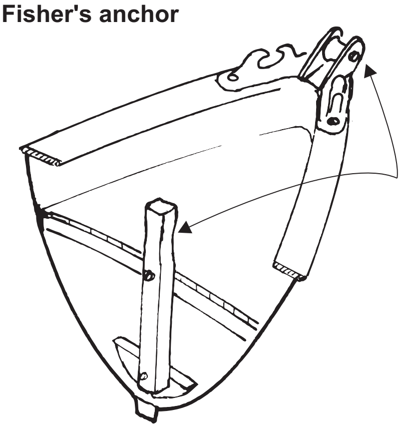
Fisher's anchor



Grapnel anchor



Danforth



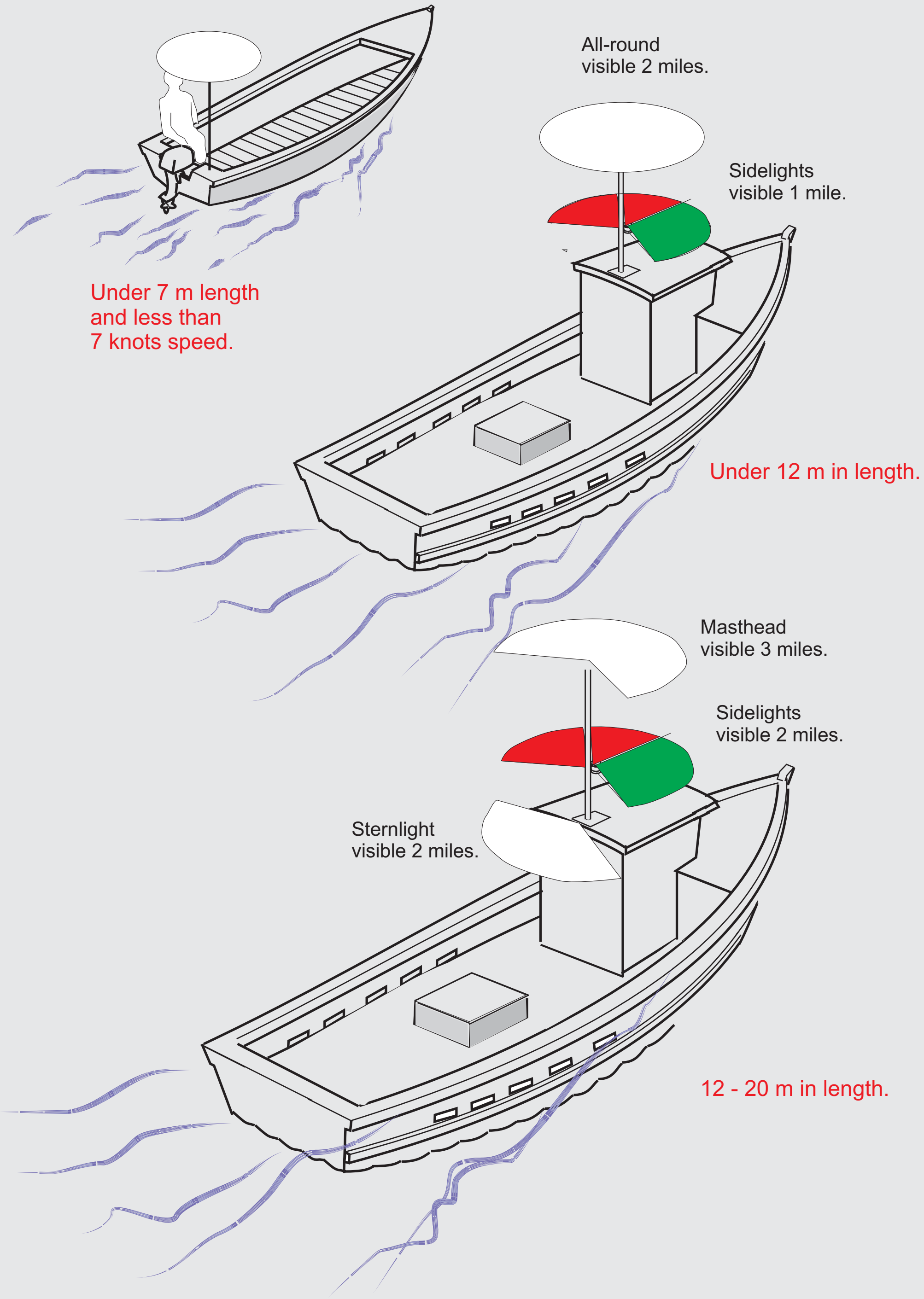
Having a good anchor is not enough. There must also be a strong point on the boat to fix the anchor rope and be able to protect it against chafe with a good fairlead. To haul up a heavy anchor, an anchor roller will be of great help.

Every boat should carry two anchors, a main anchor used for anchoring overnight and in heavy wind and a kedge for anchoring for a short time. In rough weather, both anchors can be used.

The table below gives the anchor equipment for boats in category A and B. For category C, the anchor weight can be 0.75 x figure in the table.

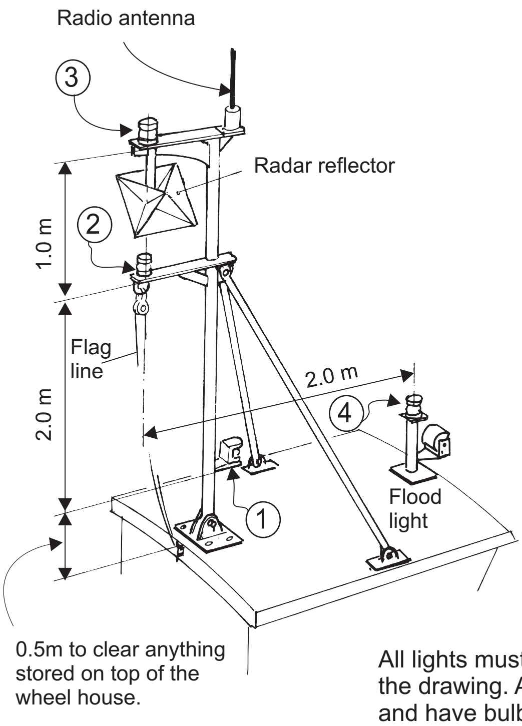
CUNO	Total anchor weight (kg)	Length of anchor rope (m)	Minimum diameter of anchor rope (nylon rope) (mm)	Length of anchor chain (m)	Diameter of anchor chain (mm)
5	8	20	10	5	8
10	12	25	12	5	8
15	15	30	15	6	8
25	21	32	15	6	8
35	25	35	18	8	9.5
45	31	40	18	8	9.5
60	37	45	20	10	9.5
80	43	50	20	10	9.5
100	52	55	25	15	12
155	62	60	25	15	12

NAVIGATION LIGHTS UNDER WAY



Note that all vessels under 20 m can carry a combined lantern for both sidelights.
Vessels above 20 m must have separate sidelights.

NAVIGATION LIGHTS AND FISHING LIGHTS

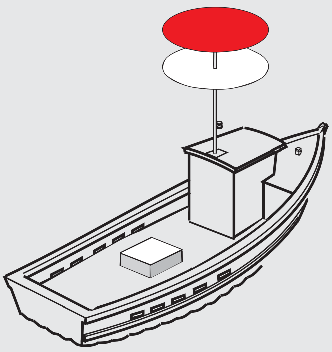


BOAT LESS THAN 12 m IN LENGTH

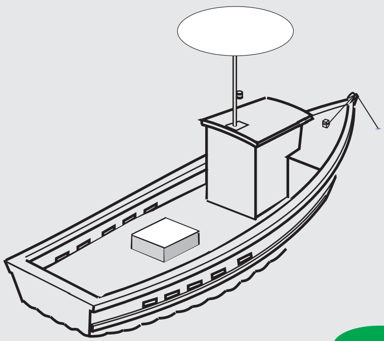
According to international rules, fishing boats less than12 m in length must carry the following lights to prevent collision at night.

1. Sidelights or a combined (RED and GREEN) lantern mounted exactly parallel to the centre line of the boat.
2. Combined all-round lantern, lower fishing light and anchor light. WHITE showing all around.
3. Upper fishing light showing all around – GREEN if the boat is trawling, RED for other fishing methods.
4. Fishing light, WHITE showing all around. When the boat is using floating fishing gear extending more than 150 m from the boat, this light indicates the direction of the floating fishing gear so that other boats can avoid the gear.

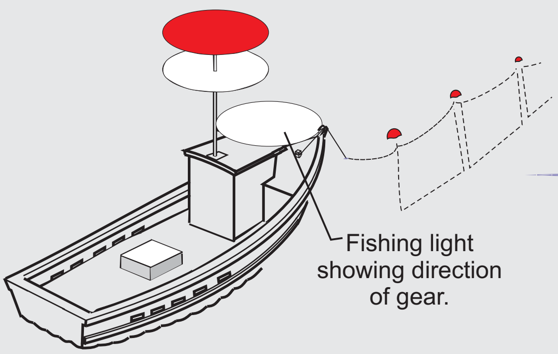
All lights must be fixed at the minimum distances shown in the drawing. All lights must be approved for boats up to 12 m and have bulbs of 18 W.



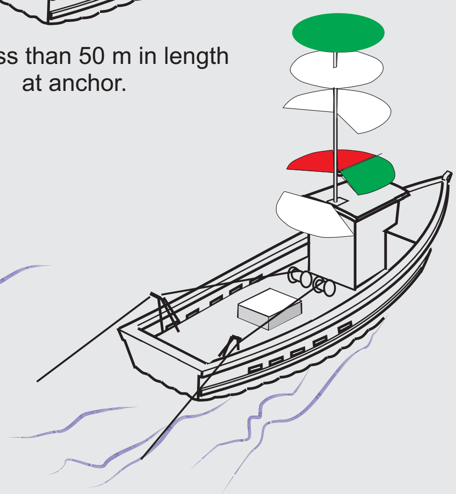
Boat fishing, but not under way.



Boat less than 50 m in length at anchor.



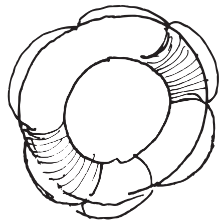
Boat doing surface gillnetting with gear extended more than 150 m.



Boat 12-20 m doing trawling.

LIFE – SAVING EQUIPMENT

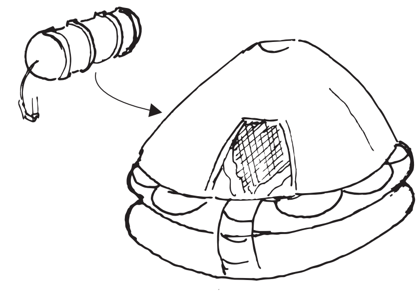
SAFETY GEAR



All boats should carry life jackets for every crew member, and should be stored in an accessible place. Small boats without possibility for storage of life jackets should satisfy the requirement for flotation in a flooded condition.

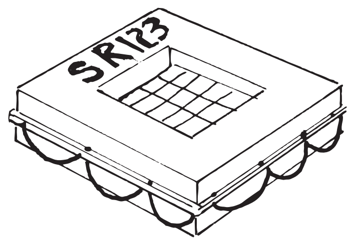
LIFE BUOY

One per boat, stored on the port or starboard side of the deckhouse.



INFLATABLE LIFE RAFT

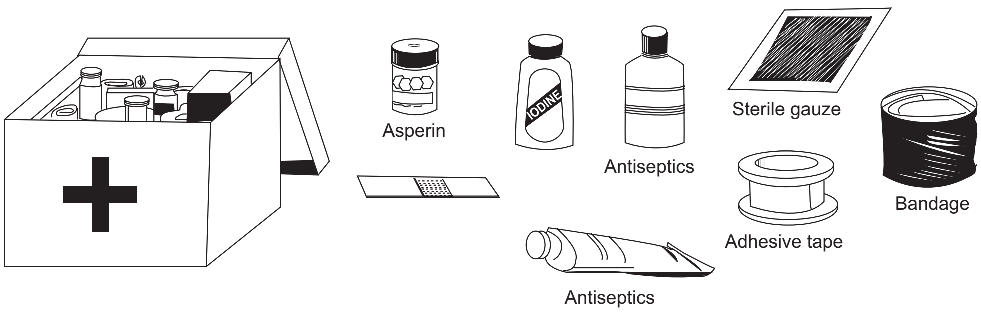
Unfortunately, expensive.
Must be checked every year.



BUOYANT APPARATUS (LIFE FLOAT) WITH MARKING

Can be made locally, but does not offer the crew much protection.

FIRST AID KIT

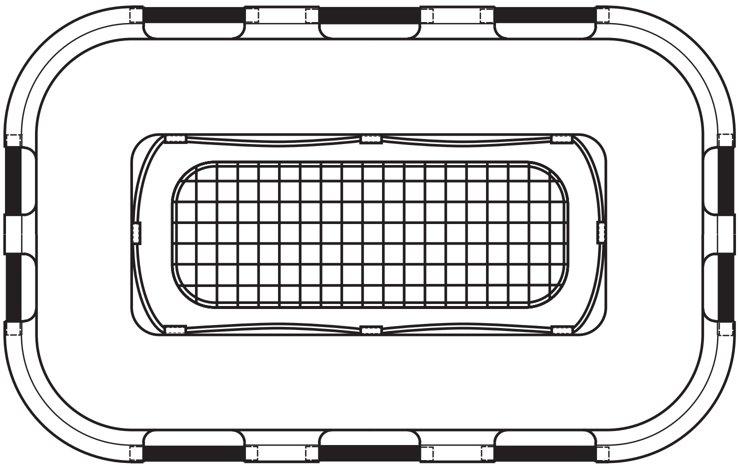


Every boat should have a first aid kit, even if it is not mandatory. It should include pain killers, antiseptic bandages, tape, cotton wool, etc. For injuries, gloves, scissors, sharp cutter and any other items that may be recommended by a doctor. It is also advisable to have a first aid manual to help you to deal with injuries, such as treatment of minor cuts, broken bones, getting a hook out of a finger, etc. on board.

ALTERNATE LIFE FLOATS

Life belt made from net floats if a lifebuoy is unavailable*

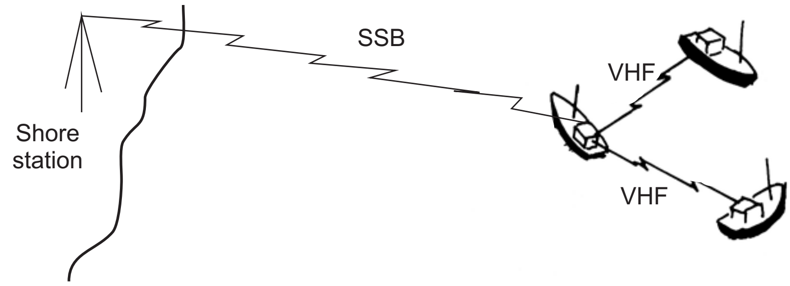
FRP life float for larger boats as an alternative to an inflatable life raft*

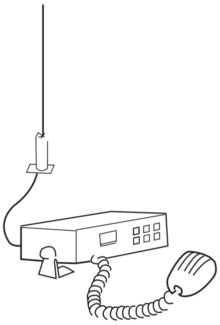


* *Developed under the Government of Bangladesh/ UNDP Project on 'Empowerment of Coastal Fishing Communities Livelihood Security (BGD/97/07)' in Cox's Bazaar, Bangladesh.*

* *Developed under the FAO Technical Cooperation Programme on 'Measures to Reduce Loss of Life During Cyclone (TCP/IND/6712)' in Andhra Pradesh, India.*

CALLING FOR HELP





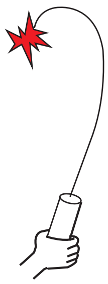
To be able to send messages to other boats or to shore stations, telling them that you are in trouble, is the first step towards rescue.

The only radio that can transmit to the shore when you are more than 30 miles offshore is the single sideband (SSB) radio. Unfortunately, it is also very expensive.

Nearer the shore, a very high frequency (VHF) radio can be used. It has a maximum range of 30 miles. It costs much less than the SSB radio.

The VHF radio is useful for offshore boats if skippers of other boats agree to as follows.

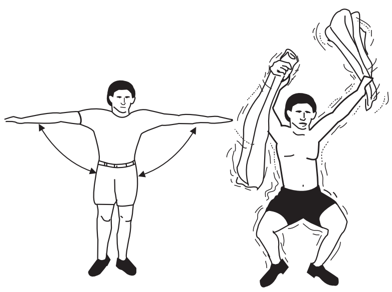
1. Fish in the same area.
2. Communicate daily with each other on the VHF radio at a set time.
3. Determine position with a Global Positioning System (GPS) and inform each other.
4. If you have engine trouble, other fishing boats will assist in towing you to shore.
5. If the larger boats have an SSB radio, they can send distress messages to shore stations.



PARACHUTE DISTRESS ROCKETS

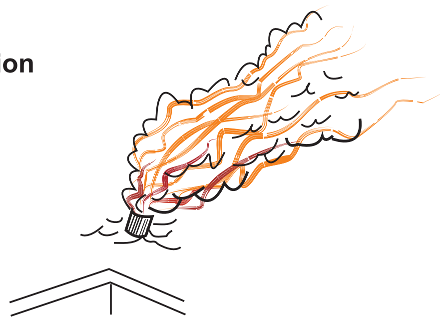
Boats in category A and B should carry four parachute rockets. Two rockets may be replaced with hand held flares. Boats in category C should carry two hand held flares.

Calling attention



'ARM' SIGNALS

The recognized arm signal for distress is to hold arms out horizontally from the sides and lower and raise them repeatedly. If there is no response to this signal, wave arms about frantically, using coloured cloths as a flag.

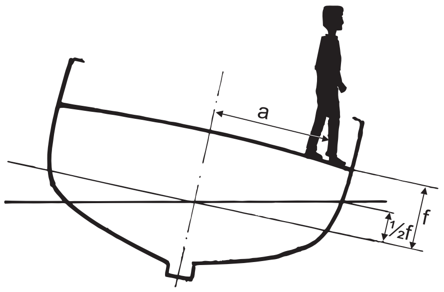


SMOKE SIGNAL

EMERGENCY SAIL

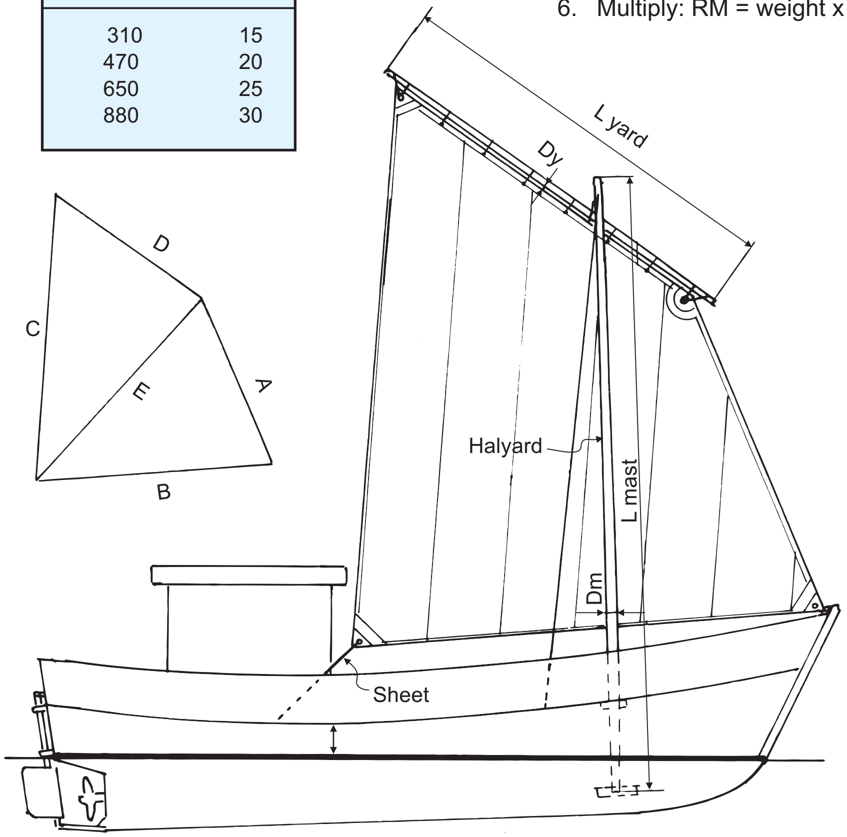
If your engine breaks down and you are far from shore, an emergency sail may be your only means to get home. The simplest type of sail is the dipping lug sail. The sail area will depend on the stability of your boat. Estimate the sail area as follows:

1. Measure the minimum freeboard (f) without any load in the fish hold.
2. Make a mark on the side of the boat at half f.
3. Get a number of people to stand alongside the rail until the boat is inclined to half f.
4. If you do not have a weighing scale, estimate the weight of the people: number x 70 kg.
5. Measure distance “a”.
6. Multiply: RM = weight x a.



7. Find sail area

RM (Weight x a) Kgm	Sail area m^2
310	15
470	20
650	25
880	30



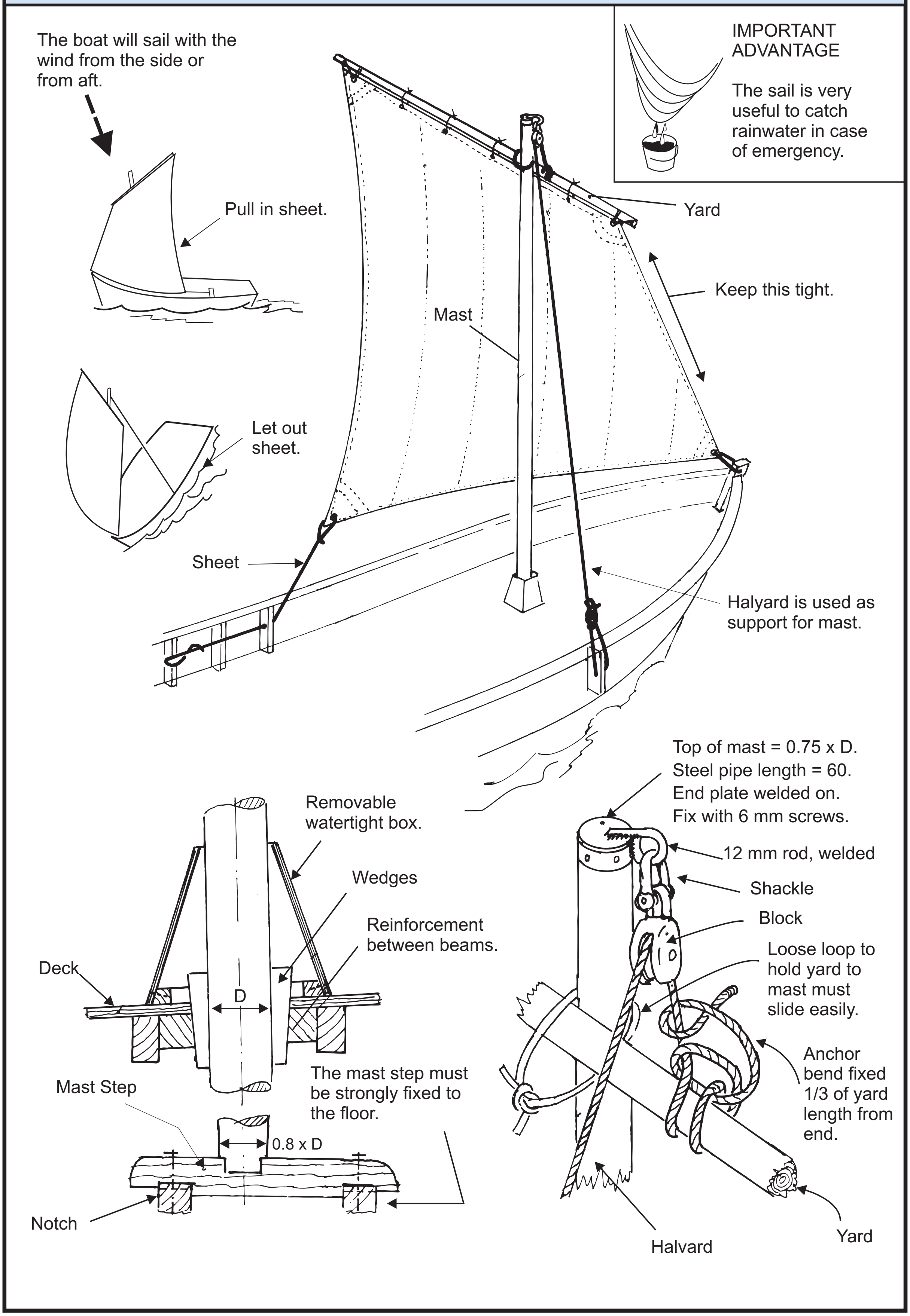
8. Find dimensions of sail, mast and yard from tables (in m)

Sail					
Sail area m^2	A	B	C	D	E
15	3.4	4.5	5.5	3.3	4.8
20	4.0	5.2	6.3	3.8	5.5
25	4.4	5.8	7.1	4.4	6.1
30	4.8	6.4	7.8	4.9	6.5

Halyard		Sheet	
Length m	Dia mm	Length m	Dia mm
13	10	12	10
15	12	14	10
16	12	15	10
18	12	17	12

Sail area m^2	Mast		Yard	
	Length m	Dia mm	Length m	Dia mm
15	6.4	105	3.6	60
20	7.0	120	4.1	65
25	7.7	130	4.7	70
30	8.4	140	5.2	75

EMERGENCY SAIL DETAILS



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