Advisory Circular

PART 40C Design, Construction and Equipment - Non-Passenger Ships which are not SOLAS Ships

Issue No. 40C-1 20 February 2001

1. General

Maritime Safety Authority Advisory Circulars are designed to give you assistance and explanations about the standards and requirements set out in the rules. However, the notes contained in Advisory Circulars should not be treated as a substitute for the rules themselves, which are the law.

When a number such as 40C.7 is referred to, this is a reference to a specific rule within Part 40C.

2. Definitions

Two lengths are referred to in Part 40C, the first 'length' is that defined by the international conventions, i.e. 96 per cent of the length measured on a waterline at 85 per cent of the ships least moulded depth. This 'length' is only used in determining application of the rule, e.g. it applies to ships of less than 45 metres 'length', if the ship goes beyond restricted limits. Such non-passenger ships of 45 metres or more 'length' must comply with the SOLAS requirements of Part 40B.

The second length referred to throughout Part 40C is the 'length overall'. This is not the true overall length but a length defined to represent as near as possible the true length of the ship's hull, for the purposes of specifying requirements to be applied to a hull of that size. Appendix 1 of this Advisory Circular illustrates the 'length overall' for a variety of ship types and hull forms. Where there is any doubt about a particular ships 'overall length' a ruling should be obtained from the MSA Head Office.

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3. Rule 40C.9 equivalence with Australian limits

Rule 40C.9(2)(b) indicates that the construction of ships certificated as complying with the requirements of the *Uniform Shipping Laws Code* published by the Australian Transport Advisory Council is acceptable provided that the operating limits stated in the certificate are considered by the Director to be equivalent to the ship's operating limits in New Zealand.

The classification of ships under the *Uniform Shipping Laws Code* and the equivalent New Zealand operating limits are indicated below for ships to which Part 40C applies.

USL Code Classification	*NZ Operational Limits*
2D & 2E	Enclosed waters
2C – Inshore operations	Inshore
2C – Restricted offshore operations	Restricted coastal
2B	Coastal and Offshore
2A	Unlimited

The appropriate authorities issuing such certification are –

Queensland Transport
Department of Transport, South Australia
NSW Waterways Authority
Department of Transport, Western Australia
Department of Transport and Works, The Northern Territory
The Navigation and Survey Authority of Tasmania
Marine Board of Victoria

4. Intact Stability

Rule 40C.13 and Appendix 1 prescribe the intact stability requirements for new decked ships to which Part 40C applies. These requirements should also apply to an existing ship which is being inspected, on or after 1 February 2001,

by a surveyor for the purpose of issuing a certificate in accordance with rule 21.13(2)(a), in order that the ship may enter an approved safe ship management system.

Rule 40C.14 provides that for existing ships to which Part 40C applies and which were in possesion of a certificate of survey prior to 1 February 1998 (when the safe ship management requirements of Part 21 came into force), the intact stability of those ships is acceptable and they are not required to comply with rule 40C.13. This may also apply to ships which entered a safe ship management system after 1 February 1998 but before 1 February 2001 where a surveyor has issued a certificate in accordance with rule 21.13(2)(a) and which must be assumed to certify compliance with intact stability requirements in force during that period.

Where a series of identical ships or similar sister ships are constructed the surveyor may accept the inclining and stability information for the prototype as applying to the subsequent ship or ships.

5. Open/partially open boats – swamping test/calculation

Rule 40C.13(2) requires that any new monohull boat of less than 6 metres in length which is –

(a) an open boat; or

(b) a partially decked boat operating beyond enclosed waters

must be subject to a test or calculation approved by the Director to determine its susceptibility to swamping.

Appendix 2 of this Advisory Circular describes a calculation for determining the volume and location of flotation material that will need to be installed if the boat is to float upright and level when full of water.

The calculation in Appendix 2 undertaken or approved by a surveyor recognised by the Director for that purpose may satisfy the requirement of rule 40C.13(2).

6. Freeboard

In rule 40C.15(2)(c) reference is made to ships fitted with a cockpit. A 'cockpit' means a depression in the weather deck which is weathertight and may have an opening leading below, fitted with a weathertight closing device, at its forward or after end.

Rule 40C.15(3) provides for a lower freeboard to be accepted on smaller restricted limit ships fitted with intact short raised deck forward in association with cuddy cabin or intact wheelhouse forward, and long 'well' deck aft. It is recommended that the effects on stability of such craft with water on the deck and the freeing arrangements be investigated.

7. Towing

Rule 40C.60 clauses (b) and (c) need not apply to any boat that may be fitted with a means of towing other boats but is not engaged in commercial towing or salvage operations e.g. boats engaged in rescue operations. It being assumed that the skipper will exercise prudence in regard to the nature of the tow.

Appendix 1, Clause (4) should only be applied where the ship is engaged in commercial towing or salvage operations.

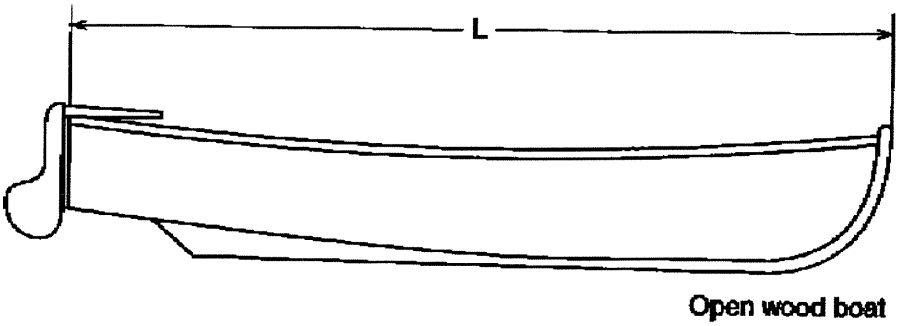
8. Childrens Lifejackets

Appendix 3 provides for a number of lifejackets to be carried which are suitable for children. For ships operating in coastal, restricted coastal and restricted limits the childrens lifejackets carried should have an appropriate mix of buoyancies corresponding with the body weights specified in New Zealand Standard NZS 5823.2001[1] *Specification for Buoyancy Aids and Marine Safety Harnesses and Lines.* For ships operating in the offshore limit the childrens lifejackets should have a minimum buoyancy of 75 Newtons.

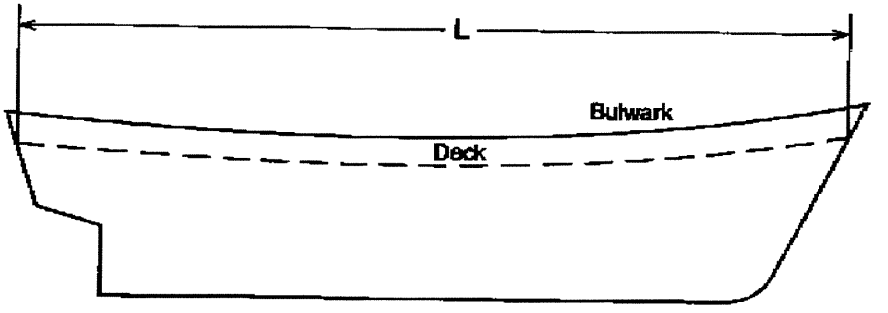
[1] The revised 2001 version of this standard to be published in February 2001 should be referred to as this information is not in earlier versions.

Appendix 1. Length Overall

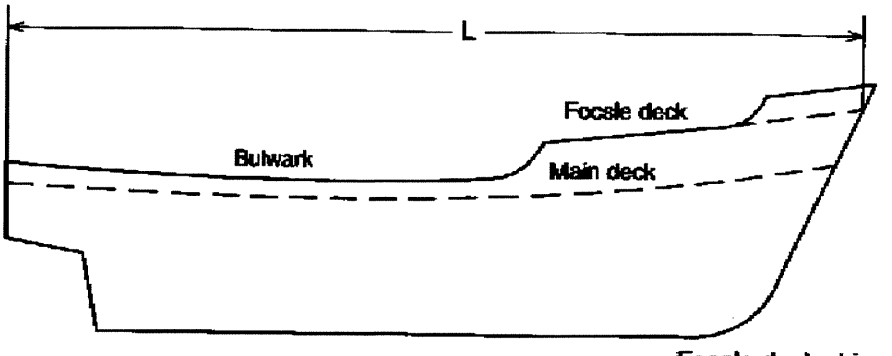
Length overall as used in the maritime rules is illustrated below.



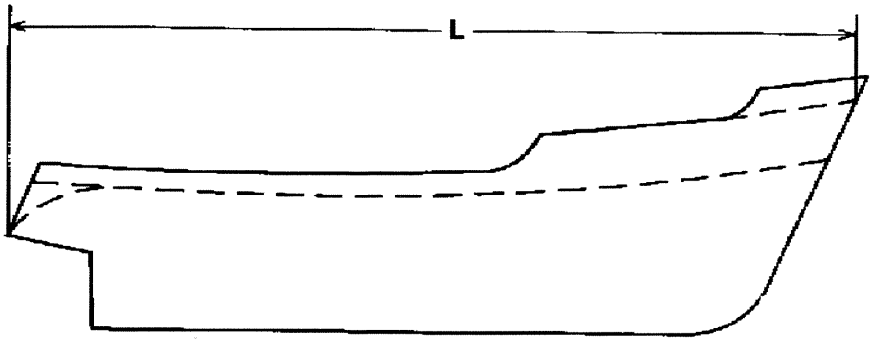
Open wood boat



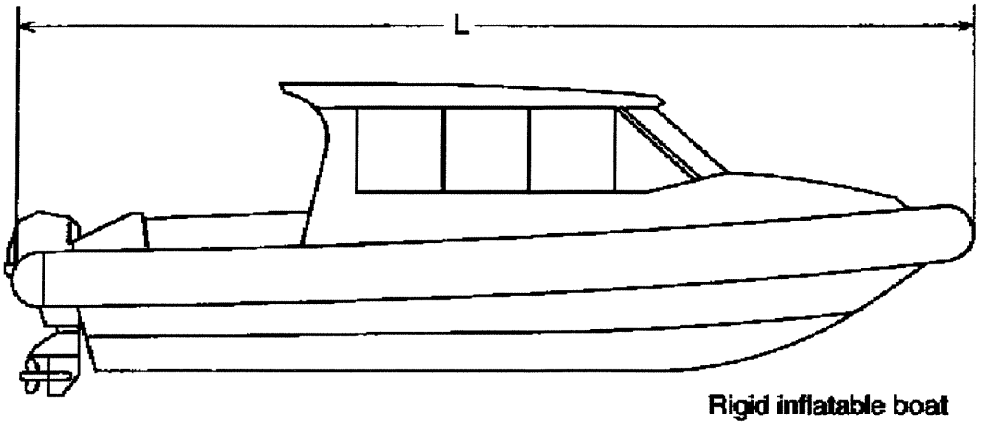
Single deck ship



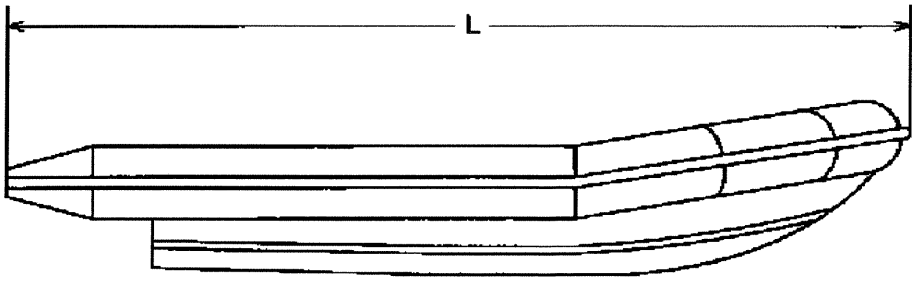
Focsle deck ship



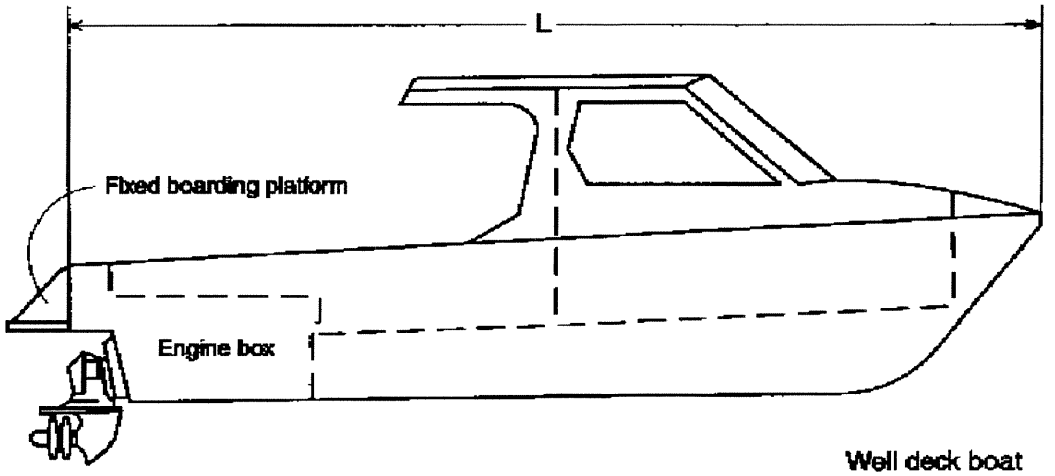
Stern ramp ship



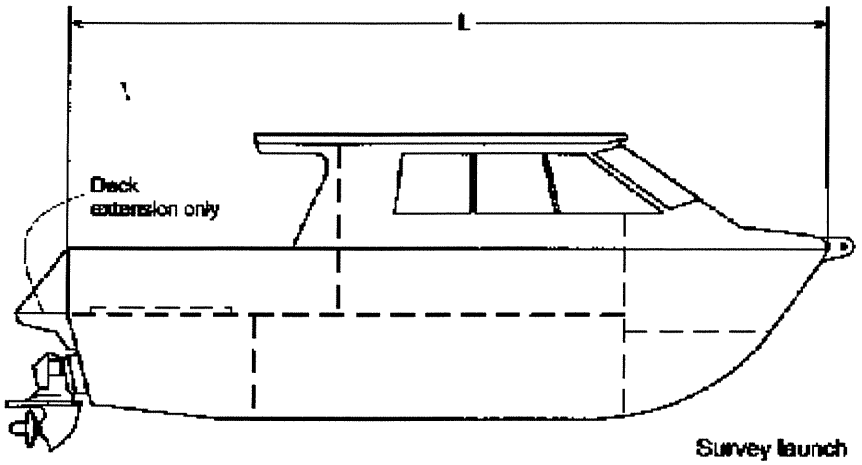
Rigid inflatable boat



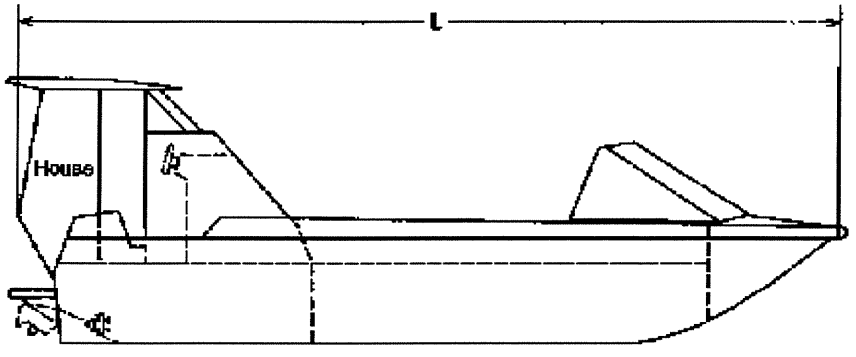
Pontoon boat



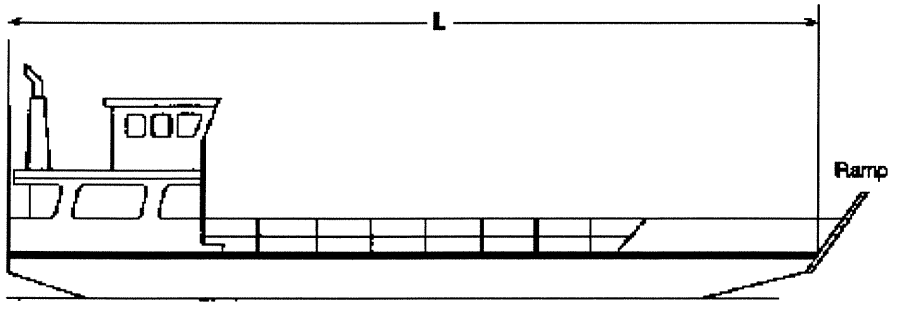
Well deck boat



Survey launch



Restricted passenger boat



Motorised barge

Appendix 2 New Open Boats

Determination of Required Volume and Location of Flotation Material

This Appendix sets out a method for determining the amount and position of flotation material in an open boat which will enable it to float upright and level when full of water.

Sufficient flotation material must be installed in specific areas of the boat to support –

(a) the weight of the boat when partly submerged; and

(b) the weight of the swamped motor and its associated equipment; and

(c) the weight of persons in the partly submerged boat.

Each of these 3 volumes of flotation material must be installed to provide buoyancy which symetrically balances the 3 weights.

Before carrying out any calculations a small boat should be put over a weighbridge to determine its dry weight and be balaced on a roller to provide an estimate of its longitudinal centre of gravity. These can provide useful checks for the following calculations.

1. Determination of volume and location of flotation material required to support partially submerged boat.

(a) Determine the submerged weight of the boat (W_b) in kgs using the following equation –

$$W_b = W_h k + W_d k + W_s + 0.69 W_e$$

Where W_h = dry weight of hull in kgs

W_d = dry weight of deck in kgs

W_s = dry weight of superstructure in kgs

W_e = dry weight of factory installed equipment, hardware and accessories in kgs.

k = conversion factor for material taken from Table 1.

This equation will give an approximate submerged weight for the boat which is accurate enough in most cases for use in determining the amount of flotation material needed. If necessary, for greater accuracy more of the weights of different materials used in the construction of the boat might be determined and multiplied by their appropriate conversion factor.

(b) Determine the volume of flotation material required to support the partly submerged boat using the following equation –

$$V_b = \frac{W_b}{D} \quad m^3$$

Where D = 1000 - density of flotation material to be used (kg/m^3).

This flotation material will need to be uniformly distributed about the swamped boat's centre of flotation

2. Determination of volume and location of flotation material required to support the swamped weight of the motor and related equipment.

(a) For an outboard motor installation determine the swamped weight (W_m kgs) of the motor from Table 1 using the largest motor for which the boat is rated.

(b) For an inboard motor installation determine the installed weight of the engine/gearbox/shafting/propeller or drive unit/fuel tanks and fuel and multiply this weight by 0.75 to determine the swamped weight (W_m kgs).

(b) Determine the volume of flotation material required to support the swamped motor and related equipment using the following equation –

$$V_m = \frac{W_m}{D} \quad m^3$$

Where D = 1000 - density of flotation material to be used (kg/m^3).

For an outboard powered boat this flotation material will need to be uniformly distributed within 1 metre (0.75 metre for boats of less than 4.6 metres long) inboard of the transom and above the sole. For inboard powered boats the flotation material should be distributed about the area of the machinery and above the sole.

3. Determination of volume and location of flotation material required to support the persons in the partly submerged boat.

   (a) Use the maximum load capacity or maximum number of persons the boat may carry to determine their weight in the partly submerged boat (W_p) kgs. For each person assume a weight of 90 kgs (75 kgs plus 15 kgs of gear).

   (b) Determine the volume of flotation material required to support the swamped load/persons in the partly submerged boat using the following equation –

   $$V_p = \frac{0.25W_p}{D} \text{ m}^3$$

   Where D = 1000 - density of flotation material to be used (kg/m^3).

   This flotation material should be distributed fore and aft along the sides of, and symetrically about the centre of, the passenger carrying area. It should be as close to the topsides as possible.

4. The total flotation material required is the sum of that determined in steps 1, 2 and 3 (i.e. $V_b + V_m + V_p$ m^3).

A suitable flotation material is expanded foam of a closed cell type which is resistant to oil fuel and solvents. It is recommended that a sample of supplied block foam, or foam converted by the boatbuilder in situ from materials supplied by the manufacturer, is cut and examined to ascertain its uniformity and absence of any air pockets. The foam's suitability may be tested by cutting two 150 mm^3 cubes from the foam and immersing them under a 1.12 metre head of water for 12 hours. The two foam cubes should be weighed before and after immersion, the surface water being removed, using blotting paper, after removal from the water and before weighing. The foam is acceptable if, after immersion there is no change in the dimensions of the cubes and the weight of the cube does not exceed twice its original weight or 280 grams, whichever is less.

Figure 1 illustrates the desired location of the flotation material distributed as recommended by steps 1, 2 and 3. Boats fitted with floatation material only in the bottom of the boat may not float upright when swamped.

The foam material must be permanently fixed in the boat and sealed or covered.

Example

The following simple example illustrates the above calculations.

The boat considered is a stock aluminium alloy open boat with the following particulars –

Length overall	4000 mm
Beam	1550 mm
Freeboard	550 mm
Hull weight	100 kgs (with standard options)
Capacity/Persons	270 kgs /3 persons
Recommended Max. HP	25

The closed-cell foam that it is proposed to use for flotation material has a density of 45 kgs/m^3.

Step 1

Submerged weight of boat (W_b) = $W_h k$

W_h = 100 kgs and k = 0.62 (from Table 1 for aluminium alloy)

Therefore $W_b = 100 \times 0.62 = 62$ kgs

The volume of flotation material required to support the partly submerged boat (V_b) is obtained from –

$V_b = W_b \div D$, where D = (1000 – 45) = 955.

Thus $V_b = 62 \div 955 = 0.065\ m^3$ (Note! 3 decimal places)

Step 2

The swamped weight of the 25 hp outboard motor and related equipment (W_m) is obtained from Table 2. W_m = 60 kgs.

The volume of floatation material required to support the swamped motor (V_m) is obtained from –

$V_m = W_m \div D$, where $D = (1000 - 45) = 955$

Thus $V_m = 60 \div 955 = 0.063\ m^3$

Step 3

The weight of 3 persons in the partly submerged boat (W_p) will be $3 \times 90 = 270$ kgs.

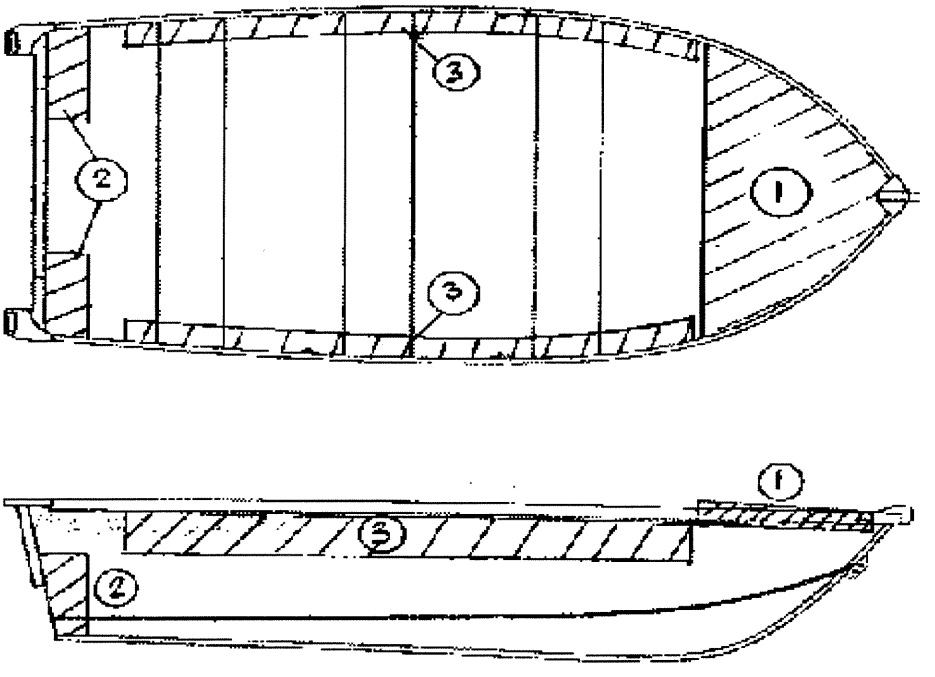
The volume of flotation material (V_p) required to support the swamped persons in the partly submerged boat is obtained from –

$V_p = (0.25 \times W_p) \div D = (0.25 \times 270) \div (1000 - 45) = 0.071\ m^3$

Step 4

The total volume of flotation material is $V_b + V_m + V_p = 0.065 + 0.063 + 0.071 = 0.199\ m^3$.

This flotation material is distributed as recommended and shown below.



Item 2 the 0.065 m^3 flotation material required to support the swamped outboard engine etc.is arranged at the transom either side of the motor. To this is added a portion of Item 1, the flotation material required to support the partially submerged boat, in this case 0.016 m^3.

Item 3 the 0.071 m^3 flotation material required to support the 3 persons in the partially submerged boat is arranged along the topsides each side of the boat in way of the passenger space. To this is added a portion of Item 1, the flotation required to support the partially submerged boat, in this case 0.21 m^3.

Item 1 the 0.065 m^3 flotation material required to support the partially submerged boat, is partly arranged at the underside of the short foredeck, being 0.028 m^3, which with the 0.016 m^3 combined with Item 2 and 0.021 m^3 combined with Item 3 provides a toatal of 0.065 m^3. This achieves a spread of this flotation material about the boat's centre of flotation throughout the length of the boat.

Whilst it would be easier to accommodate the flotation material under the athwartship seats, at the bottom of the boat, this would result in the swamped boat having a tendency to capsize if heeled. The boat would be more stable in the inverted position and difficult to right.

Table 1

Material	*Relative density*	*Density (kgs/m^3)*	*Factor k*
Lead	11.34	11340	+0.91
Monel metal	8.97	8970	+0.89
Phospher bronze	8.88	8880	+0.89
Copper	8.88-8.95	8880-8950	+0.89
Brass(cast)	8.4-8.7	8400-8700	+0.88
Steel	7.80	7800	+0.87
Cast iron	7.03-7.13	7030-7130	+0.86
Aluminium alloy	2.55-2.80	2550-2800	+0.62

Glass (ordinary plate)	2.4-2.8	2400-2800	+0.62
Concrete (1:2:4 mix)	2.2-2.4	2200-2400	+0.57
PVC (flexible)	1.3	1300	+0.23
Perspex	1.18	1180	+0.16
Sea water	1.02-1.03	1020-1030	-
Fresh water	0.998	998	-
Kauri	0.53	530	-0.88
Kahikatea	0.465	465	-1.15
Macrocarpa	0.496	496	-1.10
Mahogany (African)	0.5-0.64	500-640	-1.0 to –0.56
Douglas fir	0.43-0.5	430-500	-1.32 to –1.0
Teak	0.61-0.64	610-640	-0.64 to –0.56
Klinki pine	0.45-0.51	450-510	-1.22 to –0.96
Kwila	0.67-0.81	670-810	-0.49 to –0.23
Moulded plywood	0.61	610	-0.63
Plywood	0.57	570	-0.73
Balsawood	0.06-0.39	60-390	-14 to –1.6
Glass fibre laminates	See Figure 1		

Note! – For materials not listed the following formula for k may be used –

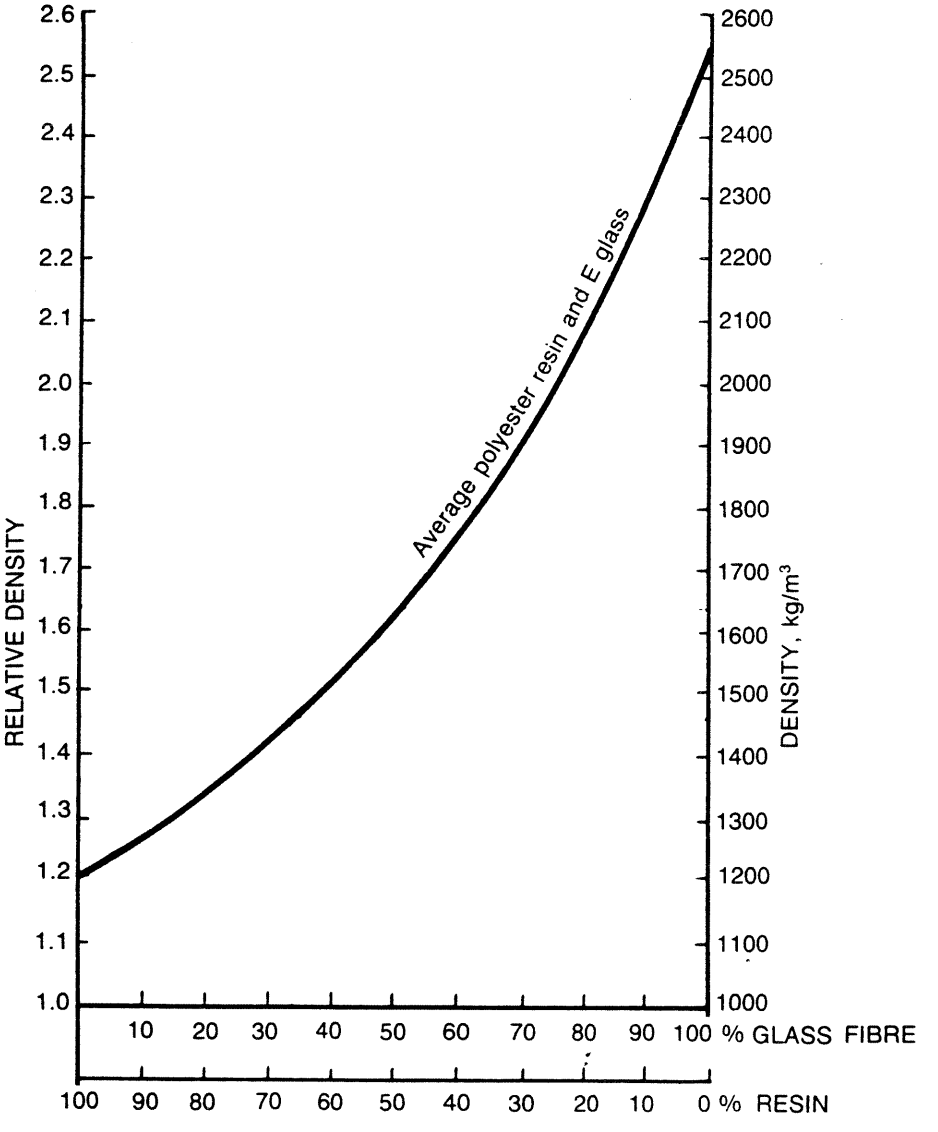
$$k = \frac{\text{density of material} - \text{density of fresh water}}{\text{density of material}}$$

Table 2

Maximum Power Capacity (kW)	*Motor and Controls (Kgs)*	*Battery (Kgs)*	*Portable fuel tank and fuel (Kgs)*	*Total weight (Kgs)*	*Submerged weight (Kgs)*	*Swamped weight (Kgs)h*
≤ 3	15	-	-	15	10	15
>3 ≤ 4	25	-	10	35	15	20
> 4 ≤ 7.5	30	10	20	60	30	35
> 7.5 ≤ 25	50	20	20	90	50	60
> 25 ≤ 40	85	20	45	150	75	95
> 40 ≤ 55	110	20	45	175	90	115
> 55 ≤ 115	140	20	45	205	110	140

Figure 1

Density Range of Laminates Composed of Various Percentages of Resins and Glass Fibre



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