

BUOYANCY IN BOATS



What's the issue?

A prime function of a boat is to provide buoyancy to its occupants. A boat should float on the surface, even if it is flooded, swamped or has capsized. Ideally the boat will stay upright, even if full of water, and will support its own weight plus the motors and occupants. This is referred to as level flotation.

Many older boats may not have sufficient buoyancy when full of water to provide support to those on board. If your boat does not have an Australian Builder's Plate (ABP), or if the plate does not state that the boat has level flotation, it may not have sufficient buoyancy.

The amount of buoyancy a vessel requires is dependent on the amount of weight it supports. Any changes to the boat, its engine or fittings will change its buoyancy requirements. A vessel should be checked regularly and the buoyancy requirements should be recalculated whenever there is a weight change; for example, if a new motor is fitted.

Why is it important?

The occupants of a swamped or flooded boat will have a better chance of survival if it remains floating, upright and level. Correctly sized and fitted internal buoyancy will keep the boat in this position.

A floating upright boat:

- > reduces the occupants' immersion in water and their chances of drowning or hypothermia.
- > provides the occupants with an opportunity to access their safety equipment, such as flares, radios, emergency position indicating radio beacon (EPIRB), torch.
- > is much easier for searchers to see than people in the water.

Finally, it is a condition of registration that when a boat is operated the materials or items that form part of the boat's reserve buoyancy are not missing or damaged.

What should I do?

If your boat has no reserve buoyancy, or has insufficient or damaged buoyancy, you should consider retro-fitting buoyancy.

Calculation for required buoyancy¹

Formula for an aluminium, glass reinforced plastic (GRP) or steel vessel.

$$1.2 \times ((M \times K) + F)$$

1000-D

Formula for a timber vessel.

$$1.2 \times F$$

1000-D

M = hull and deck mass

K = alum 0.62, GRP 0.375, steel 0.87

F = mass of machinery and fittings

D = density of buoyancy material (foam approx 35kg/cubic metre)

Example for an aluminium vessel

$$1.2 \times (425 \times 0.62 + 135)$$

1000 - 35

M = 425kg (hull and deck mass)

K = alum 0.62

F = 135kg (machinery/motor)

D = 35kg/cubic metre

Amount of buoyancy required = 0.496 cubic metres

To determine how much additional buoyancy is required, you need to determine how much buoyancy you currently have. In the case of boats with foam buoyancy, you need to measure the dimensions of the individual pieces of foam and multiply the length x width x height.

Example: Our aluminium vessel has a piece of foam measuring 750mm x 400mm x 350mm : 0.75 x 0.40 x 0.35 = 0.105 cubic metres.

¹ Source: The International Standard ISO-12217: Small Craft - Stability and Buoyancy, Annex D.



What should I do? (continued)

Subtracting the current buoyancy from the required amount of buoyancy (0.496 cubic metres in our example) gives the amount of buoyancy you need to add, in this case 0.391 cubic metres.

Important: If your vessel's hull has been constructed with a foam or balsa core you should not assume that this provides sufficient buoyancy. The core is fitted to provide internal strength not buoyancy. The material and its distribution may not contribute significantly to the vessel's flotation and should be ignored for the purpose of this calculation.

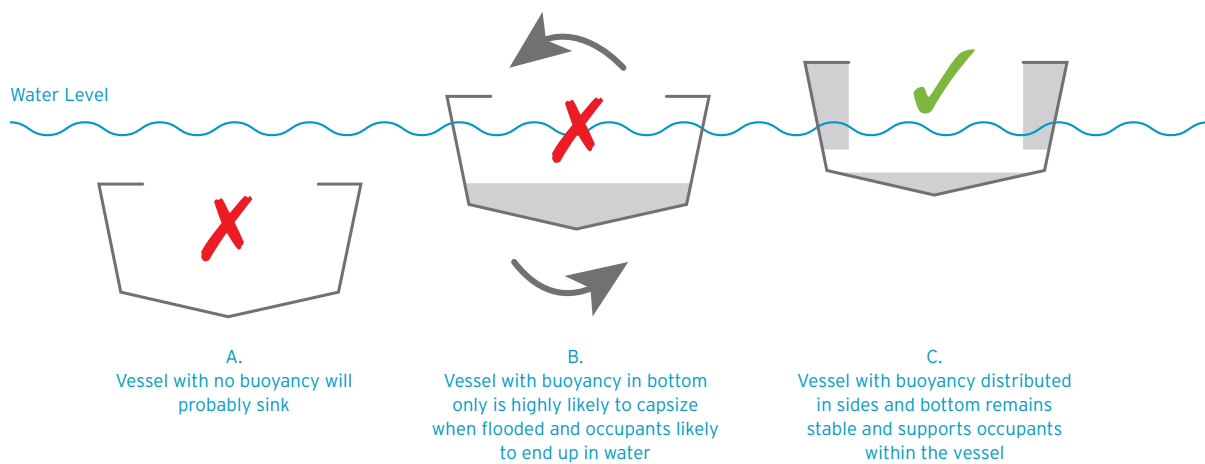
What should I consider if I decide to add foam buoyancy?

Air cavities are better than nothing, but can admit water if welds give way or the structure becomes non-watertight. Air-filled bladders are also an option. However, cavities are best filled with closed-cell foam that is designed for marine use.

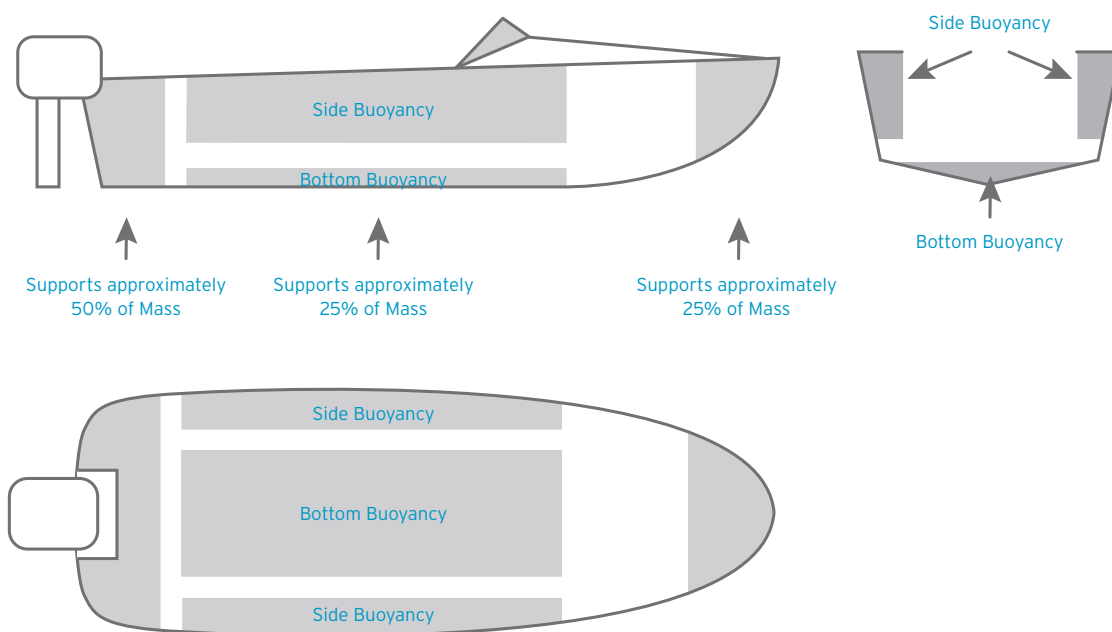
You might want to engage a qualified person to fit buoyancy but, with care, it is something you can do for yourself.

Placement of buoyancy

> In vertical profile, do not place all of the buoyancy low down as this will make the boat very unstable if it floods and can cause it to turn over. At least 50 percent of the foam should be under the gunwales and high in the hull so that, as the hull is flooded, the foam intersects the water line and stabilises the boat.



> Buoyancy should be distributed along the length of the boat in a similar proportion to the distribution of weight in the vessel. For most small boats with outboard motors this will translate into these proportions: 50 percent aft, 25 percent midway, 25 percent in the bow.



Choice of material

Block foam is the most convenient way to fit buoyancy in a small boat.

Use a closed-cell foam that is intended for the purpose. Polyethylene and polyurethane foams will have the desired characteristics. *The National Register of Compliant Equipment* on the National Marine Safety Committee (NMSC) website (www.nmsc.gov.au) lists a range of accepted buoyancy products by brand and supplier.

Non-marine foams are generally unsuitable for use as buoyancy in boats because they:

- > react with metal hulls and cause corrosion.
- > absorb water over time.
- > may be flammable or soluble in petrol.

Foam blocks can be cut to size and fixed under the gunwales, under bench seats, to the underside of decking and against the face of the transom. They can be held in place by battens, straps or appropriate adhesives. There is a useful video demonstration on the website of Marine & Safety Tasmania (www.mast.tas.gov.au) that shows foam blocks being fitted to a range of small boats.

- > Foam should be firmly secured to prevent movement. Securely fitting the foam will stop it wearing against the hull and creating particles that can block valves and pumps. It is good practice to fit it in such a way that it can be replaced.
- > Foam should be secured within the structure of the boat. If the boat is flooded the buoyancy will try to float free of the boat.
- > Wrapping foam blocks in strong plastic sheeting will help to protect them and keep them dry.

Pouring 'two pot' foam can be used to fill awkward spaces and can provide excellent buoyancy but it is best installed by a suitably qualified person. Be aware that:

- > if you pour foam into a space you are unlikely to be able to access that space later and it is very difficult to inspect or replace the foam.
- > pouring foams expand and it is important to accurately calculate quantities. If used incorrectly the foam can stress the hull and rupture joints. This can occur even if there are 'escape holes' as some foams expand in all directions.

Where to get more information

- > **Phone:** 1800 223 022
- > **Website:** www.transportsafety.vic.gov.au
- > **Email:** information@transportsafety.vic.gov.au

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Inspection

You should visually inspect the buoyant materials at least every twelve months and replace any degraded materials.

There is a range of standards that deal with buoyancy in small vessels which can be used for guidance. The following standards are recognised by the NMSC for commercial vessels:

- > ISO 12217-1:2002 Small craft - Stability and buoyancy assessment and categorization - Part 1: Non-sailing boats of hull length greater than or equal to 6 m.
- > ISO 12217-2:2002 Small craft - Stability and buoyancy assessment and categorization - Part 2: Sailing boats of hull length greater than or equal to 6 m.
- > ISO 12217-3:2002 Small craft - Stability and buoyancy assessment and categorization - Part 3: Boats of hull length less than 6 m.
- > AS1799:2009 Small craft - General requirements.
- > American Boat and Yacht Council standard.

Reference can also be made to the National Standard for Commercial Vessels (NSCV): *NSCV C6B Buoyancy and Stability after Flooding* and *NSCV C7A Safety Equipment*.

When to call for help

Boat operators should call for help if they are unable to ensure their safety or that of their passengers or vessel. There is no charge for search and rescue services.

Marine radio: 27MHz Channel 88 or VHF Channel 16

EPIRB: 406 MHz

Phone: 000

Flares: activate them when you see a potential rescuer