whichever number shall be less.

7. A buoyant appliance shall be coloured a highly visible colour.

8. A buoyant appliance shall not exceed 180 kg unless suitable means are provided to enable it to be launched and, where the appliance exceeds 136 kg but does not exceed 180 kg, suitable handles or rings shall be fitted to enable it to be launched by hand.

9. The buoyant appliance shall be fitted with retro-reflective tapes of an approved type (each tape being not less than 300 millimetres long and not less than 50 millimetres wide) on the top and bottom of the buoyant appliance, spaced around the perimeter of the appliance so that the distance between the centre of a tape and the centre of the tape next in line is not greater than 500 millimetres.

APPENDIX N

INTERNAL BUOYANCY IN SMALL VESSELS

1. The material shall have the following properties:
   - 1.1 Density—32 kg/m^3 minimum
   - 1.2 Compressive Strength (at 10 per cent strain)—235 kPa minimum
   - 1.3 Closed Cell Content—92 per cent minimum
   - 1.4 Water Uptake—400 cc/m^3 maximum
   - 1.5 Dimensional Stability—(original linear dimension = 100)
     - 1.5.1 Temperature Cycling— −15°C to + 70°C
     - 1.5.2 14 days under 100 mm head of kerosene, toluene (conforming to ASTM/D841/1977), xylene (conforming to ASTM/D843/1977) or distillate (90 minimum).
   - 1.6 Self-extinguishing to A.S.T.M. D—1692/68—Burning rate maximum 10 cm per minute.
   - 1.7 High resistance to kerosene, petrol, distillate and oils.
2. Tests to confirm the above properties shall be carried out as described in Appendix O.
3. The required quantity of material in cubic metres shall be calculated by:
   - 3.1 Wooden Vessels

$$\frac{1.2 \times F}{1000 - D}$$

   - 3.2 Other Vessels

$$\frac{1.2\,(MK + F)}{1000 - D}$$

where

M = dry mass of hull material in kgs

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

F = total dry mass of fittings and equipment, and machinery installation if fitted, in kgs

D = density of buoyancy material in kg/m^3

Note:

Unless otherwise determined by the Authority K may be taken as:

Aluminium 0.62

G.R.P.	0.375
Steel	0.87

4. The material shall not be sprayed in, in situ, but shall be manufactured in slab form under controlled conditions, cut to the required size and fitted into the vessel.

5. Before fitting into position, each slab of the material shall be coated on all surfaces with an approved fire retardant paint or fire retardant resin.

6. The material shall be fitted into the vessel so that:

6.1 the centre of mass of the material is above the flooded centre of gravity of the vessel;

6.2 it is protected from physical damage;

6.3 it is protected from direct sunlight;

6.4 it is at least 0.5 metres away from any dry exhaust line or other source of heat;

6.5 it is secured to the satisfaction of the Surveyor.

APPENDIX O

TESTING OF FOAM BUOYANCY MATERIALS FOR LIFE-SAVING APPLIANCES

1. General

1.1 The tests detailed in 2, 3 and 4 of this appendix are to be carried out on foam buoyancy materials intended for use in lifeboats, rigid rescue boats, rigid liferafts, buoyant appliances, lifejackets and lifebuoys.

1.1.1 The tests need not be carried out on foam buoyancy materials intended for use in SOLAS lifeboats, rescue boats, liferafts, lifejackets or lifebuoys where the prototype articles have satisfactorily completed the tests required by Chapter III and IMO Resolution A 521 (13).

1.2 A foam buoyancy material shall be used solely in connection with the buoyancy of those types of life-saving appliances for which the material has been satisfactorily tested.

1.3 Other inherent properties, not mentioned in this appendix, may render a material unsuitable for use in certain appliances or for particular applications. For example, a material acceptable for use as buoyancy material in lifeboats may be too brittle for other applications, e.g. in lifejackets. The suitability of a material will also depend on the way in which it is to be used in relation to the appliance under consideration.

1.4 Except for the fire resistance test and bonding test and for those tests carried out on completed lifebuoys the tests are to be carried out on specimens (without skin or coverings) measuring initially 150 mm x 150 mm x 150 mm. However, where the standard thickness of the material as manufactured is less than 150 mm, sufficient layers of material should be bonded together with an adhesive compatible with the foam and any materials used in the tests to obtain the required test thickness.

1.5 The density, in kg/m^3 of each specimen is to be determined before test and included in the test report.

1.6 The tests are to be carried out by an independent testing authority, acceptable to the Authority and their report forwarded for consideration to the Authority. Wherever possible details of the precise way in which the material is intended to be used in the appliance should be included with the report.

2. Lifeboats, rigid liferafts, buoyant apparatus

2.1 The following tests should be carried out on specimens of buoyancy materials intended for use in lifebuoys, rigid liferafts and buoyant apparatus and appliances.

2.1.1 Test for Stability under Temperature Cycling

(a) Six specimens are to be alternately submitted to surrounding air temperatures of $-40° \pm 5°C$ and $66°C \pm 5°C$ for periods of

8 hours each. Ten complete cycles of cooling and warming are to be carried out.

(b) For the convenience of the testing authority, these alternating cycles need not follow immediately after each other and the following procedure is acceptable:

(ii) An 8 hour cycle at 66°C ± 1°C to be completed in one day.

(ii) The specimens removed from the warming chamber that same day and left exposed under ordinary room conditions until the next day.

(iii) An 8 hour cycle at −40° ± 1°C to be completed the next day.

(iv) The specimens removed from the cold chamber that same day and left exposed under ordinary room conditions until the next day.

(v) Repeated for ten cycles.

(c) The dimensions of the specimens are to be recorded at the beginning and end of the ten cycle period. At the end of the tests the specimens are to be carefully examined externally for signs of cracking, and two of the specimens are to be cut open and examined for change of internal structure.

(d) The remaining four specimens are to be submitted to further tests as follows:

(i) two specimens shall undergo the tests for water absorption; and

(ii) two specimens shall undergo the test for oil resistance with toluene (conforming to ASTM/D841/1977) or xylene (conforming to ASTM/D843/1977) and shall then undergo the tests for water absorption.

(e) The test report shall include a reference to any loss of rigidity under high temperature.

2.1.2 Test for Petrol and Oil Resistance

(a) Ten additional specimens not previously subjected to any other tests are to be tested as follows:

(i) two specimens are to be immersed for a period of 14 days under a 100 mm head of Crude Oil;

(ii) two specimens are to be immersed for a period of 14 days under a 100 mm head of Fuel Oil;

(iii) two specimens are to be immersed for a period of 14 days under a 100 mm head of Diesel Oil;

(iv) two specimens are to be immersed for a period of 14 days under a 100 mm head of toluene (conforming to ASTM/D841/1977) or xylene (conforming to ASTM/D843/1977);

(v) two specimens are to be immersed for a period of 14 days under a 100 mm head of Kerosene.

(b) The tests shall be carried out at normal room temperature (approximately 20°C).

(c) The dimensions of the specimens are to be recorded at the beginning and end of these tests.

(d) The results should state the mass in kilograms which each specimen could support out of the liquid after 1, 7 and 14 days immersion.

(e) The specimens should be examined on completion of the tests for evidence of attack by solvents and a report included in the final test report.

(f) Two additional specimens which have already been subjected to the temperature cycling tests are to be tested against toluene (conforming to ASTM/D841/1977) or xylene (conforming to ASTM/D843/1977) and afterwards subjected to the water absorption test.

2.1.3 Test for Water Absorption

(a) The tests are to be carried out in fresh water and the specimens are to be immersed for a period of 14 days under a 1.2 m head of water.

(b) The following tests are required:

(i) On two specimens not previously subjected to any other tests;

(ii) On two specimens which have been subjected to the temperature cycling test.

(iii) On two specimens which have been subjected to the temperature cycling test followed by the toluene or xylene test.

(c) The dimensions of the specimens are to be recorded at the beginning and end of these tests.

(d) The results should state the mass in kilograms which each specimen could support out of the water after 1, 7 and 14 days immersion (the selection of a test method suitable for obtaining this form of result directly or indirectly is left to the discretion of the testing authority).

2.1.4 Fire Resistance

(a) Tests should be carried out in accordance with American Standard for Testing Materials (ASTM) D 1692/68.

2.1.5 Combustion Products

(a) The test report shall include details of any gases given off on combustion, and the concentration of such gases.

2.1.6 Chemical and Physical Effects

(a) Manufacturers shall guarantee that the material does not contain any elements which would have an adverse effect on, or be adversely affected by, wood, steel, aluminium alloy, polyester/epoxide glass fibre laminates, paints or varnishes. Additionally, manufacturers shall confirm that the material contains no water soluble elements which on leaching out would adversely affect the above materials.

2.1.7 Bonding Tests

(a) The following adhesives shall be used to bond specimens of the buoyancy material 25 mm x 50 mm x 50 mm to form cubes 50 mm x 50 mm x 50 mm. Three such cubes shall be formed for each adhesive to be used in the test:

(i) an epoxy-resin adhesive,

(ii) a synthetic rubber adhesive, solvent based.

(iii) any adhesive recommended by the manufacturer.

(b) When the adhesive has cured, the test specimens are to be cut open perpendicular to glue line and the buoyancy material examined for any deterioration due to the adhesive.

3. Lifejackets

3.1 For buoyancy material intended for use in lifejackets the requirements of the tests in 2 are to be applied, except that:

3.1.1 In 2.1.1 (d) the reference to 'toluene (conforming to ASTM/D841/1977) or xylene (conforming to ASTM/D843/1977)' should be to 'diesel oil' and 'fuel oil';

3.1.2 In 2.1.2 (a) (ii) and (iii) the test shall be for 24 hours and not 14 days; and

3.1.3 In 2.1.3 (a) the tests shall be for 7 days and not 14 days.

3.2 Manufacturers of lifejackets shall guarantee to the Authority that the buoyancy material of the lifejacket is compatible with the covering material.

4. Lifebuoys

4.1 For buoyancy material intended for use in lifebuoys, all the tests specified in 2 are to be applied.

4.2 Alternatively, tests on two lifebuoys, complete in all respects, may be carried out as follows:

4.2.1 Temperature cycling tests—as in 2.1.1(a) and (b) the lifebuoys should be carefully examined for loss of rigidity under high temperature and afterwards for signs of cracking and shrinkage.

4.2.2 Test for oil resistance—the lifebuoys should be immersed for a period of 24 hours under a 100 mm head of toluene (conforming to ASTM/D841/1977) or xylene (conforming to ASTM/D843/1977) at normal room temperature, and the effect, if any, on the lifebuoys reported.

4.2.3. Drop Test—after completion of the tests in 4.2.1 and 4.2.2 one lifebuoy is to be drop tested by dropping from a height of 1.5 m onto a hard surface. The lifebuoy is to be dropped on edge and the height is to be measured from the lowest part of the lifebuoy. The lifebuoy is to be critically examined for distortion or cracking and is then to be cut open and examined internally for deterioration and the absorption of toluene or xylene and of fuel oil or diesel oil.

4.2.4 Flotation Test—the remaining test lifebuoy should be capable of floating in fresh water for at least 24 hours with a 14.5 kg mass of iron suspended from it, both before and after the tests detailed in 4.2.1 and 4.2.2 above. (The initial mass of the lifebuoy should be determined and reported, and the maximum mass of iron which the lifebuoy is capable of supporting, both initially and after 24 hours should be reported.)

(a) Prior to undergoing the final flotation test, four approximately equally spaced holes of 6 mm diameter should be bored through the minor axis section of the lifebuoy.

4.2.5 Drop Test of second specimen—after completion of flotation test, the remaining lifebuoy is to be drop tested and examined as per 4.2.3 above.

4.2.6 A sample of the untested buoyancy material is to be submitted after the lifebuoys have satisfactorily passed all the tests for purposes of comparison.

4.2.7 Manufacturers of lifebuoys shall guarantee that the completed lifebuoys would not have an adverse effect on wood, steel, aluminium alloy, glass