CHAPTER 4

LIFEBOATS

4.1 General

4.1.1 Statutory requirements

These are contained in Schedule 2, Part 1 of MSN 1676(M) or MSN 1677(M).

4.1.2 Constructional plans and submissions

Plans and specifications showing fully the materials scantlings, construction, seating, buoyancy, air support system, water-spray system, machinery and lifting arrangements are to be submitted to a 'Nominated' or 'Notified Body' for acceptance.

4.1.3 Early application for inspection

Shipowners and boatbuilders should be urged to make applications for survey in good time as certification may be delayed unless the lifeboat is adequately inspected during building. If for any reason a lifeboat which has not been fully surveyed and certified prior to being completed and placed on a ship it may require to be stripped completely for examination before being certified.

4.1.4 Inspection during construction

4.1.4.1 Construction

When inspecting during construction or repair, surveyors are to check that all statutory requirements affecting the construction are complied with and any departures from the requirements have been accepted by the Nominated or Notified Body.

4.1.4.2 Inspection at boatyard

All lifeboats under construction should be inspected at the boatbuilder's premises. The exception being when lifeboats are manufactured outside of the United Kingdom where agreed arrangements have been given by the Nominated or Notified Body for the inspection to be carried out on behalf of the Nominated or Notified Body by the Administration in the country where the boatyard is sited.

4.1.4.3 Quality inspection

(i) The Nominated or Notified Body should be satisfied in all respects about the material, workmanship and finish of lifeboats and make as many inspections during construction as are necessary for a proper survey. Where a lifeboat is one of a series modelled on a prototype lifeboat approved by the Nominated or Notified Body then reliance may be placed on the manufacturer's own inspection and quality assurance control and inspection by the Nominated Body will be limited to spot checks and random inspections to ensure that manufacturing methods and quality remain acceptable. Manufacturers with BS EN ISO 9001:1994 or BS EN ISO 9002:1994 certification will be subjected to the least number of such inspections.

(ii) The degree of inspection will be at the discretion of the Nominated or Notified Body according to individual circumstances. Repairs to a lifeboat should follow, as far as is practicable, the standards of construction of new lifeboats.

4.1.4.4 Certification

(i) When a Nominated or Notified Body approved lifeboat (which has previously been prototype tested in accordance with the requirements of Chapter 1 of Volume 2 - Testing of Life-Saving Appliances, and issued with a Certificate of Inspection and Tests) is satisfactorily completed, a report of the inspection should be issued by the boatbuilder in the form of a Builders Certificate.

(ii) As part of the quality control arrangements the manufacturer will prepare his own certificate. This should be countersigned by the surveyor responsible for inspection at the manufacturer's premises to certify that the boat has been produced in accordance with agreed and accepted arrangements.

(iii) The weight of the lifeboat, including fixed equipment, should be entered on the form. In the case of lifeboat of accepted design it will be sufficient to verify the weight of the prototype of the lifeboat concerned; surveyors should, however, be satisfied in all cases that, so far as is possible, the weight entered on the form is correct.

(iv) When a lifeboat is retained in stock after the issue of the Builders Certificate measures should be taken by the builders or owners to keep the lifeboat in good condition. When visiting boatbuilder’s yards, surveyors should call attention to this matter if they see any lifeboats that appear to have been in stock for a long period of time.

4.1.5 Marking of boats

4.1.5.1 Lifeboats

As part of certification the boatbuilder is required to permanently mark the boat as required by Schedule 2, Part 1, paragraph 6 of MSN 1676(M) including ship's identification number. After the manufacturer's name or trade mark and the date of manufacture the words 'Nominated or Notified Body' should be indelibly marked. As the boats have been produced under the manufacturer's quality approval system it will be for the surveyor undertaking the safety equipment survey of the ship to accept the builders certificate as evidence of satisfactory manufacture and he should carry out such further inspection and operational tests as are required. The surveyor at the ship will verify that the marking of the lifeboat is in accordance with the regulations.

4.1.5.2 Marking of glass-reinforced plastic boats

Where, because of the nature of the material used, it is not possible to adopt the conventional methods of "cutting-in or centre punching" the required markings should be engraved in or stamped on plates of metal or plastic which should be secured to the main structure by means of rivets, bolts with ends clenched, or screws with the slots removed by filing. Alternatively, the metal or plastic plates should be secured by means of epoxy adhesives and coated with translucent epoxy resin after fitting. Guidance on any other equally effective method may be sought from a Notified or Nominated Body.

4.1.5.3 Marking of dimensions

Dimensions marked on the lifeboat should be in metric to the nearest centimetre. The surveyor should ensure that the ship's name or radio call sign letters are clearly marked on top of the lifeboat canopy.

4.1.5.4 Alteration of markings

Once a lifeboat has been marked the marking should not be altered without the permission of the MCA, Nominated or Notified Body.

4.1.5.5 Marking indicating position on ship

In addition, a number should be painted on each bow to indicate the position of the lifeboat on the ship. Lifeboats fitted on the starboard side should be allocated odd numbers, from forward to aft, whilst those on the port side should be allocated even numbers in a similar manner.

4.1.6 Tests of lifeboats

4.1.6.1 General

(i) A prototype lifeboat should be tested as required by Chapter 1, Part 1 of Volume 2 - Testing of Life-Saving Appliances and the results of the tests submitted to and retained by the Nominated Body.

(ii) Lifeboats built subsequently to the same design need not be subjected to prototype testing provided that the material and workmanship are satisfactory and the production and installation tests listed in Chapter 1, Part XII of Volume 2 are completed satisfactorily.

4.1.6.2 Rowing and manoeuvrability

All prototype lifeboats, when loaded with equipment and the full complement of persons with each person wearing a lifejacket, should undergo rowing tests sufficient to make headway in calm seas, with the exception of free-fall lifeboats.

4.1.7 Internal buoyancy

4.1.7.1 Metal air cases

For lifeboats built prior to 1st July 1986 where they were manufactured with air cases forming internal buoyancy made of metal, there may be occasions when these have to be repaired or rebuilt. Where air cases forming the buoyancy are to be fabricated in metal, details should be submitted to the MCA.

4.1.7.2 Foam buoyancy

(i) Expanded foam or other materials are acceptable for internal buoyancy provided that they comply with the requirements of Chapter 1, Part 1, Paragraph 3 of Volume 2 - Testing of Life-Saving Appliances and have been accepted by the MCA. In some cases the manufacturers will be supplying the basic material for conversion by the user into foam material. In these cases the method of use should be acceptable to the MCA. The user should be asked to demonstrate that his operators can produce satisfactory foam from the basic materials and for this purpose the following procedure should be adopted, the foaming and tests being witnessed by a surveyor. Sample material should be foamed under the same conditions as would apply in practice.

(ii) If it is intended to foam into built-in tanks then the sample should be foamed in a tank of the same material, shape, and approximate size as the built-in tank.

(iii) The foam sample should be checked for density, quality and water absorption:

(a) the density should be within the limits as stated in the relevant acceptance, however, a slight increase above the upper limit is acceptable;

(b) the sample should be cut for visual examination to ascertain the uniformity of density and absence of air pockets,

(c) two specimens cut from the sample foam shall be tested in accordance with paragraph 3.4 in particular with 3.4.1.2 of Chapter 1 of Volume 2. The material is acceptable provided that after immersion there is no change in the dimensions of the cubes, and the weight of each cube does not exceed twice the original weight or 0.283 kg whichever is the less.

4.1.7.3 Position of buoyancy

(i) The buoyancy should be so placed in the lifeboat as to secure stability when fully laden under adverse weather conditions. To comply with this requirement the buoyancy as a general rule should be placed along the sides of the lifeboat and should be as wide as practicable in order to secure the maximum stability when the lifeboat is partially swamped. If, however, it is not practicable to fit all the buoyancy required along the sides, a proportion should be fitted in the ends, and not in the bottom of the lifeboat.

(ii) In large lifeboats there may be some difficulty in obtaining the most favourable disposition of the buoyancy; full particulars should be referred to the Nominated Body.

4.2 Wooden lifeboats

Any inquiry or proposal to fabricate a wooden lifeboat should be referred to a Nominated or Notified Body.

4.3 Steel lifeboats

Any inquiry or proposal to fabricate a steel lifeboat should be referred to a Nominated or Notified Body.

4.4 Aluminium alloy lifeboats

4.4.1 General

The following instructions apply to lifeboats constructed of aluminium alloy unless other arrangements are accepted by a Nominated or Notified Body. Reference

should also be made to the general requirements for lifeboats contained in paragraphs 4.1, 4.6 and 4.8 to 4.13.7.

4.4.2 Materials

The specification of the alloys used for structural members should normally be as follows:

Sheets: NS5 - BS EN 485 Parts 1 - 4, BS EN 515:1993 and BS EN 573 Parts 1 - 4.
Extrusions: NE5 - BS EN 755 Parts 3 - 6.
Castings: Normally Alloys LM 5,6 or 10, ISO 3522, ISO 7722 will be accepted but all proposals for castings should be submitted to MSPP2.

4.4.3 Construction

Full details of the structure including the attachment of the disengaging gear should be submitted to a Nominated or Notified Body for consideration and approval.

4.4.4 Painting

All surfaces should normally be de-greased and wire brushed before painting but where suitable etch-priming paints are used it is only necessary to de-grease. If the surface has been treated by the application of an etch primer the normal primary coat containing zinc chromate should be retained and other coats of paint should be of zinc oxide base or other suitable type. To ensure mutual compatibility of coats it is desirable that the paint system be supplied by one manufacturer. Lead based paints should not be used. All facing surfaces should be painted with the primer before assembly. The hollow formed at the junction of the garboard strake with the keel inside the boat should be filled in with bitumen and the floor plates should be notched at the keel to provide a good waterway.

4.4.5 Internal buoyancy

Where independent air cases are proposed details should be submitted to the Nominated or Notified Body.

4.5 Glass-reinforced plastic lifeboats

4.5.1 General

The following instructions apply to lifeboats constructed of glass-reinforced plastic (GRP) unless other arrangements are accepted by the MCA, Nominated or Notified Body. Paragraphs (4.1.1 to 4.1.7.3) also apply to GRP lifeboats.

4.5.2 Acceptance of establishment

The boatbuilder should give notice to the Nominated or Notified Body of his intention to build GRP lifeboats. The surveyor should check that the premises are suitable and that the persons who are employed have been properly trained for the type of work to be undertaken.

4.5.3 Premises

4.5.3.1 The type of workshop which is used for moulding GRP lifeboats is important because to a large extent this will affect the quality of the completed lifeboat. The moulding shop should be protected above and on all sides from the weather; it should be free of damp, maintained in a clean condition and adequately ventilated and lighted. Arrangements should be provided for maintaining the temperature between 15°C and 21°C and ideally, for controlling humidity at a low level. Above 21°C the loss of styrene from the surface layer may be excessive, resulting in an unsatisfactory laminate. The minimum temperature is governed by consideration of production techniques as although the laminate will cure satisfactorily even at low temperatures under these conditions the time to cure will be greatly increased.

4.5.3.2 Thermometers and a hygrometer should be provided and placed in suitable positions to ensure the environment is fit for the purpose. Undue draughts from openings, windows and doors should be avoided as these will impair temperature control and may result in excessive loss of styrene in the moulding. Where an air blower is used to remove the obnoxious styrene fumes whilst laminating it should not be allowed to play directly onto the surface of the laminate.

4.5.3.3 Direct sunlight will cause premature gelation of the resin and this factor should be borne in mind particularly with regard to the position of the mixing section. Also, because ultra-violet light affects the curing of the resin, fluorescent and mercury lighting, if fitted, should be kept well above the moulds.

4.5.4 Storage of materials

4.5.4.1 Materials used in the laminates should be carefully stored under conditions recommended by the manufacturers and used in accordance with their recommendations within their stated time limits. This is essential if deterioration and contamination, which can lead to unsatisfactory cure, are to be avoided.

4.5.4.2 Resins, catalysts and accelerators should be stored in a dry, cool place and during hot weather or in hot climates the use of a refrigerated chamber may be necessary. There is some evidence to suggest that glass reinforcing materials will deteriorate when stored in conditions of high humidity and it is essential for them to be kept in a dry place which is not subject to high

humidity conditions. Fillers should also be stored in a dry atmosphere. Unless there is another equally suitable place, these materials should be kept in the moulding shop.

4.5.5 Inspection during manufacture

4.5.5.1 In the case of prototypes, and particularly where the lifeboat is the first GRP lifeboat to be built by the boatbuilders, the surveyor should spend as much time as necessary to ensure that the proper procedures are being adopted and to satisfy himself that the arrangements used for the prototype will be equally acceptable for production lifeboats. The boatbuilder should appoint an inspector and if necessary a deputy inspector to supervise the process of laminating and they should be persons who, in the opinion of the surveyor, are qualified for this work. It will be a condition of the 'Nominated or Notified Body's' acceptance of the lifeboat that it has been inspected and certified at all stages by the inspectors. For this purpose the boatbuilder should keep, in a form agreed with the surveyor, records in accordance with BS EN ISO 9001:1994 or BS EN 9002:1994 which in general should include details of the resins, additives, accelerator, catalyst and glass-reinforcements for both the gel coat and main lay-up; workshop temperatures and humidity (including maximum and minimum readings); gel times; time between various stages of construction, including time lapse between each layer of laminate; post-curing and fitting out.

4.5.5.2 The records should be made available for the surveyor's inspection on request, and should be initialled and dated by him when inspected.

4.5.6 Plans and data

4.5.6.1 The plans should include a diagrammatic section showing the proposed lay-up, with a single line representing each layer of reinforcement. The method of fabricating the lifeboat should also be described. Where spray techniques are used, thicknesses should be quoted.

4.5.6.2 A longitudinal strength calculation should also be submitted by the boatbuilder showing the stresses which will arise in the gunwale and keel when the lifeboat is fully loaded and suspended by the lifting hooks. For the purpose of this calculation the bending moment should be taken as WL/6 where W is the weight of the fully laden lifeboat, including persons, stores and equipment, rations and water, and L is the distance between the lifting hooks. In view of the wide scatter in the strength of GRP materials and to ensure a high factor of safety, these stresses should not normally exceed 78.7 kgf/cm^2.

4.5.6.3 The names of the manufacturers of the resins and glass fibres it is proposed to use, the reference numbers of these materials and the names of the suppliers of ancillary materials should be stated. The resin formulations for the various parts of the lay-up (e.g. gel coat and main lay-up) should be stated and details of the additives, including catalyst and accelerator, should be quoted in

parts by weight of 100 parts of resin. The proposed resin/glass ratio should be stated.

4.5.6.4 The resin formulation, resin/ glass ratios, gel times, time allowable between successive laminating operations and time/ temperature curing conditions should comply with the resin manufacturer's published recommendations. The reason for any proposed departure from these recommendations should be given and the explanation accompanied by the resin manufacturer's agreement in writing to the proposed changes.

4.5.7 Resins and glass fibre reinforcements

4.5.7.1 Resins and glass fibre reinforcements should be of types which are recommended by the manufacturers for boatbuilding applications and are acceptable to the MCA, Nominated or Notified Body. Resins should comply with the requirements of British Standard 3532:1990 (1995) - Specification for Unsaturated Polyester Resin Systems for Low Pressure Fibre Reinforced Plastics except that the maximum absorption of cast resin, determined by Test Method 430 B of BS 2782 Part 4 - 1983, should not exceed 16.5 mg or by ISO 62 - 1980 - Plastics - Determination of Water Absorption - Method 2. Glass fibre reinforcing materials should comply with the requirements of the British Standard Specifications:

BS 3496 1989 (1995)	Glass Fibre Chopped Strand Mat for the Reinforcement of Polyester Resin Systems.
BS 3396	Woven Glass Fibre Fabrics for Plastics Reinforcement.
1991 (1996) = ISO 4605, ISO 4606	Part 1 Loom State Fabrics
1987 (1995)	Part 2 Desized Fabrics
1987 (1995)	Part 3 Finished Fabrics for use with Polyester Resin Systems

BS 3691 - 1990 (1995) Glass Fibre Rovings Fabrics for the Reinforcement of Polyester Resin Systems.

4.5.7.2 Resins used should be suitable for the production of laminates which will satisfactorily withstand the permissible stress at temperatures within the range 65°C to minus 30°C. Glass fibre reinforcements should be of the low alkali "E" glass type. (viz: containing not more than 1% alkali, calculated as $Na_2 0$). Chopped strand mats should be used for the main lay-up and these should not exceed a nominal 600 gm/m² in weight. Where alternative methods of lay-up are proposed using heavier chopped strand mats, full details should be supplied to the Nominated or Notified Body for consideration. Woven cloths, rovings and tapes may be used for parts of the lifeboat which are considered to be suitable for their application subject to the approval of the Nominated or Notified Body.

4.5.7.3 Where woven glass fibre reinforcements are used these should be supplied in the desized state and finished so as to provide good resin to glass adhesion and laminated wet strength retention. This requirement should be borne in mind by builders when glass fibre materials are ordered from the weavers instead of from the glass fibre manufacturer.

4.5.8 Fire retardant and other fillers

4.5.8.1 The mouldings should be made of self-extinguishing laminates. The test method to be used to ensure this is described in Chapter 1, Part 1, Paragraph 2 of Volume 2 Testing of Life-Saving Appliances. Specimens used for this test should be cut from sample panels one metre square made up as proposed for the intended lifeboat in way of the minimum laminate thickness. The self-extinguishing property should be imparted to the whole of the laminate, excluding the gel coat; to achieve this, either self-extinguishing resin acceptable to the Nominated or Notified Body as supplied by the resin manufacturer may be used, or fire retarding agents may be added by the boatbuilder to the non-self-extinguishing resin which should also be of a type acceptable to the Nominated or Notified Body. As it is possible for too great an addition of fire retarding agents to have an adverse effect on the mechanical and/or weathering properties of the laminate, the amounts used should be limited so that the fire retarding agents do not exceed a combined total of 20 parts to 100 parts by weight of resin.

4.5.8.2 When fillers such as pigments and calcium carbonate are added they should be limited so that the total quantity of fillers, excluding the fire retarding agents, does not exceed 10 parts to 100 parts by weight of resin. The fillers used should be as recommended by the resin manufacturer. (See paragraph 4.5.6 -"Plans and data".)

4.5.9 Wood and metal inserts

4.5.9.1 The use of wood or metal inserts should be avoided if possible. Any penetration of moisture will give rise to swelling of the wood or corrosion of the metal which may lead to delamination or fracture of the GRP material.

4.5.9.2 Where, however, it is proposed to use wood inserts as important load-bearing members, e.g.: the keel, full details of the method used for incorporating such members in the structure should be submitted for acceptance.

4.5.10 Mixing

4.5.10.1 A separate section within the moulding shop should be set aside for the mixing of the resin and the ancillary materials. Ideally one person should be in sole charge of the mixing section, and should have been properly trained in this aspect of the work.

4.5.10.2 Accurate weighing scales, measuring devices and mechanical mixers should be available for making the bulk mixes for the various applications. It is important that the ingredients should be thoroughly dispersed in the resin (particularly the catalyst, or the accelerator, whichever is used in the bulk mix) to ensure uniformity of the finished laminate, correct gel times and a uniform cure. Bulk mixes should be left to stand for a few minutes after mixing to allow air bubbles to escape.

4.5.10.3 The containers for the bulk mixes should be provided with suitable lids to exclude foreign matter and sunlight. Accurate measures should be available for adding the very small quantities of accelerator or catalyst to the small quantities of resin from the bulk mix which are issued to the operators.

4.5.10.4 These final additions of accelerator or catalyst should also be thoroughly dispersed in the mix. It should be noted that because they can react with explosive violence operators must never add catalyst and accelerator simultaneously to the resin.

4.5.11 Moulding equipment

4.5.11.1 Types of equipment used for impregnating the glass reinforcement vary between fabricators and it is important that the method employed and the tools used will ensure that thorough impregnation is achieved, air bubbles are to be kept to a minimum and the distribution of the glass fibres is not unduly disturbed. It may be found, for example, that in changing from one type of mat to another, a roller which was suitable for the former is not fully effective with the latter.

4.5.11.2 If rollers are dipped in styrene to prevent clogging during lay-up great care should be taken that no significant amount of this solvent is left on the rollers when continuing with the lay-up. If brushes and rollers are washed in household detergents as well as solvents such as acetone, trichloroethylene etc., they should be thoroughly rinsed and dried before being used again.

4.5.12 Moulds

4.5.12.1 Various materials have been found to be satisfactory for making moulds e.g.; cement, plaster, wood, metal, and reinforced plastic. Wood moulds made of synthetic boards should not, however, be used as these may contain products which can adversely affect the cure of the resin. For the same reason metal moulds made of copper or any of its alloys should not be used. Care should be taken to ensure that moulds made of wood or other porous materials are thoroughly dry before they are used.

4.5.12.2 The mould should be sufficiently rigid to prevent any deformation during moulding operations and its moulding surface should be capable of being polished to a high gloss. When necessary, the mould should be mounted

in such a manner that it can be rotated to facilitate laying-up parts which otherwise would not be readily accessible. Moulds for internal structures such as bulkheads, decking and seating should be made up in a similar manner.

4.5.13 Mould release agents

4.5.13.1 Before laying-on, the moulding surface should be thoroughly cleaned, polished and coated with a release film so that the moulding will not be damaged when it is released from the mould. The release film should be allowed to dry before proceeding with the lay-up.

4.5.13.2 Silicone and wax release agents should not be used for surfaces which are to be bonded or painted during a later stage because these types of release agents are difficult to remove. In all such cases a polyvinyl alcohol release agent should be used.

4.5.14 Gel coats

4.5.14.1 The function of a gel coat is to provide a good surface finish and to protect the main reinforcement from contact with water. The outsides of the hulls of GRP lifeboats should therefore be provided with a gel coat applied to the mould before laminating is started.

4.5.14.2 The gel coat should be a thin even coat of resin, thixotropic additives being used as prescribed by the resin manufacturer to prevent excessive drainage on inclined or vertical surfaces. The gel coat may comprise two separate coats, the second being applied at right angles to the first and the first coat should be completely dry before the second is applied. Excessive thickness of the completed gel coat should be avoided otherwise cracking or crazing may result.

4.5.14.3 The gel coat should be allowed to harden to a hard rubbery state before laminating is started. The laminating resin should then be applied without much delay or the result may be poor adhesion with the gel coat.

4.5.15 Laminating the shell

4.5.15.1 A glass or other accepted scrim cloth or surfacing tissue should first be applied to the gel coat as this will reduce its tendency to crack and will improve the weathering properties of the laminate. All air should be excluded between this layer and the gel coat (e.g.: there should be no wrinkling), or blisters will probably appear later on the outside surface of the shell.

4.5.15.2 Methods of applying and impregnating the glass reinforcement may vary between fabricators. As a general rule, each layer should be applied and impregnated separately using a resin mix having a short gel time. Care must be taken by the operator to ensure that there is a sufficient time lapse for the impregnation of the glass fibre with the resin after the resin has wet-out the glass

fibre before any rolling operations are carried out to remove air, unless the surveyor is satisfied that a suitable method is adopted which deals satisfactorily with more than one layer at a time and avoids any possibility of resin starved areas arising in the laminate. In no case, however, should more than two layers at a time be applied and the scrim cloth or surfacing tissue should always be applied separately.

4.5.15.3 Mineral fillers as additives to the resin and particularly to the gel coat should be used with great caution. In the former case they may lead to de-lamination if used to excess and in the case of gel coats to crazing under conditions of severe exposure.

4.5.15.4 The butts and laps of successive layers should be well staggered and each mat should overlap the adjacent mat by approximately 25 mm.

4.5.15.5 In the case of comparatively small mouldings, it will be possible to apply successive layers before the previous layer has gelled but with larger mouldings this will not be possible. The time between successive laminating operations should be as short as possible and in any case should not exceed the maximum interval recommended by the resin manufacturer.

4.5.15.6 Before applying each mat the surface should be checked to see that it is clean and free from dust etc. When the required number of layers has been applied, those parts of the inside surface which will be exposed should be finished with a glass or other approved scrim cloth or surfacing tissue to improve the weathering properties of the laminate.

4.5.15.7 The finished laminate should be essentially free of voids, cracks, blisters and dry areas and the surface finish should, in addition, be free from protruding fibres.

4.5.16 Spray gun construction

4.5.16.1 Where it is proposed that the resin and glass reinforcement be deposited by the spray gun method the boatbuilders should first apply to the Nominated or Notified Body for acceptance. Where GRP lifeboats are constructed by this method surveyors should visit the builders' premises as frequently as possible to inspect the methods of procedure and quality of the workmanship.

4.5.16.2 To ensure that consistent thicknesses of lay-up are obtained laminates should be tested for thickness by non-destructive methods, and physically where holes are drilled through the hull for fitting attachments. It is important that the settings by the operator on the two supply tanks are such that the correct resin to glass ratio is maintained.

4.5.16.3 The spray gun should generally be employed in the downhand position. In restricted spaces, such as built-in keels, or other places having sharp

changes in section, special care should be taken by the operators to ensure even distribution of the deposit. All lifeboats constructed by the spray gun method should be designated GS on the Builders Certificate.

4.5.17 Laminating rigid covers, buoyancy units, bulkheads, floors, seats, thwarts etc.

4.5.17.1 Where any of the remaining structure is to be of GRP material, the procedure and conditions for laminating will in general follow those for laminating the shell. When parts of the internal structure are to be laid-up integrally with the shell, formers are necessary for this purpose. These formers should be sufficiently rigid and secured to enable the operators to impregnate and roll out the mats properly.

4.5.17.2 Surfaces which may be walked upon should provide a good non-slip foothold both in wet and dry conditions.

4.5.18 Release of the moulding from the mould

Mouldings should not be removed from the mould until at least 12 hours after completion of the lay-up otherwise serious distortion may arise. Various means may be used for the purpose e.g. screw jacks, compressed air etc. After removal, the gel coat should be closely inspected and any defective spots touched-up and polished to a smooth finish.

4.5.19 Fitting-out

Upon removal from the mould, the moulding should not be subjected to an environment that is detrimental to curing. If any laminating or bonding is to be done during the fitting-out stage, the workshop conditions should be as required for the moulding shop. The shell moulding should be supported in a suitable cradle during its fitting-out stage, the cradle giving the support necessary to maintain the correct shape and dimensions of the hull, and this is particularly important where the lifeboat is made from half-mouldings. In such cases suitable jigging arrangements and supports should be provided to maintain the correct moulded shape and dimensions and thus prevent any undue locked-up stresses which might otherwise result.

4.5.20 Connections

4.5.20.1 Where internal GRP structures such as buoyancy units, bulkheads, floors, seats, thwarts etc., are not laid-up integral with the shell, or where half-shell mouldings are used, full details of the proposed methods for fixing and joining these items should be submitted to the Nominated or Notified Body.

4.5.20.2 The following types of connections have been adopted in GRP work; the practice indicated for each type is included for general guidance:

4.5.20.2(a) Bonding

Surfaces to be bonded should first be rendered free from release agent, grease and dust, then roughened and any dust removed. The gel coat should be removed in way of the surface to be bonded. The total thickness of fillet bonding strips should be approximately equal to the thickness of the thinner of the parts to be joined.

4.5.20.2(b) Riveting

Where rivets are used care should be taken not to damage the GRP materials. To avoid this, rivets should be cold-driven, the heads and points bearing on strips, plates or washers of appropriate material with proper precautions taken against bi-metallic corrosion. Where a watertight joint is required a suitable compound should be used. The rivets should be dipped in resin or other suitable sealant to seal the exposed fibres in the holes. The distance between the centre of the hole and the edge of GRP material should be at least three times the diameter of the hole. Where aluminium alloy rivets are used the material should be NR5 of BS 1473:1972 ISO 209-1, ISO 209-2 or equivalent.

4.5.20.2(c) Bolting

The conditions for riveting apply equally to bolted joints. Bolts should be of a non-corrodible material other than copper or a copper alloy. The holes should be of just sufficient diameter to take the bolts.

4.5.20.2(d) Screwing

This method is not acceptable except for the connection of items of relatively minor importance where a better type of connection cannot be readily employed. In such cases bolts or screws of coarse threads should be used.

4.5.21 Internal buoyancy

Owing to the difficulties in maintaining the air-tightness of built-in buoyancy tanks, the buoyancy spaces should be filled with an accepted buoyancy material. The surveyor should ensure that the materials are fitted in accordance with the conditions of acceptance.

4.5.22 Colouring and painting

4.5.22.1 Pigments are normally incorporated in the resin mixes to give the required colour finish.

4.5.22.2 Mouldings may, however, be painted provided this is done after the moulding is fully cured. A water-resistant grade of pre-treatment primer or an epoxide based primer paint should be used followed by any of the usual finishing coatings.

4.5.22.3 Before painting gel coat surfaces, all traces of the polyvinyl alcohol release agent should be removed from the surface by washing with warm water. Silicone and wax release agents should not be used for surfaces which are to be painted. (See paragraph 4.5.13).

4.5.22.4 The surface to be painted should be lightly rubbed down with a fine abrasive and cleaned to provide a good key for the priming paint, care being taken that only the surface layer of resin is abraded.

4.5.23 Curing

4.5.23.1 Although polyester resins will cure at temperatures below that of the moulding shop, to ensure quality control and to preclude the possibility of a lifeboat being put into service before it is fully cured, mouldings should not be subjected to temperatures below that of the moulding shop until they are in fact fully cured.

4.5.23.2 If curing at elevated temperatures is adopted to accelerate the curing process it is important that it should not be post-cured immediately after gelation of the resin. There should be a time lapse of at least 24 hours and if possible longer, before post-curing at an elevated temperature, and the post curing heat should be applied gradually as failure to do so may result in an unsatisfactory laminate. Also, the method used should ensure that the moulding is raised to an even temperature; this is particularly important where the moulding is left in the mould during the process of heat curing.

4.5.23.3 Care should be taken that there are no local areas subjected to too high a temperature as considerable damage can result, e.g.; blistering or under-curing.

4.5.24 Tests for degree of cure

4.5.24.1 At present, no simple and reliable test is available for use on site for assessment of the degree of cure and it is necessary for a series of both mechanical and chemical tests to be carried out by a competent authority to determine this.

4.5.24.2 Before the boatbuilder fabricates his first GRP lifeboat he should be asked to prepare a sample laminate for submission for assessment of the degree of cure to an authority acceptable to the Nominated or Notified Body. This sample laminate should be flat, 305 mm (12 inches) square and made with three 600 gm/m^2 (2oz/ft^2), or equivalent, chopped strand mats; these sample laminates are to be cut from a whole one metre square panel (which should not be cut from the edges) the chopped strand mats, the resin mix, the resin/glass ratio, gel coat and the curing conditions for this sample laminate should be as proposed for the lifeboat.

4.5.24.3 A copy of the report of any such tests including the self-extinguishing property test referred to in paragraph 4.5.8 should be requested by the surveyor from the boatbuilder. The Nominated or Notified Body may also ask for these tests to be repeated at any time.

4.5.24.4 Tapping with a hard light metal object, e.g.; a coin, is a useful form of test and, providing due regard is made to the position of the parts of the structure being tapped, under-cured and poorly impregnated areas would be indicated by the emission of dull sounds.

4.5.24.5 Laminates whose surfaces are “tacky” should be suspect and the boat should not be accepted in this condition. A “tacky” surface indicates that the surface resin is undercured but this does not indicate, however, the state of cure of the laminate beneath the surface.

4.5.25 Tests of the completed boat

4.5.25.1 The prototype of each size and design should be tested as prescribed in Chapter 1 of Volume 2 - Testing of Life-Saving Appliances. After each of the tests, the lifeboat should be examined thoroughly, particular attention being given to the various connections of the lifting arrangements. Where bolts are used for connections which may be highly stressed a number should be withdrawn for examination. During the overload test the behaviour of the lifeboat should be closely observed and attention paid to any sound which might indicate the weakness or failure of any part of the structure.

4.5.25.2 The results of the tests should be submitted to the Nominated or Notified Body for acceptance. Tests on subsequent lifeboats should be carried out in accordance with Chapter 1, Part XII of Volume 2 - Testing of Life-Saving Appliances.

4.5.25.3 Where any departure is made from the accepted materials or the method of construction used in an accepted prototype design, special instructions will be given about test requirements by the Nominated or Notified Body.

4.5.26 Repairs to faults and damage

Faults found during manufacture should be repaired immediately otherwise more serious defects may arise. Some faults, may not develop until the lifeboat has been in service for some time and when these are found the lifeboat should be removed for repair to a place where conditions are similar to those detailed in paragraph 4.5.3. Curing of the resin should be to the resin manufacturer's specification (see paragraph 4.5.23).

4.5.26.1 Minor repairs

(i) Faults such as slight surface blisters, abrasion or superficial damage can be readily dealt with by repair outfits suitable for use on GRP and which should be used in accordance with the manufacturer's instruction.

(ii) Where the gel coat only has suffered minor abrasion, the surface can be prepared and painted as described in paragraph 4.5.22.

4.5.26.2 Major repairs

These should be carried out by experienced personnel in accordance with the boatbuilder's instructions.

4.5.27 Cleaning during maintenance

GRP surfaces should be washed with water which may contain a household detergent provided all traces of the detergent are thoroughly washed away afterwards. Caustic washes should not be used because of the danger of attack on the surface resin which may later occur.

4.5.28 Repair outfits

4.5.28.1 These are sometimes supplied by the boatbuilder or resin manufacturer for emergency repairs.

4.5.28.2 All such repair outfits should be marked with their effective date: a notice should be included in each outfit to the effect that its contents should not be used after the expiry date quoted and that when they are used the repairs should be inspected by a surveyor at the earliest opportunity. This notice should also refer to the danger of unqualified persons using the repair materials on life-saving appliances and indicate that their use should be limited to repairs of a minor nature only.

4.5.28.3 Repair outfits should be examined by the surveyor at re-survey times and if out-of-date or incomplete they should be replaced.

4.6 Lifeboat propulsion

4.6.1 General

4.6.1.1 Paragraph 4 Part 1 of Schedule 2 of MSN 1676(M) gives the requirements for lifeboat propulsion.

4.6.1.2 In the use of new designs and modifications to existing designs of machinery installation a general arrangement plan of engine electric circuits, gearbox, stern gear and fuel tanks, including dimensions and properties of the

shafting, fuel tank and fuel lines and details of electrical fittings and ratings should be submitted to the Nominated Body

4.6.2 Acceptance of engine and gear box designs

The design of the engine and gear box should be accepted by one of the approved classification societies (see paragraph 4.6.4). For such acceptance by the Nominated or Notified Body, dimensioned and detailed drawings of the engine components and transmission gear, together with particulars of the maximum cylinder pressure, mean indicated pressure, revolutions per minute, brake horse power, estimated fuel consumption and lubricating arrangements should be submitted along with details of materials used for various components.

4.6.3 Inspection during manufacture

In the case of engines approved by the Nominated or Notified Body for which only the makers' certificates are to be produced, the makers' works should be visited on the occasion of the first order, and occasionally thereafter, by the Nominated or Notified Body's surveyors who should be satisfied regarding the standard of production and testing and they may at their discretion require Brinell or other check tests of the shafts at any time. However, if the works are large and well known and the engines are produced on a mass production basis, inspection of the works need not be made unless there is reason to doubt the quality of workmanship, inspection and testing facilities used.

4.6.4 Certificate of materials and tests

4.6.4.1 The makers should normally furnish certificates covering the physical properties of the material of crankshaft, gearbox shafts and hydraulic tests of the cooling water spaces.

4.6.4.2 Alternatively, certificates issued by the following Nominated Bodies covering the engine and gearbox are acceptable:

The British Technical Committee of the American Bureau of Shipping
The British Committee of Bureau Veritas
The British Committee of Det Norske Veritas
The British Committee of Germanischer Lloyd
The British Committee of Lloyd's Register of Shipping

4.6.4.3 Alternatively, certificates issued by a Notified Body under the EU Marine Equipment Directive covering the engine and gearboxes are acceptable.

4.6.5 Inspection and tests of prototype engines

For the prototype engine, a Nominated Body surveyor shall witness cold starting, and other tests in accordance with Part X of Chapter 1 to Volume 2 - Testing of Life-

Saving Appliances. Nominated or Notified Body certificates or certificates issued by other administrations backed up by test reports for some or all of these tests may be accepted if adequate and satisfactory.

4.6.6 Intermediate and propeller shafts

4.6.6.1 Intermediate shafts should have a diameter not less than that determined by the following formula:-

$$d = 100 \{ 560\, P/(t + 160)R\}^{0.333}$$

where
- d = diameter of shaft in mm
- P = Power transmitted by the shaft in kW
- R = revolutions per minute of the intermediate shaft
- t = specified minimum tensile strength of the material normally between 400 N/mm^2 and 800 N/mm^2 provided percentage elongation on a test length of $5.65\,(So)^{0.5}$ is between 26 and 11.

(Note: 1. (So) is the cross sectional area of the test piece.
2. If the percentage elongation at corresponding minimum tensile strength is not satisfactory the material may not be acceptable for the intermediate shaft, or the propeller shaft as described below).

4.6.6.2 Propeller shafts protected from sea water by oil lubrication and effective seals, or by a continuous liner should have a diameter not less than that determined by the following formula:-

$$d_p = 100\, k \{ 560\, P / (t+160)R \}^{0.333}$$

where
- d_p = diameter of the propeller shaft in mm

P, R and t are the same as for Intermediate shaft, however the value of t in the formula now will be limited to 600 N/mm^2 although in actuality it might exceed this value and with satisfactory elongation
- k = 1.22 where the propeller is keyless
- = 1.26 where the propeller is keyed.

If a non-corrosion resistant propeller shaft is exposed to sea water k will be taken as 1.26 and t will be taken as 400 N/mm^2 in the above formula so that the formula reduces to: $d_p = 126\,\{P/R\}^{0.333}$ where the symbols are as defined above.

If the propeller shaft is made of a corrosion resistant material and is exposed to sea water the diameter should be determined by multiplying the reduced formula above by a factor A which is less than 1 and its value dependent on its corrosion fatigue resistance property. For stainless steel 316 the A value has

been accepted as 0.71. For other materials suitable A values would be considered based on metallurgist's report on any tests.

4.6.7 Fuel tanks etc.

4.6.7.1 Fuel tanks must be of sufficient capacity for 24 hours continuous operation at speed of 6 knots, and should be substantially constructed of steel or other accepted material and should be free standing as opposed to built-in design. Aluminium alloy fuel tanks may be considered if sited in a position separated and removed from the engine. Aluminium should not be used in association with copper pipes or fittings, unless adequate precautions are taken against electrolytic action. The exterior of the tanks should be protected against corrosion from sea water by metal spraying or other means affording protection equivalent to galvanising. Completed fuel tanks and their connections should be capable of withstanding hydraulic pressure to a head of at least 5 metres above the top of the tank. The fuel tank shall have no external load on it.

4.6.7.2 Surveyors may accept a maker's certificate for the fuel tank test. The number of joints in a fuel pipe should be kept to a minimum and a shut-off cock must be fitted at each end. Fuel pipes should be of copper or steel except as indicated in paragraphs 5.2.2.8 and 6.4.9. Any shut-off cocks fitted in fuel pipes should be clearly marked to show whether they are OPEN or SHUT.

4.6.8 Protection of installation

4.6.8.1 The engine and its accessories including the fuel tanks, pipes, and fittings should be adequately protected to ensure reliable operation under adverse weather conditions with water spraying over the boat and collecting in the bilges. Attention should be given to the location of alternators fitted to recharge batteries to ensure ease of access and protection from adverse weather or water thrown up by the engine flywheel.

4.6.8.2 The engine casing must be fire resistant and should preferably be made of steel; if made of aluminium alloy, glass reinforced plastic or marine plywood they should be lined with materials the insulating properties of which should be equivalent to an A.30 standard.

4.6.8.3 Proposed methods of insulating engine casings should take the form of attaching a 25 mm approved A.30 fire insulation to the engine casing sides and tops by steel pins and spring washers, all covered with a vapour barrier and held in place by a wire mesh. The steel pins with a back plate should be glazed to the casing when the engine casing is made of glass reinforced plastic. When the engine casing is made of aluminium the pins should be stainless steel and mechanically attached to the casing. All conduits and penetrations through the casing will need to be plugged to prevent the spread of fire and fumes within the boat. "INTUMESCENT" paint or resins should NOT be used on the inside of glass reinforced plastic engine casings. Casings for air cooled engines, whilst maintaining the necessary fire protection, should allow adequate

circulation of the cooling air and any openings in the casings necessary for this purpose should be capable of ready closure in case of fire.

4.6.8.4 Cooling water circulating pumps, where fitted, should be self- priming and permit operation for at least five minutes without damage to the pump with the boat clear of the water.

4.6.9 Exhaust piping

Care should be taken in the siting of the exhaust pipes to ensure that:

- there are no exhaust system leaks;
- the exhaust and its lagging runs clear of the bilge water area and that there is little risk of bilge water contacting the engine manifold and exhausts when the boat is in use;
- exhaust lagging is clean and dry and is provided with suitable protection; and
- any paint used on engines, manifolds and exhausts does not give off fumes when it is heated.

4.6.10 Machinery for special lifeboats and inflated boats

4.6.10.1 For machinery for dual purpose lifeboat/passenger launches, see paragraph 4.7.3.

4.6.10.2 For outboard motors for rescue boats and inflated boats, see paragraphs 5.2.2 and 6.4 respectively.

4.6.11 Lubricating oil

Lubricating oil supplied for use in motor lifeboats should be of a grade suitable for the temperatures likely to be encountered in service.

4.6.12 Spare parts and tools

4.6.12.1 A box of durable construction containing spares and tools should be supplied with the engine and include the following:

- one set of inlet and exhaust valves for one cylinder, with springs, washers and cotters;
- one fuel injection nozzle and joint;
- one fuel pipe;
- one set of pressure joints;
- one fuel filter element;
- associated spanners to enable the spares to be fitted;

- screwdriver and pliers; and
- an instruction manual.

4.6.12.2 The box should be carried in the lifeboat and contain an engine "Fault location chart" which should indicate the likely faults and how they should be remedied. The chart should be printed in "English" in prominent type on a waterproof card.

4.6.13 Fire extinguishing appliances

(See under Lifeboat equipment)

4.6.14 Manoeuvring and manning trials

The surveyor should witness manoeuvring and speed trials of a prototype of each motor lifeboat in both the loaded and light conditions. For each subsequent motor lifeboat he should normally witness engine manoeuvring and running trials to satisfy himself that the machinery has been properly installed.

4.7 Dual lifeboat/passenger launches (tenders)

4.7.1 General

4.7.1.1 Where motor lifeboats carried on cruising passenger vessels are used habitually to ferry passengers between ships and shore, they should comply as far as is reasonable and practicable with the requirements for Class VI passenger ships. For a single occasion in connection with the trials of a new ship consideration will be given to dealing with the matter by exemption under section 85(6) of the Merchant Shipping Act 1995 and if such an exemption is granted no passenger certificate will be required.

4.7.1.2 When the parent ships are in ports outside the UK the lifeboat/launches will be subject to the requirements of the local administration which may require relevant certification for lifeboats when operating as passenger tenders in their particular ports. A copy of a typical "Lifeboat/Passenger Tender Safety Certificate" is reproduced at Appendix B.

4.7.2 Additional equipment

The following additional equipment is appropriate to a lifeboat when it is used for ferrying passengers:

- Mast with mast head lantern.
- Side and stern lanterns.
- Mechanical fog horn, whistle or klaxon.

- Two 760 mm lifebuoys (one with smoke marker and self-igniting light and one with 18 metres of buoyant line).

- One lifejacket of a type normally carried by the ship, for each person or alternatively of a type approved for Class VI passenger ship operations under the 1999 Regulations.

- Fixed VHF radio telephone installation or hand held portable VHF capable of uninterrupted communication with the ship.

Note:-
Under the 1999 Life-Saving Appliances Regulations applicable to Class VI passenger ships open reversible liferafts and/or buoyant apparatus are required to be carried dependant on the standard of survivability of the boat and the number of passengers carried (see Regulation 8(1) of the Merchant Shipping Passenger Ship Construction: Ships of Classes III to VI(A)1998 Regulations). As lifeboats have superior buoyancy characteristics, when compared to a normal Class VI ship, the MCA has accepted that it is not necessary to carry such liferafts or buoyant apparatus on tenders/lifeboats provided that;

(i) During any passenger ferrying operations at least two tenders or lifeboats are in the water at any one time.

In the event of an accident to one, the other will be able to assist. Other potential rescue craft should be available aboard the parent ship, or elsewhere, and their number, capacity and availability should reflect the number of persons that may need to be rescued;

(ii) The tenders only operate in "favourable weather" as defined in regulation 2(3) of the 1999 Regulations; and

(iii) The master of a cruise passenger ship operating lifeboat/tenders for ferrying passengers arranges a ship/tender(s) communication link which is open and manned at all times when ferrying operations are in progress.

4.7.3 Machinery installations

The machinery installations will be given special consideration and whilst they should comply with the requirements for motor lifeboats (see paragraph 4.6) they should also be generally in accordance with the requirements for construction and inspection appropriate to Class VI passenger launches. Where acoustic insulation is proposed for the engine enclosure, arrangements should be made to prevent oil absorption by the insulating material. In appropriate cases, supplemental fire extinguishing appliances may be necessary, but at least a two gallon foam extinguisher or equivalent should be provided in each passenger cabin, with a minimum of two to be carried, and it is strongly recommended that a fixed fire extinguishing installation be provided when the propelling machinery is contained within an enclosed compartment. Where remote control of the machinery and

steering is proposed, arrangements for local control of the machinery and a hand tiller should be provided.

4.7.4 Points of particular observation

4.7.4.1 The following should be particularly observed:

(i) The lifejackets should be readily available and protected from the weather.

(ii) The person in charge of the boat should be a certified officer or lifeboatman or person holding the relevant grade of Boatmaster's Licence and at least one other person should be carried as crew; the latter is to be a member of the ships crew with some knowledge of the boat's engine.

(iii) Passengers should be carried only in favourable weather and their number limited to an agreed figure less than the number of persons for which the lifeboat is certified.

(iv) After completion of the passenger tender service, the additional equipment should be removed and the boat returned to its full operational mode as an open or partially enclosed lifeboat before the ship proceeds on any other voyage to sea. An exception to this requirement may occur if the boat is prototype tested and approved as a lifeboat with all of the additional tender equipment installed and the seating capacity in the lifeboat mode is not reduced by the presence of such equipment.

4.7.4.2 Special cruise launches not included in the ship's life-saving appliances should be treated in a similar manner except that the equipment carried need not be removed from the boats before the ship proceeds to sea.

4.8 Lifeboat fittings

4.8.1 General

The requirements are listed in Schedule 2, Part 1, paragraph 5 of the MSN 1676(M).

4.8.2 Drain valves

Where access is not possible at arms length by an occupant other suitable means of closing the valve should be provided. Working instructions should be posted adjacent to the position indicator. The surveyor should be satisfied that the design and attachment to the main hull of the automatic drain valve is acceptable.

4.8.3 Rudder

4.8.3.1 Rudders should be of suitable form and strength for the size of the lifeboat. They may be constructed of laminated plywood conforming to BS

1088 and 4079 provided that the edges are suitably sealed. Rudders may also be constructed of glass reinforced plastic, steel or other suitable materials in which case full particulars should be submitted to the Nominated or Notified Body.

4.8.3.2 Where a nozzle rudder is fitted it may be necessary to provide protection for the safety of persons in the water and to prevent the entry of debris into the propeller stream and cause fouling.

4.8.4 Steering gear

4.8.4.1 The basic requirements are to be in accordance with paragraph 5.2 of Schedule 2. Details of the tiller and associated remote steering either by direct linkage, wire-operated lever system or by a hand operated hydraulic system connected to the helmsman's position should be submitted to the Nominated Body for approval. The surveyor should carry out manoeuvring tests ahead and astern to prove the adequacy of the system when the lifeboat is in the light condition and also in the loaded condition.

4.8.4.2 The surveyor should also be satisfied that in an emergency the steering gear can be easily disconnected or by-passed and the emergency tiller can be easily and quickly shipped such that control of the lifeboat may be regained.

4.8.5 Buoyant lifelines

4.8.5.1 A line must be becketed round the outside of the boat clear of the rudder and the propeller. It should be of 16 mm diameter rope complying with the material requirements of Appendix O, having full loops reaching within 76 mm of the load water line.

4.8.5.2 On fire protected lifeboats the lines should be 4 mm diameter flexible stainless steel wire rope sheathed with PVC and led through hardwood handgrips. The surveyor should ensure that the method of attachment to the hull precludes corrosive action.

4.8.6 Bilge rails

This paragraph applies to partially enclosed lifeboats which are not self-righting. Bilge rails shall be fitted on each side at the turn of the bilge and shall extend over the midships' half of the length of the lifeboat. They shall be of steel, aluminium alloy or equivalent material and the fastening of the bilge rail brackets to the main hull of the lifeboat should in no case penetrate the hull and should be designed to break off following an impact.

4.8.7 Lockers

A sufficient number of lockers should be provided to stow food, water and small items of equipment. The access covers shall be as large as practicable and fitted with a watertight closure. The closure shall be hand operated and shall not require any special tools.

4.8.8 Painter release

4.8.8.1 Details of the design including the specification of the materials should be submitted to the Nominated or Notified Body for approval. The device should be capable of releasing the painter of the fully equipped and loaded lifeboat when the lifeboat is being towed at speeds of up to 5 knots.

4.8.8.2 The release gear should operate from within the cover of the lifeboat to protect the operator from any backlash. The surveyor should check the attachment to the lifeboat and the operation under fully loaded conditions to ensure that it will release the lifeboat effectively and safely.

4.8.9 Antenna

For details see paragraph 12.2.2.2.

4.8.10 Skates and fenders

4.8.10.1 Fender

If a rubber or other equivalent material fender is fitted it should be fastened all round the lifeboat at gunwale level. The surveyor should check the attachments to the hull for corrosive action and depth of countersinking.

4.8.10.2 Skates

(i) The primary purpose of skates if fitted is to enable a lifeboat when being launched to override projections on the side of a listed ship and to protect the occupants and the lifeboat from severe impact loading when swinging horizontally under adverse sea conditions. They should be designed to minimise injuries to the occupants and to prevent serious and troublesome distortion within the lifeboat.

(ii) The skates should not be unduly heavy to facilitate their ready removal if not permanently attached when the lifeboat is waterborne. Skates should be manufactured of metal or other suitable material and shaped to the form of the lifeboat. The skates and their attachment to the lifeboat should withstand impact loading and also the lowering friction induced by a high side abandonment. The attachment of the skates may be taken around the outside of the lifeboats and should be designed for quick release by an occupant from within the lifeboat. Arrangements which involve the fitting of a wire or chain or any other attachment which passes across the lifeboat from gunwale to gunwale is not acceptable. Plans

showing particulars of the scantlings, materials and details of the securing and release arrangements should be forwarded to the Nominated or Notified Body for acceptance. The surveyor when witnessing the impact test carried under the requirement of Part I of Chapter 1 to Volume 2-Testing of Life-Saving Appliances should examine the skates and the lifeboat for any indications of damage.

4.8.11 Lights

An external light shall be fitted on top of the cover and shall comply with the requirements of Schedule 2, Part 1, paragraph 7 of MSN 1676(M). An internal light or lights depending on the size and arrangement of the lifeboat shall be fitted and shall also comply with the requirements of Schedule 2, Part 1, paragraph 7 of MSN 1676(M). Prototype testing of the lights shall be in accordance with Part XI of Chapter 1 to Volume 2-Testing of Life-Saving Appliances.

4.8.12 Pumping system

4.8.12.1 The statutory requirements for manual pumps are contained in Part 5 of Schedule 2 of MSN 1677(M). The arrangements should enable all parts of the lifeboat to be kept clear of water. Where the engine compartment is contained by deep floors forming an oil dam a separate suction should be provided. Suction hoses may be of rubber or other equivalent material and should be fitted with suitable strainers or strum box at the bilge opening.

4.8.12.2 The number of pumps is to be to the satisfaction of the Nominated or Notified Body, however as a guide, lifeboats certified to carry more than 60 persons should be provided with two pumps suitably separated.

4.9 Partially enclosed lifeboats

4.9.1 General

4.9.1.1 Partially enclosed lifeboats should comply with Parts 1, 2 and 3 of Schedule 2 of the MSN 1676(M).

4.9.1.2 Reference should also be made to the general requirements for lifeboats contained in the previous paragraphs Chapter 4.1 to 4.8.12.

4.9.1.3 Prototype testing should be in accordance with Part II of Volume 2 - Testing of Life-Saving Appliances.

4.9.2 Rigid covers

Details of their construction and attachment to the main hull of the lifeboat should be submitted in accordance with paragraph 4.1.

4.9.3 Access hatches

4.9.3.1 An access hatch should be provided at each end of the lifeboat of sufficient dimensions to permit one person standing within the hatch to operate the lifting assembly, the painter attachment and the re-cocking gear attached to both and to receive and secure the towing painter. Hatch openings of 550 mm x 550 mm have been found to be generally suitable.

4.9.3.2 The hatch should be operable when the lifeboat is stowed and in the secured position on board the ship. The lifeboat launching sequence should be unaffected with the hatch open or closed.

4.9.4 Windows

Windows should be fitted to provide the helmsman with reasonable all-round visibility and to provide daylight and orientation within the lifeboat. The windows may be of Perspex or other translucent material having the same properties of strength and fire resistance as the rigid cover. Suitable protection should be arranged where the position of the windows may be struck by the lower fall block or lifting pendant.

4.9.5 Guard rails

Where access is provided around the outside of the lifeboat suitable rails should be fitted externally to provide a secure hand hold at the appropriate height port and starboard.

4.9.6 Non-Skid treads

External and internal surfaces which may be used for walking and stepping should have a raised pattern or an adhesive type non-skid tread.

4.9.7 Canopy

4.9.7.1 Stowage and securing

(i) The method of stowage, support arrangements, openings and closing and emergency quick release from inside and outside should be examined carefully by the surveyor to establish that the system is practicable.

(ii) Where the canopy is also used as a boat cover the surveyor should check that the time taken to prepare the boat for launching and embarkation does not exceed the maximum allowed.

4.9.7.2 Materials

Details of the materials including strength, fire-retardant properties and insulation against cold should be submitted to the Nominated or Notified Body.

4.9.7.3 Rowing

Ports or flaps should be incorporated in the canopy to permit the shipping of oars.

4.9.7.4 Rainwater collection

Where part of the canopy or a separate piece of canvas is rigged for the collection of rain-water it should incorporate a short length of hose with a suitable stopper to facilitate transfer into suitable fresh water containers.

4.10 Totally enclosed lifeboats

4.10.1 General

4.10.1.1 Totally enclosed lifeboats should comply with Parts 1, 2 and 4 of Schedule 2 of MSN 1676(M).

4.10.1.2 Reference should also be made to the general requirements for lifeboats contained in paragraphs 4.1.1 to 4.6.14 and 4.8.1 to 4.8.12.

4.10.1.3 Prototype testing should be in accordance with Chapter 1 Part III of Volume 2- Testing of Life-Saving Appliance.

4.10.2 Propulsion

4.10.2.1 Paragraph 4 Parts 1 and 4 of Schedule 2 of MSN 1676(M) gives the requirements for lifeboat propulsion. (See also Paragraphs 4.6.1 to 4.6.14 of these Instructions.)

4.10.2.2 The engine and pumps associated with it should be able to run on no load with the lifeboat out of the water for a period of at least 5 minutes without overheating or other damage. Sea water pumps associated with the engine should be self-priming.

4.10.2.3 Engine and gearbox dipsticks and lubricating oil filler caps should be oil tight, and arrangements to prevent the loss of oil through crankcase breather pipes should be provided, to enable the engines to run inverted.

4.10.2.4 Means of preventing sea water entering the exhaust pipe, and air locks forming in the fuel system, should be provided, and the fuel tank ventilating arrangements should not allow the escape of fuel oil when the tank is inverted.

4.10.2.5 To demonstrate that the fuel and exhaust arrangements are satisfactory, an inversion test on the lifeboat with the engine running should be conducted to verify that either:

(i) the engine installation is capable of running in any position during capsize and continues to run after the lifeboat returns to the upright, or

(ii) the engine installation automatically stops on capsizing and can easily be restarted after the lifeboat returns to the upright.

4.10.2.6 The propulsion machinery should be arranged so that the helmsman is able to remotely start the engine in the case of electric starting and is also able to control the engine output and direction of rotation of the propeller.

4.10.2.7 If electric accumulator batteries are fitted they should be of a type that will not allow the electrolyte to leak during capsizing. Where charging of batteries in situ from the ship's main source of power is employed, the charging arrangements should not interfere with the launching of the lifeboat, and the electrical supply into the boat should not be more than 55 volts. The batteries should be suitably ventilated to outside atmosphere.

4.10.3 Rigid cover

4.10.3.1 Details of the construction and attachment to the main hull of the lifeboat should be submitted in accordance with paragraph 4.1.

4.10.3.2 The cover should be watertight and of sufficient strength such that the combination of the main hull and the rigid cover structure may be regarded as a single unit for assessment of strength.

4.10.4 Strength

4.10.4.1 The structure should be capable of supporting the total loaded mass when the lifeboat is inverted. For lifeboats constructed of glass-reinforced plastic the longitudinal strength should be assessed as in paragraph 4.5.6.

4.10.4.2 For lifeboats constructed of steel, aluminium-alloy or other materials details will be given on request by the Nominated or Notified Body.

4.10.4.3 An inner hull comprising of the floors, seats, tanks for fresh water, provisions and equipment which extends over the main length of the lifeboat and which is properly connected to the main hull of the lifeboat may be taken into account when assessing the strength.

4.10.5 Access openings

4.10.5.1 These should be fitted port and starboard either amidships or aft depending on the arrangement and the method of embarkation adopted. This is not applicable to free-fall lifeboats.

4.10.5.2 The openings should be suitably stiffened, corners should be rounded and any sharp edges should be protected to avoid injury to persons moving around the lifeboat.

4.10.6 Access doors

4.10.6.1 Doors should be stiffened and provided with sealing arrangements such that the overall integrity of the cover is maintained. Clips and hinges should be of non-corrodible material and the clips should be operable from both sides. To facilitate control at all times suitable handles should be fitted. Hinged doors should have a suitable device fitted to hold the door securely in the open position.

4.10.6.2 If sliding doors are fitted the surveyor should check that the sliding tolerances are adequate and that the sealing arrangements are such that in the worst case the watertight standard is maintained.

4.10.7 Hatches

4.10.7.1 Where there are side embarkation doors a hatch should be fitted at each end of the lifeboat. See paragraph 4.9.3.1.

4.10.7.2 Where embarkation doors are fitted at the after end a hatch should be fitted forward and consideration should be given to fitting a hatch directly above the helmsman's position if it is fitted aft.

4.10.7.3 The hatches should be operable when the lifeboat is in the stowed position on board the ship and should be arranged to function without interfering with the launching sequence.

4.10.7.4 Clips and hinges should be of non-corrodible material arranged to secure the hatch watertight. Clips are to be operational from both sides.

4.10.8 Visibility

4.10.8.1 Windows should be fitted in the cover port and starboard to provide reasonable illumination of the interior and also to provide orientation within the lifeboat.

4.10.8.2 Windows should be fitted in the helmsman's conning tower to provide reasonable all-round visibility.

4.10.8.3 The windows may be made of Perspex or other translucent material having the same properties of strength and fire resistance as the cover. Suitable protection should be arranged if there is any likelihood of the windows being struck by the lower fall block, lifting pendant or recovery strop.

4.10.9 Guard rails

4.10.9.1 Where access is provided around the outside of the lifeboat suitable rails should be fitted at an appropriate height port and starboard.

4.10.9.2 Grab rails should be fitted adjacent to the access doors to facilitate boarding. The surveyor should examine the method of boarding bearing in mind the rescue of persons from the water and the transfer to and from another lifeboat or rescue craft when determining the provision and positioning of grab rails.

4.10.10 Ventilators

Ventilators in the rigid cover should close automatically in the event of capsizing and provision should be made for manual closing of the ventilators from within the cover.

4.10.11 Sole

4.10.11.1 Soles are to be fitted to permit boarding to take place without anyone having to climb over thwarts or other obstructions.

4.10.11.2 Surveyors should check that a non-skid finish is provided for all walkways.

4.10.12 Headroom clearance

Surveyors should check that any projections, particularly above eye-level, which may cause injury to anyone should be fitted with an energy absorbing cushion.

4.10.13 Rowing

It is assumed that the access doors are open and the oars are positioned in way of the door opening. Crutches are to be provided and be securely attached to the lifeboat by lanyards or chains.

4.10.14 Seat belts

4.10.14.1 Four point seat belts consisting of lap and shoulder harness are to be provided for each seat position marked. The surveyor should ensure that the attachment to the lifeboat structure is adequate. In glass-fibre lifeboats the attachment may consist of a steel plate bonded into the structure and the bolts should be examined for security and waterproofing to eliminate damp entering the glass-reinforcing structure.

4.10.14.2 Surveyors should also ascertain that the lifejackets supplied to the ship are compatible with the lifeboat seating arrangements. This is very important with regard to head protection and lengths of the restraining straps of the four-point harness fitted.

4.10.15 Head protection

4.10.15.1 In conjunction with wearing an approved life-jacket and the fitting of a four-point safety harness during the launch of the lifeboat suitable head protection should be fitted at each seat position.

4.10.15.2 This may consist of a 50 mm polyethylene foam pad with a flame retardant cover. The pad may require a head restraint strap and wings to provide forward and lateral support, respectively, for the head.

4.10.15.3 The surveyor should be satisfied that the protection is adequate considering each position in the lifeboat.

4.11 Totally enclosed lifeboats with self-contained air support system

4.11.1 General

4.11.1.1 Totally enclosed lifeboats having an air support system should comply with Parts 1, 2, 4 and 5 of Schedule 2 of MSN 1676(M).

4.11.1.2 Reference should also be made to the general requirements for lifeboats contained in the previous paragraphs, 4.1 to 4.6.14, 4.8.1 to 4.8.12 and 4.10.1 to 4.10.15.

4.11.1.3 Prototype testing should be in accordance with Chapter 1 Part IV of Volume 2 - Testing of Life-Saving Appliances.

4.11.2 Air supply

4.11.2.1 Air of breathable quality should be supplied to meet the requirements of the occupants, and for the engine at full power, and to ensure that a small positive air pressure is maintained within the lifeboat and rigid cover.

4.11.2.2 The air should be distributed within the lifeboat so that all the occupants receive replacement air during the period when the lifeboat is closed down.

4.11.2.3 Air cylinders should be made to BS 5045 Part 1: 1982 ISO 4750 and Part 2: 1989 - "Transportable gas containers" or other acceptable equivalent, and should be provided with a pressure gauge to permit a check on the contents without the loss of air and a demand valve to regulate the supply and pressure within the lifeboat.

4.11.2.4 The periodic inspection, testing and maintenance of transportable gas containers should be in accordance with BS 5430: Part 1: 1990 i.e. 5 years for internal, external and hydraulic test.

4.11.3 Control

4.11.3.1 These controls should be readily accessible to one person whilst seated and strapped in to his seat. There should be easy means of communication between the operator and the helmsman. Visual indication of the air pressure remaining in the system and operating instructions should be placed adjacent to the controls.

4.11.3.2 The surveyor should examine the system and the means of limiting the over and under ambient pressures when the engine is running at full power and when stopped to ensure that the distribution and quantity of air is satisfactory.

4.12 Totally enclosed lifeboats, fire protected

4.12.1 General

4.12.1.1 Totally enclosed lifeboats - fire protected should comply with Parts 1, 2, 4, 5 and 6 of Schedule 2 of MSN 1676(M).

4.12.1.2 Reference should also be made to the general requirements for lifeboats contained in paragraphs 4.1 to 4.6.14, 4.8.1 to 4.8.12 and 4.10 to 4.11.3.

4.12.1.3 Prototype testing should be in accordance with Chapter 1, Part V of Volume 2 - Testing of Life-Saving Appliances.

4.12.1.4 The lifeboat should be capable of safely conveying the complement through a fire on the surface of the water for a period of not less than 8 minutes.

4.12.2 Water spray system

4.12.2.1 Where a water spray system is fitted the sea water pump should be self-priming. When driven from the lifeboat engine, simple and readily operable means should be provided to control the output without damage to the pump so that the lifeboat may be used for normal duties without the spray system operating.

4.12.2.2 When an air-driven sprinkler system is fitted means should be provided for the periodic testing of the system without depleting the air supply in the lifeboat. To allow the spray system to be tested, each ship with this type of lifeboat should be supplied with either a charging set or a small portable air bottle and all necessary fittings to test the equipment. When a charging set is provided the air compressor should be fitted with a suitable filter on the discharge side, and sited so that only clean dry air, of breathable quality is supplied to the air cylinder. Portable air cylinders may be used when suitable charging facilities are available on board the ship.

4.12.2.3 Air cylinders should be made to BS 5045 Part 1: 1982 ISO 4750 and Part 2: 1989 - "Transportable gas containers" or other acceptable equivalent, and should be provided with a pressure gauge to permit a check on the contents without the loss of air.

4.12.2.4 The periodic inspection, testing and maintenance of transportable gas containers should be in accordance with BS 5430: Part 1: 1990, i.e. 5 years for internal, external and hydraulic test.

4.12.2.5 Any spray system fitted should be capable of operating for at least the same period as the air supply for engine and occupants (see paragraph 4.11.2).

4.12.2.6 It is recommended that the spray system be flushed through with fresh water after it has been tested in sea water, and the necessary connections and drains should be supplied and fitted to the lifeboat.

4.12.3 Instructions and controls

4.12.3.1 Controls provided in the lifeboat for operation of the air supply, water sprinkler system and to close ventilators should be provided with clear and conspicuous notices regarding their use at both the operating position and the helmsman's position.

4.12.3.2 The controls should be positioned so that the number of persons required to operate them is a minimum, and they should be capable of operation with the helmsman or crew member strapped in his seat.

4.12.3.3 Instructions should be provided at the helmsman's position indicating the means of starting and controlling the engine, and the use of the emergency tiller.

4.12.3.4 A comprehensive instruction manual should be supplied with each lifeboat, and the recommended frequency and details of testing of the special equipment should be included in the manual.

4.13 Free-fall lifeboats

4.13.1 General

Free-fall lifeboats should comply with Parts 1, 2, 4, 5, 6 and 9 of Schedule 2 of MSN 1676(M) as appropriate. Reference should also be made to the general requirements for lifeboats contained in the previous paragraphs 4.1.1 to 4.12.3 with the exception of 4.5.6.2, 4.7.1 to 4.7.4 and 4.9.1 to 4.9.7.4.

4.13.2 Prototype testing

4.13.2.1 Prototype testing should be in accordance with:-

(i) Chapter 1, Parts VI, VII and VIII as appropriate of Volume 2 - Testing of Life-Saving Appliances; and

(ii) Part 1, Sections 6.6 and 6.18 of IMO Resolution A.689(17) - Testing and Evaluation of Life-Saving Appliances.

4.13.2.2 Most of the prototype tests required for certification are the same as those required for conventional davit launched lifeboats, e.g. the speed and self-righting tests. Other tests required are unique to free-fall lifeboats i.e.

(i) The lifeboat must have adequate reserve strength. This is demonstrated by satisfactorily launching the lifeboat from a height at least 30% greater than the height from which the lifeboat is to be certificated.

(ii) The lifeboat must make positive headway immediately after water entry, and the occupants must be protected from harmful acceleration forces, during launches from the certification height under credible conditions of load, list and trim. This is demonstrated by satisfactorily completing the following tests:

- Group A - With the launch platform on even keel and the lifeboat at the design launch angle, launches should be conducted with the total occupant load on board, with only the required operating crew on board, with 50% of the occupants in the forward part of the lifeboat, and with 50% of the occupants in the aft part of the boat.

- Group B - The tests in Group A should be conducted under the following conditions of list and trim: +10 degrees trim and no list, -10 degrees trim and no list, no trim and 20 degrees list, +10 degrees trim and 20 degrees list, and -10 degrees trim and 20 degrees list.

- The launches in Group A must be conducted with a full-scale lifeboat. The launches in Group B can be conducted with a properly scaled model provided that the launches in Group A are duplicated with the model so as to obtain a correlation between the full-scale and model

tests. During the full-scale tests, properly distributed ballast can be used to represent the occupants.

(iii) It should also be ensured that for certain cargo ships where an "after damage condition" is investigated, (under the load line assigned freeboard requirements), that in the worst condition positive headway is achieved. This launch condition is in addition to the normal free-fall operation under adverse list and trim requirements. The resultant after damage waterline should be shown on the Lifeboat Stowage Arrangement Plans.

(iv) During the launches required in Group B bullet point above, acceleration forces should be measured and evaluated in accordance with IMO Resolution A.689(17), Part 1, paragraph 6.18.

4.13.2.3 Free-fall lifeboats are also required to be capable of a secondary mode of launching by wire, where the primary free-fall launching may not be possible. This alternative launching method must also be tested. See paragraph 18.5.7.

4.13.3 Lifejackets

All occupants of free-fall lifeboats should be provided with an approved inflatable lifejacket, which can be worn during free-fall launching. For safety reasons it is not acceptable to carry inherent buoyant lifejackets during free-fall launching. For this reason all loose gear should be stowed and secured correctly.

4.13.4 Hatches

Where embarkation doors are fitted at the after end, a hatch should be fitted forward. (See paragraph 4.10.7.) As these hatches have to be positioned to allow launching and recovery operations to be performed without any occupant leaving the boat, it may be necessary in a free-fall lifeboat to provide a step at the fore end to enable the occupants to gain sufficient height through the hatch to attach lifting hooks or slings. This could take the form of a local step in the floor in way of the hatch or fitting a hinged device to the side of one of the seats in way of the forward hatch.

4.13.5 Guard rails

Where access is provided around the outside of the boat suitable rails should be fitted. (See paragraph 4.10.9.) In order to aid disembarkation or persons attempting to rescue occupants in a free fall lifeboat, grab rails should be fitted P & S in way of the launch rail. If a gap exists between the end of the launch rail and the forward hatch a centre line rail should be provided on the top of the canopy to bridge this gap. To prevent occupants slipping into the water the top of the canopy between the hatch and the length of the centre-line handrail should have a non-slip surface. Depending on the distance between the launch rail and the top of the canopy it may be necessary to provide one or two dog-step type hand grips to bridge this gap.

4.13.6 Access

Noting that these boats are stowed at an inclined angle, special attention should be given to the centre-line gangway in order to avoid occupants slipping or tripping when entering the boat. The surface should remain relatively non-slip even when the sole of the shoe has become contaminated with oil and grease. Surveyors should check that a non-slip finish is provided for all walkways, and 'steps' or ridges may need to be introduced as necessary.

4.13.7 Launching arrangements

Special attention should be given to the sliding rail and trackway rollers to ensure that they are maintained in a serviceable condition.

4.14 Hyperbaric evacuation systems

4.14.1 Guidelines

4.14.1.1 The Merchant Shipping (Life-Saving Appliances for Ships Other Than Ships of Classes III to VI(A)) Regulations 1999 require the provision of life-saving appliances for all sea-going personnel. Divers in saturation are not able to take advantage of conventional lifeboats in an emergency.

4.14.1.2 Guidelines and Specifications for Hyperbaric Evacuation are attached as Appendix F to these instructions. In addition compliance with these guidelines will satisfy Chapter 3 of the Code of Safety for Diving Systems, IMO Resolution A536(13) in respect of United Kingdom ships.

4.14.2 Certification

4.14.2.1 Where a hyperbaric evacuation system complies with the provisions of the Guidelines and Specifications (Appendix F) and has been duly surveyed by competent person(s) it may be recorded on the supplement to the Cargo Ship Safety Equipment Certificate and/or MSF 1102 Safety Equipment Record of Inspection as providing the life-saving appliances and arrangements for divers in compression.

4.14.2.2 It is recognised that in the survey and testing of evacuation systems no one person may have all the necessary expertise and in certain circumstances it may be necessary for the owner to engage a competent person for particular tests and inspections. In ensuring that the system as a whole has been fully tested and before the Cargo Ship Safety Equipment Certificate can be endorsed, the MCA's surveyor should be provided with test and inspection certificates covering all the appropriate systems and equipment tested by other competent persons.

4.14.2.3 In so far as suitable "competent persons" are concerned reference should be made to the International Marine Contractors Association Code of Practice on The Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment - AODC 056 Issue 1 dated December 1991.