PART VIII

BOILERS AND MACHINERY

For guidance in the survey and inspection of steam turbines, boilers and their associated equipment for Class III to VI(A) passenger ships, reference should be made to the Instructions to Surveyors, Part 8 for Classes I to II(A) passenger ships.

8.1 Machinery (Regulations 49 and 50)

8.1.1 General

8.1.1.1 The propelling machinery of every passenger ship should have sufficient power for going astern to ensure proper control of the ship in all circumstances. The arrangements should be such that astern thrust can be applied with the minimum delay from full ahead to full astern.

8.1.1.2 There are no statutory requirements for passenger vessels to have multiple propellers, however, Regulation 50 requires that trials be undertaken to determine the ability of the ship to manoeuvre with one propeller inoperative. Such trial reports for vessels built after 1st September 1998 should be available. Vessels not being able to manoeuvre satisfactorily with one propeller inoperative would not be permitted to operate.

8.1.1.3 Steel used in the manufacture of boilers, superheaters, economisers and other pressure vessels, steam pressure pipes and the more important forgings and castings for machinery, and bronze used for shafting and for special purposes are to be of suitable materials and tested in accordance with recognised procedures.

8.1.2 Compression ignition engines

8.1.2.1 Fuel oil used in such engines should have a closed flashpoint not less than 60º Celsius.

8.1.2.2 In the case of direct reversing engines the reversing gear should be such that when operated quickly from ahead to astern or vice versa there should be no possibility of the propelling machinery continuing to run in the direction contrary to that corresponding to the position of the reversing gear.

8.1.2.3 Where it is considered safe to do so, only one means of preventing overspeeding need be fitted. However, main engines developing 300 HP or more which are capable of being declutched, or which drive a controllable pitch propeller, should be fitted with an additional overspeed protection device.

8.1.2.4 The two means of speed limitation referred to in paragraph 8.1.2.3 should be independent and the additional overspeed protection device

should limit the engine speed to not more than 20% above the normal running speed. The additional device should normally be arranged to shut off the fuel supply to the engine.

8.1.2.5 Engine cylinders over 230mm in diameter should be fitted with an efficient relief valve, the discharge from which should be directed so as not to be harmful to those in attendance. The relief valve should, in general, be set to not more than 40% in excess of the maximum design cylinder pressure.

8.1.2.6 Scavenge spaces in open connection with cylinders should be provided with explosion relief valves.

8.1.3 Compressed air starting arrangements

8.1.3.1 Ships of Classes III to VI(A) propelled by diesel engines which require compressed air for starting shall be provided with:

(i) at least one starting air compressor which should be of efficient design and of sufficient capacity for the intended service;

(ii) in addition to the foregoing air compressor, a starting air compressor which can be put into operation without external aid, when no power units are running and when no compressed air is available in the ship. The additional air compressor will not however be required if the compressor referred to can be put into operation under these conditions; and

(iii) at least one starting air receiver, the capacity of which should be sufficient to start each main engine at least twelve times where the engines are reversible, or six times when they are non-reversible. The arrangements should be such that the receiver can be kept fully charged ready for use. The number starts from the air receiver, and the lowest pressure at which the engine can be satisfactorily started, should be recorded.

8.1.3.2 Air pressure pipes should be made of steel. Pipes of less than 20mm bore may be made of copper.

8.1.3.3 Every air pressure pipe and every fitting connected to such pipe should be capable of withstanding the maximum working pressure to which it may be subjected with a factor of safety which is adequate having regard to the material of which it is constructed, and the working conditions under which it is intended to be used.

8.1.3.4 Air pressure pipes and fittings should, in general, be tested by hydraulic pressure to twice the maximum working pressure. However, when bursting discs are fitted the test pressure should not be less than the normal bursting pressure of the disc plus 14 bar.

8.1.3.5 Representative samples of bursting discs fitted to protect the pipes and fittings from the effects of an internal explosion should be tested to destruction to verify their nominal bursting pressure.

8.1.3.6 Air pressure pipes should be properly supported. Provision should be made to keep the interior of the pipes free from oil and to either prevent the passage of flame from the cylinders of the engine to the pipes or to protect the pipes from the effects of an internal explosion.

8.1.3.7 All discharge pipes from starting air compressors should lead directly to the starting air receivers and all starting air pipes from the air receivers to main or auxiliary engines should be kept entirely separate from the compressor discharge pipe system.

8.1.3.8 Means should be provided in any ship to prevent overpressure in any part of any compressed air system and, where water jackets or casings of air compressors and coolers might otherwise be subjected to dangerous overpressure due to leakage, suitable pressure relief arrangements should be provided.

8.1.3.9 If any air pressure pipe may receive air from any source at a higher pressure than it can withstand with an adequate factor of safety, an efficient reducing valve, relief valve and pressure gauge should be fitted to the pipe.

8.1.3.10 An isolating non-return valve or the equivalent should be fitted at the inlet end of the starting air manifold. Engines should be fitted with a flame arrester or pressure relief device at the starting air valve on each cylinder if the bore of the air pipes between the manifold and the starting valves on the cylinders exceeds 20mm. Engines not fitted with a flame arrester or pressure relief device at each cylinder should be fitted with a pressure relief device on the starting air manifold at about its mid-length. In small engines where the bore of the starting air main supply does not exceed 20mm the requirement for flame arresters or pressure relief devices may be waived.

8.1.3.11 Valves used in air pressure systems should be so designed and constructed as to prevent the cover of the valve chest being slackened back or loosened when the valve is operated.

8.1.4 Electric starting arrangements

8.1.4.1 Electric starting may be accepted as the sole means of starting the propulsion engines of launches and small ships up to 80 tons gross tonnage of Classes III to VI(A) inclusive, provided the arrangements meet the following requirements:

(i) the electric storage batteries are to be permanently installed in a suitably protected and well ventilated space;

(ii) the batteries are to be capable of starting each propelling engine twelve times without recharging;

(iii) a charging dynamo, fitted with an automatic voltage control unit, is to be installed and driven from the propelling engines or by a hand starting independent auxiliary generator engine; and

(iv) in the case of Class VI launches over 18m in length and all Class VI(A) launches, the batteries are to be arranged in two sets, either of which can start each propelling engine twelve times without recharging; or alternatively a hand starting independent auxiliary generator with a single set of batteries may be fitted.

8.1.5 Diesel engines driving electric generators and auxiliaries

8.1.5.1 The normal governor is accepted as one means of preventing overspeed. The second method should be independent of the governor and should limit the speed of the engine to not more than 20% above normal running speed. The second device should normally be arranged to shut off the fuel supply to the engine.

8.1.5.2 Generally generating sets should be installed with their axes of rotation in a fore and aft direction.

8.1.5.3 Starting and running trials of main and emergency generators, after installation on board, should normally be witnessed by the surveyor.

8.1.5.4 Use of low melting point materials in diesel engines.

(i) Aluminium fuel filters, fuel pumps etc. may be permitted provided that not more than 45 litres of flammable fluid would be released in the event of destruction of the fitting by fire, or otherwise.

(ii) If more than 45 litres of fuel oil would be released, a valve operable from outside the engine room, or closed automatically by the rise in temperature at the fitting, should be fitted to limit the escape of flammable fluid.

(iii) Aluminium sumps may be accepted if the quantity of oil involved is not more than 90 litres (20 gallons). An aluminium sump holding up to 135 litres (30 gallons) could be permitted, if the engine is installed at the bottom of the engine room where the temperature in a fire can be expected to be lower than would be the case if it were installed higher in the space. If more than 135 litres (30 gallons) are involved a save-all or gutters of steel would be fitted below the sump to prevent the spread of oil.

8.1.5.5 In the case of engines where:

(i) the engine is fitted with more than one fuel supply pump;

(ii) a fuel shut-off valve adjacent to the engine and operable from outside the engine room is not fitted;

(iii) a temperature operated fuel shut-off is fitted; and

(iv) one or more of the fuel supply pumps could be damaged by direct flame impingement without the temperature-operated valve closing;

then the fuel pumps should be protected by suitable screens against direct flame impingement and the temperature-operated shut-off valve should be fitted as near as possible to the first low melting point material fitting through which the fuel oil flows.

8.1.5.6 If a fitting will withstand a fire test of 800° Celsius for 20 minutes with no flow of fluid through the fitting, the fitting may, in general, be permitted without consideration of the quantities of fluid involved etc. This is based on the premise that the outlet valves from fuel oil daily service tanks will be fitted with remote closing arrangements in accordance with the appropriate Merchant Shipping (Fire Protection) Regulations. If the fitting referred to is in a lubricating oil system, e.g. a lubricating oil filter, and failure of the fitting when the engine is stopped would release more than 45 litres of oil, then a valve automatically operated by rise of temperature at the fitting, or a remotely controlled valve, should be fitted to limit the release of oil.

8.1.5.7 Brazed joints

Brazed joints may be accepted provided the melting point of the brazing metal is not lower than 800° Celsius.

8.1.5.8 Jointing material

Where failure of the joint under fire conditions would release more than 45 litres of flammable fluid, the thickness of the jointing material should not, in general, be greater than 0.8mm but, if the jointing material is not readily rendered ineffective by heat, thickness up to 1.6mm may be accepted.

8.1.5.9 Crankcase safety arrangements

(Ships constructed on or after 1st September 1998)

(i) The construction of crankcases and associated fittings of engines with forced lubricating oil systems should be such as to prevent, as far as practicable, danger to personnel in the event of a crankcase explosion.

(ii) The crankcases and inspection doors should be of robust construction and the attachment of the doors to the crankcase or entablature substantial.

(iii) Except in the case of small engines, there should be fitted to the crankcase of each engine, and when necessary to any associated gearcase, one or more valves designed to relieve any abnormal pressure. The number of relief valves fitted should be as follows:

(a) engines having cylinders less than 200mm bore and a gross crankcase volume less than 0.6 cubic metres need not be fitted with crankcase explosion relief valves;

(b) engines having cylinders greater than 200mm but not greater than 250mm (10 in) bore, should be fitted with two relief valves, one at each end of the engine. If the crankcase has more than eight throws an additional relief valve should be fitted at or near the centre of the engine;

(c) If the bore of the cylinders is greater than 250mm but not greater than 300mm a relief valve should be fitted at each alternate crank with a minimum of two relief valves. The number of relief valves should not be less than half the number of cranks; and

(d) If the bore of the cylinders is greater than 300mm a relief valve should be fitted at each crank.

A relief valve should also be fitted to any separate engine gearcase, chaincase etc. when the gross volume of the space is 0.6 cubic metres or more.

(iv) The total clear area through the relief valves should not, in general, be less than 115 square cm per cubic metre of gross crankcase volume. The clear area through the relief valves for other spaces should be determined on the same basis.

(v) Explosion relief valves should be of the non-return type and should open at a pressure not greater than 0.2 bar.

(vi) Relief valves and their outlets should be so arranged, or provided with efficient flame arresters, that the discharge of the products of a crankcase explosion will reduce, as far as practicable, the danger to the watchkeeping personnel.

(vii) Lubricating oil drain pipes from engine sump to drain tank should extend to well below the working level of the oil in the tank.

(viii) In multiple engine installations, drain pipes are to be arranged so that the flame of an explosion cannot pass from one engine to another.

(ix) Where crankcase vent pipes are fitted they should be as small as practicable to minimise the inrush of air after an explosion. Vent pipes should be led to a safe position outside the engine room and the outlet ends should be fitted with wire gauze or other suitable flame arresters. In multiple engine installations, the vent pipe from each engine is to be kept separate from the vent pipe(s) from other engine(s).

(x) Consideration should be given to the provision of means for the detection of overheating of running parts in the crankcase.

8.1.6 Cooling water systems

8.1.6.1 Cooling water systems should comply with the following:

(i) Each system, including the connected water passages, should be arranged so as to avoid air pockets as far as possible. Air cocks should be provided where necessary.

(ii) Suitably placed doors should be provided in the water spaces for cleaning and inspection.

(iii) Suitable means should be provided for ascertaining that the system is in order, and that sufficient water is passing through each part which requires to be cooled.

(iv) Means should be provided for preventing overpressure in any part of the system.

8.1.6.2 Ships propelled by compression ignition engines, or having compression ignition auxiliary engines for the maintenance of services essential for the safety of the ship or persons on board, should comply with the following:

(i) at least one cooling water pump should be provided, which should be capable of providing an adequate supply of sea water to the machinery, auxiliary engines and any oil coolers, or water

cooled fresh water coolers or water cooled exhaust connected thereto;

(ii) where direct sea water cooling is employed suitable suction strainers shall be fitted. The strainers should be capable of being cleaned from within the ship without interruption of the water supply; and

(iii) in ships where a fresh water cooling system is fitted, the pumping arrangements should be such that an adequate supply of fresh water will be provided, and that an adequate supply of cooling water will be available from a stand-by fresh water pump, or from an emergency connection to a sea water pump.

8.1.7 Lubricating oil systems

8.1.7.1 The main propulsion machinery should be provided with at least one lubricating oil pump, which should be of sufficient capacity to supply the propulsion machinery under normal operating conditions. In multiple engined ships where each main propulsion unit has its own lubricating oil system which includes a pump, a stand-by pump need not be provided if in the even of the failure of one of the propulsion units the ship can still be operated safely at navigable speed.

8.1.7.2 The lubricating oil systems for the main propelling machinery should be provided with an audible alarm to give a warning should the pressure of the oil supply fall to the minimum safe level.

8.1.7.3 Strainers should be provided for straining the lubricating oil and should be capable of being cleaned without interrupting the supply of such oil.

8.1.7.4 Means should be provided for ascertaining whether the lubricating system is working properly and for preventing overpressure in any part of the system. If the means of preventing overpressure is a relief valve it should be in closed circuit.

8.1.7.5 Where necessary means should be provided so that the pressure, temperature and flow prevailing in the various parts of the lubricating system can be readily observed. In this respect, particular attention is drawn to the indication of pressure on the discharge side of the lubricating oil pumps, and the inlet and outlet sides of the lubricating oil filters. The change-over arrangements for the filters should be such that it is not possible to take the cover off the filter that is in use.

8.1.7.6 Lubricating oil pipes, valves and fittings, should be made of materials suitably resistant to the effects of fire.

8.1.7.7 Flexible pipes used in lubricating oil systems should meet the appropriate requirements for flexible pipes conveying fuel oil.

8.1.7.8 Oil level indicators fitted to lubricating oil storage or service tanks should meet the requirements for level indicators for fuel oil tanks.

8.1.8 Controllable pitch propellers

8.1.8.1 In ships fitted with controllable pitch propellers, an emergency means of controlling the pitch from a position adjacent to where the control rods or operating oil enters the line shafting should be fitted. Means of communication between the emergency control position and the bridge should be provided if the propulsion engines are not reversible.

8.1.8.2 Controllable pitch propellers should be fitted with an emergency means of putting the blades into ahead pitch, in the event of failure of the normal pitch changing system. The emergency means may be either automatic in operation or may be a manual jacking arrangement, and should be capable of holding the blades in ahead pitch whilst the ship maintains a navigable speed. Provision should be made so that an alarm is sounded at the control station or stations, in the event of the pressure in the pitch changing hydraulic system falling to a dangerously low level.

8.1.8.3 Where two or more engines are geared to one line of shafting, the pitch of the propeller in the emergency jacked position should be such that the engines can be clutched in without overloading the engines, or any other part of the system.

8.1.8.4 An emergency stop for the main engines should be fitted on the bridge. The emergency stop should be independent of the normal pitch control and pitch changing arrangement.

8.1.9 Air compressors and air receivers

8.1.9.1 Air compressors

(i) An efficient relief valve should be fitted in the high pressure discharge from each air compressor. The relief valve should be of such a size, and so set, that the maximum accumulation pressure will not exceed the working pressure by more than 10% should the compressor discharge valve be closed when the compressor is running normally.

(ii) An efficient relief valve or safety diaphragm should be fitted on the casing of the high pressure air cooler to provide ample relief in the event of a high pressure air tube bursting.

(iii) Means for draining water and oil should be fitted at each interstage and final discharge pipes of air compressors.

(iv) Air compressor cylinders, cooling coils and tubular intercoolers should be tested by hydraulic pressure to one and one-half times the maximum working pressure.

(v) The cooling water passages of air compressors should be tested by hydraulic pressure to 4 bar or one and one-half times the maximum working pressure, whichever is the greater.

8.1.9.2 Air receivers

(i) The design, construction and testing of fusion welded steel air receivers should be in accordance with good practice and to an acceptable standard. The inner surfaces should be capable of being examined and cleaned. Where practicable this should be done by the provision of an opening sufficiently large to permit entry.

(ii) Air receivers should be provided with efficient drains and be protected by relief valves of satisfactory design which are suitably loaded and positioned to prevent any possibility of overpressure. Any air receiver which can be isolated from the relief valves should be fitted with a fusible plug or plugs to discharge the contents in case of fire.

(iii) On completion, each air receiver is to be stamped over an access hole as follows:

TEST AUTHORITY

TESTED ..... bar

WP ..... bar

DATE

SURVEYOR'S INITIALS

8.1.10 Air bottles

8.1.10.1 The design, construction and testing of steel air bottles should be in accordance with recognised Standards. Certificates of Manufacture furnished by the manufacturer may be accepted.

8.1.10.2 Where applicable, the appropriate requirements of paragraph 8.1.9.2 should be complied with.

8.1.11 Ventilation

8.1.11.1 Ample ventilation should be provided in main and auxiliary machinery spaces, at oil filling stations, and in all compartments adjacent to any oil storage tanks, or in which an oil storage tank is situated. This

ventilation should provide fresh air to all parts of the spaces, and be capable of removing foul air in a reasonably short time.

8.1.11.2 The clearance space between boilers and tops of double bottoms, and between boilers and the sides of the storage tanks or bunkers in which oil fuel is carried, must be adequate for the free circulation of air necessary to keep the temperature of the stored oil well below the flashpoint.

8.1.12 Dampers in exhaust gas uptakes

Dampers should not, as a rule, be fitted. Should they be fitted then they should be provided with a suitable device whereby they may be securely locked in the fully open position. There should be clear indication to show whether the dampers are open or shut. Casings and uptake joints should be gas tight.

8.2 Oil Fuel Installations (Regulation 57)

8.2.1 General

8.2.1.1 The requirements concerning oil fuel installations in both oil fired steam ships and vessels with internal combustion engines, are directed towards the prevention and spread of fire; they will have little or no effect if certain simple precautions are not taken. Fires generally originate from occurrences which might be regarded as insignificant, e.g. oil dripping from furnace fronts onto tank tops, or from ignition of an almost imperceptible spray of oil leaking from a gland or joint. A significant contribution to safety can be made by the avoidance of design features that may lead to the escape of oil by failure of a component being subjected to stresses other than those due to internal pressure, e.g. unsupported pipes or overtightened securing nuts on fuel oil filters. A safety assessment of the oil fuel system should be made during the construction of the ship or whenever major modifications to the system are made.

8.2.1.2 In open launches the space occupied by the motor and fuel tank should preferably be at the stern of the vessel, and separated from the space allotted for the accommodation of passengers and crew by a substantial bulkhead as high as the seats, and watertight up to at least half it height, to prevent the spread of oil to the passenger or crew space. If it is desired to place the motor amidships or forward, either arrangement may be allowed provided that a bulkhead or casing, formed in the manner stated, is placed between the motor space and the passenger or crew space.

8.2.1.3 Motors in open launches should be covered in, preferably by a suitable metal casing, but if the casing is of wood it should be lined with mineral board or other non-combustible insulation, faced with sheet metal. The purpose of the sheet metal casing is to retain the insulation material in position, to protect it from damage or disintegration, and to prevent the collection or absorption of oil and vapours by the material. Perforated or

expanded metal are not acceptable as substitutes. Consideration will be give to material having equivalent fire and oil resisting properties.

8.2.1.4 Decked motor compartments in wood launches should be similarly lined on the underside of the deck, on any wood bulkheads and on any exposed ship's side above platform level. Platforms should be of metal.

8.2.1.5 If the launch is of wood, a metal tray, which can be readily cleaned and is of suitable depth, is to be fitted under the motor; the bilge's must be protected against saturation by oil. In a situation when it is totally impracticable to fit a metal drip tray in way of the engine, the use of the engine bearers as a means of containment of the oil may be accepted when they are of sufficient height and have no limber holes. If the bearers are of wood they should be faced on their inner surface with sheet metal to prevent oil absorption. Provision should be made for the clearing of spillage and drainage collected in the engine space.

8.2.1.6 Acoustical insulation applied to machinery space bulkheads should be non-flammable and, where necessary, suitably protected from oil absorption from any source.

8.2.2 Oil fuel storage

8.2.2.1 The expression oil fuel tank includes an oil fuel storage, oil fuel settling, oil fuel service and an oil fuel overflow tank.

8.2.2.2 Oil fuel may be carried in double bottom tanks, deep tanks and other tanks of approved construction. Oil fuel tanks should not be sited directly over boilers or other heated surfaces, nor should they be abreast the boilers unless this is unavoidable and adequate precautions are taken. Cofferdams should be provided between fresh water and oil fuel tanks.

8.2.2.3 Heating coils should be provided in tanks where the viscosity of the fuel at low temperatures may create pumping difficulties.

8.2.2.4 All oil fuel tanks in the machinery spaces should be fitted with save-alls, gutters or cofferdams as appropriate to contain and prevent the spread of oil and to contain or guide such oil to a safe place such as a special oily bilge reserved for that purpose.

8.2.2.5 Oil fuel tanks forming the boundaries to cargo spaces need only be provided with save-alls or gutters in way of manholes, valves or fittings on any other area where leakage may occur.

8.2.2.6 An air pipe should be led from every fuel tank to the open air and the outlet thereof should be in a position such that the ingress of sea water is unlikely and such that there will be no danger of fire or explosion resulting from the emergence of oil vapour or fuel whilst the tank is being filled. Every

such outlet should be fitted with a detachable wire gauze diaphragm. If such a pipe serves as an overflow, provision should be made which will prevent the overflow from running into or
near a boiler room, galley or other place where ignition sources may be present.

8.2.2.7 On any oil tank filled under pressure, either from the ship's pumps or when bunkering, the aggregate area of the air pipe or pipes or air and overflow pipes connected to the tank should not be less than one and one quarter times the aggregate area of the filling pipes.

8.2.2.8 Where separate overflow and air pipes are provided the air pipes need not exceed the minimum size of 50mm but the overflow pipes should not be less than one and one quarter times the aggregate area of the filling pipes. Generally any air pipe should not be less than 50mm bore.

8.2.3 Settling, storage and service tanks

8.2.3.1 Oil fuel tanks may be constructed internally with the ship's structure when the hull is made of steel.

8.2.3.2 All tanks not forming part of the ship's structure should be securely fastened to the hull.

8.2.3.3 Consideration should be given in the design stages to the combined effects of the interior of the tank contents and the motion of the vessel in a seaway.

8.2.3.4 In launches constructed of glass reinforced plastic or aluminium alloy consideration may be given to oil fuel tanks constructed of the same material, due regard being paid to their size and situation in the launch, but in no case are they to be installed within the machinery space, nor are they to form part of the boundary of such a space.

8.2.3.5 A suitable thermometer pocket should be fitted in settling tanks fitted with heating arrangements.

8.2.3.6 Open drains for removing water from oil in storage, settling or service tanks are not permitted unless the drain valve is of the weighted lever or other self-closing type.

8.2.4 Oil filling arrangements

8.2.4.1 Oil fuel stations should be isolated from other spaces in the vessel and should be efficiently ventilated; any oil present should be drained to a safe and suitable receptacle within the vessel.

8.2.4.2 Provision should be made to prevent overpressure in any oil filling line such as may occur during filling operations if one tank filling valve is closed before another is open. Any relief valve on the filling line should be downstream of the main filling line shut-off valve and discharge into an overflow tank of suitable capacity fitted with an
audible (high level) alarm. Alternatively the discharge from the relief valve may be led back to the fuelling barge or station.

8.2.4.3 For launches of class V, VI and VI(A) the arrangements for filling the fuel tanks are to be such that oil will not spill or overflow either into the compartment containing the tanks or any other part of the launch. Each fuel tank shall be fitted with a vapour discharge, and the fuelling system should incorporate means to prevent pressurising the tanks during the fuelling operation. If the tanks are filled through a wood deck, the woodwork surrounding the inlet pipe must be covered with sheet metal to prevent it becoming saturated with oil. A beading must be fitted at the end of the sheathing to prevent the oil from spreading. A properly secured wire gauze diaphragm or tube strainer, which can easily be taken off for cleaning and examination, is to be fitted to each filling inlet, and at each vapour or oil outlet on the tanks and the filling pipe, or orifices must have a suitable screwed cap. No loose cans of fuel are to be carried, and the fuel tanks must not be filled when passengers are on board.

8.2.5 Sounding arrangements

8.2.5.1 Efficient means are to be provided for determining the level in every oil fuel tank either by sounding pipe or by an accepted indicating apparatus. Sounding pipes should not terminate in passenger or crew spaces.

8.2.5.2 Sounding pipes or connections to indicators should be suitably protected against damage if passing through cargo holds. Short sounding pipes in or below machinery spaces should be avoided as far as is possible. Where fitted they should be provided with self-closing fittings. If the self-closing fittings are in the form of cocks they should have parallel plugs with handles permanently attached and so loaded that on being released they close automatically.

8.2.5.3 Sounding pipes terminating in boiler or engine rooms should be so arranged that oil cannot be discharged on any part of the boilers or their fittings, or onto any heated surface as exhaust pipes of internal combustion engines or onto electric motors, if the self-closing fittings on the sounding pipes are opened when tank filling or due to motion of the vessel in a seaway.

8.2.5.4 Oil level indicators should be of a type which will not impair the oil tight integrity of the tank and be of such construction that they will not be readily damaged either mechanically or as a result of fire thereby permitting the contents of the tank to escape.

8.2.6 Pumping arrangements

8.2.6.1 The arrangements should be such that provision is made to isolate oil fuel from water ballast. Pumping arrangements should permit oil fuel to be transferred from any storage or settling tank to another part of the vessel.

8.2.6.2 Provision should be made to prevent, as far is reasonable and practicable, the accidental discharge or overflow of oil overboard.

8.2.7 Steam heating arrangements

Steam condensate returns from oil fuel tanks should discharge to an observation tank. The steam heating pipe which may be in contact with the oil should be made of steel and together with its joints should, before being put into service for the first time, be subjected to a test by hydraulic pressure to twice its maximum working pressure and should, at any time thereafter, be capable of withstanding such a test.

8.2.8 Oil fuel pumps heaters, filters and separators

8.2.8.1 Every ship should be provided with [at least one] oil fuel unit comprising a pressure pump, filter and a heater. Such pump, filter and heater should be of efficient design and substantial construction. Provision should be made which will prevent overpressure in any part of the oil fuel units; every oil fuel pressure pipe and joint therein should, before being put into service for the first time, be subjected to the test by hydraulic pressure referred to in paragraph 8.2.9.2; every fitting connected to oil pressure pipes and all parts of oil fuel units which are subjected to oil pressure should, before being put into service for the first time, be subjected to a test by hydraulic pressure to twice the maximum working pressure; every oil pressure pipe, joint fitting and pressure part of an oil fuel unit should, at any time thereafter, be capable of withstanding the relevant hydraulic test stated above; any relief valves fitted to prevent over-pressure in the oil fuel heater should be in closed circuit.

8.2.8.2 Every pump provided for use in connection with the oil fuel system should be separate from the ship's feed water pumps, bilge pumps and ballast pumps and the connections of any such pumps.

8.2.8.3 Such oil fuel pumps should be provided with an efficient relief valve which should be in close circuit (i.e. discharging to the suction side of the pump).

8.2.8.4 Valves should be provided in the pipe lines to enable the pumps to be isolated for overhaul.

8.2.8.5 Means should be provided for stopping every oil fuel pressure and oil fuel transfer pump from a position outside the compartment in which the pump is situated. The arrangement should not allow starting of the pump

from the remote position. The remote position should be such that it is not likely to be rendered inaccessible by a fire in the machinery space.

8.2.8.6 Electric immersion heaters should be provided with high temperature cut-outs and should be so situated in the tanks that they are fully immersed at all times.

8.2.8.7 Save-alls or gutters should be provided under oil fuel units to catch any oil which may leak or be spilled. Save-alls should also be provided in way of furnace mouths to catch leakage's from burners.

8.2.8.8 Provision should be made to prevent oil that may escape from oil fuel units or burners coming in contact with boilers or heated surfaces.

8.2.8.9 Every fuel oil separator should be of efficient design and substantial construction; provision should be made which will prevent overpressure in any part and which will prevent the discharge of oil vapour into confined spaces.

8.2.8.10 Where thermal oil heating systems are used:

(i) the inlet and outlet valves of thermal oil heaters are to be operable from outside the compartment where they are situated unless an arrangement for quick gravity draining of the thermal oil in the system into a separate collecting tank is provided;

(ii) the system is to be arranged so that a positive pressure is maintained in the heating coil at least equivalent to 3 m water column above the static head of the fuel level in the tank at all times, including when the circulation pump is not in operation;

(iii) the thermal oil system expansion tank is to be fitted with high and low level alarms;

(iv) a means is to be provided in the thermal oil system expansion tank for detection of flammable oil fuel vapours. Portable equipment may be accepted;

(v) valves which could isolate individual heating coils are to be provided with locking arrangements to ensure that the coils are under static pressure at all times;

(vi) the thermal oil circulating pump is to be arranged to permit emergency stopping from a position outside the space in which the pump is situated;

(vii) the temperature of the thermal oil in the pipes and heating coils are not to exceed 220°C. Suitable cut outs are to be fitted to the thermal oil heater to prevent this;

(viii) if an exhaust fired thermal oil heater is fitted, in addition to the requirements specified above, the heater is to be so designed and installed that all tubes may easily and readily be inspected for signs of corrosion and leakage;

(ix) the heater is to be fitted with temperature sensors and an alarm for fire detection; and

(x) a fixed fire extinguishing and cooling system is to be fitted. A water drenching system may be considered.

8.2.9 Oil fuel pipes and valves

8.2.9.1 For the purpose of these Instructions, an oil fuel pressure pipe is a pipe on the discharge side of an oil fuel pressure pump forming part of an oil fuel unit, which conveys oil to boiler front or engines and operates at a working pressure in excess of 1.7.2 bars (25 lbf/in^2).

8.2.9.2 Oil pressure pipes shall be of seamless steel or other suitable material approved by the MCA. Those for conveying heated oil should be placed in a conspicuous position above the platforms, in well lighted parts of the boiler room or engine room. Flexible pipes of suitable construction may be accepted between the burners and the supply line, if made of fire and oil resistant material.

8.2.9.3 The thickness of seamless steel pressure pipes shall be in accordance with paragraph 4.5.2 for a working pressure of 14 bars (200 lbf/in^2), or in the pressure to which the relief valve in the system are set to lift, whichever is the greater. The scantlings of the coupling flanges should be suitable for a corresponding pressure. The flanges should be machines, and any jointing material used should be the thinnest possible and impervious to oil heated to 120°C.

8.2.9.4 Pressure pipes and associated fittings are to be tested after jointing to 28 bars (400 lbf/in^2) or twice the working pressure, whichever is the greater. Other pipes and fittings shall be made of steel or other suitable material approved by the MCA. They should be led sufficiently high above the inner bottom if any, to facilitate the inspection and repair of the pipes. The scantlings of the coupling flanges should be suitable for a working pressure of at least 7 bars (100 lbf/in^2) and the flanges should be machined and jointing material used impervious to oil. After jointing the pipes and fittings are to be tested to 3.5 bars (50 lbf/in^2), or twice the maximum working pressure, whichever is the greater.

8.2.9.5 Every oil pipe not being an oil pressure pipe should be made of seamless steel or other suitable material and should be led at such a height above the ship's inner bottom, if any, as will facilitate the inspection and repair of the pipe.

8.2.9.6 Every such pipe and joint therein and every fitting connected to such pipe should, before being put into service for the first time, be subjected to a test by hydraulic pressure to 3.5 bar or to twice the working pressure whichever is greater and should, at any time thereafter, be capable of withstanding such a test.

8.2.9.7 Non-metallic flexible pipes conveying oil to boiler fronts and other high fire risk areas should be designed, manufactured and tested in accordance with Section 8.3.

8.2.9.8 Every valve used in connection with an oil fuel installation should be so designed and constructed as to prevent the cover of the valve chest being slackened back or loosened when the valve is being operated.

8.2.9.9 Every master valve at the furnace fronts which controls the supply of oil to sets of burners should be of quick closing type and fitted in a conspicuous position and readily accessible; provision should be made to prevent oil from being turned on to any burner unless such burner has been correctly coupled up to the oil supply line.

8.2.10 Cooking ranges and other heating appliances

8.2.10.1 In any ship, if a cooking range or other heating appliance is supplied with fuel from an oil tank, the tank should not be situated in a galley, and the supply of oil to the burners should be capable of being controlled from a position outside the galley. No range or burner should be fitted which is designed to be operated by means of having a flashpoint of less than 60° (Closed Cup Test).

8.2.10.2 The tank should be provided with an air pipe leading to the open air. The pipe should be in such a position that there will be no danger of fire or explosion resulting from the emergence of oil vapour from the pipe when the tank is being filled. The pipe should be fitted with a detachable wire gauze diaphragm.

8.2.10.3 Safe and efficient means should be provided for filling every such tank and for preventing overpressure therein.

8.3 Flexible Pipes Carrying Flammable Liquids (FPCFL)

8.3.1 General

8.3.1.1 Non-metallic FPCFL where necessarily used should be constructed according to BS 3832: 1991 (ISO 1436-1991) or BS 4586: 1992 (ISO 3862-1991) with an inner tube of seamless construction with reinforcement outside and the complete pipe should be wholly oil resistant. Such pipes should pass a hydraulic pressure test of twice the working pressure, or 3.5 bar, whichever is greater and should have an adequate recommended service life under expected working conditions of temperature, pressure, bending, flexing, vibration and pulsing and should be certified by the manufacturer to this effect. Such non-metallic FPCFL which are not used in Category A machinery spaces, or in any other space where there is a significant risk of fire, should be capable of withstanding the pressure test mentioned above followed by the fire test outlined in paragraph 8.3.2.

8.3.1.2 Metallic FPCFL should be of steel, bronze, or other suitable acceptable material and should be capable of withstanding a test pressure of 5 times the working pressure. However, when the working pressure exceeds 10 bar, the test pressure should be 3.5 times the working pressure or 50 bar, whichever is greater. Such pipes should also have an adequate recommended service life under expected working conditions of temperature, pressure, bending, flexing, vibration and pulsing and should be certified by the manufacturer to this effect.

8.3.1.3 All FPCFL should be restricted in length to that which is the minimum necessary to provide the required degree of flexibility and any FPCFL which may be subjected to a high degree of fatigue in service should meet the impulse test requirements in the British Standards mentioned above, or any other tests considered equivalent by the MCA.

8.3.1.4 End fittings of FPCFL should be of steel, or equivalent construction. They should be designed so that when properly tightened during installation they will not cause the FPCFL to twist. To facilitate checking whether a FPCFL has been twisted during installation, a straight longitudinal line running the full length of FPCFL should be marked clearly and indelibly to the outside of each length of FPCFL. During installation the surveyor should ensure that FPCFL are properly fitted in the piping system to withstand the degree and nature of use in service. The rigid pipes or other connections at each end of FPCFL should be so arranged that the amplitude of vibration of FPCFL is kept to a minimum i.e. the axis of FPCFL shall be as close as possible to the axis of vibration.

8.3.2 Fire test

8.3.2.1 A sample length of non-metallic FPCFL with end attachments, which has already passed the pressure test and if necessary the impulse test, (as detailed in the BS/ISO standards referred to in paragraph 8.3.1.1) should be subjected to a fire test for 30 minutes at a temperature of at least 800° while water at the maximum service pressure is circulated inside the pipe.

The temperature of the water at the outlets should not be less than 80°. No leak should be recorded during or after the test.

8.3.2.2 This test is only applicable to non-metallic FPCFL, and to non-metallic joints or other non-metallic equipment's which are claimed as suitable for use in fire hazard areas.

8.3.3 Range of sizes

When a range of FPCFL of a particular type of construction is submitted for consideration, it will suffice if every third size in the range, beginning with the smallest, is subjected to the impulse and/or fire test as appropriate.

8.3.4 Shelf life and service life

So far as practicable the contents of BS 5244: 1991 should be taken into consideration, and the surveyor should check that the manufacturer's recommended shelf life and service life for intended temperature and pressure range (as well as degree of bending, flexing, vibration and pulsing as applicable) are not exceeded. For any shipboard use the expected minimum service life should be adequate in proportion to length of voyage etc. so that renewals can be effected at a convenient time with regard to survey, refit etc.

8.3.5 Certification and installation

8.3.5.1 If a manufacturer of FPCFL (or other non-metallic joints or equipment's used in fire hazard areas) requires to be issued with formal Certificates of Inspection and Tests which are acceptable to the MCA then the manufacturer should be directed to contact one of the Nominated Bodies in accordance with the procedures laid down in Merchant Shipping Notice No. M.1645. Tests witnessed by other authorities meeting the provisions of Merchant Shipping Notice No. M.1440 (or its replacement) will not be issued with a formal Certificate of approval, however the FPCFL (or equipment) will be acceptable on UK registered vessels.

8.3.5.2 Notwithstanding the meeting of the requirements of certification or acceptability by the MCA, each piece of FPCFL (or other similar equipment for fire hazard areas), will be required to be pressure tested to twice the working pressure before actual installation on board.

8.4 Steering Gear (Regulation 60)

Regulation 60 requires the provision of an efficient main and auxiliary steering gear and meeting the requirements of Schedule 9 to Merchant Shipping Notice MSN 1699(M).

8.5 Protection Against Noise (Regulation 62)

8.5.1 Regulation 62 requires that measures should be taken to reduce noise levels in machinery spaces as far as is reasonable and practical.

8.5.2 Compliance with the Code of Practice for Noise Levels in Ships should also ensure compliance with IMO Resolution A.468(XII) and also the requirements of various other Merchant Shipping legislation.

8.5.3 Further information on the Code is contained in Appendix F to these Instructions whilst additional guidance on the use of ear protectors can also be found in Appendix G.