CHAPTER 10

AUXILIARY SYSTEMS

EU Directive on Electromagnetic Compatibility (2004/108/EC)

Electrical and electronic equipment fitted to Community Craft that may either generate or be affected by electromagnetic disturbance shall meet the requirements of EU Directive 2004/108/EC, as amended. Equipment complying with this directive should have an EC mark or CE marking in accordance with EU Directives 2004/108/EC or 93/68/EEC, as amended.

EU Directive on Electrical Equipment designed for use within certain voltage limits (2006/95/EC)

Electrical equipment designed for use with a voltage rating of between 50 and 1000 volts for alternating current and between 75 and 1500 volts for direct current shall meet the requirements of EU Directive 2006/95/EC, except for specialised electrical equipment, for use on ships, which comply with the safety provisions drawn up by international bodies in which the Member States participate.

PART A - GENERAL

10.1 General

10.1.1 Fluid systems shall be constructed and arranged so as to assure a safe and adequate flow of fluid at a prescribed flow rate and pressure under all conditions of craft operation. The probability of a failure or a leakage in any one fluid system, causing damage to the electrical system, a fire or an explosion hazard shall be extremely remote. Attention shall be directed to the avoidance of impingement of flammable liquid on hot surfaces in the event of leakage or fracture of the pipe.

See Annex 3 and Annex 4 for Failure Modes and Effects Analysis (FMEA). This requirement should be adequately covered within the FMEA, although the use of the term 'extremely remote' should not be taken in the context of numerical probabilities described in Annex 3.

10.1.2 The maximum allowable working pressure in any part of the fluid system shall not be greater than the design pressure, having regard to the allowable stresses in the materials. Where the maximum allowable working pressure of a system component, such as a valve or a fitting, is less than that computed for the pipe or tubing, the system pressure shall be limited to the lowest of the component maximum allowable working pressures. Every system which may be exposed to pressures higher than the system's maximum allowable working pressure shall be safeguarded by appropriate relief devices.

10.1.3 Tanks and piping shall be pressure-tested to a pressure that will assure a safety margin in excess of the working pressure of the item. The test on any storage tank or reservoir shall take into account any possible static head in the overflow condition and the dynamic forces arising from craft motions.

10.1.4 Materials used in piping systems shall be compatible with the fluid conveyed and selected giving due regard to the risk of fire. Non-metallic piping material may be permitted

in certain systems provided the integrity of the hull and watertight decks and bulkheads is maintained*.

* Refer to the Guidelines for the application of plastic pipes on ships, adopted by the Organization by resolution A.753(18).

Pipes carrying fuel shall be of steel or other satisfactory material. Plastic or frp pipes in fuel systems shall be avoided. Refer to section 7.5.4. Plastic pipes would need to pass the fire tests documented in the Code for Application of Fire Test Procedures (FTP Code). Plastic pipes are suitable however for low pressure systems such as fresh water, sewage and grey water.

10.2 Arrangement of oil fuel, lubricating oil and other flammable oil

10.2.1 The provisions of 7.1.2.2 apply to the use of oil as fuel.

10.2.2 Oil fuel, lubricating oil and other flammable oil lines shall be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages onto hot surfaces, into machinery air intakes or other sources of ignition. The number of joints in such piping systems shall be kept to a minimum. Flexible pipes carrying flammable liquids shall be of an approved type*.

* Refer to the Guidelines to minimize leakages from flammable liquid systems for improving reliability and reducing risk of fire (MSC/Circ.647).

Flexible pipes carrying flammable liquids shall be permissible in positions where the MCA are satisfied that they are necessary. See notes under 10.2.4.9 relating to flexible pipes and 9.4 for high pressure pipe arrangements.

10.2.3 Fuel oil, lubricating oils and other flammable oils shall not be carried forward of public spaces and crew accommodation.

Oil fuel arrangements

10.2.4 In a craft in which oil fuel is used, the arrangements for the storage, distribution and utilisation of the oil fuel shall be such as to ensure the safety of the craft and persons on board and shall at least comply with the following provisions.

See also 7.5 for additional requirements for fuel systems and for the use of fuel with a flash point less than 60°C.

10.2.4.1 As far as practicable, all parts of the oil fuel system containing heated oil under pressure exceeding 0.18 N/mm^2 shall not be placed in a concealed position such that defects and leakage cannot readily be observed. The machinery spaces in way of such parts of the oil fuel system shall be adequately illuminated.

10.2.4.2 The ventilation of machinery spaces shall be sufficient under all normal conditions to prevent accumulation of oil vapour.

See also 10.7 for machinery space ventilation requirements.

10.2.4.2.1 Location of fuel tanks shall be in accordance with 7.5.2.

Taking into account 10.2.3 above.

10.2.4.4 No oil fuel tank shall be situated where spillage or leakage therefrom can constitute a hazard by falling on heated surfaces. Reference is made to the fire safety requirements in 7.5.

10.2.4.5 Oil fuel pipes shall be fitted with cocks or valves in accordance with 7.5.3.

10.2.4.6 Every fuel tank shall, where necessary, be provided with savealls or gutters to catch any fuel which may leak from such tanks.

10.2.4.7 Safe and efficient means of ascertaining the amount of oil fuel contained in any oil fuel tank shall be provided.

10.2.4.7.1 Where sounding pipes are used, they shall not terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they shall not terminate in public spaces, crew accommodation or machinery spaces. Terminations shall be provided with a suitable means of closure and provision to prevent spillage during refuelling operations.

10.2.4.7.2 Other oil-level gauges may be used in place of sounding pipes. Such means are subject to the following conditions:

.1 In passenger craft, such means shall not require penetration below the top of the tank and their failure or overfilling of the tanks will not permit release of fuel.

.2 The use of cylindrical gauge glasses shall be prohibited. In cargo craft, the Administration may permit the use of oil-level gauges with flat glasses and self-closing valves between the gauges and fuel tanks. Such other means shall be acceptable to the Administration and shall be maintained in the proper condition to ensure their continued accurate functioning in service.

10.2.4.8 Provision shall be made to prevent overpressure in any oil tank or in any part of the fuel system, including bunkering pipes and any filling pipes served by on-board pumps. Any relief valves and air or overflow pipes shall discharge to a safe position where there is no risk of fire or explosion from the emergence of oils and vapour, shall not lead into crew spaces, passenger spaces, special category spaces, ro-ro spaces (other than open ro-ro spaces), machinery spaces or similar spaces. For fuel of flashpoint less than 43°C such valves and pipes shall terminate with flame arresters in accordance with the standards developed by the Organization.*

***** Refer to the Revised standards for the design, testing and locating of devices to prevent the passage of flame into cargo tanks in tankers (MSC/Circ.677).

Refer to 7.5.2 and 7.5.6 for the use of fuels having a flash point of less than 60℃.

10.2.4.9 Oil fuel pipes and their valves and fittings shall be of steel or other approved material*, except that restricted use of flexible pipes shall be permissible in positions where the Administration is satisfied that they are necessary[#]. Such flexible pipes and end attachments shall be approved fire-resisting materials of adequate strength and shall be constructed to the satisfaction of the Administration.

* For valves fitted to oil fuel tanks, and which are under static pressure-head, steel or nodular cast iron may be accepted. However, ordinary cast iron valves may be used in piping systems where the design pressure is lower than 0.7 N/mm^2 and the design temperature is below 60ºC.

Refer to the recommendations published by the International Organization for Standardization, in particular, publication ISO 15540:1999 – Ships and marine technology – fire resistance of hose assemblies – test methods, and ISO 15541:1999 – Ships and marine technology – Fire resistance of hose assemblies – Requirements for the test bench.

Note: ISO 15540:1999 and ISO 15541:1999 are now superseded by more recent versions, which should be used instead.

As an alternative IACS Requirements governing Fire Protection F42 (1995) contain fire testing requirements for flexible piping. This is a 30 minute test at 800°C.

Flexible pipes of an approved fire resistant type should be fitted between fixed ship piping and flexibly mounted equipment. Refer to 10.1.4 and 7.5.4, also MCA internal guidance on Flexible Fuel Pipework – Construction – Fire resistance standards.

See 9.4.2 for guidance on high pressure fuel pipes.

Lubricating oil arrangements

10.2.5 The arrangements for the storage, distribution and utilisation of oil used in pressure lubrication systems shall be such as to ensure the safety of the craft and persons on board. The arrangements made in machinery spaces and, whenever practicable, in auxiliary machinery spaces shall at least comply with the provisions of 10.2.4.1 and 10.2.4.4 to 10.2.4.8 except that:

.1 this does not preclude the use of sight-flow glasses in lubricating systems provided they are shown by test to have a suitable degree of fire resistance;

.2 sounding pipes may be permitted in machinery spaces if fitted with appropriate means of closure; and

.3 lubricating oil storage tanks with a capacity of less than 500 *l* may be permitted without remote operated valves as required in 10.2.4.5.

Arrangements for other flammable oils

10.2.6 The arrangements for storage, distribution and utilisation of other flammable oil employed under pressure in power transmission systems, control and activating systems and heating systems shall be such as to ensure the safety of the craft and persons on board. In locations where means of ignition are present, such arrangements shall at least comply with the provisions of 10.2.4.4 and 10.2.4.7 and with the provisions of 10.2.4.8 and 10.2.4.9 in respect of strength and construction.

Arrangement within machinery spaces

10.2.7 In addition to the requirements of 10.2.1 to 10.2.6, the oil fuel and lubricating oil systems shall comply with the following:

.1 Where daily service fuel tanks are filled automatically or by remote control, means shall be provided to prevent overflow spillages.

.2 Other equipment which treats flammable liquids automatically, such as oil fuel purifiers, which, whenever practicable, should be installed in a special space reserved for purifiers and their heaters, shall have arrangements to prevent overflow spillages.

.3 Where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high-temperature alarm shall be provided if the flashpoint of the oil can be reached due to failure of the thermostatic control.

Where daily service tanks service engines that return fuel to the tank, it should be shown that the temperature of the fuel in the tank cannot reach the flashpoint with regard to the heat in the return fuel.

10.3 Bilge pumping and drainage systems

See also 10.9 or 10.10 of this Code.

10.3.1 Arrangements shall be made for draining any watertight compartment other than the compartments intended for permanent storage of liquid. Where, in relation to particular compartments, drainage is not considered necessary, drainage arrangements may be omitted, but it shall be demonstrated that the safety of the craft will not be impaired.

10.3.2 Bilge pumping arrangements shall be provided to allow every watertight compartment other than those intended for permanent storage of liquid to be drained. The capacity or position of any such compartment shall be such that flooding thereof could not affect the safety of the craft.

See also 2.6.5 for void spaces that the Administration may not require to be fitted with bilge pumping arrangements.

10.3.3 The bilge pumping system shall be capable of operation under all possible values of list and trim after the craft has sustained the postulated damage in 2.6.6 to 2.6.10. The bilge pumping system shall be so designed as to prevent water flowing from one compartment to another. The necessary valves for controlling the bilge suctions shall be capable of being operated from above the datum. All distribution boxes and manually operated valves in connection with the bilge pumping arrangements shall be in positions which are accessible under ordinary circumstances. The spindles of manually operated valves shall be easily accessible and all valves shall be clearly marked.

See 1.4.20 for a definition of the term “datum”.

10.3.4 The power operated self-priming bilge pumps may be used for other duties such as fire fighting or general service but not for pumping fuel or other flammable liquids.

10.3.5 Each power bilge pump shall be capable of pumping water through the required bilge pipe at a speed of not less than 2 m/s.

Pipe loss calculations should be presented to show that the selected pump is capable of pumping out from the most remote bilge suction.

10.3.6 The diameter (d) of the bilge main shall be calculated according to the following formula, except that the actual internal diameter of the bilge main may be rounded off to the nearest size of a recognized standard:

$d = 25 + 1.68(L(B + D))^{0.5}$

where :

d is the internal diameter of the bilge main (mm);

L is the length of the craft (m) as defined in chapter 1;

B is, for monohull craft, the breadth of the craft (m) as defined in chapter 1 and, for multi-hull craft, the breadth of a hull at or below the design waterline (m); and

D is the moulded depth of the craft to the datum (m).

10.3.7 Internal diameters of suction branches shall meet the requirements of the Administration but shall not be less than 25 mm. Suction branches shall be fitted with effective strainers.

10.3.8 An emergency bilge suction shall be provided for each machinery space containing a propulsion prime mover. This suction shall be led to the largest available power pump other than a bilge pump, propulsion or oil pump. Emergency bilge suctions shall be provided for craft with common bilge pumping systems according to 10.3.6 and for craft with individual bilge pumps according to 10.3.13.

10.3.9 The spindles of the sea inlet valves shall extend well above the machinery space floor plates.

10.3.10 All bilge suction piping up to the connection to the pumps shall be independent of other piping.

10.3.11 Spaces situated above the water level in the worst anticipated damage conditions may be drained directly overboard through scuppers fitted with nonreturn valves.

10.3.12 Any unattended space for which bilge pumping arrangements are required shall be provided with a bilge alarm.

Refer also to 11.4.1.2.4 of this Code.

10.3.13 For craft with individual bilge pumps, the total capacity Q of the bilge pumps for each hull shall not be less than 2.4 times the capacity of the pump defined in 10.3.5 and 10.3.6.

10.3.14 In bilge pumping arrangements where a bilge main is not provided, then, with the exception of the spaces forward of public spaces and crew accommodation, at least one fixed submersible pump shall be provided for each space. In addition, at least one portable pump shall be provided supplied from the emergency supply, if electric, for use on individual spaces. The capacity of each submersible pump Q_n shall not be less than:

$Q_n = Q/(N - 1)$ tonnes/h with a minimum of 8 tonnes/h

where :

N = number of submersible pumps

Q = total capacity as defined in 10.3.13.

10.3.15 Non-return valves shall be fitted in the following components:

.1 bilge valve distribution manifolds;

.2 bilge suction hose connections where fitted directly to the pump or to the main bilge suction pipe; and

.3 direct bilge suction pipes and bilge pump connections to main bilge suction pipe.

10.4 Ballast systems

10.4.1 Water ballast shall not in general be carried in tanks intended for oil fuel. In craft in which it is not practicable to avoid putting water in oil fuel tanks, oily-water separating equipment shall be fitted, or other alternative means such as discharge to shore facilities shall be provided for disposing of the oily-water ballast. The provisions of this paragraph are without prejudice to the provisions of the International Convention for the Prevention of Pollution from Ships in force.

The possible contamination of the fuel by organisms from sea water should be considered and means to dose the fuel should be provided.

10.4.2 Where a fuel-transfer system is used for ballast purposes, the system shall be isolated from any water ballast system and meet the requirements for fuel systems and the International Convention for the Prevention of Pollution from Ships in force.

10.5 Cooling systems

The cooling arrangements provided shall be adequate to maintain all lubricating and hydraulic fluid temperatures within the manufacturers' recommended limits during all operations for which the craft is to be certificated.

10.6 Engine air intake systems

Arrangements shall provide sufficient air to the engine and shall give adequate protection against damage, as distinct from deterioration, due to ingress of foreign matter.

10.7 Ventilation systems

Machinery spaces shall be adequately ventilated so as to ensure that when machinery therein is operating at full power in all weather conditions, including heavy weather, an adequate supply of air is maintained to the spaces for the safety and comfort of personnel and the operation of the machinery. Auxiliary machinery spaces shall be adequately ventilated appropriate for the purpose of those spaces. The ventilation arrangements shall be adequate to ensure that the safe operation of the craft is not put at risk.

For guidance some Classification Societies require enough ventilation air to:

- *limit the temperature rise in a machinery space to 10°C above ambient temperature, and*
- *if the prime movers draw their combustion air from within the compartment, then the total ventilation air should not to be less than that required for combustion plus 50%.*

Single or two stage water filtration systems should be fitted to machinery space ventilation systems of craft liable to generate spray in conditions up to the maximum the craft is certified to operate in.

10.8 Exhaust systems

10.8.1 All engine exhaust systems shall be adequate to assure the correct functioning of the machinery and that safe operation of the craft is not put at risk.

Pressure loss calculations should be presented to show that the back pressure does not exceed the engine manufacturer's requirements.

10.8.2 Exhaust systems shall be so arranged as to minimise the intake of exhaust gases into manned spaces, air-conditioning systems, and engine intakes. Exhaust systems shall not discharge into air-cushion intakes.

In some cases it may be necessary to carry out wind tunnel tests to show that this requirement can be met. This is particularly applicable to multi-engined gas turbine driven craft where the quantity of exhaust gas is relatively large.

10.8.3 Pipes through which exhaust gases are discharged through the hull in the vicinity of the waterline shall be fitted with erosion-/corrosion-resistant shut-off flaps or other devices on the shell or pipe end and acceptable arrangements made to prevent water flooding the space or entering the engine exhaust manifold.

10.8.4 Gas turbine engine exhausts shall be arranged so that hot exhaust gases are directed away from areas to which personnel have access, either on board the craft or in the vicinity of the craft when berthed.

PART B - REQUIREMENTS FOR PASSENGER CRAFT

10.9 Bilge pumping and drainage systems

See also 10.3 of this Code.

10.9.1 For Category B craft at least three and for Category A craft at least two power bilge pumps shall be fitted connected to the bilge main, one of which may be driven by the propulsion machinery. Alternatively, the arrangement may be in accordance with the requirements of 10.3.14.

10.9.2 The arrangements shall be such that at least one power bilge pump shall be available for use in all flooding conditions which the craft is required to withstand as follows:

.1 one of the required bilge pumps shall be an emergency pump of a reliable submersible type having an emergency source of power; or

.2 the bilge pumps and their sources of power shall be so distributed throughout the length of the craft that at least one pump in an undamaged compartment will be available.

10.9.3 On multihull craft, each hull shall be provided with at least two bilge pumps.

10.9.4 Distribution boxes, cocks and valves in connection with the bilge pumping system shall be so arranged that, in the event of flooding, one of the bilge pumps may be operative in any compartment. In addition, damage to a pump or its pipe connecting to the bilge main shall not put the bilge system out of action. When, in addition to the main bilge pumping system, an emergency bilge pumping system is provided, it shall be independent of the main system and so arranged that a pump is capable of operating in any compartment under flooding conditions as specified in 10.3.3. In that case only the valves necessary for the operation of the emergency system need be capable of being operated from above the datum.

10.9.5 All cocks and valves referred to in 10.9.4 which can be operated from above the datum shall have their controls at their place of operation clearly marked and shall be provided with means to indicate whether they are open or closed.

PART C - REQUIREMENTS FOR CARGO CRAFT

10.10 Bilge pumping systems

See also 10.3 of this Code.

10.10.1 At least two power pumps connected to the main bilge system shall be provided, one of which may be driven by the propulsion machinery. If the Administration is satisfied that the safety of the craft is not impaired, bilge pumping arrangements may be dispensed with in particular compartments. Alternatively, the arrangement may be in accordance with the requirements of 10.3.14.

10.10.2 On multihull craft, each hull shall be provided with at least two power pumps, unless a bilge pump in one hull is capable of pumping bilge in the other hull. At least one pump in each hull shall be an independent power pump.