SECTION 9 OTHER SYSTEMS

1 Cooling systems

1.1 Application

1.1.1 This article applies to all cooling systems using the following cooling media:

- sea water
- fresh water.

Air cooling systems will be given special consideration.

1.2 Principle

1.2.1 General

Sea water and fresh water cooling systems are to be so arranged as to maintain the temperature of the cooled media (lubricating oil, hydraulic oil, charge air, etc.) for propulsion machinery and essential equipment within the manufacturers' recommended limits during all operations, including starting and manoeuvring, under the inclination angles and the ambient conditions specified in Ch 1, Sec 1.

1.3 Design of sea water cooling systems

1.3.1 General

a) Sea water cooling of the propulsion engines, auxiliary engines and other essential equipment is to be capable of being supplied by two different means

b) Where required, stand-by pumps are not to be connected to the sea inlet serving the other sea water pumps, unless the two sea inlets are connected by a cross-over.

1.3.2 Number of pumps

a) Cooling systems of propulsion engines are to include at least:

- one main cooling water pump, which can be driven by the engine
- one independently driven stand-by pump of at least the same capacity

b) A general service pump of sufficient capacity can be used as stand-by pumps

c) In yachts having two or more propulsion engines, each with its own cooling pump, or where the output of the engine does not exceed 375 kW, the independent stand-by pump may be replaced by a spare pump of appropriate capacity ready to be connected to the cooling circuit

d) For yacht having the navigation notation **sheltered area** or **coastal area** or **unrestricted navigation limited to 60 nautical miles** as defined in Pt A, Ch 1, Sec 2, and where the output of the engine does not exceed 375 kW, the independent stand-by pump may be omitted.

1.4 Design of fresh water cooling systems

1.4.1 General

a) Fresh water cooling systems are to be designed according to the applicable requirements of [1.3]

b) Where the engines are cooled by fresh water, the second means stated in [1.3.2] a) may be omitted if a connection is fitted from the fresh water system to a suitable sea water system.

1.4.2 Expansion tanks

Fresh water expansion tanks are to be provided with at least:

- a de-aerating device
- a water level indicator
- a filling connection
- a drain.

1.5 Arrangement of cooling systems

1.5.1 Sea inlets

a) Not less than two sea inlets are to be provided for the engine cooling system. These sea inlets are to be distinct for the two means of cooling given in [1.3.2] a), but they may be cross connected by a cross pipe

b) In yachts having two or more propulsion engines, each with its own sea inlet, or where the output of the engine does not exceed 375 kW, the second sea inlet may be omitted

c) These sea inlets are to be low inlets and one of them may be that of the ballast pump or of the general service pump. A sea inlet is considered as low provided it remains submerged under all normal navigating conditions

d) When the second means of cooling is a spare pump, the two sea inlets are to be provided in any event, both serving the main cooling pump

e) A valve is to be fitted directly on the sea inlet.

1.5.2 Coolers

a) Coolers are to be fitted with isolating valves at the inlets and outlets.

b) Coolers external to the hull (chest coolers and keel coolers) are to be fitted with isolating valves at the shell.

1.5.3 Filters

a) Where propulsion engines and auxiliary engines for essential services are directly cooled by sea water, both in normal service and in emergency operating conditions, filters are to be fitted on the suction of cooling pumps

b) When the output of the engine exceeds 375 kW, these filters are to be so arranged that they can be cleaned without interrupting the cooling water supply.

1.5.4 Pumps

a) When redundancy of pumps is not required, the pump connected to the cooling systems may be either independent or driven by the machine it serves

b) Relief valves are to be fitted on the discharge of cooling pumps driven by main engines, except for centrifugal type pumps.

1.5.5 Control and monitoring

a) Means are to be provided for controlling the temperature and the water circulation of each engine

b) A high temperature alarm is to be fitted clearly visible or audible from the steering position

c) In addition, when propulsion engines power exceeds 220 kW, alarms and indications are to be fitted in accordance with the relevant requirement of Part C, Chapter 1, Section 2 of the Rules for Steel Ships.

2 Ballast systems

2.1 Applications

2.1.1 Scope

This article applies to ballast systems fitted on every type of yachts.

2.2 Design of ballast systems

2.2.1 Independence of ballast lines

Ballast lines are to be entirely independent and distinct from lines conveying lubricating oil and fuel oil.

2.2.2 Prevention of undesirable communication between spaces or with the sea

Ballast systems in connection with bilge systems are to be so designed as to avoid any risk of undesirable communication between spaces or with the sea.

2.2.3 Bilge and ballast systems

The arrangement of the bilge and ballast pumping system are to be such as to prevent the possibility of water passing from the sea and from water ballast spaces into machinery spaces, or from one compartment to another.

2.2.4 Alternative carriage

Alternative carriage of fuel oil, feed water and ballast water in the same tanks is not permitted.

2.3 Ballast pumping arrangement

2.3.1 Filling and suction pipes

a) All tanks including aft and fore peak and double bottom tanks intended for ballast water are to be provided with suitable filling and suction pipes connected to a power driven pump of adequate capacity

b) Suctions are to be so positioned that the transfer of sea water can be suitably carried out in the normal operating conditions of the yacht.

2.3.2 Pumps

a) Bilge pumps may be used for ballast water transfer provided the provisions of Ch 1, Sec 5, [3.3.4] are fulfilled

b) Small tanks may be served by hand pumps.

3 Lubricating oil systems

3.1 Application

3.1.1 This Article applies to lubricating oil systems serving diesel engines, reduction gears, clutches and controllable pitch propellers, for lubrication or control purposes.

3.2 Principle

3.2.1 General

a) Lubricating oil systems are to be so designed as to ensure reliable lubrication of the engines and other equipment intended for propulsion:
   - over the whole speed range, including starting, stopping and, where applicable, manoeuvring
   - for all the inclinations angles stated in Ch 1, Sec 1

b) Lubricating oil systems are to be so designed as to ensure sufficient heat transfer and appropriate filtration of the oil

c) Lubricating oil systems are to be so designed as to prevent oil from entering into contact with sources of ignition

d) Lubricating oil pipes are to be independent of any other fluid system.

3.2.2 Arrangement of lubricating oil systems

a) The arrangements for the storage, distribution and utilisation of oil used in pressure lubrication systems are to be such as to ensure the safety of the yacht and persons on board and to minimise the risk of fire or explosion

b) The provisions of Ch 1, Sec 4, [9.10] are to be complied with, where applicable.

3.2.3 Filtration

a) In forced lubrication systems, a device is to be fitted which efficiently filters the lubricating oil in the circuit

b) The filters provided for this purpose for main machinery and machinery driving electric propulsion generators are to be so arranged that they can be easily cleaned without stopping the lubrication of the machines

c) The fineness of the filter mesh is to comply with the requirements of the engine or turbine manufacturers

d) Where filters are fitted on the discharge side of lubricating oil pumps, a relief valve leading back to the suction or to any other convenient place is to be provided on the discharge of the pumps.

3.3 Design of oil lubrication and oil control systems

3.3.1 Lubrication of propulsion engines

a) Main engines are to be provided with at least two power lubricating pumps, of such a capacity as to maintain normal lubrication with any one pump out of action

b) In the case of propulsion plants comprising:

- more than one engine, each with its own lubricating pump, or
- one engine with an output not exceeding 375 kW

one of the pumps mentioned in a) may be a spare pump ready to be connected to the lubricating oil system, provided disassembling and reassembling operations can be carried out on board in a short time.

c) For yacht having the navigation notation **sheltered area** or **coastal area** or **unrestricted navigation limited to 60 nautical miles** as defined in Pt A, Ch 1, Sec 2, and where the output of the engine does not exceed 375 kW, one pump is sufficient.

3.3.2 Lubrication of auxiliary engines

a) For auxiliary engines with their own lubricating pump, no additional pump is required

b) For auxiliary engines with a common lubricating system, at least two pumps are to be provided. However, when such engines are intended for non-essential services, no additional pump is required.

3.3.3 Control of controllable pitch propeller and clutches

a) Separate oil systems intended for the control of controllable pitch propellers, or clutches are to include at least two power pumps, of such a capacity as to maintain normal control with any one pump out of action

b) In the case of propulsion plants comprising:

- more than one shaft line with the propellers and/or the clutches fitted with their own control system, or
- one engine with an output not exceeding 375 kW

one of the pumps mentioned in item a) may be a spare pump ready to be connected to the oil control system, provided disassembling and reassembling operations can be carried out on board in a short time.

c) However, when the propulsion plant comprises one or more engines, each with an output not exceeding 375kW, the stand-by or spare pump may be omitted for the controllable pitch propellers and clutches provided that they are so designed as to be fixed mechanically in the “forward” position or in the “clutched” position and that the capacity of the starting means ensures the numbers of starts required in such conditions.

3.4 Design of lubricating oil tanks

3.4.1 Remote control of valves

Lubricating oil tanks with a capacity of 500 litres and above are to be fitted with remote controlled valves in accordance with the provisions of Ch 1, Sec 8, [3.3.2].

The remote controlled valves need not be arranged for storage tanks on which valves are normally closed except during transfer operation, or where it is determined that an unintended operation of a quick closing valve on the oil lubricating tank would endanger the safe operation of the main propulsion and essential auxiliary machinery.

3.4.2 Filling and suction pipes

Filling and suction pipes are to comply with the provisions of Ch 1, Sec 8, [3.3.1].

3.4.3 Air and overflow pipes

Air and overflow pipes are to comply with the provisions of Ch 1, Sec 7, [2.2] and Ch 1, Sec 7, [1.4].

3.4.4 Sounding pipes and level gauges

a) Safe and efficient means of ascertaining the amount of lubricating oil contained in the tanks are to be provided

b) Sounding pipes are to comply with the provisions of Ch 1, Sec 7, [1.3]

c) Oil-level gauges complying with Ch 1, Sec 4, [8.5.2] may be used in place of sounding pipes

d) Gauge cocks for ascertaining the level in the tanks are not to be used.

3.5 Control and monitoring

3.5.1 Alarms

In addition to the requirements in Ch 1, Sec 2 for diesel engines and gears, the following alarms are to be provided :

- a high level alarm, when the lubricating oil tank is fitted with an air pipe water trap
- a local level indication, when a sludge tank is provided.

3.5.2 Safety devices

Lubricating oil systems for propulsive engines are to be provided with an alarm device giving audible warning in the event of an appreciable reduction of the oil pressure.

3.6 Construction of lubricating oil piping systems

3.6.1 Materials

Materials used for oil piping system in machinery spaces are to comply with the provisions of Ch 1, Sec 8, [2.2.4].

3.6.2 Sight-flow glasses

The use of sight-flow glasses in lubricating systems is permitted, provided that they are shown by testing to have a suitable degree of fire resistance.

4 Hydraulic systems

4.1 Application

4.1.1 Hydraulic installations intended for essential services

Unless otherwise specified, this Article applies to all hydraulic power installations intended for essential services.

4.1.2 Hydraulic installations located in spaces containing sources of ignition

Hydraulic power installations not serving essential services but located in spaces where sources of ignition are present are to comply with the provisions of [4.3.2] to [4.4.6].

4.1.3 Hydraulic installations intended for steering gear

Additionally to this Article, hydraulic installations intended for steering gear are to comply with the relevant provisions of Ch 1, Sec 2 .

4.1.4 Low pressure or low power hydraulic installations

Hydraulic power installations with a design pressure of less than 2,5 MPa and hydraulic power packs of less than 5 kW will be given special consideration by the Society.

4.1.5 Very high pressure hydraulic installations

Hydraulic power installations with a design pressure exceeding 35 MPa will be given special consideration by the Society.

4.2 General

4.2.1 Design requirements

As far as practicable, hydraulic systems are to be so designed as to:

- avoid any overload of the system
- maintain the actuated equipment in the requested position (or the driven equipment at the requested speed)
- avoid overheating of the hydraulic oil
- prevent hydraulic oil from coming into contact with sources of ignition.

4.2.2 Availability

a) As a rule, hydraulic systems are to be so designed that, in the event that any one essential component becomes inoperative, the hydraulic power supply to essential services can be maintained. Partial reduction of the propulsion capability may be accepted, however, when it is demonstrated that the safe operation of the yacht is not impaired

b) When a hydraulic power system is simultaneously serving one essential system and other systems, it is to be ensured that:

- operation of such other systems, or
- a single failure in the installation external to the essential system

is not detrimental to the operation of the essential system.

c) Provision b) applies in particular to steering gear

d) Hydraulic systems serving lifting or hoisting appliances, including platforms, ramps, hatch covers, lifts, etc., are to be so designed that a single failure of any component of the system may not result in a sudden undue displacement of the load or in any other situation detrimental to the safety of the yacht and persons on board.

4.3 General

4.3.1 Definitions

a) A power unit is the assembly formed by the hydraulic pump and its driving motor

b) An actuator is a component which directly converts hydraulic pressure into mechanical action.

4.3.2 Limitations of use of hydraulic oils

a) Oils used for hydraulic power installations are to have a flash point not lower than 150°C and be suitable for the entire service temperature range

b) The hydraulic oil is to be replaced in accordance with the specification of the installation manufacturer.

4.3.3 Location of hydraulic power units

a) Whenever practicable, hydraulic power units are to be located outside main engine rooms

b) Where this requirement is not complied with, shields or similar devices are to be provided around the units in order to avoid an accidental oil spray or jet on heated surfaces which may ignite oil.

4.4 Design of hydraulic pumps and accessories

4.4.1 Power units

a) Hydraulic power installations are to include at least two power units so designed that the services supplied by the hydraulic power installation can operate simultaneously with one power unit out of service. A reduction of the performance may be accepted

b) Power hydraulic installations not supplying essential services may be fitted with a single power unit, provided that alternative means, such as a hand pump, are available on board

c) Low power hydraulic installations not supplying essential services may be fitted with a single power unit.

4.4.2 Pressure reduction units

Pressure reduction units used in hydraulic power installations are to be duplicated.

4.4.3 Filtering equipment

a) A device is to be fitted which efficiently filters the hydraulic oil in the circuit

b) Where filters are fitted on the discharge side of hydraulic pumps, a relief valve leading back to the suction or to any other convenient place is to be provided on the discharge of the pumps.

4.4.4 Flexible hoses

Flexible hoses are to be type approved by the Society.

4.4.5 Provision for cooling

Where necessary, appropriate cooling devices are to be provided.

4.4.6 Provision against overpressure

a) Safety valves of sufficient capacity are to be provided at the high pressure side of the installation

b) Safety valves are to discharge to the low pressure side of the installation or to the service tank.

4.4.7 Provision for venting

Cocks are to be provided in suitable positions to vent the air from the circuit.

4.4.8 Provision for drainage

Provisions are to be made to allow the drainage of the hydraulic oil contained in the installation to a suitable collecting tank.

4.5 Design of hydraulic tanks and other components

4.5.1 Hydraulic oil service tanks

a) Service tanks intended for hydraulic power installations supplying essential services are to be provided with at least:
   - a level gauge complying with Ch 1, Sec 4, [8.5.2]
   - a temperature indicator
   - a level switch complying with [4.6.2].

b) The free volume in the service tank is to be at least 10% of the tank capacity.

4.5.2 Hydraulic oil storage tanks

a) Hydraulic power installations supplying essential services are to include a storage tank of sufficient capacity to refill the whole installation should the need arise case of necessity

b) For hydraulic power installations of less than 5 kW, the storage means may consist of sealed drums or tins stored in satisfactory conditions.

4.5.3 Hydraulic accumulators

The hydraulic side of the accumulators which can be isolated is to be provided with a relief valve or another device offering equivalent protection in case of overpressure.

4.6 Control and monitoring

4.6.1 Indicators

Arrangements are to be made for connecting a pressure gauge where necessary in the piping system.

4.6.2 Monitoring

Alarms and safeguards for hydraulic power installations intended for essential services, except steering gear, for which the provisions of Ch 1, Sec 2 apply, are to be provided with the following:

- low pump pressure alarm
- low service tank level.

5 Compressed air systems

5.1 Application

5.1.1 This Article applies to compressed air systems intended for essential services, and in particular to:

- starting of engines
- control and monitoring.

5.2 Principle

5.2.1 General

a) As a rule, compressed air systems are to be so designed that the compressed air delivered to the consumers:
   - is free from oil and water, as necessary
   - does not have an excessive temperature.

b) Compressed air systems are to be so designed as to prevent overpressure in any part of the systems.

c) Compressed air receivers are to comply with the requirements of, Chapter 1, Section 3 of the Rules for Steel Ships, regarding pressure vessels.

5.2.2 Availability

a) Compressed air systems are to be so designed that, in the event of failure of one air compressor or one air receiver intended for starting, control purposes or other essential services, the air supply to such services can be maintained

b) The compressed air system for starting main engines and auxiliary engines for essential services is to be so arranged that it is possible to ensure the initial charge of air receiver(s) without the aid of a power source outside the yacht.

5.3 Design of starting air systems

5.3.1 Initial charge of starting air receivers

a) Where, for the purpose of [5.2.2], an emergency air compressor is fitted, its driving engine is to be capable of being started by hand-operated devices. Independent electrical starting batteries may also be accepted

b) A hand compressor may be used for the purpose of [5.2.2] only if it is capable of charging within one hour an air receiver of sufficient capacity to provide 3 consecutive starts of a propulsion engine or of an engine capable of supplying the energy required for operating one of the main compressors.

5.3.2 Number and capacity of air compressors

Where main and auxiliary engines are arranged for starting by compressed air, an air compressor is to be fitted with a capacity sufficient to supply within one hour the quantity of air needed to satisfy the folloing provisions:

a) The total capacity of the compressed air available for starting purpose is tà be sufficient to provide, without replenishment, not less than 12 consecutive starts alternating between ahead and astern of each main engine of the reversible type, and not less than 6 consecutive starts of each main non-reversible type engine connected to a controllable pitch propeller or other device enabling the start without opposite torque.

   The number of starts refers to the engine in cold and ready-to-start condition (all the driven equipment that cannot be disconnected is to be taken into account).

   A greater number of starts may be required when the engine is in warm running condition.

   At least 3 consecutive starts is to be possible for each engine driving electric generators and engines for other purposes. The capacity of a starting system serving two or more of the above specified purposes is to be the sum of the capacity requirements.

b) For multi-engine propulsion plants, the capacity of the starting air receivers is to be sufficient to ensure at least 3 consecutive starts per engine. However, the total capacity is not to be less than 12 starts and need not exceed 18 starts.

5.3.3 Number and capacity of air receivers

Where main engines are arranged for starting by compressed air, at least one air receiver is to be fitted with a capacity sufficient to provide without replenishment the number of starts required in [5.3.2]. It is also to take into account the air delivery to other consumers, such as control systems, whistle, etc., which are connected to the air receiver.

5.3.4 Air supply for starting the emergency generating set

Where starting air arrangement is one of two independent means of starting required in Part C, Ch 1, Sec 2, [3.1.3] of the Rules for Steel Ships for the emergency generator, the following is to be complied with:

a) The starting air arrangement is to include a compressed air vessel, storing the energy dedicated only for starting of the emergency generator. The capacity of the compressed air available for starting purpose is to be sufficient to provide, without replenishment, at least three consecutive starts

b) The compressed air starting systems may be maintained by the main or auxiiiary compressed air receivers through a non-return valve fitted in the emergency generator space, or by an emergency air compressor which, if electrically driven, is supplied from the emergency switchboard

c) All of these starting, charging and energy storing devices are to be located in the emergency generator space and is not to be used for any purpose other than the operation of the emergency generating set.

5.4 Design of control and monitoring air systems

5.4.1 Air supply

a) At least one air vessel fitted with a non-return valve is to be provided for control and monitoring purposes

b) Failure of the control air supply is not to cause any sudden change of the controlled equipment which may be detrimental to the safety of the yacht.

5.4.2 Pressure control

Arrangements are to be made to maintain the air pressure at a suitable value in order to ensure satisfactory operation of the installation.

5.4.3 Air treatment

In addition to the provisions of [5.8.3], arrangements are to be made to ensure cooling, filtering and drying of the air prior to its introduction in the monitoring and control circuits.

5.5 Design of air compressor

5.5.1 Prevention of overpressure

a) Air compressor is to be fitted with a relief valve complying with Ch 1, Sec 4, [8.1.3]

b) Means are to be provided to prevent overpressure wherever water jackets or casings of air compressors may be subjected to dangerous overpressure due to leakage from air pressure parts

c) Water space casings of intermediate cooler of air compressor are to be protected against any overpressure which might occur in the event of rupture of air cooler tubes.

5.5.2 Provision for draining

Air compressors are to be fitted with a drain valve.

5.6 Control and monitoring of compressed air systems

5.6.1 Monitoring

Alarms and safeguards are to be provided for compressed air systems with the following:

- low and high air pressure alarm after reducing valves
- low and high air vessel pressure.

5.6.2 Automatic controls

Automatic pressure control is to be provided for maintaining the air pressure in the air receivers within the required limits.

5.7 Materials

5.7.1 Pipes and valve bodies in control and monitoring air systems and in other air systems intended for non-essential services may be made of plastic in accordance with the provisions of Ch 1, Sec 4, [5] to Ch 1, Sec 4, [7].

5.8 Arrangement of compressed air piping systems

5.8.1 Prevention of overpressure

Suitable pressure relief arrangements are to be provided for all systems.

5.8.2 Air supply to compressors

a) Provisions are to be made to reduce to a minimum the entry of oil into air pressure systems.

b) Air compressor is to be located in spaces provided with sufficient ventilation.

5.8.3 Air treatment and draining

a) Provisions are be made to drain air pressure systems

b) Efficient oil and water separators, or filters, are to be provided on the discharge of compressors, and drains are to be installed on compressed air pipes wherever deemed necessary.

5.8.4 Lines between compressors, receivers and engines

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

5.8.5 Protective devices for starting air mains

Non-return valves and other safety devices are to be provided on the starting air mains of each engine in accordance with the following provisions:

The main starting air arrangements for main propulsion or auxiliary diesel engines are to be adequately protected against the effects of backfiring and internal explosion in the starting air pipes. To this end, the following safety devices are to be fitted:

- An isolating non-return valve, or equivalent, at the starting air supply connection to each engine
- A bursting disc or flame arrester:
  - in way of the starting valve of each cylinder, for direct reversing engines having a main starting air manifold
  - At least at the supply inlet ta the starting air manifold, for non-reversing engines.

The bursting disc or flame arrester above may be omitted for engines having a bore not exceeding 230 mm.

Other protective devices are to be specially considered by the Society.

Note 1: The requirements of this item c) do not apply to engines started by pneumatic motors.

6 Exhaust gas systems

6.1 General

6.1.1 Application

This Article applies to exhaust gas pipes from engines and smoke ducts from incinerators.

6.1.2 Principle

Exhaust gas systems are to be so designed as to:

- limit the risk of fire
- prevent gases from entering manned spaces
- prevent water from entering engines.

6.2 Design of exhaust systems

6.2.1 General

a) Exhaust systems are to be so arranged as to minimise the intake of exhaust gases into manned spaces, air conditioning systems and engine intakes.

b) The exhaust system is to be gas-tight throughout its passage inside the yacht.

c) When piping is led through an accommodation, locker or similar compartment, it is to be of thick, corrosion resistant material, adequately insulated or to be routed in a gas-tight casing.

6.2.2 Limitation of exhaust line surface temperature

a) Exhaust gas pipes and silencers are to be either water cooled or efficiently insulated where:
   - their surface temperature may exceed 220°C, or
   - they pass through spaces of the yacht where a temperature rise may be dangerous.

b) The insulation of exhaust systems is to comply with the provisions of Ch 1, Sec 1, [3.7.1].

c) If not oil-proof, the insulating material may be covered with an oil-proof material. If foamed plastic is used, it must be of a closed-cell type, resistant to oil, grease and be fire-resistant.

6.2.3 Limitation of pressure losses

Exhaust gas systems are to be so designed that pressure losses in the exhaust lines do not exceed the maximum values permitted by the engine manufacturer.

6.2.4 Intercommunication of engine exhaust gas lines

Exhaust pipes of several engines are not to be connected together but are to be run separately to the atmosphere unless arranged to prevent the return of gases to an idle engine.

6.2.5 Exhaust gas pipe terminations

a) Where exhaust pipes are led overboard, means are to be provided to prevent water from entering the engine or the yacht

b) The pipes are to be looped or fitted with a suitable device such as a riser to prevent the return of water to the engine

c) Where a shut-off valve is fitted at the overboard discharge, means are to be provided to prevent the engine from being started when the valve is not fully open

   Moreover this valve is to be readily operable from an accessible position

d) Outlet is to be fitted, where necessary, with a cowl or other suitable means which prevents the ingress of rain or snow

e) When a free board is assigned to the yacht, exhaust outlets may discharge through the shell below the free board deck, provided that efficient means are fitted to prevent flooding in case of exhaust system damage.

6.2.6 Control and monitoring

a) When water-cooled exhaust gas pipes are used, a high temperature alarm must be fitted after the water injection device. Alternatively, a low sea water flow rate may be fitted

b) If silencers or plastic waterlock are fitted, an alarm for low water level or an alternative water supply is to be provided.

6.3 Materials

6.3.1 General

Materials of exhaust gas pipes and fittings are to be resistant to exhaust gases and suitable for the maximum temperature expected.

6.3.2 Use of plastics

a) The use of non-metallic materials may be accepted in water cooled systems in accordance with the provisions of Ch 1, Sec 4, [5] to Ch 1, Sec 4, [7]

Especially exhaust gases are to be water-cooled to a temperature not exceeding 60°C

b) Plastic pipes used for water cooled exhaust system are to be subjected to a 30 minutes fire endurance test in wet conditions according to IMO Res. A.753(18).

6.4 Arrangement of exhaust piping systems

6.4.1 Provision for thermal expansion

a) Exhaust pipes and smoke ducts are to be so designed that any expansion or contraction does not cause abnormal stresses in the piping system, and in particular in the connection with engine turboblowers

b) The devices used for supporting the pipes are to allow their expansion or contraction.

6.4.2 Provision for draining

a) Drains are to be provided where necessary in exhaust systems in order to prevent water flowing into the engine

b) Where exhaust pipes are water cooled, they are to be so arranged as to be self-draining overboard.

6.4.3 Flexible hoses

The use of flexible hoses in water cooled exhaust systems will be given special consideration by the Society.

6.4.4 Silencers

Engine silencers are to be so arranged as to provide easy access for cleaning and overhaul.

7 Ventilation

7.1 General

7.1.1 Application

This Article applies to ventilation system of spaces containing propulsion engines or flammable products.

7.1.2 Principle

Adequate ventilation is to be provided for spaces containing engines or other heat generating apparatuses, as well as for spaces where flammable vapours are likely to accumulate.

7.2 Design of ventilation systems

7.2.1 Ventilation capacity

Except where the machinery or fuel tank spaces are of open type, they are to be provided with the necessary ventilation in accordance with the engine's air consumption and heat emission as specified by the engine manufacturer and the necessary ventilation to prevent the accumulation of oil flammable or explosive vapors.

7.2.2 Open type space definition

A space may be considered as of open type when it complies with the following conditions:

- space is located above the weather deck with openings at the top and the bottom
- space has at least 0,35 m2 of area exposed to the atmosphere per cubic meter of its net volume provided that no long or narrow unvented spaces remain inside in which a flame front might propagate.

7.3 Arrangement of ventilation systems

7.3.1 Ventilation type

Natural or mechanical ventilation are acceptable.

7.3.2 Operating conditions

The ventilation is to be operated with all access openings closed.

7.3.3 Independence of the line

Ventilation ducts serving the machinery space are to be separated from other ventilation systems and should not pass, as a rule, through the accommodation spaces.

If air ducts are passing through the accommodation spaces, they are to be gastight and suitably insulated with a material having low flame spread characteristics.

7.3.4 Water ingress prevention

Air intakes and air outlets are to be so arranged and located to prevent water ingress into the yacht and re-entry of exhausted fumes. They are to be located 40 cm from the gasoline fill and vent fittings.

7.3.5 Air inlet and outlet disposal

The inlet air ventilation is to be located as far as practicable at the forward end of the space which is to be ventilated and led down to within the lowest part. The outlet is to be fitted at the opposite, as far as practicable, at the top of the space and terminated at the open air.

7.3.6 Ventilation outlet

a) Where cowls or scoops are provided on any ventilation duct, the free area of the cowl or scoop is not to be less than twice the duct area. Where the cowls or scoops are screened, the mouth area is to be increased to compensate for the area of the screen wire.

b) Outlet ventilation ducts are not to discharge within one metre of possible source of ignition

c) Precautions are to be taken to prevent recycling.

7.3.7 Mechanical ventilation

a) Where mechanical ventilation is fitted, ventilators serving the machinery spaces are to be capable of being closed in case of fire, from outside the said spaces. Skylights and other openings serving these spaces are to meet the requirements stated in Part C, Chapter 4

b) Mechanical ventilating fans are to be capable of being stopped from outside the space supplied by these ventilating fans.

7.3.8 Height of air ventilators

On yacht above 24 metres in load line length the height of ventilators are to have a sill of a height of at least:

- 900 mm above the deck in fore area, ie the area extending on the forward 1/3 of the yacht's length
- 760 mm above the deck in aft area, ie the area extending on the aft 2/3 of the yacht's length.

Note 1: Smaller sills as indicated in Pt B, Ch 2, Sec 2, [3.2.1]may be accepted within the scope of Classification (refer to Pt B, Ch 2, Sec 2, [1.1]).

7.3.9 Closing appliances

On yacht above 24 metres in load line length ventilators are to be fitted with weathertight closing appliances, permanently attached.

7.4 Gas consuming appliances

7.4.1 Arrangement

a) Spaces containing a gas consuming appliance are to be provided with high and low ventilation openings

b) Natural or mechanical ventilation are acceptable

c) Where mechanical ventilation is fitted to any space in which gas containers or gas consuming appliances are situated, the material and design of the fan are to be such as to eliminate incendive sparking due to friction or impact of the fan impeller with the casing. Electric motors driving fans are to be situated outside the space, outside the ventilation trunking and clear of outlets. Alternatively suitably certified flameproof motors may be used if this cannot be achieved. Ventilation outlets are to be in a safe area free from ignition hazard. Mechanical exhaust ventilation trunking are to be led down to The lower part of the space and adjacent to the appliance

d) Any gas-consuming appliance is to be so located in relation to the ventilation system that air flow would not extinguish the gas flames.

7.5 First category fuel installation

7.5.1 Scope

This sub-article apply to installation using first category fuel, i.e fuel having a flashpoint less than 60°C, additionally to the requirements of [7.3].

7.5.2 General

a) Except for spaces open to the atmosphere, a natural ventilation system is to be provided for:

- engine space
- spaces which contain a permanently installed fuel tank or a portable fuel tank that vents into the space,
- enclosed spaces in direct connection with spaces for engines or fuel tank.

b) Except for spaces open to the atmosphere a mechanical ventilation complying with [7.5.4] is to be provided for each space with a permanently installed first category fuel engine in addition to the natural ventilation.

c) Accommodation, machinery and fuel tank spaces are to be separated from each other with gastight subdivision to prevent the circulation of explosive vapors throughout the yacht.

7.5.3 Natural Ventilation

a) Each natural ventilation system is to include at least one intake and one exhaust opening

b) Exhaust ducts and intake ducts are to be located in accordance with [7.3.5]

c) The cross section area of exhaust, intake ducts or openings, are to be sufficient to supply necessary ventilation in accordance with the engine's air consumption and heat emission as specified by the engine manufacturer and the necessary ventilation to prevent the accumulation of oil flammable or explosive vapors

d) Increased air intake area may be required for space of a complicated shape after consideration by the Society.

7.5.4 Mechanical ventilation

a) The mechanical ventilation system is to be of the local exhaust type, in which the intake has a duct extending in the lower part of the space and below the carburettor air intake. Each power exhaust duct pickup is to be permanently and substantially fixed as near as possible below the engine(s) which it serves or at the point(s) where fuel vapours are most likely to accumulate, and above normal accumulations of bilge water.

b) The minimum blower capacity is defined in Tab 1

c) Blower motors and any other electrical equipment located in the ventilated spaces are to be ignition protected according to ISO/DIS 8846 project (or equivalent test procedure such as UL 1128 - SAE J 11 7 1) or are to be of a certified safe type suitable for use in the considered gases in accordance with IEC 79-0.

The fans are to be non-sparking type.

d) Blowers are to be mounted as high as practicable above the bilge low point except for blowers designed in combination with bilge pumps which can be run in submerged condition

e) The blowers may be installed with separate ducting or may be installed in a natural ventilation duct

f) A notice plate is to be fitted at the steering console stating that the ventilation fan is to be run for at least 5 minutes prior to starting the engine.

Table 1 : Minimum blower capacity

Net compartment volume V, in m^3	Blower capacity, in m^3/min
V < 1	1,4
1 < V < 3	1,5 V
V > 1	V/2 +2,8

Note 1: necessary ventilation capacity is to be provided in accordance with the engine' s air consumption and heat emission as specified by the engine manufacturer.