BIRO KLASIFIKASI INDONESIA

Regulations for Ventilation Systems on Board Seagoing Ships

EDITION 2004

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Section 1 - General

1. Scope

1.1 These Regulations are intended as a guide to the design and construction or ventilation systems.

1.2 They reflect the present state or the art. They must remain subject to the changes and additions dictated by technical progress. The diversity or ships and designs may necessitate specially engineered ventilation systems, in which case these Regulations shall be treated as a recommendation.

1.3 They contain parts of the BKI Construction Rules which are applicable to ventilation systems.

1.4 Due account is taken or the Amendments to SOLAS 2000 enforced up to February 1, 1992 as well as or ILO Convention No.92.

1.5 Sections 1 and 2 or these Regulations apply to all ventilation systems on all types or seagoing ships.

1.6 Sections 3 and 4 contain additional regulations for tankers and passenger ships.

1.7 The Regulations in connection with fire protection are valid generally also for cargo ships of less than 500 GRT .

1.8 The Regulations do not contain information on ventilation or refrigerated cargo holds.

2. Documents for approval

2.1 Arrangement drawings or the ventilation or air-conditioning systems stating the volumes or air, size or spaces, intended use or spaces, air changes, climatic conditions, sections or air ducts, type or mechanical ventilators, etc. are to be submitted in triplicate.

2.2 The ventilation equipment is to be included in the fire protection plan together with all the necessary details (DIN 87 903).

2.3 Where so agreed, measurements of temperature, humidity and air flow are to be performed after installation of the systems.

2.4 Proof of suitability of the electrical equipment for use in hazardous areas on board tankers, ro-ro ships, etc. is to be furnished by BKI-Form (F.212-2000), including the pertinent certificates (copies) issued by a recognized testing

institution.

3. Definitions

For the purposes of these Regulations the following definitions shall apply:

Air ducts

Thin-walled piping or ducting (circular or rectangular) used exclusively to conduct air.

Air pipes

Parts of tank pressure-equalizing systems not dealt with in these Regulations. See Rules for Hull, Volume II, Section 21.

Air trunks

Parts of the hull which may either themselves be used to conduct air or which contain air ducts as well as other lines (pipes, cables).

Ventilator coamings

Those thick-walled portions of air ducts which extend above a weather deck and are welded to it (see Regulation 19, LLC 1966).

Mechanical ventilation systems

Systems through which air is passed by ventilators driven hydraulically, pneumatically or by electric motors.

Natural ventilation systems

Systems in which the air movement is caused solely by temperature differences, natural wind or head wind.

Tankers

Ships for the carriage of flammable, toxic, caustic or otherwise hazardous liquids.

Oil tankers

Ships for the carriage of oil with a flash point of 60^0 C or below (closed-cup test) and Reid vapour pressure under atmospheric pressure as well as similar liquids in bulk.

Liquefied gas tankers

Ships for the carriage of liquefied gases in bulk (see Rules for Ships Carrying

Liquefied Gases in Bulk, Volume IX).

Chemical tankers

Ships for the carriage of hazardous chemicals in bulk (see Rules for Ships Carrying Dangerous Chemicals in Bulk, Volume X).

Accommodation spaces

Public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, barber shops, pantries without cooking appliances and similar spaces.

Public spaces

Those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

Service spaces

Galleys, pantries containing cooking appliances, lockers, mail and specie rooms, stores, workshops other than those forming part of machinery spaces and similar spaces and trunks to such spaces.

Cargo holds

All spaces used for cargo (including cargo oil tanks) and trunks to such spaces.

Special category spaces

Enclosed spaces on passenger ship above or below the bulkhead deck intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion, into and from which such vehicles can be driven and to which passengers have access.

Machinery spaces of category A

are those spaces and trunks to such spaces which contain:

.1 internal combustion machinery used for main propulsion, or

.2 internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW, or

.3 any oil-fired boiler or an oil fuel unit.

Machinery spaces

Machinery spaces of category A and all other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilating and air-conditioning machinery and similar spaces, and trunks to such spaces.

Control stations

Spaces in which the ship's radio or main navigating equipment, the emergency source of power or the central fire-detecting or fire-control-detecting equipment.

Cargo areas

The cargo tanks, slop tanks, cargo containment system, spaces in which cargo tanks are installed, cargo pump rooms, pump rooms, cargo compressor rooms, cofferdams, ballast or void spaces adjacent to throughout the entire cargo tanks and slop tanks and also deck areas length and breadth of the part of the ship over the aforementioned spaces.

Where fitted, the cofferdams, ballast or void spaces at the after end of the aftermost hold space or of the forward end of the forwardmost hold space are excluded from the cargo area.

An area bounded by a 3 m spherical radius about a stern cargo connection counts as cargo area.

Cargo pump rooms

Spaces containing pumps and their accessories for the handling of cargo.

Pump rooms

Spaces located in the cargo area, containing pumps and their accessories for the handling of ballast water and oil fuel.

Hazardous areas on exposed decks

a) On oil and chemical tankers:

.1 Cargo flash point above 60 °C, cargo heated to above 15 °C below its flash point:

Areas within 3 m of the heated tank openings and 3 m of ventilator openings or entrances to cargo pump rooms.

.2 Cargo flash point of 60 °C or below, or above 60 °C with cargo heated to above its flash point:

Areas (including those in partly enclosed spaces) within a spherical radius of 3 m about cargo tank openings, blow-off line outlets, cargo line flanges and cargo valves or of the entrances and ventilation openings of cargo pump rooms; exposed deck in the cargo area above all cargo tanks and holds including all ballast tanks and cofferdams within the cargo area and extending over the whole breadths of the ship and to a distance of 3 m forward and aft of the cargo area and up to a height of 2.4 m above the deck.

b) On liquefied gas tankers:

Areas (including those in partly enclosed spaces) within 3 m of cargo tank outlets, blow-off line outlets, cargo line flanges and cargo shutoff valves or of the entrances and ventilation openings of cargo pump and cargo compressor rooms; exposed deck above the cargo area including an area of the free deck extending 3 m forward and aft of the cargo area and up to a height of 2.4 m above the weather deck as well as in zones lying within 2.4 m, measured from the outer surface of the cargo tank system, if this surface is situated above the weather deck (is exposed to the weather).

c) On all tankers:

In the case of bow and stern loading equipment, exposed decks within the coamings and within a distance of 3 m forward of the coamings, up to a height of 2.4 m above the deck.

4. Materials

4.1 Parts which are welded together or to the hull must be made of weldable steels in accordance with the Rules for Materials, Volume V.

4.2.1 Air ducts are to be made of non-combustible material [1] (see Section 4, 2.1.2).

4.2.2 Short end portions of ducts measuring not more than 2 m in length and not more than 0.02 m^2 in cross-section (Ø160 mm) may be made of other material, provided that

a) the material concerned has a low fire risk,

b) only ventilation line terminal ducts are made of this material, and

c) such ducts are located in a distance of 600 mm or more from "A" or "B" bulkhead/deck penetrations and from continuous "B" class ceiling penetrations. The distance is to be measured along the duct.

4.2.3 Other materials may be used for parts of the system of minor significance

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1) As defined SOLAS 1974

for the ship's safety.

4.2.4 Any national regulations remain unaffected.

4.3 Ducts which are insulated for reasons of fire protection are to be made of steel, 8.10.1 b) and c) are then applicable.

As a guidance for the insulation with mineral wool (100 kg/m^3) can be:

A 15 - 30 mm thickness
A 30 - 50 mm thickness
A 60 - 90 mm thickness

4.4 Air ducts are to be protected against corrosion.

4.5 Means must also be provided for the internal preservation of air trunks. A sufficient number of inspection openings is to be provided.

4.6 All insulating materials used must be non-combustible [1)].

5. Ventilator coamings

5.1 The height of ventilator coamings on exposed freeboard decks and quarter decks as well as on exposed superstructure decks situated forward of a point located 0.25 **L** aft of the forward perpendicular must be at least 900 mm.

5.2 The height of ventilator coamings on exposed superstructure decks situated more than 0.25 **L** aft of the forward perpendicular must be at least 760 mm.

5.3 Should any necessary damaged stability calculation dictate greater coaming heights, these greater heights are to be applied.

5.4 Where the ventilator coaming height exceeds 900 mm, the coamings are to be specially strengthened.

5.5 The wall thickness of coamings with a free cross-section of up to 300 cm^2 (200 mm diameter) must be at least 7.5 mm and with free cross-sections of more than 1600 cm^2 (450 mm diameter) must be at least 10 mm. For intermediate values, interpolation is required. In superstructures which are not fully enclosed, a thickness of 6 mm is generally sufficient.

5.6 The wall thickness of ventilator posts must be at least equal to the wall thickness of the coamings as specified in 5.5.

5.7 The wall thickness of ventilator posts with a cross-section of more than 1600 cm^2 is to be increased in accordance with the anticipated loads.

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1) As defined in SOLAS 1974

5.8 The wall thickness of ventilator houses are to be determined in the same way as for protective deckhouses (see Rules for Hull, Volume II).

5.9 In general, coamings and posts are to extend through the deck and are to be welded to the deck plating above and below.

If coamings or posts are welded to the top of the deck, reinforced fillet welds are to be applied externally and internally.

5.10 Coamings and posts specially exposed to the impact of the sea must have suitably reinforced hull connections. .

5.11 Where the deck plating is less than 10 mm thick, a welding plate at least 10 mm thick is to be fitted with sides equal in length to about twice the length and breadth of the coaming.

5.12 For reinforcements of the strength deck in way of coamings and posts, see Rules for Hull, Volume II.

5.13 The outer edge of openings for ventilation pipe penetrations shall be located at a distance of at least 1 x the opening diameter from the side of the hull.

5.14 Where a deck beam is interrupted by a ventilator coaming, the strength of the deck structure is to be restored by fitting carlings.

6. Weathertight closures

6.1 Intakes and outlets of ventilation systems (to the open air) are to be provided with efficient weathertight closures. On ships less than 100 m in length the closures are to be permanently attached. On longer vessels they may be conveniently stowed near the ventilator openings to which they are to be fitted.

6.2 The weathertightness of the closures is to be tested by hosing.

6.3 Ball valves as a means of ventilator closure are permitted with special authorization only. In such cases the pipe diameter must not exceed 200 mm. A fire damper is then additionally required.

6.4 Wooden plugs, tarpaulin covers or similar closures are not acceptable.

6.5 Weathertight means of closures are required only in special cases for ventilator posts more than 4.5 m in height on exposed freeboard decks and quarter decks as well as on exposed superstructure decks situated forward of a point located 0.25 **L** aft of the forward perpendicular and for ventilator posts more than 2.3 m in height on superstructure decks more than 0.25 **L** aft of the forward perpendicular.

6.6 An unrestricted supply of air to essential consumers must be assured in all weather (see Section 2, 9.1).

The air supply to rooms in which combustible, toxic or suffocating gases or vapours may accumulate is also to be assured.

These requirements are considered to have been met where air is supplied exclusively through openings which conform to the provisions of Rule 19(3) of LLC 1966 for ventilators without weathertight closures (see 6.5).

6.7 Ventilation openings in the shell plating are not allowed below the freeboard or bulkhead deck.

7. Fire closures

7.1 Fire dampers at main inlets and outlets

7.1.1 Air supply and exhaust systems must be fitted at their main inlets and outlets to the open air with fire closures of non-combustible material which can be actuated from outside the protected space.

7.1.2 The thickness of steel fire dampers (in ducts and coamings) is shown in the following Table.

Diameter of duct [mm]	Cross-section of duct [m^2]	Thickness of shutoff devices [mm]
up to 200	up to 0.03	4
over 200 up to 400	over 0.03 up to 0.13	5
over 400 up to 600	over 0.13 up to. 0.28	6
over 600 up to 800	over 0.28 up to. 0.50	7
over 800	over 0.50	8

7.1.3 If an incombustible material other than steel is intended to be used, the following conditions are to be met:

- The closing devices are to be strengthened accordingly.
- Non-combustibility of the damper material is to be proved by a test in accordance with IMO Res. A.472 (XII).
- The complete fire damper (housing, flap, etc.) is to be subjected to a one hour standard fire test on the basis of IMO Res. A.517 or an equivalent Regulation, with the damper flap being exposed to the fire.
- After that test the fire damper must still be in workable condition.
- The damper material must be resistant to corrosion and must be suitable for use at sea.
- The damper material must be capable of resisting the outside stresses, to

which it will be exposed during ship operation.

- The Administration will have to approve of the material.

7.1.4 Hinges and bearings of the dampers are to be largely maintenance-free and easily accessible for inspections and repairs.

The means of control is to be capable of being locked in open and closed position.

When shut, the dampers must have close contact with a steel strip throughout their circumference.

7.1.5 All closures must be easily accessible and capable of being operated easily and safely.

The controls must not be located more than 2 m above deck (or standing position). They are to be clearly and permanently marked.

This also applies to the "open" and "closed" position of the closures.

7.1.6 Fire closures and weathertight closures may be combined.

In that case, weathertight closures are to be permanently attached, irrespective of the length of the ship.

7.1.7 Jalousie flaps or lamellar shutters are not permitted as fire dampers at main inlets and outlets.

7.1.8 Special requirements for fire dampers, e.g. on liquefied gas tankers, in emergency generator rooms and on ro-ro vessels are to be observed.

7.1.9 The location of fire dampers, including their identification numbers, is to be indicated in the 'Fire Control Plan'.

7.2 Automatically closing fire dampers within the duct system

7.2.1 Under certain conditions automatically closing fire dampers are to be fitted in the ducts.

7 .2.2 These dampers shall close automatically at a release temperature of approx. 70 °C.

7.2.3 The dampers must also be capable of being closed manually from both sides of the bulkhead.

7.2.4 At least on one side of the division the damper is to be provided with an indicator, which shows the open/closed condition.

7.2.5 The dampers must be operationally safe.

7.2.6 The location of damper controls at main fire divisions (decks) must be readily accessible and be marked in red fluorescent paint.

7.2.7 The sensor for closing the damper automatically is to be placed within the air flow.

7.2.8 The thickness of the (steel) damper casings shall be at least 3 mm and 5 mm for ducts the heights/widths or diameters of which are up to and including 300 mm and 760 mm and over respectively (interpolation between both).

7.2.9 The thickness of a steel damper plate is to be not less than 3 mm.

7.2.10 A circumferential resting bar is recommended for the damper plate.

7.2.11 Drawings of the damper are to be submitted for approval.

7.2.12 A function test of the damper is to be performed on board the ship.

7.2.13 If a certificate on the fire safety of the dampers is requested, first a standard fire test with positive result is to be carried out by a recognized test institute in compliance with the IMO Recommendations.

7.2.14 If an incombustible material other than steel is intended to be used for the dampers, the requirements as per 7.1.3 are to be met.

7.3 Manually operated fire dampers within the duct system

7.3.1 Occasionally manually operated fire dampers or smoke flaps are required, e.g. in accordance with SOLAS 74, Chapter II-2, Regulation 9.7.5.2.1.2, for exhaust ducts from galley ranges or smoke dampers for separating various decks in accordance with SOLAS, where passenger ships with more than 36 passengers are concerned (Regulation 9.7.4.3).

7.3.2 The damper is to be provided with an indicator, which shows the open/closed position.

7.3.3 The thickness of the (steel) damper casing shall be at least 3 mm and 5 mm for ducts the heights/widths or diameters of which are up to and including 300 mm and 760 mm and over respectively (interpolation between both).

7.3.4 The thickness of a steel damper plate is to be not less than 3.0 mm.

7.3.5 A circumferential resting bar is recommended for the damper plate.

7.3.6 The damper is to be capable of being locked in open and closed position.

7.3.7 The controls and "open" and "closed" positions are to be clearly and permanently marked.

7.3.8 If an incombustible material other than steel is intended to be used for the dampers, the requirements as per 1.1.3 are to be met.

8. Construction

8.1 Main intakes and outlets are to be fitted with gratings to prevent fouling and the entry of rats and other large vermin (see 8.15.1 and Section 2, 2.21).

8.2 Ducts are to be routed in such a way that neither machinery nor switch gear can be endangered by condensation or spray water. Where necessary , water traps, baffles and similar devices are to be fitted.

Effective water traps are to be provided with oppositely directed baffle plates. The lowermost baffle of the water trap is to be provided with a drainage tube of approx. 50 mm in thickness and a non return valve.

8.3 Where necessary, outlet openings inside spaces are to be provided with shut off devices and means for reversing the direction of flow.

8.4 Unless otherwise specified in the relevant sections, the dimensional calculation of the free cross-section of the ducts of natural ventilating systems is to be based on a maximum flow velocity of 4 m/s.

8.5 Natural ventilating systems shall not employ a branched ducting system.

8.6 Ventilating equipment is to be designed to keep noise pollution to a tolerable level.

8.7 Short-circuiting between intakes and exhaust openings must be preventable even under unfavorable steaming conditions.

The position of the intake and exhaust openings must be clearly indicated in the plans of the ventilating system to be submitted.

8.8.1 All ventilators on board are to be chosen, designed and arranged such as to ensure undisturbed continuous operation under the conditions of trim, air temperatures and other environmental conditions mentioned in Rules for Electrical Installations, Volume IV, Section 1.

8.8.2 Means must be provided for switching off mechanical ventilators from an easily accessible position outside the ventilated spaces.

The position must continue to be accessible even in the event of a fire in the ventilated space.

All switching positions for ventilator motors are to be indicated in the fire control plan (see 2.2).

8.9.1 Where air ducts with a cross-section of up to 0.02 m^2 (free Ø 160 mm) pass

through Type A partitions, the penetrations shall be fume-tight.

8.9.2 Where air ducts with a cross-section of more than 0.02 m^2 (Ø160 mm) pass through "A" bulklheads or " A " decks, the penetrations are to be fitted with steel sleeves, unless this part of the duct is itself made of steel.

Sleeves or ducts are to have a minimum thickness of 3 to 5 mm over a length of 900 mm and are to be insulated in a manner compatible with the bulkhead or deck (see 8.10.1 b) (preferably over a length of 450 mm on each side of the bulkhead).

On application, authorization may be given for equivalent designs.

This Regulation continues to apply even where the duct passing through the "A" bulkhead or the " A "-deck does not ventilate the adjoining spaces.

8.9.3 Air ducts with a cross-section of more than 0.075 m^2 (free Ø 310 mm) are, in addition, to be fitted with automatic fire dampers in accordance with 7.2.

The duct between damper and bulkhead/deck is to be made of steel and is to be insulated in accordance with the insulation of the partitions. The plate thickness of the duct is to be in accordance with 7.2.8.

These fire dampers may be dispensed with where the duct is. insulated and is routed without opening through a space bounded by "A " bulkheads. A ventilator room is acceptable in this connection if ventilation openings in ducts do not exist within this room, Thin sheeted ducts, ventilator housings, etc. will be assumed as being of A-0 type. Sleeve-links (vibration compensators) at ventilators are to be protected by non-combustible covers. Approval by the competent Administration has to obtained.

8.9.4 Ventilation openings without ducts are not acceptable in type A divisions.

8.10.1 Where air ducts provided for machinery spaces of category A, galleys, car deck spaces and ro-ro cargo spaces pass through accommodation spaces, service spaces or control stations, the following conditions are to be met:

a) The ducts are to be made of steel.

b) Up to and including a diameter or height/width of 300 mm, the wall thickness of the ducts must be 3 mm, and for a diameter or height/width of 760 mm or over it must be 5 mm. Intermediate values are to be determined by linear interpolation.

c) The ducts are to be suitably supported and stiffened.

d) Automatic fire dampers in accordance with 7 .2 are to be fitted close to the boundary penetration. For the duct between boundary and damper 8.10.1 b) is to be applied.

e) The penetration is to be sealed.

f) A-60 insulation is to be fitted between the pierced boundary of the ventilated rooms and a point at least 5 m beyond the automatic fire damper.

g) Where the insulation specified in f) is fitted continuously in accommodation spaces, service spaces and control stations, the automatic fire damper may be dispensed with.

8.10.2 For galley ventilation see Section 2, 4.

8.11.1 Where air ducts for accommodation spaces, service spaces and control stations pass through machinery spaces of category A, galleys, car deck spaces and ro-ro cargo spaces, the following conditions are to be met:

a) The ducts are to be made of steel.

b) Up to and including a diameter or height/width of 300 mm, the wall thickness of the ducts must be 3 mm, and for a diameter of height/width of 760 mm or over it must be 5 mm. Intermediate values are to be determined by linear interpolation.

c) The ducts are to be suitably supported and stiffened.

d) Automatic fire dampers in accordance with 7 .2 are to be fitted close to the bulkhead penetration. For the duct between boundary and damper 8.11.1 b) is to be applied.

e) The penetrations are to be sealed and insulated.

f) Where the ducts within machinery spaces of category A, galleys, motor vehicle holds and ro-ro cargo holds are fitted with continuous A-60 insulation, the automatic fire damper may be dispensed with.

8.11.2 For galley ventilation see Section 2, 4:

8.12.1 Where air ducts with a cross-section of up to 0.02 m^2 (Ø 160 mm) pass through "B"-walls, the penetrations are to be made fume-tight.

8.12.2 Where air ducts with a cross-section of more than 0.02 m^2 (Ø 160 mm) pass through "B"-walls, the penetrations are to be fitted with steel sleeves unless this part of the duct is itself made of steel. Sleeve or duct shall conform to this requirement to a distance of 450 mm on each side of the bulkhead, and the bulkhead penetration shall be made fumetight. Only in exceptional cases may the sleeve be located on one side only (900 mm).

8.13 Ducts leading through watertight bulkheads and other hull elements

8.13.1 In general, watertight bulkheads must not be penetrated by air ducts.

Where (in exceptional cases) this cannot be avoided, ventilator openings are admissible on one side of the bulkhead only. Ventilation ducts without openings are to be thick-walled and watertight.

8.13.2 If on board cargo vessels with **Ls** exceeding 100 m air ducts are arranged within areas assumed to be damaged in the damaged condition, arrangements are to be made for preventing the floading of other non-damaged compartments.

8.13.3 Large duct penetrations in girders, web-plate beams and other hull structural elements are subject to approval.

8.14 Duct insulation for fire protection

8.14.1 The fire protection insulation of air ducts and sleeves is to be in accordance with the space-group pairings indicated below. The tables relating to the bulkheads, are likewise applicable to ducts routed through decks.

A space pairing refers to the spaces separated by a bulkhead or deck, irrespective of any other spaces served by the duct in question.

8.14.2 Passenger ships for more than 36 passengers

"A" -bulkheads within main fire zones

Room / spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Control Stations (1)	B-0[a]	A-0	A-0	A-0	A-0	A-60	A-60	A-60	A-0	A-0	A-60	A-60	A-60	A-60
Stairways (2)		A-0[a]	A-0	A-0	A-0	A-0	A-15	A-15	A-0[c]	A-0	A-15	A-30	A-15	A-30
Corridors (3)			B-15	A-60	A-0	B-15	B-15	B-15	B-15	A-0	A-15	A-30	A-0	A-30
Evacuation stations and external escape routes (4)				-	A-0	A-60[d]	A-60[d]	A-60[d]	A-0[d]	A-0	A-60[b]	A-60[b]	A-60[b]	A-60[b]
Open deck spaces (5)					–	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accomodation spaces of minor fire risk (6)						B-0	B-0	B-0	C	A-0	A-0	A-30	A-0	A-30
Accomodation spaces of moderate fire risk (7)							B-0	B-0	C	A-0	A-15	A-60	A-15	A-60
Accomodation spaces of greater fire risk (8)								B-0	C	A-0	A-30	A-60	A-15	A-60
Sanitary and similar spaces (9)									C	A-0	A-0	A-0	A-0	A-0
Tanks, voids and auxiliary machinery spaces presenting little or no fire risk (10)										A-0[a]	A-0	A-0	A-0	A-0
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk (11)											A-0[a]	A-0	A-0	A-15
Machinery spaces and main galleys (12)												A-0[a]	A-0	A-60
Storerooms, work-shops, pantries etc (13)													A-0[a]	A-0
Other spaces in which flammable liquids are stowed (14)														A-30

Notes :

a Where adjacent spaces are in the same numerical category and the superscript [a] appears, a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Administration. For example, in category (12) a bulkhead need not required between a galley and its annexed pantries provided that the pantry bulkheads and decks maintain the integrity of the galley boundaries. A bulkhead is, however, required between a galley and a machinery space even though both spaces are in category (12).

b The ship's side, to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below the adjacent to the liferafts and evacuation slides may be reduced to "A-30".

c Where public toilets are installed completely within the stairway enclosure, the public toilet bulkhead within the stairway enclosure can be of "B" class integrity.

d Where spaces of category 6,7,8 and 9 are located completely within the outer perimeter of the muster station, the bulkhead of these spaces are allowed to be of "B-0" class integrity. Control positions for audio, video and light installations may be considered as part of the muster station.

For determining the appropriate fire integrity standards to be applied to the boundary structures between adjacent spaces, the latter have been classified into the following categories 1 -14 according to their fire risk. The number in brackets preceding each category refers to the applicable vertical or horizontal division in table.

(1) Control stations

Spaces containing emergency sources of power and lighting; wheelhouse and chart-room; spaces containing the ship's radio equipment; fire-extinguishing rooms, fire-control rooms and fire-recording stations; control room for propulsion machinery when located outside the propulsion machinery space, e.g. on the bridge, but not the engine control room; spaces containing centralized fire alarm equipment; spaces containing the centralized emergency public address system stations and equipment.

(2) Stairways

Interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) for passengers and crew and enclosures thereto.

In this connection a stairway which is enclosed at only one deck shall be regarded as part of the space from which it is not separated by a fire door.

(3) Corridors

Passenger and crew corridors and lobbies.

(4) Evacuation stations and external escape routes

Survival craft stowage area; open deck spaces and enclosed promenades forming lifeboat and liferaft embarkation and lowering stations; muster stations, internal and external; external stairs and open decks used for escape routes; the ship's side to the waterline in the lightest seagoing

condition, superstructure and deckhouse sides situated below and adjacent to the liferaft and evacuation slide embarkation areas.

(5) Open deck spaces

Open deck spaces and enclosed promenades clear of lifeboat and liferaft embarkation and lowering stations; air spaces (spaces outside superstructures and deckhouses).

(6) Accommodation spaces of minor fire risk

Cabins containing furniture and furnishings of restricted fire risk.

Offices and dispensaries containing furniture and furnishings of restricted fire risk.

Public spaces containing furniture and furnishings of restricted fire risk and. having a deck area of less than 50 square metres .

(7) Accommodation spaces of moderate fire risk

Spaces as indicated under (6) but containing furniture and furnishings of other than restricted fire risk.

Public spaces containing furniture and furnishings of ,restricted fire risk and covering a deck area of 50 square meters or more.

Isolated lockers and small store-rooms in accommodation spaces of less than 4 m^2 (in which flammable liquids are not stowed).

Sale Shops;

Motion picture projection and film stowage rooms;

Diet kitchens (containing no open flame);

Cleaning gear lockers (in which flammable liquids are not stowed);

Laboratories (in which flammable liquids are not stowed);

Pharmacies;

Small drying rooms (with a deck area of 4 square meters or less);

Specie rooms.

(8) Accommodation spaces of greater fire risk

Public spaces containing furniture and furnishings of other than restricted

fire risk and having a deck area of 50 square meters or more; barber shops and beauty parlours.

(9) Sanitary and similar rooms

Communal sanitary facilities, showers, baths, water closets, etc;

Small laundries;

Indoor swimming pool area;

Operating rooms;

Isolated pantries containing no cooking appliances in accommodation spaces.

Private sanitary facilities shall be considered a portion of the space in which they are located.

(10) Tanks, voids and auxiliary machinery spaces having little or no fire risk

Water tanks forming part of ship's structure;

Voids and cofferdams;

Auxiliary machinery spaces which do not contain machinery having a pressure lubrication system and where storage of combustibles is prohibited, such as:

Ventilation and air-conditioning rooms; windlass room; steering gear room; stabilizer equipment room; electrical propulsion motor room, rooms containing section switchboards and purely electrical equipment other than oil-filled electrical transformers (above 10 kVA); shaft and pipe tunnels; spaces for pumps and refrigerating machinery (not handling or using flammable liquids); closed trunks serving the spaces listed above; other closed trunks, such as pipe and cable trunks.

(11) Auxiliary machinery spaces, cargo spaces, special category spaces, cargo and other oil tanks and other similar spaces of moderate fire risk

Cargo oil tanks;

Cargo holds, trunkways and hatchways;

Refrigerated chambers;

Oil fuel tanks (where installed in separate space with no machinery);

Shaft and pipe tunnels allowing storage of combustibles;

Auxiliary machinery spaces as in category 10 which contain machinery having a pressure lubrication system or where storage of combustibles is permitted;

Oil fuel filling stations;

Spaces containing oil-filled transformers (over 10 kVA);

Spaces containing turbine and reciprocating steam engine driven auxiliary generators and small internal combustion engines of power output up to 110 kW driving emergency generators, sprinkler, drencher or fire pumps, bilge pumps, etc.

Closed trunks serving the spaces listed above.

(12) Machinery spaces and main galleys

Main propulsion machinery rooms (other than electric propulsion motor rooms) and boiler rooms;

Auxiliary machinery spaces other than those in categories 10 and 11 which contain internal combustion machinery or other oil-burning, heating or pumping units;

Main galleys and annexes;

Trunks and casings to the spaces listed above.

(13) Storerooms, workshops, pantries, etc.

Main pantries not annexed to galleys;

Main laundry;

Large drying rooms (with a deck area of more than 4 square meters);

Miscellaneous stores;

Mail and baggage rooms;

Garbage rooms;

Workshops (not part of machinery spaces, galleys, etc.).

Storerooms of 4 m^2 and over, in which no combustible liquids are stored.

(14) Other spaces, in which flammable liquids are stored

Lamp rooms;

Paint rooms;

Storerooms containing flammable liquids (including dyes, medicines, etc.);

Laboratories (in which flammable liquids are stowed).

Cargo ships
Fire bulkheads

Rooms/spaces		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations	(1)	A-0[c]	A-0	A-60	A-0	A-15	A-60	A-15	A-60	A-60	★	A-60
Corridors	(2)		C	B-0	B-0 A-0[c]	B-0	A-60	A-0	A-0	A-0	★	A-30
Accommodation spaces	(3)			C[a,b]	B-0 A-0[c]	B-0	A-60	A-0	A-0	A-0	★	A-30
Stairways	(4)				B-0 A-0[c]	B-0 A-0[c]	A-60	A-0	A-0	A-0	★	A-30
Service rooms (low risk)	(5)					C	A-60	A-0	A-0	A-0	★	A-0
Machinery spaces of category A	(6)						★	A-0	A-0[g]	A-60	★	A-60
Other machinery spaces	(7)							A-0[d]	A-0	A-0	★	A-0
Cargo spaces	(8)									A-0	★	A-0
Service spaces (high risk)	(9)									A-0[d]	★	A-30
Open decks	(10)										-	A-0
Ro-Ro cargo spaces	(11)											★[h]

Notes :

a No special requirements are imposed upon bulkheads in methods II C and III C.

b In case of Method III C "B" class bulkheads of "B-O" rating shall be provided between spaces or groups of spaces of 50 m^2 and over in area.

c For clarification as to which applies, see regulations 9.2.3.2 and 9.2.3.4.

d Where spaces are of the same numerical category and superscript d appears, a bulkhead or deck of the rating shown in the tables is only required when the adjacent spaces are for a different purposes, e.g. in category (9). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.

e Bulkheads separating the wheelhouse, chart room and radio room from each other may be "B-0" rating.

f "A-O" rating may be used if no dangerous goods are intended to be carried or if such goods are stowed not less than 3 m horizontally from such bulkhead.

g For cargo spaces in which dangerous goods are intended to be carried, regulation 54.2.8 applies.

h Bulkheads and decks separating ro-ro cargo spaces shall be capable of being closed reasonably gastight and such divisions shall have "A" class integrity in so far as is reasonable and practicable in the opinion of the Administration.

★ Where an asterisk appears in the tables, the division is required to be of steel or other equivalent material but is not required to be of "A" class standard.

For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories 1 to 11 below. The number in parentheses preceding each category refers to the 'applicable column or row in the tables.

(1) Control stations

Spaces containing emergency sources of power and lighting; wheelhouse and chart room; spaces containing the ship's radio equipment fire extinguishing rooms, fire control rooms and fire-recording stations; control room for propulsion machinery when located outside the machinery space; spaces containing centralized fire-alarm equipment.

(2) Corridors

Corridors and lobbies.

(3) Accommodation spaces

Spaces as defined in 3, excluding corridors.

(4) Stairways

Interior stairways, lifts and escalators (other than those wholly contained within the machinery space), and enclosures thereto.

In this connection, a stairway which is enclosed only at one level shall be regarded as part of the space from which it is not separated by a fire door.

(5) Service spaces (low risk)

Lockers and store-rooms not having provisions for the storage of flammable liquids and having areas less than 4 m^2 and drying rooms and laundries.

(6) Machinery spaces of category A

Spaces as defined in 3.

(7) Other machinery spaces

Spaces as defined in 3, excluding machinery spaces of category A.

(8) Cargo spaces

All spaces used for cargo (including cargo oil tanks) and the trunkways and hatchways to such spaces.

(9) Service spaces (high risk)

Galleys, pantries containing cooking appliances, paint and lamp rooms, lockers and store-rooms having areas of 4 m^2 or more, spaces for the storage of flammable liquids, and workshops other than those forming part of the machinery spaces.

(10) Open decks

Open deck spaces and enclosed promenades having no fire risk. Air spaces (the space outside superstructures and deckhouses).

(11) Ro-ro cargo spaces

Cargo spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion.

Tankers
Fire bulkheads

Rooms/spaces		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control stations	(1)	A-0[c]	A-0	A-60	A-0	A-15	A-60	A-15	A-60	A-60	★
Corridors	(2)		C	B-0	B-0 A-0[a]	B-0	A-60	A-0	A-60	A-0	★
Accommodation spaces	(3)			C	B-0 A-0[a]	B-0	A-60	A-0	A-60	A-0	★
Stairways	(4)				B-0 A-0[a]	B-0 A-0[a]	A-60	A-0	A-60	A-0	★
Service rooms (low risk)	(5)					C	A-60	A-0	A-60	A-0	★
Machinery spaces of category A	(6)						★	A-0	A-0[d]	A-60	★
Other machinery spaces	(7)							A-0[b]	A-0	A-0	★
Cargo pump-rooms	(8)								★	A-60	★
Service spaces (high risk)	(9)									A-0[b]	★
Open decks	(10)										-

Notes :

a Which value applies is to be determined by reference to the SOLAS 1974.

b Where spaces are of the same numerical category and superscript b appears, a bulkhead or deck of the rating shown in the table is only required when the adjacent spaces are for a different purposes, e.g. in category (9). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.

c Bulkheads separating the wheelhouse, chart room and radio room from each other may be "B-0" rating.

d Bulkheads and decks between cargo pump-rooms and machinery spaces of category A may be penetrated by cargo pump shaft glands and similar glanded penetrations, provided that gastight seals with efficient lubrication or other means of ensuring the permanence of the gas seal are fitted in way of the bulkhead or deck.

★ Where an asterisk appears in the table, the division is required to be of steel or other equivalent material but is not required to be of "A" class standard.

For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories 1 to 10 below.

The number in parentheses preceding each category refers to the applicable column or row in the tables.

(1) Control stations

Spaces containing emergency sources of power and lighting; wheelhouse and chart room; spaces containing the ship's radio equipment; fire-extinguishing rooms, fire control rooms and fire-recording stations; control room for propulsion machinery when located outside the machinery space; spaces containing centralized fire-alarm equipment.

(2) Corridors

Corridors and lobbies.

(3) Accommodation spaces

Spaces as defined in Regulation 3, excluding corridors.

(4) Stairways

Interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto.

In this connection, a stairway which is enclosed only at one level shall be regarded as part of the space from which it is not separated by a fire door

(5) Service spaces (low risk)

Lockers and store-rooms having provisions for the storage of flammable liquids and having areas of less than 4 m^2 and drying rooms and laundries.

(6) Machinery spaces of category A

Spaces as defined in Regulation 3

(7) Other machinery spaces

Spaces as defined in Regulation 3, excluding machinery spaces of category A.

(8) Cargo pump-rooms

Spaces containing cargo pumps and entrances and trunks to such spaces.

(9) Service spaces (high risk)

Galleys, pantries containing cooking appliances, paint and lamp rooms, lockers and store-rooms having an area of 4 m^2 or more, spaces for the storage of flammable liquids and workshops other than those forming part of the machinery spaces.

(10) Open decks

Open deck spaces and enclosed promenades having no fire risk. Air spaces (the space outside superstructures and deckhouses).

8.15 Design of explosion-proof mechanical fans

8.15.1 Fan intake and outlet ducts (into the open air) are to be fitted with protective screens with a mesh size not exceeding 13 mm.

8.15.2 Overheating of the mechanical components of fans and the creation of sparks is to be avoided by appropriate design and by the choice of suitable materials. The safety clearance between the fan housing and the impeller must be such as to preclude any contact between the housing and the rotor.

The same applies to portable fans.

8.15.3 The requirements stated in 8.15.2 are considered to be met if the fan design and combination of materials conform to 8.15.4 or 8.15.5.

8.15.4

a) The clearance between the impeller and the housing shall not be less than 1/10 of the impeller bearing diameter, subject to a minimum of 2 mm. This clearance need not, however, be greater than 13 mm.

b) The following materials or combinations of materials may be used:

- Non-metallic materials[2)] for the impeller and/or the housing in way of the impeller, or
- non-ferrous materials for the impeller and the housing, or
- aluminium or magnesium alloys for the impeller and steel (including austenitic steel) for the housing, provided that a non- ferrous ring of adequate size is fitted in .way of the impeller.

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2) Non-metallic materials are to have an electrical resistance not exceeding 10^{8} Ohm, unless special measures are taken for preventing the risk of supercharging on the surface of the material.

8.15.5 Any steel combination (including austenitic steel) may be used for the impeller and the housing, if the clearance is at least 13 mm.

8.15.6 A combination of aluminium or magnesium alloys for the impeller and steel for the housing or of steel for the impeller and aluminium or magnesium alloys for the housing is not allowed, irrespective of the clearance.

8.15.7 Where aggressive vapours occur, this fact is to be taken into account when selecting the materials.

8.15.8 Paints containing light metals are not to be used.

8.15.9 Fan shafts are to run in suitable anti-friction bearings. Plain bearings may only be used in cases where adequate maintenance is assured.

8.15.10 The fan shaft is to be so designed that its critical speed differs by at least 20 % from its operating speed.

8.15.11 The rotor is to be mounted and secured on the shaft in such a way that it cannot be twisted or displaced axially.

8.15.12 Fans must function safely and reliably despite permanent transverse inclinations of up to 15° and temporary heeling angles of up to 25° as well as with longitudinal inclinations of up to 10 for ships up to 150 m long or up to 5° for ships over 150 m in length.

8.15.13 The rotor is to be statically and dynamically balanced.

8.15.14 The rotor must be so designed that the clearance between the rotor and the housing experiences no significant change at rated speed. This requirement is considered to be satisfied if, in trial operation over 24 hours at 1.2 times the rated speed, the clearance is not reduced by more than 10%.

8.15.15 The rotor housing and the protective hood must possess sufficient mechanical strength. This requirement is considered to be satisfied if an impact test on the weakest components in accordance with DIN EN 50 014 (test weight 1 kg, dropping height 0,7 m, hemispherical striker made of hardened steel with a diameter of 25 mm) produces a dent small enough to avert contact with the rotor.

8.15.16 The fan must be electrically bonded to the hull.

The electrical leakage resistance of all metal parts of the fan and of the connected ducts must not exceed 10^6 Ohm.

8.15.17 Electrostatically conductive belts are to be used for belt drives.

8.15.18 Where the electric motors are to be located outside the air stream (air duct), this point is mentioned in the relevant sections.

8.15.19 The types of explosion-proof enclosure shall be as specified in the relevant sections,

8.15.20 Sufficient spare parts are to be carried on board for every fan.

9. Temperature, humidity and air flow measurements

9.1 Performance of measurements

Measurements are subject to special agreement which must cover their nature and extent.

If the agreed accuracy of measurement cannot be achieved at reasonable cost, the client is to be notified of this before the measurement is performed.

9.2 Temperature measurement

9.2.1 Measuring equipment and procedure

Of the recommended mechanical and electrical contact thermometers, the mercury thermometer, the thermocouple and the resistance thermometer are particularly suitable.

A disadvantage of the glass thermometer is that, because of its relatively large mass and low coefficient of heat transmission (air against solid body), it needs to be installed at least 15 minutes prior to measurement to assume the temperature of its surroundings.

Thermocouples, on the other hand, react with virtually no inertia at all, due to their small mass at the hot soldered connection. Further advantages are that they can be fitted easily and offer practically no flow resistance.

Both thermocouples and resistance thermometers are subject to aging and therefore need to be recalibrated at intervals.

In work locations, the agreed point for measuring the air temperature should be at head height wherever possible. In spaces where considerable radiant heat is likely, e.g. in engine rooms, measurements are also to be performed close to vertical and horizontal partitions.

9.3 Air humidity measurement

9.3.1 The measurements are to be performed in the same places as air temperature measurements.

Instructions concerning measurement :

Atmospheric humidity is determined by the relative humidity φ in % and the air

pressure, or by the moisture content x expressed in g/kg dry air .

9.3.2 Relative humidity can be determined in various ways:

- directly, using a hygrometer,
- more accurately, using a psychrometer and measuring the dry and wet bulb temperature.

Where a psychrometer is used, Sprung's equation is applied to ascertain the relative humidity from the dry and web bulb temperatures and the barometer reading taken at the same time. As an approximation, it can also be determined by reference to an h-x diagram.

Agreement is to be reached concerning the points' of measurement in the accommodation area. As experience shows that the water vapour partial pressure is evenly distributed throughout the space, it is sufficient to designate one or two locations not directly affected by the air supply.

According to DIN 1946, Part 2, a tolerance of ± 5 % on the specified value is permitted.

9.4 Air flow measurement

9.4.1 For measurement of the air changes, all openings except those directly assigned to the ventilation system are to be closed. Openings to be closed include hatches, companionways, bulkhead doors, etc.

9.4.2 The measurement is to be performed in the air duct using Prantl's pilot tube or at air intakes/outlets, using vane or shutter-type anemometers.

The correction values given in the instructions on the use of the instruments are to be taken into account when evaluating the measurements. The most recent calibration of the instruments shall not have taken place more than 2 years previously.

9.4.3 Measurement in the air duct is to be preferred wherever possible because of its simplicity and accuracy. For this operation, the cross-section of the duct should be divided into a sufficient number of compartments to enable the mean velocity in the duct to be calculated from the velocities measured in the individual compartments (reticular measurement).

The reticular measurements are evaluated by a simple arithmetic process to determine the mean value.

The designation of the measuring points depends amongst other things on the structure of the flow profile. A sufficient length of duct to overcome any air turbulence must, however, be provided. The entry distance (upstream of the

measuring point) must be at least 5 D, and the exit distance (downstream of the measuring point) must be at least 2 D. Where measurements are performed downstream of bends, shut off or regulating valves, a length of duct equivalent to 40 D is required. A measuring distance of 5 D is sufficient only where baffles are used to establish a stable flow profile. In this context, D refers to the diameter or to the equivalent diameter in the case of rectangular ducts

$$Dg = \frac{2\ a\ b}{a + b}$$

If measurement in the duct is not possible owing to the unfavorable configuration of the length available, the measurement must be performed at the air intakes/outlets. Because of the spreading and/or deflection of the jet at air inlets, it is necessary, when measuring, to determine the direction of the air flow (using a length of thread or similar means).

9.5 A report on the measurements is to be prepared and attached to the certificate. The capacities of holds are to be determined from the ship's documents or from relevant drawings. The outside air temperature is to be measured and noted in the certificate as an indication of the air density and fan performance during the measurement.

Section 2

Regulations for particular ship spaces and installations

1. Reference values for air changes

1.1 The following table contains air change reference values for the design of ventilating systems.

1.2 These reference values, like all other data relating to air changes in these Regulations, refer to the empty space.

1.3 The reference values for air changes are not applicable to air-conditioning systems [1)]

Ventilated space	Air changes/h Supply air	Air changes/h Exhaust air	See text :	Remarks
Living and sleeping quarters	15		2	
Messes, saloons, officers	15	20		
Passageways		5		
Hospitals	12	12	3	
Galleys	20-40	40-60	4	
Pantries	15	30		
Sanitary rooms		10-15	2	
Laundries	10-20	15-30		
Drying rooms	25	30		
Control stations			5	
Wheelhouse			5.3	
Radio room			5.3 + 16.1	acc. to local heat
Paint and lamp rooms	10		6	
Dry cargo holds	in accordance with owners' instruction	in accordance with owners' instruction	7	
Cargo holds for air-cooled containers			7.14	
Cargo holds for coal	formula	formula	7.11	
Cargo holds for livestock	20		7.12	if possible reversible
Dangerous goods		6/2	7.13	
Motor vehicle holds		10/6	8.6	
Ro-Ro motor vehicle holds			8.7	
Engine room			9	acc. to local heat
Turbine room			9	acc. to local heat
Boiler room			9	acc. to local heat
Power source for emergency fire pump	10-15		9.15	
Cable ducts			9.17	
Electrical machines			10	
CO_2 cylinder room		15	11	lower-deck only
Refrigerating machine rooms	30		12.3	Group 1 refrigerant
Refrigerating machine rooms	≥40 and formula	≥40 and formula	12.4	Group 2 refrigerant
Battery rooms	formula	formula	13	
Separator rooms		30	14.1	
Shaft tunnels			14.2	
Emergency generator rooms			14.3	acc. to local heat
Rooms for power electronics			15	
Gyroscopic compass rooms			16	
Rooms for dry provisions	10-12	10-12	16	
Workshops			16	
Engine control rooms			16	acc. to local heat
Pipe tunnels on dry cargo ships		5	17.1	
Pipe tunnels on tankers			Section 3, 1.11	
Emergency fire extinguishing pump rooms			18	

1) Where an air change figure is given both for supply and exhaust air, it is sufficient for the installation to be designed as an exhaust system provided that a deficit of supply air is assured.

Ventilated space	Air changes/h Supply air	Air changes/h Exhaust air	See Text :	Remarks
Oil Tankers				
Spaces in cargo area normally entered during cargo handling operations		20	see Section 3, 2.4	
Spaces in cargo area not normally entered		8	see Section 3, 2.5	
Gassafe spaces on oil recovery vessels and ships suitable for operation in oil-covered waters			see Section 3, 2.6	Over pressure
Liquefied Gas Tankers				
Cargo control room in gas safe area	8		see Section 3, 3.8.1.3	
Gas locks			see Section 3, 3.4.2	Over pressure
Spaces in cargo area entered during cargo handling operations	30	30	see Section 3.8	Whether incoming or exhaust air : see 3.8.1.5 and 3.8.1.6
Spaces in cargo area not normally entered		8	see Section 3, 3.9.6	
Chemical Tanker				
Spaces in cargo area entered during cargo handling operation		30 20	see Section 3, 4.3 see Section 3, 4.4	More air changes for certain cargo
Spaces in cargo area not normally entered		8/16	see Section 3, 4.5.5	For portable fans without ducting
Spaces housing incinerating furnace on chemicals incineration ships	45		see Section 3, 4.6.5.3	Over pressure in relation to furnace incinerating chamber
Spaces housing incinerator blowers on chemicals incineration ships	20		see Section 3, 4.6.6.3	Over pressure in relation to furnace incinerating chamber

2. Accommodation spaces

2.1 Accommodation spaces must be assured of sufficient air renewal under all the conditions of weather and climate proper to the proposed range of service.

2.2 Ventilating systems are to be capable of effecting the changes of air specified in 1.1.

2.3 Ships navigating in the tropics or similar regions are to be equipped with mechanical ventilation or an air-conditioning system. The tropics are the area lying between the Tropic of Cancer and the Tropic of Capricorn. Areas with similar climatic conditions include the following:

The Gulf of California,

the Gulf of Mexico and the waters round Florida,

the Red Sea,

the Persian Gulf and the northern Arabian Sea

the East China Sea to the south of the islands of Japan,

the northern Pacific to latitude 30^0 north.

2.4 Living and sleeping quarters, messes, pantries, other accommodation spaces, hospitals and offices must be directly connected to an air-conditioning system installed on the ship or must be provided with air-conditioning equipment.

2.5 Storerooms and sanitary rooms must at least have their air renewed from the air-conditioned rooms, and such air renewal may be effected via passageways situated in the air-conditioned area.

2.6 Air conditioning systems

2.6.1 The following conditions apply :

Every endeavor is to be made to attain the values given in the following Table in all rooms with direct air-conditioning except for pantries and dry provisions rooms.

Outside Air temperature	Room air temperature	Relative humidity inside room
below + 25° C	+ 22 ° C	35 % to 70 %
+ 25° C	+ 22 ° C	35 % to 70 %
+ 28° C	+ 23 ° C	35 % to 65 % 1)
+ 30° C	+ 23,5 ° C	35 % to 65 % 1)
+ 32° C	+ 24 ° C	35 % to 65 % 1)
+ 35° C	+ 25 ° C	35 % to 60 % 1)
+ 40° C	+ 26,5 ° C	35 % to 55 % 1)
+ 45° C	+ 28 ° C	35 % to 50 %
above + 45° C	+ 30 ° C	35 % to 40 %
1) Values conform to DIN 1946 - sheet 3		

2.6.2 On board other ships hydrazine filters are regarded as adequate protection against cancerogenous substances. The regulations of the respective flag states concerning dangerous substances are to be observed.

2.6.3 The total air supply to air-conditioned rooms shall contain not less than 50 % fresh air.

2.6.4 The minimum volume of air for air-conditioned rooms is determined by the higher of the following values:

a) the volume needed to comply with 2.6.1 a)

b) the volume needed to comply with 2.6.1 b)

c) 30 m^3/h for each intended occupant of the room.

d) The number of hourly air changes in messes and recreation rooms shall be at least 8 and in all other rooms at least 6.

2.7 Cabins with an atmosphere shared with their own sanitary facilities must be supplied with approximately 10% more incoming air that is extracted from the sanitary space.

2.8 When cooling, the temperature of the supply air shall not be more than 10° C below the mean room temperature.

2.9 The temperature variation within a room should not be greater than 2° C.

2.10 Air-conditioning systems are to encompass a number of control areas in which the temperature can be indecently regulated. The minimum quantity of air per hour and person is to be observed.

2.11 The air-conditioning system must be equipped with its own refrigerating unit.

2.12.1 The velocity and direction of the air flow are to be chosen so as to prevent troublesome draughts. Air outlets shall not be located at the .head end of bunks.

2.12.2 Air movements in the accommodation area should not exceed 0,2 to 0,3 m/s. The accommodation area means the area in which persons are normally seated or lying down.

2.12.3 The air velocity through exhaust gratings may not exceed 5 m/s.

2.13 Air intake apertures are to be sited in such a way that no harmful or noxious foreign substances are sucked into the accommodation spaces.

2.14 Sufficient means must be provided to ensure the emergency ventilation of accommodation spaces in the event of a failure affecting the drive of a mechanical ventilating or air-conditioning system (e.g. by opening windows).

2.15 The exhaust air from pantries and sanitary rooms is generally to be directly and independently conducted to the outside atmosphere.

2.16 Air equalization apertures in doors are to be placed in the bottom third of the door. On the escape side, they must be provided with means of closure made of incombustible material [2)]

The clear cross-section of the opening may not exceed 0,05 m^2.

2.17 The same also applies to air equalization ducts between cabin and passageway. Here, the closing shutter must be operable from the escape side.

2.18 Doors in Type A partitions may not have any openings.

2.19 The balance of incoming and exhaust air should be equalized by decks.

2.20 Wherever necessary, hot air, fumes or humidity are to be extracted immediately at their point of origin within the space.

2.21 It is recommended with major ventilating systems, including those on board cargo ships, to separate individual decks and/or individual groups of spares by smoke dampers in the air ducts (see Section 1, 7.3)

3. Hospitals

3.1 The exhaust air of the hospital and its sanitary room is to be directly and independently conducted to the outside atmosphere.

3.2 Hospitals must be provided with an air supply which is either independent of other systems or is at least isolated from the latter by non-return flaps.

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2) As defined in SOLAS 1974

3.3 The exhaust-air rate shall exceed the supply-air rate, if the hospital is not provided with an air balance aperture leading to the free deck.

3.4 If the mechanical exhaust-air system of the hospital is dimensioned so as not to be capable of evacuating 100 % of the supply air of the hospital in the event of failure of its drive, an additional air balance aperture leading to the free deck is to be provided.

3.5 Air equalization apertures are not permitted in sickroom doors leading to passageways.

3.6 The ventilating system for the consulting room and the dispensary is separate from that for the hospital.

4. Galleys

4.1 Galley exhaust ventilation must be separate from the ventilation system for other spaces.

4.2 Supply ventilation should preferably be independent of the ventilation system for other spaces.

If supply ventilators for other accommodations or service spaces (e.g. the air-conditioning system) simultaneously supply the galley, the ducts/pipes are to be separately conducted to the galley from the ventilator/air conditioner.

In that case either at the galley wall or inside the ventilator room always an (automatically or manually operated) fire damper is to be provided (see Section 1, 7.2 or Section 1, 7.3).

4.3 For the galley ventilation Section 1, 8.10.1 and Section 1, 8.11.1 are to be observed.

4.4 Each exhaust duct from a canopy is to be equipped with :

a) a grease trap which can easily be removed for cleaning;

b) a fire damper located in the lower end of the duct;

c) devices for switching off the exhaust fan, which can be operated from the galley;

d) permanently installed devices for extinguishing a fire inside the duct.

4.5 The necessary air changes are specified in 1.1 and 2.6.4 respectively.

5. Control stations

5.1 For control stations located outside engine rooms, all practically feasible measures are to be taken to ensure satisfactory ventilation, visibility and freedom from smoke so that, in the event of fire, the machines and equipment in these rooms can be supervised and continue to be operated effectively. Two supply ventilators are to be

provided which shall be mutually independent and capable of being operated optionally. Their intake openings shall be sited in such a way as to minimize the danger of smoke penetrating simultaneously into both openings. Biro Klasifikasi Indonesia may waive the application of these Rules in the case of control stations situated on, and opening on to, an open deck or in circumstances where means of closure provided locally would have the same effect.

Deviations are likewise admissible for "unattended" control stations.

Instead of the two ventilators, a combination of a reversible mechanical ventilator and natural ventilation is also possible.

5.2 Paras. Section 1, 8.10.1 and Section 1, 8.11.1 are to be complied with.

5.3 For raisable wheelhouses, in general, mechanical ventilation is not stipulated.

6. Paint lockers and lamp rooms

6.1 Paint lockers and lamp rooms must have a ventilation system capable of effecting at least 10 changes of air per hour. It may not be connected to the ventilation systems serving other rooms.

The ducts are to be arranged such that both vapours lighter than air and vapours heavier than air are removed.

Where CO_2 is used for fire extinguishing within these spaces, a mechanical exhaust ventilation is to be provided.

6.2 The drives of mechanical ventilators are to be installed outside the rooms or are to be of explosion-proof type.

6.3 For electrically driven axial fans, use is to be made of motors having at least explosion group II B and temperature class T 3.

6.4 The ventilator design must conform to Section 1, 8.15.

6.5 The cables of ventilator motors exposed to the exhaust air flow have to be arranged such as to be mechanically protected, e.g. in tubes leading up to the terminal box.

7. Cargo holds

7.1 Where the nature of the cargo so requires, every cargo hold must be capable of being ventilated.

7.2 Cargo hold ventilating systems shall not be connected to other rooms/spaces.

7.3 The drives of mechanical cargo hold ventilators are to be installed outside the holds. (Axial fans are, however, permitted.)

7.4 For the types of protection to be applied to ventilating systems and the associated electrical equipment, see the Rules for Electrical Installations, Volume IV , Section 1, K.1.

7.5 Air ducts are to be so installed that they are largely protected from damage.

7.6 Penetrations for ducts through watertight bulkheads are subject to special approval by Biro Klasifikasi Indonesia.

Ventilation openings in such ducts are permitted only on one side of the bulkhead.

The watertight air duct must have the same mechanical strength as the surrounding bulkhead at the same height.

7.7 Air ducts may only be located forward of the collision bulkhead if they constitute, or may be regarded as, recesses in the bulkhead structure. No part of the ducts may be located within the area extending to 0,05 **L** aft of the forward perpendicular.

7.8 A common air trunk for two cargo holds is to be divided by a watertight partition extending upwards to the stipulated coaming height specified in Section 1, 5.

The installation of a common fire damper shall not establish a connection between the two holds.

7.9 Where parts of a cargo hold have to be kept separate from each other for reasons of freeboard or fire protection (e.g. separate flooding with CO2), 7.8 applies in analogous manner.

7.10 Portions of cargo hold air ducts routed through the accommodation area must be gastight.

7.11 Coal cargo

7.11.1 Where coal cargo is carried, the free cross-section of all the ventilators serving a cargo hold must, as a minimum requirement, conform to the following formula:

$$F = 10 \times \ell \times b \qquad (cm^2)$$

where: ℓ = length of hold (m)
b = breadth of hold (m)

7.11.2 At least one ventilator is required at each end of the hold. Holds over 25 m long must have three ventilators, and holds over 15 m wide must have four ventilators.

7.11.3 The means of ventilating the surface of the coal cargo must be specially effective. However, direct introduction of air into the coal has to be avoided; see. "Code of Safe Practice for Solid Bulk Cargoes".

7 .11.4 Natural supply ventilators are to be sited aft, natural exhaust ventilators forward.

7.11.5 Where gas-emitting coal cargo is carried, the motors of electrically driven axial fans are to have explosion-proof enclosure corresponding at least to explosion group II A and temperature class T3.

7.12 Holds for the transport of livestock

7.12.1 Holds for the transport of livestock must be provided with mechanical ventilating systems capable of effecting at least 20 changes of air per hour.

7.12.2 Some of the air ducts must extend downwards to a distance of about 0,30 m from the cargo deck.

7.13 Dangerous goods

7.13.1 For cargo holds suitable for the transport of dangerous goods separate mechanical exhaust ventilation is to be provided.

7.13.2 2/3 of the quantity of air are to be exhausted in the lower and 1/3 in the upper part of the hold.

7.13.3 6 changes of air per hour must be assured.

7.13.4 On container ships carrying closed freight and tank containers ventilation may be reduced to two air changes per hour. (see SOLAS 1974, Chapter II-2, Reg. 19)

Where transport is restricted exclusively to closed freight containers with goods of classes 4 and 5.1, natural ventilation is sufficient.

7.13.5 For dangerous solid goods carried in bulk natural ventilation is sufficient except where mechanical ventilation is prescribed in the Code of Safe Practice for Solid Bulk Cargoes.

The use of portable fans is subject to the consent of Biro Klasifikasi Indonesia.

7.13.6 If it is intended to carry packaged dangerous goods of class[3)], combustible gases of class 2 or goods of classes 3, 6.1 and 8 with flash points below 23° C, additionally the requirements mentioned in 7.13.8 -7.13.11 are to be observed.

7.13.7 Air outlets must be located at a safe distance of possible ignition sources. It is recommended to observe a spherical radius of 3 m.

7.13.8 The exhaust openings on deck are to be provided with permanently installed protective screens with mesh sizes not exceeding 13 mm.

7.13.9 The motors of electrically driven axial fans are to have explosion-proof enclosure appropriate to the characteristics of the cargo but corresponding at least to

3) except for sub-class 1.4, compatibility group S.

II B type protection and temperature class T 4.[4)]

7.13.10 The ventilator design must comply with Section 1, 8.15.

7.13.11 For the transport of dangerous solid goods in bulk motors of electrically driven axial ventilators of explosion-protected design appropriate to the characteristics of the cargo are to be employed. In detail, the requirements are to be agreed with BKI.

7.14 Cargo holds tor refrigerated cargo containers

If a cargo hold is intended to exclusively carry refrigerated cargo containers with sets of air-cooled refrigerating machines, an adequate quantity of air is to be provided for compensating the condensation heat with maximum condenser output at a cargo hold temperature of 45° C. Proof of the quantity of air thus required and of the simultaneity factor is to be furnished to BKI by relevant computations.

8. Holds for the transport of motor vehicles with fuel in their tanks and holds of Ro-Ro Ships

8.1.1 Mechanical ventilation is to be provided (where possible, exhaust air).

8.1.2 The supply air may be conducted into the holds without mechanical means and generally from the top.

8.2 The ventilation systems must be independent of other installations.

8.3 The mechanical ventilators must be capable of being controlled from a position outside the ventilated hold.

8.4.1 Failure to achieve the necessary air change rate must be signalled in the wheelhouse. This function can be performed by running lights.

8.4.2 If inlets capable of being closed watertight are fitted, a limit switch has to switch off the ventilator motor, with the inlet being in closed condition.

8.5.1 The ventilating system must prevent dangerous accumulations or layers of gas forming in the holds and must ensure effective and thorough ventilation even in heavy weather.

8.5.2 In general, the exhaust trunks are to be arranged such as to reach down to the lowermost point of cargo holds.

8.5.3 2/3 of the volume of air are to be exhausted in the lower portion, 1/3 in the upper portion of the hold.

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4) For goods of class 1. except for 1.4 S. at least explosion group II A. temperature class T 5. For goods of classes 2. 3. 6.1 and 8 it will have to be checked from case to case whether the explosion protection provided meets the respective explosion group and temperature class requirements.

8.5.4 The ventilation openings must not be covered by any structural elements of the ship or by cargo.

8.5.5 The air flow rate in the gratings should not exceed 10 m/s.

8.6.1 On board passenger vessels carrying more than 36 passengers the cargo holds are to be provided with a forced ventilation system designed for at least 10 changes of air per hour.

8.6.2 On board passenger vessels carrying not more than 36 passengers the cargo holds are to be provided with a forced ventilation system designed for at least 6 changes of air per hour.

8.6.3 On board passenger vessels special-category spaces are to be provided with a forced ventilation system designed for 10 changes of air per hour.

8.6.4 On board cargo vessels and ro-ro ships the cargo holds are to be provided with a forced ventilation system designed for at least 6 and/or 10 changes of air per hour, depending on the envisaged design of the electrical installation, see Rules for Electrical Installations, Volume IV, Section 16.

8.7 During loading and unloading periods an hourly air change rate greater than that specified in 8.6 is to be maintained.

8.8 The portions of air ducts for other rooms which are routed through the hold are to be gastight.

8.9 Tween-deck penetrations must have a coaming height of 380 mm.

8.10 Fire dampers must be capable of being closed quickly and efficiently under all sea conditions and in all weathers.

8.11 Air ducts are to be made of steel.

8.12 When installing electrical drives and equipment for ventilating systems, attention is to be paid to the protection zone 0.45 m above each enclosed deck on which motor vehicles are carried. In unfavorable circumstances, an accumulation of combustible or explosive gases and/or vapors is liable to occur in this zone.

If operational considerations render it necessary to install electrical equipment for ventilating systems within the protection zone, such equipment must have explosion-proof enclosure.

For details see the Rules for Electrical Installations, Volume IV, Section 16.

8.13 Electrical drives and equipment (e.g. fan motors) located in the exhaust airstream must have explosion-proof enclosure and conform, as a minimum requirement, to explosion group II A and temperature class T 3.

8.14 Air outlets must be located at a safe distance from possible sources of ignition.

These sources of ignition include the ventilator openings of rooms containing electrical equipment without explosion-proof enclosure.

8.15 The design of ventilators must conform to Section 1, 8.15.

8.16 The provisions stated in 8 also apply to other vehicles presenting a similar hazard.

9. Main and auxiliary engine rooms and boiler rooms

9.1 Mechanical ventilation is to be provided which is sufficient to ensure the reliable operation of the plant under all operating conditions and in all weathers (see Section 1, 6.6).

The required total amount of air is to be supplied to these spaces via openings which do not need watertight closures according to Reg, 19(3) or the LLC 1966.

9.2 The ventilating system of engine and boiler rooms may not be connected to the ventilating systems of other ship's rooms/spaces.

9.3 The air is to be conducted in such a way as to avoid local accumulations of heat wherever possible (e.g. by means of a secondary system of selective ventilation or by under-floor ducting or exhaust air).

9.4 The stream of supply air shall not be directed immediately towards hot machine parts, turbine components, measuring instruments or switchboards. Electrical machinery and installations (switch cabinets, etc.) are to be protected such that water particles having penetrated into the air ducts will not cause disturbances. Risks of this kind are to be minimized by appropriate duct and air outlet arrangement.

9.5 In the vicinity of switchgear and essential electrical machinery (generators, electrical propulsion units), air ducts are to be routed in such a way that possible leakages cannot jeopardize the electrical equipment.

9.6 The ventilating system is to be so installed that no gases can accumulate even below deck between the deck beams.

9.7 The ventilating system must be sufficient to prevent the accumulation of oil vapours under normal operating conditions.

9.8 Engine room ventilator openings in the vicinity of the navigating bridge are to be designed to avoid as far as possible any adverse effects on the operation of the ship due to suction and mechanical noise.

9.9 The number of engine room ventilator openings shall be kept to a minimum.

9.10 Mechanical engine room ventilators are to be provided with two switching point, one of which must be located at a central point outside the engine room.

The switching point outside the engine room must be electrically separated from the switching points of other ventilators.

9.11 The power supply to the engine room ventilators must be designed to prevent a total loss of engine room ventilation when non-essential consumers are disconnected due to overloading of the generator.

9.12 The exhaust air of air-cooled motors shall not cause any inadmissible permanent temperature rise in the spaces in which they are installed. If necessary, special exhaust ducts are to be fitted.

9.13 Where individual engine rooms have separate arrangements for flooding with CO_2, the ventilating system must also be separate.

9.14 It is to be ensured by an appropriate ventilating system that following flooding of the engine room with CO_2 the operating room has definitely been freed from gas.

9.15 In engine and boiler rooms, the air flow is to be calculated by reference to the heat dissipated by all the equipment installed in the space.

For determination of the volume of air, DIN ISO 8861 defines the design criteria and computation methods to be applied for ventilation of engine rooms aboard seagoing merchant vessels propelled by diesel engines.

The mean air temperature in the room shall not exceed the outside temperature by more than 15^0 C (see 9.19).

9.16 All air balance openings (such as skylights, funnel openings, etc.) must be provided with means of closure from outside.

9.17 Control points for funnel flaps and fire dampers are to be provided on deck outside the engine rooms. These points must continue to be accessible in the event of a fire in the ventilated space.

9.18 The ventilating system serving the space containing the power source for the emergency fire pump must be sufficient to keep this space free from smoke in the event of a fire in the engine room (see 18).

10 to 15 changes of air per hour should be attained.

9.19 Electrical installations, equipment and cables are generally designed for an ambient temperature of 45^0 C. Care is to be taken to ensure that, wherever possible, this temperature is not exceeded in any part of the engine room (see 9.15).

9.20 Enclosed cable ducts for power circuits, especially for electrical propeller drives, are to be provided with selective mechanical ventilation.

9.21 Switchboards, current converters, switch gear cabinets, etc. are to be ventilated from the bottom upwards.

10. Electrical machines

10.1 Cooling air taken from the engine room for electrical machines with forced ventilation shall, as far as possible, be free from oil vapour, dust and liquid particles.

10.2 Exhaust air expelled into the engine room shall not short-circuit the air flow, thereby causing these machines to overheat.

10.3 The air supply and exhaust system must ensure satisfactory operation even in heavy weather

10.4 Where, in enclosed ventilated machines, filters are mounted in the forced ventilation circuit of electrical machines, temperature detectors are to be fitted which trip an alarm in the event of an excessive rise in the winding temperature.

10.5 Where electrical machines are provided with forced-draught ventilation (supplied by their own mechanical fans), the failure of the latter shall trip an alarm.

Where machines are fitted with air ducts leading to the upper deck, the motors driving these fans must be provided with an emergency disconnecting switch outside the engine room.

10.6 If air is supplied directly from the upper deck to switchboards or important electrical machines (e.g. electrical propulsion units), moisture traps are to be fitted in order, as far as possible, to remove the liquid particles entrained in the air .

10.7 Where ducts have, unavoidably, to be routed over electrical equipment items, they are to be fitted with drip pans with means of drainage.

11. CO_2 Rooms

11.1 Rooms for CO_2 bottles must be adequately ventilated.

11.2 CO_2 bottle rooms located below the exposed deck are to be provided with mechanical ventilation capable of effecting 15 changes of air per hour (i.e., where the CO_2 cannot escape into the open air through existing apertures).

11.3 No other rooms/spaces may be connected to this exhaust ventilation.

11.4 Air ducts routed through the accommodation area must be gastight.

11.5 The exhaust air may only be expelled into the open atmosphere.

12. Refrigerating machinery rooms

12.1 Refrigerating machinery rooms must be equipped with an effective and suitably arranged ventilation system.

In the case of refrigerants, the gases of which are heavier than air (group 1), the exhaust -air openings are to be arranged directly above the floor of the room; in the

case of refrigerants, the gases of which are lighter than air (groups 2 and 3), they are to be arranged at the ceilings of the rooms.

12.2 Except for supply ducts, in the case of group 1 refrigerants, there shall be no connection whatever with ventilating systems serving other ship's rooms/spaces.

If group 1 refrigerant are employed, the supply ducts may not be connected to the ventilating systems of accommodation spaces.

12.3 Refrigerating machinery rooms using group 1 refrigerants must be equipped with mechanical ventilation capable of effecting at least 30 changes of air per hour .

If a refrigerant condenser is installed in a room, where other machinery and equipment are arranged (e.g., in engine rooms, ventilator rooms, etc.), the requirement for 30 air changes per hour will be waived, if following a leakage the level of the total refrigerant charge will in the form of superheated steam not exceed 200 mm above the floor (for R 22 with a superheating temperature of + 25° C room temperature and a pressure or 1,03 bar, the specific volume is 0,278 m^3/kg, and for R 12, the specific volume is 0,193 m^3/kg)

12.4 The minimum flow rate of mechanical ventilating systems for refrigerating machine rooms with group 2 refrigerants is to be determined by applying the formula

$$V = 60 \cdot \sqrt[3]{m^2}$$

where:

V (m^3 /h) = flow rate

m (kg) = weight of refrigerant charge in system

The number of hourly air changes shall not, however, be less than 40.

12.5 In the case of ammonia systems where the refrigerating machine room is equipped with an effective water sprinkler system, the minimum flow rate of mechanical ventilating systems in accordance with 12.4 may be reduced by 20 %.

12.6 In machinery rooms, in which non-approved group 3 refrigerants (e.g., hydrocarbons, such as ethane, ethylene) are condensed in cargo reliquefaction plants, the procedure outlined in 12.4 and 12.5 is to be applied.

Special requirements on account of toxicity limits, degree of causticity and explosion limits, are to be agreed with BKI.

12.7 The ventilators required as per 12.4 are to be provided in insulated refrigerating machine rooms as well. However, they are to be switched on only, if these rooms are entered.

12.8 Means must also be provided for switching on and off the mechanical ventilators of refrigerating machinery rooms from outside these rooms. The switches are to be clearly marked .

12.9 The exhaust air trunks of refrigerating machinery room ventilators inside the ship arc to be made gastight. The exhaust air ducting must prevent gas penetrating into other ship's rooms/spaces.

13. Battery rooms

13.1 All battery rooms, cabinets and boxes. must be ventilated in such a way that an accumulation of ignitable gas mixtures is as far as possible avoided.

13.2 The ventilation inlets and outlets are to be so arranged that fresh air flows over the entire storage battery.

13.3 Devices which hinder the free passage of air, e.g. flame arresters and safety screens, shall not to be mounted in the ventilation inlet and outlet ducts of battery rooms.

13.4 Where storage batteries are operated only in parallel or switch over operation with the network, battery rooms, containers and cupboards may be naturally ventilated, provided that the charging power does not exceed

- 3 kW for lead acid storage batteries, or
- 2 kW for nickel cadmium storage batteries

even under boost charging conditions.

If this charging power is exceeded, forced ventilation has to be provided.

13.5 The quantity of air to be removed shall be at least :

$$Q = 0,11.I.n$$

where :

Q quantity of air removed in m^3/h

I the current according to the charger characteristic, but at least 1/4 of the maximum charger current.

n number of battery cells

13.6 If only batteries with sealed cells and internal oxygen consumption are used, the exhaust quantity of air may be reduced to :

$$Q = 0,03.I.n$$

13.7 With natural ventilation, the requirements of 13.5 are fulfilled if the design of the ducts conforms to the following table, assuming an air speed of 0,5 meter/second.

The inclination of air ducts should not exceed 45 ° from vertical.

13.8 Wherever possible, for forced ventilation abstract fans should be used. The fan motors must be either explosion proof and resistant to electrolyte or, preferably, located outside of the endangered area.

13.9 Where storage batteries are charged automatically, with automatic start of the fan at the beginning of the charging, arrangements must be made for the ventilation to continue for at least 1 hour after completion of charging.

Cross sections of ventilation ducts

Charging power P [W]	**Ventilation duct cross section [cm^2]**	
	lead acid batteries	**nickel cadmium batteries**
< 1000	80	120
1000 < 1500	120	180
1500 < 2000	160	240
2000 ≤ 3000	240	forced ventilation
> 3000	forced ventilation	

Section 3

Additional Regulations for Tankers

1. General rules

1.1 For the gas-freeing of tanks, cofferdams, pipe tunnels etc. see the Rules for Machinery Installations, Volume III, Section 15.

1.2 Portable fans (not electrically driven) must be capable of being bonded electrically to the hull before being put into operation.

1.3 Where air ducts are located in areas deemed to be affected if the ship should suffer damage, measures are to be taken to prevent the flooding of other, undamaged compartments.

1.4 The heights of ventilator coamings must extend upwards above the most unfavourable leakage water level.

1.5 Ventilation openings (inlets and outlets to the open deck) leading to accommodation, service and machinery spaces, engine rooms and control stations shall not face the cargo area. They are to be located either in the end bulkhead not facing the cargo area or in the side walls. The distance from the end of the superstructure or house facing the cargo area shall be at least **L/25** subject to a minimum of 3 m. The distance need not exceed 5 m.

The end of the house is deemed to be the end bulkhead on the level concerned.

1.6 1.5 applies analogously in the case of bow or stern cargo handling facilities.

1.7 Main ventilation intake and exhaust openings are to be located above the first deck above the cargo deck.

1.8 Ventilator coamings of rooms below the freeboard deck are to be made especially robust or are to be effectively protected by superstructures or other means.

1.9 Para 2, 3 and 4 contain additional regulations and/or regulations deviating from the general rules as applicable to oil tankers, oil recovery ships, liquefied gas and chemical tankers.

1.10 Cargo and ballast pump rooms in the cargo area

1.10.1 Pump rooms are to be provided with efficient means of ventilation. These systems are not to be connected to the ventilation systems of other spaces in the ship.

1.10.2 Pump rooms are to be ventilated by mechanically driven exhaust fans.

The exhaust duct is to be so installed that its suction opening is close to the bottom of the pump room. An emergency suction opening is to be located about 2 m above the pump room floor. This opening is to be fitted with a means of closing which can also be operated from the main deck.

The emergency opening is to be of sufficient size to enable at least 3/4 of the necessary volume of exhaust air to be exhausted with the bottom opening closed.

1.10.3 Inlet openings of supply ventilators are to be located in a sufficient height above deck and in such a way that re-intake of hazardous gas/air mixtures is avoided.

1.10.4 The supply air openings are to be arranged at the top of the room.

1.11 Pipe tunnels in the cargo area

1.11.1 The rules set out under para 2, 3 or 4 governing spaces which are, or are not, entered during cargo handling are applicable.

1.11.2 Pipe tunnels with openings into the pump room area to be treated as pump rooms.

1.12 Separate inert gas spaces

1.12.1 Inert gas spaces must not be provided with ventilation openings leading to accommodation spaces, service spaces and control stations.

1.12.2 Air inlet openings are to be located in the end bulkhead not facing the cargo area. Alternatively they may be arranged in a side wall. The distance from the front bulkhead shall be **L/25** subject to a minimum of 5 m.

1.12.3 In rooms, in which burner systems are installed, supply ventilating systems are to be provided.

2. Oil tankers (flash points of cargo $\leq$ 60° C)

2.1 Ventilation openings into closed spaces containing sources of ignition are to be located at a horizontal distance of at least 10 m from the cargo tank vent outlets used in cargo handling operations.

2.2 Ventilation openings into enclosed spaces containing sources of ignition are to be located at a horizontal distance of at least 5 m from the cargo tank vent outlets for small quantities of gas (breather valves).

2.3 On bulk carriers/oil tankers, portable or fixed mechanical ventilators are to be provided for cargo holds and the adjacent spaces.

2.4 Spaces in the cargo area required to be entered during normal cargo handling operations.

2.4.1 Cargo pump rooms and other enclosed spaces which contain cargo handling equipment and similar spaces in which cargo handling operations are performed shall be fitted with an independent mechanical ventilation system capable of being controlled from a point outside the spaces concerned.

2.4.2 Provision is to be made to ventilate such spaces prior to entering the compartment and operating the equipment.

A warning notice must be mounted outside the room to the effect that the ventilation system is to be switched on prior to entry.

2.4.3 Mechanical ventilation inlets and outlets shall be arranged to ensure sufficient air movement through the space to avoid the accumulation of flammable or toxic vapours and to ensure a safe working environment, but in no case shall the ventilation system have a capacity of less than 20 changes of air per hour based upon the total volume of the space.

2.4.4 Ventilation systems must be permanently installed.

2.4.5 Cargo pump rooms are to be equipped with mechanical exhaust ventilators. The air supply is to be at the top of the pump room. The exhaust duct is to extend downwards to within a short distance of the pump room floor .

An emergency opening is to be provided approximately 2 m above the floor. The opening is to be fitted with a cover which can also be operated from the main deck.

The size of the emergency opening shall be such that at least 3/4 of the required exhaust air flow can be expelled with the bottom opening closed.

2.4.6 Ventilation exhaust ducts from spaces within the cargo area are to discharge upwards in locations at least 3 m in the horizontal direction from ventilation intakes and openings to accommodation, service and machinery spaces and control stations and other spaces outside the cargo area.

The height of ventilation outlets is not to be less than 3 m above the weatherdeck or 2 m above the fore-and-aft gangway (if any), if fitted within 3 m of the gangway.

2.4.7 Ventilation intake openings are to be arranged above the hazardous area such as to minimize the probability of re-intake of hazardous vapours from any ventilation discharge openings.

They are to be fitted at a minimum horizontal distance of 3 m from air intake openings and (other) openings to accommodation, service and machinery spaces, control stations and other spaces outside the cargo area.

Air intake openings must be arranged at a minimum height of 3 m above the weatherdeck.

2.4.8 Openings in air ducts on deck must be fitted with protective screens of corrosion-resistant metal mesh (see Section1, 8.15.1).

2.4.9 Electrically powered ventilators may be driven only by motors with explosion-proof enclosure corresponding at least to explosion group II B and temperature class T3 (depending on where they are installed).

The motors are to be located outside the air stream and outside such spaces.

2.4.10 For the design and construction of ventilators, see Section 1, 8.15.

2.5 Spaces in the cargo area not normally entered.

2.5.1 Cargo tanks, cargo holds, voids, cofferdams, spaces containing cargo pipelines and other spaces in which gases or cargo can accumulate must be provided with means of ventilation to create a safe atmosphere, should it be necessary to enter these spaces. If these spaces are not provided with a permanent ventilation system, approved portable ventilators are required.

2.5.2 Where ventilators are connected to the cargo piping system for gas-freeing the tanks, measures must be taken, e.g. by removal of parts of the air duct or by the use of spectacle flanges, to ensure that, when the ventilation is switched off, neither cargo nor vapours can penetrate into the ventilators.

This also applies to cargo with flash points exceeding 60^0 C.

2.5.3 Electrically powered ventilators may be driven only by motors with explosion-proof enclosure corresponding at least to explosion group II B and temperature class T 3 (depending on where they are installed).

The motors are to be located outside the air stream and outside such spaces.

2.5.4 For the design and construction of motor-driven fans, see Section1, 8.15.

2.5.5 The ventilation system design shall be compatible with the size of the tanks or spaces. A value of 8 changes of air per hour may be taken as a reference.

2.5.6 In the case of permanently installed ventilation systems, mechanical exhaust ventilators are to be provided, except for spaces of zone 0 (see. 2.6.6), which are required to be supply ventilated.

2.5.7 In the case of permanently installed ventilation systems, it must be possible to extract exhaust air from the lower as well as the upper portion of the space.

2.6 Oil recovery vessels and ships suitable for navigating in oil-covered waters (for oil with a flash point $\leq 60^0$ C)

2.6.1 The ventilation openings (inlets and outlets) leading to non-dangerous areas, such as accommodation, service and machinery spaces, control station rooms and to the bridge, which are used during oil recovery operations and/or not closed gastight are to be located at least 6 m above the waterline and are at any rate to be arranged outside dangerous areas.

2.6.2 Spaces with entrances and openings into hazardous zones in zone 2 which are normally used during oil recovery operations must be mechanically ventilated from outside the hazardous zones.

Provision is to be made for at least 6 changes of air per hour .

If the equipment in these spaces is not provided with zone 2 type protection, ventilation in accordance with 2.6.3 is to be installed.[1]

2.6.3 Spaces with entrances and openings into hazardous zones (see 2.6.6) in zone 1 which are normally used during oil recovery operations must be mechanically ventilated from outside the hazardous zones and must be kept at overpressure. The overpressure in these spaces should be approximately 0,5 -1 mbar and is to be monitored.

2.6.4 Spaces in zones 0 and 1 which are not normally used during oil recovery operations are not to be ventilated from hazardous zones 0 and 1 even if their equipment is provided with the corresponding explosion protection.

Spaces which must be accessible at all times for safety reasons, such as the steering gear compartment for example, are to be equipped with a ventilation system of the extraction type ensuring at least 6 changes of air per hour .

2.6.5 Air locks are to be kept at overpressure, see 3.4.

2.6.6 Hazardous zones

For the purposes of the present Section hazardous zones are zones in which flammable or explosive gases or vapours are liable to accumulate in dangerous concentration.

Hazardous zones are divided into zones 0, 1 and 2 as per IEC 79-10, according to the likelihood of a dangerous explosive atmosphere occurring there.

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1) See Regulations for the Construction of Oil Recovery Ships.

Locations comparable with zone 0:

- Cargo tanks for the storage of oil and the insides of pipelines and vessels belonging to the cargo tank system.

- Spaces extending to a height of 1 m above the oil-covered surface of the water or the deepest load waterline.

Locations comparable with zone 1:

- Cofferdams and other spaces adjoining cargo tanks.

- Cargo pump rooms

- Enclosed or semi-enclosed spaces directly above cargo tanks or with walls in line with cargo tank bulkheads.

- Stowage spaces for cargo hoses and oil recovery equipment (oil skimmers).

- Spaces on the open deck, including semi-enclosed spaces within a spherical radius of 3 m of tank openings and openings to pump rooms or cofferdams (e.g. cargo tank hatches, inspection holes, ventilation openings, access openings).

- The open deck over the full breadth and length of the ship up to a height of 2.4 m above the uppermost continuous deck.

- Spaces without overpressure ventilation which can be entered directly (without air lock) from a zone or which have openings to this zone.

- Enclosed or semi-enclosed spaces containing pipelines belonging to the cargo tank system.

Locations comparable with zone 2:

- Spaces above the hazardous zone 1 over the full breadth and length of the ship to a height of 6 m above the deepest load waterline.

- Spaces without overpressure ventilation which can be entered directly (without air lock) from zone 2 or which have openings to this zone.

2.7 Oil tankers using cargo as fuel

2.7.1 See Rules for Machinery Installations, Volume III, Section 15. D.

3. Liquefied gas tankers (see Rules for Ship Carrying Liquefied Gases in Bulk, Volume IX, Section 12)

3.1 Ventilation openings to accommodation and service spaces and control station rooms must be fitted with gastight means of closure which can be operated from inside the ventilated spaces, if toxic gases are to be carried.

This requirement applies to radio rooms and main navigating rooms, cabins, messes, toilets, hospitals, galleys, etc., but not to engine room casings, store rooms on deck, steering gear rooms, workshops, etc. The requirement does likewise not apply to store rooms in the forecastle and loading control spaces within the cargo area.

Any closures required, which have to be operated from inside, are to be arranged at air intake and outlet openings. The closures have to be adequately gastight. Simple steel fire dampers without sealings are not sufficient.

3.2 Where a cargo control room is situated in the area of accommodation and service spaces, and control rooms, 3.6 is applicable.

3.3 The ventilation openings for gasfree spaces are to be located in gasfree zones.

3.4 Air locks

3.4.1 Air locks are to be mechanically ventilated from a gasfree zone.

3.4.2 An overpressure of approx. 5 -10 mm water column (0,5 -1,0 hPa) is to be maintained to the area of exposed weather deck with a gas hazard.

3.4.3 This ventilation system may be connected to that of other gasfree spaces.

3.5 Bow or stern cargo handling arrangements

3.5.1 The ventilation openings (inlets and outlets to the exposed deck) leading to accommodation, service and machinery spaces and control stations must not face the cargo shore connection of bow or stern loading and unloading arrangements. They have to be located on the outboard side of the superstructure or deckhouse at a minimum distance of **L/25** but at least at a distance of 3 m from the end of the superstructure or deckhouse facing the cargo shore connection location of the bow or stern .cargo handling equipment. This distance need, however, not exceed 5 m.

The end bulkhead at each level is regarded as end of the deckhouse.

Beyond this, during operation of the bow or stern cargo handling arrangements all shutters in the respective superstructure or deckhouse side walls have to be kept closed.

Where in smaller ships the above requirements and in addition those of para 1.5 cannot be met, relaxations may be granted.

3.5.2 During operation of the bow or stern cargo handling facilities the ventilation openings leading to spaces within 10 m of the pipe connection shall be kept closed.

3.6 The ventilation openings leading to accommodation and service spaces, control stations and other gasfree spaces are to be located at a minimum distance equivalent to B (the breadth of the ship) or 25 m, whichever is the lesser value, from the nearest exit of a cargo tank safety valve.

Smaller distances may be permitted for ships less than 90 m long.

A distance of 10 m is to be maintained from all other vent outlets connected to the cargo tank system.

The distances are to be measured in a straight line.

3.7 Where enclosed spaces with a gas hazard contain permanently installed equipment for inerting or smothering a fire, closing of the ventilation shutters shall be accompanied by a warning signal inside the space so that, in an emergency, the crew can quit the space in good time.

3.8 Spaces in the cargo area required to be entered during normal cargo handling operations.

3.8.1 Electric motor rooms, cargo compressor and pump rooms, other enclosed spaces which contain cargo handling equipment and similar spaces in which cargo handling operations are performed shall be fitted with independent mechanical ventilation systems capable of being controlled from outside such spaces.

3.8.2 Provision is to be made to ventilate such spaces prior to entering the compartment and operating the equipment.

A warning notice requiring the use of such ventilation prior to entry is to be placed outside the compartment.

3.8.3 Mechanical ventilation inlets and outlets shall be arranged to ensure sufficient air movement through the space to avoid the accumulation of flammable or toxic vapours and to ensure a safe working environment, but in no case shall the ventilation system have a capacity of less than 30 changes of air per hour based upon the total volume of the space.

As an exception, gasfree cargo control rooms may have 8 changes of air per hour .

3.8.4 Ventilation systems are to be permanent and if of the exhaust type, permit extraction from either or both upper and lower parts of the spaces, depending on the density of the vapours of the products carried.

3.8.5 In rooms housing electric motors driving cargo compressors or pumps, spaces except machinery spaces containing inert gas generators, cargo control rooms if considered as gasfree spaces and other gasfree spaces within the cargo area, the ventilation has to be of the positive pressure type.

The overpressure is to be monitored.

The following means of monitoring overpressure in spaces protected by air-locks are considered acceptable alternatives to differential pressure sensing devices:

- monitoring of current or power in the electrical supply to the ventilation motors; or

- air flow sensors in the ventilation ducts.

(see Rules for Ship Carrying Liquefied Gases in Bulk, Volume IX, 3.6 -0.1.)

3.8.6 In cargo compressor and pump rooms and in gas-dangerous cargo control rooms the ventilation is to be of exhaust type.

3.8.7 The exhaust ducts must vent upwards from discharge points located at a horizontal distance of at least 10 m from the air intake and (other) openings leading to accommodation and service spaces, control stations and other gasfree spaces.

The height of ventilation outlets is not to be less than 3 m above the weatherdeck or 2 m above the fore-and-aft gangway (if any), if fitted within 3 m of the gangway.

3.8.8 Gas-dangerous spaces for the purpose of this para. are spaces mentioned in 3.8.6. For other spaces, which are "gas-dangerous spaces" only due to their position, relaxations may be granted.

3.8.9 Ventilation intakes are to be arranged above the gas-dangerous zone so as to minimize the possibility of recycling hazardous vapours from any ventilation discharge opening.

They are to be situated at a distance of at least 3 m in the horizontal direction from ventilation intakes and (other) openings to accommodation, service and machinery spaces, control stations and other spaces outside the cargo area.

The height of ventilation intakes is not to be less than 3 m above the weatherdeck.

3.8.10 Ventilation ducts from gas-dangerous spaces are not to be led through accommodation, service and machinery spaces or control stations.

3.8.11 Electric motors driving fans are to be placed outside the ventilation ducts if the carriage of flammable products is intended. Ventilation fans shall not produce a source of vapour ignition in either the ventilated space or the ventilation system associated with the space:

Their enclosure must, as a minimum requirement, conform to explosion group II B and temperature class T 3.

For gas-dangerous spaces the design of ventilators must conform to Section 1, 8.15.

3.9 Spaces in the cargo area not normally entered

3.9.1 Hold spaces, interbarrier spaces, void spaces, cofferdams, spaces containing cargo piping and other spaces where cargo vapours may accumulate, shall be capable of being ventilated to ensure a safe environment when entry into the spaces is necessary.

3.9.2 Where a permanent ventilation system is not provided for such spaces, approved means of portable mechanical ventilation is to be provided.

3.9.3 Where necessary owing to the arrangement of spaces (such as hold spaces and interbarrier spaces), essential ducting for such ventilation shall be permanently installed.

3.9.4 If fixed or portable ventilation ducting is arranged, defined distances from the vessel's structural elements to be surveyed or from insulations have to be maintained (see Rules for Ship Carrying Liquefied Gases in Bulk, Volume IX, Section 3.5- 0.2.1 to .4).

3.9.5 Fans are to be clear of personnel access openings, and are to comply with Section 1, 8.15.

For electrically driven ventilators use may only be made of explosion-proof motors with enclosure

corresponding, as a minimum requirement, to explosion group II B and temperature class T3 (depending on where they are installed).

The motors are to be located outside the airstream and outside these spaces.

3.9.6 Provision is to be made for at least 8 air changes per hour.

In special cases a smaller number or air changes is admissible for cargo spaces surrounding an independent tank.

3.9.7 A dry air generation plant (inert gas system) may also be used for ventilation purposes, provided the plant is equipped with an appropriate system.

3.10 Liquefied gas tankers using cargo as fuel

See Rules for Ship Carrying Liquefied Gases in Bulk, Volume IX, Section 16.

4. Chemical tankers (see BKI Rules for Ships Carrying Dangerous Chemical in Bulk, Volume X, Section 12)

4.1.1 Particular attention is to be paid to the arrangement of ventilation openings (inlets and outlets to the exposed deck), taking into account cargo and tank venting pipings.

4.1.2 The minimum distance from the nearest tank vent must be 10 m.

4.1.3 Where toxic cargo is carried this distance must be 15 m.

4.1.4 Where it is intended to carry oil cargo, this distance is to be measured in the horizontal direction.

4.2 Bow or stern cargo handling arrangements

4.2.1 The ventilation openings (inlets and outlets to the exposed deck) leading to accommodation, service and machinery spaces and control stations must not face the cargo shore connection location of bow or stern cargo handling equipment. They have to be located on the outboard side of the superstructure or deckhouse at a minimum distance of L/25 and at least at a distance of 3 m from the end of the superstructure or deckhouse facing the cargo shore connection location of the bow or stern cargo handling equipment. This distance need, however, not exceed 5 m.

The end bulkhead at each level is regarded as end of the deckhouse.

Beyond this, during operation of the bow or stern cargo handling facilities all shutters in the respective superstructure or deckhouse side walls have to be kept closed.

Where in smaller ships the above requirements and those of para 1.5 cannot be observed, relaxations may be granted.

4.2.2 During operation of the bow or stem cargo handling facilities the ventilation openings leading to spaces within 10 m of the pipe connection shall be kept closed.

4.3 Spaces in cargo area normally entered during cargo handling operations

4.3.1 Cargo pump rooms and other enclosed spaces which contain cargo handling equipment and similar spaces in which work is performed on the cargo are to be fitted with mechanical ventilation systems capable of being controlled from outside such spaces.

4.3.2 Provision is to be made to ventilate such spaces prior to entering the compartment and operating the equipment.

4.3.3 A warning notice requiring the use of such ventilation is to be placed outside the compartment.

4.3.4 Mechanical ventilation inlets and outlets are to be arranged to ensure sufficient air movement through the space to avoid the accumulation of toxic or flammable vapours (taking into account their vapour densities) and to ensure sufficient oxygen to provide a safe working environment. ,

In no case is the ventilation system to have a capacity of less than 30 changes of air per hour, based upon the total volume of the space.

For certain products increased ventilation rates for cargo pump rooms are prescribed (see 4.3.12).

4.3.5 Ventilating systems must be permanently installed.

4.3.6 Mechanical exhaust ventilation in accordance with 2.4.5 is to be provided. Extraction from approximately 2 m above and below the floor plates is to be possible.

4.3.7 Ventilation exhaust ducts from spaces within the cargo area are to discharge upwards in locations at least 10 m in the horizontal direction from ventilation intakes and openings to accommodation, service and machinery spaces and control stations and other spaces outside the cargo area.

The height of ventilation outlets is not to be less than 3 m above the weatherdeck or 2 m above the fore-and-aft gangway (if any), if fitted within 3 m of the gangway.

For certain products increased heights may be prescribed.

4.3.8 Ventilation intakes are to be arranged above the hazardous area such as to minimize the possibility of recycling hazardous vapours from any ventilation discharge opening.

They are to be fitted at a distance of at least 3 m in the horizontal direction from ventilation intakes and (other) openings to accommodation, service and machinery spaces, control stations and other spaces outside the cargo area.

The height of ventilation intakes is not to be less than 3 m above the weatherdeck.

4.3.9 Ventilation ducts from spaces within the cargo area are not to be led through machinery, accommodation and service spaces, control stations or other similar spaces.

4.3.10 Electric motors driving fans are to be placed outside the ventilation ducts, if the carriage of flammable products is intended.

The type of protection must be compatible with the characteristics of the cargo, but shall conform, as a minimum requirement, to explosion group II B and temperature class T4.

For spaces with a gas hazard the design of ventilators must conform to Section 1, 8.15.

4.3.11 Certain cargoes (e.g. phosphorus and sulphur) may require additional requirements to be imposed.

4.3.12.1 Where toxic substances are carried, the number of air changes for cargo pump rooms has to be increased to 45 per hour.

4.3.12.2 The exhaust vents must then be situated at least 10 m away from accommodation spaces, working areas or similar rooms as well as from the intakes of other ventilation systems.

The height of ventilation outlets is not to be less than 4 m above the weatherdeck or 2 m above the fore-and-aft gangway (if any), if fitted within 4 m of the gangway.

4.3.13 In all special cases, the Rules for Ships Carrying Dangerous Chemical in Bulk, Volume X Construction Rules, Section 15, are to be complied with.

4.3.14 Where flammable cargo with a flash point of 60 °C or below is carried, compliance with the regulations for oil tankers is additionally required.

4.4 Spaces in the cargo area normally entered

4.4.1 Ballast pump rooms and other enclosed spaces in the cargo area not covered by 4.3.1 are subject to 4.3.2 to 4.3.10, except that 20 air changes per hour are required and the horizontal distance as per 4.3.7 is to be not less than 3 m only.

4.5 Spaces in the cargo area not normally entered

4.5.1 Double bottoms, cofferdams, duct keels, pipe tunnels, spaces for cargo tanks and other spaces, where cargo or cargo vapours may accumulate, are to be capable of being ventilated to ensure a safe environment when entry into the spaces is necessary.

4.5.2 Where a permanent ventilation system is not provided for such spaces, approved means of portable mechanical ventilation are to be provided.

4.5.3 Where necessary owing to the arrangement of spaces (e.g. cargo holds), essential ducting for such ventilation is to be permanently installed.

4.5.4 Fans are to be clear of personnel access openings and are to comply with Section 1, 8.15.

For electrically driven fans only explosion-proof motors located outside the airstream and compatible with the characteristics of the cargo are permitted; however, they should at least be of explosion group II B and temperature class T 4.

4.5.5 Provision is to be made for at least 8 air changes per hour. For portable ventilators without ducting at least 16 changes of air per hour are required.

4.6 Chemical incinerator ships

4.6.1 The rules set out in 1. and in 4.1 to 4.9 are also to be observed, as far as applicable and in line with the additions or amendments in these paragraphs.

4.6.2 The ventilating systems of cargo pump rooms are subject to the provisions of 4.3.12.

4.6.3 If accommodations, service spaces, control spaces and machinery spaces not coming under category A are arranged forward of the cargo area, para 1.5 applies analogously, i.e. the distances indicated are to be measured from the aft end of the deckhouse arranged forward of the cargo area.

4.6.4 The effects of the combustion gases upon air inlets and outlets are to be taken into account.

4.6.5.1 Spaces housing incineration furnaces are to be equipped with permanently installed supply ventilation systems. These may not be connected to the ventilating systems of other spaces in the ship.

4.6.5.2 A permanent overpressure must be maintained in relation to the furnace combustion chamber.

4.6.5.3 At least 45 air changes per hour are required.

4.6.5.4 During maintenance work on the burners, adequate ventilation must be provided in this area as well.

4.6.5.5 Special safety measures must be taken if non-explosion-proof electrical equipment is used.

Interlocks are to be provided between fans and the switch gear of such equipment to ensure adequate ventilation before the equipment is put into operation (see Rules for Ships Carrying Dangerous Chemical in Bulk, Volume X, Section 19.9.2).

4.6.6.1 Spaces housing the ventilators supplying the combustion air are to be provided with permanently installed air intakes.

4.6.6.2 These may not be connected to the ventilating systems of other spaces in the ship.

4.6.6.3 At least 20 air changes per hour are required.

4.6.6.4 The air pressure always has to be exceed the pressure inside the furnace.

Section 4

Additional Regulations for Passenger Ships

1. Additional regulations for passenger ships of all sizes

1.1 Construction

1.1.1 Watertight bulkheads below the bulkhead deck may not be penetrated by air ducts.

Where (in exceptional cases) this cannot be avoided, ventilation openings are admissible on one side of the bulkhead only. On the other side of the bulkhead the ventilation duct is to be without openings and of watertight and thick-walled design.

It must not be arranged within the "area susceptible to damages" as per the damage stability calculation.

Where air ducts are arranged such as to penetrate more than one watertight bulkhead, a power-driven locking device is to be provided at the bulkheads , capable of being closed from a central position above the bulkhead deck. Here, too, ventilation openings are admissible in one compartment only.

1.1.2 The ducts leading to the various spaces must generally be located within the same vertical main fire zone.

1.1.3 Air ducts of all sizes which exceptionally penetrate boundaries (bulkheads/decks) of the vertical main fire zones are to be fitted with automatically closing fire dampers as per Section1, 7.2.

1.1.4 The duct between the damper and the partition must be made of steel and is to be insulated in conformity with the partition.

1.1.5 The plate thickness of this duct is to be not less than 3 to 5 mm (see Section 1, 8.10b).

1.1.6 Automatic fire dampers are also required where the ducts are routed, with insulation and without openings, through the adjoining main fire zone.

1.1.7 1.1.6 does not apply to air trunks, ducts and pipes which insulated in conformity with the room/space groups lead through horizontal main fire zones without openings (e.g. ro-ro decks) and to very short insulated duct bends which lead through the adjoining vertical main fire zone without openings.

1.2 Carriage of motor vehicles

Beyond the areas mentioned in Section 2, 8.12, in enclosed special spaces (i.e. in ro-ro spaces on board passenger vessels) for the carriage of motor vehicles underneath the bulkhead deck and in cargo holds for motor vehicles carrying fuel in their tanks the entire cargo hold area is a protected area required electrical equipment of explosion-protected type.

For details see Rules for Electrical Installations, Volume IV, Section 16.

1.3 Central control places

Central control places for funnel naps and fire-dampers of engine room ,ventilators are to be provided outside the engine rooms.

2. Additional regulations for passenger vessels carrying more than 36 passengers

2.1 Construction

2.1.1 Where decks are penetrated by trunks or ducts, smoke dampers as per Section 1, 7.3 are to be fitted to isolate the various deck areas from each other. This also applies to separate ducting leading to the ventilator room, however, the damper may in this case be located in the ventilator room.

If there are no ventilation openings in a particular deck area, the damper may be dispensed with, provided that the portion of duct in the side area is insulated in conformity with the room/space groups concerned.

Vertical ducts are, as a matter of principle, to be insulated in conformity with the room/space groups.

2.1.2 Deviating from Section 1, 4.2, the following air ducts are to be made of steel or another equivalent material:

- Ducts with a cross-section of 0.075 m^2 and over;
- Vertical ducts of all sizes serving more than one deck.

2.1.3 2.1.2 does not apply to ventilation ducts in cargo holds.

2.1.4 Means must be provided to enable all mechanically driven ventilators to be switched off from two switching points located as far as possible apart. (For engine room ventilators see Section 2, 9.7, for cargo hold ventilators Section 2, 8.8 and for control stations 2.2).

It must be possible to switch off all the ventilators from each of these switching points.

2.2 Control stations

The second control station ventilator need be capable of being switched on and off from only one location outside the ventilated room.

2.3 Stair cases

Ventilation ducts for stair cases are to he routed separately from the ventilator room and may not supply air to any other space.

2.4 Public spaces extending over three or more decks

2.4.1 Where public spaces extend over three or more decks and contain combustible materials, such as furniture, and include enclosed spaces, such as shops, offices and restaurants, an exhaust system with air balance for the discharge of smoke is to be provided.

2.4.2 The system shall he capable of being switched on by either the required smoke-detecting system or manually.

Once it has been switched on, it must not be possible to switch it off unintentionally from the positions referred to in 2.1.4 (separate labelled switch).

2.4.3 It is to be ensured that, when switching on the ventilators, the fire dampers pertaining to this system are open.

2.4.4 The ventilator capacity must be sufficient for extracting the space volume within a period of 10 minutes (6 air changes/hour).

2.4.5 Any existing exhaust-air system may be employed, taking into account. the requirements contained in 2.4.2 to 2.4.4.