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**ECONOMIC COMMISSION FOR EUROPE**

INLAND TRANSPORT COMMITTEE

Working Party on the Transport  
of Dangerous Goods

Joint Meeting of Experts on the Regulations  
annexed to the European Agreement concerning  
the International Carriage of Dangerous Goods  
by Inland Waterway (ADN)\*  
(Fifth session, 21-25 January 2002)

**RESTRUCTURING OF THE REGULATIONS ANNEXED TO ADN**

**Part 9: Rules of construction**

**Addendum 6**

**Note by the secretariat**

The secretariat presents below restructure Part 9 of the draft Regulations annexed to the European Agreement concerning International Carriage of Dangerous Goods by Inland Waterway (ADN).

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\* This meeting is organized jointly by the Economic Commission for Europe and the Central Commission for the Navigation of the Rhine.



## **PART 9**

### **Rules for construction**



## Contents

### **9.1 Rules for construction of dry cargo vessels**

9.1.0.0	Materials of construction
9.1.0.1-	
9.1.0.10	<i>(Reserved)</i>
9.1.0.11	Holds
9.1.0.12	Ventilation
9.1.0.13-	
9.1.0.16	<i>(Reserved)</i>
9.1.0.17	Accommodation and service spaces
9.1.0.18-	
9.1.0.19	<i>(Reserved)</i>
9.1.0.20	Water ballast
9.1.0.21-	
9.1.0.30	<i>(Reserved)</i>
9.1.0.31	Engines
9.1.0.32	Oil fuel tanks
9.1.0.33	<i>(Reserved)</i>
9.1.0.34	Exhaust pipes
9.1.0.35	Stripping installation
9.1.0.36-	
9.1.0.39	<i>(Reserved)</i>
9.1.0.40	Fire-extinguishing arrangements
9.1.0.41	Fire and naked light
9.1.0.42-	
9.1.0.51	<i>(Reserved)</i>
9.1.0.52	Type and location of electrical equipment
9.1.0.53-	
9.1.0.55	<i>(Reserved)</i>
9.1.0.56	Electric cables
9.1.0.57-	
9.1.0.69	<i>(Reserved)</i>
9.1.0.70	Metal wires, masts
9.1.0.71	Admittance on board
9.1.0.72-	
9.1.0.73	<i>(Reserved)</i>
9.1.0.74	Prohibition of smoking, fire and naked light
9.1.0.75-	
9.1.0.79	<i>(Reserved)</i>
<b>9.1.0.80</b>	<b>Additional rules applicable to double-hull vessels</b>
9.1.0.81-	
9.1.0.87	<i>(Reserved)</i>
9.1.0.88	Classification

- 9.1.0.89-
- 9.1.0.90       (*Reserved*)
- 9.1.0.91       Holds
- 9.1.0.92       Emergency exit
- 9.1.0.93       Stability (general)
- 9.1.0.94       Stability (intact)
- 9.1.0.95       Stability (damaged condition)

**9.2               Rules for construction applicable to seagoing vessels which comply with the requirements of the SOLAS Convention, Chapter II-2, Regulation 54**

**9.2.0.0           Materials of construction**

- 9.2.0.1-
- 9.2.0.19       (*Reserved*)
- 9.2.0.20       Water ballast
- 9.2.0.21-
- 9.2.0.30       (*Reserved*)
- 9.2.0.31       Engines
- 9.2.0.32-
- 9.2.0.33       (*Reserved*)
- 9.2.0.34       Exhaust pipes
- 9.2.0.35-
- 9.2.0.40       (*Reserved*)
- 9.2.0.41       Fire and naked light
- 9.2.0.42-
- 9.2.0.70       (*Reserved*)
- 9.2.0.71       Admittance on board
- 9.2.0.72-
- 9.2.0.73       (*Reserved*)
- 9.2.0.74       Prohibition of smoking, fire and naked light
- 9.2.0.75-
- 9.2.0.79       (*Reserved*)

**9.2.0.80           Additional rules applicable to double-hull vessels**

- 9.2.0.81-
- 9.2.0.87       (*Reserved*)
- 9.2.0.88       Classification
- 9.2.0.89-
- 9.2.0.90       (*Reserved*)
- 9.2.0.91       Holds
- 9.2.0.92       (*Reserved*)
- 9.2.0.93       Stability (general)
- 9.2.0.94       Stability (intact)
- 9.2.0.95       Stability (damaged condition)

- 9.3 Rules for construction of tank vessels**
- 9.3.1 Rules for construction of type G tank vessels**
- 9.3.1.0 Materials of construction
  - 9.3.1.1-  
9.3.1.7 (*Reserved*)
  - 9.3.1.8 Classification
  - 9.3.1.9 (*Reserved*)
  - 9.3.1.10 Protection against the penetration of gases
  - 9.3.1.11 Hold spaces and cargo tanks
  - 9.3.1.12 Ventilation
  - 9.3.1.13 Stability (general)
  - 9.3.1.14 Stability (intact)
  - 9.3.1.15 Stability (damaged condition)
  - 9.3.1.16 Engine rooms
  - 9.3.1.17 Accommodation and service spaces
  - 9.3.1.18-  
9.3.1.20 (*Reserved*)
  - 9.3.1.21 Safety and control installations
  - 9.3.1.22 Cargo tank openings
  - 9.3.1.23 Pressure test
  - 9.3.1.24 (*Reserved*)
  - 9.3.1.25 Pumps and piping
  - 9.3.1.26 (*Reserved*)
  - 9.3.1.27 Cargo refrigeration systems
  - 9.3.1.28 Water-spray system
  - 9.3.1.29-  
9.3.1.30 (*Reserved*)
  - 9.3.1.31 Engines
  - 9.3.1.32 Oil fuel tanks
  - 9.3.1.33 (*Reserved*)
  - 9.3.1.34 Exhaust pipes
  - 9.3.1.35 Bilge pumping and ballasting arrangements
  - 9.3.1.36-  
9.3.1.39 (*Reserved*)
  - 9.3.1.40 Fire-extinguishing arrangements
  - 9.3.1.41 Fire and naked light
  - 9.3.1.42-  
9.3.1.49 (*Reserved*)
  - 9.3.1.50 Documents concerning electrical installations
  - 9.3.1.51 Electrical installations
  - 9.3.1.52 Type and location of electrical equipment
  - 9.3.1.53 Earthing
  - 9.3.1.54-  
9.3.1.55 (*Reserved*)
  - 9.3.1.56 Electrical cables

- 9.3.1.57-
- 9.3.1.59        (*Reserved*)
- 9.3.1.60        Special equipment
- 9.3.1.61-
- 9.3.1.70        (*Reserved*)
- 9.3.1.71        Admittance on board
- 9.3.1.72-
- 9.3.1.73        (*Reserved*)
- 9.3.1.74        Prohibition of smoking, fire or naked light
- 9.3.1.75-
- 9.3.1.91        (*Reserved*)
- 9.3.1.92        Emergency exit

**9.3.2            Rules for construction of type C tank vessels**

- 9.3.2.0         Materials of construction
- 9.3.2.1-
- 9.3.2.7         (*Reserved*)
- 9.3.2.8         Classification
- 9.3.2.9         (*Reserved*)
- 9.3.2.10        Protection against the penetration of gases
- 9.3.2.11        Hold spaces and cargo tanks
- 9.3.2.12        Ventilation
- 9.3.2.13        Stability (general)
- 9.3.2.14        Stability (intact)
- 9.3.2.15        Stability (damaged condition)
- 9.3.2.16        Engine rooms
- 9.3.2.17        Accommodation and service spaces
- 9.3.2.18-
- 9.3.2.19        (*Reserved*)
- 9.3.2.20        Arrangement of cofferdams
- 9.3.2.21        Safety and control installations
- 9.3.2.22        Cargo tank openings
- 9.3.2.23        Pressure tests
- 9.3.2.24        (*Reserved*)
- 9.3.2.25        Pumps and piping
- 9.3.2.26        Residual cargo tanks and slop tanks
- 9.3.2.27        (*Reserved*)
- 9.3.2.28        Water-spray system
- 9.3.2.29-
- 9.3.2.30        (*Reserved*)
- 9.3.2.31        Engines
- 9.3.2.32        Oil fuel tanks
- 9.3.2.33        (*Reserved*)
- 9.3.2.34        Exhaust pipes
- 9.3.2.35        Bilge pumping and ballasting arrangements

- 9.3.2.36-
- 9.3.2.39 *(Reserved)*
- 9.3.2.40 Fire-extinguishing arrangements
- 9.3.2.41 Fire and naked light
- 9.3.2.42 Cargo heating system
- 9.3.2.43-
- 9.3.2.49 *(Reserved)*
- 9.3.2.50 Documents concerning electrical installations
- 9.3.2.51 Electrical installations
- 9.3.2.52 Type and location of electrical equipment
- 9.3.2.53 Earthing
- 9.3.2.54-
- 9.3.2.55 *(Reserved)*
- 9.3.2.56 Electrical cables
- 9.3.2.57-
- 9.3.2.59 *(Reserved)*
- 9.3.2.60 Special equipment
- 9.3.2.61-
- 9.3.2.70 *(Reserved)*
- 9.3.2.71 Admittance on board
- 9.3.2.72-
- 9.3.2.73 *(Reserved)*
- 9.3.2.74 Prohibition of smoking, fire or naked light
- 9.3.2.75-
- 9.3.2.91 *(Reserved)*
- 9.3.2.92 Emergency exit

### **9.3.3 Rules for construction of type N tank vessels**

- 9.3.3.0 Materials of construction
- 9.3.3.1-
- 9.3.3.7 *(Reserved)*
- 9.3.3.8 Classification
- 9.3.3.9 *(Reserved)*
- 9.3.3.10 Protection against the penetration of gases
- 9.3.3.11 Hold spaces and cargo tanks
- 9.3.3.12 Ventilation
- 9.3.3.13 Stability (general)
- 9.3.3.14 Stability (intact)
- 9.3.3.15 *(Reserved)*
- 9.3.3.16 Engine rooms
- 9.3.3.17 Accommodation and service spaces
- 9.3.3.18-
- 9.3.3.19 *(Reserved)*
- 9.3.3.20 Arrangement of cofferdams
- 9.3.3.21 Safety and control installations
- 9.3.3.22 Cargo tank openings

- 9.3.3.23 Pressure tests
- 9.3.3.24 *(Reserved)*
- 9.3.3.25 Pumps and piping
- 9.3.3.26 Residual cargo tanks and slop tanks
- 9.3.3.27 *(Reserved)*
- 9.3.3.28 Water-spray system
- 9.3.3.29-
- 9.3.3.30 *(Reserved)*
- 9.3.3.31 Engines
- 9.3.3.32 Oil fuel tanks
- 9.3.3.33 *(Reserved)*
- 9.3.3.34 Exhaust pipes
- 9.3.3.35 Bilge pumping and ballasting arrangements
- 9.3.3.36-
- 9.3.3.39 *(Reserved)*
- 9.3.3.40 Fire-extinguishing arrangements
- 9.3.3.41 Fire and naked light
- 9.3.3.42 Cargo heating system
- 9.3.3.43-
- 9.3.3.49 *(Reserved)*
- 9.3.3.50 Documents concerning electrical installations
- 9.3.3.51 Electrical installations
- 9.3.3.52 Type and location of electrical equipment
- 9.3.3.53 Earthing
- 9.3.3.54-
- 9.3.3.55 *(Reserved)*
- 9.3.3.56 Electrical cables
- 9.3.3.57-
- 9.3.3.59 *(Reserved)*
- 9.3.3.60 Special equipment
- 9.3.3.61-
- 9.3.3.70 *(Reserved)*
- 9.3.3.71 Admittance on board
- 9.3.3.72-
- 9.3.3.73 *(Reserved)*
- 9.3.3.74 Prohibition of smoking, fire or naked light
- 9.3.3.75-
- 9.3.3.99

**[Part 9 - Rules for construction**

**CHAPTER 9.1**

**RULES FOR CONSTRUCTION OF DRY CARGO VESSELS]**

**[9.1.0** Provisions of 9.1.0.0 to 9.1.0.79 applicable to all dry cargo vessels.]

**9.1.0.0 Materials of construction**

The vessel's hull shall be constructed of shipbuilding steel or other metal, provided that this metal has at least equivalent mechanical properties and resistance to the effects of temperature and fire.

**9.1.0.1-  
9.1.0.10**

**9.1.0.11 Holds**

9.1.0.11.1 (a) Each hold shall be bounded fore and aft by watertight metal bulkheads.

(b) The holds shall have no common bulkhead with the oil fuel tanks.

9.1.0.11.2 The bottom of the holds shall be such as to permit them to be cleaned and dried.

9.1.0.11.3 The hatchway covers shall be spraytight and weathertight or be covered by waterproof tarpaulins.

Tarpaulins used to cover the holds shall not readily ignite.

9.1.0.11.4 No heating appliances shall be installed in the holds.

**9.1.0.12 Ventilation**

9.1.0.12.1 Ventilation of each hold shall be provided by means of two mutually independent extraction ventilators having a capacity of not less than five changes of air per hour based on the volume of the empty hold. The ventilator fan shall be designed so that no sparks may be emitted on contact of the impeller blades with the housing and no static electricity may be generated. The extraction ducts shall be positioned at the extreme ends of the hold and extend down to not more than 50 mm above the bottom. The extraction of gases and vapours through the duct shall also be ensured for carriage in bulk.

Ventilators are not required on vessels only carrying dangerous goods packed in containers. If the extraction ducts are movable they shall be suitable for the ventilator assembly and capable of being firmly fixed. Protection shall be ensured against bad weather and spray. The air intake shall be ensured during ventilation.

9.1.0.12.2 The ventilation system of a hold shall be arranged so that dangerous gases cannot penetrate into the accommodation, wheelhouse or engine rooms.

9.1.0.12.3 Ventilation shall be provided for the accommodation and for service spaces.

**9.1.0.13-  
9.1.0.16**

**9.1.0.17 Accommodation and service spaces**

9.1.0.17.1 The accommodation shall be separated from the holds by metal bulkheads having no openings.

9.1.0.17.2 Gastight closing appliances shall be provided for openings in the accommodation and wheelhouse facing the holds.

9.1.0.17.3 No entrances or openings of the engine rooms and service spaces shall face the protected area.

**9.1.0.18-  
9.1.0.19**

**9.1.0.20 Water ballast**

The double-hull spaces and double bottoms may be arranged for being filled with water ballast.

**9.1.0.21-  
9.1.0.30**

**9.1.0.31 Engines**

9.1.0.31.1 Only internal combustion engines running on fuel having a flashpoint above 55 °C are allowed.

9.1.0.31.2 The air vents in the engine rooms and the air intakes of the engines which do not take air in directly from the engine room shall be located not less than 2.00 m from the protected area.

9.1.0.31.3 Sparking shall not be possible in the protected area.

**9.1.0.32 Oil fuel tanks**

9.1.0.32.1 Double bottoms within the hold area may be arranged as oil fuel tanks provided their depth is not less than 0.6 m. Oil fuel pipes and openings to such tanks are not permitted in the holds.

9.1.0.32.2 The air pipes of all oil fuel tanks shall be led to 0.50 m above the open deck. Their open ends and the open ends of the overflow pipes leading to the deck shall be fitted with a protective device consisting of a gauze grid or by a perforated plate.

#### **9.1.0.33**

#### **9.1.0.34 Exhaust pipes**

9.1.0.34.1 Exhausts shall be evacuated from the vessel into the open air either upwards through an exhaust pipe or through the shell plating. The exhaust outlet shall be located not less than 2.00 m from the hatchway openings. The exhaust pipes of engines shall be arranged so that the exhausts are led away from the vessel. The exhaust pipes shall not be located within the protected area.

9.1.0.34.2 Exhaust pipes shall be provided with a device preventing the escape of sparks, e.g. spark arresters.

#### **9.1.0.35 Stripping installation**

The stripping pumps intended for the holds shall be located in the protected area. This requirement shall not apply when stripping is effected by eductors.

#### **9.1.0.36- 9.1.0.39**

#### **9.1.0.40 Fire-extinguishing arrangements**

9.1.0.40.1 A fire-extinguishing system shall be installed on the vessel. This system shall comply with the following requirements:

- It shall be supplied by two independent fire or ballast pumps one of which shall be ready for use at any time. These pumps shall not be installed in the same space;
- It shall be provided with a water main fitted with at least three hydrants in the protected area above deck. Three suitable and sufficiently long hoses with spray nozzles having a diameter of not less than 12 mm shall be provided. It shall be possible to reach any point of the deck in the protected area simultaneously with at least two jets of water which do not emanate from the same hydrant. A spring-loaded non-return valve shall be fitted to ensure that no gases can escape through the fire-extinguishing system into the accommodation or service spaces outside the protected area;

- The capacity of the system shall be at least sufficient for a jet of water to reach a distance of not less than the vessel's breadth from any location on board with two spray nozzles being used at the same time.

A single fire or ballast pump shall suffice on board pushed barges without their own means of propulsion.

9.1.0.40.2 The engine rooms shall be provided with a fixed fire-extinguishing system [permanently fixed and able to be operated from the deck].

9.1.0.40.3 The two hand fire-extinguishers referred to in 8.1.4 shall be located in the protected area.

[9.1.0.40.4 The fire-extinguishing agent and the quantity contained in the permanently fixed fire-extinguishing system shall be suitable and sufficient for fighting fires.]

#### **9.1.0.41 Fire and naked light**

9.1.0.41.1 The outlets of funnels shall be located not less than 2 m from the hatchway openings. Arrangements shall be provided to prevent the escape of sparks and the entry of water.

9.1.0.41.2 Heating, cooking and refrigerating appliances shall not be fuelled with liquid fuels, liquid gas or solid fuels. The installation in the engine room or other separate space of heating appliances fuelled with liquid fuel having a flashpoint above 55 °C is, however, permitted.

Cooking and refrigerating appliances are permitted only in wheelhouses with metal floor and in the accommodation.

9.1.0.41.3 Electric lighting appliances only are permitted outside the accommodation and the wheelhouse.

#### **9.1.0.42- 9.1.0.51**

#### **9.1.0.52 Type and location of electrical equipment**

9.1.0.52.1 It shall be possible to isolate the electrical equipment in the protected area by means of centrally located switches except where:

- it is of a certified safe type corresponding at least to temperature class T4 and explosion group II B; and
- in the protected area it is of the limited explosion risk type.

The corresponding electrical circuits shall have control lamps to indicate whether or not the circuits are live.

The switches shall be protected against unintended unauthorized operation. The sockets used in this area shall be so designed as to prevent connections being made except when they are not live.

9.1.0.52.2 Electric motors for hold ventilators which are arranged in the air flow shall be of the “certified safe” type.

9.1.0.52.3 Sockets for the connection of signal lights, gangway lighting and containers shall be fitted to the vessel close to the signal mast or the gangway or the containers. Sockets intended to supply the submerged pumps and hold ventilators shall be permanently fitted to the vessel in the vicinity of the hatches.

**9.1.0.53-  
9.1.0.55**

**9.1.0.56 Electric cables**

9.1.0.56.1 Cables and sockets in the protected area shall be protected against mechanical damage.

9.1.0.56.2 Movable cables are prohibited in the protected area, except for intrinsically safe electric circuits or for the supply of signal lights and gangway lighting, for containers, for submerged pumps, hold ventilators and for electrically operated cover gantries.

9.1.0.56.3 For movable cables permitted in accordance with 9.1.0.56.2 above, only rubber-sheathed cables of type H07 RN-F in accordance with 245 IEC 66 or cables of at least equivalent design having conductors with a cross-section of not less than 1.5 mm<sup>2</sup>, shall be used. These cables shall be as short as possible and installed so that accidental damage is not likely to occur.

**9.1.0.57-  
9.1.0.69**

**9.1.0.70 Metal wires, masts**

All metal wires passing over the holds and all masts shall be earthed, unless they are electrically bonded to the metal hull of the vessel through their installation.

**9.1.0.71 Admittance on board**

The notice boards displaying the prohibition of admittance in accordance with 7.1.3.71 shall be clearly legible from either side of the vessel.

**9.1.0.72-**

**9.1.0.73**

**9.1.0.74      Prohibition of smoking, fire and naked light**

9.1.0.74.1      The notice boards displaying the prohibition of smoking in accordance with 7.1.3.74 shall be clearly legible from either side of the vessel.

9.1.0.74.2      Notice boards indicating the circumstances under which the prohibition applies shall be fitted near the entrances to the spaces where smoking or the use of fire or naked light is not always prohibited.

9.1.0.74.3      Ashtrays shall be provided close to each exit of the accommodation and the wheelhouse.

**9.1.0.75-**

**9.1.0.79**

## ADDITIONAL RULES APPLICABLE TO DOUBLE-HULL VESSELS

### **[9.1.0.80**      *Additional rules applicable to double-hull vessels*

The rules of 9.1.0.88 to 9.1.0.99 are applicable to double-hull vessels intended to carry dangerous goods of Classes 2, 3, 4.1, 5.2, 6.1, 7, 8 or 9, except those bearing label No. 1 in Chapter 3.2, Table A, column 5, in quantities exceeding those of 7.1.4.1.1.]

### **9.1.0.81- 9.1.0.87**

### **9.1.0.88**      **Classification**

9.1.0.88.1      Double-hull vessels intended to carry dangerous goods of Classes 2, 3, 4.1, 5.2, 6.1, [7], 8 or 9 except those [those bearing label No. 1 in Chapter 3.2, Table A, column 5] in quantities exceeding those referred to [in 7.1.4.1.1] shall be built or transformed under survey of a recognized classification society in accordance with the rules established by this classification society to its highest class. This shall be confirmed by the classification society by the issue of an appropriate certificate.

9.1.0.88.2      Continuation of class is not required.

9.1.0.88.3      Future conversions and major repairs to the hull shall be carried out under survey of this classification society.

### **9.1.0.89- 9.1.0.90**

### **9.1.0.91**      **Holds**

9.1.0.91.1      The vessel shall be built as a double-hull vessel with double-hull spaces and double bottom within the protected area.

9.1.0.91.2      The distance between the sides of the vessel and the longitudinal bulkheads of the hold shall be not less than 0.80 m. Regardless of the requirements relating to the width of walkways on deck, a reduction of this distance to 0.60 m is permitted, provided that, compared with the scantlings specified in the rules for construction published by a recognized classification society, the following reinforcements have been made:

- (a)      Where the vessel's sides are constructed according to the longitudinal framing system, the frame spacing shall not exceed 0.60 m.

The longitudinals shall be supported by web frames with lightening holes similar to the floors in the double bottom and spaced not more than 1.80 m apart;

- (b) Where the vessel's sides are constructed according to the transverse framing system, either:
- two longitudinal side shell stringers shall be fitted. The distance between the two stringers and between the uppermost stringer and the gangboard shall not exceed 0.80 m. The depth of the stringers shall be at least equal to that of the transverse frames and the cross-section of the face plate shall be not less than 15 cm<sup>2</sup>.

The longitudinal stringers shall be supported by web frames with lightening holes similar to plate floors in the double bottom and spaced not more than 3.60 m apart. The transverse shell frames and the hold bulkhead vertical stiffeners shall be connected at the bilge by a bracket plate with a height of not less than 0.90 m and thickness equal to the thickness of the floors;

or:

- web frames with lightening holes similar to the double bottom plate floors shall be arranged on each transverse frame;
- (c) the gangboards shall be supported by transverse bulkheads or cross-ties spaced not more than 32 m apart.

As an alternative to compliance with the requirements of (c) above, a proof by calculation, issued by a recognized classification society confirming that additional reinforcements have been fitted in the double-hull spaces and that the vessel's transverse strength may be regarded as satisfactory.

9.1.0.91.3 The depth of the double bottom shall be not less than 0.50 m. The depth below a suction well may however be locally reduced to 0.40 m, provided that the suction well has a capacity of not more than 0.03 m<sup>3</sup>.

**9.1.0.92 Emergency exit**

Spaces the entrances or exits of which are partly or fully immersed in damaged condition shall be provided with an emergency exit not less than 0.10 m above the waterline. This does not apply to forepeak and afterpeak.

**9.1.0.93 Stability (general)**

9.1.0.93.1 Proof of sufficient stability shall be furnished including stability in the damaged condition.

9.1.0.93.2 The basic values for the stability calculation - the vessel's lightweight and the location of the centre of gravity - shall be determined either by means of an inclining experiment or by detailed mass and moment calculation. In the latter case the lightweight shall be checked by means of a lightweight test with a resulting difference of not more than  $\pm 5\%$  between the mass determined by the calculation and the displacement determined by the draught readings.

9.1.0.93.3 Proof of sufficient intact stability shall be furnished for all stages of loading and unloading and for the final loading condition.

Floatability after damage shall be proved for the most unfavourable loading condition. For this purpose calculated proof of sufficient stability shall be established for critical intermediate stages of flooding and for the final stage of flooding. Negative values of stability in intermediate stages of flooding may be accepted only if the continued range of curve of righting lever in damaged condition indicates adequate positive values of stability.

**9.1.0.94 Stability (intact)**

9.1.0.94.1 The requirements for intact stability resulting from the damaged stability calculation shall be fully complied with.

9.1.0.94.2 For the carriage of containers, proof of sufficient stability shall also be furnished in accordance with the provisions of the regulations referred to [in the section].

9.1.0.94.3 The most stringent of the requirements of 9.1.0.94.1 and 9.1.0.94.2 above shall prevail for the vessel.

**9.1.0.95 Stability (damaged condition)**

9.1.0.95.1 The following assumptions shall be taken into consideration for the damaged condition:

(a) The extent of side damage is as follows:

longitudinal extent: at least 0.10 L, but not less than 5.00 m;  
transverse extent: 0.59 m;  
vertical extent: from the baseline upwards without limit.

(b) The extent of bottom damage is as follows:

longitudinal extent: at least 0.10 L, but not less than 5.00 m;  
transverse extent: 3.00 m;  
vertical extent: from the base 0.49 m upwards, the sump excepted.

- (c) Any bulkheads within the damaged area shall be assumed damaged, which means that the location of bulkheads shall be chosen so as to ensure that the vessel remains afloat after the flooding of two or more adjacent compartments in the longitudinal direction.

The following provisions are applicable:

- For bottom damage also two adjacent athwartships compartments shall be assumed as flooded.
- The lower edge of any openings that cannot be closed watertight (e.g. doors, windows, access hatchways) shall, at the final stage of flooding, be not less than 0.10 m above the damage waterline.
- In general, permeability shall be assumed to be 95%. Where an average permeability of less than 95% is calculated for any compartment, this calculated value may be used.

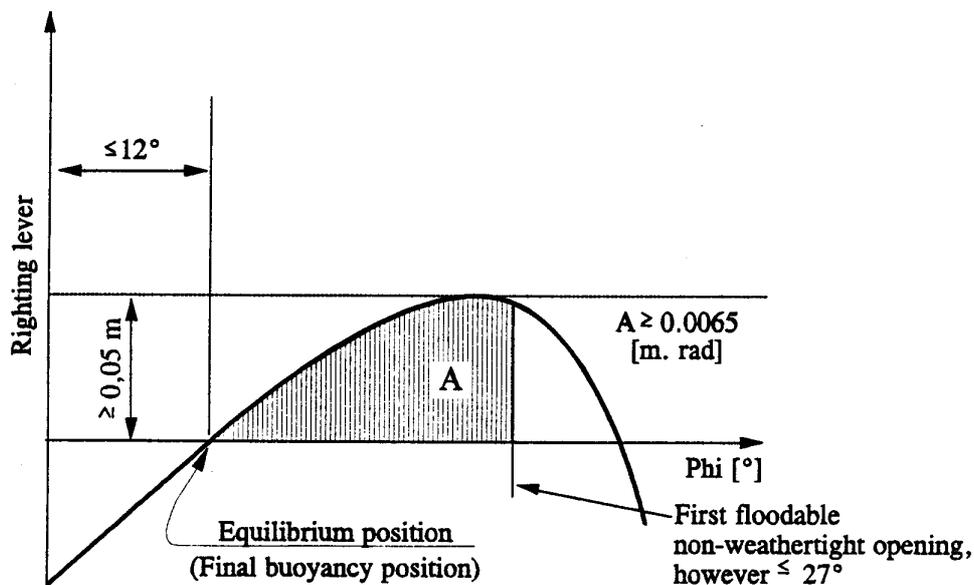
However, the following minimum values shall be used:

- |  |           |
|--|-----------|
| – engine rooms:  | 85%       |
| – accommodation:   | 95%       |
| – double bottoms, oil fuel tanks, ballast tanks, etc.,<br>depending on whether, according to their<br>function, they have to be assumed as full or<br>empty for the vessel floating at the maximum<br>permissible draught: | 0% or 95% |

For the main engine room only the one-compartment standard needs to be taken into account, i.e. the end bulkheads of the engine room shall be assumed as not damaged.

- 9.1.0.95.2 At the stage of equilibrium (final stage of flooding) the angle of heel shall not exceed 12°. Non-watertight openings shall not be immersed before reaching the stage of equilibrium. If such openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purpose of stability calculation.

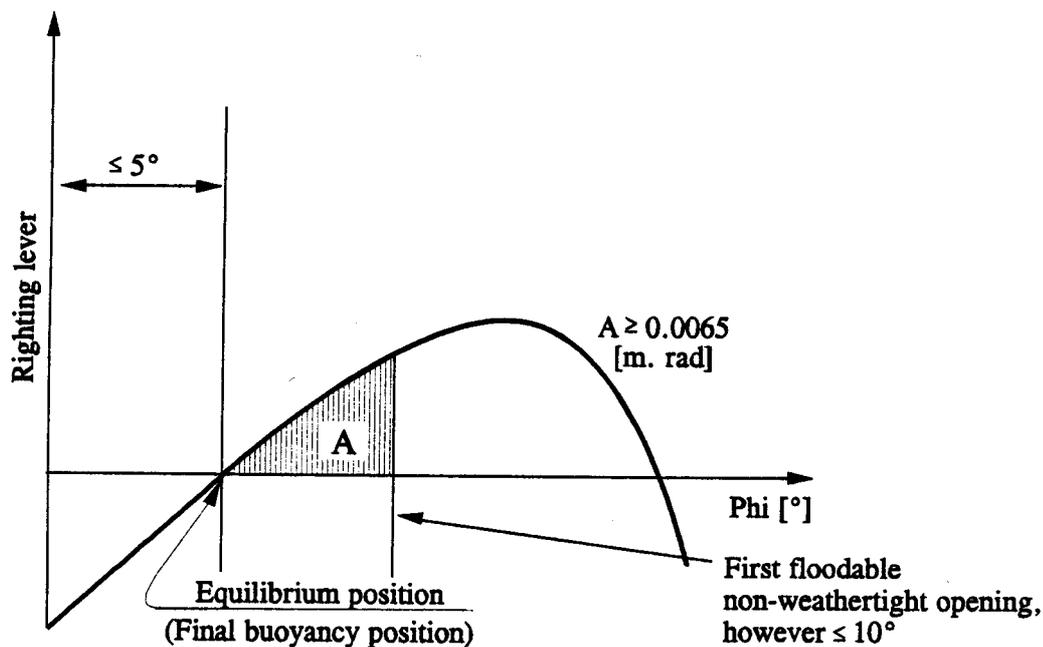
The positive range of the righting lever curve beyond the position of equilibrium shall have a righting lever of  $\geq 0.05$  m in association with an area under the curve of  $\geq 0.0065$  m.rad. The minimum values of stability shall be satisfied up to immersion of the first non-weather-tight opening and in any event up to an angle of heel  $\leq 27^\circ$ . If non-weather-tight openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purposes of stability calculation.



9.1.0.95.3 Inland navigation vessels carrying containers which have not been secured shall satisfy the following damage stability criteria.

At the stage of equilibrium (final stage of flooding) the angle of heel shall not exceed  $5^\circ$ . Non-watertight openings shall not be immersed before reaching the stage of equilibrium. If such openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purpose of stability calculation.

The positive range of the righting lever curve beyond the position of equilibrium shall have an area under the curve of  $\geq 0.0065$  m.rad. The minimum values of stability shall be satisfied up to immersion of the first non-weather-tight opening and in any event up to an angle of heel  $\leq 10^\circ$ . If non-weather-tight openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purposes of stability calculation.



9.1.0.95.4 If openings through which undamaged compartments may become additionally flooded are capable of being closed watertight, the closing devices shall be appropriately marked.

9.1.0.95.5 Where cross- or down-flooding openings are provided for reduction of unsymmetrical flooding, the time for equalization shall not exceed 15 minutes if during the intermediate stages of flooding sufficient stability has been proved.

9.1.0.96-  
9.1.0.99

[CHAPTER 9.2]

**RULES FOR CONSTRUCTION APPLICABLE TO SEAGOING  
VESSELS WHICH COMPLY WITH THE REQUIREMENTS OF  
THE SOLAS CONVENTION, CHAPTER II-2, REGULATION 54**

**9.2.0 Rules for construction applicable to seagoing vessels which comply with the requirements of the SOLAS Convention, Chapter II-2, Regulation 54**

[The requirements of 9.2.0.0 to 9.2.0.79 are applicable to seagoing vessels which comply with the requirements of the SOLAS Convention, Chapter II-2, Regulation 54.

Seagoing vessels which do not comply with the requirements of the SOLAS Convention, Chapter II-2, Regulation 54, shall comply with the requirements of 9.1.0.0 to 9.1.0.79.]

**9.2.0.0 Materials of construction**

The vessels hull shall be constructed of shipbuilding steel or other metal, provided that this metal has at least equivalent mechanical properties and resistance to the effects of temperature and fire.

**9.2.0.1-  
9.2.0.19**

**9.2.0.20 Water ballast**

The double-hull spaces and double bottoms may be arranged for being filled with water ballast.

**9.2.0.21-  
9.2.0.30**

**9.2.0.31 Engines**

9.2.0.31.1 Only internal combustion engines running on a fuel having a flashpoint above 60° C, are allowed.

9.2.0.31.2 Air intakes of the engines shall be located not less than 2.00 m from the protected area.

9.2.0.31.3 Sparking shall not be possible in the protected area.

**9.2.0.32-**

**9.2.0.33**

**9.2.0.34 Exhaust pipes**

9.2.0.34.1 Exhausts shall be evacuated from the vessel into the open-air either upwards through an exhaust pipe or through the shell plating. The exhaust outlet shall be located not less than 2.00 m from the hatchway openings. The exhaust pipes of engines shall be arranged so that the exhausts are led away from the vessel. The exhaust pipes shall not be located within the protected area.

9.2.0.34.2 Exhaust pipes shall be provided with a device preventing the escape of sparks, e.g. spark arresters.

**9.2.0.35-**

**9.2.0.40**

**9.2.0.41 Fire and naked light**

9.2.0.41.1 The outlets of funnels shall be located not less than 2.00 m from the hatchway openings. Arrangements shall be provided to prevent the escape of sparks and the entry of water.

9.2.0.41.2 Heating, cooking and refrigerating appliances shall not be fuelled with liquid fuels, liquid gas or solid fuels. The installation in the engine room or other separate space of heating appliances fuelled with liquid fuel having a flashpoint above 55° C shall, however, be permitted. Cooking and refrigerating appliances are permitted only in wheelhouses with metal floor and in the accommodation.

9.2.0.41.3 Electric lighting appliances only are permitted outside the accommodation and the wheelhouse.

**9.2.0.42-**

**9.2.0.70**

**9.2.0.71 Admittance on board**

The notice boards displaying the prohibition of admittance in accordance with 7.2.3.71 shall be clearly legible from either side of the vessel.

**9.2.0.72-**

**9.2.0.73**

**9.2.0.74 Prohibition of smoking, fire and naked light**

9.2.0.74.1 The notice boards displaying the prohibition of smoking in accordance with 7.2.3.74 shall be clearly legible from either side of the vessel.

9.2.0.74.2 Notice boards indicating the circumstances under which the prohibition applies shall be fitted near the entrances to the spaces where smoking or the use of fire or naked light is not always prohibited.

9.2.0.74.3 Ashtrays shall be provided close to each exit of the wheelhouse.

**9.2.0.75-**  
**9.2.0.79**

## ADDITIONAL RULES APPLICABLE TO DOUBLE-HULL VESSELS

### 9.2.0.80 *Additional rules applicable to double-hull vessels*

[The rules of 9.2.0.88 to 9.2.0.99 are applicable to double-hull vessels intended to carry dangerous goods of Classes 2, 3, 4.1, 5.2, 6.1, 7, 8 or 9, except those bearing label No. 1 in Chapter 3.2, Table A, column 5, in quantities exceeding those of 7.1.4.1.1.]

### 9.2.0.81- 9.2.0.87

### 9.2.0.88 **Classification**

9.2.0.88.1 Double-hull vessels intended to carry dangerous goods of Classes 2, 3, 4.1, 5.2, 6.1 [7], 8 or 9 except those bearing label No. 1 in Chapter 3.2, Table A, column 5, in quantities exceeding those referred to in 7.1.4.1, shall be built under survey of a recognized classification society in accordance with the rules established by that classification society to its highest class. This shall be confirmed by the classification society by the issue of an appropriate certificate.

9.2.0.88.2 The vessel's class shall be continued.

### 9.2.0.89- 9.2.0.90

### 9.2.0.91 **Holds**

9.2.0.91.1 The vessel shall be built as a double-hull vessel with double-wall spaces and double bottom within the protected area.

9.2.0.91.2 The distance between the sides of the vessel and the longitudinal bulkheads of the hold shall be not less than 0.80 m. A locally reduced distance at the vessel's ends shall be permitted, provided the smallest distance between vessel's side and the longitudinal bulkhead (measured perpendicular to the side) is not less than 0.60 m. The sufficient structural strength of the vessel (longitudinal, transverse and local strength) shall be confirmed by the class certificate.

9.2.0.91.3 The depth of the double bottom shall be not less than 0.50 m.

The depth below the suction wells may however be locally reduced to 0.40 m, provided the suction well has a capacity of not more than 0.03 m<sup>3</sup>.

**9.2.0.92**

**9.2.0.93 Stability (general)**

9.2.0.93.1 Proof of sufficient stability shall be furnished including stability in the damaged condition.

9.2.0.93.2 The basic values for the stability calculation - the vessel's lightweight and the location of the centre of gravity - shall be determined either by means of an inclining experiment or by detailed mass and moment calculation. In the latter case the lightweight shall be checked by means of a lightweight test with a resulting difference of not more than  $\pm 5\%$  between the mass determined by the calculation and the displacement determined by the draught readings.

9.2.0.93.3 Proof of sufficient intact stability shall be furnished for all stages of loading and unloading and for the final loading condition.

Floatability after damage shall be proved for the most unfavourable loading condition. For this purpose calculated proof of sufficient stability shall be established for critical intermediate stages of flooding and for the final stage of flooding. Negative values of stability in intermediate stages of flooding may be accepted only if the continued range of curve of righting lever in damaged condition indicates adequate positive values of stability.

**9.2.0.94 Stability (intact)**

9.2.0.94.1 The requirements for intact stability resulting from the damaged stability calculation shall be fully complied with.

9.2.0.94.2 For the carriage of containers, additional proof of sufficient stability shall be furnished in accordance with the requirements of the regulations referred to [in Part 1].

9.2.0.94.3 The most stringent of the requirements of 9.2.0.94.1 and 9.2.0.94.2 shall prevail for the vessel.

9.2.0.94.4 For seagoing vessels the provisions of 9.2.0.94.2 above may be regarded as having been complied with if the stability conforms to Resolutions [IMO A.749 (18)] and the stability documents have been checked by the competent authority. This applies only when all containers are secured as usual on seagoing vessels and a relevant stability document has been approved by the competent authority

**9.2.0.95 Stability (damaged condition)**

9.2.0.95.1 The following assumptions shall be taken into consideration for the damaged condition:

(a) The extent of side damage is as follows:

longitudinal extent: at least 0.10 L, but not less than 5.00 m;  
transverse extent: 0.59 m;  
vertical extent: from the baseline upwards without limit.

(b) The extent of bottom damage is as follows:

longitudinal extent: at least 0.10 L, but not less than 5.00 m;  
transverse extent: 3.00 m;  
vertical extent: from the base 0.49 m upwards, the sump excepted.

(c) Any bulkheads within the damaged area shall be assumed damaged, which means that the location of bulkheads shall be chosen so that the vessel will remain afloat after flooding of two adjacent compartments in the longitudinal direction.

The following provisions are applicable:

- For bottom damage, adjacent athwartship compartments shall also be assumed as flooded.
- The lower edge of any openings that cannot be closed watertight (e.g. doors, windows, access hatchways) shall, at the final stage of flooding, be not less than 0.10 m above the damage waterline.
- In general, permeability shall be assumed to be 95%. Where an average permeability of less than 95% is calculated for any compartment, this calculated value may be used.

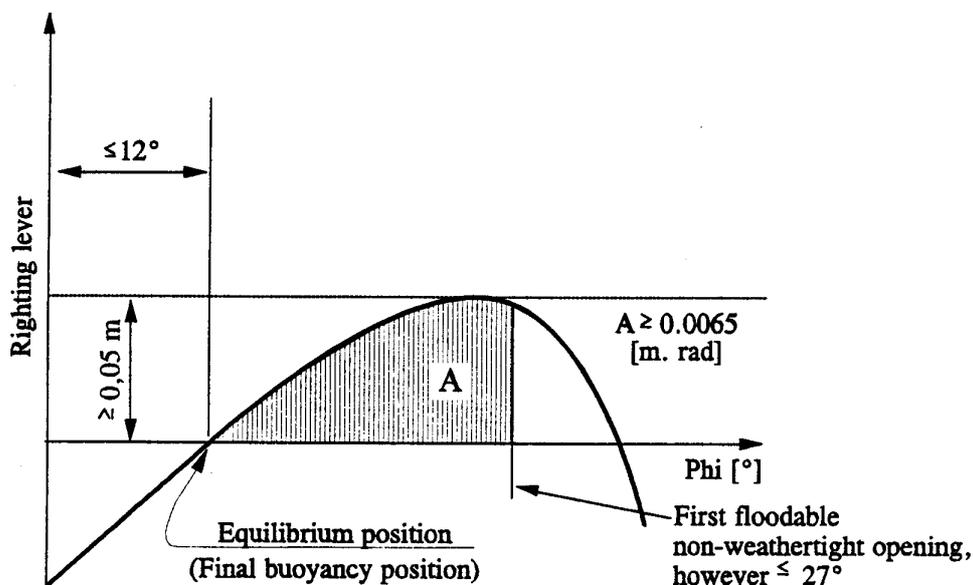
However, the following minimum values shall be used:

- |   |           |
|---|-----------|
| - engine rooms  | 85%       |
| - accommodation   | 95%       |
| - double bottoms, oil fuel tanks, ballast tanks, etc.,<br>depending on whether according to their function,<br>they have to be assumed as full or empty for the<br>vessel floating at the maximum permissible draught | 0% or 95% |

For the main engine room only the one-compartment standard needs to be taken into account. (Consequently, the end bulkheads of the engine room shall be assumed as not damaged.)

9.2.0.95.2 At the stage of equilibrium (final stage of flooding) the angle of heel shall not exceed  $12^\circ$ . Non-watertight openings shall not be immersed before reaching the stage of equilibrium. If such openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purpose of stability calculation.

The positive range of the righting lever curve beyond the position of equilibrium shall have a righting lever of  $\geq 0.05$  m in association with an area under the curve of  $\geq 0.0065$  m.rad. The minimum values of stability shall be satisfied up to immersion of the first non-weathertight opening and in any event up to an angle of heel  $\leq 27^\circ$ . If non-weathertight openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purposes of stability calculation.



9.2.0.95.3 If openings through which undamaged compartments may become additionally flooded are capable of being closed watertight, the closing devices shall be appropriately marked.

9.2.0.95.4 Where cross- or down-flooding openings are provided for reduction of unsymmetrical flooding, the time for equalization shall not exceed 15 minutes if during the intermediate stages of flooding sufficient stability has been proved.

**9.2.0.96-**  
**9.2.0.99**

[CHAPTER 9.3]

**RULES FOR CONSTRUCTION OF TANK VESSELS**

**9.3.1 Rules for construction of type G tank vessels**

[The provisions of 9.3.1.0 to 9.3.1.99 apply to type G tank vessels.]

**9.3.1.0 Materials of construction**

9.3.1.0.1 (a) The vessel's hull and the cargo tanks shall be constructed of shipbuilding steel or other at least equivalent metal.

The independent cargo tanks may also be constructed of other materials, provided these have at least equivalent mechanical properties and resistance against the effects of temperature and fire.

(b) Every part of the vessel including any installation and equipment which may come into contact with the cargo shall consist of materials which can neither be dangerously affected by the cargo nor cause decomposition of the cargo or react with it so as to form harmful or hazardous products.

9.3.1.0.2 Except where explicitly permitted in 9.3.1.0.3 below or in the certificate of approval, the use of wood, aluminium alloys or plastic materials within the cargo area is prohibited.

9.3.1.0.3 (a) The use of wood, aluminium alloys or plastic materials within the cargo area is only permitted for:

- gangways and external ladders;
- movable items of equipment;
- chocking of cargo tanks which are independent of the vessel's hull and chocking of installations and equipment;
- masts and similar round timber;
- engine parts;
- parts of the electrical installation;
- lids of boxes which are placed on the deck.

- (b) The use of wood or plastic materials within the cargo area is only permitted for:
  - supports and stops of any kind.
- (c) The use of plastic materials or rubber within the cargo area is only permitted for:
  - all kinds of gaskets (e.g. for dome or hatch covers);
  - electric cables;
  - hoses for loading and unloading;
  - insulation of cargo tanks and of hoses for loading and unloading.
- (d) All permanently fitted materials in the accommodation or wheelhouse, with the exception of furniture, shall not readily ignite. They shall not evolve fumes or toxic gases in dangerous quantities, if involved in a fire.

9.3.1.0.4 The paint used in the cargo area shall not be liable to produce sparks in case of impact.

9.3.1.0.5 The use of plastic material for vessel's boats is permitted only if the material does not readily ignite.

**9.3.1.1-  
9.3.1.7**

**9.3.1.8 Classification**

9.3.1.8.1 The tank vessel shall be built under survey of a recognized classification society in accordance with the rules established by that classification society for its highest class, and the tank vessel shall be classed accordingly.

The vessel's class shall be continued.

9.3.1.8.2 The cargo pump-rooms shall be inspected by a recognized classification society whenever the certificate of approval has to be renewed as well as during the third year of validity of the certificate of approval. The inspection shall comprise at least:

- an inspection of the whole system for its condition, for corrosion, leakage or conversion works which have not been approved;
- a checking of the condition of the gas detection system in the cargo pump-rooms.

Inspection certificates signed by the recognized classification society with respect to the inspection of the cargo pump-rooms shall be kept on board. The inspection certificates shall at least include particulars of the above inspection and the results obtained as well as the date of the inspection.

- 9.3.1.8.3 The condition of the gas detection system referred to in 9.3.1.52.3 (b) shall be checked by a recognized classification society whenever the certificate of approval has to be renewed and during the third year of validity of the certificate of approval. A certificate signed by the recognized classification society shall be kept on board.

### **9.3.1.9**

### **9.3.1.10 Protection against the penetration of gases**

- 9.3.1.10.1 The vessel shall be designed so as to prevent gases from penetrating into the accommodation and the service spaces.

- 9.3.1.10.2 The lower edges of door-openings in the sidewalls of superstructures and the coamings of access hatches to under-deck spaces shall have a height of not less than 0.50 m above the deck

This requirement need not be complied with if the wall of the superstructures facing the cargo area extends from one side of the ship to the other and has doors the sills of which have a height of not less than 0.50 m. The height of this wall shall not be less than 2.00 m. In this case, the lower edges of door-openings in the sidewalls of superstructures and the coamings of access hatches behind this wall shall have a height of not less than 0.10 m. The sills of engine room doors and access hatches shall, however, always have a height of not less than 0.50 m.

- 9.3.1.10.3 The bulwarks, foot-rails, etc shall be provided with sufficiently large openings which are located directly above the deck.

**9.3.1.11 Hold spaces and cargo tanks**

- 9.3.1.11.1 (a) The maximum permissible capacity of a cargo tank shall be determined in accordance with the following table:

$L \cdot B \cdot H$ (m <sup>3</sup> )	Maximum permissible capacity of a cargo tank (m <sup>3</sup> )
up to 600	$L \cdot B \cdot H \cdot 0.3$
600 to 3 750	$180 + (L \cdot B \cdot H - 600) 0.0635$
> 3 750	380

In the table above  $L \cdot B \cdot H$  is the product of the main dimensions of the tank vessel in metres (according to the measurement certificate), where:

L = overall length of the hull;

B = extreme breadth of the hull;

H = shortest vertical distance between the top of the keel and the lowest point of the deck at the side of the vessel (moulded depth) within the cargo area;

For trunk vessels, H shall be replaced by H', where H' shall be obtained from the following formula:

$$H' = H + (ht \cdot bt/B \cdot lt/L)$$

where:

ht = trunk height (distance between trunk deck and main deck measured on trunk side at L/2);

bt = trunk breadth;

lt = trunk length;

- (b) Pressure cargo tanks whose ratio of length to diameter exceeds 7 are prohibited.
- (c) The pressure cargo tanks shall be designed for a cargo temperature of + 40° C.

9.3.1.11.2 (a) In the cargo area, the hull shall be designed as follows:\*

- as a double-hull and double bottom vessel. The internal distance between the sideplatings of the vessel and the longitudinal bulkheads shall not be less than 0.80 m, the height of the double bottom shall be not less than 0.60 m, the cargo tanks shall be supported by saddles extending between the tanks to not less than 20° below the horizontal centreline of the cargo tanks.

Refrigerated cargo tanks shall be installed only in hold spaces bounded by double-hull spaces and double-bottom. Cargo tank fastenings shall meet the requirements of a recognized classification society;

or:

- as a single-hull vessel with the sideplatings of the vessel between gangboard and top of floor plates provided with side stringers at regular intervals of not more than 0.60 m which are supported by web frames spaced at intervals of not more than 2.00 m. The side stringers and the web frames shall have a height of not less than 10% of the depth, however, not less than 0.30 m. The side stringers and web frames shall be fitted with a face plate made of flat steel and having a cross-section of not less than 7.5 cm<sup>2</sup> and 15 cm<sup>2</sup>, respectively.

The distance between the sideplating of the vessel and the cargo tanks shall be not less than 0.80 m and between the bottom and the cargo tanks not less than 0.60 m. The depth below the suction wells may be reduced to 0.50 m.

The lateral distance between the suction well of the cargo tanks and the bottom structure shall be not less than 0.10 m.

The cargo tank supports and fastenings shall be as follows:

- the cargo tanks shall be supported by saddles extending between the tanks to not less than 10° below the horizontal centreline of the tanks; and
- for adjacent cylindrical cargo tanks, a spacer of 500 mm x 450 mm shall be provided at the saddles, and a spacer of 2,000 mm x 450 mm shall be provided midway between the saddles.

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\* For a different design of the hull in the cargo area, proof shall be furnished by way of calculation that in the event of a lateral collision with another vessel having a straight bow, an energy of 22 MJ can be absorbed without any rupture of the cargo tanks and the piping leading to the cargo tanks.

The spacers shall fit the adjacent cargo tanks closely.

The spacers shall consist of an energy-absorbing material.

- (b) The cargo tanks shall be fixed so that they cannot float.
  - (c) The capacity of a suction well shall be limited to not more than 0.10 m<sup>3</sup>. For pressure cargo tanks, however, the capacity of a suction well may be of 0.20 m<sup>3</sup>.
  - (d) Side-stringers linking or supporting the load-bearing components of the sides of the vessel with the load-bearing components of the longitudinal walls of cargo tanks and side-stringers linking the load-bearing components of the vessel's bottom with the tank-bottom are prohibited.
- 9.3.1.11.3
- (a) The hold spaces shall be separated from the accommodation and service spaces outside the cargo area below deck by bulkheads provided with a Class A-60 fire protection insulation according to SOLAS Chapter II-2, Regulation 3. A space of not less than 0.20 m shall be provided between the cargo tanks and the end bulkheads of the hold spaces. Where the cargo tanks have plane end bulkheads this space shall be not less than 0.50m.
  - (b) The hold spaces and cargo tanks shall be capable of being inspected.
  - (c) All spaces in the cargo area shall be capable of being ventilated. Means for checking their gas-free condition shall be provided.
- 9.3.1.11.4
- The bulkheads bounding the hold spaces shall be watertight. The cargo tanks and the end bulkheads of the hold spaces as well as the bulkheads bounding the cargo area shall have no openings or penetrations below deck. Penetrations through bulkheads between two hold spaces are, however, permitted. The bulkhead between the engine room and the service spaces within the cargo area or between the engine room and a hold space may be fitted with penetrations provided that they conform to the requirements of 9.3.1.17.5.
- 9.3.1.11.5
- Double-hull spaces and double bottoms in the cargo area shall be arranged for being filled with ballast water only. Double bottoms may, however, be used as oil fuel tanks, provided they comply with the requirements of 9.3.1.32.
- 9.3.1.11.6
- (a) A space in the cargo area below deck may be arranged as a service space, provided that the bulkhead bounding the service space extends vertically to the bottom and the bulkhead not facing the cargo area extends from one side of the vessel to the other in one frame plane. This service space shall only be accessible from the deck.

- (b) The service space shall be watertight with the exception of its access hatches and ventilation inlets.
- (c) No pipes for loading or unloading shall be fitted within the service space referred to under (a) above.

Pipes for loading and unloading may be fitted in the cargo pump-rooms below deck only when they conform to the provisions of 9.3.1.17.6.

9.3.1.11.7 Where service spaces are located in the cargo area under deck, they shall be arranged so as to be easily accessible and to permit persons wearing protective clothing and breathing apparatus to safely operate the service equipment contained therein. They shall be designed so as to allow injured or unconscious personnel to be removed from such spaces without difficulty, if necessary by means of fixed equipment.

9.3.1.11.8 Hold spaces and other accessible spaces within the cargo area shall be arranged so as to ensure that they may be completely inspected and cleaned in an appropriate manner. The dimensions of openings, except for those of double-hull spaces and double bottoms which do not have a wall adjoining the cargo tanks, shall be sufficient to allow a person wearing breathing apparatus to enter or leave the space without difficulty. These openings shall have a minimum cross-sectional area of 0.36 m<sup>2</sup> and a minimum side length of 0.50 m. They shall be designed so as to allow injured or unconscious personnel to be removed from the bottom of such spaces without difficulties, if necessary by means of fixed equipment.

In these spaces the distance between the reinforcements shall not be less than 0.50 m. In double bottoms this distance may be reduced to 0.45 m.

Cargo tanks may have circular openings with a diameter of not less than 0.68 m.

#### **9.3.1.12 Ventilation**

9.3.1.12.1 Each hold space shall have two openings the dimensions and location of which shall be such as to permit effective ventilation of any part of the hold space. If there are no such openings, it shall be possible to fill the hold spaces with inert gas or dry air.

9.3.1.12.2 Double-hull spaces and double bottoms within the cargo area which are not arranged for being filled with ballast water and cofferdams between engine rooms and pump-rooms, if they exist, shall be provided with ventilation systems.

9.3.1.12.3 Any service spaces located in the cargo area below deck shall be provided with a system of forced ventilation with sufficient power for ensuring at least 20 changes of air per hour based on the volume of the space. The ventilator fan shall be designed so as that no spark may be emitted on contact of the impeller blades with the housing and no static electricity may be generated.

The ventilation exhaust ducts shall extend down to 50 mm above the bottom of the service space. The air shall be supplied through a duct at the top of the service space. The air inlets shall be located not less than 2.00 m above the deck, at a distance of not less than 2.00 m from tank openings and 6.00 m from the outlets of safety valves.

The extension pipes, which may be necessary, may be of the hinged type.

- 9.3.1.12.4 Ventilation of accommodation and service spaces shall be possible.
- 9.3.1.12.5 Ventilators used for gas-freeing of cargo tanks shall be designed so that no sparks may be emitted on contact of the impeller blades with the housing and no static electricity may be generated.
- 9.3.1.12.6 Notice boards shall be fitted at the ventilation inlets indicating the conditions when they shall be closed. All ventilation inlets of accommodation and service spaces leading outside shall be fitted with fire flaps. Such ventilation inlets shall be located not less than 2.00 m from the cargo area.

Ventilation inlets of service spaces in the cargo area below deck may be located within such area.

### **9.3.1.13 Stability (general)**

- 9.3.1.13.1 Proof of sufficient stability shall be furnished including for stability in damaged condition.
- 9.3.1.13.2 The basic values for the stability calculation - the vessel's lightweight and location of the centre of gravity - shall be determined either by means of an inclining experiment or by detailed mass and moment calculation. In the latter case the lightweight of the vessel shall be checked by means of a lightweight test with a tolerance limit of  $\pm 5\%$  between the mass determined by calculation and the displacement determined by the draught readings.
- 9.3.1.13.3 Proof of sufficient intact stability shall be furnished for all stages of loading and unloading and for the final loading condition.

Floatability after damage shall be proved for the most unfavourable loading condition. For this purpose, calculated proof of sufficient stability shall be established for critical intermediate stages of flooding and for the final stage of flooding. Negative values of stability in intermediate stages of flooding may be accepted only if the continued range of curve of righting lever in damaged condition indicates adequate positive values of stability.

**9.3.1.14 Stability (intact)**

The requirements for intact stability resulting from the damaged stability calculation shall be fully complied with.

**9.3.1.15 Stability (damaged condition)**

9.3.1.15.1 The following assumptions shall be taken into consideration for the damaged condition:

(a) The extent of side damage is as follows:

longitudinal extent: at least 0.10 L, but not less than 5.00 m;  
 transverse extent: 0.79 m;  
 vertical extent: from the base line upwards without limit.

(b) The extent of bottom damage is as follows:

longitudinal extent: at least 0.10 L, but not less than 5.00 m;  
 transverse extent: 3.00 m;  
 vertical extent: from the base 0.59 m upwards, the well excepted.

(c) Any bulkheads within the damaged area shall be assumed damaged, which means that the location of bulkheads shall be chosen so as to ensure that the vessel remains afloat after the flooding of two or more adjacent compartments in the longitudinal direction.

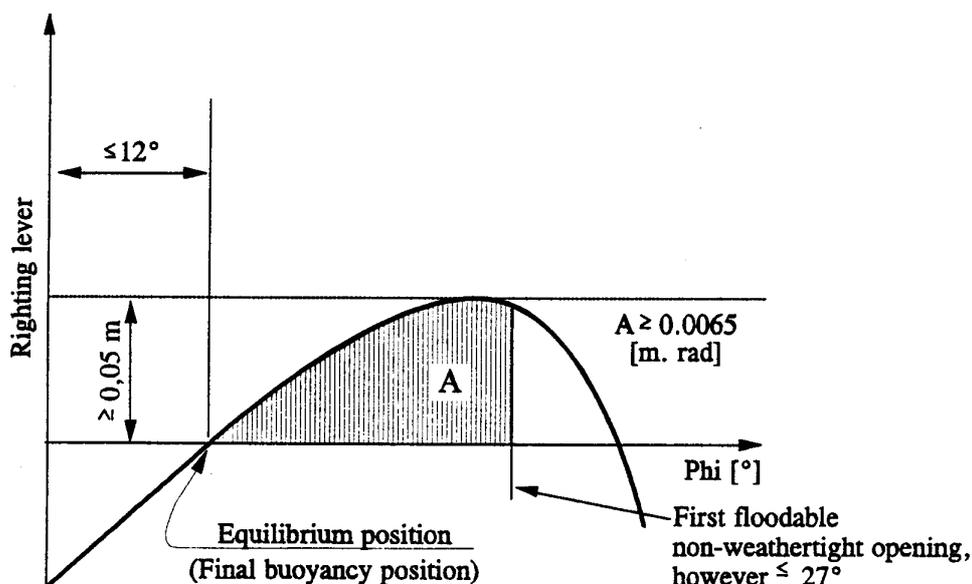
The following provisions are applicable:

- For bottom damage, adjacent athwartship compartments shall also be assumed as flooded;
- The lower edge of any non-watertight openings (e.g. doors, windows, access hatchways) shall, at the final stage of flooding, be not less than 0.10 m above the damage waterline;
- In general, permeability shall be assumed to be 95%. Where an average permeability of less than 95% is calculated for any compartment, this calculated value obtained may be used. However, the following minimum values shall be used:
  - engine rooms: 85%
  - accommodation: 95%
  - double bottoms, oil fuel tanks, ballast tanks, etc., depending on whether, according to their function, they have to be assumed as full or empty for the vessel floating at the maximum permissible draught: 0% or 95%.

For the main engine room only the one-compartment standard need be taken into account, i.e. the end bulkheads of the engine room shall be assumed as not damaged.

9.3.1.15.2 At the stage of equilibrium (final stage of flooding), the angle of heel shall not exceed  $12^\circ$ . Non-watertight openings shall not be flooded before reaching the stage of equilibrium. If such openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purpose of stability calculation.

The positive range of the righting lever curve beyond the stage of equilibrium shall have a righting level of  $\geq 0.05$  m in association with an area under the curve of  $\geq 0.0065$  m.rad. The minimum values of stability shall be satisfied up to immersion of the first non-weather-tight opening and in any event up to an angle of heel  $\leq 27^\circ$ . If non-watertight openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purpose of stability calculation.



9.3.1.15.3 If openings through which undamaged compartments may additionally become flooded are capable of being closed watertight, the closing appliances shall be marked accordingly.

9.3.1.15.4 When cross- or down-flooding openings are provided for reduction of unsymmetrical flooding, the time for equalization shall not exceed 15 minutes, if during the intermediate stages of flooding sufficient stability has been proved.

**9.3.1.16 Engine rooms**

9.3.1.16.1 Internal combustion engines for the vessel's propulsion as well as internal combustion engines for auxiliary machinery shall be located outside the cargo area. Entrances and other openings of engine rooms shall be at a distance of not less than 2.00 m from the cargo area.

9.3.1.16.2 The engine room shall be accessible from the deck; the entrances shall not face the cargo area. When the doors are not located in a recess whose depth is at least equal to the door width, the hinges shall face the cargo area.

**9.3.1.17 Accommodation and service spaces**

9.3.1.17.1 Accommodation spaces and the wheelhouse shall be located outside the cargo area forward of the fore vertical plane or abaft the aft vertical plane bounding the part of cargo area below deck. Windows of the wheelhouse which are located not less than 1.00 m above the bottom of the wheelhouse may tilt forward.

9.3.1.17.2 Entrances to spaces and openings of superstructures shall not face the cargo area. Doors opening outward and not located in a recess the depth of which is at least equal to the width of the doors shall have their hinges facing the cargo area.

9.3.1.17.3 Entrances from the deck and openings of spaces facing the weather shall be capable of being closed. The following instruction shall be displayed at the entrance of such spaces:

**DO NOT OPEN DURING LOADING, UNLOADING OR GAS-FREEING  
WITHOUT PERMISSION FROM THE MASTER.  
CLOSE IMMEDIATELY.**

9.3.1.17.4 Entrances and windows of superstructures and accommodation spaces which can be opened as well as other openings of these spaces shall be located not less than 2.00 m from the cargo area. No wheelhouse doors and windows shall be located within 2.00 m from the cargo area, except where there is no direct connection between the wheelhouse and the accommodation.

- 9.3.1.17.5
- (a) Driving shafts of the bilge or ballast pumps may penetrate through the bulkhead between the service space and the engine room, provided the arrangement of the service space is in compliance with 9.3.1.11.6.
  - (b) The penetration of the shaft through the bulkhead shall be gastight and shall have been approved by a recognized classification society.
  - (c) The necessary operating instructions shall be displayed.

- (d) Penetrations through the bulkhead between the engine room and the service space in the cargo area, and the bulkhead between the engine room and the hold spaces may be provided for electrical cables, hydraulic lines and piping for measuring, control and alarm systems, provided that the penetrations have been approved by a recognized classification society. The penetrations shall be gastight. Penetrations through a bulkhead with an "A-60" fire protection insulation according to SOLAS II-2, Regulation 3, shall have an equivalent fire protection.
- (e) Pipes may pass through the bulkhead between the engine room and the service space in the cargo area provided that these are pipes between the mechanical equipment in the engine room and the service space which do not have any openings within the service space and which are provided with shut-off devices at the bulkhead in the engine room.
- (f) Pipes from the engine room may pass through the service space in the cargo area or a hold space to the outside provided that within the service space or hold space they are of the thick-walled type and have no flanges or openings.
- (g) Where a driving shaft of auxiliary machinery penetrates through a wall located above the deck the penetration shall be gastight.

9.3.1.17.6 A service space located within the cargo area below deck shall not be used as a cargo pump-room for the vessel's own gas discharging system, e.g. compressors or the compressor/heat exchanger/pump combination, except where:

- the pump-room is separated from the engine room or from service spaces outside the cargo area by a cofferdam or a bulkhead with an "A-60" fire protection insulation according to SOLAS Chapter II-2, Regulation 3, or by a service space or a hold space;
- the "A-60" bulkhead required above does not include penetrations referred to in 9.3.1.17.5 (a);
- ventilation exhaust outlets are located not less than 6.00 m from entrances and openings of the accommodation and service spaces;
- the access hatches and ventilation inlets can be closed from the outside;
- all pipes for loading and unloading (at the suction side and delivery side) are led through the deck above the pump-room. The necessary operation of the control devices in the pump-room, starting of pumps or compressors and control of the liquid flow rate shall be effected from the deck;
- the system is fully integrated in the gas and liquid piping system;

- the cargo pump-room is provided with a permanent gas detection system which automatically indicates the presence of explosive gases or lack of oxygen by means of direct-measuring sensors and which actuates a visual and audible alarm when the gas concentration has reached 20% of the lower explosive limit. The sensors of this system shall be placed at suitable positions at the bottom and directly below the deck.

Measurement shall be continuous;

- the audible and visual alarms are installed in the wheelhouse and in the cargo pump-room and, when the alarm is actuated, the loading and unloading system is shut down. Failure of the gas detection system shall be immediately signalled in the wheelhouse and on deck by means of audible and visual alarms;
- the ventilation system prescribed in 9.3.1.12.3 has a capacity of not less than 30 changes of air per hour based on the total volume of the service space.

9.3.1.17.7 The following instruction shall be displayed at the entrance of the cargo pump-room:

**BEFORE ENTERING THE CARGO PUMP-ROOM CHECK WHETHER  
IT IS FREE FROM GASES AND CONTAINS SUFFICIENT OXYGEN  
DO NOT OPEN DOORS AND ENTRANCE OPENINGS WITHOUT  
THE PERMISSION OF THE MASTER.  
LEAVE IMMEDIATELY IN THE EVENT OF ALARM.**

**9.3.1.18-**

**9.3.1.20**

**9.3.1.21 Safety and control installations**

9.3.1.21.1 Cargo tanks shall be provided with the following equipment:

- (a) (reserved);
- (b) a level gauge;
- (c) a level alarm device which is activated at the latest when a degree of filling of 86% is reached;
- (d) a high level sensor for actuating the facility against overflowing at the latest when a degree of filling of 97.5% is reached;

- (e) an instrument for measuring the pressure;
- (f) an instrument for measuring the temperature of the cargo [if a possibility of heating the cargo is required in Chapter 3.2, Table C, column 9 or if a maximum temperature is indicated in column 20];
- (g) a nozzle with a closure connected to a sampling device of the closed type;
- (h) (reserved).

9.3.1.21.2 When the degree of filling in per cent is determined, an error of not more than 0.5% is permitted. It shall be calculated on the basis of the total cargo tank capacity including the expansion trunk.

9.3.1.21.3 The level gauge shall allow readings from the control position of the shut-off devices of the particular cargo tank.

9.3.1.21.4 The level alarm device shall give a visual and audible warning on board when actuated. The level alarm device shall be independent of the level gauge.

9.3.1.21.5 The high level sensor referred to in 9.3.1.21.1 (d) shall give a visual and audible alarm on board and at the same time actuate an electrical contact which in the form of a binary signal interrupts the electric current loop provided and fed by the shore facility, thus initiating measures at the shore facility against overflowing during loading operations.

The signal shall be transmitted to the shore facility via a watertight two-pin plug of a connector device in accordance with IEC Publication No. 309 for direct current of 40 to 50 volts, identification colour white, position of the nose 10 h.

The plug shall be permanently fitted to the vessel close to the shore connections of the loading and unloading pipes.

The high level sensor shall also be capable of switching off the vessel's own discharging pump.

The high level sensor shall be independent of the level alarm device, but it may be connected to the level gauge.

9.3.1.21.6 The visual and audible signals given by the level alarm device shall be clearly distinguishable from those of the high level sensor.

The visual alarm shall be visible at each control position on deck of the cargo tank stop valves. It shall be possible to easily check the functioning of the sensors and electric circuits or these shall be of the "failsafe" design.

9.3.1.21.7 When the pressure or the temperature exceeds a set value, the instruments for measuring the pressure and the temperature of the cargo shall activate a visual and an audible alarm in the wheelhouse. When the wheelhouse is unoccupied the alarm shall also be perceptible in a location occupied by a crew member. When the pressure exceeds a set value during loading or unloading, the instrument for measuring the pressure shall simultaneously initiate an electrical contact which, by means of the plug referred to in 9.3.1.21.5 above, enables measures to be taken to interrupt the loading operation. When the vessel's own discharge pump is used, it shall be switched off automatically. The sensor for the alarms referred to above may be connected to the alarm installation. If the overpressure or the vacuum measurement is effected using a manometer, its indicator scale shall not be less than 0.14 m in diameter. The maximum permissible overpressure or vacuum values shall be indicated by a red mark. The manometers shall be capable of being read at all times from the location where it is possible to interrupt loading or unloading.

9.3.1.21.8 Where the control elements of the shut-off devices of the cargo tanks are located in a control room, reading of the level gauges shall be possible in the control room and the visual and audible warning given by the level alarm device, the high level sensor referred to in 9.3.2.21.1 (d) and the instruments for measuring the pressure and temperature of the cargo shall be noticeable in the control room and on deck.

Satisfactory monitoring of the cargo area shall be ensured from the control room.

9.3.1.21.9 The closed sampling device penetrating through the boundary of the cargo tank but constituting a part of a closed system shall be designed so that during sampling no gas or liquid may escape from the cargo tank. The device shall be of a type approved by the competent authority for this purpose.

[9.3.1.21.10 The vessel shall be so equipped that loading or unloading operations can be interrupted by means of a switch, i.e. the quick-action stop valve located on the flexible vessel-to-shore connecting line must be capable of being closed. The switch shall be placed at the two points on the vessel (fore and aft).

The interruption systems shall be designed according to the quiescent current principle.]

### **9.3.1.22 Cargo tank openings**

9.3.1.22.1 Cargo tank openings shall be located on deck in the cargo area.

9.3.1.22.2 Cargo tank openings shall be fitted with gastight closures capable of withstanding the test pressure in accordance with 9.3.1.23.1.

9.3.1.22.3 The exhaust outlets of the pressure relief valves shall be located not less than 2.00 m above the deck at a distance of not less than 6.00 m from the accommodation and from the service spaces located outside the cargo area. This height may be reduced when within a radius of 1.00 m round the pressure relief valve outlet there is no equipment, no work is being carried out and signs indicate the area.

[9.3.1.22.4 The closing devices normally used in loading and unloading operations shall not be capable of producing sparks when operated.]

### **9.3.1.23 Pressure test**

9.3.1.23.1 Cargo tanks and pipes for loading and unloading shall comply with the provisions concerning pressure vessels which have been established by the competent authority or a recognized classification society for the substances carried.

The test pressure of refrigerated cargo tanks shall be not less than 25 kPa (0.25 bar) gauge pressure.

9.3.1.23.2 Any cofferdams shall be subjected to initial tests before being put into service and thereafter at the prescribed intervals.

The test pressure shall be not less than 10 kPa (0.10 bar) gauge pressure.

9.3.1.23.3 The maximum intervals for the periodic tests referred to in paragraph (2) above shall be 11 years.

### **9.3.1.24**

### **9.3.1.25 Pumps and piping**

9.3.1.25.1 Pumps, compressors and accessory loading and unloading piping shall be placed in the cargo area. Cargo pumps and compressors shall be capable of being shut down from the cargo area and, in addition, from a position outside the cargo area. Cargo pumps and compressors situated on deck shall be located not less than 6.00 m from entrances to, or openings of, the accommodation and service spaces outside the cargo area.

9.3.1.25.2 (a) Pipes for loading and unloading shall be independent of any other piping of the vessel. No cargo piping shall be located below deck, except those inside the cargo tanks and in the service spaces intended for the installation of the vessel's own gas discharging system.

(b) (reserved)

- (c) Pipes for loading and unloading shall be clearly distinguishable from other piping, e.g. by means of colour marking.
- (d) The pipes for loading and unloading on deck, the vapour pipes with the exception of the shore connections but including the safety valves, and the valves shall be located within the longitudinal line formed by the outer boundaries of the domes and not less than one quarter of the vessel's breadth from the outer shell. This requirement does not apply to the relief pipes situated behind the safety valves. If there is, however, only one dome athwartships, these pipes and their valves shall be located at a distance not less than 2.70 m from the shell.

Where cargo tanks are placed side by side, all the connections to the domes shall be located on the inner side of the domes. The external connections may be located on the fore and aft centre line of the dome. The shut-off devices shall be located directly at the dome or as close as possible to it. The shut-off devices of the loading and unloading piping shall be duplicated, one of the devices being constituted by a remote-controlled quick-action stop device. When the inside diameter of a shut-off device is less than 50 mm this device may be regarded as a safety device against bursts in the piping.

- (e) The shore connections shall be located not less than 6.00 m from the entrances to or openings of, the accommodation and service spaces outside the cargo area.
- (f) Each shore connection of the vapour pipe and shore connections of the pipes for loading and unloading, through which the loading or unloading operation is carried out, shall be fitted with a shut-off device and a quick-action stop valve. However, each shore connection shall be fitted with a blind flange when it is not in operation.

9.3.1.25.3 The distance referred to in 9.3.1.25.1 and 9.3.1.25.2 (e) may be reduced to 3.00 m if a transverse bulkhead complying with 9.3.1.10.2 is situated at the end of the cargo area. The openings shall be provided with doors. The following notice shall be displayed on the doors:

**DO NOT OPEN DURING LOADING AND UNLOADING WITHOUT  
THE PERMISSION OF THE MASTER.  
CLOSE IMMEDIATELY.**

9.3.1.25.4 Every component of the pipes for loading and unloading shall be electrically connected to the hull.

9.3.1.25.5 The stop valves or other shut-off devices of the pipes for loading and unloading shall indicate whether they are open or shut.

9.3.1.25.6 The pipes for loading and unloading shall have, at the test pressure, the required elasticity, leakproofness and resistance to pressure, [the latter calculated as the working pressure multiplied by the safety coefficient].

9.3.1.25.7 The pipes for loading and unloading shall be fitted with pressure gauges at the inlet and outlet of the vessel's own gas discharging system.

Where these pressure gauges are manometers, the indicator scale shall have a diameter of not less than 0.14 m.

Reading of the pressure gauges shall be possible from the control position of the vessel's own gas discharging system. The maximum permissible overpressure or vacuum shall be indicated by a red mark.

9.3.1.25.8 Use of the cargo piping for ballasting purposes shall not be possible.

### **9.3.1.26**

#### **9.3.1.27 Cargo refrigeration systems**

9.3.1.27.1 When refrigeration is required in [in Chapter 3.2, Table C, column 9], the list of substances of Appendix 4, the vessel shall be provided with two independent refrigeration systems:

- (a) The capacity of the cargo refrigeration systems shall be such that, in the event of the failure of one system, the remaining system may maintain the temperature of the cargo at such a value that gas cannot escape through safety devices;
- (b) If the systems are operated electrically, they shall be connected to two electric circuits which are independent of each other and which are supplied by at least two different sources of electrical power. In addition, there shall be a possibility for connection to a power source on shore; the necessary connecting cable shall be available on board;
- (c) Cargo tanks, piping and accessories shall be insulated so that, in the event of a failure of all cargo refrigeration systems, the entire cargo remains for at least 52 hours in a condition not causing the safety valves to open.

This provision shall be satisfied in the following ambience temperature conditions:

air temperature:	+30° C
water temperature:	+20° C;

- (d) The cargo refrigeration systems shall be arranged so that their function can be taken over by a third system independent of the vessel.

9.3.1.27.2 The safety devices and the connecting lines from the refrigeration system shall be connected to the cargo tanks above the liquid phase of the cargo when the tanks are filled to their maximum permissible degree of filling. They shall remain within the gaseous phase, even if the vessel has a list up to 12 degrees.

9.3.1.27.3 The cargo refrigeration system shall be installed in a separate service space provided with forced mechanical ventilation.

9.3.1.27.4 For all cargo systems, the heat transmission coefficient shall be determined by calculation. The correctness of the calculation shall be checked by means of a refrigeration test (heat balance test).

This test shall be performed in accordance with the rules set up by a recognized classification society.

9.3.1.27.5 A certificate from a recognized classification society stating that [9.3.1.27.1 and 9.3.1.27.4] above have been complied with shall be submitted together with the application for issue or renewal of the certificate of approval.

### **9.3.1.28 Water-spray system**

When water-spraying is required [in Chapter 3.2, Table C, column 9] a water-spray system shall be installed in the cargo area on deck for the purpose of reducing vapours given off by the cargo [by spraying water over the whole surface].

The system shall be fitted with a connection device for supply from the shore. The system shall be capable of being put into operation from the wheelhouse and from the deck. The capacity of the water-spray system shall be such that when all the spray nozzles are in operation, the outflow is of 50 litres per square metre of cargo deck area and per hour.

### **9.3.1.29-**

### **9.3.1.30**

### **9.3.1.31 Engines**

9.3.1.31.1 Only internal combustion engines running on fuel with a flashpoint of more than 55° C are allowed.

9.3.1.31.2 Ventilation inlets of the engine room and, when the engines do not take in air directly from the engine room, the air intakes of the engines shall be located not less than 2.00 m from the cargo area.

- 9.3.1.31.3 Sparking shall not be possible within the cargo area.
- 9.3.1.31.4 The surface temperature of the outer parts of engines used during loading or unloading operations, as well as that of their air inlets and exhaust ducts shall not exceed the allowable temperature according to the temperature class. This provision does not apply to engines installed in service spaces provided the provisions of 9.3.1.52.3 (b) are fully complied with.
- 9.3.1.31.5 The ventilation in the closed engine room shall be designed so that, at an ambient temperature of 20° C, the average temperature in the engine room does not exceed 40° C.

**9.3.1.32 Oil fuel tanks**

- 9.3.1.32.1 Double bottoms within the cargo area may be arranged as oil fuel tanks, provided their depth is not less than 0.60 m.

Oil fuel pipes and openings of such tanks are not permitted in the hold space.

- 9.3.1.32.2 Open ends of air pipes of all oil fuel tanks shall extend to [not less than] 0.5 m above the open deck. The open ends and the open ends of overflow pipes leading on the deck shall be fitted with a protective device consisting of a gauze diaphragm or a perforated plate.

**9.3.1.33**

**9.3.1.34 Exhaust pipes**

- 9.3.1.34.1 Exhausts shall be evacuated from the vessel into the open air either upwards through an exhaust pipe or through the shell plating. The exhaust outlet shall be located not less than 2 m from the cargo area. The exhaust pipes of engines shall be arranged so that the exhausts are led away from the vessel. The exhaust pipes shall not be located within the cargo area.
- 9.3.1.34.2 Exhaust pipes shall be provided with a device preventing the escape of sparks, e.g. spark arresters.

**9.3.1.35 Bilge pumping and ballasting arrangements**

- 9.3.1.35.1 Bilge and ballast pumps for spaces within the cargo area shall be installed within such area.

This provision does not apply to:

- double-hull spaces and double bottoms which do not have a common boundary wall with the cargo tanks;
- cofferdams and hold spaces where ballasting is carried out using the piping of the fire-fighting system in the cargo area and bilge-pumping is performed using educators.

9.3.1.35.2 Where the double bottom is used as an oil fuel tank, it shall not be connected to the bilge piping system.

9.3.1.35.3 Where the ballast pump is installed in the cargo area, the standpipe and its outboard connection for suction of ballast water shall be located within the cargo area.

[9.3.1.35.4 It shall be possible for an under-deck pump-room to be stripped in an emergency using a system located in the cargo area and independent of any other system: This stripping system shall be located outside the pump-room.]

**9.3.1.36-  
9.3.1.39**

**9.3.1.40 Fire-extinguishing arrangements**

9.3.1.40.1 A fire-extinguishing system shall be installed on the vessel.

This system shall comply with the following requirements:

- It shall be supplied by two independent fire or ballast pumps, one of which shall be ready for use at any time. These pumps shall not be installed in the same space;
- It shall be provided with a water main fitted with at least three hydrants in the cargo area above deck. Three suitable and sufficiently long hoses with spray nozzles having a diameter of not less than 12 mm shall be provided. It shall be possible to reach any point of the deck in the cargo area simultaneously with at least two jets of water which do not emanate from the same hydrant;
- A spring-loaded non-return valve shall be fitted to ensure that no gases can escape through the fire-extinguishing system into the accommodation or service spaces outside the cargo area;
- The capacity of the system shall be at least sufficient for a jet of water to have a minimum reach of not less than the vessel's breadth from any location on board with two spray nozzles being used at the same time.

9.3.1.40.2 In addition the engine room, the cargo pump-room and all spaces containing essential equipment (switchboards, compressors, etc.) for the refrigeration equipment, if any, shall be provided with a fixed fire-extinguishing system which can be operated from the deck.

9.3.1.40.3 The two hand fire-extinguishers referred to in 8.1.4 shall be located in the cargo area.

[9.3.1.40.4 The fire-extinguishing agent and the quantity contained in the permanently fixed fire-extinguishing system shall be suitable and sufficient for fighting fires.]

#### **9.3.1.41 Fire and naked light**

9.3.1.41.1 The outlets of funnels shall be located not less than 2.00 m from the cargo area. Arrangements shall be provided to prevent the escape of sparks and the entry of water.

9.3.1.41.2 Heating, cooking and refrigerating appliances shall not be fuelled with liquid fuels, liquid gas or solid fuels.

The installation in the engine room or in another separate space of heating appliances fuelled with liquid fuel having a flash-point above 55° C is, however, permitted.

Cooking and refrigerating appliances are permitted only in the accommodation.

9.3.1.41.3 Only electrical lighting appliances are permitted.

#### **9.3.1.42- 9.3.1.49**

#### **9.3.1.50 Documents concerning electrical installations**

9.3.1.50.1 In addition to the documents required by the "Recommendations on Technical Requirements for Inland Navigation Vessels", the following documents shall be on board:

- (a) a drawing indicating the boundaries of the cargo area and the location of the electrical equipment installed in this area;
- (b) a list of the electrical equipment referred to in (a) above including the following particulars:

**machine or appliance, location, type of protection, type of protection against explosion, testing body and approval number;**

- (c) a list of or general plan indicating the electrical equipment outside the cargo area which may be operated during loading, unloading or gas-freeing. All other electrical equipment shall be marked in red. See 9.3.1.52.3 and 9.3.1.52.4.

9.3.1.50.2 The documents listed above shall bear the stamp of the competent authority issuing the certificate of approval.

### **9.3.1.51 Electrical installations**

9.3.1.51.1 Only distribution systems without return connection to the hull are permitted.

This provision does not apply to:

- local installations outside the cargo area (e.g. connections of starters of diesel engines);
- the device for checking the insulation level referred to in 9.3.1.51.2 below.

9.3.1.51.2 Every insulated distribution network shall be fitted with an automatic device with a visual and audible alarm for checking the insulation level.

9.3.1.51.3 For the selection of electrical equipment to be used in zones presenting an explosion risk, the explosion groups and temperature classes assigned to the substances carried in the list of substances shall be taken into consideration [(See Chapter 3.2, Table C, columns 15 and 16)].

### **9.3.1.52 Type and location of electrical equipment**

9.3.1.52.1 (a) Only the following equipment may be installed in cargo tanks and pipes for loading and unloading (comparable to zone 0):

- measuring, regulation and alarm devices of the EEx (ia) type of protection.

(b) Only the following equipment may be installed in the cofferdams, double-hull spaces, double bottoms and hold spaces (comparable to zone 1):

- measuring, regulation and alarm devices of the “certified safe” type;
- lighting appliances of the “flame-proof enclosure” or “pressurized apparatus” type of protection;
- hermetically sealed echo sounding devices the cables of which are led through thick-walled steel tubes with gastight connections up to the main deck;

- cables for the active cathodic protection of the shell plating in protective steel tubes such as those provided for echo sounding devices.
- (c) Only the following equipment may be installed in the service spaces in the cargo area below deck (comparable to zone 1):
- measuring, regulation and alarm devices of the “certified safe” type;
  - lighting appliances of the “flame-proof enclosure” or “pressurized apparatus” type of protection;
  - motors driving essential equipment such as ballast pumps; they shall be of the “certified safe” type.
- (d) The control and protective equipment of the electrical equipment referred to in paragraphs (a), (b) and (c) above shall be located outside the cargo area if they are not intrinsically safe.
- (e) The electrical equipment in the cargo area on deck (comparable to zone 1) shall be of the “certified safe” type.

9.3.1.52.2 Accumulators shall be located outside the cargo area.

- 9.3.1.52.3 (a) Electrical equipment used during loading, unloading and gas-freeing during berthing and which are located outside the cargo area (comparable to zone 2) shall be at least of the “limited explosion risk” type.
- (b) This provision does not apply to:
- (i) lighting installations in the accommodation, except for switches near entrances to accommodation;
  - (ii) radiotelephone installations in the accommodation or the wheelhouse;
  - (iii) electrical installations in the accommodation, the wheelhouse or the service spaces outside the cargo areas if:
    1. These spaces are fitted with a ventilation system ensuring an overpressure of 0.1 kPa (0.001 bar) and none of the windows is capable of being opened; the air intakes of the ventilation system located as far away as possible, however, not less than 6.00 m from the cargo area and not less than 2.00 m above the deck;

2. The spaces are fitted with a gas detection system with sensors:
    - at the suction inlets of the ventilation system;
    - directly at the top edge of the sill of the entrance doors of the accommodation and service spaces;
  3. The gas concentration measurement is continuous;
  4. When the gas concentration reaches 20% of the lower explosive limit, the ventilators shall be switched off. In such a case and when the overpressure is not maintained or in the event of failure of the gas detection system, the electrical installations which do not comply with (a) above, shall be switched off. These operations shall be performed immediately and automatically and activate the emergency lighting in the accommodation, the wheelhouse and the service spaces, which shall comply at least with the “limited explosion risk” type. The switching-off shall be indicated in the accommodation and wheelhouse by visual and audible signals;
  5. The ventilation system, the gas detection system and the alarm of the switch-off device fully comply with the requirements of (a) above;
  6. The automatic switch-off device is set so that no automatic switching-off may occur while the vessel is under way.
- 9.3.1.52.4 The electrical equipment which does not meet the requirements set out in (3) above together with its switches shall be marked in red. The disconnection of such equipment shall be operated from a centralized location on board.
- 9.3.1.52.5 An electric generator which is permanently driven by an engine and which does not meet the requirements of 9.3.1.52.3 above, shall be fitted with a switch capable of shutting down the excitation of the generator. A notice board with the operating instructions shall be displayed near the switch.
- 9.3.1.52.6 Sockets for the connection of signal lights and gangway lighting shall be permanently fitted to the vessel close to the signal mast or the gangway. Connecting and disconnecting shall not be possible except when the sockets are not live.

9.3.1.52.7 The failure of the power supply for the safety and control equipment shall be immediately indicated by visual and audible signals at the locations where the alarms are usually actuated.

**9.3.1.53 Earthing**

9.3.1.53.1 The metal parts of electrical appliances in the cargo area which are not live as well as protective metal tubes or metal sheaths of cables in normal service shall be earthed, unless they are so arranged that they are automatically earthed by bonding to the metal structure of the vessel.

9.3.1.53.2 The provisions of 9.3.1.53.1 above apply also to equipment having service voltages of less than 50 V.

9.3.1.53.3 [Independent] Cargo tanks [intermediate bulk containers (IBCs) and metal tank containers] shall be earthed.

**9.3.1.54-  
9.3.1.55**

**9.3.1.56 Electrical cables**

9.3.1.56.1 All cables in the cargo area shall have a metallic sheath.

9.3.1.56.2 Cables and sockets in the cargo area shall be protected against mechanical damage.

9.3.1.56.3 Movable cables are prohibited in the cargo area, except for intrinsically safe electric circuits or for the supply of signal lights and gangway lighting.

9.3.1.56.4 Cables of intrinsically safe circuits shall only be used for such circuits and shall be separated from other cables not intended for being used in such circuits (e.g. they shall not be installed together in the same string of cables and they shall not be fixed by the same cable clamps).

9.3.1.56.5 For movable cables intended for signal lights and gangway lighting, only sheathed cables of type H 07 RN-F in accordance with 245 IEC 66 or cables of at least equivalent design having conductors with a cross-section of not less than 1.5 mm<sup>2</sup> shall be used.

These cables shall be as short as possible and installed so that damage is not likely to occur.

**9.3.1.57-**

**9.3.1.59**

**9.3.1.60      **Special equipment****

A shower and an eye and face bath shall be provided on the vessel at a location which is directly accessible from the cargo area.

**9.3.1.61-**

**9.3.1.70**

**9.3.1.71      **Admittance on board****

The notice boards displaying the prohibition of admittance in accordance with 7.2.3.71 shall be clearly legible from either side of the vessel.

**9.3.1.72-**

**9.3.1.73**

**9.3.1.74      **Prohibition of smoking, fire or naked light****

9.3.1.74.1      The notice boards displaying the prohibition of smoking in accordance with 7.2.3.74 shall be clearly legible from either side of the vessel.

9.3.1.74.2      Notice boards indicating the circumstances under which the prohibition is applicable shall be fitted near the entrances to the spaces where smoking or the use of fire or naked light is not always prohibited.

9.3.1.74.3      Ashtrays shall be provided close to each exit of the accommodation and the wheelhouse.

**9.3.1.75-**

**9.3.1.91**

**9.3.1.92      **Emergency exit****

Spaces the entrances or exits of which are likely to become partly or completely immersed in the damaged condition shall have an emergency exit which is situated not less than 0.10 m above the damage waterline. This does not apply to forepeak and afterpeak.

**9.3.1.93-**

**9.3.1.99**

### **9.3.2 Rules for construction of type C tank vessels**

The rules for construction [of 9.3.2.0 to 9.3.2.99] apply to type C tank vessels.

#### **9.3.2.0 Materials of construction**

- 9.3.2.0.1 (a) The vessel's hull and the cargo tanks shall be constructed of shipbuilding steel or other at least equivalent metal.

The independent cargo tanks may also be constructed of other materials, provided these have at least equivalent mechanical properties and resistance against the effects of temperature and fire.

- (b) Every part of the vessel including any installation and equipment which may come into contact with the cargo shall consist of materials which can neither be dangerously affected by the cargo nor cause decomposition of the cargo or react with it so as to form harmful or hazardous products.
- (c) Inside vapour pipes and gas discharge pipes shall be protected against corrosion.

- 9.3.2.0.2 Except where explicitly permitted in 9.3.2.0.3 below or in the certificate of approval, the use of wood, aluminium alloys or plastic materials within the cargo area is prohibited.

- 9.3.2.0.3 (a) The use of wood, aluminium alloys or plastic materials within the cargo area is only permitted for:
- gangways and external ladders;
  - movable items of equipment (aluminium gauging rods are, however permitted, provided that they are fitted with brass feet or protected in another way to avoid sparking);
  - chocking of cargo tanks which are independent of the vessel's hull and chocking of installations and equipment;
  - masts and similar round timber;
  - engine parts;
  - parts of the electrical installation;
  - loading and unloading appliances;
  - lids of boxes which are placed on the deck.

- (b) The use of wood or plastic materials within the cargo area is only permitted for:
  - supports and stops of any kind.
- (c) The use of plastic materials or rubber within the cargo area is only permitted for:
  - coating of cargo tanks and of pipes for loading and unloading;
  - all kinds of gaskets (e.g. for dome or hatch covers);
  - electric cables;
  - hoses for loading and unloading;
  - insulation of cargo tanks and of hoses for loading and unloading.
- (d) All permanently fitted materials in the accommodation or wheelhouse, with the exception of furniture, shall not readily ignite. They shall not evolve fumes or toxic gases in dangerous quantities, if involved in a fire.

9.3.2.0.4 The paint used in the cargo area shall not be liable to produce sparks in case of impact.

9.3.2.0.5 The use of plastic material for vessel's boats is permitted only if the material does not readily ignite.

**9.3.2.1-  
9.3.2.7**

**9.3.2.8 Classification**

9.3.2.8.1 The tank vessel shall be built under survey of a recognized classification society in accordance with the rules established by that classification society for its highest class, and the tank vessel shall be classed accordingly.

The vessel's class shall be continued.

9.3.2.8.2 The cargo pump-rooms shall be inspected by a recognized classification society whenever the certificate of approval has to be renewed as well as during the third year of validity of the certificate of approval. The inspection shall comprise at least:

- an inspection of the whole system for its condition, for corrosion, leakage or conversion works which have not been approved;
- a checking of the condition of the gas detection system in the cargo pump-rooms.

Inspection certificates signed by the recognized classification society with respect to the inspection of the cargo pump-rooms shall be kept on board. The inspection certificates shall at least include particulars of the above inspection and the results obtained as well as the date of the inspection.

- 9.3.2.8.3 The condition of the gas detection system referred to in 9.3.2.52.3 (b) shall be checked by a recognized classification society whenever the certificate of approval has to be renewed and during the third year of validity of the certificate of approval. A certificate signed by the recognized classification society shall be kept on board.

### **9.3.2.9**

#### **9.3.2.10 Protection against the penetration of gases**

- 9.3.2.10.1 The vessel shall be designed so as to prevent gases from penetrating into the accommodation and the service spaces.

- 9.3.2.10.2 The lower edges of door-openings in the sidewalls of superstructures and the coamings of access hatches to under-deck spaces shall have a height of not less than 0.50 m above the deck.

This requirement need not be complied with if the wall of the superstructures facing the cargo area extends from one side of the ship to the other and has doors the sills of which have a height of not less than 0.50 m. The height of this wall shall be not less than 2.00 m.

In this case, the lower edges of door-openings in the sidewalls of superstructures and of coamings of access hatches behind this wall shall have a height of not less than 0.10 m. The sills of engine-room doors and access hatches shall, however, always have a height of not less than 0.50 m.

- 9.3.2.10.3 The bulwarks, foot-rails, etc. shall be provided with sufficiently large openings which are located directly above the deck.

**9.3.2.11 Hold spaces and cargo tanks**

- 9.3.2.11.1 (a) The maximum permissible capacity of a cargo tank shall be determined in accordance with the following table:

$L \cdot B \cdot H$ (m <sup>3</sup> )	Maximum permissible capacity of a cargo tank (m <sup>3</sup> )
up to 600	$L \cdot B \cdot H \cdot 0.3$
600 to 3 750	$180 + (L \cdot B \cdot H - 600) \cdot 0.0635$
> 3 750	380

In the table above  $L \cdot B \cdot H$  is the product of the main dimensions of the tank vessel in metres (according to the measurement certificate), where:

L = overall length of the hull;

B = extreme breadth of the hull;

H = shortest vertical distance between the top of the keel and the lowest point of the deck at the side of the vessel (moulded depth) within the cargo area;

- (b) The relative density of the substances to be carried shall be taken into consideration in the design of the cargo tanks. The maximum relative density shall be indicated in the certificate of approval;
- (c) When the vessel is provided with pressure cargo tanks, these tanks shall be designed for a working pressure of 400 kPa (4 bar);
- (d) For vessels with a length of not more than 50.00 m, the length of a cargo tank shall not exceed 10.00 m;

for vessels with a length of more than 50.00 m, the length of a cargo tank shall not exceed 0.20 L.

This provision does not apply to vessels with independent built-in cylindrical tanks having a length to diameter ratio  $\leq 7$ .

- 9.3.2.11.2 (a) In the cargo area (except cofferdams) the vessel shall be designed as a flush-deck double-hull vessel, with double-hull spaces and double bottoms, but without a trunk.

Cargo tanks independent of the vessels' hull and refrigerated cargo tanks may only be installed in a hold space which is bounded by double-hull spaces and double bottoms in accordance with 9.3.2.11.7 below. The cargo tanks shall not extend beyond the deck.

- (b) The cargo tanks independent of the vessel's hull shall be fixed so that they cannot float.
  - (c) The capacity of a suction well shall be limited to not more than 0.10 m<sup>3</sup>.
  - (d) Side-stringers linking or supporting the load-bearing components of the sides of the vessel with the load-bearing components of the longitudinal walls of cargo tanks and side-stringers linking the load-bearing components of the vessel's bottom with the tank-bottom are prohibited.
- 9.3.2.11.3
- (a) The cargo tanks shall be separated by cofferdams of at least 0.60 m in width from the accommodation, engine room and service spaces outside the cargo area below deck or, if there are no such accommodation, engine room and service spaces, from the vessel's ends. Where the cargo tanks are installed in a hold space, a space of not less than 0.50 m shall be provided between such tanks and the end bulkheads of the hold space. In this case an insulated end bulkhead meeting at least the definition for Class "A-60" according to SOLAS II-2, Regulation 3, shall be deemed equivalent to a cofferdam. For pressure cargo tanks, the 0.50 m distance may be reduced to 0.20 m.
  - (b) Hold spaces, cofferdams and cargo tanks shall be capable of being inspected.
  - (c) All spaces in the cargo area shall be capable of being ventilated. Means for checking their gas-free condition shall be provided.
- 9.3.2.11.4
- The bulkheads bounding the cargo tanks, cofferdams and hold spaces shall be watertight. The cargo tanks, cofferdams and the end bulkheads of the hold spaces, as well as the bulkheads bounding the cargo area shall have no openings or penetrations below deck. Penetrations through bulkheads between two hold spaces are, however, permitted.
- The bulkhead between the engine room and the cofferdam or service space in the cargo area or between the engine room and a hold space may be fitted with penetrations provided that they conform to the provisions of 9.3.2.1.7.5.
- The bulkhead between the cargo tank and the cargo pump-room below deck may be fitted with penetrations provided that they conform to the provisions of 9.3.2.1.7.6. If the vessel is fitted with a cargo pump-room below deck, the bulkheads between the cargo tanks may be fitted with passages provided that the loading pipes are fitted with shut-off devices in the cargo tank direct at the bulkhead and in the cargo pump-room direct at the bulkhead. The shut-off devices shall be capable of being activated from the deck.

9.3.2.11.5 Double-hull spaces and double bottoms in the cargo area shall be arranged for being filled with ballast water only. Double bottoms may, however, be used as oil fuel tanks, provided they comply with the provisions of 9.3.2.32.

- 9.3.2.11.6 (a) A cofferdam, the centre part of a cofferdam or another space below deck in the cargo area may be arranged as a service space, provided the bulkheads bounding the service space extend vertically to the bottom. This service space shall only be accessible from the deck.
- (b) The service space shall be watertight with the exception of its access hatches and ventilation inlets.
- (c) No pipes for loading and unloading shall be fitted within the service space referred to under (a) above.

Pipes for loading and unloading may be fitted in the cargo pump-rooms below deck only when they conform to the provisions of 9.3.2.17.6.

9.3.2.11.7 For double-hull construction with the cargo tanks integrated in the vessel's structure, the distance between the side wall of the vessel and the longitudinal bulkhead of the cargo tanks shall be not less than 1.00 m. A distance of 0.80 m may however be permitted, provided that, compared with the scantling requirements specified in the rules for construction of a recognized classification society, the following reinforcements have been made:

- (a) 25% increase in the thickness of the deck stringer plate;
- (b) 15% increase in the side plating thickness;
- (c) Arrangement of a longitudinal framing system at the vessel's side, where depth of the longitudinals shall be not less than 0.15 m and the longitudinals shall have a face plate with the cross-sectional area of at least 7.0 cm<sup>2</sup>.
- (d) The stringer or longitudinal framing systems shall be supported by webframes, and like bottom girders fitted with lightening holes, at a maximum spacing of 1.80 m. These distances may be increased if the longitudinals are strengthened accordingly.

When a vessel is built according to the transverse framing system, a longitudinal stringer system shall be arranged instead of (c) above. The distance between the longitudinal stringers shall not exceed 0.80 m and their depth shall be not less than 0.15 m, provided they are completely welded to the frames. The cross-sectional area of the facebar or faceplate shall be not less than 7.0 cm<sup>2</sup> as in (c) above. Where cut-outs are arranged in the stringer at the connection with the frames, the web depth of the stringer shall be increased with the depth of cut-outs.

The mean depth of the double bottoms shall be not less than 0.70 m. It shall, however, never be less than 0.60 m.

The depth below the suction wells may be reduced to 0.50 m.

- 9.3.2.11.8 When a vessel is built with cargo tanks located in a hold space or refrigerated cargo tanks, the distance between the double walls of the hold space shall be not less than 0.80 m and the depth of the double bottom shall be not less than 0.60 m.
- 9.3.2.11.9 Where service spaces are located in the cargo area under deck, they shall be arranged so as to be easily accessible and to permit persons wearing protective clothing and breathing apparatus to safely operate the service equipment contained therein. They shall be designed so as to allow injured or unconscious personnel to be removed from such spaces without difficulties, if necessary by means of fixed equipment.
- 9.3.2.11.10 Cofferdams, double-hull spaces, double bottoms, cargo tanks, hold spaces and other accessible spaces within the cargo area shall be arranged so that they may be completely inspected and cleaned in an appropriate manner. The dimensions of openings except for those of double-hull spaces and double bottoms which do not have a wall adjoining the cargo tanks shall be sufficient to allow a person wearing breathing apparatus to enter or leave the space without difficulties. These openings shall have a minimum cross-sectional area of 0.36 m<sup>2</sup> and a minimum side length of 0.50 m. They shall be designed so as to allow injured or unconscious personnel to be removed from the bottom of such a space without difficulties, if necessary by means of fixed equipment. In these spaces the distance between the reinforcements shall not be less than 0.50 m. In double bottoms this distance may be reduced to 0.45 m.

Cargo tanks may have circular openings with a diameter of not less than 0.68 m.

### **9.3.2.12 Ventilation**

- [9.3.2.12.1 Each hold space shall have two openings the dimensions and location of which shall be such as to permit effective ventilation of any part of the hold space. If there are no such openings, it shall be possible to fill the hold spaces with inert gas or dry air.]
- 9.3.2.12.2 Double-hull spaces and double bottoms within the cargo area which are not arranged for being filled with ballast water, hold spaces and cofferdams shall be provided with ventilation systems.

9.3.2.12.3 Any service spaces located in the cargo area below deck shall be provided with a system of forced ventilation with sufficient power for ensuring at least 20 changes of air per hour based on the volume of the space. The ventilator fan shall be designed so that no sparks may be emitted on contact of the impeller blades with the housing and no static electricity may be generated.

The ventilation exhaust ducts shall extend down to 50 mm above the bottom of the service space. The air shall be supplied through a duct at the top of the service space. The air inlets shall be located not less than 2.00 m above the deck, at a distance of not less than 2.00 m from tank openings and 6.00 m from the outlets of safety valves. The extension pipes, which may be necessary, may be of the hinged type.

9.3.2.12.4 Ventilation of accommodation and service spaces shall be possible.

9.3.2.12.5 Ventilators used for gas-freeing of tanks shall be designed so that no sparks may be emitted on contact of the impeller blades with the housing and no static electricity may be generated.

9.3.2.12.6 Notice boards shall be fitted at the ventilation inlets indicating the conditions when they shall be closed. Any ventilation inlets of accommodation and service spaces leading outside shall be fitted with fire flaps. Such ventilation inlets shall be located not less than 2.00 m from the cargo area.

Ventilation inlets of service spaces in the cargo area below deck may be located within such area.

9.3.2.12.7 The flame-arresters prescribed in 9.3.2.20.4, 9.3.2.21.11, 9.3.2.22.4, 9.3.2.22.5 and 9.3.2.26.3 shall be of a type approved for this purpose by the competent authority.

### **9.3.2.13 Stability (general)**

9.3.2.13.1 Proof of sufficient stability shall be furnished including for stability in damaged condition.

9.3.2.13.2 The basic values for the stability calculation - the vessel's lightweight and location of the centre of gravity - shall be determined either by means of an inclining experiment or by detailed mass and moment calculation. In the latter case the lightweight of the vessel shall be checked by means of a lightweight test with a tolerance limit of  $\pm 5\%$  between the mass determined by calculation and the displacement determined by the draught readings.

9.3.2.13.3 Proof of sufficient intact stability shall be furnished for all stages of loading and unloading and for the final loading condition.

Floatability after damage shall be proved for the most unfavourable loading condition. For this purpose, calculated proof of sufficient stability shall be established for critical intermediate stages of flooding and for the final stage of flooding. Negative values of stability in intermediate stages of flooding may be accepted only if the continued range of curve of righting lever in damaged condition indicates adequate positive values of stability.

**9.3.2.14 Stability (intact)**

- 9.3.2.14.1 The requirements for intact stability resulting from the damage stability calculation shall be fully complied with.
- 9.3.2.14.2 For vessels with cargo tanks of more than  $0.70 \cdot B$  in width, additional proof shall be furnished that, at an angle of  $5^\circ$  or, when this angle is less, at a heeling angle at which an opening becomes immersed, the righting arm is 0.10 m. The stability-reducing free surface effect in the case of cargo tanks filled to less than 95% of their capacity shall be taken into account.
- 9.3.2.14.3 The most stringent requirement of 9.3.2.14.1 and 9.3.2.14.2 is applicable to the vessel.

**9.3.2.15 Stability (damaged condition)**

- 9.3.2.15.1 The following assumptions shall be taken into consideration for the damaged condition:
- (a) The extent of side damage is as follows:
- longitudinal extent: at least 0.10 L, but not less than 5.00 m;
  - transverse extent: 0.79 m;
  - vertical extent: from the base line upwards without limit.
- (b) The extent of bottom damage is as follows:
- longitudinal extent: at least 0.10 L, but not less than 5.00 m;
  - transverse extent: 3.00 m;
  - vertical extent: from the base 0.59 m upwards, the sump excepted.
- (c) Any bulkheads within the damaged area shall be assumed damaged, which means that the location of bulkheads shall be chosen so as to ensure that the vessel remains afloat after the flooding of two or more adjacent compartments in the longitudinal direction.

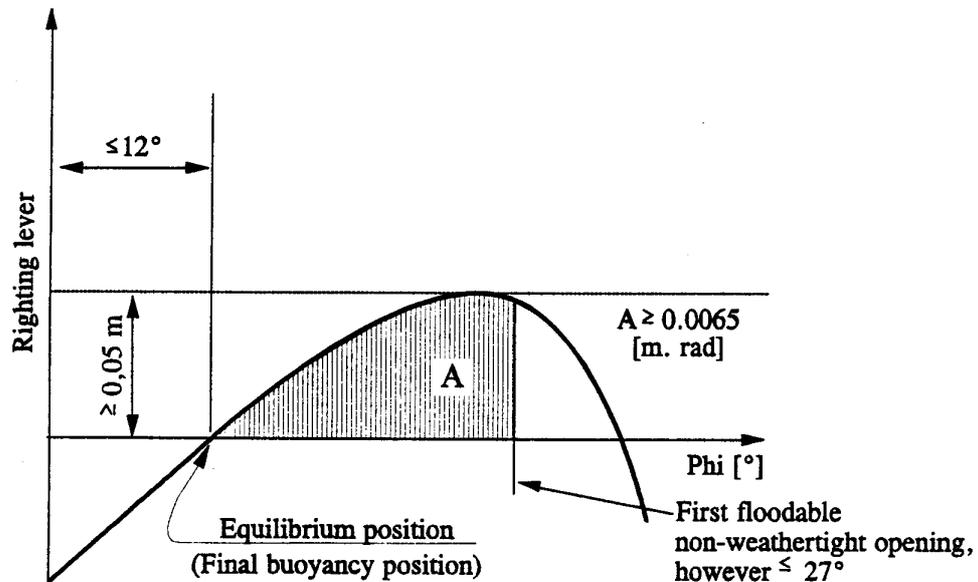
The following provisions are applicable:

- For bottom damage, adjacent athwartship compartments shall also be assumed as flooded;
- The lower edge of any non-watertight openings (e.g. doors, windows, access hatchways) shall, at the final stage of flooding, be not less than 0.10 m above the damage waterline;
- In general, permeability shall be assumed to be 95%. Where an average permeability of less than 95% is calculated for any compartment, this calculated value obtained may be used. However, the following minimum values shall be used:
  - engine rooms: 85%
  - accommodation: 95%
  - double bottoms, oil fuel tanks, ballast tanks, etc., depending on whether, according to their function, they have to be assumed as full or empty for the vessel floating at the maximum permissible draught: 0% or 95%.

For the main engine room only the one-compartment standard need be taken into account, i.e. the end bulkheads of the engine room shall be assumed as not damaged.

9.3.2.15.2 At the stage of equilibrium (final stage of flooding), the angle of heel shall not exceed 12°. Non-watertight openings shall not be flooded before reaching the stage of equilibrium. If such openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purpose of the stability calculation.

The positive range of the righting lever curve beyond the stage of equilibrium shall have a righting lever of  $\geq 0.05$  m in association with an area under the curve of  $\geq 0.0065$  m.rad. The minimum values of stability shall be satisfied up to immersion of the first non-watertight opening and in any event up to an angle of heel  $\leq 27^\circ$ . If non-watertight openings are immersed before that stage, the corresponding spaces shall be considered as flooded for the purposes of stability calculation.



- 9.3.2.15.3 If openings through which undamaged compartments may additionally become flooded are capable of being closed watertight, the closing appliances shall be marked accordingly.
- 9.3.2.15.4 Where cross- or down-flooding openings are provided for reduction of unsymmetrical flooding, the time for equalization shall not exceed 15 minutes, if during the intermediate stages of flooding sufficient stability has been proved.
- 9.3.2.16 Engine rooms**
- 9.3.2.16.1 Internal combustion engines for the vessel's propulsion as well as internal combustion engines for auxiliary machinery shall be located outside the cargo area. Entrances and other openings of engine rooms shall be at a distance of not less than 2.00 m from the cargo area.
- 9.3.2.16.2 The engine rooms shall be accessible from the deck; the entrances shall not face the cargo area. Where the doors are not located in a recess whose depth is at least equal to the door width, the hinges shall face the cargo area.
- 9.3.2.17 Accommodation and service spaces**
- 9.3.2.17.1 Accommodation spaces and the wheelhouse shall be located outside the cargo area forward of the fore vertical plane or abaft the aft vertical plane bounding the part of cargo area below deck. Windows of the wheelhouse which are located not less than 1.00 m above the bottom of the wheelhouse may tilt forward.

9.3.2.17.2 Entrances to spaces and openings of superstructures shall not face the cargo area. Doors opening outward and not located in a recess the depth of which is at least equal to the width of the doors shall have their hinges face the cargo area.

9.3.2.17.3 Entrances from the deck and openings of spaces facing the weather shall be capable of being closed. The following instruction shall be displayed at the entrance of such spaces:

**DO NOT OPEN DURING LOADING, UNLOADING OR GAS-FREEING  
WITHOUT PERMISSION FROM THE MASTER.  
CLOSE IMMEDIATELY.**

9.3.2.17.4 Entrances and windows of superstructures and accommodation spaces which can be opened as well as other openings of these spaces shall be located not less than 2.00 m from the cargo area. No wheelhouse doors and windows shall be located within 2.00 m from the cargo area, except where there is no direct connection between the wheelhouse and the accommodation.

- 9.3.2.17.5
- (a) Driving shafts of the bilge or ballast pumps in the cargo area may penetrate through the bulkhead between the service space and the engine room, provided the arrangement of the service space is in compliance with 9.3.2.11.6.
  - (b) The penetration of the shaft through the bulkhead shall be gastight and shall have been approved by a recognized classification society.
  - (c) The necessary operating instructions shall be displayed.
  - (d) Penetrations through the bulkhead between the engine room and the service space in the cargo area and the bulkhead between the engine room and the hold spaces may be provided for electrical cables, hydraulic and piping for measuring, control and alarm systems, provided that the penetration have been approved by a recognized classification society. The penetrations shall be gastight. Penetrations through a bulkhead with an "A-60" fire protection insulation according to SOLAS II-2, Regulation 3, shall have an equivalent fire protection.
  - (e) Pipes may penetrate the bulkhead between the engine room and the service space in the cargo area provided that these are pipes between the mechanical equipment in the engine room and the service space which do not have any openings within the service space and which are provided with shut-off devices at the bulkhead in the engine room.
  - (f) Pipes from the engine room may pass through the service space in the cargo area or a cofferdam or a hold space to the outside provided that within the service space or cofferdam or hold space they are of the thick-walled type and have no flanges or openings.

- (g) Where a driving shaft of auxiliary machinery penetrates through a wall located above the deck the penetration shall be gastight.

9.3.2.17.6 A service space located within the cargo area below deck shall not be used as a cargo pump-room for the loading and unloading system, except where:

- the pump room is separated from the engine room or from service spaces outside the cargo area by a cofferdam or a bulkhead with an “A-60” fire protection insulation according to SOLAS Chapter II-2, Regulation 3, or by a service space or a hold space;
- the “A-60” bulkhead required above does not include penetrations referred to in 9.3.2.17.5 (a);
- ventilation exhaust outlets are located not less than 6.00 m from entrances and openings of the accommodation and service spaces outside the cargo area;
- the access hatches and ventilation inlets can be closed from the outside;
- all pipes for loading and unloading as well as those of stripping systems are provided with shut-off devices at the pump suction side in the cargo pump-room immediately at the bulkhead. The necessary operation of the control devices in the pump-room, starting of pumps and control of the liquid flow rate shall be effected from the deck;
- the bilge of the cargo pump-room is equipped with a gauging device for measuring the filling level which activates a visual and audible alarm in the wheelhouse when liquid is accumulating in the cargo pump-room bilge;
- the cargo pump-room is provided with a permanent gas-detection system which automatically indicates the presence of explosive gases or lack of oxygen by means of direct-measuring sensors and which actuates a visual and audible alarm when the gas concentration has reached 20% of the lower explosive limit. The sensors of this system shall be placed at suitable positions at the bottom and directly below the deck. Measurement shall be continuous.
- The audible and visual alarms are installed in the wheelhouse and in the cargo pump-room and, when the alarm is actuated, the loading and unloading system is shut down. Failure of the gas detection system shall be immediately signalled in the wheelhouse and on deck by means of audible and visual alarms;
- the ventilation system prescribed in 9.3.9.12.3 has a capacity of not less than 30 changes of air per hour based on the total volume of the service space.

- 9.3.2.17.7 The following instruction shall be displayed at the entrance of the cargo pump-room:

**BEFORE ENTERING THE CARGO PUMP-ROOM CHECK WHETHER IT IS FREE FROM GASES AND CONTAINS SUFFICIENT OXYGEN. DO NOT OPEN DOORS AND ENTRANCE OPENINGS WITHOUT THE PERMISSION OF THE MASTER. LEAVE IMMEDIATELY IN THE EVENT OF ALARM.**

**9.3.2.18-**

**9.3.2.19**

**9.3.2.20 Arrangement of cofferdams**

- 9.3.2.20.1 Cofferdams or cofferdam compartments located next to a service space which has been arranged in accordance with 9.3.2.11.6 shall be accessible through an access hatch. The access hatches and ventilation inlets shall be located not less than 0.50 m above the deck.

- 9.3.2.20.2 Cofferdams shall be capable of being filled with water and emptied by means of a pump. Filling shall be effected within 30 minutes. These requirements are not applicable when the bulkhead between the engine room and the cofferdam comprises fire-protection insulation "A-60" in accordance with SOLAS II-2, Regulation 3, or has been fitted out as a service space. The cofferdams shall not be fitted with inlet valves.

- 9.3.2.20.3 No fixed pipe shall permit connection between a cofferdam and other piping of the vessel outside the cargo area.

- 9.3.2.20.4 The ventilation openings of cofferdams shall be fitted with a flame-arrester withstanding a deflagration.

**9.3.2.21 Safety and control installations**

- 9.3.2.21.1 Cargo tanks shall be provided with the following equipment:

- (a) a mark inside the tank indicating the liquid level of 95%;
- (b) a level gauge;
- (c) a level alarm device which is activated at the latest when a degree of filling of 90% is reached;
- (d) a high level sensor for actuating the facility against overflowing at the latest when a degree of filling of 97.5% is reached;

- (e) an instrument for measuring the pressure of the vapour phase inside the cargo tank;
- (f) an instrument for measuring the temperature of the cargo, when a system for heating the cargo is required in Chapter 3.2, Table C, column 9, or a maximum temperature is indicated in column 20 of that list;
- (g) a nozzle with a closure connected to a sampling device, closed or partially closed, and/or a sampling opening as required in Chapter 3.2, Table C, column 13.

9.3.2.21.2 When the degree of filling in per cent is determined, an error of not more than 0.5% is permitted. It shall be calculated on the basis of the total cargo tank capacity including the expansion trunk.

9.3.2.21.3 The level gauge shall allow readings from the control position of the shut-off devices of the particular cargo tank.

9.3.2.21.4 The level alarm device shall give a visual and audible warning on board when actuated. The level alarm device shall be independent of the level gauge.

9.3.2.21.5 The high level sensor referred to in 9.3.2.21.1 (d) above shall give a visual and audible alarm on board and at the same time actuate an electrical contact which in the form of a binary signal interrupts the electric current loop provided and fed by the shore facility, thus initiating measures at the shore facility against overflowing during loading operations. The signal shall be transmitted to the shore facility via a watertight two-pin plug of a connector device in accordance with IEC Publication No. 309 for direct current of 40 to 50 volts, identification colour white, position of the nose 10 h.

The plug shall be permanently fitted to the vessel close to the shore connections of the loading and unloading pipes.

The high level sensor shall also be capable of switching off the vessel's own discharging pump. The high level sensor shall be independent of the level alarm device, but it may be connected to the level gauge.

9.3.2.21.6. The visual and audible signals given by the level alarm device shall be clearly distinguishable from those of the high level sensor.

The visual alarm shall be visible at each control position on deck of the cargo tank stop valves. It shall be possible to easily check the functioning of the sensors and electric circuits or these shall be of the "failsafe" design.

- 9.3.2.21.7 When the pressure or temperature exceeds a set value, instruments for measuring the vacuum or overpressure of the gaseous phase in the cargo tank or the temperature of the cargo, shall activate a visual and audible alarm in the wheelhouse. When the wheelhouse is unoccupied the alarm shall also be perceptible in a location occupied by a crew member. When the pressure exceeds the set value during loading, the instrument for measuring the pressure shall, by means of the plug referred to in 9.3.2.21.5 above, initiate simultaneously an electrical contact which shall put into effect measures to interrupt the loading operation. If the vessel's own discharge pump is used, it shall be switched off automatically.

The instrument for measuring the overpressure or vacuum shall activate the alarm when an overpressure equal to 1.15 times the opening pressure of the pressure valve, or a vacuum pressure of 1.1 times the opening pressure of the vacuum pressure valve is reached. The maximum allowable temperature is indicated in Chapter 3.2, Table C, column 20. The sensors for the alarms mentioned in this paragraph may be connected to the alarm device of the sensor.

When a manometer is used to measure the overpressure or the vacuum pressure, its indicator scale shall not be less than 0.14 m in diameter. The maximum permissible overpressure or vacuum values shall be indicated by a red mark. The manometers shall be capable of being read at all times from the location where it is possible to interrupt loading or unloading.

When it is prescribed in Chapter 3.2, Table C, column 20, the instrument for measuring the overpressure of the gaseous phase shall activate a visible and audible alarm in the wheelhouse when the overpressure exceeds 40 kPa during the voyage. When the wheelhouse is unoccupied, the alarm shall also be perceptible in a location occupied by a crew member. The manometers shall be capable of being read [at any time from the deck where it is possible to interrupt loading or unloading or] in the immediate vicinity of the water-spray system control.

- 9.3.2.21.8 Where the control elements of the shut-off devices of the cargo tanks are located in a control room, reading of the level gauges shall be possible in the control room and the visual and audible warning given by the level alarm device, the high level sensor referred to in 9.3.2.21.1 (d) and the instruments for measuring the pressure of the vapour phase and temperature of the cargo shall be noticeable in the control room and on deck.

Satisfactory monitoring of the cargo area shall be ensured from the control room.

- 9.3.2.21.9 The closed-type sampling device penetrating through the boundary of the cargo tank but constituting a part of a closed system shall be designed so that during sampling no gas or liquid may escape from the cargo tank. The device shall be of a type approved by the competent authority for this purpose.

- 9.3.2.21.10 The partly closed sampling device penetrating through the boundary of the cargo tank shall be such that during sampling only a small quantity of gaseous or liquid cargo can escape into the open air. As long as the device is not used it shall be closed completely. The device shall be of a type approved by the competent authority for this purpose.
- 9.3.2.21.11 The sampling openings shall have a diameter of not more than 0.30 m. They shall be fitted with a flame arrester plate stack, capable of withstanding steady burning and shall be so designed that the opening period will be as short as possible and that the flame arrester plate stack cannot remain open without external intervention. The manometers shall be capable of being read in the immediate vicinity of the water-spray system control.
- [9.3.2.21.12 The vessel shall be so equipped that loading or unloading operations can be interrupted by means of a switch, i.e. the quick-action stop valve located on the flexible vessel-to-shore connecting line must be capable of being closed. The switch shall be placed at two points on the vessel (fore and aft).

The interruption system shall be designed according to the quiescent current principle.]

### **9.3.2.22 Cargo tank openings**

- 9.3.2.22.1 (a) Cargo tank openings shall be located on deck in the cargo area.
- (b) Cargo tank openings with a cross-section of more than 0.10 m<sup>2</sup> and openings of safety devices for preventing overpressures shall be located not less than 0.50 m above deck.
- 9.3.2.22.2 Cargo tank openings shall be fitted with gastight closures capable of withstanding the test pressure in accordance with 9.3.2.23.1.
- 9.3.2.22.3 Closures which are normally used during loading or unloading operations shall not cause sparking when operated.
- 9.3.2.22.4 (a) Each cargo tank or group of cargo tanks connected to a common vapour pipe shall be fitted with:
- safety devices for preventing unacceptable overpressures or vacuums. When anti-explosion protection is required in Chapter 3.2, Table C, column 17, the vacuum valve shall be fitted with a flame arrester capable of withstanding a deflagration and the pressure-relief valve with a high-velocity vent valve capable of withstanding steady burning.

The gases shall be discharged upwards. The opening pressure of the high-velocity vent valve and the opening pressure of the vacuum valve shall be indelibly indicated on the valves;

- a connection for the safe return ashore of gases expelled during loading;
- a device for the safe depressurization of the tanks consisting of at least a fire-resistant flame-arrester and a stop valve which clearly indicates whether it is open or shut.

- (b) The outlets of high-velocity vent valves shall be located not less than 2.00 m above the deck and at a distance of not less than 6.00 m from the accommodation and from the service spaces outside the cargo area. This height may be reduced when within a radius of 1.00 m round the outlet of the high-velocity vent valve, there is no equipment, no work is being carried out and signs indicate the area. The setting of the high-velocity vent valves shall be such that during the transport operation they do not blow off until the maximum permissible working pressure of the cargo tanks is reached.

- 9.3.2.22.5 (a) Insofar as anti-explosion protection is prescribed in Chapter 3.2, Table C, column 17, a vapour pipe connecting two or more cargo tanks shall be fitted, at the connection to each cargo tank, with a flame arrester with a fixed or spring-loaded plate stack, capable of withstanding a detonation.

This equipment may consist of:

- (i) a flame arrester fitted with a fixed plate stack, where each cargo tank is fitted with a vacuum valve capable of withstanding a deflagration and a high-velocity vent valve capable of withstanding steady burning;
- (ii) a flame arrester fitted with a spring-loaded plate stack, where each cargo tank is fitted with a vacuum valve capable of withstanding a deflagration;
- (iii) a flame arrester with a fixed plate stack;
- (iv) a flame arrester with a fixed plate stack, where the pressure-measuring device is fitted with an alarm system in accordance with 9.3.2.21.7;

- (v) a flame arrester with a spring-loaded plate stack, where the pressure-measuring device is fitted with an alarm system in accordance with 9.3.2.21.7.

When a fire-fighting installation is permanently mounted on deck in the cargo area and can be brought into service from the deck and from the wheelhouse, flame arresters need not be required for individual cargo tanks.

Only substances which do not mix and which do not react dangerously with each other may be carried simultaneously in cargo tanks connected to a common vapour pipe.

or

- (b) Insofar as anti-explosion protection is prescribed in Chapter 3.2, Table C, column 17, a vapour pipe connecting two or more cargo tanks shall be fitted, at the connection to each cargo tank, with a pressure/vacuum relief valve incorporating a flame arrester capable of withstanding a detonation/deflagration.

Only substances which do not mix and which do not react dangerously with each other may be carried simultaneously in cargo tanks connected to a common vapour pipe.

or

- (c) Insofar as anti-explosion protection is prescribed in Chapter 3.2, Table C, column 17, an independent vapour pipe for each cargo tank, fitted with a pressure/vacuum valve incorporating a flame arrester capable of withstanding a deflagration and an eductor incorporating a flame arrester capable of withstanding steady burning. Several different substances may be carried simultaneously.

or

- (d) Insofar as anti-explosion protection is prescribed in Chapter 3.2, Table C, column 17, a vapour pipe connecting two or more cargo tanks shall be fitted, at the connection to each cargo tank, with a shut-off device capable of withstanding a detonation, where each cargo tank is fitted with a vacuum valve capable of withstanding a deflagration and a high-velocity vent valve capable of withstanding steady burning.

Only substances which do not mix and which do not react dangerously with each other may be carried simultaneously in cargo tanks connected to a common vapour pipe.

**9.3.2.23 Pressure tests**

9.3.2.23.1 The cargo tanks, residual cargo tanks, cofferdams, pipes for loading and unloading shall be subjected to initial tests before being put into service and thereafter at prescribed intervals.

Where a heating system is provided inside the cargo tanks, the heating coils shall be subjected to initial tests before being put into service and thereafter at prescribed intervals.

9.3.2.23.2 The test pressure for the cargo tanks and residual cargo tanks shall be not less than 1.3 times the construction pressure. The test pressure for the cofferdams and open cargo tanks shall be not less than 10 kPa (0.10 bar) gauge pressure.

9.3.2.23.3 The test pressure for pipes for loading and unloading shall be not less than 1,000 kPa (10 bar) gauge pressure.

9.3.2.23.4 The maximum intervals for the periodic tests shall be 11 years.

9.3.2.23.5 The procedure for pressure tests shall comply with the provisions established by the competent authority or a recognized classification society.

**9.3.2.24**

**9.3.2.25 Pumps and piping**

9.3.2.25.1 Pumps, compressors and accessory loading and unloading piping shall be placed in the cargo area. Cargo pumps shall be capable of being shut down from the cargo area and, in addition, from a position outside the cargo area.

Cargo pumps situated on deck shall be located not less than 6.00 m from entrances to, or openings of, the accommodation and service spaces outside the cargo area.

- 9.3.2.25.2
- (a) Pipes for loading and unloading shall be independent of any other piping of the vessel. No cargo piping shall be located below deck, except those inside the cargo tanks and inside the cargo pump-room.
  - (b) The pipes for loading and unloading shall be arranged so that, after loading or unloading operations, the liquid remaining in these pipes may be safely removed and may flow either into the vessel's tanks or the tanks ashore.
  - (c) Pipes for loading and unloading shall be clearly distinguishable from other piping, e.g. by means of colour marking.

- (d) The pipes for loading and unloading located on deck, with the exception of the shore connections, shall be located not less than a quarter of the vessels' breadth from the outer shell.
- (e) The shore connections shall be located not less than 6.00 m from the entrances to, or openings of, the accommodation and service spaces outside the cargo area.
- (f) Each shore connection of the vapour pipe and shore connections of the pipes for loading and unloading, through which the loading or unloading operation is carried out, shall be fitted with a shut-off device. However, each shore connection shall be fitted with a blind flange when it is not in operation.

Each shore connection of the pipes for loading and unloading through which the loading or unloading operation is carried out shall be fitted with the device intended for the discharge of residual cargo described in 8.6.4.1.

- (g) The vessel shall be equipped with an additional stripping system.
- (h) The flanges and stuffing boxes shall be provided with a spray protection device.

9.3.2.25.3 The distance referred to in 9.3.2.25.1 and 9.3.2.25.2 (e) may be reduced to 3.00 m if a transverse bulkhead complying with 9.3.2.10.2 is situated at the end of the cargo area. The openings shall be provided with doors.

The following notice shall be displayed on the doors:

**DO NOT OPEN DURING LOADING AND UNLOADING  
WITHOUT THE PERMISSION OF THE MASTER.  
CLOSE IMMEDIATELY.**

- 9.3.2.25.4 (a) Every component of the pipes for loading and unloading shall be electrically connected to the hull.
- (b) The pipes for loading shall extend down to the bottom of the cargo tanks.
- 9.3.2.25.5 The stop valves or other shut-off devices of the pipes for loading and unloading shall indicate whether they are open or shut.
- 9.3.2.25.6 The pipes for loading and unloading shall have, at the test pressure, the required elasticity, leakproofness and resistance to pressure.

- 9.3.2.25.7 The pipes for loading and unloading shall be fitted with pressure gauges at the pump outlet.

Where these pressure gauges are manometers, the indicator scale shall have a diameter of not less than 0.14 m.

Reading of the pressure gauges shall be possible from the control position of the loading pump at any time. The maximum permissible overpressure or vacuum shall be indicated by a red mark.

- 9.3.2.25.8 (a) When pipes for loading and unloading are used for supplying the cargo tanks with washing or ballast water, the suctions of these pipes shall be located within the cargo area but outside the cargo tanks.

Pumps for tank washing systems with associated connections may be located outside the cargo area, provided the discharge side of the system is arranged in such a way that the suction is not possible through that part.

A spring-loaded non-return valve shall be provided to prevent any gases from being expelled from the cargo area through the tank washing system.

- (b) A non-return valve shall be fitted at the junction between the water suction pipe and the cargo loading pipe.

- 9.3.2.25.9 [The permissible loading and unloading flows shall be calculated.

Calculations concerning the permissible maximum loading and unloading flow for each cargo tank or each group of cargo tanks, taking into account the design of the ventilation system. These calculations shall take into consideration the fact that in the event of an unforeseen cut-off of the gas return piping or the compensation piping of the shore facility, the safety devices of the cargo tanks will prevent pressure in the cargo tanks from exceeding the following values:

over-pressure: 115% of the opening pressure of the high-velocity vent valve

vacuum pressure: 110% of the opening pressure of the vacuum pressure valve but not more than 3.85 kPa.

The main factors to be considered are the following:

1. Dimensions of the ventilation system of the cargo tanks.
2. Gas formation during loading: multiply the largest loading flow by a factor of not less than 1.25.

3. Density of the vapour mixture of the cargo based on 50% vol. vapour of 50% vol. air.
4. Loss of pressure through ventilation pipes, valves and fittings. Account will be taken of a 30% clogging of the mesh of the flame-arrester.
5. Chocking pressure of the safety valves.

The permissible maximum loading and unloading pressure for each cargo tank or for each group of cargo tanks shall be given in an on-board instruction.]

- 9.3.2.25.10 The stripping system shall be subjected to initial tests before being put into service or thereafter if any alteration has been made to it, using water as test medium. The test and the determination of the residual quantities shall be carried out in accordance with the requirements of 8.6.4.2.

In this test, the following residual quantities shall not be exceeded:

- (a) 5 l for each cargo tank;
- (b) 15 l for each pipe system.

The residual quantities obtained in the test shall be entered in the certificate for the test of the stripping system referred to in 8.6.4.3.

- [9.3.2.25.11 If the vessel is carrying several dangerous substances liable to react dangerously with each other, a separate pump with its own piping for loading and unloading shall be installed for each substance. The piping shall not pass through a cargo tank containing dangerous substances with which the substance in question is liable to react.]

### **9.3.2.26 Residual cargo tanks and slop tanks**

- 9.3.2.26.1 The vessel shall be provided with at least one residual cargo tank and with slop tanks for slops which are not suitable for pumping. These tanks shall be located only in the cargo area. Intermediate bulk containers or tank-containers in accordance with 7.2.4.1 may be used instead of a fixed residual cargo tank. During filling of these intermediate bulk containers or tank-containers, means for collecting any leakage shall be placed under the filling connections.
- 9.3.2.26.2 Slop tanks shall be fire resistant and shall be capable of being closed with lids (e.g. drums with lever closing ring lids). The tanks shall be marked and easy to handle.
- 9.3.2.26.3 The maximum capacity of a residual cargo tank is 30 m<sup>3</sup>.

The residual cargo tank shall be equipped with:

- a vacuum valve and a high-velocity vent valve. The valve shall be so regulated as not to open during carriage. This condition is met when the opening pressure of the valve meets the conditions set out in Chapter 3.2, Table C, column 10, for the substance to be carried. When anti-explosion protection is required in Chapter 3.2, Table C, column 17, the vacuum valve shall be capable of withstanding deflagrations and the educator steady burning;
- a device for measuring the degree of filling;
- connections with shut-off devices, for pipes and hoses.

No connection between the residual cargo tanks and the vapour pipe of the cargo tanks is permitted.

Residual cargo tanks, intermediate bulk containers or tank-containers placed on the deck shall be located at a minimum distance from the sideplatings equal to not less than one quarter of the vessel's breadth.

#### **9.3.2.27**

#### **9.3.2.28 Water-spray system**

When water-spraying is required in Chapter 3.2, Table C, column 9, a water-spray system shall be installed in the cargo area on deck for the purpose of reducing vapours given off by the cargo, and of cooling the tops of cargo tanks [by spraying water over the whole surface].

The system shall be fitted with a connection device for supply from the shore. The system shall be capable of being put into operation from the wheelhouse and from the cargo deck area. The capacity of the water-spray system shall be such that when all the spray nozzles are in operation, the outflow is not less than 50 litres per square metre of cargo deck area and per hour.

#### **9.3.2.29- 9.3.2.30**

#### **9.3.2.31 Engines**

9.3.2.31.1 Only internal combustion engines running on fuel with a flashpoint of more than 55° C are allowed.

- 9.3.2.31.2. Ventilation inlets of the engine room, and when the engines do not take in air directly from the engine room, air intakes of the engines shall be located not less than 2.00 m from the cargo area.
- 9.3.2.31.3 Sparking shall not be possible within the cargo area.
- 9.3.2.31.4 The surface temperature of the outer parts of engines used during loading or unloading operations, as well as that of their air inlets and exhaust ducts shall not exceed the allowable temperature according to the temperature class. This provision does not apply to engines installed in service spaces provided the provisions of 9.3.2.52.3 (b) are fully complied with.
- 9.3.2.31.5 The ventilation in the closed engine room shall be designed so that, at an ambient temperature of 20° C, the average temperature in the engine room does not exceed 40° C.

**9.3.2.32 Oil fuel tanks**

- 9.3.2.32.1. Where the vessel is provided with hold spaces, the double bottoms within these spaces may be arranged as oil fuel tanks, provided their depth is not less than 0.60 m.

Oil fuel pipes and openings of such tanks are not permitted in the hold space.

- 9.3.2.32.2 The open ends of the air pipes of all oil fuel tanks shall extend to not less than 0.50 m above the open deck. Their open ends and the open ends of overflow pipes leading to the deck shall be fitted with a protective device consisting of a gauze diaphragm or a perforated plate.

**9.3.2.33**

**9.3.2.34 Exhaust pipes**

- 9.3.2.34.1 Exhausts shall be evacuated from the vessel into the open air either upwards through an exhaust pipe or through the shell plating. The exhaust outlet shall be located not less than 2.00 m from the cargo area. The exhaust pipes of engines shall be arranged so that the exhausts are led away from the vessel. The exhaust pipes shall not be located within the cargo area.
- 9.3.2.34.2 Exhaust pipes shall be provided with a device preventing the escape of sparks, e.g. spark arresters.

**9.3.2.35 Bilge pumping and ballasting arrangements**

9.3.2.35.1 Bilge and ballast pumps for spaces within the cargo area shall be installed within such area.

This provision does not apply to:

- double-hull spaces and double bottoms which do not have a common boundary wall with the cargo tanks;
- cofferdams and hold spaces where ballasting is carried out using the piping of the fire-fighting system in the cargo area and bilge-pumping is performed using educators.

9.3.2.35.2 Where the double bottom is used as an oil fuel tank, it shall not be connected to the bilge piping system.

9.3.2.35.3 Where the ballast pump is installed in the cargo area, the standpipe and its outboard connection for suction of ballast water shall be located within the cargo area but outside the cargo tanks.

9.3.2.35.4 A cargo pump-room below deck shall be capable of being drained in an emergency by an installation located in the cargo area and independent from any other installation. This installation shall be provided outside the cargo pump-room.

**9.3.2.36-  
9.3.2.39**

**9.3.2.40 Fire-extinguishing arrangements**

9.3.2.40.1 A fire-extinguishing system shall be installed on the vessel.

This system shall comply with the following requirements:

- It shall be supplied by two independent fire or ballast pumps, one of which shall be ready for use at any time. These pumps shall not be installed in the same space;
- It shall be provided with a water main fitted with at least three hydrants in the cargo area above deck. Three suitable and sufficiently long hoses with spray nozzles having a diameter of not less than 12 mm shall be provided. It shall be possible to reach any point of the deck in the cargo area simultaneously with at least two jets of water which do not emanate from the same hydrant.

A spring-loaded non-return valve shall be fitted to ensure that no gases can escape through the fire-extinguishing system into the accommodation or service spaces outside the cargo area;

- The capacity of the system shall be at least sufficient for a jet of water to have a minimum reach of not less than the vessel's breadth from any location on board with two spray nozzles being used at the same time.

9.3.2.40.2 In addition, the engine rooms, the pump-room and all spaces containing essential equipment (switchboards, compressors, etc.) for the refrigeration equipment, if any, shall be provided with a fixed fire-extinguishing system which can be operated from the deck.

9.3.2.40.3 The two hand fire-extinguishers referred to in 8.1.4 shall be located in the cargo area.

[9.3.2.40.4 The fire-extinguishing agent and the quantity contained in the permanently fixed fire-extinguishing system shall be suitable and sufficient for fighting fires.]

#### **9.3.2.41 Fire and naked light**

9.3.2.41.1 The outlets of funnels shall be located not less than 2.00 m from the cargo area. Arrangements shall be provided to prevent the escape of sparks and the entry of water.

9.3.2.41.2 Heating, cooking and refrigerating appliances shall not be fuelled with liquid fuels, liquid gas or solid fuels.

The installation in the engine room or in another separate space of heating appliances fuelled with liquid fuel having a flash-point above 55° C is, however, permitted.

Cooking and refrigerating appliances are permitted only in the accommodation.

9.3.2.41.3 Only electrical lighting appliances are permitted.

#### **9.3.2.42 Cargo heating system**

9.3.2.42.1 Boilers which are used for heating the cargo shall be fuelled with a liquid fuel having a flashpoint of more than 55° C. They shall be placed either in the engine room or in another separate space below deck and outside the cargo area, which is accessible from the deck or from the engine room.

9.3.2.42.2 The cargo heating system shall be designed so that the cargo cannot penetrate into the boiler in the case of a leak in the heating coils. A cargo heating system with artificial draught shall be ignited electrically.

9.3.2.42.3 The ventilation system of the engine room shall be designed taking into account the air required for the boiler.

9.3.2.42.4 Where the cargo heating system is used during loading, unloading or gas-freeing, the service space which contains this system shall fully comply with the requirements of 9.3.2.52.3 (b). This requirement does not apply to the inlets of the ventilation system. These inlets shall be located at a minimum distance of 2.00 m from the cargo area and 6.00 m from the openings of cargo tanks or residual cargo tanks, loading pumps situated on deck, openings of high velocity vent valves, pressure valves and shore connections of loading and unloading pipes and must be located not less than 2.00 m above the deck.

The requirements of 9.3.2.52.3 (b) are not applicable to the unloading of substances having a flash point of 61° C or more when the temperature of the product is at least 15 K lower at the flash point.

**9.3.2.43-**

**9.3.2.49**

**9.3.2.50 Documents concerning electrical installations**

9.3.2.50.1 In addition to the documents required by the *Recommendations on Technical Requirements for Inland Navigation Vessels*, the following documents shall be on board:

- (a) a drawing indicating the boundaries of the cargo area and the location of the electrical equipment installed in this area;
- (b) a list of the electrical equipment referred to in (a) above including the following particulars:

**machine or appliance, location, type of protection, type of protection against explosion, testing body and approval number;**

- (c) a list of or general plan indicating the electrical equipment outside the cargo area which may be operated during loading, unloading or gas-freeing. All other electrical equipment shall be marked in red. See 9.3.2.52.3 and 9.3.2.52.4.

9.3.2.50.2 The documents listed above shall bear the stamp of the competent authority issuing the certificate of approval.

### **9.3.2.51 Electrical installations**

9.3.2.51.1 Only distribution systems without return connection to the hull are permitted:

This provision does not apply to:

- local installations outside the cargo area (e.g. connections of starters of diesel engines);
- the device for checking the insulation level referred to in 9.3.2.51.2 below.

9.3.2.51.2 Every insulated distribution network shall be fitted with an automatic device with a visual and audible alarm for checking the insulation level.

9.3.2.51.3 For the selection of electrical equipment to be used in zones presenting an explosion risk, the explosion groups and temperature classes assigned to the substances carried in accordance with Chapter 3.2, Table C, columns 15 and 16 shall be taken into consideration.

### **9.3.2.52 Type and location of electrical equipment**

9.3.2.52.1 (a) Only the following equipment may be installed in cargo tanks, residual cargo tanks and pipes for loading and unloading (comparable to zone 0):

- measuring, regulation and alarm devices of the EEx (ia) type of protection;

(b) Only the following equipment may be installed in the cofferdams, double-hull spaces, double bottoms and hold spaces (comparable to zone 1):

- measuring, regulation and alarm devices of the “certified safe” type;
- lighting appliances of the “flame-proof enclosure” or “pressurized enclosure” type of protection;
- hermetically sealed echo sounding devices the cables of which are led through thick-walled steel tubes with gastight connections up to the main deck;
- cables for the active cathodic protection of the shell plating in protective steel tubes such as those provided for echo sounding devices;

- (c) Only the following equipment may be installed in the service spaces in the cargo area below deck (comparable to zone 1):
  - measuring, regulation and alarm devices of the “certified safe” type;
  - lighting appliances of the “flame-proof enclosure” or “pressurized apparatus” type of protection;
  - motors driving essential equipment such as ballast pumps; they shall be of the “certified safe” type;
- (d) The control and protective equipment of the electrical equipment referred to in paragraphs (a), (b) and (c) above shall be located outside the cargo area if they are not intrinsically safe;
- (e) The electrical equipment in the cargo area on deck (comparable to zone 1) shall be of the “certified safe” type.

9.3.2.52.2 Accumulators shall be located outside the cargo area.

- 9.3.2.52.3
- (a) Electrical equipment used during loading, unloading and gas-freeing during berthing and which are located outside the cargo area shall (comparable to zone 2) be at least of the “limited explosion risk” type.
  - (b) This provision does not apply to:
    - (i) lighting installations in the accommodation, except for switches near entrances to accommodation;
    - (ii) radiotelephone installations in the accommodation or the wheelhouse;
    - (iii) electrical installations in the accommodation, the wheelhouse or the service spaces outside the cargo areas if:
      1. These spaces are fitted with a ventilation system ensuring an overpressure of 0.1 kPa (0.001 bar) and none of the windows is capable of being opened; the air intakes of the ventilation system shall be located as far away as possible, however, not less than 6.00 m from the cargo area and not less than 2.00 m above the deck;

2. The spaces are fitted with a gas detection system with sensors:
  - at the suction inlets of the ventilation system;
  - directly at the top edge of the sill of the entrance doors of the accommodation and service spaces;
3. The gas concentration measurement is continuous;
4. When the gas concentration reaches 20% of the lower explosive limit, the ventilators are switched off. In such a case and when the overpressure is not maintained or in the event of failure of the gas detection system, the electrical installations which do not comply with (a) above, shall be switched off. These operations shall be performed immediately and automatically and activate the emergency lighting in the accommodation, the wheelhouse and the service spaces, which shall comply at least with the “limited explosion risk” type. The switching-off shall be indicated in the accommodation and wheelhouse by visual and audible signals;
5. The ventilation system, the gas detection system and the alarm of the switch-off device fully comply with the requirements of (a) above;
6. The automatic switching-off device is set so that no automatic switch off may occur while the vessel is under way.

- 9.3.2.52.4 The electrical equipment which does not meet the requirements set out in 9.3.2.52.3 above together with its switches shall be marked in red. The disconnection of such equipment shall be operated from a centralized location on board.
- 9.3.2.52.5 An electric generator which is permanently driven by an engine and which does not meet the requirements of 9.3.2.52.3 above, shall be fitted with a switch capable of shutting down the excitation of the generator. A notice board with the operating instructions shall be displayed near the switch.
- 9.3.2.52.6 Sockets for the connection of signal lights and gangway lighting shall be permanently fitted to the vessel close to the signal mast or the gangway. Connecting and disconnecting shall not be possible except when the sockets are not live.

- 9.3.2.52.7 The failure of the power supply for the safety and control equipment shall be immediately indicated by visual and audible signals at the locations where the alarms are usually actuated.

**9.3.2.53 Earthing**

- 9.3.2.53.1 The metal parts of electrical appliances in the cargo area which are not live as well as protective metal tubes or metal sheaths of cables in normal service shall be earthed, unless they are so arranged that they are automatically earthed by bonding to the metal structure of the vessel.

- 9.3.2.53.2 The provisions of 9.3.2.53.1 above apply also to equipment having service voltages of less than 50 V.

- 9.3.2.53.3 Independent cargo tanks, metal intermediate bulk containers and tank-containers shall be earthed.

**9.3.2.54-**

**9.3.2.55**

**9.3.2.56 Electrical cables**

- 9.3.2.56.1 All cables in the cargo area shall have a metallic sheath.

- 9.3.2.56.2 Cables and sockets in the cargo area shall be protected against mechanical damage.

- 9.3.2.56.3 Movable cables are prohibited in the cargo area, except for intrinsically safe electric circuits or for the supply of signal lights and gangway lighting.

- 9.3.2.56.4 Cables of intrinsically safe circuits shall only be used for such circuits and shall be separated from other cables not intended for being used in such circuits (e.g. they shall not be installed together in the same string of cables and they shall not be fixed by the same cable clamps).

- 9.3.2.56.5 For movable cables intended for signal lights and gangway lighting, only sheathed cables of type H 07 RN-F in accordance with 245 IEC 66 or cables of at least equivalent design having conductors with a cross-section of not less than 1.5 mm<sup>2</sup> shall be used.

These cables shall be as short as possible and installed so that damage is not likely to occur.

**9.3.2.57-**

**9.3.2.59**

**9.3.2.60 Special equipment**

A shower and an eye and face bath shall be provided on the vessel at a location which is directly accessible from the cargo area.

**9.3.2.61-  
9.3.2.70**

**9.3.2.71 Admittance on board**

The notice boards displaying the prohibition of admittance in accordance with 7.2.3.71 shall be clearly legible from either side of the vessel.

**9.3.2.72-  
9.3.2.73**

**9.3.2.74 Prohibition of smoking, fire or naked light**

9.3.2.74.1 The notice boards displaying the prohibition of smoking in accordance with 7.2.3.74 shall be clearly legible from either side of the vessel.

9.3.2.74.2 Notice boards indicating the circumstances under which the prohibition is applicable shall be fitted near the entrances to the spaces where smoking or the use of fire or naked light is not always prohibited.

9.3.2.74.3 Ashtrays shall be provided close to each exit of the accommodation and the wheelhouse.

**9.3.2.75-  
9.3.2.91**

**9.3.2.92 Emergency exit**

Spaces the entrances or exits of which are likely to become partly or completely immersed in the damaged condition shall have an emergency exit which is situated not less than 0.10 m above the damage waterline. [This requirement does not apply to forepeak and afterpeak.]

**9.3.2.93-  
9.3.2.99**

### **9.3.3 Rules for construction of type N tank vessels**

The rules for construction of 9.3.3.0 to 9.3.3.99 apply to type N tank vessels.

#### **9.3.3.0 Materials of construction**

- 9.3.3.0.1 (a) The vessel's hull and the cargo tanks shall be constructed of shipbuilding steel or other at least equivalent metal.

The independent cargo tanks may also be constructed of other materials, provided these have at least equivalent mechanical properties and resistance against the effects of temperature and fire.

- (b) Every part of the vessel including any installation and equipment which may come into contact with the cargo shall consist of materials which can neither be dangerously affected by the cargo nor cause decomposition of the cargo or react with it so as to form harmful or hazardous products.
- (c) Inside vapour pipes and gas discharge pipes shall be protected against erosion.

- 9.3.3.0.2 Except where explicitly permitted in 9.3.3.03 below or in the certificate of approval, the use of wood, aluminium alloys or plastic materials within the cargo area is prohibited.

- 9.3.3.0.3 (a) The use of wood, aluminium alloys or plastic materials within the cargo area is only permitted for:
- gangways and external ladders;
  - movable items of equipment (aluminium gauging rods are, however, permitted provided that they are fitted with brass feet or protected in another way to avoid sparking);
  - chocking of cargo tanks which are independent of the vessel's hull and chocking of installations and equipment;
  - masts and similar round timber;
  - engine parts;
  - parts of the electrical installation;
  - loading and unloading appliances;
  - lids of boxes which are placed on the deck.

- (b) The use of wood or plastic materials within the cargo area is only permitted for:
  - supports and stops of any kind.
- (c) The use of plastic materials or rubber within the cargo area is only permitted for:
  - coating of cargo tanks and of hoses for loading and unloading;
  - all kinds of gaskets (e.g. for dome or hatch covers);
  - electric cables;
  - hoses for loading and unloading;
  - insulation of cargo tanks and of hoses for loading and unloading.
- (d) All permanently fitted materials in the accommodation or wheelhouse, with the exception of furniture, shall not readily ignite. They shall not evolve fumes or toxic gases in dangerous quantities, if involved in a fire.

9.3.3.0.4 The paint used in the cargo area shall not be liable to produce sparks in case of impact.

9.3.3.0.5 The use of plastic material for vessel's boats is permitted only if the material does not readily ignite.

**9.3.3.1-  
9.3.3.7**

**9.3.3.8 Classification**

9.3.3.8.1 The tank vessel shall be built under survey of a recognized classification society in accordance with the rules established by that classification society for its highest class, and the tank vessel shall be classed accordingly.

The vessel's class shall be continued.

9.3.3.8.2 The cargo pump-rooms shall be inspected by a recognized classification society whenever the certificate of approval has to be renewed as well as during the third year of validity of the certificate of approval. The inspection shall comprise at least:

- an inspection of the whole system for its condition, for corrosion, leakage or conversion works which have not been approved;
- a checking of the condition of the gas detection system in the cargo pump-rooms.

Inspection certificates signed by the recognized classification society with respect to the inspection of the cargo pump-rooms shall be kept on board. The inspection certificates shall at least include particulars of the above inspection and the results obtained as well as the date of the inspection.

9.3.3.8.3 The condition of the gas detection system referred to in 9.3.3.52.3 (b) shall be checked by a recognized classification society whenever the certificate of approval has to be renewed and during the third year of validity of the certificate of approval. A certificate signed by the recognized classification society shall be kept on board.

9.3.3.8.4 9.3.3.8.2 and 9.3.3.8.3, checking of the condition of the gas detection system, do not apply to open type N.

### **9.3.3.9**

#### **9.3.3.10 Protection against the penetration of gases**

9.3.3.10.1 The vessel shall be designed so as to prevent gases from penetrating into the accommodation and the service spaces.

9.3.3.10.2 The lower edges of door-openings in the sidewalls of superstructures and the coaming of access hatches to under-deck spaces shall have a height of not less than 0.50 m above the deck.

This requirement need not be complied with if the wall of the superstructures facing the cargo area extends from one side of the ship to the other and has doors the sills of which have a height of not less than 0.50 m above the deck. The height of this wall shall be not less than 2.00 m.

In this case, the lower edges of door-openings in the sidewalls of superstructures and the coamings of access hatches behind this wall shall have a height of not less than 0.10 m above the deck. The sills of engine room doors and access hatches shall, however, always have a height of not less than 0.50 m.

9.3.3.10.3 The bulwarks, foot-rails etc. shall be provided with sufficiently large openings which are located directly above the deck.

9.3.3.10.4 9.3.3.10.1 to 9.3.3.10.3 above do not apply to open type N.

**9.3.3.11 Hold spaces and cargo tanks**

- 9.3.3.11.1 (a) The maximum permissible capacity of a cargo tank shall be determined in accordance with the following table:

$L \cdot B \cdot H$ (m <sup>3</sup> )	Maximum permissible capacity of a cargo tank (m <sup>3</sup> )
up to 600	$L \cdot B \cdot H \cdot 0.3$
600 to 3 750	$180 + (L \cdot B \cdot H - 600) \cdot 0.0635$
> 3 750	380

In the table above  $L \cdot B \cdot H$  is the product of the main dimensions of the tank vessel in metres (according to the measurement certificate), where:

L = overall length of the hull;

B = extreme breadth of the hull;

H = shortest vertical distance between the top of the keel and the lowest point of the deck at the side of the vessel (moulded depth) within the cargo area.

For trunk vessels, H shall be replaced by H', where H' shall be obtained from the following formula:

$$H' = H + (ht \cdot bt/B \cdot lt/L)$$

where:

ht = trunk height (distance between trunk deck and main deck measured on trunk side at L/2);

bt = trunk breadth;

lt = trunk length.

- (b) The relative density of the substances to be carried shall be taken into consideration in the design of the cargo tanks. The maximum relative density shall be indicated in the certificate of approval.
- (c) When the vessel is provided with pressure cargo tanks, these tanks shall be designed for a working pressure of 400 kPa (4 bar).

- (d) For vessels with a length of not more than 50.00 m, the length of a cargo tank shall not exceed 10.00 m;

for vessels with a length of more than 50.00 m, the length of a cargo tank shall not exceed 0.20 L.

This provision does not apply to vessels with independent built-in cylindrical tanks having a length to diameter ratio  $\leq 7$ .

- 9.3.3.11.2 (a) The cargo tanks independent of the vessel's hull shall be fixed so that they cannot float.

- (b) The capacity of a suction well shall be limited to not more than 0.10 m<sup>3</sup>.

- 9.3.3.11.3 (a) The cargo tanks shall be separated by cofferdams of at least 0.60 m in width from the accommodation, engine room and service spaces outside the cargo area below deck or, if there are no such accommodation, engine room and service spaces, from the vessel's ends. Where the cargo tanks are installed in a hold space, a space of not less than 0.50 m shall be provided between such tanks and the end bulkheads of the hold space. In this case an insulated end bulkhead meeting the definition for Class "A-60" according to SOLAS II-2, Regulation 3, shall be deemed equivalent to a cofferdam. For pressure cargo tanks, the 0.50 m distance may be reduced to 0.20 m.

- (b) Hold spaces, cofferdams and cargo tanks shall be capable of being inspected.

- (c) All spaces in the cargo area shall be capable of being ventilated. Means for checking their gas-free condition shall be provided.

- 9.3.3.11.4 The bulkheads bounding the cargo tanks, cofferdams and hold spaces shall be watertight. The cargo tanks, cofferdams and the end bulkheads of the hold spaces, as well as the bulkheads bounding the cargo area shall have no openings or penetrations below deck. Penetrations through bulkheads between two hold spaces are, however, permitted.

The bulkhead between the engine room and the cofferdam or service space in the cargo area or between the engine room and a hold space may be fitted with penetrations provided that they conform to the provisions of 9.3.3.17.5.

The bulkhead between the cargo tank and the cargo pump-room below deck may be fitted with penetrations provided that they conform to the provisions of 9.3.3.17.6. If the vessel is fitted with a cargo pump-room below deck, the bulkheads between the cargo tanks may be fitted with passages provided that the

loading pipes are fitted with shut-off devices in the cargo tank direct at the bulkhead and in the cargo pump-room direct at the bulkhead. The shut-off devices shall be capable of being activated from the deck.

9.3.3.11.5 Double-hull spaces and double bottoms in the cargo area shall be arranged for being filled with ballast water only. Double bottoms may, however, be used as oil fuel tanks, provided they comply with the provisions of 9.3.3.32.

9.3.3.11.6 (a) A cofferdam, the centre part of a cofferdam or another space below deck in the cargo area may be arranged as a service space, provided the bulkheads bounding the service space extend vertically to the bottom. This service space shall only be accessible from the deck.

(b) The service space shall be watertight with the exception of its access hatches and ventilation inlets.

(c) No pipes for loading and unloading shall be fitted within the service space referred to under 9.3.3.11.4 above.

Pipes for loading and unloading may be fitted in the cargo pump-rooms below deck only when they conform to the provisions of 9.3.3.17.6.

9.3.3.11.7 Where a vessel is constructed with hold spaces containing cargo tanks which are independent of the structure of the vessel, the space between the wall of the hold space and the wall of the cargo tanks shall be not less than 0.60 m. The space between the bottom of the hold space and the bottom of the cargo tanks shall be not less than 0.50 m.

[The space between the suction well and the bottom structures shall be not less than 0.10 m.]

The space may be reduced to 0.40 m under the pump sumps.

If the above-mentioned spaces are not feasible, it shall be possible to remove the cargo tanks easily.

9.3.3.11.8 Where service spaces are located in the cargo area under deck, they shall be arranged so as to be easily accessible and to permit persons wearing protective clothing and breathing apparatus to safely operate the service equipment contained therein. They shall be designed so as to allow injured or unconscious personnel to be removed from such spaces without difficulties, if necessary by means of fixed equipment.

- 9.3.3.11.9 Cofferdams, double-hull spaces, double bottoms, cargo tanks, hold spaces and other accessible spaces within the cargo area shall be arranged so that they may be completely inspected and cleaned. The dimensions of openings except for those of double-hull spaces and double bottoms which do not have a wall adjoining the cargo tanks shall be sufficient to allow a person wearing breathing apparatus to enter or leave the space without difficulties. These openings shall have a minimum cross-section of 0.36 m<sup>2</sup> and a minimum side length of 0.50 m. They shall be designed so as to allow injured or unconscious personnel to be removed from the bottom of such a space without difficulties, if necessary by means of fixed equipment. In these spaces the distance between the reinforcements shall not be less than 0.50 m. In double bottoms this distance may be reduced to 0.45 m.

Cargo tanks may have circular openings with a diameter of not less than 0.68 m.

- 9.3.3.11.10 9.3.3.11.6 (c) above does not apply to open type N.

- [9.3.3.11.11 The outside of cargo tanks for the carriage of UN No. 2448, SULPHUR, MOLTEN, shall be fitted with insulation which is not readily flammable. Such insulation must be sufficiently solid to resist shocks and vibrations. Under the deck, the insulation shall be protected by a cover.

The temperature of the outside of this cover shall not exceed 70° C.]

### **9.3.3.12 Ventilation**

- [9.3.3.12.1 Each hold space shall have two openings the dimensions and location of which shall be such as to permit effective ventilation of any part of the hold space. If there are no such openings, it shall be possible to fill the hold spaces with inert gas or dry air.]

- 9.3.3.12.2 Double-hull spaces and double bottoms within the cargo area which are not arranged for being filled with ballast water, hold spaces and cofferdams shall be provided with ventilation systems.

- 9.3.3.12.3 Any service spaces located in the cargo area below deck shall be provided with a system of forced ventilation with sufficient power for ensuring at least 20 changes of air per hour based on the volume of the space. The ventilator fan shall be designed so that no sparks may be emitted on contact of the impeller blades with the housing and no static electricity may be generated.

The ventilation exhaust ducts shall be located up to 50 mm above the bottom of the service space. The fresh air inlets shall be located in the upper part; they shall be not less than 2.00 m above the deck, not less than 2.00 m from the openings of the cargo tanks and not less than 6.00 m from the outlets of safety valves. The extension pipes which may be necessary may be of the hinged type.

{On board open type N vessels fixed ventilation devices shall be sufficient.}

- 9.3.3.12.4 Ventilation of accommodation and service spaces shall be possible.
- 9.3.3.12.5 Ventilators used for gas-freeing of tanks shall be designed so that no sparks may be emitted on contact of the impeller blades with the housing and no static electricity may be generated.
- 9.3.3.12.6 Notice boards shall be fitted at the ventilation inlets indicating the conditions when they shall be closed. Any ventilation inlets of accommodation and service spaces leading outside shall be fitted with fire flaps. Such ventilation inlets shall be located not less than 2.00 m from the cargo area.
- Ventilation inlets of service spaces in the cargo area below deck may be located within such area.
- 9.3.3.12.7 Flame-arresters prescribed in 9.3.3.20.4, 9.3.3.21.11, 9.3.3.22.4, 9.3.3.22.5 and 9.3.3.26.3 shall be of a type approved for this purpose by the competent authority.
- 9.3.3.12.8 9.3.3.12.5, 9.3.3.12.6 and 9.3.3.12.7 above do not apply to open type N.
- [9.3.3.12.9 Hold spaces containing cargo tanks for the carriage of UN No. 2448, SULPHUR, MOLTEN, shall be provided with ventilation. Provision shall be made for connections for forced ventilation.
- 9.3.3.12.10 Cargo tanks for the carriage of UN No. 2448, SULPHUR, MOLTEN, shall be provided with forced ventilation systems which, under all conditions of carriage, maintain securely the concentration of hydrosulphuric acid above the liquid phase below 1.85% in volume.
- The ventilation systems shall be so arranged so as to avoid any deposit from the goods to be carried.
- The ventilation exhaust duct shall be so arranged as not to constitute a hazard for persons.]
- 9.3.3.13 Stability (general)**
- 9.3.3.13.1 Proof of sufficient stability shall be furnished. This proof is not required for vessels with cargo tanks the width of which is not more than  $0.70 \cdot B$ .
- 9.3.3.13.2 The basic values for the stability calculation - the vessel's lightweight and location of the centre of gravity - shall be determined either by means of an inclining experiment or by detailed mass and moment calculation. In the latter case the lightweight of the vessel shall be checked by means of a lightweight test with a tolerance limit of  $\pm 5\%$  between the mass determined by calculation and the displacement determined by the draught readings.

- 9.3.3.13.3 Proof of sufficient intact stability shall be furnished for all stages of loading and unloading and for the final loading condition.

**9.3.3.14 Stability (intact)**

For vessels with cargo tanks the width of which is more than  $0.70 \cdot B$ , proof shall be furnished that, at an angle of  $5^\circ$  or, when this angle is less, at a heeling angle at which an opening becomes immersed, the righting arm is 0.10 m. The stability-reducing free surface effect in the case of cargo tanks filled to less than 95% of their capacity shall be taken into account.

**9.3.3.15**

**9.3.3.16 Engine rooms**

- 9.3.3.16.1 Internal combustion engines for the vessel's propulsion as well as internal combustion engines for auxiliary machinery shall be located outside the cargo area. Entrances and other openings of engine rooms shall be at a distance of not less than 2.00 m from the cargo area.

- 9.3.3.16.2 The engine rooms shall be accessible from the deck; the entrances shall not face the cargo area. Where the doors are not located in a recess whose depth is at least equal to the door width, the hinges shall face the cargo area.

- 9.3.3.16.3 The last sentence of 9.3.3.16.2 does not apply to oil separator or supply vessels.

**9.3.3.17 Accommodation and service spaces**

- 9.3.3.17.1 Accommodation spaces and the wheelhouse shall be located outside the cargo area forward of the fore vertical plane or abaft the aft vertical plane bounding the part of cargo area below deck. Windows of the wheelhouse which are located not less than 1.00 m above the bottom of the wheelhouse may tilt forward.

- 9.3.3.17.2 Entrances to spaces and openings of superstructures shall not face the cargo area. Doors opening outward and not located in a recess whose depth is at least equal to the width of the doors shall have their hinges face the cargo area.

- 9.3.3.17.3 Entrances from the deck and openings of spaces facing the weather shall be capable of being closed. The following instruction shall be displayed at the entrance of such spaces:

**DO NOT OPEN DURING LOADING, UNLOADING OR GAS-FREEING  
WITHOUT PERMISSION FROM THE MASTER.  
CLOSE IMMEDIATELY.**

- 9.3.3.17.4 Entrances and windows of superstructures and accommodation spaces which can be opened as well as other openings of these spaces shall be located not less than 2.00 m from the cargo area. No wheelhouse doors and windows shall be located within 2.00 m from the cargo area, except where there is no direct connection between the wheelhouse and the accommodation.
- 9.3.3.17.5
- (a) Driving shafts of the bilge or ballast pumps may penetrate through the bulkhead between the service space and the engine room, provided the arrangement of the service space is in compliance with 9.3.3.11.6.
  - (b) The penetration of the shaft through the bulkhead shall be gastight and shall have been approved by a recognized classification society.
  - (c) The necessary operating instructions shall be displayed.
  - (d) Penetrations through the bulkhead between the engine room and the service space in the cargo area and the bulkhead between the engine room and the hold spaces may be provided for electrical cables, hydraulic lines and piping for measuring, control and alarm systems, provided that the penetrations have been approved by a recognized classification society. The penetrations shall be gastight. Penetrations through a bulkhead with an “A-60” fire protection insulation according to SOLAS II-2, Regulation 3, shall have an equivalent fire protection.
  - (e) Pipes may penetrate the bulkhead between the engine room and the service space in the cargo area provided that these are pipes between the mechanical equipment in the engine room and the service space which do not have any openings within the service space and which are provided with shut-off devices at the bulkhead in the engine room.
  - (f) Pipes from the engine room may penetrate through the service space in the cargo area or a cofferdam or a hold space to the outside provided that within the service space or cofferdam or hold space they are of the thick-walled type and have no flanges or openings.
  - (g) Where a driving shaft of auxiliary machinery penetrates through a wall located above the deck the penetration shall be gastight.
- 9.3.3.17.6 A service space located within the cargo area below deck shall not be used as a cargo pump-room for the loading and unloading system, except where:
- the cargo pump-room is separated from the engine room or from service spaces outside the cargo area by a cofferdam or a bulkhead with an “A-60” fire protection insulation according to SOLAS Chapter II-2, Regulation 3, or by a service space or a hold space;

- the “A-60” bulkhead required above does not include penetrations referred to in 9.3.3.17.5 (a);
- ventilation exhaust outlets are located not less than 6.00 m from entrances and openings of the accommodation and service spaces outside the cargo area;
- the access hatches and ventilation inlets can be closed from the outside;
- all pipes for loading and unloading as well as those of stripping systems are provided with shut-off devices at the pump suction side in the cargo pump-room immediately at the bulkhead. The necessary operation of the control devices in the pump-room, starting of pumps and control of the liquid flow rate shall be effected from the deck;
- the bilge of the cargo pump-room is equipped with a gauging device for measuring the filling level which activates a visual and audible alarm in the wheelhouse when liquid is accumulating in the cargo pump-room bilge;
- the cargo pump-room is provided with a permanent gas detection system which automatically indicates the presence of explosive gases or lack of oxygen by means of direct-measuring sensors and which actuates a visual and audible alarm when the gas concentration has reached 20% of the lower explosive limit. The sensors of this system shall be placed at suitable positions at the bottom and directly below the deck.

Measurement shall be continuous.

The audible and visual alarms are installed in the wheelhouse and in the cargo pump-room and, when the alarm is actuated, the loading and unloading system is shut down. Failure of the gas detection system shall be immediately signalled in the wheelhouse and on deck by means of audible and visual alarms;

- the ventilation system prescribed in 331 212 (3) has a capacity of not less than 30 changes of air per hour based on the total volume of the service space.

9.3.3.17.7 The following instruction shall be displayed at the entrance of the cargo pump-room:

**BEFORE ENTERING THE CARGO PUMP-ROOM CHECK WHETHER  
IT IS FREE FROM GASES AND CONTAINS SUFFICIENT OXYGEN.  
DO NOT OPEN DOORS AND ENTRANCE OPENINGS WITHOUT  
THE PERMISSION OF THE MASTER.  
LEAVE IMMEDIATELY IN THE EVENT OF ALARM.**

- 9.3.3.17.8 9.3.3.17.5 (g), 9.3.3.17.6 and 9.3.3.17.7 do not apply to open type N.
- 9.3.3.17.2, last sentence, 9.3.3.17.3, last sentence and 9.3.3.17.4 do not apply to oil separator and supply vessels.

**9.3.3.18-  
9.3.3.19**

**9.3.3.20 Arrangement of cofferdams**

- 9.3.3.20.1 Cofferdams or cofferdam compartments located next to a service space which has been arranged in accordance with 9.3.3.11.6 shall be accessible through an access hatch. These requirements are not applicable when the bulkhead between the engine room and the cofferdam has an “A-16” fire protection insulation according to SOLAS II-2, Regulation 3 or has been arranged as a service space.

The access hatch and ventilation inlets shall be located not less than 0.50 m above the deck.

- 9.3.3.20.2 Cofferdams shall be capable of being filled with water and emptied by means of a pump. Filling shall be effected within 30 minutes. These requirements are not applicable when the bulkhead between the engine room and the cofferdam has an “A-16” fire protection insulation according to SOLAS II-2, Regulation 3.

The cofferdams shall not be fitted with inlet valves.

- 9.3.3.20.3 No fixed pipe shall permit connection between a cofferdam and other piping of the vessel outside the cargo area.

- 9.3.3.20.4 The ventilation openings of cofferdams shall be fitted with a flame-arrester.

- 9.3.3.20.5 9.3.3.20.4 above does not apply to open type N.

9.3.3.20.2 above does not apply to oil separator and supply vessels.

**9.3.3.21 Safety and control installations**

- 9.3.3.21.1 Cargo tanks shall be provided with the following equipment:

- (a) a mark inside the tank indicating the liquid level of 97%;
- (b) a level gauge;
- (c) a level alarm device which is activated at the latest when a degree of filling of 90% is reached;

- (d) a high level sensor for actuating the facility against overflowing when a degree of filling of 97.5% is reached;
- (e) an instrument for measuring the pressure of the vapour phase inside the cargo tank;
- (f) an instrument for measuring the temperature of the cargo, when a system for heating the cargo is required in Chapter 3.2, Table C, column 9 or a maximum temperature is indicated in column 20 of that list;
- (g) a nozzle with a closure connected to a sampling device of the closed or partially closed type and/or a sampling opening as required in Chapter 3.2, Table C, column 13;
- (h) an ullage opening.

9.3.3.21.2 When the degree of filling in per cent is determined, an error of not more than 0.5% is permitted. It shall be calculated on the basis of the total cargo tank capacity including the expansion trunk.

9.3.3.21.3 The level gauge shall allow readings from the control position of the shut-off devices of the particular cargo tank.

9.3.3.21.4 The level alarm device shall give a visual and audible warning on board when actuated. The level alarm device shall be independent of the level gauge.

9.3.3.21.5 (a) The high level sensor referred to in 9.3.3.21.1 (d) above shall give a visual and audible alarm on board and at the same time actuate an electrical contact which in the form of a binary signal interrupts the electric current loop provided and fed by the shore facility, thus initiating measures at the shore facility against overflowing during loading operations. The signal shall be transmitted to the shore facility via a watertight two-pin plug of a connector device in accordance with IEC Publication No. 309 for direct current of 40 to 50 volts, identification colour white, position of the nose 10 h.

The plug shall be permanently fitted to the vessel close to the shore connections of the loading and unloading pipes.

The high level sensor shall also be capable of switching off the vessel's own discharging pump.

The high level sensor shall be independent of the level alarm device, but it may be connected to the level gauge.

- (b) On board oil separator vessels the sensor referred to in 9.3.3.21.1 (d) shall activate a visual and audible alarm and switch off the pump used to evacuate bilge water.
- (c) Supply vessels and other vessels which may be delivering products required for operation shall be equipped with a connecting nozzle conforming to European standard EN 12 827 and a rapid closing device enabling refuelling to be interrupted. A control facility shall actuate this device by a binary signal from the section of the facility for the prevention of overflowing located on the supply vessel. It shall be possible to actuate the rapid closing device independently of the binary signal.

The control facility shall convert the binary signal into a signal actuating the rapid closing device.

The electrical circuits actuating the rapid closing device shall be secured according to the quiescent current principle or other appropriate error detection measures. The state of operation of electrical circuits which cannot be controlled using the quiescent current principle shall be capable of being easily checked.

It shall be possible to transmit the binary signal to the control facility using a fail-safe electrical circuit fitted with a connector device in accordance with IEC publication 309, for direct current of 40 to 50 volts, identification colour white, position of the nose 10 h.

The rapid closing device shall actuate a visual and an audible alarm on board.

- 9.3.3.21.6 The visual and audible signals given by the level alarm device shall be clearly distinguishable from those of the high level sensor.

The visual alarm shall be visible at each control position on deck of the cargo tank stop valves. It shall be possible to easily check the functioning of the sensors and electric circuits or these shall be of the “failsafe” design.

- 9.3.3.21.7 When the pressure or temperature exceeds a set value, instruments for measuring the vacuum or overpressure of the gaseous phase in the cargo tank or the temperature of the cargo, shall activate a visual and audible alarm in the wheelhouse. When the wheelhouse is unoccupied, the alarm shall also be perceptible in a location occupied by a crew member. When the pressure exceeds the set value during loading, the instrument for measuring the pressure shall, by means of the plug referred to in 9.3.3.21.5, initiate simultaneously an electrical contact which shall put into effect measures to interrupt the loading operation. If the vessel’s own discharge pump is used, it shall be switched off automatically.

The instrument for measuring the overpressure or vacuum shall activate the alarm when an overpressure equal to 1.15 times the opening pressure of the pressure valve, or a vacuum pressure of 1.1 times the opening pressure of the vacuum pressure valve is reached. The maximum allowable temperature is indicated in Chapter 3.2, Table C, column 20. The sensors for the alarms mentioned in this paragraph may be connected to the alarm device of the sensor.

When a manometer is used to measure the overpressure or the vacuum pressure, its indicator scale shall not be less than 0.14 m in diameter. The maximum permissible overpressure or vacuum values shall be indicated by a red mark. The manometers shall be capable of being read at all times from the location where it is possible to interrupt loading or unloading.

When it is prescribed in Chapter 3.2, Table C, column 20 the instrument for measuring the overpressure of the gaseous phase shall activate a visible and audible alarm in the wheelhouse when the overpressure exceeds 40 kPa during the voyage. When the wheelhouse is unoccupied, the alarm shall also be perceptible in a location occupied by a crew member. The manometers shall be capable of being read in the immediate vicinity of the water-spray system control.

- 9.3.3.21.8 Where the control elements of the shut-off devices of the cargo tanks are located in a control room, reading of the level gauges shall be possible in the control room and the visual and audible warning given by the level alarm device, the high level sensor referred to in 9.3.3.21 (d) and the instruments for measuring the pressure of the vapour phase and temperature of the cargo shall be noticeable in the control room and on deck.

Satisfactory monitoring of the cargo area shall be ensured from the control room.

- 9.3.3.21.9 The closed-type sampling device penetrating through the boundary of the cargo tank but constituting a part of a closed system shall be designed so that during sampling no gas or liquid may escape from the cargo tank. The device shall be of a type approved by the competent authority for this purpose.
- 9.3.3.21.10 The partly closed sampling device penetrating through the boundary of the cargo tank shall be such that during sampling only a small quantity of gaseous or liquid cargo can escape into open air. As long as the device is not used it shall be closed completely. The device shall be of a type approved by the competent authority for this purpose.
- 9.3.3.21.11 The sampling openings shall have a diameter of not more than 0.30 m. They shall be fitted with a flame-arrester plate stack capable of withstanding steady burning and shall be so designed that the period during which they remain open is as short as possible and the flame-arrester plate stack does not remain open without external intervention.

Flame-arrester plate stacks are not required on board open type N tank vessels.

9.3.3.21.12 The ullage openings shall be such that the filling level may be measured by means of a gauging rod. The ullage openings shall be fitted with a self-closing lid.

9.3.3.21.13 9.3.3.21.1 (h) does not apply to closed type N.

9.3.3.21.1 (e), 9.3.3.21.7 as regards measuring the pressure, 9.3.3.21.9 and 9.3.3.21.10 do not apply to open type N with flame-arrester and to open type N.

9.3.3.21.1 (h) and 9.3.3.21.12 do not apply to open type N.

9.3.3.21.1 (f) and 9.3.3.21.7 do not apply to supply vessels.

9.3.3.21.5 (a) does not apply to oil separator vessels.

[9.3.3.21.14 Cargo tanks and hold spaces for the carriage of UN No. 2448, SULPHUR, MOLTEN shall be provided with openings and piping for gas-sampling.]

### **9.3.3.22 Cargo tank openings**

9.3.3.22.1 (a) Cargo tank openings shall be located on deck in the cargo area.

(b) Cargo tank openings with a cross-section of more than 0.10 m<sup>2</sup> and openings of safety devices for preventing overpressures shall be located not less than 0.50 m above deck.

9.3.3.22.2 Cargo tank openings shall be fitted with gastight closures capable of withstanding the test pressure in accordance with 9.3.3.23.1.

9.3.3.22.3 Closures which are normally used during loading or unloading operations shall not cause sparking when operated.

9.3.3.22.4 (a) Each cargo tank or group of cargo tanks connected to a common vapour pipe shall be fitted with safety devices for preventing unacceptable overpressures or vacuums.

These safety devices shall be as follows:

for the open N type:

- safety devices designed to prevent any accumulation of water and its penetration into the cargo tanks;

for the open N type with flame-arresters:

- safety equipment fitted with flame-arresters capable of withstanding steady burning and designed to prevent any accumulation of water and its penetration into the cargo tank;

for the closed N type:

- safety devices for preventing unacceptable overpressure or vacuum. Where anti-explosion protection is required in Chapter 3.2, Table C, column 17, the vacuum valve shall be fitted with a flame arrester capable of withstanding a deflagration and the pressure relief valve with a high-velocity vent valve acting as a flame arrester capable of withstanding steady burning. Gases shall be discharged upwards. The opening pressure of the high-velocity vent valve and the opening pressure of the vacuum valve shall be permanently marked on the valves.
- a connection for the safe return ashore of gases expelled during loading;
- a device for the safe depressurization of the cargo tanks consisting of at least a flame-arresters and a stop valve the position of which shall clearly indicate whether it is open or shut.

- 9.3.3.22.5 (a) Insofar as anti-explosion protection is prescribed in Chapter 3.2, Table C, column 17, a vapour pipe connecting two or more cargo tanks shall be fitted, at the connection to each cargo tank, with a flame arrester with a fixed or spring-loaded plate stack, capable of withstanding detonation.

This equipment may consist of:

- (i) a flame arrester fitted with a fixed plate stack, where each cargo tank is fitted with a vacuum valve capable of withstanding a deflagration and a high-velocity vent valve capable of withstanding steady burning;
- (ii) a flame arrester fitted with a spring-loaded plate stack, where each cargo tank is fitted with a vacuum valve capable of withstanding a deflagration;
- (iii) a flame arrester with a fixed plate stack;
- (iv) a flame arrester with a fixed plate stack, where the pressure measurement device is fitted with an alarm system in accordance with 9.3.3.21.7;

- (v) a flame arrester with a spring-loaded plate stack, where the pressure measurement device is fitted with an alarm system in accordance with 9.3.3.21.7.

[When a fire-fighting installation is permanently mounted on deck in the cargo area and can be brought into service from the deck and from the wheelhouse, flame arresters need not be required for individual cargo tanks.]

Only substances which do not mix and which do not react dangerously with each other may be carried simultaneously in cargo tanks connected to a common vapour pipe.

or

- (b) Insofar as anti-explosion protection is prescribed in Chapter 3.2, Table C, column 17, a vapour pipe connecting two or more cargo tanks shall be fitted, at the connection to each cargo tank, with a pressure/vacuum valve incorporating a flame arrester capable of withstanding a detonation/deflagration.

Only substances which do not mix and which do not react dangerously with each other may be carried simultaneously in cargo tanks connected to a common vapour pipe

or

- (c) Insofar as anti-explosion protection is prescribed in the Chapter 3.2, Table C, column 17, an independent vapour pipe for each cargo tank, fitted with a pressure/vacuum valve incorporating a flame arrester capable of withstanding a deflagration and a high-velocity vent valve incorporating a flame arrester capable of withstanding steady burning. Several different substances may be carried simultaneously.

or

- (d) Insofar as anti-explosion protection is prescribed in Chapter 3.2, Table C, column 17, a vapour pipe connecting two or more cargo tanks shall be fitted, at the connection to each cargo tank, with a shut-off device capable of withstanding a detonation, where each cargo tank is fitted with a vacuum valve capable of withstanding a deflagration and a high-velocity vent valve capable of withstanding steady burning.

Only substances which do not mix and which do not react dangerously with each other may be carried simultaneously in cargo tanks connected to a common vapour pipe.

9.3.3.22.6 9.3.3.22.2, 9.3.3.22.4 (b) and 9.3.3.22.5 do not apply to open type N with flame-arrester and to open type N.

9.3.3.22.3 does not apply to open type N.

[9.3.3.22.7 The openings of cargo tanks for the carriage of UN No. 2448, SULPHUR, MOLTEN shall be located at a height such that for a 2° trim and 10° heel there can be no leakage of sulphur. All openings shall be provided with an adequate and permanently attached closing device.

One of these devices shall open when there is a slight overpressure inside the tank.]

### **9.3.3.23 Pressure tests**

9.3.3.23.1 The cargo tanks, residual cargo tanks, cofferdams, pipes for loading and unloading, with the exception of discharge hoses shall be subjected to initial tests before being put into service and thereafter at prescribed intervals.

Where a heating system is provided inside the cargo tanks, the heating coils shall be subjected to initial tests before being put into service and thereafter at prescribed intervals.

9.3.3.23.2 The test pressure for the cargo tanks and residual cargo tanks shall be not less than 1.3 times the construction pressure. The test pressure for the cofferdams and open cargo tanks shall be not less than 10 kPa (0.10 bar) gauge pressure.

9.3.3.23.3 The test pressure for pipes for loading and unloading shall be not less than 1,000 kPa (10 bar) gauge pressure.

9.3.3.23.4 The maximum intervals for the periodic tests shall be 11 years.

9.3.3.23.5 The procedure for pressure tests shall comply with the provisions established by the competent authority or a recognized classification society.

### **9.3.3.24**

### **9.3.3.25 Pumps and piping**

9.3.3.25.1 (a) Pumps and accessory loading and unloading piping shall be located in the cargo area.

- (b) Cargo pumps shall be capable of being shut down from the cargo area and from a position outside the cargo area.
  - (c) Cargo pumps situated on deck shall be located not less than 6.00 m from entrances to, or openings of, the accommodation and service spaces outside the cargo area.
- 9.3.3.25.2
- (a) Pipes for loading and unloading shall be independent of any other piping of the vessel. No cargo piping shall be located below deck, except those inside the cargo tanks and inside the cargo pump-room.
  - (b) The pipes for loading and unloading shall be arranged so that, after loading or unloading operations, the liquid remaining in these pipes may be safely removed and may flow either into the vessel's cargo tanks or the tanks ashore.
  - (c) Pipes for loading and unloading shall be clearly distinguishable from other piping, e.g. by means of colour marking.
  - (d) (reserved)
  - (e) The shore connections shall be located not less than 6.00 m from the entrances to, or openings of, the accommodation and service spaces outside the cargo area.
  - (f) Each shore connection of the vapour pipe and shore connections of the pipes for loading and unloading, through which the loading or unloading operation is carried out, shall be fitted with a shut-off device. However, each shore connection shall be fitted with a blind flange when it is not in operation.  
  
Each shore connection of the pipes for loading and unloading through which the loading or unloading operation is carried out shall be fitted with the device intended for the discharge of residual cargo described in the model in 8.6.4.1.
  - (g) The vessel shall be equipped with a stripping system.
  - (h) The flanges and stuffing boxes shall be provided with a spray protection device. This device is required only for the carriage of corrosive substances (hazard or subsidiary risk of Class 8).
- 9.3.3.25.3
- The distance referred to in 9.3.3.25.1 (a) and 9.3.3.25.2 (e) may be reduced to 3.00 m if a transverse bulkhead complying with 9.3.3.10.2 is situated at the end of the cargo area. The openings shall be provided with doors.

The following notice shall be displayed on the doors:

**DO NOT OPEN DURING LOADING AND UNLOADING WITHOUT  
THE PERMISSION OF THE MASTER.  
CLOSE IMMEDIATELY.**

- 9.3.3.25.4 (a) Every component of the pipes for loading and unloading shall be electrically connected to the hull.
- (b) The pipes for loading shall extend down to the bottom of the cargo tanks.
- 9.3.3.25.5 The stop valves or other shut-off devices of the pipes for loading and unloading shall indicate whether they are open or shut.
- 9.3.3.25.6 The pipes for loading and unloading shall have, at the test pressure, the required elasticity, leakproofness and resistance to pressure.
- 9.3.3.25.7 The pipes for loading and unloading shall be fitted with pressure gauges at the pump outlet.

Where these pressure gauges are manometers, the indicator scale shall have a diameter of not less than 0.14 m.

Reading of the pressure gauges shall be possible from the control position of the loading pump at any time. The maximum permissible overpressure or vacuum shall be indicated by a red mark.

- 9.3.3.25.8 (a) When pipes for loading and unloading are used for supplying the cargo tanks with washing or ballast water, the suctions of these pipes shall be located within the cargo area but outside the cargo tanks.
- Pumps for tank washing systems with associated connections may be located outside the cargo area, provided the discharge side of the system is arranged in such a way that suction is not possible through that part.
- A spring-loaded non-return valve shall be provided to prevent any gases from being expelled from the cargo area through the tank washing system.
- (b) A non-return valve shall be fitted at the junction between the water suction pipe and the cargo loading pipe.
- 9.3.3.25.9 [The permissible loading and unloading flows shall be calculated. For open type N with flame-arrester and open type N the loading and unloading flows depend on the total cross-section of the exhaust ducts.

Calculations concerning the permissible maximum loading and unloading flows for each cargo tank or each group of cargo tanks, taking into account the design of the ventilation system. These calculations shall take into consideration the fact that in the event of an unforeseen cut-off of the gas return piping or the compensation piping of the shore facility, the safety devices of the cargo tanks will prevent pressure in the cargo tanks from exceeding the following values:

- over pressure: 115% of the opening pressure of the high velocity vent valve
- vacuum pressure: 110% of the opening pressure of the vacuum pressure valve but not more than 3.85 kPa

The main factors to be considered are the following:

1. Dimensions of the ventilation system of the cargo tanks.
2. Gas formation during loading: multiply the largest loading flow by a factor of not less than 1.25.
3. Density of the vapour mixture of the cargo based on 50% vol. vapour of 50% vol. air.
4. Loss of pressure through ventilation pipes, valves and fittings. Account will be taken of a 30% clogging of the mesh of the flame-arrester
5. Chocking pressure of the safety valves.

The permissible maximum loading and unloading pressure for each cargo tank or for each group of cargo tanks shall be given in an on-board instruction].

- 9.3.3.25.10 The stripping system shall be subjected to initial tests before being put into service or thereafter if any alteration has been made to it, using water as test medium. The test and the determination of the residual quantities shall be carried out in accordance with the requirements of 8.6.4.2.

In this test, the following residual quantities shall not be exceeded:

- (a) 5 l for each cargo tank;
- (b) 15 l for each pipe system.

The residual quantities obtained in the test shall be entered in the [inspection mentioned] certificates in 8.6.4.3.

[9.3.3.25.11 If the vessels is carrying several dangerous substances liable to react dangerously with each other, a separate pump with its own piping for loading and unloading shall be installed for each substance. The piping shall not pass through a cargo tank containing dangerous substances with which the substance in question is liable to react.]

9.3.3.25.1 (a) and (c), 9.3.3.25.2 (e), 9.3.3.25.3 [and 9.3.3.25.4 (a)] do not apply to type N open unless the substance carried has corrosive properties (hazard 8).

9.3.3.25.2 (b) does not apply to open type N.

9.3.3.25.2 (f), last sentence, 9.3.3.25.2 (g), 9.3.3.25.8 (a), last sentence and 9.3.3.25.10 do not apply to oil separator and supply vessels.

9.3.3.25.9 does not apply to oil separator vessels.

9.3.3.25.2 (h) does not apply to supply vessels.

[9.3.3.25.12 Loading and unloading pipes for the carriage of UN No. 2448, SULPHUR, MOLTEN, shall be provided with adequate insulation. They shall be capable of being heated.]

### **9.3.3.26 Residual cargo tanks and slop tanks**

9.3.3.26.1 The vessel shall be provided with at least one residual cargo tank and with at least one tank for slops. These tanks shall be located only in the cargo area. Intermediate bulk containers or tank-containers in accordance with 7.2.4.1 may be used instead of a fixed residual cargo tank. During filling of intermediate bulk containers or tank-containers, means for collecting any leakage shall be placed under the filling connections.

9.3.3.26.2 Slop tanks shall be fire resistant and shall be capable of being closed with lids (e.g. drums with lever closing ring lids). The tanks shall be marked and easy to handle.

9.3.3.26.3 The maximum permissible capacity of a residual cargo tank is 30 m<sup>3</sup>.

The residual cargo tanks shall be equipped with:

in the case of an open system:

- a device for ensuring pressure equilibrium;
- an ullage opening;
- connections, with stop valves, for pipes and hoses;

in the case of a protected system:

- a device for ensuring pressure equilibrium, fitted with a flame-arrester capable of withstanding steady burning;
- an ullage opening;
- connections, with stop valves, for pipes and hoses;

in the case of a closed system:

- a vacuum valve and a high-velocity vent valve.

The valve shall be so regulated that it does not open during carriage. This condition is met when the opening pressure of the valve meets the conditions required in Chapter 3.2, Table C, column 10 for the substance to be carried. When Chapter 3.2, Table C, column 17 requires anti-explosion protection, the vacuum valve shall be capable of withstanding deflagrations and the high-velocity vent valve steady burning;

- a device for measuring the degree of filling;
- connections, with stop valves, for pipes and hoses.

No connection between the residual cargo tanks and the vapour pipe of the cargo tanks shall be permitted.

9.3.3.26.4 9.3.3.26.1 and 9.3.3.26.3 above do not apply to oil separator vessels.

### **9.3.3.27**

### **9.3.3.28 Water-spray system**

When water-spraying is required in Chapter 3.2, Table C, column 9, a water-spray system shall be installed in the cargo area on deck for the purpose of reducing vapours given off by the cargo, and of cooling the tops of cargo tanks.

The system shall be fitted with a connection device for supply from the shore. The system shall be capable of being put into operation from the wheelhouse and from the deck. The capacity of the water-spray system shall be such that when all the spray nozzles are in operation, the outflow is of 50 litres per square metre of cargo deck area and per hour.

### **9.3.3.29- 9.3.3.30**

**9.3.3.31 Engines**

- 9.3.3.31.1 Only internal combustion engines running on fuel with a flashpoint of more than 55° C are allowed.
- 9.3.3.31.2 Ventilation inlets of the engine room and, when the engines do not take in air directly from the engine room, air intakes of the engines shall be located not less than 2.00 m from the cargo area.
- 9.3.3.31.3 Sparking shall not be possible within the cargo area.
- 9.3.3.31.4 The surface temperature of the outer parts of engines used during loading or unloading operations, as well as that of their air inlets and exhaust ducts shall not exceed the allowable temperature according to the temperature class. This provision does not apply to engines installed in service spaces provided the provisions of 9.3.3.52.3 (b) are fully complied with.
- 9.3.3.31.5 The ventilation in the closed engine room shall be designed so that, at an ambient temperature of 20° C, the average temperature in the engine room does not exceed 40° C.
- 9.3.3.31.6 9.3.3.31.2 above does not apply to oil separator or supply vessels.

**9.3.3.32 Oil fuel tanks**

- 9.3.3.32.1 Where the vessel is provided with hold spaces, the double bottoms within these spaces may be arranged as [liquid] oil fuel tanks, provided their depth is not less than 0.60 m.
- [Liquid] oil fuel pipes and openings of such tanks are not permitted in the hold space.
- 9.3.3.32.2 The open ends of the air pipes of each liquid oil fuel tank shall extend to 0.5 m above the open deck. These open ends and the open ends of overflow pipes leading to the deck shall be provided with a protective device consisting of a gauze diaphragm or a perforated plate.

**9.3.3.33**

**9.3.3.34 Exhaust pipes**

- 9.3.3.34.1 Exhaust shall be evacuated from the vessel into the open air either upwards through an exhaust pipe or through the shell plating. The exhaust outlet shall be located not less than 2.00 m from the cargo area. The exhaust pipes of engines shall be arranged so that the exhausts are led away from the vessel. The exhaust pipes shall not be located within the cargo area.

9.3.3.34.2 Exhaust pipes shall be provided with a device preventing the escape of sparks, e.g. spark arresters.

9.3.3.34.3 The distance prescribed in 9.3.3.34.1 above does not apply to oil separator or supply vessels.

### **9.3.3.35 Bilge pumping and ballasting arrangements**

9.3.3.35.1 Bilge and ballast pumps for spaces within the cargo area shall be installed within such area.

This provision does not apply to:

- double-hull spaces and double bottoms which do not have a common boundary wall with the cargo tanks;
- cofferdams and hold spaces where ballasting is carried out using the piping of the fire-fighting system in the cargo area and bilge-pumping is performed using eductors.

9.3.3.35.2 Where the double bottom is used as a [liquid] oil fuel tank, it shall not be connected to the bilge piping system.

9.3.3.35.3 Where the ballast pump is installed in the cargo area, the standpipe and its outboard connection for suction of ballast water shall be located within the cargo area but outside the cargo tanks.

9.3.3.35.4 A cargo pump-room below deck shall be capable of being drained in an emergency by an installation located in the cargo area and independent from any other installation. The installation shall be provided outside the cargo pump-room.

### **9.3.3.36- 9.3.3.39**

### **9.3.3.40 Fire-extinguishing arrangements**

9.3.3.40.1 A fire-extinguishing system shall be installed on the vessel. This system shall comply with the following requirements:

- It shall be supplied by two independent fire or ballast pumps, one of which shall be ready for use at any time. These pumps shall not be installed in the same space;

- It shall be provided with a water main fitted with at least three hydrants in the cargo area above deck. Three suitable and sufficiently long hoses with spray nozzles having a diameter of not less than 12 mm shall be provided. It shall be possible to reach any point of the deck in the cargo area simultaneously with at least two jets of water which do not emanate from the same hydrant;

A spring-loaded non-return valve shall be fitted to ensure that no gases can escape through the fire-extinguishing system into the accommodation or service spaces outside the cargo area;

- The capacity of the system shall be at least sufficient for a jet of water to have a minimum reach of not less than the vessel's breadth from any location on board with two spray nozzles being used at the same time.

9.3.3.40.2 In addition the engine room, the pump-room and all spaces containing essential equipment (switchboards, compressors, etc.) for the refrigeration equipment, if any, shall be provided with a fixed fire-extinguishing system which can be operated from the deck.

9.3.3.40.3 The two hand fire-extinguishers referred to in 8.1.4 shall be located in the cargo area.

[9.3.3.40.4 The fire-extinguishing agent and the quantity contained in the permanently fixed fire-extinguishing system shall be suitable and sufficient for fighting fires.]

9.3.3.40.5 9.3.3.40 and 9.3.3.40.2 above do not apply to oil separator or supply vessels. The requirements of 9.3.3.52.3 (b) are not applicable to the unloading of substances having a flashpoint of 61° C or more when the temperature of the product is at least 15 K lower at the flashpoint.

### **9.3.3.41 Fire and naked light**

9.3.3.41.1 The outlets of funnels shall be located not less than 2.00 m from the cargo area. Arrangements shall be provided to prevent the escape of sparks and the entry of water.

9.3.3.41.2 Heating, cooking and refrigerating appliances shall not be fuelled with liquid fuels, liquid gas or solid fuels.

The installation in the engine room or in another separate space of heating appliances fuelled with liquid fuel having a flashpoint above 55° C is, however, permitted.

Cooking and refrigerating appliances are permitted only in the accommodation.

9.3.3.41.3 Only electrical lighting appliances are permitted.

**9.3.3.42 Cargo heating system**

- 9.3.3.42.1 Boilers which are used for heating the cargo shall be fuelled with a liquid fuel having a flashpoint of more than 55° C. They shall be placed either in the engine room or in another separate space below deck and outside the cargo area, which is accessible from the deck or from the engine room.
- 9.3.3.42.2 The cargo heating system shall be designed so that the cargo cannot penetrate into the boiler in the case of a leak in the heating coils. A cargo heating system with artificial draught shall be ignited electrically.
- 9.3.3.42.3 The ventilation system of the engine room shall be designed taking into account the air required for the boiler.
- 9.3.3.42.4 Where the cargo heating system is used during loading, unloading or gas-freeing, the service space which contains this system shall fully comply with the requirements of 9.3.3.52.3 (b). This requirement does not apply to the inlets of the ventilation system. These inlets shall be located at a minimum distance of 2.00 m from the cargo area and 6.00 m from the openings of cargo tanks or residual cargo tanks, loading pumps situated on deck, openings of high-velocity vent valves, pressure valves and shore connections of loading and unloading pipes and must be located not less than 2.00 m above the deck.

The requirements of 9.3.3.52.3 (b) are not applicable to the unloading of substances having a flashpoint of 61° C or more when the temperature of the product is at least 15 K lower at the flashpoint.

- [9.3.3.42.5 In the case of the carriage of UN No. 2448, SULPHUR, MOLTEN, the heat-generating fluid shall be such that in the event of leakage in the tank there is no risk of a dangerous reaction with the sulphur.]

**9.3.3.43-  
9.3.3.49**

**9.3.3.50 Documents concerning electrical installations**

- 9.3.3.50.1 In addition to the documents required by the *Recommendations on Technical Requirements for Inland Navigation Vessels*, the following documents shall be on board:
- (a) a drawing indicating the boundaries of the cargo area and the location of the electrical equipment installed in this area;

- (b) a list of the electrical equipment referred to in (a) above including the following particulars:

machine or appliance, location, type of protection, type of protection against explosion, testing body and approval number;

- (c) a list of or general plan indicating the electrical equipment outside the cargo area which may be operated during loading, unloading or gas-freeing. All other electrical equipment shall be marked in red. See 9.3.3.52.3 and 9.3.3.52.4.

9.3.3.50.2 The documents listed above shall bear the stamp of the competent authority issuing the certificate of approval.

### **9.3.3.51 Electrical installations**

9.3.3.51.1 Only distribution systems without return connection to the hull are permitted:

This provision does not apply to:

- [certain limited sections of the installations] situated outside the cargo area (e.g. connections of starters of diesel engines);
- the device for checking the insulation level referred to in 9.3.3.51.2 below.

9.3.3.51.2 Every insulated distribution network shall be fitted with an automatic device with a visual and audible alarm for checking the insulation level.

9.3.3.51.3 For the selection of electrical equipment to be used in zones presenting an explosion risk, the explosion groups and temperature classes assigned to the substances carried in Chapter 3.2, Table C, columns 15 and 16 shall be taken into consideration.

### **9.3.3.52 Type and location of electrical equipment**

9.3.3.52.1 (a) Only the following equipment may be installed in cargo tanks, residual cargo tanks, and pipes for loading and unloading (comparable to zone 0):

- measuring, regulation and alarm devices of the EEx (ia) type of protection;

(b) Only the following equipment may be installed in the cofferdams, double-hull spaces, double bottoms and hold spaces (comparable to zone 1):

- measuring, regulation and alarm devices of the “certified safe” type;
  - lighting appliances of the “flame-proof enclosure” or “pressurized apparatus” type of protection;
  - hermetically sealed echo sounding devices the cables of which are led through thick-walled steel tubes with gastight connections up to the main deck;
  - cables for the active cathodic protection of the shell plating in protective steel tubes such as those provided for echo sounding devices;
- (c) Only the following equipment may be installed in the service spaces in the cargo area below deck (comparable to zone 1):
- measuring, regulation and alarm devices of the “certified safe” type;
  - lighting appliances of the “flame-proof enclosure” or “pressurized apparatus” type of protection;
  - motors driving essential equipment such as ballast pumps; they shall be of the “certified safe” type;
- (d) The control and protective equipment of the electrical equipment referred to in paragraphs (a), (b) and (c) above shall be located outside the cargo area if they are not intrinsically safe;
- (e) The electrical equipment in the cargo area on deck (comparable to zone 1) shall be of the “certified safe” type.

9.3.3.52.2 Accumulators shall be located outside the cargo area.

- 9.3.3.52.3 (a) Electrical equipment used during loading, unloading and gas-freeing during berthing and which are located outside the cargo area shall (comparable to zone 2) be at least of the “limited explosion risk” type;
- (b) This provision does not apply to:
- (i) lighting installations in the accommodation, except for switches near entrances to accommodation;
  - (ii) radiotelephone installations in the accommodation or the wheelhouse;

- (iii) electrical installations in the accommodation, the wheelhouse or the service spaces outside the cargo areas if:
1. These spaces are fitted with a ventilation system ensuring an overpressure of 0.1 kPa (0.001 bar) and none of the windows is capable of being opened; the air intakes of the ventilation system shall be located as far away as possible, however, not less than 6.00 m from the cargo area and not less than 2.00 m above the deck;
  2. The spaces are fitted with a gas detection system with sensors:
    - at the suction inlets of the ventilation system;
    - directly at the top edge of the sill of the entrance doors of the accommodation and service spaces;
  3. The gas concentration measurement is continuous;
  4. When the gas concentration reaches 20% of the lower explosive limit, the ventilators are switched off. In such a case and when the overpressure is not maintained or in the event of failure of the gas detection system, the electrical installations which do not comply with (a) above, shall be switched off. These operations shall be performed immediately and automatically and activate the emergency lighting in the accommodation, the wheelhouse and the service spaces, which shall comply at least with the “limited explosion risk” type. The switching-off shall be indicated in the accommodation and wheelhouse by visual and audible signals;
  5. The ventilation system, the gas detection system and the alarm of the switch-off device fully comply with the requirements of (a) above;
  6. The automatic switch-off device is set so that no automatic switching-off may occur while the vessel is under way.

9.3.3.52.4 The electrical equipment which does not meet the requirements set out in 9.3.3.52.3 above together with its switches shall be marked in red. The disconnection of such equipment shall be operated from a centralized location on board.

- 9.3.3.52.5 An electric generator which is permanently driven by an engine and which does not meet the requirements of 9.3.3.52.3 above, shall be fitted with a switch capable of shutting down the excitation of the generator. A notice board with the operating instructions shall be displayed near the switch.
- 9.3.3.52.6 Sockets for the connection of signal lights and gangway lighting shall be permanently fitted to the vessel close to the signal mast or the gangway. Connecting and disconnecting shall not be possible except when the sockets are not live.
- 9.3.3.52.7 The failure of the power supply for the safety and control equipment shall be immediately indicated by visual and audible signals at the locations where the alarms are usually actuated.

### **9.3.3.53 Earthing**

- 9.3.3.53.1 The metal parts of electrical appliances in the cargo area which are not live as well as protective metal tubes or metal sheaths of cables in normal service shall be earthed, unless they are so arranged that they are automatically earthed by bonding to the metal structure of the vessel.
- 9.3.3.53.2 The provisions of 9.3.3.53.1 above apply also to equipment having service voltages of less than 50 V.
- 9.3.3.53.3 Independent cargo tanks, metal intermediate bulk containers and tank-containers shall be earthed.

### **9.3.3.54- 9.3.3.55**

### **9.3.3.56 Electrical cables**

- 9.3.3.56.1 All cables in the cargo area shall have a metallic sheath.
- 9.3.3.56.2 Cables and sockets in the cargo area shall be protected against mechanical damage.
- 9.3.3.56.3 Movable cables are prohibited in the cargo area, except for intrinsically safe electric circuits or for the supply of signal lights, gangway lighting and submerged pumps on board oil separator vessels.
- 9.3.3.56.4 Cables of intrinsically safe circuits shall only be used for such circuits and shall be separated from other cables not intended for being used in such circuits (e.g. they shall not be installed together in the same string of cables and they shall not be fixed by the same cable clamps).

- 9.3.3.56.5 For movable cables intended for signal lights, gangway lighting, and submerged pumps on board oil separator vessels, only sheathed cables of type H 07 RN-F in accordance with 245 IEC 66 or cables of at least equivalent design having conductors with a cross-section of not less than 1.5 mm<sup>2</sup> shall be used.

These cables shall be as short as possible and installed so that damage is not likely to occur.

**9.3.3.57-  
9.3.3.59**

**9.3.3.60 Special equipment**

A shower and an eye and face bath shall be provided on the vessel at a location which is directly accessible from the cargo area.

This requirement does not apply to oil separator and supply vessels.

**9.3.3.61-  
9.3.3.70**

**9.3.3.71 Admittance on board**

The notice boards displaying the prohibition of admittance in accordance with 7.2.3.71 shall be clearly legible from either side of the vessel.

**9.3.3.72-  
9.3.3.73**

**9.3.3.74 Prohibition of smoking, fire or naked light**

- 9.3.3.74.1 The notice boards displaying the prohibition of smoking in accordance with 7.2.3.74 shall be clearly legible from either side of the vessel.

- 9.3.3.74.2 Notice boards indicating the circumstances under which the prohibition is applicable shall be fitted near the entrances to the spaces where smoking or the use of fire or naked light is not always prohibited.

- 9.3.3.74.3 Ashtrays shall be provided close to each exit in the accommodation and the wheelhouse.

**9.3.3.75-  
9.3.3.99**