RULES FOR CLASSIFICATION

Ships

Edition July 2021

Part 5 Ship types

Chapter 5 Oil tankers

DNV AS

FOREWORD

DNV rules for classification contain procedural and technical requirements related to obtaining and retaining a class certificate. The rules represent all requirements adopted by the Society as basis for classification.

Any comments may be sent by e-mail to *rules@dnv.com*

CHANGES – CURRENT

This document supersedes the July 2020 edition of DNVGL-RU-SHIP Pt.5 Ch.5.
The numbering and/or title of items containing changes is highlighted in red.

Changes July 2021, entering info force 1 January 2022

Topic	*Reference*	*Description*
Rebranding to DNV	All	This document has been revised due to the rebranding of DNV GL to DNV. The following have been updated: the company name, material and certificate designations, and references to other documents in the DNV portfolio. Some of the documents referred to may not yet have been rebranded. If so, please see the relevant DNV GL document. No technical content has been changed.

Editorial corrections

In addition to the above stated changes, editorial corrections may have been made.

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SECTION 1 GENERAL

1 Introduction

1.1 Introduction

These rules apply to ships intended for carriage of oil in bulk.

1.2 Scope

1.2.1 The rules in this chapter give requirements related to:

— safety hazards
— marine pollution hazards
— additional hull attributes
— functional capability of systems.

Incorporated in the rules are some SOLAS Ch. II-2 requirements, where these are specifically mentioned as applicable for tankers only. Requirements of MARPOL Annex I, insofar as design and equipment are concerned, are also covered.

1.2.2 Machinery installations and their auxiliary systems that support cargo handling, shall meet the same rule requirements as if they were considered to support a main function, see Pt.1 Ch.1 Sec.1 [1.2].

1.3 Application

1.3.1 These rules apply to ships intended for the carriage of liquid oil cargoes in bulk with a flashpoint not exceeding 60°C (closed cup test), as well as ships heating its cargo to within 15°C of its flashpoint.

For ships intended for carriage of oil products with flashpoint exceeding 60°C, the requirements in Sec.2, Sec.3 [1], Sec.3 [2.1.8] to Sec.3 [2.1.9], Sec.3 [3], Sec.3 [4.2], Sec.3 [5] to Sec.3 [6], Sec.3 [9], Sec.4 [1] to Sec.4 [4], Sec.7, Sec.8 [3.3.1] and Sec.9 [1] to Sec.9 [5] apply.

Liquid cargoes with vapour pressure above atmospheric pressure at 37.8°C reid vapor pressure (RVP) shall not be carried unless the ship is especially designed and equipped for this purpose. Relevant requirements may be found in Ch.6, e.g. Ch.6 Sec.1 [3], Ch.6 Sec.7 and Ch.6 Sec.15 [2.2].

1.3.2 The requirements in this chapter are supplementary to those given for the assignment of main class.

1.3.3 Oil cargoes and cargoes other than oils, covered by the classification in accordance with this chapter, are listed in App.A.

1.3.4 Oil tankers of 20 000 dwt and above and all ships fitted with equipment for crude oil washing, shall fulfil the requirements for inert gas plants as given in Sec.11.

1.3.5 Simultaneous carriage of dry cargo (including vehicles and passengers) and oil cargo with flashpoint not exceeding 60°C is not permitted for ships with class notations as stated in Table 1, see SOLAS Ch.II-2 Reg.2.6.5.

1.3.6 Ships designed for alternate carriage of liquid cargoes with a flashpoint not exceeding 60°C and dry cargo shall comply with the requirements in Sec.10 and the requirements to protected slop tank in Sec.12.

1.3.7 Tanks for liquids with density exceeding 1.025 t/m^3, see Pt.6 Ch.1 Sec.3.

1.3.8 Ships carrying asphalt/bitumen or other cargoes which through their physical properties inhibit effective product/water separation and monitoring, may be exempted from the requirements to slop tanks (see Sec.3 [3.4]), oil discharge monitoring system (see Sec.4 [2.4]) and oil/water interface detector (see Sec.9 [5]) in accordance with Regulation 2.4 of MARPOL Annex I.

2 Class notations

2.1 Ship type notations for oil tankers

Vessels built in compliance with the requirements of this chapter will be assigned one of the mandatory class notations and applicable qualifiers as specified in Table 1:

Table 1 Ship type notations

Class notation	*Description*	*Design requirements, rule reference*
Tanker for oil	vessel purpose carriage of crude oil and/or oil products in bulk	This chapter except Sec.3 [2.2], Sec.4 [3.3], Sec.5 [1.2], Sec.5 [2.3] and Sec.10
Tanker for oil products	vessel purpose carriage of oil products in bulk	
Tanker for asphalt/bitumen	vessel purpose carriage of asphalt/bitumen in bulk	
Tanker for oil products with flashpoint above 60°C	vessel purpose carriage of oil products with flashpoint above 60°C in bulk	[1.3.1]
Barge for oil	vessel purpose carriage of crude oil and/or oil products in bulk	Ch.11 and this chapter, except Sec.10
Barge for oil products	vessel purpose carriage of oil products in bulk	
Barge for asphalt/bitumen	vessel purpose carriage of asphalt/bitumen in bulk	
Barge for oil products with flashpoint above 60°C	vessel purpose carriage of oil products with flashpoint above 60°C in bulk	Ch.11 and [1.3.1]
Bulk carrier or tanker for oil	vessel purpose carriage of dry bulk cargo alternating with carriage of crude oil and/or oil products in bulk	This chapter except Sec.3 [2.2], Sec.4 [3.3], Sec.5 [1.2] and Sec.5 [2.3]
Bulk carrier or tanker for oil products	vessel purpose carriage of dry bulk cargo alternating with carriage of oil products in bulk	

2.1.1 The term oil tanker is used as a general reference for ships with class notation **Tanker for oil**. The term combination carrier is used as a general reference for ships with class notation **Bulk carrier or Tanker for oil**.

2.2 Additional notations

The additional class notations specified in Table 2, are typically also applied to tankers and combination carriers:

Table 2 Additional notations

Class notation	*Description*	*Application*	*Rule reference*
CSR	ships designed and built according to IACS common structural rules	mandatory for **Tanker for oil** and **Tanker for oil products** with $L \geq 150$ m	IACS common structural rules
HL	tanks or holds strengthened for heavy liquid	all ships	Pt.6 Ch.1 Sec.3
Plus	extended fatigue analysis of ship details	all ships	Pt.6 Ch.1 Sec.6
CSA	direct analysis of ship structures	all ships	Pt.6 Ch.2 Sec.7
Bow loading	bow loading arrangement	mandatory for **Tanker for oil** when installed	Ch.4 Sec.1
CCO	centralised cargo control for liquid cargoes	all ships	Pt.6 Ch.4 Sec.2
ETC	effective tank cleaning	all ships	Pt.6 Ch.4 Sec.4
STL	submerged turret loading system	mandatory when installed	Pt.6 Ch.4 Sec.1
Inert	inert gas system	mandatory if installed on **Tanker for oil** DWT < 8 000 tonn	Pt.6 Ch.5 Sec.8
SPM	single point mooring	mandatory for **Tanker for oil** when installed	Pt.6 Ch.5 Sec.12
VCS	system for control of vapour emissions from cargo tanks	mandatory for **Tanker for oil** and **Tanker for oil products**	Pt.6 Ch.4 Sec.11
ESP	ships subject to an enhanced survey programme	mandatory for ships with class notations: — **Bulk carrier** — **Bulk carrier or Tanker for oil** — **Ore carrier Ore carrier or Tanker for oil** — **Tanker for chemicals Tanker for C** — **Tanker for oil** — **Tanker for oil products**.	Pt.6 Ch.9 Sec.2
Hot	cargo tanks designed for high temperature cargo with a specified maximum design cargo temperature	mandatory for ships with notation **Tanker for asphalt/bitumen** and other oil tankers intended for the carriage of liquid cargo at a temperature higher than 80°C at atmospheric pressure.	Pt.6 Ch.1 Sec.12
CMON	Construction monitoring of hull critical locations	all ships	Pt.6 Ch.9 Sec.6

For a full definition of all additional class notations, see Pt.1 Ch.2.

2.3 Register information

The register information *ssp* indicates that cargo piping and all equipment in contact with cargo and cargo vapours are made of stainless steel.

3 Definitions

3.1 Terms

Table 3 Definitions

Terms	*Definition*
accommodation spaces	spaces used for public spaces, corridors, lavatories, cabins, offices, barber shops, hospital, cinemas, games and hobbies rooms, pantries containing no cooking appliances and similar spaces
air lock	enclosed space for entrance between a hazardous area on open deck and a non-hazardous space, arranged to prevent ingress of gas to the non-hazardous space
cargo area	part of the ship which contains the cargo tanks, pump rooms, cofferdams and similar compartments adjacent to cargo tanks, and includes deck areas over the full beam and length of above spaces The cargo area extends to the full beam and depth of the ship from the aftmost bulkhead of compartment adjacent to the aftmost cargo tanks to the full beam of the forwardmost bulkhead of a compartment adjacent to the forward most cargo tank. Where independent tanks are installed in hold spaces, cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the forward-most hold space are excluded from the cargo area.
cargo control room	space used in the control of cargo handling operations
cargo handling spaces	enclosed spaces which contain fixed cargo handling equipment, and similar spaces in which work is performed on the cargo, e.g.: pump rooms
cargo handling systems	piping systems in which cargo liquid, vapour or residue is transferred or likely to occur in operation and includes systems such as cargo pumping systems, cargo stripping systems, drainage systems within the cargo area, cargo tank venting systems, cargo tank washing systems, inert gas systems, vapour emission control systems and gas freeing systems for cargo tanks
cargo tank	liquid tight shell designed to be the primary container of the cargo Cargo tanks shall be taken to include also slop tanks, residual tanks and other tanks containing cargo with a flashpoint not exceeding 60°C.
cargo tank block	part of the ship extending from the aft bulkhead of the aftmost cargo tank to the forward bulkhead of the forward most cargo tank, extending to the full beam and depth of the ship, but not including the area above the deck of the cargo tank
cofferdam	isolating space between two adjacent steel bulkheads or decks. This space may be a dry space or a tank, see Sec.3 [6.1]
control stations	spaces in which the ship's radio or main navigating equipment or the emergency source of power is located. Spaces where the fire recording or fire control equipment is centralised are also considered to be a fire control station
design vapour pressure p_0	maximum gauge pressure at the top of the tank that has been used in the design of the tank
flame arrester	device through which an external flame front cannot propagate and ignite an internal gas mixture

Terms	*Definition*
flame screen	flame arrester consisting of a fine-meshed wire gauze of corrosion-resistant material
hazardous area	area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus Hazardous areas are divided into zone 0, 1 and 2 as defined below and according to the area classification specified in Sec.8 [3]. — Zone 0 Area in which an explosive gas atmosphere is present continuously or is present for long periods. — Zone 1 Area in which an explosive gas atmosphere is likely to occur in normal operation. — Zone 2 Area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only.
high velocity vent valve	cargo tank vent valve which at all flow rates expels the cargo vapour upwards at a velocity of at least 30 m/s, measured at a distance equal to the nominal diameter of the standpipe above the valve outlet opening
non-hazardous area	area not considered to be hazardous
oil discharge monitoring equipment (ODME)	equipment used for controlling the discharge of oily ballast and tank washing water from oil tankers
pressure-vacuum (P/V) valve	valve which keeps the tank overpressure or under-pressure within approved limits
public spaces	portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces
residual tank	tank particularly designated for carriage of cargo residues and cargo mixtures typically transferred from slop tanks, cargo tanks and cargo piping Residual tanks which are intended for the storage of cargo or cargo residue with a flashpoint not exceeding 60°C or that are connected to cargo handling piping systems serving cargo or slop tanks, shall comply with the requirements for cargo tanks. Residual tanks that are not intended for carriage of cargo, are not required to comply with the requirements of crude oil washing in Sec.13.
segregated ballast tanks	tanks that are completely separated from the cargo oil and fuel oil systems and are permanently allocated to the carriage of ballast or cargoes other than oil or noxious substances as defined in MARPOL
service spaces	spaces used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, store rooms, workshops other than those forming part of the machinery spaces and similar spaces and trunks to such spaces
slop tanks	tanks particularly designated for the collection of tank draining, tank washing and other oily mixtures Slop tanks that are intended for the carriage of cargo or cargo residue with a flashpoint not exceeding 60°C or that are connected to cargo handling piping systems serving cargo or slop tanks, shall comply with the requirements for cargo tanks. Slop tanks that are not intended for carriage of cargo, are not required to comply with the requirements of crude oil washing in Sec.13.

Terms	Definition
spaces not normally entered	cofferdams, double bottoms, duct keels, pipe tunnels, stool tanks, spaces containing cargo tanks and other spaces where cargo may accumulate
spark arrester	a device preventing sparks from the combustion in prime movers, boilers etc. to reach open air
STS	ship-to-ship transfer of oil cargo between oil tankers at sea according to MARPOL Annex I
tank deck	the following decks are designated tank deck: — a deck or part of a deck that forms the top of a cargo tank — part of a deck upon which cargo tanks, cargo hatches, valves, pumps or other equipment intended for loading, discharging or transfer of the cargo, are located — part of a deck within the cargo area, located lower than the top of a cargo tank — deck or part of deck within the cargo area, located lower than 2.4 m above a deck as described above.
tank types	see Ch.6 Sec.1 [2.6]
void space	enclosed space in the cargo area, external to a cargo containment system, not being a hold space, ballast space, fuel oil tank, cargo pump or compressor room, or any space in normal use by personnel

Table 4 Abbreviations

Abbreviation	Definition
CCR	cargo control room
LEL	lower explosion limit
MBL	minimum breaking load
NLS	noxious liquid substances
P/V	pressure-vacuum
RVP	Reid vapor pressure
STL	submerged turret loading
STS	ship-to-ship
USCG	United States Coast Guard

4 Documentation

4.1 Documentation requirements

4.1.1 Oil tankers

Documentation shall be submitted as required by Table 5.

Table 5 Documentation requirements

Object	*Documentation type*	*Additional description*	*Info*
Internal access	H200 – Ship structure access manual	The plan shall include details enabling verification of compliance with requirements to safe access to cargo tanks, ballast tanks, cofferdams and other spaces within and forward the cargo area as required by SOLAS Ch.II-1 Reg.3-6.	AP
Vessel arrangement	Z010 – General arrangement plan	Including: — cargo hatches, butterworth hatches and any other openings to cargo tanks — doors, hatches and any other openings to pump rooms and other hazardous areas — ventilating pipes and openings for cargo hatches, pump rooms and other hazardous areas — doors, air locks, hatches, ventilating pipes and openings, hinged scuttles which can be opened, and other openings to non-hazardous spaces adjacent to the cargo area including spaces in and below the forecastle — cargo pipes over the deck with shore connections including stern pipes for cargo discharge or pipes for bow loading arrangement.	FI
Emergency towing arrangement	Z030 – Arrangement plan	Plan providing information for item regarding: — list of towing components and, corresponding safe working load and minimum breaking load — length of towing pennant and pick-up gear — location of strongpoint and fairleads — chafing chain if used — towing connection — ready availability of towing arrangements.	AP
Hazardous areas	G080 – Hazardous area classification drawing		AP
Electrical equipment in hazardous areas	E170 – Electrical schematic drawing	Single line diagrams for all intrinsically safe circuits, for each circuit including data for verification of the compatibility between the barrier and the field components.	AP
	Z030 – Arrangement plan	Where relevant, based on an approved hazardous area classification drawing where location of electric equipment in hazardous area is added (except battery room, paint stores and gas bottle store).	AP
	Z163 – Maintenance manual	As specified in Sec.8.	AP
Hydrocarbon gas detection and alarm system, fixed	Z030 – Arrangement plan	Shall include fixed gas detection for pumprooms and spaces adjacent to cargo tanks. Shall include arrangement of sampling piping, location of all sampling points, detectors, call points and alarm devices.	FI

Object	*Documentation type*	*Additional description*	*Info*
	I200 – Control and monitoring system documentation		AP
Ventilation systems for hazardous cargo areas	S012 – Ducting diagram (DD)		AP
	S030 – Capacity analysis		AP
	C030 – Detailed drawing	Rotating parts and casing of fans.	AP
	I200 – Control and monitoring system documentation		AP
Oil pollution prevention	S150 – Shipboard oil pollution emergency plan (SOPEP)	Applicable when GT ≥ 150.	AP
	Z161 – Operation manual	Ship-to-ship transfer manual (STS). Applicable for oil tankers involved in ship-to-ship transfer when GT ≥ 150.	AP
Cargo handling arrangements	C030 – Detailed drawing	Gastight bulkhead stuffing boxes: including details of lubrication arrangement and temperature monitoring.	AP
	Z161 – Operation manual	VOC management plan, see MARPOL Annex VI Reg.15.	AP
Cargo piping system	S010 – Piping diagram (PD)	Including cargo stripping system. For vacuum stripping systems details shall include termination of air pipes and openings from drain tanks and other tanks. For ships with cargo pumprooms specification of temperature monitoring equipment for cargo pumps and shaft penetrations shall be included.	AP
Cargo pumps and remotely operated valves control and monitoring system	S010 – Piping diagram (PD)		AP
	I200 – Control and monitoring system documentation	For ships with cargo pumprooms, specification of temperature monitoring equipment for cargo pumps and shaft penetrations shall be included.	AP
Vapour return systems	S010 – Piping diagram (PD)		AP
Oil discharge (ODM) control and monitoring system	I200 – Control and monitoring system documentation		AP
	S010 – Piping diagram (PD)		AP
	Z161 – Operation manual	**Guidance note:** In accordance with IMO MEPC.108(49) as amended by IMO Res. MEPC.240(65) - *Revised Guidelines and Specifications for Oil Discharge Monitoring and Control Systems for Oil Tankers*. ---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---	AP
Cargo tanks	H210 – Protected tank location drawing	In accordance with MARPOL Annex I Reg. 19 and 22.	AP

Object	*Documentation type*	*Additional description*	*Info*
	Z265 – Calculation report	Accidental oil outflow performance in accordance with MARPOL Annex I Reg.23.	FI
Cargo tanks gas-freeing system	S010 – Piping diagram (PD)	Only applicable for fixed mechanical ventilation cargo tank gas freeing system if installed.	AP
Cargo tanks venting system	S010 – Piping diagram (PD)	Including settings of P/V-devices.	AP
	Z100 – Specification	For P/V-devices and other flame arresters: details, flow curves and references to type approval certificates.	FI
Cargo tanks level measurement system, fixed	I200 – Control and monitoring system documentation		AP
	Z030 – Arrangement plan	Shall indicate type and location of level indicators.	FI
Cargo tanks level alarm system, fixed	I200 – Control and monitoring system documentation		AP
	Z030 – Arrangement plan	Shall indicate type and location of sensors, as well as location of audible and visible alarms.	FI
Cargo tanks pressure monitoring system, fixed	I200 – Control and monitoring system documentation	If required as a secondary means of cargo tank venting as per Sec.5.	AP
	Z030 – Arrangement plan	Shall indicate type and location of sensors, as well as location of audible and visible alarms.	FI
Cargo temperature monitoring system	I200 – Control and monitoring system documentation	If required by Sec.4 [4.4].	AP
Cargo heating system	S010 – Piping diagram (PD)		AP
Bilge system	S010 – Piping diagram (PD)	As required by Pt.4 Ch.6 but shall also include bilge and drainage piping systems serving e.g. pump rooms, cofferdams, pipe tunnels and other dry spaces within cargo area. The drawing shall include arrangement for transfer of sludge/bilge water to slop tanks if installed. The drawing shall also include number and location of any bilge level sensors.	AP
Ballast system	S010 – Piping diagram (PD	As required by Pt.4 Ch.6 but shall also include ballast systems serving ballast tanks in the cargo area. The diagram shall include piping arrangement for forepeak tank (if connected to the ballast system serving the cargo area) as well as details related to ballast treatment systems if installed. For ships with cargo pump rooms, specification of temperature monitoring equipment for ballast pumps and shaft penetrations shall be included.	AP

Object	*Documentation type*	*Additional description*	*Info*
Inert gas system	C030 – Detailed drawing	- non-return valves - deck water seals - double-block and bleed arrangements - scrubbers - P/V breakers.	AP
	S010 – Piping diagram (PD)	Inert gas distribution to cargo tanks, ballast tanks and cargo piping. Shall include connections to e.g. cargo tank venting and vapour return systems.	AP
	S010 – Piping diagram (PD)	Piping systems serving the inert gas unit such as exhaust gas, fuel supply, water supply and discharge piping.	AP
	Z161 – Operation manual	See MSC/Circ.353 Ch.8 and 11, as amended by MSC/Circ.387.	AP
Inert gas generator	Z100 – Specification	If applicable.	AP
Inert gas control and monitoring system	I200 – Control and monitoring system documentation		AP
Cargo tanks cleaning systems	S010 – Piping diagram (PD)	The drawing shall show number of and location of cargo tank washing machines.	AP
	S110 – Shadow diagram*		AP
	Z030 – Arrangement plan	- washing machines including installation and supporting arrangements - hand dipping and gas sampling arrangements.	AP
	Z161 – Operation manual	In accordance with MEPC.3(XII), as amended by resolution MEPC.81(43).	AP
Crude oil washing machines	Z100 – Specification	- manufacturer - type - nozzle diameter - capacity.	FI
Sacrificial anodes	M050 – Cathodic protection specification, calculation and drawings	In ballast tanks and, when applicable, tanks for cargo with flash point below 60°C, and adjacent tanks.	FI
	Z030 – Arrangement plan		AP
	C030 – Detailed drawing	Fastening of anodes in ballast tanks.	AP
	C030 – Detailed drawing	Fastening of anodes in tanks for cargo with flash point below 60°C, and adjacent tanks.	AP

AP = for approval; FI = for information ACO = as carried out; L = local handling; R = on request; TA = covered by type approval; VS = vessel specific
*Shadow diagram is only pertaining to COW (tanker for oil > 20000) and class notation **ETC**.

4.1.2 Combination carriers

Additional documentation for combination carriers shall be submitted as required by Table 6.

Table 6 Additional documentation requirements

Object	*Documentation type*	*Additional description*	*Info*
Cargo handling arrangements	Z161 – Operational manual	See Sec.10 [4.1].	AP
Cargo tank cleaning system	S010 – Piping diagram (PD)	Shall also include arrangements for cleaning of cargo piping and shall include water supply and discharge piping.	AP
Cargo tank gas freeing system	S010 – Piping diagram (PD)	Shall also include arrangements for gas freeing of cargo piping.	AP
AP = for approval; FI = for information ACO = as carried out; L = local handling; R = on request; TA = covered by type approval; VS = vessel specific			

4.1.3 For general requirements for documentation, including definition of the info codes, see DNV-CG-0550 Sec.6.

4.1.4 For a full definition of the documentation types, see DNV-CG-0550 Sec.5.

4.1.5 Other plans, specifications or information may be required depending on the arrangement and the equipment used in each separate case.

4.2 Required compliance documentation

4.2.1 General

Products shall have compliance documents as required in Table 7.

Table 7 Compliance documents

Object	*Compliance document type*	*Issued by*	*Compliance standard**	*Additional description*
Emergency towing strongpoints	PC	Society		
	MD	Manufacturer		
Emergency towing fairleads	PC	Society		
	MD	Manufacturer		
P/V-valves and other flame arresting elements	TAC	Society	2)	
Cargo pumps	PC	Society		Including stripping pumps.
Cargo tanks gas-freeing fans	PC	Society		
Ventilation fans for hazardous areas	PC	Society		Permanently installed fans.
Hydrocarbon gas detection and alarm system, fixed	PC	Society	2)	

Object	*Compliance document type*	*Issued by*	*Compliance standard**	*Additional description*
Cargo valves and pumps control and monitoring system	PC	Society		
Cargo tanks level monitoring system	PC	Society		
Cargo tanks overflow protection alarm system	PC	Society		
Cargo tanks pressure monitoring alarm system	PC	Society		If required as a secondary mean of cargo tank venting as per Sec.5.
Cargo tank temperature monitoring system	PC	Society		If required by Sec.4 [4.4].
Portable cargo tank oil and water interface detection system	TAC	Society	2)	See Sec.9.
Portable gas detectors	TAC	Society	2)	See Sec.9.
Inert gas blowers	PC	Society	2)	
Inert gas generators	PC	Society	2)	
Scrubbers	PC	Society	2)	
Deck water seals	PC	Society	2)	
Scrubber sea water supply pumps	PC	Society	2)	
Deck water seal sea water supply pumps	PC	Society	2)	
Liquid pressure/vacuum breakers	PC	Society	2)	
Pressure/vacuum valves	TAC	Society	2)	
Inert gas control and monitoring system	PC	Society	2)	

Associated electric equipment (motors, switchgear and control gear and frequency converters) serving an item that is required to be delivered with a product certificate issued by the Society is regarded as important equipment, and shall be certified as required by Pt.4 Ch.8 Sec.1 [2.3.1].

Cargo valves shall have compliance documents according to requirements in Pt.4 Ch.6 Sec.9.

1) Unless otherwise specified the compliance standard is the Society's rules.

2) For EEA flagged ships, EC-MED may be required for inert gas components, fixed hydrocarbon gas detection and alarm systems and portable gas detectors, PV valves and other flame arresting elements.
   - For EEA flagged ships, EC-MED (B+F) may be accepted in lieu of a PC issued by the Society.
   - For non-EEA flagged ships, equipment serving an item that is required delivered with a PC issued by the Society, EC-MED (B+F) may be accepted if issued by the Society.

4.2.2 For general compliance documentation requirements, see DNV-CG-0550 Sec.4.

4.2.3 For a definition of the compliance document types, see DNV-CG-0550 Sec.4 and DNV-CG-0550 Sec.3.

5 Testing

5.1 Testing during newbuilding

5.1.1 Survey requirements for inert gas systems are given in Sec.11 [6.1].

5.1.2 Testing requirements for materials of strong points for emergency towing are given in Sec.2 [2.2].

5.1.3 Testing requirements for cargo piping are given in Sec.4 [3.2.10] and Sec.4 [3.4].

5.1.4 Testing requirements for flame arresting elements in gas outlets and air inlets for cargo tanks are given in Sec.5 [2.2.12].

5.1.5 Testing requirements for electrical installations are given in Sec.8 [4].

5.1.6 Testing requirements for inert gas systems are given in Sec.11 [6.2].

SECTION 2 HULL

1 General

1.1 Application

1.1.1 Requirements with respect to strength of the hull structure and selection of hull materials shall follow the requirements and principles given in Pt.3, supplemented by the requirements given in this section. For fabrication and testing of integral tanks and prismatic independent tanks, seePt.2 Ch.4. For scantlings and testing of tanks other than integral tanks, e.g. independent tanks of type C and process pressure vessels, see Ch.7 Sec.5.

1.1.2 The additional notation **CSR** is mandatory for tankers and combination carriers with class notation **Tanker for oil** or **Tanker for oil products** and with $L \geq 150$ m.

This includes combination carriers and chemical tankers with $L \geq 150$ m, also intended for carriage of oil.

The **CSR** notation documents that the newbuilding is designed and built according to common structural rules for double hull oil tankers as described in [1.2].

1.2 Common structural rules

1.2.1 The common structural rules for bulk carriers and oil tankers define the scantling requirements for oil tankers contracted July 2015. and comprises the scantling requirements for the classification of new tankers.

1.2.2 Requirements given in [2], [3] and [4] do not apply for vessels with **CSR** notation.

1.2.3 Requirements given in Pt.3 Ch.1 to Pt.3 Ch.13 are covered by the common structural rules and are not applicable for vessels with **CSR** notation. Pt.3 Ch.14 and Pt.3 Ch.15 apply also to **CSR** notation.

1.2.4 For parts of the structure for which the common structural rules do not apply, the appropriate classification rules shall be applied. In cases where the common structural rules do not address certain aspects of the ship's design, the applicable classification rules shall be applied.

1.2.5 Combination carriers with class notation **Bulk carrier** or **Tanker for oil ESP**, or **Ore carrier** or **Tanker for oil ESP** shall fulfil design requirements for bulk carrier or ore carrier in addition to the common structural rules for double hull oil tankers.

1.2.6 For ships of GT ≥500 with notation **CSR**, access to and within spaces in, and forward of, the cargo area shall comply with SOLAS Regulation II-1/3-6 and IACS UI SC191.

1.2.7 For ships intended to carry cargo with temperatures above 80°C and/or below 0°C, Pt.3 Ch.1 Sec.2 [3.7.2], Pt.3 Ch.3 Sec.1 [2.1.5] and Pt.3 Ch.3 Sec.1 [2.4.2] are applicable.

1.2.8 For ships intended to operate in areas with low air temperatures, i.e. design temperatures below -10°C, Pt.3 Ch.3 Sec.1 [2.4.1] is applicable.

1.2.9 Equivalency to the rules of alternative methods used for the design and the determination of scantlings shall be assessed following IACS Rec. 165.

2 Hull strength

2.1 Vertically corrugated bulkhead without stool

2.1.1 For ships having a moulded depth less than 16 m, vertically corrugated bulkhead may extend to inner bottom, otherwise a lower stool shall be fitted.

2.1.2 The inner bottom and hopper tank plating in way of corrugations shall be of at least the same material yield strength as the attached corrugation. Z-grade steel in accordance with Pt.2 Ch.2 Sec.2 [6] shall be used or through thickness properties shall be documented. Brackets shall be arranged below inner bottom and hopper tank plating in line with corrugation webs as far as practicable.

2.2 Emergency towing

2.2.1 Tankers of 20 000 dwt and above, including oil tankers, chemical tankers and gas carriers shall be fitted with an emergency towing arrangement in accordance with IMO resolution MSC.35(63).

2.2.2 An arrangement drawing specified in Sec.1 [4.1.1], which includes details of towing pennant, chafing chain and pick-up gear, shall be submitted for approval. Towing arrangements shall be arranged both forward and aft. Supports shall be adequate for towing angles up to 90° from the ship's centreline to both port and starboard and 30° vertically downwards.

2.2.3 Emergency towing arrangements shall have a working strength (SWL) of:

— 1 000 kN for vessels less than 50 000 dwt
— 2 000 kN for vessels of 50 000 dwt and above.

The minimum breaking load (MBL) of the major components of the towing arrangements, as defined in MSC.35(63), shall be two (2) times the SWL.

2.2.4 The strong point and supporting structure for the towing arrangement shall be designed for a load of twice the SWL with allowable stresses as follows:

Normal stresses:	1.00 R_{eh}
Shear stresses:	0.58 R_{eh}

The capacity of the structure to resist buckling failure shall be assured with acceptance criteria as given in Pt.3 Ch.8 Sec.1 Table 3 for AC-II.

Guidance note:

These requirements should be assessed using a simplified engineering analysis based on elastic beam theory, two dimensional grillage or finite element analysis using gross scantlings.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.5 Material of welded parts used in the strong point shall be Charpy V-notch tested (minimum 27 J at 0°C), see Pt.2 Ch.1 Sec.3.

2.2.6 The pick-up gear shall be a floating line of minimum length 120 m and with a minimum breaking load (MBL) of 200 kN.

2.2.7 Emergency towing components shall be certified as required by Sec.1 Table 7.

3 Fatigue assessment

3.1 General

3.1.1 These requirements apply to oil tankers with length above 90 m and ship types given in Ch.6, chemical tankers, with length above 90 m.

3.1.2 The fatigue strength calculations shall be carried out for the following locations:

— longitudinal stiffener end connections in midship area
— lower hopper knuckle connections forming boundary of inner skin amidships.

3.1.3 The following two loading conditions shall be taken into account:

— fully loaded condition, departure
— normal ballast condition, arrival.

3.2 Longitudinals in way of end-supports

Longitudinals end connections on outer shell shall be subject to fatigue evaluation according to Pt.3 Ch.9 and DNV-CG-0129 *Fatigue assessment of ship structure*.

3.3 Lower hopper knuckle

3.3.1 The fatigue strength of the knuckle between inner bottom and hopper plate shall be evaluated according to Pt.3 Ch.9 and to DNV-CG-0129 *Fatigue assessment of ship structure*.

Guidance note:

The calculation scope should normally cover one transverse frame in the midship area.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.2 The fatigue calculation required in [3.3.1] may be omitted for knuckles with proper support.

Guidance note:

To have proper support of the knuckle, brackets should be fitted in ballast tanks in line with the inner bottom. Geometrical eccentricity in the knuckle should be avoided or kept to a minimum. In addition, one of the following structural solutions for knuckles with angles between inner bottom and hopper plate between 30° and 75°, should be adequate:

a) Bracket inside cargo tank. The bracket should extend approximately to the first longitudinals and the bracket toe should have a soft nose design.

b) Insert plate of 2.0 times the thickness normally required. Insert plates should be provided in inner bottom, hopper plate, and web frame. The insert plates should extend approximately 400 mm along inner bottom and hopper plate, approximately 800 mm in longitudinal direction, and 400 mm in the depth of the web.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4 Direct strength calculations

4.1 General

4.1.1 Requirements given in this subsection apply to oil tankers and ship types given in Ch.6, chemical tankers.

4.1.2 A simplified engineering analysis based on elastic beam theory, two dimensional grillage or finite element analysis shall be carried out to demonstrate that the stresses are acceptable when the structure is loaded as described in [4.2].

4.1.3 Calculations as mentioned in [4.1.2] shall be carried out for:

- transverse, horizontal and vertical girders in cargo tanks
- bulkhead structures
- double bottom structures
- other structures as deemed necessary by the Society.

4.2 Direct strength calculations for ships with length above 90 m

4.2.1 Requirements given in this subsection apply to ships with length above 90 m.

4.2.2 Cargo hold finite element analysis shall be carried out for midship region according to requirements given in Pt.3 Ch.7 Sec.3.

4.2.3 Local fine mesh analysis shall be carried out:

- for laterally loaded local stiffeners and their connected brackets, subject to relative deformation between supports in the midship region according to requirements given in Pt.3 Ch.7 Sec.4
- for a connection of the corrugation and lower supporting structure to inner bottom if no lower stool is fitted.

4.2.4 Finite element analysis shall be based on loading conditions as described in [4.3]. Hull girder loads shall be included.

Guidance note:

FE modelling procedures are given in DNV-CG-0127 Sec.3.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.2.5 Analysis criteria in partial ship FE analysis

Analysis criteria in partial ship analysis are given in Pt.3 Ch.7 Sec.3 [4]. In addition, for a vertically corrugated bulkhead where lower stool is not fitted, coarse mesh allowable yield and buckling utilization factor are given in Table 1.

Table 1 Permissible coarse mesh permissible yield utilization factor λ_{perm} and allowable buckling utilization factor η_{all} for a vertically corrugated bulkhead where lower stool is not fitted

Structural member	*Acceptance criteria*	*Load components*	λ_{perm}	η_{all}
supporting structure in way of lower end of corrugated bulkheads without lower stool [1)]	AC-I	S	0.72	0.72
	AC-II	S+D	0.90	0.90
corrugation of vertically corrugated bulkheads without lower stool under lateral pressure from liquid loads and without lower stool, for shell elements only	AC-I	S	0.65	0.65
	AC-II	S+D	0.81	0.81

Structural member	*Acceptance criteria*	*Load components*	λ_{perm}	η_{all}
1) Supporting structure for a transverse corrugated bulkhead refers to the structure in the longitudinal direction within half a web frame space forward and aft of the bulkhead, and within a vertical extent equal to the corrugation depth. Supporting structure for a longitudinal corrugated bulkhead refers to the structure in the transverse direction within 3 longitudinal stiffener spacings from each side of the bulkhead, and within a vertical extent equal to the corrugated depth.				

4.2.6 Analysis criteria in fine mesh analysis

Analysis criteria in fine mesh analysis are given in Pt.3 Ch.7 Sec.4 [4]. Where a lower stool is not fitted to a vertically corrugated bulkhead, the permissible stresses given in Pt.3 Ch.7 Sec.4 [4.2.2] shall be reduced by 10% for the areas under investigation by fine mesh analysis.

4.3 Load conditions

4.3.1 The girder structure in the cargo region shall generally be considered for the load conditions given in [4.3.2] and [4.3.3]. These loading conditions shall be based on the actual design, considering possible combinations of tank filling and draught.

4.3.2 Load conditions following the principles below shall be examined for upright seagoing conditions:

a) any cargo tank to be empty on full draught (T) with adjacent cargo tanks full
b) any cargo tank to be filled on a minimum relevant seagoing draught (T_A) with the adjacent tanks empty
c) all cargo tanks within a transverse section of the ship to be filled on minimum relevant seagoing draught (T_A) with adjoining cargo tanks forward and aft empty.

4.3.3 Load conditions following the principles below shall be examined for upright harbour conditions:

a) any cargo tank may be filled on a draught of 0.25 D (0.35 T if this is less) with adjacent tanks empty
b) all cargo tanks in a section of the ship to be filled at a draught of 0.35 D (0.5 T if this is less) with adjoining cargo tanks forward and aft empty.

4.3.4 Girders on transverse bulkheads in ships with 1 or 2 longitudinal bulkheads shall additionally be considered for alternate loading of the cargo tanks. In this condition a draught of T_A shall be applied.

4.3.5 Ships with two (2) longitudinal bulkheads and with cross ties in the centre tank shall be considered for an asymmetric load condition with one wing tank filled and other tanks empty, where such loading pattern is included in the ship loading manual for seagoing conditions. If loading patterns is not considered, an operational restriction describing that the difference in filling level between corresponding port and starboard wing cargo tanks shall not exceed 25% of the filling height in the wing cargo tank, shall be added in the loading manual.

SECTION 3 SHIP ARRANGEMENT AND STABILITY

1 Intact stability

The intact stability requirements of Pt.3 Ch.15 shall be complied with. In addition, vessels with class notation **Tanker for Oil** of 5000 dwt and above shall comply with the intact stability criteria as specified in MARPOL Annex I, Reg. 27.

2 Location and separation of spaces

2.1 General

2.1.1 Machinery space shall be isolated from cargo tanks and slop tanks by cofferdams, pump rooms, oil fuel bunker tanks or ballast tanks.

Spaces which may be approved as cofferdams, see [6.1].

2.1.2 Fuel oil bunker tanks shall not be situated within the cargo tank block. Such tanks may, however, be situated at forward and aft end of the cargo tanks instead of cofferdams. Fuel oil tanks shall not extend fully nor partly above or beneath cargo or slop tanks and are not permitted to extend into the protective area of cargo tanks required by [3].

2.1.3 Machinery and boiler spaces and accommodation and service spaces shall be positioned aft of the cargo area, but not necessarily aft of fuel oil tanks.

Note:

Machinery spaces should not be located fully nor partly within the cargo area including within e.g. pumprooms or other spaces approved as cofferdams, except as specified in [2.1.4].

Machinery spaces other than those of category A that contain electrically driven equipment or systems required for cargo handling may upon special considerations be accepted located within the cargo area. Area classification requirements apply. Examples of such systems are: hydraulic power units for cargo systems, nitrogen generators and dehumidification plants.

---e-n-d---o-f---n-o-t-e---

2.1.4 The lower portion of the cargo pump room may be recessed into machinery and boiler spaces to accommodate pumps, provided the deck head of the recess is in general not more than one-third of the moulded depth above the keel. For ships of not more than 25 000 tons deadweight, where it is demonstrated that for reasons of access and satisfactory piping arrangements this is impracticable, a recess in excess of such height may be permitted, though not exceeding one half of the moulded depth above the keel.

2.1.5 Spaces mentioned in [2.1.3] except machinery spaces of category A, may be positioned forward of the cargo area after consideration in each case.

Guidance note:

Machinery spaces other than those of category A may be accepted located in forecastle spaces above forepeak tanks even if said forepeak tank is located adjacent to a cargo tank.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.1.6 Where bow thruster spaces are defined as other machinery space, they shall not be located adjacent to cargo tanks (SOLAS Ch.II-2 Reg.4.5.1.3).

2.1.7 Where the fitting of a navigation position above the cargo area is shown to be necessary, it shall be separated from the cargo tank deck by means of an open space with a height of at least 2 m.

2.1.8 Deck spills shall be kept away from accommodation and service areas and from discharge into the sea by a permanent continuous coaming of minimum 100 mm high surrounding the cargo deck. In the aft corners of the cargo deck the coaming shall be at least 300 mm high and extend at least 4.5 m forward from each corner and inboard from side to side. Scupper plugs of mechanical type are required. Means of draining or removing oil or oily water within the coamings shall be provided.

2.1.9 Where a corner-to-corner situation occurs between a non-hazardous space and a cargo tank, a small enclosed space (cofferdam) created by a diagonal plate across the corner on the non-hazardous side, may be accepted as separation.

2.1.10 Paint lockers shall not be located within the cargo tank block, but may be located above oil fuel bunker tanks or ballast tanks aft of the cargo tanks/slop tanks.

2.2 Arrangements of barges

The spaces forward of the collision bulkhead (forepeak) and aft of the aftermost bulkhead (afterpeak) shall not be arranged as cargo oil tanks.

3 Tank and pump room arrangement

3.1 Segregated ballast tanks

3.1.1 Ships of 20 000 tons deadweight and above having the class notation **Tanker for oil** and ships of 30 000 tons deadweight and above with class notation **Tanker for oil products** shall have segregated ballast tanks.

The capacity of segregated ballast tanks shall be at least such that, in any ballast condition at any part of the voyage, including the conditions consisting of lightweight plus segregated ballast only, the ship's draughts and trim can meet each of the following requirements:

a) the moulded draught amidships (dm) in metres (without taking into account any ship's deformation) shall not be less than:

   $dm = 2.0 + 0.02\ L_F$

   where L_F is the length of the ship as defined by MARPOL.

b) the draughts at the forward and after perpendiculars shall correspond to those determined by the draught amidships (dm) as specified in subparagraph a) of this paragraph, in association with the trim by the stern of not greater than $0.015\ L_F$; and

c) in any case the draught at the after perpendicular shall not be less than that which is necessary to obtain full immersion of the propeller(s).

3.2 Protection of cargo tanks

3.2.1 Ships of 600 tons deadweight but less than 5 000 tons deadweight shall have a double hull arrangement covering the entire cargo tank length with particulars as follows:

a) Double side width (m):

$w = 0.4 + \frac{2.4DW}{20\,000}$ or w = 0.76 whichever is the greater.

DW = deadweight capacity of ship in metric tons.

b) Tankers where each cargo tank does not exceed 700 m^3 may be designed with single side.

Ships intended for carriage of heavy grade oil (as defined in MARPOL Annex I, Reg. 21) as cargo, shall comply with a).

c) Double bottom height (m):

$h = \frac{B}{15}$ or h = 0.76 whichever is the greater.

3.2.2 Ships of 5 000 tons deadweight and above shall have double hull in the entire cargo tank length with arrangement as follows:

a) Double side width (m):

$w = 0.5 + \frac{DW}{20000}$ or w = 2.0 whichever is the lesser, but not less than 1.0 m.

b) Double bottom height (m):

$h = \frac{B}{15}$ or h = 2.0 whichever is the lesser, but not less than 1.0 m.

When the distances h and w are different, the distance w shall have preference at levels exceeding 1.5 *h* above the baseline as shown in Figure 1.

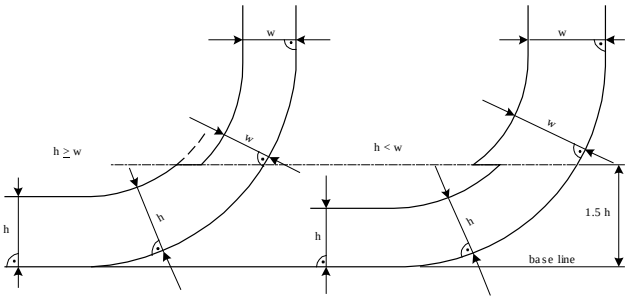

Figure 1 Double hull distances

3.2.3 Double bottom tanks or spaces as required by [3.2.1] may be dispensed with, provided that the design of the tanker is such that the cargo and vapour pressure exerted on the bottom shell plating forming a single boundary between the cargo and the sea does not exceed the external hydrostatic water pressure, as expressed by the following formula:

$$f\, h_c\, \rho_c g + 100\, \delta_p \leq d_n\, \rho_s g$$

where:

h_c = height of cargo in contact with the bottom shell plating in metres
ρ_c = maximum cargo density in t/m^3
d_n = minimum operating draught under any expected loading condition in metres
ρ_s = density of seawater in t/m^3
δ_p = maximum set pressure of pressure/vacuum valve provided for the cargo tank in bars
f = safety factor = 1.1
g = standard acceleration of gravity (9.81 m/s^2).

Any horizontal partition necessary to fulfil the above requirements shall be located at a height of not less than *B*/6 or 6 m, whichever is the lesser, but not more than 0.6 *D*, above the baseline where *D* is the moulded depth amidships.

The location of wing tanks or spaces shall be as defined in [3.2.2] except that below a level 1.5 *h* above the baseline where *h* is as defined in [3.2.2] the cargo tank boundary line may be vertical down to the bottom plating.

3.2.4 Suction wells in cargo tanks may protrude into the double bottom below the boundary line defined by the distance h provided that such wells are as small as practicable and the distance between the well bottom and bottom shell plating is not less than 0.5 *h*.

Guidance note:

For combined oil and chemical tankers, the requirements for the suction well in Ch.6 Sec.3 [1.1] are stricter.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.3 Cargo tanks and slop tanks

3.3.1 Accidental oil outflow performance in the case of side damage and bottom damage shall be within the limits required in MARPOL Annex I, Reg. 23.

3.3.2 Oil tankers of 150 GT and above shall be provided with arrangements of slop tank or combination of slop tanks with a total capacity complying with MARPOL Annex I, Reg. 29.

3.3.3 Oil tankers of 70 000 tons deadweight and above shall be provided with at least two slop tanks.

3.3.4 Slop tanks shall be designed particularly with respect to decantation purpose. Positions of inlets, outlets, baffles or weirs where fitted, shall be placed so as to avoid excessive turbulence and entrainment of oil or emulsion with the water.

3.4 Double bottom in pump rooms

Pump rooms containing cargo pumps in ships of 5 000 tons deadweight and above, shall be provided with a double bottom with depth h as follows:

$h = \frac{B}{15}$ (m) or h = 2.0 m, whichever is lesser, but not less than 1.0 m.

4 Arrangement of access and openings to spaces and tanks

4.1 Accommodation and non-hazardous spaces

4.1.1 Entrances, air inlets and openings to accommodation spaces, service spaces, control stations and machinery spaces shall not face the cargo area. They shall be located on the end bulkhead or on the outboard side of the superstructure or deckhouse at a distance of at least $L/25$ but not less than 3 m from the end of the superstructure or deckhouse facing the cargo area. This distance, however, need not exceed 5 m.

Within the limits specified above, the following apply:

a) Bolted plates for removal of machinery may be fitted. Such plates shall be insulated to A-60 class standard. Signboards giving instruction that the plates shall be kept closed unless the ship is gas-free, shall be posted on board.
b) Wheelhouse windows may be non-fixed and wheelhouse doors may be located within the above limits as long as they are so designed that a rapid and efficient gas and vapour tightening of the wheelhouse can be ensured.
c) Windows and side scuttles shall be of the fixed (non-opening) type. Such windows and side scuttles except wheelhouse windows, shall be constructed to A-60 class standard.

4.1.2 Cargo control rooms, stores and other spaces not covered by [4.1.3] but located within accommodation, service and control stations spaces, may be permitted to have doors facing the cargo area. Where such doors are fitted, the spaces are not to have access to the spaces covered by [4.1.3] and the boundaries of the spaces shall be insulated to A-60 class.

4.1.3 For access and openings to non-hazardous spaces other than accommodation and service spaces, the following provisions apply:

— entrances shall not be arranged from hazardous spaces
— entrances from hazardous areas on open deck shall normally not be arranged. If air locks are arranged such entrances may, however, be approved, see [4.1.5] and [4.1.6]
— entrances to non-hazardous forecastle spaces from hazardous areas shall be arranged with air locks, see [4.1.4].

4.1.4 Ventilation inlets for the spaces mentioned in [4.1.1] shall be located as far as practicable from gas-dangerous zones, and in no case are the ventilation inlets nor outlets to be located closer to the cargo area than specified for doors in [4.1.1].

4.1.5 Entrance through air locks to non-hazardous spaces shall be arranged at a horizontal distance of at least 3 m from any opening to a cargo tank or hazardous space containing gas sources, such as valves, hose connections or pumps used with the cargo.

4.1.6 Air locks shall comply with the following requirements:

a) Air locks shall be enclosed by gastight steel bulkheads with two substantially gas tight self-closing doors spaced at least 1.5 m and not more than 2.5 m apart. The door sill height shall comply with the requirement given in Pt.3 Ch.12 Sec.2, but shall not be less than 300 mm.
b) Air locks shall have a simple geometrical form. They shall provide free and easy passage, and shall have a deck area not less than about 1.5 m^2. Air locks shall not be used for other purposes, for instance as store rooms.
c) For requirements to ventilation of airlocks, see Sec.6.

4.2 Access to and within hazardous spaces

4.2.1 Access to and within spaces in, and forward of, the cargo area shall comply with SOLAS Regulation II-1/3-6.

4.2.2 Doors to hazardous spaces, situated completely upon the open deck, shall have as low a sill height as possible. Such compartments shall not be connected with compartments at a lower level.

4.2.3 For deck openings for scaffolding wire connections, the number and position of holes in the deck are subject to approval.

The closing of the holes may be effected by screwed plugs of metal or an acceptable synthetic material, see Sec.4 [1].

The material used in the manufacture of plugs and jointing, if any, shall be impervious to all cargoes intended to be carried.

Metal plugs shall have a fine screw thread to ensure an adequate number of engaging threads.

A number of spare plugs equal to at least 10% of the total number of holes shall be kept on board.

5 Protection of crew

5.1 Arrangement

5.1.1 Guard rails, bulwarks and arrangements for safe access to bow shall be arranged in accordance with Pt.3 Ch.11 Sec.3 [3]. On tank deck open guard rails shall normally be fitted. Plate bulwarks, with a 230 mm high continuous opening at lower edge, may be accepted upon consideration of the deck arrangement and probable gas accumulation.

Guidance note:

Permanently constructed gangways for safe access to bow should be of substantial strength and be constructed of fire resistant and non-slip material.

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5.1.2 Systems with a surface temperature above 60°C shall be provided with insulation or mechanical shielding if they are so located that crew may come in contact with them during normal operation or access.

6 Cofferdams, pipe tunnels and deck trunks

6.1 Cofferdams

6.1.1 Cofferdams shall be of sufficient size for easy access to all parts, and they shall cover the entire adjacent tank bulkhead. Minimum distance between bulkheads (and requirements to sizes of openings) shall be in accordance with [4.2], however not less than 600 mm.

6.1.2 Pump rooms and ballast tanks will be accepted as cofferdams. Ballast tanks will, however, not be accepted as cofferdams for protected slop tanks. See Sec.12.

6.2 Pipe tunnels and deck trunks

6.2.1 Pipe tunnels shall have ample space for inspection of the pipes.

6.2.2 The pipes in pipe tunnels shall be situated as high as possible above the ship's bottom.

There shall be no connection between a pipe tunnel and the engine room either by pipes or manholes.

6.2.3 Provision shall be made for at least two exits to the open deck arranged at a maximum distance from each other. One of these, fitted with a watertight closure, may lead to the cargo pump room.

6.2.4 Where there is permanent access from a pipe tunnel to the main pump-room, a watertight door shall be fitted complying with the requirements of SOLAS Ch. II-1/25-9, and in addition with the following requirements:

a) In addition to bridge operation, the watertight door shall be capable of being manually closed from outside the main pump-room entrance.
b) The watertight door shall be kept closed during normal operations of the ship except when access to the pipe tunnel is required.

6.2.5 Deck trunks containing liquid cargo and cargo vapour piping systems shall comply with IMO MSC/Circ. 1276. Deck trunks containing cargo pumps and/or cargo valves shall comply with the requirements to cargo pump rooms. The following shall be provided:

— A fixed fire detection and extinguishing system (CO_2 is acceptable). Note that the deck trunk area can be excluded from the total area used in the deck foam capacity calculations.
— A fixed gas detection in accordance with Sec.9 [6].
— A fixed mechanical ventilation system with capacity of minimum 20 air-changes per hour in accordance with Sec.6. Interlock shall be arranged between ventilation and light.
— A fixed bilge system, operable from outside the trunk.
— Bilge level alarms shall be in accordance with Sec.9 [2.1].

7 Diesel engines for emergency fire pumps

7.1 General

7.1.1 Diesel engines for emergency fire pump, shall be installed in a non hazardous space.

7.1.2 The exhaust pipe of the diesel engine, if fitted forward of the cargo area, shall have an effective spark arrester, and shall be led out to the atmosphere outside hazardous areas.

8 Chain locker and anchor windlass

8.1 General

8.1.1 The chain locker shall be arranged as a non hazardous space.

8.1.2 Windlass cable lifters and chain pipes shall be situated outside hazardous areas.

9 Equipment in tanks and cofferdams

9.1 General

Anodes, washing machines and other permanently attached equipment units in tanks and cofferdams shall be securely fastened to the structure. The units and their supports shall be able to withstand sloshing in the tanks and vibratory loads as well as other loads which may be imposed in service.

Guidance note:

When selecting construction materials in permanently attached equipment units in tanks and cofferdams, due consideration should to be paid to the contact spark-producing properties.

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9.2 Paint containing aluminium

Paint containing aluminium, when used in cargo tanks, shall comply with CSR Pt.2 Ch.2 Sec.2 [1.3].

9.3 Sacrificial anodes

9.3.1 All anodes shall be attached to the structure in such a way that they remain securely fastened even when it is wasted. The following methods are acceptable:

a) steel core connected to the structure by continuous fillet welds
b) attachment to separate supports by bolting, provided a minimum of two bolts with lock nuts are used. However, other mechanical means of clamping may be accepted.

9.3.2 Anodes shall be attached to stiffeners or aligned in way of stiffeners on plane bulkhead plating, but they shall not be attached to the shell. The two ends shall not be attached to separate members which are capable of relative movement.

9.3.3 Where cores or supports are welded to local supporting members or primary supporting members, they shall be kept clear of end supports, toes of brackets and similar stress raisers. Where they are welded to asymmetrical members, the welding shall be at least 25 mm away from the edge of the web. In the case of stiffeners or girders with symmetrical face plates, the connection may be made to the web or to the centreline of the face plate, but well clear of the free edges.

9.3.4 Cargo tanks

Cathodic protection systems, if fitted in tanks for cargo with flash point below 60°C, and adjacent tanks, shall comply with the requirements specified in CSR Pt.2 Ch.2 Sec.2 [1].

9.4 Aluminium fittings

9.4.1 Aluminium fittings in tanks used for the carriage of oil, and in cofferdams and pump rooms shall in general be avoided. Where fitted, aluminium fittings, units and supports, in tanks used for the carriage of oil, cofferdams and pump rooms shall satisfy the requirements of [9.3] for aluminium anodes.

9.4.2 The underside of heavy portable aluminium structures such as gangways, shall be protected by means of a hard plastic or wood cover, or other approved means, in order to avoid the creation of smears. Such protection shall be permanently and securely attached to the structures.

10 Surface metal temperatures in hazardous areas

Surface metal temperatures of equipment and piping in hazardous areas shall not exceed 220°C.

11 Signboards

11.1 References

Signboards are required by the rules in:

- [4.1.1] regarding plates bolted to boundaries facing the cargo area and which can be opened for removal of machinery. These shall be supplied with signboards giving instruction that the plates shall be kept closed unless ship is gas-free.
- Sec.8 [6.1.1] regarding opening of a lighting fitting. Before opening its supply circuit shall be disconnected.
- Sec.8 [6.1.2] regarding spaces where the ventilation shall be in operation before the lighting is turned on.
- Sec.8 [6.1.3] regarding portable electrical equipment supplied by flexible cables. This equipment shall not be used in areas where there is gas danger.
- Sec.8 [6.1.4] regarding welding apparatus. These shall not be used unless the working space and adjacent spaces are gas-free.
- Sec.10 [2.2.4] regarding access to stool tanks.
- Sec.12 [3.1.1] regarding hatches and other openings to cargo slop tanks. These shall be kept closed and locked during handling of dry cargo.
- Sec.12 [3.1.2] regarding instructions for handling of slop.

SECTION 4 PIPING SYSTEMS IN CARGO AREA

1 Piping materials

1.1 Selection and testing

1.1.1 Materials shall generally be selected according requirements given in Pt.4 Ch.6 for piping materials. The selected materials shall be tested according to regulations in Pt.2.

1.1.2 Other materials may be accepted after special consideration.

1.1.3 Synthetic materials for components and piping shall be approved in each separate case.

1.2 Special requirements for cargo piping system

1.2.1 Manifold valves and distance pieces or reducers outboard of valves, which are connected directly to the cargo pipeline's shore connection on deck, shall be made of steel and fitted with flanges conforming to ASME B16.5, i.e. be of flanged type or fully-lugged type.

1.3 Plastic pipes in cargo area

1.3.1 Plastic pipes of approved type and tested according to an approved specification may be accepted. For the application of plastic pipes, see Pt.4 Ch.6.

1.3.2 When used in a hazardous area, the surface resistance per unit length of pipes shall not exceed 10^5 Ω/m and the resistance to earth from any point in the piping system shall not exceed 10^6 Ω.

1.4 Aluminium coatings

1.4.1 Aluminized pipes are generally accepted in non-hazardous areas and may be permitted in hazardous areas on open deck and in inerted cargo tanks and ballast tanks, provided the pipes are protected from accidental impact.

2 Piping systems not used for cargo oil

2.1 General

2.1.1 There shall be no connection between piping systems in the cargo area and piping systems in the remainder of the ship, unless explicitly specified in this section.

Guidance note:

Piping systems for e.g. hydraulic oil, fuel lines, compressed air, steam and condensate, fire and foam located in the cargo area are permitted connected to systems in the remainder of the ship, provided they are not permanently connected to cargo handling systems or have open ends in cargo tanks.

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2.1.2 Piping systems such as compressed air, hydraulic oil which serve systems within tanks or spaces that are not used for cargo shall not be led through cargo tanks.

2.1.3 For ships not carrying homogeneous cargoes, e.g. crude oil, piping systems such as hydraulic oil serving systems within cargo tanks, shall be led to tanks from deck level and not penetrate boundaries between cargo tanks and tanks and compartments that do not contain cargo.

2.1.4 In general all piping led from machinery spaces into the cargo area shall be provided with means to preserve the integrity of the machinery space bulkhead.

2.1.5 Piping system with an open end in machinery spaces or in hazardous spaces in the cargo area and piping led from machinery spaces to the cargo area shall be led above main deck.

This also applies to ballast water treatment system piping (IACS UR M74).

Guidance note:

For closed piping system without open ends, pipe penetrations may be accepted in the ER bulkhead if readily accessible isolation valves are provided in the machinery space close to the bulkhead. The penetrations should be located as high as possible.

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2.1.6

Pipe penetrations shall be as per Pt.4 Ch.6 Sec.3 [1.4] and type approved according to DNV-CP-0165.

2.2 Drainage of pump rooms, cofferdams, pipe tunnels, ballast and fuel oil tanks

2.2.1 Cargo pump rooms shall have a bilge system connected to pumps or bilge ejectors. The bilge system shall be capable of being operated from outside the cargo pumproom.

2.2.2 Cargo pumps may be used for bilge service provided each bilge suction pipe is fitted with a screw-down non-return valve, and an additional stop valve is fitted to the pipe connection between pump and the non-return valve.

2.2.3 The bilge pipes in the cargo pump room shall not be led into the engine room.

2.2.4 Cofferdams, pipe tunnels, voids and other dry-compartments below main deck and within the cargo area shall be provided with bilge suctions.

Guidance note:

For small voids, with direct access from open deck (e.g. transverse upper stool spaces), portable draining arrangements may be accepted. Arrangements where the use of the portable drainage equipment requires entry into the void will not be accepted.

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2.2.5 Hazardous spaces (including any compartment or tank, cofferdams or void) within the cargo area shall only be drained by bilge pumps or ejectors located within the space itself or within a space with an equivalent hazard.

2.2.6 Pipe tunnels shall be drained from the cargo pump room or an equivalent hazardous space.

2.2.7 Segregated ballast tanks within the cargo area shall be served by ballast pumps in the cargo pump room, in a similar hazardous space or inside ballast tanks. Ballast tanks shall be provided with at least two drain pumping units. At least one of the pumps shall be exclusively used for ballast. As another means an eductor or an emergency connection to a cargo pump may be accepted. Segregated ballast systems shall not have any connections to the cargo system, but an emergency discharge of ballast water may be arranged by connection to a cargo pump.

The connection pipe shall be provided with a removable spool piece and a closing valve and non-return valve in series in the suction side to the cargo oil pump.

2.2.8 Arrangements for discharge of water ballast and oil contaminated water from the cargo area shall be made above the waterline in the deepest ballast condition, in accordance with MARPOL Annex I, Reg.30.

2.2.9 A discharge manifold for connection to reception facilities for the discharge of dirty ballast water or oil contaminated water shall be located on the open deck on both sides of the ship.

2.2.10 For ships arranged with emergency connection between the cargo system and the segregated ballast system as specified in [2.2.7], the discharge manifold required by [2.2.9] may be omitted.

2.2.11 Ballast tanks forward of cargo area may be connected to the ballast pumps in the aft cargo pump room, see [2.2.13].

2.2.12 Ballast piping and other piping such as sounding and vent piping to ballast tanks shall not pass through cargo tanks.

2.2.13 For requirements to drainage of ballast tanks, see Pt.4 Ch.6 Sec.4 [9].

2.2.14 Fuel oil bunker tanks adjacent to cargo tanks may be connected directly to pumps in the engine room. The pipes shall not pass through cargo tanks and shall have no connection with pipelines serving such tanks.

2.2.15 Ballast water treatment systems shall comply with safety requirements of Pt.6 Ch.7 Sec.1.

2.3 Fore peak ballast tank

2.3.1 The fore peak tank can be ballasted with the system serving other ballast tanks within the cargo area, provided:

- The fore peak tank is considered as hazardous.
- The air pipes shall be located on open deck. The hazardous zone classification in way of air pipes shall be in accordance with Sec.8.
- Means are provided, on the open deck and within tanks, to allow measurement of flammable gas concentrations within the fore peak tank by a suitable portable instrument.
- Arrangements for sounding, gas detection and other openings to the fore peak tank are direct from open deck.
- The access to the fore peak tank is direct from open deck.

As an alternative to direct access from open deck, indirect access to the fore peak tank through an enclosed space may be accepted provided that:

- In case the enclosed space is non-hazardous and separated from the cargo tanks by cofferdams, the access is through a gas tight bolted manhole located in the enclosed space and a signboard shall be provided at the manhole stating that the fore peak tank may only be opened after it has been proven to be gas free or any electrical equipment which is not certified safe in the enclosed space is isolated.
- In case the enclosed space has a common boundary with the cargo tanks and is therefore hazardous, the enclosed space is well ventilated to open deck and a signboard is provided at the manhole(s) stating that the forepeak may only be opened when the enclosed space is being thoroughly ventilated.

(IACS UR F44 Rev.1)

2.3.2 The requirements in [2.3.1] also apply to spaces other than forepeak tanks, such as upper forward voids spaces, with common boundary with cargo tanks and located below non-hazardous enclosed spaces (e.g. forecastle spaces) and without access to open deck. In order to comply with the condition that the space can be well ventilated, adequate gas-freeing arrangements shall be provided. For forepeak tanks or other ballast tanks adequate gas-freeing to open deck is ensured through filling and emptying the tank. For

voids without direct access to open deck, fixed piping extending to the bottom of the void will normally be required to ensure thorough ventilation from open deck.

2.4 Oil discharge monitoring and control systems

2.4.1 Oil tankers of 150 GT and above shall be equipped with an approved arrangement for oil content monitoring of oily ballast and tank washing water in accordance with MARPOL Annex I, Reg. 31. The system shall record continuously the discharge of oil in litres per nautical mile and total quantity of oil discharged, or the oil content and rate of discharge.

2.4.2 An instruction and operation manual describing all essential procedures for manual and automatic operations shall be submitted for approval in accordance with Sec.1 Table 5.

Guidance note:

Reference is made to IMO MEPC.108(49) as amended by MEPC.240(65) - Revised Guidelines and Specifications for Oil Discharge Monitoring and Control Systems for Oil Tankers.

IMO Res. MEPC240(65) is applicable to ships that intend to carry bio-fuel blends.

Manufacturer recommended spares for the ODME should be carried to ensure the operation of the equipment.

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2.4.3 Oil tankers of 150 GT and above, shall be provided with an effective oil and water interface detector of approved type in accordance with MARPOL Annex I, Reg. 32, for determination of the oil water inter face in slop tanks and other tanks where separation of oil and water is effected and from which it is intended to discharge effluent direct to sea.

2.5 Oil record book, shipboard oil pollution emergency plan and ship-to-ship transfer

2.5.1 Oil tankers of 150 GT and above shall be provided with an oil record book in accordance with MARPOL Annex I, Reg. 36.

2.5.2 Oil tankers of 150 GT and above shall be provided with a shipboard oil pollution emergency plan (SOPEP) approved by an administration in accordance with MARPOL Annex I, Reg. 37.

2.5.3 Oil tankers of 150 GT and above, which shall be engaged in transfer of oil cargo between oil tankers at sea, shall be provided with a ship-to-ship (STS) transfer manual in accordance with MARPOL Annex I, Reg. 41.

2.6 Air, sounding and filling pipes

2.6.1 Filling of tanks within cargo area shall be carried out from the cargo pump room or a similar hazardous space.

2.6.2 Filling lines to permanent ballast tanks and other discharge lines to cargo area may be connected to pumps outside the cargo area (e.g. engine room), provided the lines are not carried through cargo tanks and adjacent spaces and do not have a permanent connection to any cargo tank.

The arrangement is subject to approval in each separate case.

2.6.3 Filling lines to permanent ballast tanks shall be so arranged that the generation of static electricity is reduced, e.g. by reducing the free fall into the tank to a minimum.

2.6.4 Suction for seawater to permanent ballast tanks shall not be arranged in the same sea chest as used for discharge of ballast water from cargo tanks, see also [3.2.8].

Guidance note:

Seawater suction should be arranged at the opposite side from the discharge of ballast water from cargo tanks.

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2.6.5 Cofferdams shall be provided with sounding pipes and with air pipes led to the atmosphere. The air pipes shall be fitted with flame screens at their outlets.

2.6.6 An arrangement for transferring sludge, bilge water and similar from machinery spaces to e.g. slop tank may be accepted on the following conditions:

- The filling pipe is routed via deck level.
- The filling pipe is provided with a closable non-return valve (or automatic non-return valve and a closable valve in series) located in the cargo area.
- A spool piece or flexible hose not exceeding 2 m in length is provided on open deck. The design shall incorporate valve(s) so that when mounting or dismantling the spool piece the crew is not exposed to vapour from the slop tank. Blanks shall be provided for when the spool piece or hose is dismantled when it is not in use.
- The open end in the slop tank extends to the bottom of the slop tank or with the outlet bent towards a bulkhead in a suitable location of the tank in order to prevent free fall.
- Signboards with operational instructions are fitted in cargo control room and in the engine control room.

3 Cargo oil systems

3.1 General

3.1.1 A permanent system of piping and pumps shall be provided for the cargo tanks.

This system shall be entirely separate from all other piping systems on board.

Exemption, see Sec.5 [1].

3.1.2 At least two independently driven cargo oil pumps shall be connected to the system.

3.1.3 In tankers where cargo tanks are equipped with independent pumps (e.g. deep well pumps), the installation of one pump per tank may be approved. Satisfactory facilities shall be provided for emptying the tanks in case of failure of the regular pump.

3.1.4 Hydraulically powered pumps, submerged in cargo tanks (e.g. deep well pumps), shall be arranged with double barriers, preventing the hydraulic system serving the pumps from being directly exposed to the cargo. The double barrier shall be arranged for detection and drainage of possible cargo leakages.

3.1.5 Cargo pumps shall be certified as required by Sec.1 Table 7. For electrically driven pumps, associated electric motors and motor starters shall be certified as required by Pt.4 Ch.8 Sec.1 Table 3. For steam driven pumps, steam turbines shall be certified in accordance with Pt.4 Ch.3. For hydraulically driven pumps, hydraulic pumps shall be certified in accordance with Pt.4 Ch.6.

3.1.6 The wall thickness of cargo pipes will be specially considered on the basis of anticipated corrosion. The thickness of the pipes shall, however, not be less than given in Pt.4 Ch.6 Sec.9 [1].

3.1.7 Piping of all cargo handling systems shall be electrically bonded to the ship's hull. The resistance to earth from any point in the piping system is not to exceed 10^6 Ω.

Fix points may be considered as an effective bonding.

Piping sections not permanently connected to the hull, shall be electrically bonded to the hull by bonding straps.

3.1.8 For cargo pumps designed with a separate vacuum stripping system (e.g. pumproom tankers), all vent pipes from the vacuum system shall be led to a slop tank or terminate in a safe location on open deck as to prevent crew exposure to vapour as well as water ingress in the system. Vent pipes from drain tanks shall terminate in a safe location of open deck.

3.1.9 Drainage systems from cargo deck, drip trays etc. shall be arranged for transfer to cargo or slop tanks. Connections to cargo and slop tanks shall be provided with means to prevent backflow of vapor.

3.1.10 The cargo piping system shall be dimensioned according to Pt.4 Ch.6 Sec.9. The design pressure p is the maximum working pressure to which the system may be subjected. Due consideration shall be given to possible liquid hammer in connection with the closing of valves.

3.1.11 The design pressure for cargo piping shall be 10 bar as a minimum. For ships designed for the carriage of high density cargo, the design pressure shall take into account density of such cargo.

Guidance note:

Maximum pressure will occur with cargo pumps running at full speed against closed manifold valves, when pumping cargo with the maximum design density (regardless of cargo tank filling limitations).

As an alternative to increased design pressure when carrying high density cargo, a pressure monitoring system which automatically prevents the design pressure from being exceeded may be accepted. The system shall activate an alarm at the cargo control station. The system shall not impair the operation of ballast and bilge pumps connected to the cargo pump power supply system.

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3.2 Cargo piping systems

3.2.1 The complete cargo piping system, except for bow and stern loading systems complying with [5], shall be located within the cargo area.

3.2.2 Valves or branch pieces, which connect the cargo pipeline's shore connection on deck, and cargo piping shall be supported with due regard to load stresses.

3.2.3 Expansion elements shall be provided in the cargo piping as necessary.

3.2.4 Means for drainage of the cargo lines shall be provided. Tankers for oil of 20 000 tons deadweight and above, and tankers for oil products of 30 000 tons deadweight and above, shall be provided with a special small diameter line, not exceeding 10% of the cross-sectional area of main cargo line, for discharge ashore. This line shall be connected outboard of the ship's manifold valves.

Stripping systems for ships provided with deep well cargo pumps shall be specially considered.

3.2.5 The cargo piping system shall not have any connection to permanent ballast tanks.

3.2.6 Cargo piping and similar piping to cargo tanks shall not pass through ballast tanks or vice versa. Exemptions to this requirement may be granted for short length of pipes with heavy wall thickness, provided that they are completely welded.

Guidance note:

Short length of pipes may be such as through stool tanks used for ballast etc.

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3.2.7 Filling lines to cargo tanks shall be so arranged that the generation of static electricity is reduced, e.g. by reducing the free fall into the tank to a minimum.

3.2.8 The discharge of ballast water from cargo tanks shall be arranged in such a way as to prevent the ballast water from being drawn into sea suctions for other pipe systems, i.e. cooling water systems for machinery.

3.2.9 Isolation of cargo piping connections to sea shall be made by means of at least two shut-off valves. Arrangement for tightness monitoring of sea valves shall be provided.

Guidance note:

— For tankers delivered on or after 2010-01-01, MARPOL Annex I, Reg. 30.7 will apply for this arrangement.

— For arrangement of tightness testing of sea valves, see OCIMF's recommendations *Prevention of oil spillages through cargo pump room sea valves*.

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3.2.10 Where pumps in cargo room or other hazardous spaces are driven by shafting passing into the pump room through bulkheads or deck plating, gastight glands of approved type shall be fitted. The glands shall be efficiently lubricated and constructed so as to reduce the risk of overheating. Systems requiring periodic greasing type is not permitted. The glands shall be visible and easily accessible.

Parts which may accidentally come into contact if the seal is badly aligned or if a bearing is damaged, shall be of such materials that no spark may occur. If an expansion bellow is fitted, it shall be hydraulically pressure tested.

3.2.11 Displacement pumps shall have relief valves with discharge to the suction line.

3.2.12 For systems served by centrifugal pumps the design pressure for the piping shall be at least equal to the highest pressure the pump may generate. Alternatively a pressure relief valve or alternative means for automatically safeguarding against overpressure shall be provided.

3.2.13 Means shall be provided for stopping the cargo pumps at the cargo manifolds and at the lower pump room level.

3.2.14 Remote control and monitoring of the cargo handling, see Sec.9.

3.2.15 All ships having a noxious liquid substances (NLS) certificate for the carriage of liquid substances as listed in the IBC code chapter 18 category Z, shall have on board a cargo record book according to MARPOL Annex II, Appendix 2.

3.3 Cargo piping systems for barges

3.3.1 The barge shall be equipped with a permanent piping system for the oil cargo.

Closing valves operable from outside the tank shall be fitted to each branch pipe within the tank it serves.

3.3.2 At least two independently driven cargo pumps shall be connected to the cargo piping system.

If each cargo tank is fitted with a separate cargo pump, one cargo pump per tank may be accepted.

3.3.3 For unmanned barges without auxiliary machinery, non-permanent cargo pumps with external power supply may be acceptable.

The pumps shall be connected to the piping system on open deck or in a cargo pump room.

3.3.4 Cargo pump room situated below deck shall have a power operated bilge system.

Cargo pump room may have bilge suctions connected to the cargo pumps.

3.4 Testing

3.4.1 Cargo piping shall be hydrostatically tested in the presence of the surveyor to a test pressure = 1.5 × the maximum working pressure.

If hydrostatic testing of separate lengths of piping valves, expansion elements etc. has been carried out prior to the installation on board, a tightness test to at least the design pressure is required after completion of the installation onboard.

3.4.2 Cargo oil pumps shall be hydrostatically tested to 1.3 times the design pressure, with a minimum of 14 bar. For centrifugal pumps the maximum pressure shall be the maximum pressure head on the head-capacity curve. For displacement pumps the design pressure shall not be taken less than the relief valve opening pressure. The steamside of steam-driven pumps shall be hydraulically tested to 1.5 times the steam pressure. Hydrostatic testing of pump housings on submerged pumps will normally not be required.

3.4.3 Pump capacities shall be checked with the pump running at design condition (rated speed and pressure head, viscosity, etc.). Capacity test may be dispensed with for pumps produced in series when previous satisfactory tests have been carried out on similar pumps.

For centrifugal pumps having capacities less than 1 000 m^3/h, the pump characteristic (head-capacity curve) shall be determined for each type of pump. For centrifugal pumps having capacities equal to or greater than 1 000 m^3/h, the pump characteristic shall be determined over a suitable range on each side of the design point, for each pump.

3.4.4 Special survey arrangements for testing of pumps may be agreed upon.

4 Cargo heating

4.1 General

4.1.1 The heating media shall be compatible with the cargo and the temperature of the heating medium is normally not to exceed 220°C.

4.1.2 Supply and return pipes for heating coils fitted in cargo tanks, shall be arranged for blank flanging outside the engine or boiler room.

4.2 Steam heating

4.2.1 Water systems and steam systems shall comply with Pt.4 Ch.6 unless otherwise stated.

4.2.2 Condensate from cargo heating systems shall be led into an observation tank placed in an easily accessible, well ventilated and well illuminated position where it can easily be observed whether the condensate is free from oil or not. The scum pipes shall be led to a waste oil tank. If the condensate shall be used as feed water for boilers, an effective oil filtering system shall be arranged.

4.3 Thermal oil heating

4.3.1 Requirements to thermal-oil installations are given in Pt.4 Ch.7 Sec.3 [3].

4.3.2 Heating of liquid cargoes with flash point not exceeding 60°C shall be arranged by means of a separate secondary system located in the cargo area. However, a single circuit system may be accepted on the following conditions:

— system is so arranged that a positive pressure in the heating coil within a cargo tank shall be at least 3 m water column above the static head of the cargo when circulating pump is not in operation
— the thermal oil system expansion tank shall be fitted with high and low level alarms
— means shall be provided in the thermal oil system expansion tank for detection of flammable cargo vapours
— valves for the individual heating coils shall be provided with locking arrangement to ensure that the coils are under static pressure at all times.

4.4 Heating of cargo with temperatures above 120°C

4.4.1 Heating plants for asphalt tanks shall be arranged with redundancy. Redundancy is required for boilers/ thermal oil heaters, heat exchangers and as well as active components (e.g. circulation pumps). Failure of a redundant component is not to reduce the installed heating capacity by more than 50%.

4.4.2 Heating coils in asphalt tanks shall be separated into at least two independent systems. Emergency cross connections may however be accepted.

4.4.3 Cargo pumps, P/V-valves (if fitted), automatic vent heads (if fitted) and cargo lines shall be provided with arrangements for heating.

4.4.4 Temperature gauges shall be arranged in each cargo tanks enabling the recording of temperatures at bottom, midway between bottom and deck and at deck level in order to prevent overheating of cargo.

4.4.5 Heating coils shall be tested according to the non-destructive testing requirements listed in Pt.4 Ch.6 Sec.9 [1.5].

5 Bow and stern loading and unloading arrangements

5.1 General

Subject to the approval of the society, cargo piping may be fitted to permit bow and stern loading and unloading.

5.2 Piping arrangement

5.2.1 In addition to Pt.4 Ch.6 Sec.8, the following provisions apply:

a) Bow and stern loading and unloading pipes shall be led outside accommodation spaces, service and machinery spaces within the accommodation or control stations.
b) Cargo, stripping and vapour return piping (if fitted) forward or aft of the cargo area, except at the loading shore connection valve, shall have welded connections only. Such piping shall be clearly identified and fitted with two valves or one valve and a spool piece or blanks at its connection to the cargo piping system within the cargo area.
c) The shore connection shall be fitted with a shut-off valve and a blank flange.
d) Spray shields shall be provided at the connections specified in c).
e) Arrangements shall be provided for complete drainage of the stern loading pipe back to the to the cargo area, preferably into a cargo tank. This may be achieved by arranging the pipe as self-draining or providing connections for line-blowing. For piping that is not self-draining, the ability to obtain complete draining is subject to testing.

f) Arrangements shall be made to allow for inert gas purging and gasfreeing of the piping to the cargo area.

g) Entrances, air inlets and openings to accommodation spaces shall comply with SOLAS Reg. II-2/4.5.1.6 to 4.5.2.3. See also IMO MSC/Circ.474/Corr.1. Openings and access doors to mentioned spaces shall not face the cargo shore connection.

h) A fixed foam fire-extinguishing system covering loading and unloading areas shall be provided.

i) Loading and unloading arrangements shall not interfere with safety equipment.

j) Continuous coamings or drip trays with a coaming height of at least 300 mm shall be fitted to keep any spills away from accommodation and service areas.

Regarding additional class notations **Bow loading** or **STL** for offshore loading operations, see Pt.6 Ch.4 Sec.1.

Guidance note:

In e) partial elevation of the stern loading pipe should be avoided as it impairs the ability to drain the pipe back to the cargo area.

In g) an opening which does not have a direct line of sight to the shore connection and is located outside the hazardous zone in way of the shore connection is not considered to face the cargo area. Any opening located more than 10 m from the cargo shore connection may be accepted not facing the cargo shore connection on the condition that it is maintained closed during cargo handling operations. Note that ventilation openings to spaces containing machinery in use during cargo handling operations, as well as emergency generator rooms, are not considered capable of being maintained closed.

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SECTION 5 GAS-FREEING AND VENTING OF CARGO TANKS

1 Gas-freeing of cargo tanks

1.1 General

1.1.1 Means for gas-freeing of the cargo tanks shall be provided.

The gas-freeing system shall be used exclusively for ventilating and gas-freeing purposes. The system may, however, be combined with an inert gas system.

1.1.2 There shall be no connection between the gas-freeing system and the ventilation system for cargo pump room.

1.1.3 Permanently installed ventilating and gas-freeing systems with non-permanent connections to cargo tanks or cargo piping, shall comply with the following:

- Where the fans are located in a non-hazardous space, the air supply piping from the fan shall have an automatically operated shut-off valve and a non-return valve in series.
- The valves shall be located at the bulkhead where the air supply piping leaves the non-hazardous space, with at least the non-return valve on the outside.
- The shut-off valve shall open after the fans are started, and close automatically when the fans stop.
- Fans shall be of non-sparking type and certified in accordance with Sec.6 [1.2].

1.1.4 If a connection is fitted between the inert gas supply mains and the cargo piping system, arrangements shall be made to ensure an effective isolation having regard to the large pressure difference which may exist between the systems. This isolation may consist of two shut-off valves with an arrangement to vent the space between the valves. The valve on the cargo side of the separation shall be of non-return type with a positive means of closure. Alternatively, two shut-off valves with a removable spool piece may be accepted. See Figure 1.

(IACS UI SC62 (1985))

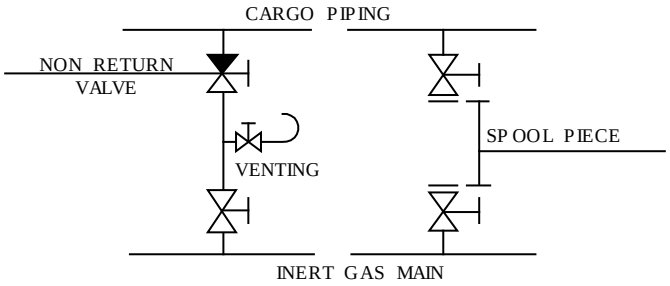

Figure 1 Example of effective isolation

1.1.5 For ships required to be inerted when carrying flammable oil, before gas-freeing with air, the cargo tanks shall be purged with inert gas. When the ship is provided with an inert gas system, gas outlets for tank purging and gasfreeing purposes shall comply with [2], and be positioned as far as practicable from the inert gas and air inlets. Alternatively, gas outlets may be arranged specifically for this purpose. Such outlets shall have a minimum height of 2 m above tank deck and dimensioned to give a minimum vertical exit velocity of 20 m/s, when any three cargo tanks are simultaneously supplied with inert gas, until the concentration of hydrocarbon vapours in the cargo tanks has been reduced to less than 2% by volume. Thereafter, gasfreeing may take place at the cargo tank deck level.

1.1.6 When the ship is not provided with an inert gas system the operation shall be such that the flammable vapour is discharged initially through the vent outlets as specified in [2], or through outlets at least 2 m above the tank deck level with a vertical efflux velocity of at least 30 m/s maintained during the gasfreeing operation, or through outlets at least 2 m above the tank deck level with a vertical efflux velocity of at least 20 m/s and which are protected by flame arresting elements as specified in [2.2.12]. When the flammable vapour concentration at the outlet has been reduced to 30% of LEL, gasfreeing may be continued at tank deck level.

1.2 Gas-freeing of cargo tanks for barges

Gas-freeing equipment is not required to be installed nor stored onboard.

The tank hatches shall be arranged so as to facilitate the use of portable gas-freeing equipment.

2 Cargo tank venting systems

2.1 General

2.1.1 All cargo tanks intended for the carriage of cargoes with a flashpoint not exceeding 60°C, shall be provided with system(s) for over- and underpressure relief as follows:

1) A breathing system for preventing excessive overpressure and vacuum created due to temperature variations and generation of cargo vapour when tanks are not being connected to or have been isolated from a venting system as specified in 2). Such breathing shall be through P/V-valves, (pressure or vacuum relief valves).
2) A venting system for preventing excessive overpressure or vacuum when tanks are being loaded or unloaded with closed tank hatch covers.

The breathing and venting systems may be independent or combined and may be connected to an inert gas system.

2.1.2 The system(s) shall be designed with a secondary mean for preventing excessive overpressure and vacuum in the event the primary mean of venting is isolated or fails. The following arrangements are acceptable:

1) For ships where cargo tanks are connected to a common venting system with a gas outlet with capacity as required by [2.2.13], the P/V-valves as required by [2.1.1].(1) are accepted as the secondary means of venting, with a capacity as required by [2.2.14].
2) For ships where cargo tanks are not connected to a common venting system with a common gas outlet with capacity as required by [2.2.13], one of the following arrangements can be accepted:
   - Two P/V-valves fitted to each individual cargo tank, without means for isolation, each with a capacity as required by [2.2.14].
   - Pressure sensors fitted in each individual cargo tank, and connected to an alarm system may be accepted. The setting of the over-pressure alarm shall be above the pressure setting of the P/V-valve and the setting of the under-pressure alarm shall be below the vacuum setting of the P/V-valve. The alarm settings shall be within the design pressures of the cargo tanks. The settings shall be fixed and not arranged for blocking or adjustment in operation, unless the ship is approved for carrying P/V-valves with different settings.
   - In case the pressure sensors required are also used for USCG vapour return purposes, then the system shall be provided with two fixed settings. For ships where inerting is not mandatory, the system shall be provided with mode selection so that the vapour return alarms are blocked except when the ship is loading with vapour return.

   See Sec.9 regarding high level alarms, overflow systems etc.

Guidance note:

For ships with tanks connected to a common venting system, the common gas outlet is considered as the primary mean of cargo tank venting during loading (and unloading for ships not required to be provided with inert gas systems when carrying oil). For ships without or having tanks not always connected to a common venting system, the full flow P/V-valves required fitted to each tank are considered to be the primary mean of venting during loading (and unloading for ships not required to be provided with inert gas systems when carrying oil). Inert gas supply is considered to be the primary mean of venting during unloading for ships required to be provided with inert gas systems when carrying oil.

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2.2 System design

2.2.1 Pipes for breathing and venting shall be led from each tank's highest point and shall be self-draining to the cargo tanks under all normal conditions of trim and list.

2.2.2 A separate system (e.g. stand pipe) for each tank or connection of tanks to a common cargo tank venting main pipe may be approved. When connection to a common main pipe is arranged, each branch pipe shall be provided with isolation valves. The isolation valves should preferably be fitted between the cargo tank and any spool piece or spectacle flange if fitted. Any stop valves fitted shall be provided with locking arrangements. There shall be a clear visual indication of the operational status of the valves or other acceptable means.

2.2.3 If the tank is not fitted with a separate P/V valve, the means of isolation shall be constructed in such a way that tank breathing is maintained when the branch pipe is isolated.

2.2.4 Shut-off valves shall not be fitted either above or below P/V valves, but by-pass valves may be provided.

2.2.5 The opening pressure of the pressure relief valves (P/V-valves) shall be less than the design vapour pressure for the cargo tanks. It shall also be less than the opening pressure of any P/V-breaker fitted, also taking into account pressure drop in the venting pipe between cargo tank and the P/V-valve. The opening pressure of the vacuum relief valves shall normally not be lower than 0.07 bar below atmospheric pressure and shall be higher than the vacuum relief opening pressure of any P/V-breaker.

Guidance note:

For ships provided with an in-line P/V-breather valve between the common cargo tank venting/inert gas main line and the mast riser outlet for the purpose of tank pressure control, the opening pressures should be such that the in-line P/V-breather valve opens before the P/V-valves fitted to each cargo tank.

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2.2.6 P/V valves shall be located on open deck and shall be of a type which allows the functioning of the valve to be easily checked. A permanent access arrangement shall be provided to enable such checking.

2.2.7 For venting systems for high temperature cargoes see Sec.4 [4.4.3].

2.2.8 Intake openings of vacuum relief valves shall be located at least 1.5 m above tank deck, and shall be protected against the sea. The arrangement shall comply with the requirements in Pt.3 Ch.12.

2.2.9 When the venting system during loading and unloading is by free flow of vapour mixtures, the outlets shall be not less than 6 m above the tank deck or gangway, if situated within 4 m of the gangway, and located not less than 10 m measured horizontally from air intakes and openings to enclosed spaces containing a source of ignition, and from equipment which may constitute an ignition hazard.

2.2.10 When the venting system during loading and unloading is by high velocity discharge the height of the gas outlets shall be located at a minimum height of 2 m above tank deck or gangway, if situated within

4 m of the gangway, and located not less than 10 m measured horizontally from air intakes and openings to enclosed spaces containing a source of ignition, and from equipment which may constitute an ignition hazard. High velocity devices shall be of an approved type.

2.2.11 Gas outlets used during loading shall be directed vertically upwards and without obstructions.

2.2.12 Gas outlets and air inlets for cargo tanks shall have flame arresting elements tested and approved according to IMO MSC/Circ.677 as amended by MSC/Circ.1009.

2.2.13 The flow area of the venting system used during loading shall be based upon not less than 125% of the gas volume flow corresponding to the maximum design loading rate.

Any P/V-valve fitted to a cargo tank as required by [2.1.1] shall have a capacity for the relief of full flow overpressure of not less than 125% of the gas volume flow corresponding to the maximum design loading rate for each tank. Similarly the P/V-valve capacity for the relief of underpressure shall be not less than the gas flow corresponding to the maximum design discharge rate for each tank.

Note:

The requirement to P/V-valve capacity applies to any P/V-valve which is required for the relief of over- and underpressure in case a cargo tank is isolated from a common cargo tank venting system (e.g. closed isolation valve) or gas outlet (e.g. mast riser valve closed).

USCG vapour emission control systems (VECS):

Note that for ship intended to comply with USCG regulations, the maximum allowable liquid loading rate when loading with vapour return will be determined by the capacity of the P/V-valves fitted to each tank. Under USCG regulations the P/V-valve capacity shall take into account the vapour growth rate (min. 1.25) and the air vapour density (min. recommended 3.0 kg/m^3) of the cargo to be carried.

For ships provided with e.g. an in-line P/V-breather valve between the common cargo tank venting/Inert gas main line and the mast riser outlet, the opening pressure of this P/V-breather valve should be taken into account in the pressure drop calculations required by the USCG. However, if it is possible to isolate the P/V-breather valve during vapour return and procedures for same is included in the VECS operation manual, the opening pressure may be disregarded.

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2.2.14 In systems where in-line P/V valves are installed, means for draining shall be fitted where condensate may accumulate.

2.3 Venting of cargo tanks for barges

2.3.1 The cargo tanks shall be provided with a venting system to facilitate loading and unloading with closed tank hatches without imposing excessive overpressure or vacuum on the tanks.

2.3.2 Breathing system with P/V valves will normally not be required.

2.4 Volatile organic compounds (VOC)

Crude oil tankers (tanker for oil) shall be provided with an approved volatile organic compound (VOC) management plan in accordance with MARPOL Annex VI, Reg. 15.

SECTION 6 VENTILATION SYSTEMS WITHIN THE CARGO AREA OUTSIDE THE CARGO TANKS

1 Ventilation systems

1.1 General

1.1.1 Any ducting used for the ventilation of hazardous spaces shall be separate from that used for the ventilation of non-hazardous spaces.

Ventilation systems within the cargo area shall be independent of other ventilation systems.

1.1.2 Air inlets for hazardous enclosed spaces shall be taken from areas which, in the absence of the considered inlet, would be non-hazardous.

Air inlets for non-hazardous enclosed spaces shall be taken from non-hazardous areas at least 1.5 m from the boundaries of any hazardous area.

Where the inlet duct passes through a more hazardous space, the duct shall have over-pressure relative to this space, unless mechanical integrity and gas-tightness of the duct will ensure that gases will not leak into it.

1.1.3 Air outlets from non-hazardous spaces shall be located outside hazardous areas.

1.1.4 Air outlets from hazardous enclosed spaces shall be located in an open area which, in the absence of the considered outlet, would be of the same or lesser hazard than the ventilated space.

1.1.5 Ventilation ducts for spaces within the cargo area shall not be led through non-hazardous spaces.

1.1.6 Non-hazardous enclosed spaces shall be arranged with ventilation of the overpressure type. Hazardous spaces shall have ventilation with under-pressure relative to the adjacent less hazardous spaces.

1.1.7 Starters for fans for ventilation of gas-safe spaces within the cargo area shall be located outside this area or on open deck.

If electric motors are installed in such spaces, the ventilation capacity shall be large enough to prevent the temperature limits specified in Pt.4 Ch.8 from being exceeded, taking into account the heat generated by the electric motors.

1.1.8 Wire mesh protection screens of not more than 13 mm square mesh shall be fitted in outside openings of ventilation ducts.

For ducts where fans are installed, protection screens shall also be fitted inside of the fan to prevent the entrance of objects into the fan housing.

1.1.9 Spare parts for fans shall be carried onboard. Normally wear parts for one motor and one impeller is required for each type of fan serving spaces in the cargo area.

1.1.10 Ventilation inlets and outlets for spaces in the cargo area that are required to be continuously mechanically ventilated at sea, shall be located so that they are operable in all weather conditions. This implies that they shall be arranged at a height above deck as required in Pt.3 Ch.12 Sec.7 [4] as a ventilator not requiring closing appliances.

Guidance note:

Spaces such as cargo pumprooms, ballast pumprooms and ballast water treatment spaces do normally not require continuous mechanical ventilation at sea. Spaces such as nitrogen rooms, cargo heater rooms and deck trunks containing cargo piping and cargo heaters may however require continuous ventilation at sea.

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1.2 Fans serving hazardous spaces

1.2.1 Fans shall be certified as required by Sec.1 Table 7. Associated electric motors and motor starters shall be certified as required by Pt.4 Ch.8 Sec.1 Table 3.

Guidance note:

It is recommended that fans are certified in accordance with EN13463-1, EN13463-5 and EN14986.

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1.2.2 Electric fan motors shall not be installed in ventilation ducts for hazardous spaces unless the motor is certified for the same hazard zone as the space served.

1.2.3 Fans shall be designed with the least possible risk for spark generation.

1.2.4 Minimum safety clearances between the casing and rotating parts shall be such as to prevent any friction with each other.

The radial air gap between the impeller and the casing shall not be less than 0.1 of the diameter of the impeller shaft in way of the bearing, but not less than 2 mm.

It may be less than 13 mm.

1.2.5 The parts of the rotating body and of the casing shall be made of materials which are recognised as being spark proof, and they shall have antistatic properties.

Furthermore, the installation on board of the ventilation units shall be such as to ensure the safe bonding to the hull of the units themselves. Resistance between any point on the surface of the unit and the hull, shall not be greater than 10^6 Ohm.

The following combinations of materials and clearances used in way of the impeller and duct are considered to be non-sparking:

- impellers and/or housing of non-metallic material, due regard being paid to the elimination of static electricity
- impellers and housings of non-ferrous metals
- impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on which a ring of suitable thickness of non- ferrous materials is fitted in way of the impeller, due regard being paid to static electricity, reliability of the arrangement for securing of the ring to the housing and corrosion between ring and housing
- impellers and housing of austenitic stainless steel
- any combination of ferrous (including austenitic stainless steel) impellers and housing with not less than 13 mm tip design clearance.

1.2.6 Any combination of an aluminium or magnesium alloy fixed or rotating component, and a ferrous fixed or rotating component, regardless of tip clearance, is considered a spark hazard and shall not be used in these places.

2 Ventilation arrangement and capacity requirements

2.1 General

2.1.1 The required capacity of the ventilation plant is normally based on the total volume of the room. An increase in required ventilation capacity may be necessary for rooms with a complicated shape.

2.1.2 Failure of required fixed mechanical ventilation shall be alarmed (audible and visual) at a manned station.

2.2 Non-hazardous spaces

2.2.1 Non-hazardous spaces with opening to a hazardous area, shall be arranged with an air lock in accordance with Sec.3 [4.1.5] and Sec.3 [4.1.6]. In addition, the following is applicable:

- The air lock shall be provided with independent mechanical ventilation.
- The non-hazardous space protected by an air lock and the air lock itself, shall be maintained at an overpressure relative to the hazardous area it opens into.
- Where the air lock protecting the non-hazardous space opens into a hazardous zone 1, the relative overpressure shall be minimum 0.25 mbar.
- In case of loss of ventilation in the non-hazardous space and/or the air lock, a visual and audible alarm shall be activated at a manned station. The ventilation monitoring shall be based on differential pressure- or flow detection.
- An alarm (acoustic and visual) shall be released on both sides of the air lock to indicate if more than one door has been moved from the fully closed position.
- Where the air lock protecting the non-hazardous space opens into a hazardous zone 1, electrical equipment located in the non-hazardous space that are not of the certified safe type, shall be automatically de-energized in case of loss of overpressure in the non-hazardous space. As an alternative to automatic disconnection based on loss of ventilation, automatic disconnection may be based on fixed gas detection within the protected space at a gas concentration not exceeding 30% LEL. The gas detection equipment shall be located where gas may accumulate and/or in the ventilation outlets. Gas dispersal analysis or a physical smoke test shall be used to find the best arrangement. An alarm shall be activated upon automatic disconnection.
- Where the air lock protecting the non-hazardous space opens into a hazardous zone 1, during initial start-up or after shut-down of the ventilation and before energizing any electrical equipment within the protected space, it shall be purged and pressurized, until the gas concentration does not exceed 30% of LEL. The purging and pressurization system shall be operable when the equipment in the protected space is de-energized (the pressurization system includes the pressurization control system, means of disconnection of electrical power, the system fan and its motor and gas detectors).
- Where the air lock protecting the non-hazardous space opens into a hazardous zone 2, electrical equipment located in the non-hazardous space that are not of the certified safe type, shall be arranged for programmed disconnection of power supply in case the overpressure in the non-hazardous space cannot be restored.

Guidance note:

Requirements applicable for air lock arrangement are given in IEC 60092-502 [4].

Equipment suitable for operating in a zone 1, is not required to be disconnected. Certified flameproof lighting, may have a separate disconnection circuit, satisfying [2.3.2].

In order for the purging and pressurization system to be operable when the protected space is de-energized, the system components need to be certified for hazardous zone 1 operation.

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2.2.2 Machinery necessary for maintaining main functions, as well as safety systems such as the emergency generator and emergency fire pumps, shall not be located in spaces where automatic disconnection of electrical equipment is required. This also includes machinery necessary for maintaining dynamic positioning.

Guidance note:

Equipment suitable for operating in a zone 1, is not required to be disconnected. Certified flameproof lighting, may have a separate disconnection circuit, satisfying [2.3.2].

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2.3 Cargo handling spaces

2.3.1 A permanent mechanical ventilation system of the extraction type shall be installed, capable of circulating sufficient air to give at least 20 air changes per hour.

In the cargo pump room, exhaust trunking shall be arranged as follows:

— in the cargo pump room bilges just above the transverse floor plates or bottom longitudinals, so that air can flow over the top from adjacent spaces
— an emergency intake located 2 m above the pump room lower grating. This emergency intake would be used when the lower intakes are sealed off due to flooding in the bilges. The emergency intake shall have a damper fitted, which can be remotely opened from the exposed main deck in addition to local opening and closing arrangement at the lower grating.

2.3.2 The electrical lighting in the cargo pump room shall be fitted with an interlock so arranged that the ventilation shall be in operation before the electrical supply to the lighting in the room gets connected. Emergency lighting shall not be interlocked. Failure of the ventilation system shall not cause the lighting to go out.

2.3.3 The exhaust outlets, which shall discharge upwards, shall be situated at least 3 m above tank deck.

2.4 Other hazardous spaces normally entered

2.4.1 Pipe tunnel, ballast pump room (when not located adjacent to cargo tanks) and other similar spaces below deck, not covered by [2.3], where access may be necessary for normal operation and maintenance, shall be equipped with a fixed separate ventilation system, with a capacity of at least 8 air changes per hour. This is also applicable for ballast pump rooms on open deck in the cargo area. Ballast pump rooms adjacent to cargo tanks and located below deck shall be equipped with a fixed separate ventilation system, with capacity of at least 20 air changes per hour.

2.4.2 Other spaces situated on or above cargo deck level (e.g. cargo handling gear lockers and cargo sample lockers) may be accepted with natural ventilation only.

2.5 Spaces not normally entered

2.5.1 Spaces not normally entered, as defined in Sec.1 [3.1], shall be arranged for gasfreeing. Where necessary, owing to the arrangement of the spaces, necessary ducting shall be permanently installed in order to ensure safe and efficient gasfreeing.

2.5.2 A mechanical ventilation system (permanent or portable) shall be provided, capable of circulating sufficient air to the compartments concerned. Where a permanent ventilation system is not provided, approved means of portable mechanical ventilation shall be provided. The capacity of the ventilation system shall give at least 8 air changes/hour for the spaces mentioned in Sec.1 Table 3, except ballast tanks. Fans or blowers shall be clear of personnel access openings, and shall comply with [1.2.5].

2.5.3 Double hull and double bottom spaces shall be fitted with suitable connections for the supply of air for gas freeing.

2.6 Ventilation systems for barges

2.6.1 Engine room and cargo pump room situated below deck shall have separate mechanical ventilation systems of overpressure type and underpressure type, respectively.

2.6.2 Engine room, cargo pump room and service spaces situated on deck may have natural ventilation systems.

2.6.3 Accommodation spaces shall be provided with mechanical ventilation of the overpressure type.

SECTION 7 FIRE PROTECTION AND EXTINCTION

1 Fire safety measures for tankers

1.1 Application

1.1.1 It is the responsibility of the government of the flag state to ensure that ships are provided with the fire safety measures required by the International Convention for the Safety of Life at Sea, 1974, as amended (hereafter referred as SOLAS).

1.1.2 Where the government of the flag state is authorizing the Society to issue the SOLAS Cargo Ship Safety Construction and Cargo Ship Safety Equipment certificates on its behalf, the Society will apply the SOLAS fire protection, detection and extinction requirements as applicable for tankers and as referred to in Pt.4 Ch.11.

1.1.3 If the government of the flag state is not authorizing the Society to take care of the fire safety measures in SOLAS related to tankers, the SOLAS Cargo Ship Safety Construction and Cargo Ship Safety Equipment certificates from the flag state will be used as basis for this notation.

SECTION 8 AREA CLASSIFICATION AND ELECTRICAL INSTALLATIONS

1 General

1.1 Application

1.1.1 The requirements in this section are additional to those given in Pt.4 Ch.8 and apply to tankers intended for the carriage of oil cargoes in bulk having a flash point not exceeding 60°C (closed cup test).

1.1.2 For combination carriers, the requirement for oil tankers generally apply. However, exemptions from the requirements for tankers may be accepted for equipment which is only used in dry cargo service, after consideration in each case. Instructions will be given that such equipment shall be disconnected and earthed when the ship is used as tanker and until it has been gas-freed after such service.

1.1.3 Oil tankers exclusively built to carry cargoes with flash point above 60°C, will be specially considered in each case. See [3.3].

1.2 Insulation monitoring

Insulation fault; Device(s) to continuously monitoring the insulation earth shall be installed for both insulated and earthed distribution systems. An audible and visual alarm shall be given at a manned position in the event of an abnormally low level of insulation resistance and or high level of leakage current.

2 Electrical installations in hazardous areas

2.1 General

2.1.1 Electrical equipment and wiring shall in general not be installed in hazardous areas. Where essential for operational purposes, arrangement of electrical installations in hazardous areas shall comply with Pt.4 Ch.8 Sec.11, based on area classification as specified in [3].

In addition, installations as specified in [2.1.2] are accepted. Except as specified in [1.1.2] and [3.3], operational procedures are not acceptable as an equivalent method of ensuring compliance with these rules.

Electrical equipment installed in hazardous areas shall as a minimum comply with the requirements to gas group IIA and temperature class T3.

2.1.2 In zone 1. Impressed cathodic protection equipment, electric depth-sounding devices and log devices are accepted provided the following is complied with:

- Such equipment shall be of gas-tight construction or be housed in a gas tight enclosure.
- Cables shall be installed in steel pipes with gas-tight joints up to the upper deck.
- Corrosion resistant pipes, providing adequate mechanical protection, shall be used in compartments which may be filled with seawater (e.g. permanent ballast tanks).
- Wall thickness of the pipes shall be as for overflow and sounding pipes through ballast or fuel tanks, in accordance with Pt.4 Ch.6 Sec.8.

3 Area classification

3.1 General

3.1.1 Area classification is a method of analyzing and classifying the areas where explosive gas atmospheres may occur. The object of the classification shall allow the selection of electrical apparatus able to be operated safely in these areas.

3.1.2 In order to facilitate the selection of appropriate electrical apparatus an the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2 according to the principles of the standards IEC 60079-10 and IEC 60092-502.

Classification of areas and spaces typical for tankers, is given in [3.2] and [3.3], based on IEC 60092-502.

3.1.3 Areas and spaces other than those classified in [3.2] and [3.3], shall be subject to special consideration. The principles of the IEC standards shall be applied.

3.1.4 A space with opening to an adjacent hazardous area on open deck, may be made into a less hazardous or non-hazardous space, by means of overpressure. Requirements to such pressurisation are given in Sec.6 [2].

3.1.5 Ventilation ducts shall have the same area classification as the ventilated space.

3.1.6 With the exception of spaces arranged in accordance with Sec.6 [2.2.1], any space having an opening into a hazardous area or space, having a more severe hazardous zone classification, will be considered to have the same hazardous zone classification as the zone it has an opening into.

Guidance note:

Openings are considered to be any access door, ventilation inlets or outlets or other boundary openings. Bolted plates that are normally closed and only opened when area has been confirmed gas free may be accepted.

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3.2 Tankers for carriage of products with flashpoint not exceeding 60°C

3.2.1 Hazardous areas zone 0

The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo or developing flammable gases or vapours.

3.2.2 Hazardous area zone 1

1) Void spaces and cofferdams adjacent to, above and below integral cargo tanks.
2) Hold spaces containing independent cargo tanks.
3) Ballast tanks and any other tanks adjacent to cargo tanks (e.g. fore peak tanks).
4) Cargo handling spaces (including cargo pump rooms).
5) Enclosed or semi-enclosed spaces, immediately above cargo tanks (for example, between decks) or having bulkheads above and in line with cargo tanks bulkheads, unless protected by a diagonal plate acceptable to the appropriate authority.
6) Spaces, other than cofferdam, adjacent to and below the top of a cargo tanks (for example, trunks, passageways, ballast pumprooms, ballast treatment spaces and hold spaces).
7) Areas on open deck, or semi- enclosed spaces on deck, within 3 m of any cargo tanks outlet, gas or vapour outlet (see note), cargo manifold valve, cargo valve, cargo pipe flange, cargo pump-room

ventilation outlets and cargo tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation.

Guidance note:

Such areas are, for example, all areas within 3 m of cargo tank hatches, sight ports, tank cleaning openings, ullage openings, sounding pipes, cargo vapour outlets.

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8) Areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of any cargo gas outlet designed for the passage of large volumes of gas or vapour mixture during cargo loading and ballasting or during discharging, within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet.
9) Areas on open deck, or semi-enclosed spaces on deck, within 1.5 m of cargo pump room entrances, cargo pump room ventilation inlets, openings into cofferdams or other zone 1 spaces.
10) Areas on the open deck within spillage coamings surrounding cargo manifold valves and 3 m beyond these, up to a height of 2.4 m above the deck.
11) Areas on open deck over all cargo tanks (including ballast tanks within the cargo tank area) where structures are restricting the natural ventilation and to the full breadth of the ship plus 3 m fore and aft of the forward-most and the aft-most cargo tank bulkhead, up to a height of 2.4 m above the deck.
12) Compartments for contaminated cargo hoses and cargo equipment.
13) Enclosed or semi-enclosed spaces in which pipes containing liquid cargoes or cargo vapour are located.

3.2.3 Hazardous areas zone 2

1) Areas within 1.5 m surrounding open or semi-enclosed spaces of zone 1 as specified in [3.2.2], if not otherwise specified in this standard.
2) Spaces 4 m beyond the cylinder and 4 m beyond the sphere defined in [3.2.2] 8).
3) The spaces forming an air-lock as defined in Sec.1 [3.1] and Sec.3 [4.1.5] and [4.1.6].
4) Areas on open deck extending to the coamings fitted to keep any spills on deck and away from the accommodation and service areas and 3 m beyond these up to a height of 2.4 m above deck.
5) Areas on open deck over all cargo tanks (including all ballast tanks within the cargo tank area) where unrestricted natural ventilation is guaranteed and to the full breadth of the ship plus 3 m fore and aft of the forward-most and aft-most cargo tank bulkhead, up to a height of 2.4 m above the deck.

   For ships subject to [3.2.2] 11), the area within 1.5 metres of the area specified in [3.2.2] 11).
6) spaces forward of the open deck areas to which reference is made in [3.2.2] 11) and 5), below the level of the main deck, and having an opening on to the main deck or at a level less than 0.5 m above the main deck, unless:
   a) the entrances to such spaces do not face the cargo tank area and, together with all other openings to the spaces, including ventilating system inlets and exhausts, are situated at least 10 m horizontally from any cargo tank outlet or gas or vapour outlet, and
   b) the spaces are mechanically ventilated.
7) Fore peak ballast tanks, if connected to a piping system serving ballast tanks within the cargo area. See Sec.4 [2.3].
8) Ballast pumprooms or ballast treatment spaces which are not located adjacent to cargo tanks, but which could contain contaminated ballast water from ballast tanks located adjacent to cargo tanks.

Spaces containing ballast pumps or treatment systems only used for filling of ballast tanks and are provided with means for prevention of backflow are not considered hazardous. See, however, Pt.6 Ch.7 Sec.1 regarding ballast treatment systems generating explosive gases.

3.3 Tankers for carriage of products with flashpoint exceeding 60°C

3.3.1 Unheated cargoes and cargoes heated to a temperature below and not within 15°C of their flashpoint.

Hazardous areas zone 2.

The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo.

3.3.2 Cargoes heated above their flashpoint and cargoes heated to a temperature within 15°C of their flashpoint.

The requirements of [3.2] are applicable.

Guidance note:

It is acceptable that an operational limitation is inserted in the appendix to class certificate specifying that the ship is approved on the condition that cargo is not heated to within 15°C of its flashpoint.

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4 Inspection and testing

4.1 General

4.1.1 Before the electrical installations in hazardous areas are put into service or considered ready for use, they shall be inspected and tested. All equipment, cables, etc. shall be verified to have been installed in accordance with installations procedures and guidelines issued by the manufacturer of the equipment, cables, etc., and that the installations have been carried out in accordance to Pt.4 Ch.8 Sec.11.

4.1.2 For spaces protected by pressurisation it shall be examined and tested that the purging can be effected. Purge time at minimum flow rate shall be documented. Required shutdowns and or alarms upon ventilation overpressure falling below prescribed values shall be tested.

For other spaces where area classification depends on mechanical ventilation it shall be tested that ventilation flow rate is sufficient, and that and required ventilation failure alarm operates correctly.

4.1.3 For equipment for which safety in hazardous areas depends upon correct operation of protective devices (for example overload protection relays) and or operation of an alarm (for example loss of pressurisation for an Ex(p) control panel) it shall be verified that the devices have correct settings and/or correct operation of alarms.

4.1.4 Where interlocking and shutdown arrangements are required (such as for submerged cargo pumps), they shall be tested.

4.1.5 Intrinsically safe circuits shall be verified to ensure that the equipment and wiring are correctly installed.

4.1.6 Verification of the physical installation shall be documented by yard. The documentation shall be available for the Society's surveyor at the site.

5 Maintenance

5.1 General

5.1.1 The maintenance manual referred to in Sec.1 Table 5, shall be in accordance with the recommendations in IEC 60079-17 and 60092-502 and shall contain necessary information on:

- Overview of classification of hazardous areas, with information about gas groups and temperature class.
- Records sufficient to enable the certified safe equipment to be maintained in accordance with its type of protection (list and location of equipment, technical information, manufacturer's instructions, spares etc.).
- Inspection routines with information about detailing level and time intervals between the inspections, acceptance/rejection criteria.
- Register of inspections, with information about date of inspections and name(s) of person(s) who carried out the inspection and maintenance work.

5.1.2 Inspection and maintenance of installations shall be carried out only by experienced personnel whose training has included instruction on the various types of protection of apparatus and installation practices that shall be found on the vessel. Appropriate refresher training shall be given to such personnel on a regular basis.

6 Signboards

6.1 General

6.1.1 Where electric lighting is provided for spaces in hazardous areas, a signboard at least 300 mm shall be fitted at each entrance to such spaces with text:

BEFORE A LIGHTING FITTING IS OPENED ITS SUPPLY CIRCUIT SHALL BE DISCONNECTED

Alternatively a signboard with the same text can be fitted at each individual lighting fitting.

6.1.2 Where electric lighting is provided in spaces where the ventilation shall be in operation before the electric power is connected, a signboard at least 200 × 300 mm shall be fitted at each entrance, and with a smaller signboard at the switch for each lighting circuit, with text:

BEFORE THE LIGHTING IS TURNED ON, THE VENTILATION SHALL BE IN OPERATION

6.1.3 Where socket-outlets are installed in cargo area or adjacent area, a signboard shall be fitted at each socket-outlet with text:

PORTABLE ELECTRICAL EQUIPMENT SUPPLIED BY FLEXIBLE CABLES SHALL NOT BE USED IN AREAS WHERE THERE IS GAS DANGER

Alternatively signboards of size approximately 600 mm × 400 mm, with letters of height approximately 30 mm, can be fitted at each end of the tank deck.

6.1.4 Where socket-outlets for welding apparatus are installed in areas adjacent cargo area, the socket outlet shall be provided with a signboard with text:

WELDING APPARATUS SHALL NOT BE USED UNLESS THE WORKING SPACE AND ADJACENT SPACES ARE GAS-FREE.

SECTION 9 INSTRUMENTATION AND AUTOMATION

1 General requirements

For instrumentation and automation, including computer based control and monitoring, the requirements in this chapter are additional to those given in Pt.4 Ch.9.

The control and monitoring systems shall be certified according to Sec.1 Table 7.

2 Cargo valves and pumps- control and monitoring

2.1 General

2.1.1 If valves and pumps for loading and unloading the ship are remotely controlled, all controls, indicators and alarms associated with a given cargo tank shall be centralised in one control station. Pump discharge pressure and vacuum meter shall be fitted in the control station.

2.1.2 Cargo pumps, ballast pumps and stripping pumps, installed in cargo pump rooms and driven by shafts passing through pump room bulkheads shall be fitted with temperature sensing devices for bulkhead shaft glands, bearings and pump casings. An alarm shall be initiated in the cargo control room or the pump control station.

2.1.3 Cargo pump rooms and hold spaces containing independent cargo tanks, shall be provided with bilge high level alarms. The alarm signals (visual and audible) shall be provided in the cargo control room or station.

2.1.4 Locally operated valves shall be provided with local position indication.

2.1.5 Remote-controlled cargo valves shall be provided with an indication system, which at the manoeuvring stand indicates to the operator whether the valves are in open or closed position. A flow indicator in the hydraulic system for manoeuvring valves may be accepted. The flow indicator shall show whether the valves are in open or closed position.

Guidance note:

Remote manual operation of valves e.g. inside tanks may be accepted from separate deck stands, provided satisfactory position indication is arranged locally and at the control station mentioned in this paragraph.

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2.1.6 Remote-controlled tank valves shall be arranged with means for manual (emergency) operation.

A handpump which can be connected to the control system as near the valve as possible, will normally be accepted.

2.2 Computer based systems for cargo handling

Local control of cargo handling systems independent of computer controlled systems will be required.

2.3 Centralised cargo control

Ships having their cargo and ballast systems built and equipped, surveyed and tested in accordance with the requirements in Pt.6 Ch.4 Sec.2, may be given the additional class notation **CCO**.

2.4 Design of integrated cargo and ballast systems

2.4.1 The operation of cargo and/or ballast systems may be necessary, under certain emergency circumstances or during the course of navigation, to enhance the safety of tankers. As such, measures shall be taken to prevent cargo and ballast pumps becoming inoperative simultaneously due to a single failure in the integrated cargo and ballast system, including its control and safety systems.

2.4.2 Integrated cargo and ballast systems meaning any integrated hydraulic and/or electric system used to drive both cargo and ballast pumps (including active control and safety systems and excluding passive components, e.g. piping), shall be designed and constructed as follows:

1) The emergency stop circuits of the cargo and ballast systems shall be independent from the circuits for the control systems. A single failure in the control system circuits or the emergency stop circuits are not to render the integrated cargo and ballast system inoperative.
2) Manual emergency stops of the cargo pumps shall be arranged in a way that they are not to cause the stop of the power pack making ballast pumps inoperable.
3) The control systems shall be provided with backup power supply, which may be satisfied by a duplicate power supply from the main switch board. The failure of any power supply shall provide audible and visible alarm activation at each location where the control panel is fitted.
4) In the event of failure of the automatic or remote control systems, a secondary means of control shall be made available for the operation of the integrated cargo and ballast system. This shall be achieved by manual overriding and/or redundant arrangements within the control systems.

3 Cargo tank level monitoring

3.1 General

3.1.1 Types of level measuring devices:

Open type:

A method which makes use of an opening in the tank and directly exposes the operator to the cargo or its vapours. Examples of this type are ullage openings and gauge hatches.

Restricted type:

A device which penetrates the tank and which, when in use, permits a limited quantity of cargo vapour or liquid to be expelled to the atmosphere. When not in use, the device is completely closed. Examples of this type are rotary tube, fixed tube, slip tube and sounding pipe.

Closed type:

A device which penetrates the tank, but which is part of a closed system which keeps the cargo completely sealed off from the atmosphere. Examples of this type are sight glasses, pressure cells, float-tape systems, electronic or magnetic probe.

3.1.2 Each cargo tank shall be fitted with at least one level gauging device. Where only one liquid level measuring device is fitted it shall be arranged so that any necessary maintenance can be carried out while the cargo tank is in service.

3.1.3 If a closed measuring device is not mounted directly on the tank, it shall be provided with shut-off valves situated as close as possible to the tank.

3.1.4 Level measuring in ships with inerted tanks, see Sec.11 [3.5] For crude oil and petroleum products having a flashpoint not exceeding 60°C, closed type only is acceptable. For other cargo oils, open type or restricted type are acceptable.

4 Cargo tank overflow protection

Provision shall be made to guard against liquid rising in the venting system to a height which will exceed the design head of cargo tanks. This shall be accomplished by high level alarms or overflow control systems or other equivalent means, together with gauging devices and cargo tank filling procedures.

High level alarms shall be independent of the closed level measuring system.

Combined level measuring system and high level alarm systems may be accepted as equivalent to independent systems provided extensive self-monitoring is incorporated in the system covering all credible faults.

Chemical carriers subject to the requirements of Ch.6 and provided with both high-level and overflow alarms, these are required to be independent of the closed level measuring system and of each other.

5 Oil and water interface detector

The ship shall be provided with instruments for measuring the interface level between oil and water. The instrument(s) may be fixed or portable.

Note:

Oil and water interface detectors should be approved by an administration.

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6 Gas detection in cargo pump room

A system for continuous monitoring of the concentration of hydrocarbon gases shall be fitted. Sampling points or detector heads shall be located in suitable positions in order that potentially dangerous leakage is readily detected. When the hydrocarbon gas concentration reaches a pre-set level, which shall not be higher than 10% of the lower flammable limit, a continuous audible and visual alarm signal shall be automatically initiated in the pump-room, engine control room, cargo control room and navigation bridge, to alert personnel to the potential hazard.

Sequential sampling is acceptable as long as it is dedicated for the pump room only, including exhaust ducts, and the sampling time is reasonably short.

The gas detection equipment shall be designed to sample and analyse from each sampling line of each protected space, sequentially at intervals not exceeding 30 min as per FSS-code Ch.16.

Guidance note:

Suitable positions should be as per IMO Res.MSC.1/Circ.1321. I.e. the exhaust ventilation duct and lower parts of the pump room above and below the floor plates.

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7 Gas detection outside cargo pumprooms

7.1 Portable gas detection

The ship shall be provided with approved portable gas detectors.

Ships with inert gas systems shall be provided with two instruments for measuring O_2-content, two instruments for measuring hydrocarbon-content in the range of 0 to 20% hydrocarbon gas by volume and two instruments for measuring low hydrocarbon gas-content 0 to 100% LEL.

Ships without inert gas system shall be provided with two instruments for measuring O_2-content and two instruments for measuring low hydrocarbon gas-content 0 to 100% LEL.

Where the atmosphere in double hull spaces cannot be reliably measured using flexible gas sampling hoses, such spaces shall be fitted with permanent gas sampling lines. Alternatively a fixed gas detection system

shall be fitted in these spaces. Alarms (visual and audible) shall be provided on the bridge and in the cargo control room.

Ships for alternate carriage of oil and dry cargo, see Sec.10 [3.1.4].

Guidance note:

Gas detectors should be approved by an administration.

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7.2 Fixed gas detection

7.2.1 Oil tankers of 20 000 dwt and above, shall be provided with a fixed hydrocarbon gas detection system for measuring hydrocarbon gas concentrations in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo or slop tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks. The system shall comply with Reg.16 of the FSS code and MSC.1/Circ.1370 as well as the requirements in this section.

7.2.2 As the cargo pumproom gas detection system is required to be continuous, sequential type gas detection system serving a cargo pumproom shall be separated from that serving spaces adjacent to cargo tanks.

7.2.3 Any tank or compartment, except fuel tanks, located below the bulkhead deck and adjacent to a cargo or slop tank shall be provided with fixed gas detection. This includes e.g. cofferdams/voids, ballast pumprooms, freshwater tanks etc.

(IACS UI SC268)

7.2.4 The term *adjacent to the cargo tanks*, also includes tanks and compartments located below the bullhead deck with a cruciform contact with the cargo or slop tanks, unless the structural configuration eliminates the possibility of leaks.

(IACS UI SC268)

7.2.5 For cofferdams/void spaces and other dry compartments such as ballast pump rooms, one bottom sampling detector is acceptable.

(IACS Rec. 123)

7.2.6 For ballast tanks and freshwater tanks top and bottom sampling points are always required unless the prohibition of partial filling is clearly stated in the trim and stability booklet/loading manual.

(IACS Rec. 123)

7.2.7 The gas detection system shall be arranged with single sampling lines from each sampling point to the gas detection cabinet. Sampling lines from each sampling point in the same space may however be combined at deck level via a manually operated three-way valve arrangement or similar. The valve shall be provided with local indication of which sampling point is active (top or bottom). A signboard should be provided in CCR to specify procedure for manual operation of valves depending on operational mode as follows:

— In loaded condition: valve shall be set so that lower sampling point is active.
— In ballast/partial ballast condition: valve shall be set so that upper sampling point is active.

(IACS Rec. 123)

7.2.8 Gas sampling pipes may penetrate a watertight subdivision provided the total cross sectional area of such pipes do not exceed 710 mm^2 between any two watertight compartments (i.e. a maximum single pipe diameter of 30 mm). The gas sampling pipes may however not be led through a cargo tank boundary. The penetrations shall be located as far as practical away from the ships shell.

(IACS Rec. 123)

8 Installation requirements for analysing units

Gas analysing units with non-explosion proof measuring equipment may be located in areas outside cargo areas, for example in the cargo control room, navigation bridge or engine room when mounted on the forward bulkhead provided the following requirements are observed:

a) Sampling lines shall not run through gas non-hazardous spaces, except where permitted under e).
b) The gas sampling pipes shall be equipped with flame arresters. Sample gas shall be led to the atmosphere with outlets arranged in a safe location.
c) Bulkhead penetrations of sample pipes between non-hazardous and hazardous areas shall be of an approved type and have the same fire integrity as the division penetrated. A manual isolating valve shall be fitted in each of the sampling lines at the bulkhead on the gas safe side.
d) The gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc. shall be located in a reasonably gas tight (e.g. fully enclosed steel cabinet with a door with gaskets) which shall be monitored by its own sampling point. At gas concentration above 30% LFL inside the steel cabinet the entire gas analysing unit shall be automatically shut down.
e) Where the cabinet cannot be arranged directly on the bulkhead, sample pipes shall be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and analysing units, and shall be routed on their shortest ways.

SECTION 10 SHIPS FOR ALTERNATE CARRIAGE OF OIL CARGO AND DRY CARGO

1 General

The requirements in this section apply to ships intended to carry liquid oil cargoes in bulk with a flashpoint not exceeding 60°C or dry cargo, alternately.

The requirements are supplementary to those for the class notation **Tanker for oil** or **Tanker for oil products**.

1.1 Class notation

Ships satisfying the requirements in this section may be assigned one of the following class notations:

Bulk carrier or tanker for oil (alternatively **Tanker for oil products**)

Ore carrier or tanker for oil (alternatively **Tanker for oil products**)

1.2 Basic assumptions

The rules in this section are based on the assumption that:

— Dry cargo and liquid cargo with a flashpoint not exceeding 60°C are not carried simultaneously, except for cargo oil-contaminated water (slop) in the protected slop tank(s).
— Before the ship enters dry cargo service, all cargo piping, tanks and compartments in the cargo area shall be cleaned and ventilated to the extent that the content of hydrocarbon gases is brought well below the lower explosion limit. Further, the cleaning shall ensure that the concentration of hydrocarbon gases remains below the lower explosion limit during the forthcoming dry cargo voyage.
— Measurements of hydrocarbon gas content are carried out regularly during dry cargo service.

Guidance note:

Measurement of hydrocarbon gas content once every day is considered appropriate during the first two weeks. Later on this may be reduced, depending on the results of the previous measurements. When sailing into higher air or sea-water temperatures, measurements should be taken daily.

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2 Cargo area arrangement and systems

The ship shall comply with the requirements of Sec.12 for protected slop tank.

2.1 Design of cargo oil tanks

2.1.1 Cargo tanks shall be designed to facilitate efficient cleaning.

The bottom, side and end boundaries of the tanks may be of the following alternative designs:

— plane surfaces
— corrugated surfaces
— vertical stiffeners, but no internal primary structural members in the tanks.

2.1.2 In tanks where primary structural members are unavoidable, particular attention shall be paid to the arrangement and outfitting of cleaning facilities. The efficiency of such equipment shall be verified by a test after the discharge of the ship's first oil cargo. The established cleanliness and gas-free condition shall be verified by a measuring program approved by the Society.

2.2 Arrangement and access to compartments

2.2.1 Compartments in the cargo area such as pipe tunnels, stool tanks, cofferdams, etc. shall be arranged so as to avoid the spreading of hydrocarbons. For instance, stool tanks and cofferdams shall not have permanent openings to pipe tunnels.

2.2.2 The double bottom shall be arranged for segregated ballast with tanks of length not exceeding 0.2 *L*.

2.2.3 Pipe tunnels and other compartments of comparable extent in the cargo area shall be provided with access openings at forward and aft end.

The access entrances shall be arranged from open deck or a cargo pump room, and shall be suitable for use for cleaning and gas-freeing operations.

2.2.4 Stool tanks and spaces containing cargo pumps and pipes shall be provided with access from open deck. The access openings shall be suitable for use for cleaning and gas-freeing operations.

Access to such spaces from pipe tunnel may be accepted if the following items are complied with:

— bolted manhole cover or equivalent gastight closing with oil-resistant packings and signboards with instruction to normally keep it closed. The cover shall be lifted 300 mm above bottom of stool tank to prevent back-flow of oil when opened.
— ventilation pipes of sufficient size on port and starboard side for cross ventilation and gas-freeing by portable fans.

2.2.5 Access entrances and passages shall have a clear opening in accordance with Sec.3 [4.2].

2.2.6 Openings which may be used for cargo operations are not permitted in bulkheads and decks separating oil cargo spaces from other spaces not designed and equipped for the carriage of oil cargoes unless alternative approved means are provided to ensure equivalent integrity.

2.3 Bilge, drainage and cargo piping

2.3.1 As far as compatible with the general arrangement of the ship, the cargo oil piping shall be located on open deck or within the cargo tanks.

2.3.2 If piping locations stated in [2.3.1] are not appropriate, the cargo oil piping may be located within special pipe tunnels of limited size.

2.3.3 The cargo oil piping system shall be designed and equipped so as to minimise the risk of oil leakage due to corrosion or to failures in the pipe connection fittings. Steel pipes inside water ballast tanks shall have a wall thickness not less than 12.5 mm.

2.3.4 A separate bilge system shall be provided for the compartments intended for carrying dry cargo. A separate cargo oil stripping system may be used for bilge pumping, provided the system has no connection to, or is easily isolated from, tanks not intended for dry cargo.

2.3.5 Bilge suctions in cargo holds, see Pt.4 Ch.6 Sec.4 [4].

2.3.6 The bilge suctions of separate bilge system in cargo holds shall be arranged for blank flanging when the ship is carrying oil.

2.3.7 The cargo oil suctions in the holds intended for dry cargo shall be arranged for blank flanging when the ship is carrying dry cargo.

2.3.8 Arrangements required by [2.3.6] and [2.3.7] are not necessary if the ship is fitted with separate cargo pumps in each cargo hold.

2.3.9 Arrangements shall be made to avoid damage to oil wells and blank-flanging arrangements due to dry cargo, grab discharging, etc.

2.3.10 Top wing tanks may be arranged with gravity overboard discharge, see Pt.3 Ch.12.

2.3.11 Dry compartments adjacent to cargo tanks shall be provided with bilge or drainage arrangement. Pipe tunnels shall be provided with bilge suctions at forward and aft ends. Bulkhead stool tanks shall be provided with bilge suctions.

2.4 Cleaning and gas-freeing

2.4.1 The cargo tanks shall be equipped with fixed or portable means for cleaning and gas-freeing.

2.4.2 The water cleaning system for cargo tanks with internal primary structural members shall comprise possibility for heating the cleaning water.

2.4.3 Compartments in the cargo area adjacent to the cargo tanks shall be arranged for cleaning and gas-freeing by equipment available onboard.

2.4.4 The cargo oil piping shall be arranged for easy cleaning, and an arrangement for gas-freeing shall be provided.

2.4.5 A branch line from the fire main shall be arranged in pipe tunnels housing cargo oil piping. A suitable number of hydrant valves shall be located along the length of the tunnel. The branch line shall be arranged for blank flanging outside the tunnel.

2.5 Ventilation

2.5.1 Pipe tunnel, ballast pump room and similar spaces within the cargo area, where access may be necessary for normal operation and maintenance, shall be equipped with a fixed separate ventilation system.

2.5.2 The capacity of the ventilation systems shall be at least 8 air changes per hour for ballast pump room and spaces normally entered. If cargo piping and equipment is arranged in ballast pump room, or the ballast pumproom is located adjacent to cargo tanks, the ventilation capacity shall be at least 20 air changes per hour.

2.5.3 Spaces not normally entered like cofferdams, double bottoms, pipe tunnels, stools and ballast tanks shall be gasfreeable with a mechanical ventilation system (permanent or portable). The ventilation capacity is normally shall be at least 8 air changes per hour for the spaces mentioned except ballast tanks.

2.5.4 Pump room arranged adjacent to protected slop tank shall be fitted with interlock between electric lighting and ventilation, so arranged that the ventilation shall be in operation before the electrical current supply to the room gets connected.

3 Gas measuring equipment

3.1 Measurement of hydrocarbon gases

3.1.1 Arrangements shall be made to facilitate measurement of gas concentration in all tanks and other compartments within the cargo area.

Measurements shall be made possible from open deck or other easily accessible locations.

3.1.2 The measuring equipment shall be of approved type, and may be fixed or portable except as stated in [3.1.3]. Note however that the requirements in Sec.9 [7.2] apply.

3.1.3 Pipe tunnel and cargo pump room shall be equipped with a fixed hydrocarbon gas detection system with alarm. The system shall cover at least three (3) locations along the length of the tunnel, however, spaced not more than 30 m apart.

3.1.4 Apart from the gas detection arrangements required by [3.1.1] to [3.1.3] the ship shall have two sets of portable gas measuring equipment, each set consisting of one apparatus for measuring O_2 content, one apparatus for measuring hydrocarbon contents in the range 0 to 20% hydrocarbon gas by volume and one apparatus for measuring low hydrocarbon gas contents (0 to 100% LEL).

4 Instructions

4.1 Operations manual

An operations manual shall be developed covering all essential operational procedures. As a minimum the following shall be included:

— Procedures for conversion from tanker trade to dry cargo trade, and vice versa.
— Procedures for cleaning and gas-freeing of cargo tanks, cargo piping and adjacent spaces.
— Procedures related to tanker cargo handling operations in port and during voyage.
— Description and listing of cleaning equipment and its intended use.
— Procedures for gas monitoring.
— Actions to be taken when the gas concentration exceeds the defined acceptable limits.

Guidance note:

The actions to be taken when gas concentrations are exceeded may be repeated ventilation, cleaning and ventilation, inerting, water filling, depending on type of compartment, nature of problem and available equipment.

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4.2 Instructions onboard

Instructions for dry cargo and tanker service shall be permanently posted in cargo control rooms and deck office.

SECTION 11 INERT GAS SYSTEMS

1 General

1.1 Application

1.1.1 The requirements in this section apply to inert gas systems for inerting of tanks and void spaces within the cargo area.

1.1.2 Oil carriers (**Tanker for oil** or **Tanker for oil products**) of 8000 tons deadweight and above intended for the carriage of oil cargoes having a flash point not exceeding 60°C (closed cup test) and all ships with crude oil washing arrangement regardless of size shall be fitted with a permanently installed inert gas system complying with the rules in this section.

Oil carriers (**Tanker for oil** or **Tanker for oil products**) less than 8000 tons deadweight fitted with inert gas system complying with the requirements in this section may be assigned the special features notation **Inert**.

Guidance note:

The requirements in this section are considered to meet the FSS Code Ch.15 and SOLAS Reg. II-2/ 4.5.5 and II-2/ 11.6.3.4. and as amended by IMO Res. MSC.367 (93).

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1.1.3 Oil tankers of 8000 tons deadweight and above constructed on or after 1 January 2016 shall be fitted with a fixed inert gas system, complying with the requirements in this section.

Guidance note:

Oxygen alarm setting will from the date 01.01.2016 be reduced from 8% to 5%.

Reference is also made to IMO Res. MSC.365 (93).

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1.1.4 Documentation and certification requirements is found in Sec.1 [4].

1.2 Operation and equipment manual

A ship specific operation and equipment instruction manual covering a technical description of the system and equipment, as well as operational safety and health requirements shall be submitted in accordance with Sec.1 Table 5. The manual shall include guidelines on procedures that shall be followed in event of failure of the inert gas system.

Guidance note:

See also Ch. 8 and Ch.11 of MSC/Circ.353, as amended by MSC/Circ.387.

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2 Materials

2.1 General

2.1.1 Materials used in piping systems for inert gas plants shall comply with the requirements specified in Pt.4 Ch.6.

2.1.2 Materials used for other parts of the inert gas plant shall comply with the requirements in applicable chapters of the rules. Works' certificates will be accepted.

2.1.3 Materials shall be selected so as to reduce the probability for corrosion and erosion. Those components which may be subjected to corrosion shall be either constructed of corrosion-resistant material or lined with rubber, glass fibre epoxy resin or other equivalent coating material.

3 Arrangement and general design

3.1 General

3.1.1 The inert gas system shall be capable of supplying a gas or mixture of gases with an oxygen content of not more than 5% at a capacity to satisfy the intended use under all normal operating conditions.

The system shall be able to maintain an atmosphere with an oxygen content not exceeding 8% by volume in any part of any cargo tank and at a positive pressure in port and at sea except when it is necessary for such a tank to be gas-free.

Inert gas plants based on flue gas from boilers which normally are not in operation during sea voyages (motor ships), and which are not equipped with separate inert gas generator for topping-up purposes, shall be arranged to enable production of flue gas of adequate quantity and quality (artificial load) whenever topping-up shall be carried out.

3.1.2 The inert gas system shall be designed and equipped in such a way as to prevent hydrocarbon gases from reaching non-hazardous spaces, and prevent interconnection between tanks and spaces within the cargo area, which normally do not have such connections, e.g. between segregated ballast tanks and cargo tanks.

3.1.3 The inert gas may be based on flue gas from boilers or from separate inert gas generators with automatic combustion control.

3.1.4 Systems using stored carbon dioxide will not be accepted unless the Society is satisfied that the risk of ignition from generation of static electricity by the system itself is minimised.

3.1.5 Inert gas systems based on other means than combustion of hydrocarbons such as inert gas produced by passing compressed air through hollow fibres, semi-permeable membranes or adsorber materials shall also comply with the requirements of Ch.6 Sec.16.

3.1.6 Inert gas generators based on combustion of fuel, shall be located outside the cargo area. Spaces containing inert gas generators shall have no direct access to accommodation service or control station spaces, but may be located in machinery spaces. When located in a separate compartment, it shall be separated by a gastight steel bulkhead and/or deck from accommodation, service and control station spaces.

Where a separate compartment is provided, it shall be fitted with an independent mechanical extraction ventilation system, providing six (6) air changes per hour. Two oxygen sensors (low oxygen alarms) shall be fitted at appropriate locations and give audible and visual alarm both inside the compartment and outside the door. The compartment shall have no direct access to accommodation spaces, service spaces and control station.

3.2 Piping arrangement

3.2.1 The piping arrangement shall allow the cargo tanks to be filled with inert gas during unloading, without having open connection to the atmosphere.

3.2.2 The piping arrangement shall allow cargo tank washing to be carried out in an inert atmosphere.

3.2.3 The supply pipes for inert gas shall be so arranged that the velocity and direction of the jet will facilitate effective change of the tank atmosphere.

Guidance note:

With an arrangement utilising the dilution method and inlet at deck level, the diameter and flowrate of inlets should be such that the jet will penetrate all the way down to the tank bottom.

Figure 1 may be used for determining the relationship between jet penetration depth inlet diameter and flowrate.

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The exhaust gas outlets shall comply with the requirements for cargo tank venting, see Sec.5 [2].

Connection to cargo oil pipes, see Sec.5 [1].

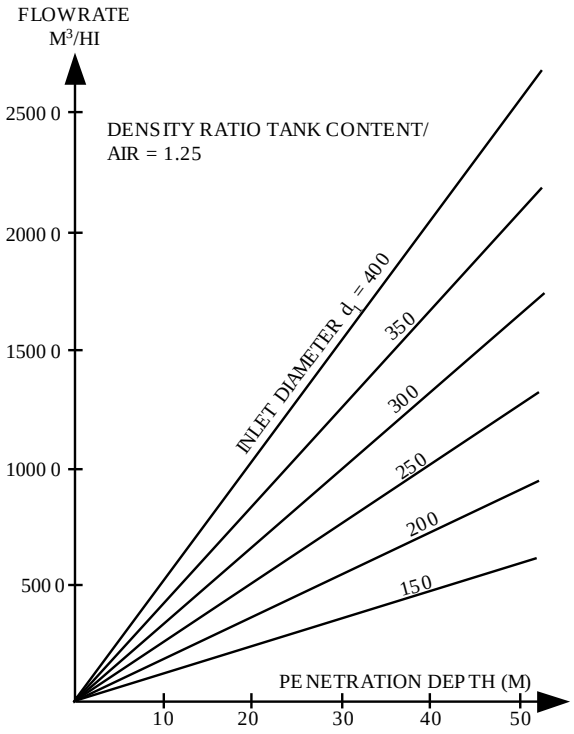

Figure 1 Relation between flowrate and penetration depth for selected inlet diameters

3.2.4 The inert gas supply main(s) shall be fitted with branch piping leading to each cargo tank. Branch piping for inert gas shall be fitted with either stop valves or equivalent means of control for isolating each tank. Any stop valves fitted shall be provided with locking arrangements. With regard to an arrangement of a common inert gas and vent pipe, see Sec.5 [2].

Each cargo tank not being inerted shall be capable of being separated from the inert gas main by one of the following alternative arrangements:

1) Removing spool-pieces, valves or other pipe sections, and blanking the pipe ends. The use of fire tested flexible hoses is considered as equivalent to a spool piece provided they are type approved in accordance with IACS P2.12, including fire testing in accordance with IACS P.2.12.5. Fire test is not required for hoses made of steel.
2) Two shutoff valves or two spectacle flanges in series, with an arrangement to vent the space between the valves in a safe manner.
3) A shutoff valve and a spectacle flange in series with an arrangement to vent the space between the valve and the spectacle flange in a safe manner.

3.2.5 To protect the tanks from a pressure exceeding design vapour pressure and a vacuum exceeding 0.07 bar, one or more pressure/vacuum breaking devices with sufficient capacity shall be provided in the system. Such device(s) shall be installed on the inert gas main unless such devices are installed in the venting system required by Sec.5, or on individual cargo tanks.

If liquid filled pressure/vacuum breaking devices are fitted, means for easy control of the liquid level shall be provided. The liquid shall be operational in the temperature range -20°C to +40°C.

3.2.6 The piping system shall be designed so as to minimize the generation of static electricity.

3.2.7 Arrangements shall be made to allow bow or stern loading and discharge pipes to be purged after use and maintained gas safe when not in use. The vent pipes connected with the purge shall be located in the cargo area.

3.2.8 The piping arrangement shall not allow the main inert gas line to be filled with cargo oil, for example by locating the main inert gas line at sufficient height above the cargo tanks or by installing liquid barriers in the branch lines.

3.2.9 Suitable arrangements shall be provided to enable the inert gas main to be connected to an external supply of inert gas. The arrangements shall be located forward of the non-return valve referred to in [3.6.3].

3.3 Inerting of double hull spaces

3.3.1 For tankers required to be fitted with inert gas system, double hull spaces shall be fitted with suitable connections for supply of inert gas. Portable means may be used. Where necessary, fixed purge pipes shall be arranged.

Double-hull spaces in the context of this requirement are all ballast tanks and void spaces of double-hull and double bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks, except cargo pump-rooms and ballast pump-rooms.

3.3.2 Where such spaces are connected to a permanently fitted inert gas system means shall be provided to prevent hydrocarbon gases from the cargo tanks entering the double hull spaces through the system, e.g. by using blank flanges.

3.4 Fresh air intakes

Fresh air intakes to the inert gas system for gas-freeing of cargo tanks shall be arranged. The air intakes shall be provided with blanking arrangement.

3.5 Level measuring of inerted tanks

Means shall be provided to allow ullaging and sounding of inerted tanks without opening the tanks.

Separate ullage openings may be fitted as a reserve means.

3.6 Prevention of gas leakage into non-hazardous spaces

3.6.1 An automatically controlled valve shall be fitted near the bulkhead where the main line leaves non-hazardous spaces. The valve shall close automatically when there is no overpressure in the main line after the fans.

3.6.2 The inert gas main line shall have a water seal located in the cargo tank area on deck. The water seal shall prevent the return of hydrocarbon vapour to any non-hazardous spaces under all normal conditions of trim, list and motion of the ship.

As far as practicable, the water seal shall prevent entrained water in the gas. Provisions shall be made to secure operation of water seal below water freezing temperature.

Means for easy control of the level in the sealed condition shall be provided.

For oil tankers arranged also for carriage of chemicals an arrangement alternative to the water seal may be considered.

Guidance note:

A double-block and bleed arrangement will be accepted for all tankers.

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3.6.3 In addition to the water seal, the inert gas main line shall have a non-return valve installed on tank deck between the water seal and the nearest connection of any cargo tank. The non-return valve shall be provided with positive means of closure. As an alternative to positive means of closure, an additional valve having such means of closure may be provided forward of the non-return valve.

3.6.4 Means shall be provided to vent the inert gas main line in a safe manner between the automatically controlled valve and the second closing device on tank deck.

3.6.5 A water loop or other approved arrangement shall also be fitted to all associated water supply and drain piping and all venting or pressure sensing piping leading to non-hazardous spaces. Means shall be provided to prevent such loops from being emptied by vacuum.

3.6.6 The deck water seal and all loop arrangements shall be capable of preventing return of hydrocarbon vapours at a pressure equal to the test pressure of the cargo tanks.

3.6.7 Provision shall be made to ensure that the water seal is protected against freezing, in such a way that the integrity of seal is not impaired by overheating.

4 Inert gas production and treatment

4.1 General

4.1.1 The inert gas scrubber, fans and inert gas generators shall be located aft of all cargo tanks, cargo pump rooms and cofferdams separating these spaces from machinery spaces.

4.1.2 The system shall be capable of delivering inert gas to the cargo tanks at a rate of at least 125% of the maximum rate of discharge capacity of the ship expressed as a volume. The fan capacity shall secure an acceptable positive pressure in the tanks and spaces at any normal operation condition.

4.1.3 At least two fans shall be provided which together will be capable of delivering to the cargo tanks at least the volume of gas required in [4.1.2]. However, no fan shall have a capacity less than one third of the combined fan capacity. In systems with gas generators a single fan may be accepted provided that sufficient spares for the fan and its prime mover are carried on board.

4.1.4 The fan pressure shall not exceed 0.3 bar. If fans with higher pressures are used, it shall be documented that the maximum pressure the inert gas system can exert on any cargo tank does not exceed its design pressure.

4.2 Flue gas system

4.2.1 The flue gas connection from the boilers shall be located before a rotary air preheater, if fitted.

4.2.2 Flue gas isolating valve(s) shall be fitted in the inert gas supply main(s) between the boiler uptake(s) and the gas scrubber. These valves shall be provided with indicators.

4.2.3 In addition to the valve nearest to the boiler uptake a sealing shall be arranged to prevent flue gas leakage when the inert gas system is not in operation.

4.2.4 A permanent arrangement for cleaning the valves nearest to the boiler uptake shall be arranged.

4.2.5 An interlocking device shall be arranged to prevent starting of sootblowing of the boiler when the valve nearest to the boiler uptake is open. For manual soot blowing, alarm and signboard is acceptable.

4.2.6 Isolating valves shall be fitted on both suction and delivery sides of each fan.

4.2.7 An adequate arrangement shall be provided for cleaning the impeller in place.

4.3 Inert gas generator

Two fuel oil pumps shall be fitted to the inert gas generator. Suitable fuel in sufficient quantity shall be provided for the inert gas generators.

Guidance note:

A complete motor, impeller and bearings for the pump will normally be considered sufficient.

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4.4 Gas cleaning and cooling

A gas scrubber shall be fitted for the purpose of effective cooling and cleaning of the gas. The scrubber shall be protected against corrosion.

Devices shall be fitted to minimise carry-over of water and solids. For flue gas system the scrubber shall be fitted on the suction side of the fans.

4.5 Water supply

4.5.1 The gas scrubber shall be supplied with cooling water from two pumps, each of sufficient capacity for supplying the system at maximum inert gas production, and without interfering with any essential service on the ship. One of the pumps shall serve the inert gas scrubber exclusively.

4.5.2 The water seal, if fitted, shall be capable of being supplied by two separate pumps, each of which shall be capable of maintaining an adequate supply at all times.

4.6 Water discharge

4.6.1 The water effluent piping from scrubber, valve(s) included, shall be protected against corrosion.

4.6.2 Distance piece between overboard valve and shell plating shall be of substantial thickness, at least shell plate thickness, but not less than 15 mm.

4.6.3 If water discharge is obtained by means of discharge pumps, a pumping arrangement equivalent to the supply shall be provided.

4.6.4 Discharge pipes from the water seal shall lead directly to sea.

5 Instrumentation

5.1 General

The instrumentation shall be in accordance with Pt.4 Ch.9.

5.2 Indication

5.2.1 Instrumentation shall be fitted for continuous indication of temperature and pressure of the inert gas at the discharge side of the gas fans, whenever the fans are operating.

5.2.2 Instrumentation shall be fitted for continuous indication and permanent recording, at all times when inert gas is being supplied, the pressure of the inert gas supply mains forward of the non-return devices on tank deck and oxygen content of the gas in the inert gas supply main on the discharge side of the fan. Such instrumentation shall, where practicable, be placed in the cargo control room, if fitted. In any case the instrumentation shall be easily accessible to the officer in charge of cargo operations.

5.2.3 In addition, meters shall be fitted on the navigation bridge to indicate the pressure of the inert gas supply main forward of the non-return devices on tank deck and in the machinery control room or machinery space to indicate the oxygen content of the inert gas in the inert gas supply main on the discharge side of the fans.

5.2.4 Portable instruments for measuring oxygen and flammable vapour concentration shall be provided, see Sec.9 [7]. In addition, suitable arrangement shall be made on each cargo tank and double hull space, such that the condition of the tank atmosphere can be determined using these portable instruments.

5.3 Monitoring

5.3.1 A common alarm connection shall be provided between the local inert gas control panel and the machinery control room or machinery space to indicate failure of the inert gas plant.

5.3.2 The extent of alarm and safety functions shall be in accordance with Table 1.

5.3.3 Monitoring of water supply to water seal and power supply for instrumentation shall also be maintained when the inert gas plant is not in use.

5.3.4

Table 1 Control and monitoring of inert gas systems

Failure/ indication	*Setting*	*Permanent recording*	*Continuous indication*	*Alarm[1)]*	*Shut-down of gas regulating valve*	*Automatic shut-down of blowers (fans)*	*Activation of double-block and bleed[2)]*	*Comment*
Operational status of the inert gas system	-	-	CCR	-	-	-	-	Indication showing that inert gas is being produced and delivered to cargo area[6)].
Operational status of isolation valves between IG main and cargo tanks[7)]	-	-	-	-	-	-	-	Position indication providing open/ intermediate/ close status information in the control panel.
Oxygen content [5)]	-	CCR	ECR and CCR	-	-	-	-	-
Pressure in IG main [4)]	-	CCR	ECR, CCR and Bridge	-	-	-	-	Shall be active also when the IG plant is not in use.
IG supply temperature	-	-	ECR and CCR	-	-	-	-	-
High oxygen content [5)]	>5%	-	-	CCR and ECR	X	-	-	The inert gas shall be automatically vented to atmosphere.
Low pressure IG main [4)]	<100 mm	-	-	CCR and ECR	-	-	-	-

Failure/ indication	*Setting*	*Permanent recording*	*Continuous indication*	*Alarm[1)]*	*Shut-down of gas regulating valve*	*Automatic shut-down of blowers (fans)*	*Activation of double-block and bleed[2)]*	*Comment*
Low-low pressure IG main	<50 mm	-	-	CCR or automatic shut-down of cargo pumps with alarm	-	-	-	Shall be independent of the low pressure alarm. I.e. separate pressure transmitter.
High pressure IG main [5)]	-	-	-	CCR	-	-	-	-
High water level in scrubber	-	-	-	CCR	X	X	-	Shall include automatic stop of water supply to the scrubber.
Low water pressure/flow to scrubber	-	-	-	CCR	X	X	-	-
High temperature of inert gas supply	65°C	-	-	CCR	-	-	-	-
High-high temperature of inert gas supply	75°C	-	-	-	X	X	-	-
Low level in deck water seal	-	-	-	CCR	-	-	-	Shall be active also when the IG plant is not in use.
Failure of blowers (fans)	-	-	-	CCR	X	-	-	-
Power failure of the control and monitoring system	-	-	-	CCR and ECR	-	-	-	-
Power failure to oxygen and pressure indicators and recorders	-	-	-	CCR and ECR	-	-	-	Shall be active also when the plant is not in use.

Failure/ indication	*Setting*	*Permanent recording*	*Continuous indication*	*Alarm[1)]*	*Shut-down of gas regulating valve*	*Automatic shut-down of blowers (fans)*	*Activation of double-block and bleed[2)]*	*Comment*
Oxygen level in inert gas room(s)	<19% O_2	-	-	Inside and outside space and ECR	-	-	-	Minimum 2 oxygen sensors shall be provided in each space. Visual and audible alarm both inside and at the entrance to the inert gas room(s).
Power failure of inert gas generator	-	-	-	CCR and ECR	-	-	-	Inert gas generators only.
Failure of burner (flame failure)	-	-	-	CCR and ECR	X	-	-	Inert gas generators only.
Low fuel oil pressure/flow to burner	-	-	-	CCR and ECR	-	-	-	Inert gas generators only.
Loss of inert gas supply (flow or differential pressure) [2)]	-	-	-	CCR	X	-	X	-
Faulty operation of double-bloack and bleed valves	-	-	-	CCR	-	-	-	See footnote [3)].
Double-block and bleed valve position	-	-	CCR	-	-	-	-	-
Loss of power to double-block and bleed	-	-	-	-	-	-	X	-

Failure/ indication	*Setting*	*Permanent recording*	*Continuous indication*	*Alarm[1)]*	*Shut-down of gas regulating valve*	*Automatic shut-down of blowers (fans)*	*Activation of double-block and bleed[2)]*	*Comment*
- = not applicable; X = applicable. [1)] Alarms shall be audible and visible. [2)] Application only for ships with double-block and bleed replacing deck water seals. [3)] Faulty operation of double-block and bleed valves: — one block valve open and other block valve closed — bleed-valve open and block valves open — bleed valve closed and block valves closed — block valves open when there is no inert gas supply. [4)] A common pressure transmitter is acceptable. [5)] A common oxygen sensor is acceptable. [6)] The indication shall be based on the operational status of the gas regulating valve and on the pressure or flow of the inert gas mains forward of the non-return devices. However, the operational status of the IG system is not considered to require additional indicators and alarms other than those specified in the FSS code. [7)] Limit switches shall be used to positively indicate both open and closed position. Intermediate position status shall be indicated when the valve is in neither open nor closed position.								

5.4 Inert gas burner control and monitoring system

5.4.1 Before ignition of first burner, the boiler shall be purged to such an extent that air quantity through the boiler is at least the greater of:

— three times the volume of the flue gas (from the burner to the chimney), or
— five times the furnace volume

This condition is considered as satisfied if the pre-purge is carried out for 15 s, the amount of air being equal to the air flow corresponding to the nominal output of the burner.

Guidance note:

Post-purge after stopping the last burner is advised. This operation does not, however, replace the pre-purge.

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5.4.2 If air supply is continuous and above 20% of the air flow at full load, a new ignition after normal stop of burner is acceptable, irrespective of the restrictions given in [5.4.1]

5.4.3 Ignition of burners is normally to take place at reduced fuel oil supply. Fuel oil shall not be supplied before ignition device produces sufficient energy for safe ignition.

5.4.4 The flame monitoring as required in Table 1 shall ensure that the safety times given in Table 2, which depend on the oil throughput of the oil burner, are complied with.

Table 2 Safety times

Fuel throughput [kg/h]	*Safety times [s] (maximum)* [1)]	
	At start-up	In operation
Up to 30	10	10
Above 30	5	3
1) The safety time is the maximum permissible time during which fuel may be delivered into the combustion space without a flame burning. This includes time to detect, time to initiate action and time to close the fuel shut-off valve.		

5.4.5 Automatic restarting after an unsuccessful ignition shall not take place till after manual resetting. After a flame failure during the operation, manual resetting locally on the control panel is required.

5.4.6 During stop of burners, including the pre-purge time before ignition, safe shut-off of fuel oil shall be ensured. If the fuel oil will be under pressure during shut-off of burners, the shut-off device shall be duplicated. A single shut-off device will be accepted if the burners are drained off.

5.4.7 The burner(s) shall be equipped with a safety device that shut off the fuel oil supply when the burners are retracted or swung out of position.

6 Survey and testing

6.1 Survey

6.1.1 Main components of the inert gas plant shall be surveyed during construction by the surveyor. The gas scrubber and water seal shall be tested for tightness.

6.1.2 After completion, the inert gas installation shall be surveyed by the surveyor.

6.2 Testing

6.2.1 All alarm, shutdown and safety devices shall be function tested.

6.2.2 A function test of the plant shall be carried out under normal operating conditions, including actual partial load conditions of boilers.

6.2.3 The capacity of the plant shall be confirmed by direct measurement of the gas flow or indirectly by running against maximum discharge capacity of the cargo oil pumps.

SECTION 12 PROTECTED SLOP TANK

1 General

1.1 Application

1.1.1 The requirements in this section apply to ships with class notation as given in Sec.10 [1.1].

1.2 Documentation

1.2.1 Documentation shall be submitted in accordance with Sec.1 [4].

2 Arrangement and systems

2.1 Arrangement

2.1.1 Where not bounded by weather decks, pump rooms or fuel oil tanks, the slop tank(s) shall be surrounded by cofferdams. These cofferdams shall not be open to a double bottom, pipe tunnel, pump room or other enclosed space. However, openings provided with gastight bolted covers may be permitted.

2.1.2 Cofferdams shall be arranged for water filling and draining.

2.1.3 Hatches and other openings to slop tanks shall be arranged for locking in closed position.

2.2 Tank venting

Slop tanks shall have a separate, independent venting system with pressure/vacuum relief valves. Gas outlets shall have a minimum horizontal distance of 10 m from openings to non-hazardous spaces and exhaust outlet from machinery.

2.3 Pumping and piping system

2.3.1 Pipe connections to slop tanks shall have means for blank flanging on open deck or at another easily accessible location.

2.3.2 Pumping system installed for handling of slop while the ship is in service not covered by the class notation **Tanker for oil** or **Tanker for oil products** shall be separated from all other piping systems. Separation from other systems by means of removal of spool pieces may be accepted.

2.4 Gas detection

Dry spaces surrounding slop tanks shall be equipped with an approved automatic gas detector system with alarm.

2.5 Protection inside slop tanks

2.5.1 An arrangement for protecting the tank atmosphere by inert gas or similar effective means, shall be provided.

2.5.2 Meter shall be fitted in the navigation bridge to indicate at all times the pressure in the slop tanks whenever those tanks are isolated from the inert gas supply main.

2.5.3 Inerting of slop tank(s) shall be possible irrespective of the blank flanging from the rest of the system.

3 Signboards and instructions

3.1 General

3.1.1 Signboards with the following text shall be fitted at hatches and other openings to cargo slop tanks:

SHALL BE KEPT CLOSED AND LOCKED DURING HANDLING OF DRY CARGO

3.1.2 Instructions for handling of slop shall be permanently posted in cargo pump room, cargo control room and deck office.

The following text shall be included in these instructions:

When the ship is on dry cargo service and cargo slop is carried in protected slop tanks, the following items shall be complied with:

- All pipe connections to the slop tanks, except vent pipes (and connection to separate slop pumping system) shall be blanked off.
- Inert gas branch connections to the slop tanks shall be kept blanked off, except when filling or re-filling of inert gas is going on.
- Slop shall be handled from open deck only.
- During handling of dry cargo:
  - all hatches and openings to the slop tanks shall be kept closed and locked
  - the slop tanks shall be kept filled with inert gas, and the O_2-content in the tanks shall not exceed 8% by volume.
- The gas detection system in cofferdams surrounding the slop tanks shall be function tested before loading of dry cargo commences.

SECTION 13 CARGO TANK CLEANING ARRANGEMENTS

1 General

1.1 Application

1.1.1 Crude oil tankers (**Tanker for oil**) of 20 000 tons deadweight and above shall be fitted with a crude oil washing arrangement complying with MARPOL Annex I, Reg. 33 and Reg. 35, which refers to *Revised Specifications for the Design, Operation and Control of Crude Oil Washing Systems* adopted by IMO with Res. A.446 (XI) as amended by A.497 (XII) and A.897 (21).

Guidance note:

For oil tankers, also classed as a chemical tanker, the use of type approved tank cleaning hoses of metallic type may be acceptable in crude oil washing system.

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1.1.2 Crude oil washing installations which are not mandatory according to MARPOL Annex I shall only comply with relevant requirements related to safety given in the specifications referred to in [1.1.1], such as installation of an inert gas system.

1.2 Tank water washing systems

1.2.1 Tank washing water may be supplied by pumps located outside the cargo area provided the connections to the tank washing system is so arranged that they can only be connected to the tank washing system when that system is completely and unmistakably disconnected from the cargo system. The connection arrangements to the tank washing system shall be arranged in the cargo tank area. Where a combined crude oil-water washing supply piping is provided, the piping shall be so designed that it can be drained so far as is practicable of crude oil before water washing is commenced, into a slop tank or a cargo tank.

1.2.2 Tank washing heaters with permanent connections to a cargo system shall be located in the cargo area.

1.2.3 Crude oil tankers below 20 000 tons deadweight, fitted with crude oil washing arrangement complying with design requirements in the specification referred to in [1.1.1] shall comply with the safety aspects of the specification given in [1.1.1].

1.2.4 On tankers where inerting of cargo tanks is mandatory, tank cleaning machines shall be permanently installed.

Guidance note:

The requirement is not to be considered as a prohibition to use additional portable washing machines through necessary access openings to enable additional complete washing of cargo tanks.

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APPENDIX A LIST OF CARGOES

1 List of oil cargoes

1.1 General

This list specifies oil cargoes [1] which may be carried on ships with class notation **Tanker for oil** and **Tanker for oil products**[2]

Asphalt solutions

— blending stocks
— roofers flux
— straight run residue.

Oils

— clarified
— crude oil
— mixtures containing crude oil
— diesel oil
— fuel oil no. 4
— fuel oil no. 5
— fuel oil no. 6
— residual fuel oil
— road oil
— transformer oil
— aromatic oil
— lubricating oils and blending stocks
— mineral oil
— motor oil
— penetrating oil
— spindle oil
— turbine oil.

Distillates

— straight run
— flashed feed stocks.

Gas oil

— cracked.

Gasoline blending stocks

— alkylates — fuel
— reformates
— polymer — fuel.

Gasolines

— casing head (natural)
— automotive
— aviation
— straight run
— fuel oil no. 1 (kerosene)

— fuel oil no. 1-D
— fuel oil no. 2
— fuel oil no. 2-D.

Jet fuels

— JP-1 (kerosene)
— JP-3
— JP-4
— JP-5 (kerosene, heavy)
— turbo fuel
— kerosene
— mineral spirit.

Naphtha

— solvent
— petroleum
— heartcut distillate oil.

1) The list of oils shall not necessarily be considered as comprehensive. Note the limitation with respect to vapour pressure in Sec.1 [1.3.1].
2) May carry all the listed oil cargoes except crude oil.

2 Cargoes other than oils

Cargoes other than oils may be carried by ships with class notation **Tanker for oil products** as follows:

a) OS (other substances), as per IBC code chapter 18 may be carried. No MARPOL requirements apply.
b) Pollution category Z, as per IBC code chapter 18 may be carried by ships which are provided with an NLS certificate. In addition, relevant safety criteria such as possible stricter foam fire extinguishing requirement shall be complied with. Density of the product will need to be considered additionally.

CHANGES – HISTORIC

July 2020 edition

Changes July 2020, entering into force 1 January 2021

Topic	*Reference*	*Description*
Emergency towing system	Sec.1 Table 5	Added a documentation requirement for emergency towing system.
Required compliance documentation	Sec.1 Table 7	Table 7 covering certification requirements has been updated to reflect the latest class guideline DNV-CG-0550.
Common structural rules	Sec.2 [1.2.9]	A reference to IACS Rec.165 is included.
Inserting of double hull spaces	Sec.11 [3.3]	Alignment with SOLAS: tankers required to be equipped with an inert gas system on board, shall have the means to inert double hull spaces. Since rules for chemical tankers refer to Pt.5 Ch.5, the requirement related to inerting of double hull spaces in the oil tanker rules shall refer to tankers in general, not only oil tanker. The reference to oil has therefore been removed.
Crude oil washing aligned with IBC code	Sec.13 [1.1.1]	Alignment with IBC code. Guidance note has been introduced to identify that flexible hoses of metallic type may be acceptable or crude oil washing system in accordance with IMO resolution A.446(XI) as amended by A.497(XII) & A.897(21) item 4.1.2 b). IBC code requires segregation between cargo handling systems and in that regards, the use of flexible tank cleaning hoses will achieve the segregation required.

July 2019 edition

Changes July 2019, entering into force 1 January 2020

Topic	*Reference*	*Description*
Air locks	Sec.6 [2.2.1] and Sec.6 [2.2.2]	The rules for connections between non-hazardous spaces and hazardous spaces (air locks) have been amended to be in line with IEC 60079-13 and IEC 60092-502. This is a clarification of the IEC-standards, and no new requirements have been introduced.
Ballast pump room ventilation	Sec.6 [2.4.1]	A requirement for ventilation capacity of 8 air changes/hour for ballast pump rooms on open deck have been introduced. This is in line with industry practice.
Clarification of rules	Sec.1 [4.1.1]	Documentation requirements for sacrificial anodes are moved from Pt.3 to Pt.5 Ch.5, as these requirements are only applicable for tankers.
	Sec.2 [1.2.7]	Reference to Pt.3 with respect to cargo temperatures higher than 80°C and lower than 0°C for CSR vessels are made.

Topic	Reference	Description
	Sec.2 [1.2.8]	Reference to Pt.3 for CSR ships intended to operate in areas with low air temperatures is added.
	Sec.3 [9]	Requirements for sacrificial anodes are moved from Pt.3 to Pt.5 Ch.5.
Double block and bleed acceptance	Sec.11 [3.6.2]	New guidance note to clarify that the alternative of double block and bleed-valves instead of deck water seal is acceptable, as per the FSS-code and Res. A567(14).
Extent of NDT for independent cargo tanks	Sec.2 [1.1.1]	References to fabrication and testing requirements for integral and independent tanks as applicable have been included.
Gas detection in cargo pump room	Sec.9 [6]	The guidance note has been updated to include a reference to relevant IMO-circular (IMO Res.MSC.1/Circ.1321) and suitable positions. A guidance note has also been included to detail what is suitable sampling time as per the FSS-code.
Inert gas burner control and monitoring	Sec.11 [5.4]	The burner control and monitoring table in Pt.4 Ch.7 is to extensive for inert gas burners and not in line with industry practice. We have introduced requirements which are suitable spesifically for inert gas burners.
MED-certification	Sec.1 Table 7	For EEA flagged ships, EC-MED may be accepted in lieu of PC issued by society. For non-EEA flagged ships, equipment serving an item required delivered with a product certificate issued by the society, EC-MED certificate may be accepted if issued by the society.
Small voids within cargo area	Sec.3 [6.1.2]	Removed the requirement for inerting, gas freeing and inspection of small voids within cargo area.
Valve position indication	Sec.9 [2.1.4] and Sec.9 [2.1.5]	Removed the requirement for remote position indication at control station for local operation of cargo valves, but at the same time included requirement for local position indication. A guidance note for remote manual operation has been included. This in line with industry practice.

January 2018 edition

Changes January 2018, entering into force 1 July 2018

Topic	Reference	Description
FSS-code	Sec.11 [3.1.6]	Updated the requirement to include a visual and audible alarm both inside and outside the compartment where an inert gas system is located (from the updated FSS-code).
Vetting	Sec.9 [7.1]	Included a requirement for instrumentation capable of detecting O_2-content, also for non-inerted tankers.

July 2017 edition

Changes July 2017, entering into force 1 January 2018.

Topic	*Reference*	*Description*
MED-certification	Sec.1 Table 7	Acceptance for MED-certified gas detection equipment has been included in Sec.1 Table 7.
OCIMF standard	Sec.4 [1.2.1]	Added text to align with OCIMF: Manifold valves and distance pieces or reducers outboard of valves, which are connected directly to the cargo pipeline's shore connection on deck, shall be made of steel and fitted with flanges conforming to ASME B16.5, i.e. be of flanged or fully logged type.
Access requirement in pipe tunnels.	Sec.10 [2.2.3]	Update the rules to adapt to current designs, i.e. removing a requirement for access point.
Tank washing machines	Sec.13 [1.2.4]	Introduced a requirement for fixed tank washing machines, based on current designs and acceptable practice for inerted ships.
Machinery space bulkhead	Sec.4 [2.1.5]	An explanation of the rule text has been made in a guidance note.
Air locks	Sec.6 [2.2.1]	Rule text has been updated based on interpretation of the IEC-code.
Cargo tank venting systems	Sec.5 [2.1.2]	Transferred guidance note into rule text.
Instrumentation	Sec.9 [4]	Transferred guidance note into rule text.
Machinery space bulkhead	Sec.4 [2.1.6]	The tanker rules has been aligned with requirements for bulkhead penetrations in Pt.4 Ch.6. These penetrations have to follow the specified TA-program.

January 2017 edition

Main changes January 2017, entering into force July 2017

- Sec.1 General

— Sec.1 Table 3: The definition of cargo area in table 3 has been amended to reflect that it also includes the full depth of the ship.

— Sec.1 Table 5: In table 5 regarding internal access, additional description has been updated with correct SOLAS reference.
— Sec.1 Table 7: In table 7 a note has been inserted indicating requirements for EC-MED certificates for P/V-valves on EEA flagged vessels.

• Sec.2 Hull

— Sec.2 [2.1]: Requirements to inerting, gas freeing and inspection of small voids within the cargo area have been deleted in order to avoid conflicting requirements compared to the common structural rules.

• Sec.3 Ship arrangement and stability

— Sec.3 [2.1.8]: Has been amended so that cleaning and gas-freeing of small voids within the cargo area is not a requirement.
— Sec.3 [6.2]: Has been amended to include deck trunks.

• Sec.4 Piping systems in cargo area

— Sec.4 [2.2.10]: Reference has been corrected.
— Sec.4 [5.2]: Has been amended to be in compliance with IMO MSC/Circ.474/Corr.

• Sec.5 Gas-freeing and venting of cargo tanks

— Sec.5 [2.2.13]: Has been amended to reflect USCG-regulations.

• Sec.10 ships for alternate carriage of oil cargo and dry cargo

— Sec.10 [2.2.4]: Has been amended to include any stool spaces containing cargo pumps and piping.
— Sec.10 [2.2.5]: Access entrances and passages shall have a clear opening in accordance with Sec.3 [4.2].

• Sec.11 Inert gas system

— Sec.11 [3.2.4]: Has been amended in accordance with forthcoming IACS unified interpretations to the FSS code.
— Sec.11 [3.3.1]: Has been amended to clarify which spaces require inert gas in accordance with IACS UI SC272.
— Sec.11 Table 1: Table 1 has been amended in accordance with FSS code amendments and forthcoming IACS unified interpretations to the FSS code.

July 2016 edition

Main changes July 2016, entering into force 1 January 2017

• Sec.1 General

— Sec.1 Table 1: Notation **Barge for oil** included
— Sec.1 Table 3: Definition of cargo tank block amended to include extending to the full depth of the ship

— Sec.1 Table 7:
  — Material certificate for emergency towing strongpoints changed from Society to manufacturer issuance
  — Certificate for liquid pressure/vacuum breakers changed from manufacturer to Society issuance
  — "Pressure/vacuum valves": The text "For EEA flagged ships EC-MED" has been removed
  — "Pressure/vacuum valves": A note has been included below the table specifying that EC-MED may be required for inert gas components for EEA flagged ships

• Sec.3 Ship arrangement and stability

— Sec.3 [3.2.1]: Protection of cargo tanks value corrected from 24 to 2.4

• Sec.4 Piping systems in cargo area

— Sec.4 [1.2.1]: The requirement has been changed from flanged type to flanges conforming to ASME B16.5 to avoid misunderstanding with the definition of flanged type valves
— Sec.4 [1.4.1]: A requirement stating protection against accidental impact for pipes with aluminium coating, as this is perceived to increase the risk for sparks, has been added
— Sec.4 [2.1.3]: It has been clarified that the boundary penetration between cargo tanks is an issue for ships not carrying homogenous cargoes

• Sec.8 Area classification and electrical installations

— Sec.8 [3.1.4]: Paragraph with reference to Sec.6 [2] for ventilation has been removed. Remaining paragraphs have been renumbered [3.1.4] to [3.1.6] accordingly

• Sec.11 Inert gas systems

— Sec.11 [4.1.4]: The requirement has been amended so that higher fan pressure can be introduced, but only if total pressure exerted on the tanks is below design pressure for said tanks
— Sec.11 Table 1:
  — The comment for "Operational status of the inert gas system" has been amended
  — Footnote 6) "Indication of position of gas regulating valve is accepted as status of delivery to cargo area" has been deleted

• Sec.12 Protected slop tank

— Sec.12 [2.2]: Requirement for gas outlets to have a minimum distance of 6 m above tank deck has been removed from the paragraph

October 2015 edition

This is a new document.

The rules enter into force 1 January 2016.

Amendments January 2016

• General

— Only editorial corrections have been made.

About DNV

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