Part 6 Additional class notations

Chapter 5 Equipment and design features
**FOREWORD**

DNV GL 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.

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CHANGES – CURRENT

This document supersedes the July 2016 edition. Changes in this document are highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Main changes January 2017, entering into force 1 July 2017

• Sec.1 Transportation of containers - Container
  — Sec.1 [2], Sec.1 [3], Sec.1 [4]: Additional sub-sections covering requirements to non-typical container securing arrangements have been added to the class notation Container.

• Sec.5 Helicopter installations - HELDK
  — Sec.5 [1.10.4]: Added clarification that aluminum-steel transition joints (bi metallic connections) are not permitted when exposed to tensile loads.
  — Sec.5 [5.2.3]: Requirement for deck cambering is replaced with a general requirement for the deck to be constructed so that water/fluids will not accumulate on the deck.

• Sec.16 Offshore gangway installations - Walk2work
  — New class notation

Editorial corrections

In addition to the above stated changes, editorial corrections may have been made.
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SECTION 1 TRANSPORTATION OF CONTAINERS - CONTAINER

1 General

1.1 Introduction
The additional class notation Container provides a design standard enabling safe and reliable transportation of containers on ships. Compliance with this notation, not only protects the ship, the cargo and the crew, but also provides for the maximum use of the available capacity of the ship, and for rapid and systematic discharging and loading.

1.2 Scope
The scope for additional class notation Container sets requirements for container storage arrangement, and refers primarily to the Society’s ship rules, IMO and IACS regulations.

1.3 Application
The additional class notation Container applies to ships without the class notation Container Ship, and will be assigned the notation Container when the vessel is found to be in compliance with the requirements in this section. The requirements include those found in Pt.5 Ch.2 Sec.8 and Pt.5 Ch.2 Sec.9, and the Code of Safe Practice for Cargo Stowage and Securing (CSS code) Annex 14 adopted by MSC.1/Circ. 1352 and related /IACS UI SC265, considering design aspects to be implemented at the newbuilding stage.

1.4 Class notation

1.4.1 Additional notation – design and survey requirements
Ships built in compliance with the requirements as specified in Table 1 will be assigned the additional class notation as follows:

Table 1 Additional class notation Container

<table>
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<th>Design and survey requirements</th>
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<td>Equipped for carriage of containers</td>
<td>Ships with class notation other than Container ship</td>
<td>Design: [2.1.1], [5.1.1] and Sec.2 Survey: Pt.7 Ch.1 Sec.2, Pt.7 Ch.1 Sec.3 and Pt.7 Ch.1 Sec.4</td>
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1.5 Documentation

1.5.1 Documentation requirements
Documentation shall be submitted as required by Pt.5 Ch.2 Sec.1 Table 4.
1.6 Certification

1.6.1 Certification requirements
For products that shall be installed on board, the builder shall request the manufacturers to order certification as described in Pt.5 Ch.2 Sec.1 Table 5.

1.7 Surveys and testing

1.7.1 Application
The survey and testing requirements shall be applied as defined in Pt.5 Ch.2 Sec.1.

2 Stowage of containers on deck

2.1 General
Typically container securing systems on deck shall be designed as described in Pt.5 Ch.2 Sec.8. Typical container stowage systems are single stowed stacks secured by twistlocks or stacks stowed in cell guides. For non-typical container securing systems which are not covered by the aforementioned rules, such as line load- or block stowage systems, the following requirements are applicable.

Guidance note:
It is strongly recommended for ships designed for carrying containers on deck to ensure the compliance with Code of Safe Practice for Cargo Stowage and Securing (CSS code) Annex 14 adopted by MSC.1/Circ. 1352 and related /ACS UI SC265, considering design aspects to be implemented at the newbuilding stage.

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

2.1.1 Linear seating of containers
If containers are stowed with linear seating in several layers, the total weight of the containers above the first layer shall not exceed the following values:
— 0.8G for 40 ft containers and
— 1.0G for 20 ft containers
where G is the container's maximum gross weight according to classification guideline DNVGL-CG-0060 App.B.

This kind of seating may be set up by arranging continuous steel or wooden dunnages below the longitudinal bottom rails of the containers or by directly seating these bottom rails on the hatch covers or the decks, with sunk-in pockets being arranged below the container corners.

The arrangement of short steel pads serving as dunnages placed on the girders of short hatch covers shall be avoided.

Equipment used to obtain a linear seating shall be configured to leave a sufficient clearance (about 5 mm) between corner castings of the container and hatch covers or decks. For ISO standard containers, a protruding depth of their corner castings of 4 mm to 17.5 mm from their bottom longitudinal rails and of 11 mm to 17.5 mm from the bottom transverse girders may be assumed. Special container types may require additional dunnages for their transportation.

Linearly seated containers shall be secured against shifting by locking devices arranged on the hatch covers and/or the deck.
2.2 Stowage on deck with neither lashing nor lateral rigid support

2.2.1 Containers in one layer
Containers carried in one layer shall be secured against tilting and shifting by locking devices arranged at their lower corner castings.

2.2.2 Containers in several layers
If containers are stowed in several layers, locking devices shall be arranged between the container layers. Containers located in the lowermost layer shall be locked as well at their lower corner castings.

2.2.3 Dunnage
Placing containers on dunnage without lashing them is only permissible if effective securing devices can be arranged to prevent them from shifting and tilting, see [2.2.1] and [2.1.1].

2.3 Stowage on deck with lashing but without lateral rigid support
Locking devices shall be arranged between container layers and below lowest container layer between container corner castings/container support fittings.

2.4 Stowage on deck with lateral rigid support

2.4.1 Buttress system stowage
Instead of being lashed, containers may also be secured against sideward shifting and/or tilting by means of buttress structures placed on deck (if necessary, on hatchways) or by a system consisting of buttress structures and cone adapters.
Containers shall be shored by buttress structures in such a way that inadmissible deformations of the container framework are prevented and the permissible container racking loads are not exceeded.

3 Stowage of containers below deck

3.1 General
Typically container securing systems on deck shall be designed as described in Pt.5 Ch.2 Sec.8. Typical container stowage systems are single stowed stacks secured by twistlocks or stacks stowed in cell guides. For non-typical container securing systems which are not covered by the aforementioned rules, such as line load- or block stowage systems, the following requirements are applicable.

3.2 Stowage below deck with neither cell guides nor lashing

3.2.1 Container securing
Container stacks placed side by side shall be coupled by dual cone adapters or equivalent devices to form container blocks. For container blocks extending over the hold width, bridge fittings for compression shall be provided on the uppermost layer of containers if there is a lateral shoring point at this level. If containers are separated into two blocks, bridge fittings for tension and compression shall be arranged at the level of the shoring points.
In the lowest container layer each container shall be secured against shifting at all four corner castings.
Each container block shall be laterally supported at its container corner fittings. Support shall be provided by sufficiently strong structural elements of the ship, such as decks and web frames.
3.2.2 Shoring forces
The number of lateral shoring points shall be determined so that the corner castings loads and container racking loads will not be exceeded, see class guideline DNVGL-CG-0060 Sec.3.
Where necessary, the force at a shoring point may be distributed to the two adjacent corner fittings by a special design of the shoring element.
Shoring forces may also be reduced by dividing the containers to be shored into two separate container blocks, thus splitting up the transverse container forces into compressive shoring forces on one side and tensile shoring forces on the other side of the hold.

3.2.3 Shoring element construction
Shoring elements shall be constructed to transmit compressive loads or, where necessary, compressive and tensile loads. Shoring elements may be of fixed or removable configuration. Both kinds shall ensure that the clearance between their contact faces and the container corner castings is as small as possible.
Wedges shall be sufficiently secured against their inadvertent loosening (e.g., on account of vibrations).
Shoring elements shall be easily accessible. Their weight and the associated number of loose parts shall be restricted to a minimum.

3.3 Stowage below deck with lashing but without cell guides
Instead of or in combination with shoring systems described in [3.2], cargo hold containers may also be secured by lashings. If this is the case, provisions in Pt.5 Ch.2 Sec.8 [2.3] apply additionally.

3.4 Dimensioning of other rigid lateral support structures
3.4.1 Dimensioning of cross ties
In general, forces acting on cross ties shall be calculated based on LC1 in accordance with Pt.5 Ch.2 Sec.8 [6.3.1]. Where necessary, additional compressive or tensile loads on the cross ties caused by transverse deformations of the ship's hull shall be taken into account.
The resulting tensile and compressive stresses in cross ties shall not exceed permissible values given in Pt.5 Ch.2 Sec.8 [7.2].

Where longitudinal ties are not arranged, also bending and shear stresses in cross ties induced by longitudinal container loads based on LC2 in accordance with Pt.5 Ch.2 Sec.8 [6.3.1] shall not exceed permissible stresses given in Pt.5 Ch.2 Sec.8 [7.2]. The distribution of longitudinal loads on cross ties follows from the arrangement of vertical guide rails. Alternatively, a load distribution throughout the length of the cross tie may be assumed, as shown in Figure 1.
Figure 1 Load distribution throughout cross tie

For cross ties not directly connected to the hull, the minimum required sectional area, $A_{s\text{ req}}$, in cm$^2$, of the cross tie bar subject to the compressive load, $P_s$, shall be calculated as following:

$$A_{s\text{ req}} = 10 \cdot \frac{P_s}{\sigma_p} \text{[cm}^2\text{]}$$

where:

$$\sigma_p = \text{permissible compressive stress, in N/mm}^2$$

$$\kappa = \frac{\kappa}{S} \cdot \frac{R_e}{H}$$

$P_s = \text{compressive tie bar load, in kN}$

$\kappa = \text{reduction factor}$

$$= \frac{1}{\varphi + \sqrt{\varphi^2 - \lambda_s^2}}$$

$\varphi = 0.5 \left[ 1 + n_p (\lambda_s - 0.2) + \lambda_s^2 \right]$  

$n_p = 0.34 \text{ for tubular and rectangular profiles}$  

$n_p = 0.49 \text{ for open sections}$

$\lambda_s = \text{degree of slenderness of the tie bar}$

$$= \frac{\ell_s}{i_s \cdot \pi} \cdot \sqrt{\frac{R_e H}{E}} \geq 0.2$$

$\ell_s = \text{length of the tie bar, in cm}$

$E = \text{Young’s modulus, in N/mm}^2$

$i_s = \text{radius of gyration of the tie bar, in cm}$

$$= \sqrt{I_s \lambda_s}$$

$I_s = \text{smallest moment of inertia of tie bar cross section, in cm}^4$
\[ S = \text{ safety factor} \]
\[ = 1.4 \text{ for } \lambda_s \leq 1 \]
\[ = 1.65 \text{ for } \lambda_s > 1 \]

3.4.2 For cross ties rigidly connected to the hull, the slenderness ratio of tie bars is required to be \( \lambda_s \leq 250 \).

The slenderness, \( \lambda_s \), is to be calculated according to [3.4.1], where the effective (buckling) length, \( s_K \), in cm, is used instead of the tie bar length, \( l_s \):

\[ s_K = 0.7 \cdot l_s \text{ for welded connections} \]
\[ s_K = l_s \text{ for screw connections and suspended structures}. \]

3.4.3 Dimensioning of longitudinal ties

Compressive and tensile loads on longitudinal ties shall be calculated based on LC2 in accordance with Pt.5 Ch.2 Sec.8 [6.3.1] and the number and arrangement of longitudinal ties. Resulting stresses shall not exceed the permissible values given in Pt.5 Ch.2 Sec.8 [7.2].

For longitudinal ties subject to compressive forces, the slenderness ratio, \( \lambda_s \), according to [3.4.1] shall not exceed 250.

Longitudinal ties shall be connected to the ship's hull in a manner to not absorb compressive and tensile stresses resulting from the ship's global deformations.

3.4.4 Dimensioning lateral supporting rails

The shoring forces according to classification guideline DNVGL-CG-0060 Sec.4 [5] shall be used for dimensioning these rails. Resulting stresses shall not exceed the permissible values given in Pt.5 Ch.2 Sec.8 [7.2].

4 Lashing computer system

4.1 General

4.1.1 For vessels with more than 2 tiers of containers on deck or more than 3 tiers of containers in hold, a lashing computer system shall be installed on board and certified by the Society in accordance with requirements given in Pt.5 Ch.2 Sec.8 [9].

4.1.2 For other ships not in compliance with [4.1.1], the container securing arrangement plan shall be prepared for a limiting metacenteric height (GM-value) not lower than that given in Pt.5 Ch.2 Sec.8 [6.1.2]. Actual operational conditions shall be below the GM-value used in the container securing arrangement plan.

5 Hull support structures

5.1 General

5.1.1 Application

The requirements regarding hull support structures for container support fittings and container securing structures shall be applied as defined in Pt.5 Ch.2 Sec.9.
6 Special requirements

6.1 Wave breakers

6.1.1 If containers are intended to be carried above the weather deck at a location forward of 0.15 \( L \) from F.E. a wave breaker shall be fitted in accordance with the requirements given in Pt.3 Ch.10 Sec.6 [10].
SECTION 2 CONTAINER SHIPS DESIGNED WITHOUT HATCHCOVER - HATCHCOVERLESS

1 General

1.1 Introduction
The additional class notation Hatchcoverless sets requirements for container ships where one or more cargo holds are not fitted with hatch covers.

1.2 Scope
The scope for additional class notation Hatchcoverless concerns the dimensioning of longitudinal structures for the intact flooded condition. Structural elements contributing to the hull girder longitudinal strength shall also be included in the calculations; as shall still water bending moment and hull girder ultimate bending capacity. An exemption from International Convention of Load Line may be granted by the relevant flag administration, and dual load line drafts can be assigned in the case of temporary operations without hatch covers.

1.3 Application
The additional class notation Hatchcoverless is applicable to container ships designed such that one or more cargo holds are not fitted with hatch covers, and may be assigned when the requirements in this section are met. Hatchcoverless notation will be assigned under the provision of compliance with MSC/Circ.608/Rev.1, Interim guidelines for open-top containerships.

2 Calculations

2.1 Strength in the intact flooded condition
The dimensioning of longitudinal structures shall be verified by proving the ultimate bending capacity for the intact flooded condition. The calculations shall include those structural elements contributing to the hull girder longitudinal strength.

2.1.1 Symbols
- $M_{SWf}$ = maximum vertical still water bending moment [kNm] in intact flooded conditions
- $M_{WV}$ = vertical wave bending moment in seagoing condition [kNm] at the ship’s transverse section
- $M_{uf}$ = ultimate vertical bending moments [kNm] of the ship’s transverse section
- $\gamma_{WV}$ = Partial safety factor = 1.20
- $\gamma_R$ = Partial safety factor = 1.20.

2.1.2 Definition
The intact flooded condition is a condition with all open holds completely filled with water to the level of the top of the hatch side or hatch coaming or, in the case of a ship fitted with cargo hold freeing ports, to the level of those ports. The hull structure is intact and not damaged.

The permeability shall be 0.70 for any container or dry cargo hold. For cases where non-standardised cargo is carried, e.g. break bulk, the permeability of the hold shall be 0.90 or substantiated by calculation.

2.1.3 Still water bending moment
The still water bending moment for the intact flooded condition shall be provided by the designer.
2.1.4 Hull girder ultimate bending capacity

The ultimate bending capacity for the intact flooded condition shall comply with the following criteria:

\[ M_{SWf} + 0.8 \cdot \gamma_{ww} \cdot M_{ww} \cdot \frac{c_s}{\gamma_R} \leq \frac{M_{uf}}{\gamma_R} \]
SECTION 3 PERMANENTLY INSTALLED CRANES - CRANE

1 General

1.1 Introduction
The additional class notation Crane sets requirements for a design standard for permanently installed cranes on vessels.

1.2 Scope
The scope for additional class notation Crane provides requirements for cranes with respect to: safety and functionality, devices for locking the crane in a parked position (vessel at sea) and for supporting the crane structure. Three terms are used in this section to describe the intended use of the crane, these are: Offshore crane - for cargo handling outside the vessel while at sea; Shipboard crane - for cargo handling in and outside of the vessel, in harbour or sheltered waters; Platform crane - for cargo handling on offshore vessels. For vessels with more than one crane installed, class notation Crane may be applied to selected cranes only. The selected cranes will be identified in the Appendix to the Class Certificate

1.3 Application
The additional class notation Crane applies to the selected cranes installed on vessels. See Pt.3 Ch.1 regarding additional requirements for the supporting structure, and Pt.5 Ch.10 Sec.2, concerning stability. DNVGL-ST-0377 Standard for shipboard lifting appliances and DNVGL-ST-0378 Standard for offshore and platform lifting appliances cover requirements for preventing overturning and sliding. Vessels found to be in compliance with the requirements in this section may be assigned the additional class notation Crane.

1.4 Definitions

1.4.1

Table 1 Definitions and abbreviation

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition or abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( L_F )</td>
<td>length of the ship as defined in the International Convention of Load Lines</td>
</tr>
<tr>
<td>offshore crane</td>
<td>a lifting appliance on board a vessel intended for handling of loads outside the vessel while at open sea.</td>
</tr>
<tr>
<td>shipboard crane</td>
<td>a lifting appliance on board a ship intended for handling loads within and outside the vessel while in harbour and within the vessel while at sea.</td>
</tr>
<tr>
<td>platform crane</td>
<td>a lifting appliance on board an offshore unit intended for handling loads within and outside the vessel while in harbour and within the vessel while at sea.</td>
</tr>
</tbody>
</table>

1.5 Certification

1.5.1
For cranes that class notation Crane shall be applied to, the builder shall request the manufacturers to order certification as described in Table 2
### Table 2 Certification requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard*</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore crane</td>
<td>PC</td>
<td>Society</td>
<td>DNVGL-ST-0378</td>
<td>Product certificate CG2, see DNVGL-ST-0378</td>
</tr>
<tr>
<td>Platform crane</td>
<td>PC</td>
<td>Society</td>
<td>DNVGL-ST-0378</td>
<td>Product certificate CG2, see DNVGL-ST-0378</td>
</tr>
<tr>
<td>Shipboard crane</td>
<td>PC</td>
<td>Society</td>
<td>DNVGL-ST-0377</td>
<td>Product certificate CG2, see DNVGL-ST-0377</td>
</tr>
</tbody>
</table>

*Unless otherwise specified the certification standard is the rules.

#### 1.5.2 For definition of certification types, see Pt.1 Ch.3

### 1.6 Documentation

#### 1.6.1 Documentation shall be submitted as required by Table 3.

### Table 3 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranes</td>
<td>Z030 - Arrangement plan</td>
<td>Including: — main dimensions — limiting positions of movable parts — location onboard during operation and in parked position.</td>
<td>FI</td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information

**Guidance note:**
Documentation requirements to hull support of the cranes are covered in Pt.3 and electrical power supply are covered in Pt.4 Ch.8.

#### 1.6.2 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

#### 1.6.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

### 2 Design loads

#### 2.1 General

In addition to the specific design loads given in DNVGL-ST-0378 Standard for offshore and platform lifting appliances and DNVGL-ST-0377 Standard for lifting appliances, loads due to ship motions shall be considered. Design values of linear and angular accelerations are given in Pt.3 Ch.1 Sec.4.
3 Overturning and sliding

3.1 Overturning

Devices shall be provided for all cranes in parked position (vessel at sea) to be anchored to the hull structure. The anchoring devices shall be designed to withstand inertia forces due to ship motions and loads due to out of service winds. The strength calculations shall be based on accepted principles of statics and strength of materials, applying the safety factors as stipulated for load case III in the DNVGL-ST-0378, or, load combinations III in DNVGL-ST-0377.

3.2 Sliding

3.2.1 In parked position (vessel at sea) sliding is preferably to be prevented by means of anchoring devices. See [3.1]. If sliding is intended to be prevented by friction between rail and wheels only, the coefficient of friction shall not be taken greater than 0.15.

3.2.2 For a crane in operation, sliding shall not to take place unless the forces parallel to rails exceed 1.3 times the values for load case II in the DNVGL-ST-0378, or, load combinations II in DNVGL-ST-0377. When this is not satisfied, sliding shall be prevented by a device locking the crane in position. The strength of this device shall be based on the safety factors for load case II/load combination II, as referred to above.

4 Testing

4.1 General

After completed installation onboard, functional testing and load testing of the crane shall be carried out as specified in the DNVGL-ST-0378, or DNVGL-ST-0377.

5 Stability

5.1 Stability requirements for heavy lift operations

The stability for vessels with length $L_{LL}$ of 24 metres and above for which lifting operations is one of the functions, shall be in compliance with the crane criteria given in Pt.5 Ch.10 Sec.2 [4.1], Pt.5 Ch.10 Sec.2 [4.2] and Pt.5 Ch.10 Sec.2 [4.3].

The crane criteria shall be applied when the maximum heeling arm created by the crane and its load exceeds 0.10 m at any operational displacement.

For lifting conditions carried out within clearly defined limitations as set forth by Pt.5 Ch.10 Sec.2 [4.4] the alternative intact and damage stability criteria as set forth in Pt.5 Ch.10 Sec.2 [4.4] and Pt.5 Ch.10 Sec.2 [4.5] may be applied, subject to prior consent by the Society.
SECTION 4 ADDITIONAL FIRE SAFETY - F

1 General

1.1 Introduction
The additional class notation F introduces preventive measures, and other measures to reduce consequences of fires beyond that of the normal regulations. Such measures include: additional firefighters’ outfits, restricted use of combustible materials, subdivision of spaces, enhanced fire detection, alarm and extinguishing systems, more attention to emergency escape and ventilation, colour TV monitoring and specific requirements for a minimum number of communication radios for firefighters and firefighting teams.

1.2 Scope
The scope for additional class notation F provides additional fire safety measures in accommodation spaces, machinery spaces and cargo areas through preventive measures, as well as measures for reducing the consequences of fire. Ships can be assigned one or a combination of different qualifiers, such as: F(A), F(M) and F(C), where A represents accommodation, M machinery spaces and C deck and cargo areas, that are built and equipped with the relevant requirements in this section.

1.3 Application
The additional class notation F applies to cargo ships or passenger ships that comply with the SOLAS regulations. The requirements in this section are supplementary to those given in SOLAS Ch. II-2, and further compliance shall be shown in the documentation required by Pt.4 Ch.11. Ships built and equipped in accordance with all of the requirements of this section will be given the additional class notation: F(A, M, C).

1.4 Class notations

1.4.1 Ships with accommodation built and equipped in accordance with the requirements in [1] and [2] will be given the additional class notation F(A).

1.4.2 Ships with machinery spaces built and equipped in accordance with the requirements in [1] and [3] will be given the additional class notation F(M).

1.4.3 Ships with deck and cargo areas built and equipped in accordance with the requirements in [1] and [4] will be given the additional class notation F(C).

1.4.4 Ships built and equipped in accordance with all the requirements of this section will be given the additional class notation F(A, M, C).

1.5 Documentation requirements

1.5.1 Compliance with the requirements in this section shall be shown in the documentation required by Pt.4 Ch.11 (using the entry for SOLAS ships where the Society is authorised to issue safety certificates). In addition to these documents and plans, documentation as required by Table 1 shall be submitted for approval or incorporated into plans required by Pt.4 Ch.11.
### Table 1 Documentation required

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class notation <strong>F(A)</strong>:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire water system</td>
<td>Z030 - Arrangement plan</td>
<td>Water hose reel system.</td>
<td>AP</td>
</tr>
<tr>
<td>Accommodation spaces</td>
<td>M070 - List of combustible materials</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Class notation <strong>F(M)</strong>:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire observation television monitoring system</td>
<td>Z030 - Arrangement plan</td>
<td>Location of TV cameras.</td>
<td>AP</td>
</tr>
<tr>
<td>Fire prevention arrangements</td>
<td>Z100 - Specification</td>
<td>Typical details and methods for shielding of couplings in oil piping systems.</td>
<td>AP</td>
</tr>
<tr>
<td>Fire prevention arrangements</td>
<td>Z241 – Measurement report</td>
<td>Infrared thermo scanning report, with corrective measures.</td>
<td>AP</td>
</tr>
<tr>
<td>Class notation <strong>F(C)</strong>:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cargo holds fire extinguishing system</td>
<td>G200 - Fixed fire extinguishing system documentation</td>
<td>For cargo holds, as installed.</td>
<td>AP</td>
</tr>
<tr>
<td>Cargo tank deck fire extinguishing system</td>
<td>G200 - Fixed fire extinguishing system documentation</td>
<td>For cargo deck areas, as installed.</td>
<td>AP</td>
</tr>
<tr>
<td>External surface protection water spraying system</td>
<td>G200 - Fixed fire extinguishing system documentation</td>
<td>Arrangement and capacity.</td>
<td>AP</td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information

1.5.2 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

1.5.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

1.5.4 Manuals

Manuals for the fire-extinguishing systems, fire-fighting appliances and fire detection and alarm systems shall be kept in one place e.g., wheelhouse or engine control room. The manuals shall include instructions for use of the systems, periodical maintenance and specification of periodical tests.

1.6 Firefighter's outfit

1.6.1 Ships with one or combinations of the additional class notations **F(A)**, **F(M)**, **F(C)** shall have at least 4 sets of firefighter's outfit as specified in Ch.3 of Fire Safety Systems (FSS) Code. Additional requirements are given for some ship types under the **F(C)** notation in [4]. The firefighter's outfit defined in these rules need not be additional to those required by SOLAS/II-2/A/17.

1.6.2 Each of the breathing apparatus shall be provided with cylinders of 1,800 litres capacity. The total weight of one apparatus (including cylinder filled with air, valves and mask) shall not exceed 12.0 kg. Two spare cylinders shall be provided for each apparatus. All cylinders, apparatus and valves shall be of the same type. Apparatus with less capacity and less weight may be accepted if deemed more suitable for the intended service and if more spares are provided.
1.6.3 The firefighter’s outfit (protective clothing, boots, gloves, helmet and breathing apparatus) shall comply with the EN and ISO standards defined by the EU marine equipment directive (MED approved).

1.6.4 A high-pressure compressor suitable for filling of the cylinders for the breathing apparatus shall be installed. The compressor shall be driven by a separate diesel engine or from the emergency power plant and shall be placed in an easily accessible and safe place onboard. The capacity of the compressor shall be at least 75 litres/minute.

Guidance note:
When considering the compressor location it should be kept in mind that, when a fire has broken out onboard, the compressor should be operable and that the air to be compressed should be sufficiently clean for breathing purposes.

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

1.6.5 The firefighter’s outfits shall be divided between two fire stations placed at a safe distance from each other. The fire stations shall be clearly marked and shall have access from open deck. Both stations shall be readily accessible and located within the main accommodation block, preferably with one station on the port side and one on the starboard side. The stations shall have minimum A-0 fire integrity towards other spaces.

1.6.6 The arrangement of the fire stations shall be such that all the equipment has its own place and is easily accessible and ready for immediate use. There shall be arrangements for hanging up protective clothing and other equipment, which should be stored in a suspended position.

2 Accommodation

2.1 General

2.1.1 Purpose and application
The purpose of the requirements for fire technical subdivision of the accommodation is:
— to prevent a fire in any other part of the ship from spreading to the accommodation
— to prevent a fire in the accommodation from spreading to other parts of the accommodation (within the time limits established for the concerned material's fire-technical class)
— to reduce the use of combustible material
— to provide rapid detection and safe escape from the cabins and corridors.

2.2 Fire integrity

2.2.1 Restricted use of combustible materials
Construction method IC (see SOLAS Ch. II-2/9.2.3.2) shall be used.

2.2.2 Curtains and other suspended textile materials shall have resistance to flame as given in Part 7 of the Fire Test Procedures (FTP) Code.

2.2.3 Furniture and other items in stairways and corridors shall only be accepted when fixed to the ship’s structure, does not obstruct the escape ways and complies with FTP Code, Part 8.

2.2.4 Bedding components shall comply with FTP Code, Part 9.

2.2.5 Subdivision of spaces
Corridors in the accommodation shall be divided by self-closing class B-15 doors at a maximum distance of 20 m from each other. When transverse corridors and longitudinal corridors are connected to each other, self-closing class B-15 doors are also to be provided if the total corridor length exceeds 20 m.
2.2.6 All doors fitted in the corridor bulkheads (providing access to cabins, public spaces, etc.) shall be of self-closing type. Service hatches need not to comply with this requirement.

2.2.7 If a door required to be self-closing is equipped with an approved hold back device, this shall automatically release the door when the fire alarm is sounded.

2.2.8 All decks in the accommodation spaces, including corridors, shall be of minimum class A-0.

2.2.9 All bulkheads and decks separating the accommodation from all machinery spaces (fire category 6 and 7), cargo holds and ballast and cargo pump rooms, as applicable, shall be of class A-60. This requirement does not apply to fire category 7 spaces located within the accommodation unit and only serving accommodation and service spaces, (examples are air condition machinery spaces and service trunks serving only cabins and similar spaces).

2.2.10 All bulkhead and decks enclosing the drying rooms and laundries shall be of minimum class A-0. The doors, ventilation system and other penetrations shall be of A-class standard. The exhaust ducts shall have service hatches for cleaning and serve no other spaces but can be connected to the common accommodation air condition unit.

2.2.11 All divisional bulkheads, linings, deckhead in accommodation spaces, service spaces and control stations shall be of at least class B-15. The sanitary unit can be accepted as part of the cabin. Divisions of minimum A-0 class will in this context be considered to be equivalent to B-15.

2.2.12 Escape ways for accommodation and service spaces
Dead end corridors are prohibited. Recesses are accepted where their length along the corridor is greater than its width.

2.2.13 Spaces exceeding 30 m² shall be provided with at least two independent escape routes. The primary escape route shall be a door directly to a corridor or an open deck. Windows that are of adequate size and provided with ladders may be used as the second means of escape for spaces between 30 m² and 50 m², whereas the secondary means of escape for spaces above 50 m² shall consists of doors, corridors and stairways being independent of the primary escape.

2.3 Fire detection and alarm system

2.3.1 General
In all accommodation, service spaces and control stations an approved automatic fire detection and alarm system of addressable type shall be installed in accordance with Pt.4 Ch.9. Optical smoke detectors shall be used, except that heat detectors shall be installed in refrigerated chambers and in any saunas. Galley shall be provided with smoke detectors in preparation parts and heat detectors above deep fat fryers, steam baths, ovens and similar equipment.
The fire detection system shall be of the addressable type.

2.4 Portable fire extinguishers

2.4.1 Number and location
The required extinguishers shall be 12 kg powder or 9 litre foam portable extinguishers of an approved type.

2.4.2 Two portable extinguishers shall be provided in corridors or stairways at each deck. In addition, at least one such extinguisher shall be installed in all pantries, laundries, crew day rooms and similar spaces. At least two extinguishers of suitable type for deep fat fryers shall be provided for the galley.
2.5 Hose reel system

2.5.1 General
The accommodation shall be provided with a water extinguishing system consisting of fire hose reels for rigid hose permanently connected to a piping system under constant pressure.

2.5.2 The hose reels shall be so located that any point in the accommodation can be reached with water spray from at least one hose reel.

2.5.3 Hoses for hose reels shall be of at least 19 mm internal diameter and shall have a combined jet or spray nozzle. Hose length shall be maximum 20 m per hose reel.

The system shall discharge freshwater of potable quality with a design pressure of not less than 3 bar at the nozzle.

2.5.4 Hose reels shall be ready for immediate use. The hose shall be operable when pressurised on the reel.

2.5.5 Conventional fire hose equipment shall be provided to fight more extensive fires in the accommodation. When planning such systems, the fact that the fire shall be fought from the outside has to be considered. Hydrants and hose equipment are therefore to be located outside the entrance doors to the accommodation. Size of fire hoses should be chosen based on the number of fire fighters dedicated to this task (38 mm hoses is recommended).

3 Machinery spaces

3.1 General

3.1.1 Emergency escape and access
At least one of the escape routes from the engine control room shall be independent of the engine room.

3.1.2 Other machinery spaces (fire category 7) and workshops not being part of engine room (fire category 9) on cargo ships and similar spaces on passenger ships shall have minimum one escape route being independent of machinery spaces of category A.

3.1.3 Ventilation
At least one of the machinery space fans shall in addition to the main power supply also have a supply from the emergency source of power in order to purge the machinery spaces after a fire incident. This fan shall be of the reversible type.

Guidance note:
Hold time after a fire will depend on type of extinguishing media and how long the space has been on fire. In case only a gas fire extinguishing system has been used, typical hold time will be several hours.

3.1.4 All ventilation and air inlets shall be fitted with dampers or other closing arrangements, which can be secured in a closed position. Indicators showing the open or closed position of the dampers shall be fitted adjacent to the controls. The dampers shall be manoeuvrable from open deck or any space separated from the space served by A-60 and with access directly from open deck. For passenger ships, this will be in addition to the controls arranged at the safety centre if arranged below weather deck. The hand lever of dampers is not to be located more than 2 m above the deck.

Guidance note:
The aim of these requirements is to isolate a fire to the space it originated and to prevent supply of oxygen.
3.1.5 All dampers and fire dampers enclosing the engine room shall be made of a material that is corrosion resistant in the marine environment, without the need for coatings or galvanizing, such as stainless steel of a type suitable for the marine environment.

3.1.6 Centralised fire control station
Controls for release of the local extinguishing system, stop of fuel pumps and ventilation fans shall be located in a manned station (typically 16 hours a day). This station can be the engine control room or a manned safety centre. The stations shall be separated from the engine room with minimum smoke tight divisions with access and escape being independent of the engine room.

3.1.7 The CCTV system required by these rules and a fire detection slave panel station shall be located in this station, in the vicinity of the controls installed in the station specified in [3.1.6].

3.1.8 Controls for release main extinguishing system and closing of oil fuel valves shall be readily accessible but can be located outside the centralised fire control station.

3.1.9 Ships accepted to operate with unmanned engine room shall in addition to the above have controls for release of the local extinguishing system also in the wheelhouse.

3.1.10 In cases where the division between engine control room and engine room is of A-class, the above requirement can be combined with the control positions required by SOLAS, as applicable.

3.1.11 Emergency fire pump and fire hoses
The emergency fire pump shall have a capacity of not less than 72 m$^3$/hour. If the emergency fire pump serves other critical safety consumers, the capacity shall be increased accordingly. The pump shall provide a minimum pressure of 5.0 bar for the hydrants in the vicinity of machinery spaces with two water jets in operation.

3.1.12 The space containing the emergency fire pump and its mover shall be well ventilated and provided with emergency light. The pump's prime mover shall be provided with heating unless the space in which it is located has adequate heating facilities. The emergency fire pump shall be tested with power served only from the emergency generator. The pump shall be started and run up to full flow with all other required consumers being connected to the emergency generator.

3.1.13 During start of the fire pump, it has to be ensured that voltage and frequency variations are kept within the limits given in Pt.4 Ch.8 Sec.2 [1.2.4]. Special considerations should be made when the motor driving the emergency fire pump has a power rating exceeding 30% of the rating of the emergency generator. Means to limit voltage peaks when starting the pump may be required.

3.1.14 The size of fire hoses intended for use in machinery spaces shall be chosen based on the number of fire fighters dedicated to this task (38 mm hoses are recommended).

3.2 Oil systems

3.2.1 General
The term oil system means systems for fuel oils, thermal oils, lubricating oils and hydraulic oils.

3.2.2 The arrangement of oil tanks, pipelines for oil under pressure, oil processing machinery etc. shall be such that the danger of leakage and ignition is reduced to a minimum.
3.2.3 Separation of risk objects
The following installations shall be located in space separated from the spaces containing combustion engines and oil fired boilers:
- oil fired thermal oil heaters
- fuel oil purifiers
- incinerators.

3.2.4 The above rooms shall be provided with fixed main fire extinguishing system as per [3.6.1] and a local extinguishing system as per [3.5.1].

3.2.5 Hydraulic power aggregates, regardless of size, accepted within the engine room shall be provided with shielding plates where facing major ignition hazards, such as combustion engines (less than 10 m away) and electric motors and similar (less than 3 m away).

3.2.6 Shielding of oil piping within machinery spaces of category A
Oil piping with working pressure above 15 bar located within a machinery space of category A, apart from those contained within separate spaces required by [3.2.3], shall not be laid above combustion machinery unless arranged in double wall piping with safe drain from annular space. All flanges and couplings shall be provided with steel sheet screens, with small diameter bore at bottom to indicate leaks and divert leakage to safe area. The requirement does not apply to flanges and coupling effectively screened from ignition sources by for instance tight floor plating.

Guidance note:
Certified tape is not accepted as an equivalent.

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3.3 Hot surfaces

3.3.1 Infrared scanning
All engines, exhaust ducts, steam ducts (if any) and similar equipment, where hot surfaces above 220°C may be expected, shall be examined by an infrared scanning camera during normal operation of the machinery (minimum 85% load).

3.3.2 A report shall be issued to the plan approval centre and the local surveyor, identifying all items with temperatures above 220°C. The infrared scanning shall be carried out by certified personnel or in co-operation with a surveyor. The calibration of equipment to be documented and the chosen emissivity factor shall be justified.

3.3.3 Corrective actions shall be taken for all surfaces with temperatures above 220°C. Such actions may include improved insulation or improved heat dissipation (cooling ribs and or similar).

3.3.4 The corrective actions may be verified by manual equipment.

3.3.5 The infrared scanning shall be repeated on an annual basis when the ship is in operation.

3.3.6 Insulation of hot surfaces
All insulation shall be made of non-combustible insulation protected by steel sheet cladding. The cladding shall be easy to dismantle and assemble wherever inspection of the protected equipment is necessary. The intersection between the ducting system and complex geometries can be accepted with foiled faced insulation provided that these areas are limited.
For steam systems the steel sheet cladding shall only be required for areas where oil leakage can be expected.
3.4 Fire detection and confirmation

3.4.1 Fire detection
The requirements in SOLAS and Ch.3 Sec.1 E for ships with periodically unattended machinery space shall be complied with for all ships with F(M) class.

3.4.2 Both machinery spaces of category A (fire category 6) and other machinery spaces (fire category 7) shall be covered by a detection system. For passenger ships, auxiliary machinery spaces (fire category 10 and 11) shall also be covered by the detection system.

3.4.3 Fire detectors of more than one type shall be used for machinery spaces of category A. Smoke detectors shall be provided throughout the space as per FSS Code. In addition, flame detectors shall cover all engines, heated fuel oil separators, oil fired boilers and similar equipment.
Each flame detector shall cover maximum two adjacent engines and in no case a larger coverage area than that approved for the detector in question. Only approved flame detectors of infrared type shall be used (UV is not considered to be equivalent).
The response time (central unit scanning time) from when any detector(s) initiates an alarm, to this alarm condition is reported at the central unit, shall not exceed 5 seconds.

3.4.4 Any workshop shall be provided smoke detectors connected to a timer function that will automatically reset after not more than 20 minutes. In addition, heat detector(s) not connected to this timer shall be provided at suitable locations.

3.4.5 TV monitoring system
A colour TV monitoring system shall cover all engines with rated power above 375 kW, heated fuel oil separators, oil fired boilers and all oil fired equipment, except for the emergency generator which need not to be provided with this system. Monitors shall be available in a manned control station or in an engine control room.

3.5 Local extinguishing systems

3.5.1 General
A local application system in accordance with SOLAS Ch. II-2, Reg.10.5.6 and IMO MSC/Circ.1387 shall be installed. Spaces identified in [3.2.3] shall also be protected.

3.5.2 The local application system and the main fire extinguishing system shall in addition to the specific rules applicable to each system comply with the following requirements:
— the local application system and the main fire extinguishing system shall be independent of each other and not have common components, and
— at least one of the systems shall be fully operable even in a situation where all power supply from the space on fire is not available and the emergency power system is out of operation.

3.5.3 The requirement addressed in [3.5.2] shall be met by accumulators having the extinguishing media stored under sufficient pressure at all times. These accumulators shall be provided in addition to the pump serving the fire extinguishing system under normal conditions.
An arrangement where pumps driven by dedicated diesel engines or ships having two independent power systems in addition to the emergency generator (for example vessels with additional class notation for redundant propulsion, RP ) may be accepted as equivalent to the accumulator solution if the arrangement is considered by the Society to be robust, reliable and quick acting.
**Guidance note:**

Examples of acceptable systems are:

1) CO₂ or equivalent gas system for main fire extinguishing system and a local application system with supply from main and emergency power supply.

2) Water based main fire extinguishing system and a local application system with a pump for continues supply and back-up of 20 minutes water supply (and foam supply, if applicable) from a dedicated pressure vessel.

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### 3.5.4 Arrangement

The local application system shall be type approved by the Society in accordance with IMO MSC/Circ.1387.

### 3.5.5

The system shall be provided with both main and emergency power supply. Systems being served by an accumulator (for instance as a means to comply with the requirement in [3.5.2]) shall also be provided with a water pump complying with all parts of this section. Installation consisting of pumps moved directly by a dedicated diesel engine shall be capable of delivering water at full pressure within 20 seconds (measured from stand-by condition).

### 3.5.6

The system shall discharge freshwater of potable quality. Foam additives are accepted, whereas use of seawater is prohibited for the first 20 minutes of the discharge. The pump shall be able to operate under all conditions without the use of any self-priming system. The pump and its mover shall be provided with heating unless the space in which they are located has adequate heating facilities.

### 3.5.7

Separation of the system into sections shall be approved in each separate case. In any case, pump capacity shall be designed to simultaneously cover risk objects less than 3m apart, also when arranged as separate sections. In addition, the water supply shall be designed to cover all auxiliary engines within a space or the main engine, whichever demands the largest water supply. For other multi-engine arrangements, the system shall cover more than half the engines within an engine room.

### 3.5.8

The spray head arrangement shall be according to the IMO MSC.1/Circ.1387 requirements and the conditions specified in the Society’s type approval certificate, with the additional requirement that fuel oil installations attached to the engines shall also be protected. Turbo charger and other turbo machinery shall be protected. The spray heads shall be installed at a minimum of 1.0 m away from such equipment.

Discharge of water directly into electric generators and engine air intakes shall be avoided.

### 3.5.9

A test and drain valve shall be provided. The valve shall be provided with means to secure it in a closed position after use, whereas any isolation valve shall be secured in the open position. The valves may be located upstream or downstream of the section valves, but shall in any case be installed close to the section valve(s). No other in-line components (check valves, etc.) shall be accepted on the dry pipe side.

### 3.5.10

It shall be possible to manually operate the section valves via a direct manual operation on the stem. Where this is not possible (for instance valves operated on pilot pressure) a manual by pass valve, complying with 3.9.5, shall be provided in parallel with the section valve. A signboard identifying the valve and its operation shall be posted adjacent to the bypass valve.

### 3.5.11

The section valves, test and drain valves, any accumulators, pump unit and its power supply and control equipment shall be readily accessible and shall be located outside the protected spaces (this being defined as outside a boundary being of A-class standard).

### 3.5.12

Automatic release shall be provided for the local application system. This shall be operational even when the ship is without main power, but not necessarily in the dead ship condition where manual release from a readily accessible position is acceptable.
A suitable combination of flame detectors of infrared type and smoke detectors shall be arranged. Discharge of water shall be arranged upon signal from not more than two detectors whereas not less than three detectors shall be provided for each section. All detectors shall be of approved type. The response time (central unit scanning time) from when any detector(s) initiates an alarm, to this alarm condition is reported at the central unit, shall not exceed 5 seconds.

3.5.13 The following procedures shall be stored in the engine control room:

— description of the operation of the system
— how many sections that can be released simultaneously, based on available pump or accumulator capacity
— recommendations for stop of ventilation
— guidelines for when and how to use the main firefighting system in case the local application system does not extinguish the fire.

Guidance note:

When considering ventilation philosophy, note that some small droplet water mist system may be sensitive with respect to performance in well ventilated spaces, especially when distance from protected object to hazard is large. Risk of reduced propulsion or power supply in case of erroneously release of the local extinguishing system should also be taken into consideration.

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3.6 Main extinguishing systems

3.6.1 General

Machinery spaces of category A shall be protected by one of the following fixed fire extinguishing systems:

— a high pressure CO₂ total flooding system as described in [3.6.2]
— a low pressure CO₂ total flooding system as described in [3.6.3]
— a water mist system as described in [3.6.4]
— a high expansion foam or inside air foam system as described in [3.6.5]
— an equivalent gaseous agent as described in [3.6.6].

3.6.2 The main fire extinguishing system shall in addition to these specific rules applicable to each system, comply with the functional requirements of [3.5.2] and [3.5.3].

3.6.3 The following spaces shall be covered by a fixed fire extinguishing system:

— spaces containing main electric propulsion systems (if fitted). This includes electrical motors if inside hull, switchboards and transformers serving such motors
— spaces containing the main switchboards (of any size) and switch boards with capacity exceeding 1000 kW for cargo handling systems (cargo pumps or cargo compressors)
— engine control room.

The system may be omitted for bow thruster rooms if these spaces contain no other fire risks; such as combustion machinery, fuel systems and similar equipment.

The switchboard rooms and similar spaces covered by this requirement shall have a fire extinguishing system suitable for use on high voltage equipment. This will in general imply use of a gas based fire extinguishing system unless that it can be documented that other systems (water mist based on potable water) has equivalent firefighting performance (small fires/enclosed cabinets) and do not damage the electrical equipment.

3.6.4 The main fire extinguishing system shall be type approved by the Society according to the IMO standard applicable to the type of system.

3.6.5 If different types of main fire extinguishing systems (e.g. gas and foam) are used onboard, the protected spaces shall be divided by minimum A-0 divisions.
### 3.6.6 Fixed high-pressure CO₂ total flooding system
Any CO₂ total flooding system for the machinery spaces category A shall comply with FSS Code Chapter 5 in addition to this sub-section element.

#### 3.6.7 The quantity of CO₂ gas shall be sufficient for a minimum volume of 40% of the complete protected space, including any casing.

#### 3.6.8 CO₂ section valve shall be designed to avoid any corrosion problems. The moving parts of the valve shall be made of corrosion resistant materials (stainless steel or equivalent), and there shall not be metal to metal contact between the main moving part (e.g. ball) and the valve housing.

#### 3.6.9 The CO₂ valve shall also be designed for manual operation. For this purpose an extended lever shall be provided for each type of valves with dimension exceeding DN25 (corresponding to pipe with 25 mm diameter).

#### 3.6.10 Piping system upstream of section valves shall be presented to the Society’s surveyor prior to installation of section valves to verify that these pipes are clean.

#### 3.6.11 Slow leak valves shall be provided for the pneumatic release lines to evacuate minor leakages, whereas a pressure gauge shall be fitted to the each enclosed manifold.

#### 3.6.12 The release station(s) shall be clearly marked. A principal diagram of the protected spaces shall be provided at each release station if the CO₂ system has more than one section valve.

### 3.6.13 Fixed low pressure CO₂ total flooding system
Any low pressure CO₂ total flooding system shall comply with FSS Code Chapter 5 and the requirements of [3.6.7] and [3.6.11] in addition to this sub-section element.

#### 3.6.14 The CO₂ tank shall be provided with an external connection (vertical pipe or multiple level drainage valves) for determining liquid level. Float indicators are not considered as being equivalent to the external pipe and shall not be accepted as single means of liquid indication.

#### 3.6.15 The main tank valve and each section valve (timer operated valve) shall be provided with a manual by pass valve. This valve shall be operated manually in case the primary valves fail to operate. A signboard stating required opening time shall be posted adjacent to the bypass valve.

#### 3.6.16 The tank and associated piping system upstream of section valves shall be presented to the Society’s surveyor prior to filling the tank, this in order to ensure that these components are clean.

#### 3.6.17 The release station(s) shall be clearly marked. A principal diagram of the protected spaces shall be provided at each release station if the CO₂ system has more than one section valve.

### 3.6.18 Water mist system
Any water mist system shall comply with SOLAS and the requirements defined in this sub-section element.

**Guidance note:**
Reference is made to IMO MSC/Circ. 1165, as amended.

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#### 3.6.19 Arrangement and dimensioning of the system shall be approved in each case, taking into consideration the volume of protected space, capacity, location of nozzles, location of pump units and power source.

#### 3.6.20 Foam injection pumps, if fitted, shall be duplicated. The backup pumps shall be installed in a manner that minimises the risk of both pumps being stuck by foam concentrate, or any other means of being put out
of operation. One acceptable solution is keep the valves to one foam pump closed after flushing, while the other is in open standby mode.

3.6.21 It shall be possible to manually operate the section valves via a direct manual operation on the stem. Where this is not possible (for instance valves operated on pilot pressure) a manual by-pass valve, complying with the above, shall be provided in parallel with the section valve. A signboard identifying the valve and its operation shall be posted adjacent to the bypass valve.

3.6.22 **High expansion and inside air foam system**
All foam systems shall comply with FSS Code Chapter 6 and the requirements defined in this sub-section element.

3.6.23 Foam injection pumps, if fitted, shall be duplicated. The backup pumps shall be installed in a manner that minimises the risk of both pumps being stuck by foam concentrate or any other means of being put out of operation. One acceptable solution is keep the valves to one foam pump closed after flushing, while the other is in open standby mode.

3.6.24 It shall be possible to operate the foam system and the exhaust fan defined in [3.1.3] simultaneously.

3.6.25 **Equivalent gaseous agent**

3.6.26 Any equivalent gaseous agent for the machinery spaces category A shall comply with IMO MSC/Circ. 848 as amended.

3.7 Portable fire extinguishers

3.7.1 **Number and location**
Only approved 12 kg powder or 9 litre foam portable extinguishers shall be installed in the category A machinery spaces.

3.7.2 The numbers of portable extinguishers shall comply with SOLAS. In addition the following minimum numbers shall be provided at readily accessible positions:
— 4 at the lower level and 4 at the platform level for each main engine (extinguisher can be combined if there are several main engines in one space)
— 1 near each auxiliary engine (3 required for 3 auxiliary engines)
— 1 at the entrance to and 1 inside the spaces defined under [3.2.3].

**Guidance note:**
The required location of the extinguishers is general, and efforts should be made to place these in the vicinity of the installations representing the greatest risk of fire. When installations are placed in separate rooms of limited size, some or all of the required extinguishers can be placed immediately outside the doors leading into these rooms.

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4 Cargo decks and cargo spaces

4.1 **Introduction**

4.1.1 **Purpose, application and general requirements**
The purpose of these requirements is:
— to quickly detect and confirm a fire (applicable for enclosed spaces)
— to ensure that the fire extinguishing system operates as intended and has the reliability and performance that is needed to extinguish a fire.
4.1.2 The rules apply to the following ship types:
— tankers for oil, tankers for chemicals (including combinations)
— tankers for liquefied gas (LNG, LPG)
— general cargo carriers and dry bulk cargo carriers
— ships with ro-ro decks (car carriers, general ro-ro ships, ferries)
— container carriers.

Each of the above ship types has a dedicated paragraph ([4.2] through [4.6]) in this section. Only the requirements defined under the applicable paragraph(s) shall apply with respect to F(C) additional class notation.

4.2 Tankers for oil, tankers for chemicals

4.2.1 Gas detection systems and inert gas systems
The fixed gas detection system required by SOLAS Ch. II-2, Reg.4.5.10 shall be extended to cover all other enclosed spaces in the cargo area, including ballast tanks, but excluding cargo tanks.

4.2.2 An inert gas generating system in compliance with SOLAS Ch. II-2, Reg.4.5.5 shall be provided for all tankers with F(C) class notation (also those being less than 20 000 GT).

4.2.3 Cargo pump rooms
Cargo pump room shall have a fixed fire extinguishing system that complies with SOLAS and the requirements defined for F(M) additional class notation ([3.6]).

4.2.4 If a CO₂ system is provided, the available quantity of CO₂ gas shall be sufficient to give a minimum volume of free gas corresponding to 45% of the gross volume. If gas fire extinguishing system of another type is provided, the gas concentration shall be minimum 1.3 times the ideal extinguishing concentration for the cargos in question, but in no case less than that required by IMO MSC/Circ. 848.

Guidance note:
Some of the cargoes carried on crude oil tankers and chemical tankers may require a higher concentration of the fire extinguishing gas than that established for refined fuel oils.

4.2.5 A smoke detection system approved for use in gas hazardous atmosphere and in compliance with IMO FSS Code Ch.9 shall be provided in the cargo pump room. The system shall be monitored from the cargo control room (if provided) and the wheelhouse.

4.2.6 One portable extinguisher shall be provided adjacent to the entrance of the cargo pump room and two shall be located in readily accessible positions in the lower part of the cargo pump room. The portable extinguishers shall be approved 12 kg powder or 9 l foam portable extinguishers.

4.2.7 Fire main system (ring main)
The ship shall have a fire main on deck arranged as a ring main to the port and starboard side. Isolation valves shall be globe valves of steel or approved fire safe butterfly valves. Both main fire pumps shall be arranged with remote start from the wheelhouse. Other requirements for the fire main shall be as specified in SOLAS and the rules.

Guidance note:
Butterfly valves tested to API 607 or equivalent may be approved.

4.2.8 There shall be fire hose equipment for at least half the number of hydrants required for the tank deck, in no case shall less than 9 fire hoses be provided for ships below 10 000 GT and 12 fire hoses for ships above this size. The equipment shall be stored in clearly marked boxes made of corrosion resistant materials.
(FRP or equivalent). One box with a minimum of 3 hoses shall be provided next to the accommodation superstructure, readily accessible for use on the tank deck (not more than one deck above the tank deck). A minimum of two portable foam applicators, required by SOLAS, shall be stored next to the front of the accommodation facing cargo area, whereas a minimum of two shall be at a suitable position for ready use on the cargo manifolds (the position will be aft of the manifold on a standard tanker).

4.2.9 The size of the fire hoses shall take into account the manning and firefighting philosophy of the ship. The size of the fire hoses placed within cargo area shall have diameters of 50 mm or 38 mm. All couplings and hose connections for use within the cargo deck area shall be interchangeable.

4.2.10 All hoses shall be capable of also handling supplies from the foam line. The hose shall be made of synthetic fibres and shall be approved according to the most recent edition of EN 671-2, ISO 15540 or 15541 or an equivalent standard. The nozzle shall be made of metallic, corrosion resistant material. All movable parts shall be of copper alloy or equivalent. All the hydrants onboard shall be made of copper alloy or an equivalent material.

4.2.11 Foam main system
These requirements apply to all tankers above 4 000 grt. Tankers below 4 000 grt need not a foam ring main but shall have a fixed foam main and monitor system in compliance with the FSS Code Chapter 14 (applicators only are not considered as equivalent).

4.2.12 The ship shall have an independent foam main for the deck foam extinguishing systems as specified in SOLAS and the rules. This line shall be arranged along the centre line as a single line with foam outlet branches to both port and starboard arranged just aft of each monitor. For the two monitors required in front of the accommodation, one foam hydrant to be arranged. Marked boxes made of corrosion resistant materials containing hose and foam nozzle to be placed adjacent to each foam hydrant. The arrangement shall otherwise comply with SOLAS and the rules.

4.2.13 The foam extinguishing system shall have redundancy in design with two foam mixing units and two foam concentrate pumps placed together with the storage tank for foam concentrate in a dedicated room.

4.2.14 The water supply to the foam extinguishing system shall be supplied by the main fire pumps. The capacity of the pumps shall be sufficient for simultaneously meeting the requirement of the foam system as defined in SOLAS and the rules (applied though the monitors) and with one foam nozzle engaged (400 l/min) from the foam line and two fire hoses engaged (2 x 400 l/min) from the fire main.

4.2.15 Arrangement of the foam concentrate pumps and the foam mixing units together with the main fire pumps shall be such that each of the two sets will be capable of delivering the required amount of foam solution. The pumps shall be installed in a manner that minimises the risk of both pumps being stuck by the foam concentrate or otherwise put out of operation. One acceptable solution is keep the valves to one foam pump closed after flushing, while the other is in open standby mode.

4.2.16 Foam concentrate sufficient for 30 minutes of continuous foam production shall be stored onboard. Only synthetic foam (not protein based) shall be provided.

4.2.17 The monitors shall have a free movement of plus or minus 45° in the vertical plane and in the horizontal plane they shall be able to point at any part of the deck intended to be protected. The monitors shall be lockable in any position within these ranges. The monitors and their foundations shall be of strong construction and capable of withstanding the loads that they will be subjected to on the open deck.

4.2.18 Two foam monitors at each side of the accommodation front and monitors covering the cargo manifold shall be arranged for remote control from the bridge or from another protected area with a good view over the area covered by the monitors. The remote control arrangement shall cover the vertical as well as the horizontal movement of the monitors. These monitors shall be of a type that is in a fixed position when not operated by crew. Valves positioned within cargo area for supply of foam mixture to the monitors shall be capable of remote operation from the same position as the remote control for the monitors.
4.2.19 Water spray protection for lifeboats
Lifeboats that are not shielded by steel bulkheads from the cargo areas shall be provided with a water spray system. The system can be supplied from the fire main and shall in any case be capable of quick release from the wheelhouse. The system shall deliver minimum 10 l/min/m² for the sides and top of each lifeboat. The capacity for water spray shall be added to the requirements for the main fire pumps given in [4.2.2] and [4.2.3] if these are used for supply to the water spray system for lifeboats.

4.2.20 Firefighter’s outfits
The ship shall be provided with not less than 6 sets of Firefighters’ outfits, which shall comply with, [1.6].

4.3 Tankers for liquefied gas

4.3.1 Cargo handling spaces
The following spaces shall be provided with a fire extinguishing system complying with this section:
— cargo compressor room
— cargo re-liquefy room, if fitted
— any electrical equipment room or other such spaces located in the cargo area.

4.3.2 The fire extinguishing system shall comply with the requirements defined for F(M) additional class notation ([3.6]). Note the requirements for ex-rating electrical equipment in gas dangerous spaces.

4.3.3 If a CO₂ system is provided, the available quantity of CO₂ gas shall be sufficient to give a minimum volume of free gas corresponding to 45% of the gross volume. If gas fire extinguishing system of another type is provided, the gas concentration shall be minimum 1.3 times the ideal extinguishing concentration for the cargos in question, but in no case less than that required by IMO MSC/Circ. 848.

Guidance note:
Substances like methane, ethane and heavier gases will normally require a higher concentration of the fire extinguishing gas than that established for fuel oils.

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4.3.4 A smoke detection system approved for use in gas hazardous atmosphere shall be provided. The system shall be monitored from the wheelhouse.

4.3.5 Fire main system
The fire main system shall be as given for other tankers under [4.2.2].

4.3.6 In addition, fixed water monitors supplied with water from the fire main shall be arranged at the same position as the powder monitors for additional coverage of the cargo manifold area. The water monitors shall have fixed arrangement for making dispersion of the water jet creating a water spray of not less than 10 l/min/m² horizontal coverage of the manifold area extending 1.5 meter to each side and aft and forward from the manifold connections. The water monitors and section valve for water supply to monitors shall be arranged with both manual and remotely operation from a safe position outside of the cargo area.

4.3.7 Powder fire-extinguishing system
The dry chemical powder fire-extinguishing systems shall satisfy the requirements as specified in Pt.5 Ch.7 Sec.11 in addition the requirements in this sub-section element.

4.3.8 The dry powder stored on the tanks shall provide for 60s operation of each system, when all attached monitors are activated.

4.3.9 The powder distribution lines and the pressure gas lines shall be made of stainless steel grade 316 or equivalent corrosion resistant materials.
### 4.3.10 Nitrogen shall be provided as pressure gas for the powder. All release lines associated to the pressure tank (also on the low pressure side) shall be regarded as class I piping. However, the main powder line can be classified as class III piping.

**Guidance note:**
CO₂ is not considered as equivalent to nitrogen as the content cannot be readily checked. Class I piping is required, as pressure regulators and safety valves are sometimes clogged by the powder and become inoperative. This can pressurise piping systems not intended for direct connection with the nitrogen cylinders.

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

### 4.3.11 The distance from the powder tank to the monitors shall be limited to 10m. However, if full scale testing has documented that the powder system can handle longer lines and measures are implemented to avoid free water in the lines (self-draining pipes for example), longer distances may be considered.

### 4.3.12 Each dry powder hose station shall consist of:
- 1 dry powder trigger nozzle
- 1 dry powder hose line
- 1 nitrogen gas container for pneumatic release.

The equipment shall be stored in boxes made of corrosion resistant materials. The boxes shall be clearly marked and provided with brief instructions for operation of the system in the official language of the flag state as well as in English.

### 4.3.13 Fire extinguishing in the gas venting arrangement
Venting masts for cargo tank venting system on liquefied gas carriers shall be provided with a fixed system for extinguishing a fire at the vent outlet. Nitrogen, CO₂ or any other suitable medium is acceptable.

### 4.3.14 Water spray system for cargo tanks and manifolds

### 4.3.15 The water spray system required by IGC Code 11.3 shall have piping made of CuNi or equivalent corrosion resistant materials.

### 4.3.16 Water spray protection for lifeboats
Lifeboats that are not shielded by steel bulkheads from the cargo areas shall be provided with a water spray system. The system can be supplied from the fire main and shall in any case be capable of quick release from the wheelhouse. The system shall deliver minimum 10 l/min/m² for the sides and top of each lifeboat. The capacity for water spray shall be added to the requirements for the main fire pumps given in [3.6] if these are used for supply to the water spray system for lifeboats.

### 4.3.17 Firefighter’s outfits
The ship shall be provided with not less than 8 sets of firefighters’ outfits, which shall comply with, [1.6].

### 4.4 General cargo carriers and dry bulk cargo carriers

#### 4.4.1 Application
The rules apply to dry cargo spaces (holds in bulk carriers and general cargo spaces) for ships having F-(C) additional class notation. The requirements apply to all cargo spaces as defined in SOLAS.

#### 4.4.2 Fire detection
The requirements of SOLAS, FSS Code and the rules shall be complied with.

#### 4.4.3 All dry cargo holds shall be fitted with a detection system based on smoke extraction or heat detection, which automatically indicates the presence of smoke or abnormal heat in any of these holds.
4.4.4 Fire extinguishing system
The requirements of SOLAS, FSS Code and the rules shall be complied with. A ship having an exemption certificate (and thus not provided with a fixed fire extinguishing system for cargo spaces) cannot be assigned F-C additional class notation.

4.4.5 The storage room for the fixed fire extinguishing medium shall be easily accessible and close to the main superstructure. Operation controls for the fixed fire extinguishing system shall be grouped and shall be easily accessible.

4.4.6 If a high pressure \( \text{CO}_2 \) system is fitted, it shall comply with the requirements regarding components specifications, cleaning of piping and operational procedures for \( F(\text{M}) \) additional class notation ([3.5.4] and [3.6.6] to [3.6.12]). Further, when \( \text{CO}_2 \) is used for extinguishing, the available quantity of \( \text{CO}_2 \) gas shall be sufficient to give a minimum volume of free gas corresponding to 40% of the gross volume of the largest hold.

4.4.7 Any other type of fire extinguishing system shall comply with applicable requirements specified in the \( F(\text{M}) \) additional class notation ([4.5.3] to [4.5.5] and [4.5.7] to [4.5.8]).

4.4.8 Piping carrying fire extinguishing media such as \( \text{CO}_2 \) and water, for example, shall be protected internally and externally against corrosion for parts located outside the cargo space being protected. Full galvanised piping is accepted unless other requirements specify higher material standards.

4.4.9 Firefighter’s outfits
The ship shall be provided with 4 sets of firefighters’ outfits, which shall comply with [1.4].

4.5 Ships with ro-ro decks (car carriers, general ro-ro ships, ferries)

4.5.1 Application
The rules apply to ro-ro decks and special category spaces for ships having \( F(\text{C}) \) additional class notation.

4.5.2 Fire detection and confirmation
The requirements of SOLAS, FSS Code and the rules shall be complied with.

4.5.3 All ro-ro and special category spaces shall be covered by combined smoke and heat detectors served by an addressable fire detection system. The system shall be connected to a software based presentation system that displays the alarms on a general layout drawing.

4.5.4 Fire confirmation (TV monitoring system for passenger ships)
A colour TV monitoring system shall cover all decks, including moveable decks. Monitors shall be available in a manned control station. This requirement if only applicable to passenger ships (ferries).

4.5.5 Portable extinguishers
The requirements of SOLAS, FSS Code and the rules shall be complied with.

4.5.6 The required portable extinguishers shall be approved 12 kg powder or 9 l foam portable extinguishers.

4.5.7 Fire extinguishing system
The requirements of SOLAS, FSS Code and the rules shall be complied with. The system that is provided shall in addition comply with [4.5.6] and [4.5.8] to [4.5.9]. One of the following systems shall be installed:
- high pressure \( \text{CO}_2 \) system as described in [4.5.8]
- low pressure \( \text{CO}_2 \) system as described in [4.5.10]
- water mist system as described in [4.5.12]
- water spray/mist system according to MSC.1/Circ.1430
- high expansion foam or inside air foam as described in [4.5.13].
4.5.8 High pressure CO\textsubscript{2} systems
The requirements regarding components specifications, cleaning of piping and operational procedures for the F(M) additional class notation ([3.5.4] and, [3.6.8] to, [3.6.11]) shall be implemented.

4.5.9 A connection from the fire main system to the CO\textsubscript{2} discharge piping shall be provided. This connection shall be non-permanent (spool piece or fire hose to be used) and located in a space being readily accessible in case of a fire. It shall be possible to release the water through any of the CO\textsubscript{2} section valves.

Guidance note:
The purpose of this system is to cool down the space on fire after a CO\textsubscript{2} release or in case the CO\textsubscript{2} system fails to operate. It can also be applied to cool down the cargo space above the space on fire.

4.5.10 Low pressure CO\textsubscript{2} systems
The requirements regarding tank level indication, components specifications, back-up valves, cleaning of piping and operational procedures for F(M) additional class notation ([3.6.13] and, [3.6.15] to [3.6.17]) shall be implemented.

4.5.11 A connection from the fire main, as defined for the high pressure CO\textsubscript{2} systems ([4.5.9]) shall be provided.

4.5.12 Water mist
The requirements regarding dimensioning and foam pump for F(M) additional class notation ([3.6.18]) shall be implemented. The applicable IMO standard for this system is MSC.1/Circ.1430.

4.5.13 High expansion and inside air foam system
The requirements regarding dimensioning and foam pump for F(M) additional class notation ([3.6.22] and [3.6.23]) shall be implemented.

4.5.14 It shall be possible to operate the foam system and at least one exhaust fan simultaneously. This fan can be served by power from the main switchboard, but power and control cables shall be routed independent of the protected space.

4.5.15 Communication - radios
The ship shall be provided with a minimum of 10 sets of type approved UHF radios of specified type. Only one type of radio shall be used for this purpose. Relevant SOLAS requirements and the Society's Statutory Interpretations apply for mandatory internal communications systems.

4.5.16 At least two of the radios shall be especially adapted for use by the firefighting team (installed inside helmet).

4.5.17 Stations for relaying the UHF signals shall be provided, where a radio at the ro-ro deck cannot communicate with the bridge or another radio on the ro-ro deck. This requirement shall apply to a minimum of 95% of the accessible ro-ro deck. Relevant SOLAS requirements and the Society's Statutory Interpretations apply for mandatory internal communications systems.

4.5.18 Firefighter's outfits
The ship shall be provided with 8 sets of firefighter's outfits, which shall comply with [1.6].

4.6 Container carriers

4.6.1 Application
The rules apply to container carriers for ships having F(C) additional class notation.
4.6.2 Fire extinguishing system – enclosed cargo holds
The requirements of SOLAS, FSS Code and the rules shall be complied with.

4.6.3 The storage room for the fixed fire extinguishing medium shall be easily accessible and close to the main superstructure. Operation controls for the fixed fire extinguishing system shall be grouped and shall be easily accessible.

4.6.4 If a high pressure CO\textsubscript{2} system is fitted, it shall comply with the requirements regarding component specifications, cleaning of piping and operational procedures for \textit{F(M)} additional class notation ([3.5.4] and [3.6.8] to [3.6.11]). Further, when CO\textsubscript{2} is used for extinguishing, the available quantity of CO\textsubscript{2} gas shall be sufficient to give a minimum volume of free gas corresponding to 40\% of the gross volume of the largest hold.

4.6.5 Any other type of fire extinguishing system shall comply with applicable requirements specified in the \textit{F(M)} additional class notation ([4.5.4], [4.5.5], [4.5.7] or [4.5.8]).

4.6.6 Piping carrying the fire extinguishing media such as CO\textsubscript{2} and water, for example, shall be protected internally and externally against corrosion for parts located outside the cargo space being protected. Full galvanised piping is accepted unless other requirements specify higher material standards.

4.6.7 Fire extinguishing systems – open decks
The main fire pumps and available general service pumps shall have a total capacity of at least 250 m\textsuperscript{3}/h at a minimum of 10 bar.

4.6.8 The fire main line on cargo deck shall be dimensioned for a flow of 250 m\textsuperscript{3}/h at a flow velocity not exceeding 5 m/s (typically pipes with 125 mm diameter) and shall be provided with manually operable isolation valves every 40 m. Isolation valve shall also be installed adjacent to the accommodation superstructure before entering the cargo spaces forward and aft of this superstructure.

4.6.9 The fire main line shall have double hydrants for each 25 m. 10 fire hoses of suitable type (38 mm diameter is recommended) shall be provided at a readily accessible locker for use on the cargo deck. The hoses shall be divided equally both sides.

4.6.10 At least two mobile water monitors with flexible supply hoses of suitable capacity and length shall be provided. These shall have a capacity of minimum 60 m\textsuperscript{3}/h each, with an effective through length of minimum 25 m when tested onboard with 2 monitors and 2 fire hoses in operation. The monitors shall be of a type that can be fixed to the ships structure and thus be operated without the crew being in position.

4.6.11 At least two water mist lances shall be provided. These shall be of a type capable of penetrating a standard container. Alternatively, dedicated tools for this purpose shall be provided. A separate water supply system, capable of supplying the two lances for 60 minutes, shall be installed if the lances cannot use the fire main system.

Guidance note:
This guidance note applies to [4.6.9], [4.6.10] and [4.6.11]. The purpose of these systems is as follows. The large numbers of hoses are required to provide flexibility for the fire fighters when fighting fires in the containers or cooling the cargo hatches to avoid collapse. The mobile monitors are intended to cool down the container on fire and adjacent containers and thereby prevent the fire from escalating and preventing any hazardous cargo form exploding due to heat radiation. The water mist lances are provided to extinguish fires in containers that cannot be accessed or where opening the container door can escalate the fire.

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

4.6.12 Communication - radios
The ship shall be provided with a minimum of 10 sets of type approved UHF radios of specified type. Only one type of radio shall be used for this purpose. Relevant SOLAS requirements and the Society’s Statutory Interpretations apply for mandatory internal communications systems.
4.6.13 At least two of the radios shall be specially adapted for use by the firefighting team (installed inside helmet). Stations for relaying the UHF signals shall be provided, where a radio at the ro-ro deck cannot communicate with the bridge or another radio on the ro-ro deck. This requirement shall apply to a minimum of 95% of the accessible ro-ro deck (see Pt.5 Ch.3).

4.6.14 Firefighter’s outfits
The ship shall be provided with 8 sets of firefighters’ outfits, which shall comply with [1.6].
SECTION 5 HELICOPTER INSTALLATIONS - HE LD K

1 General

1.1 Introduction
The additional class notation HELDK provides a design standard for vessels with an erected landing platform for helicopters, or a landing area arranged directly on the weather deck or on the top of a deckhouse.

1.2 Scope
The scope for additional class notation HELDK provides requirements for design loads, structural strength, personnel safety, vessel safety and helicopter refuelling facilities for vessels with an erected or integrated helicopter landing platform. These requirements are not intended to apply to landing areas used for occasional or emergency operations as regulated by SOLAS Ch. II-2 Reg. 18.2.2. The responsibility for compliance with national requirements, not covered by these rules, rests with the operator of the vessel on which the helicopter deck is arranged. It will be necessary also to comply with the safety regulations of the flag state in which the vessel is registered.

1.3 Application
The additional class notation HELDK applies to vessels built in compliance with the relevant requirements in this section. The basic notation HELDK may be extended by supplementary qualifiers where compliance with additional requirements have been met; such as HELDK(S), HELDK(S, H), HELDK(S, H, F). An additional supplementary qualifier CAA-N may be added when the vessel has either HELDK(S, H) or HELDK(S, H, F) notation, e.g. HELDK(S, H, CAA-N).

Details of these notations can be found in Table 1. If the Society is delegated to issue the SOLAS Safety Construction and Safety Equipment Certificates on behalf of the flag state, SOLAS Reg. II-2/18 will apply as a minimum requirement with respect to fire safety. The non-structural requirements given for the helicopter deck notations are based on CAP 437 - Offshore helicopter landing areas - guidance on standards.

1.4 Class notations

1.4.1 Vessels built in compliance with the requirements as specified in Table 1 will be assigned the class notations as follows:

Table 1 Optional class notations

<table>
<thead>
<tr>
<th>Class notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELDK</td>
<td>&lt;none&gt;</td>
<td>helicopter deck structure, see [1], [2], [3] and [4]</td>
<td></td>
</tr>
<tr>
<td>Mandatory: No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design requirements:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>— this section</td>
<td>S</td>
<td>vessel safety, see [5]</td>
<td></td>
</tr>
<tr>
<td>FiS survey requirements:</td>
<td>H</td>
<td>helicopter safety, see [6]</td>
<td></td>
</tr>
<tr>
<td>— Pt.7 Ch.1 Sec.6</td>
<td>F</td>
<td>helicopter service facility, see [7]</td>
<td></td>
</tr>
<tr>
<td>CAA-N</td>
<td></td>
<td>requirements specified by the Norwegian Civil Aviation Authorities, see [8]</td>
<td></td>
</tr>
</tbody>
</table>
1.5 Definitions

1.5.1 Terms
For terms, symbols and definitions not defined in this section, refer to Pt.3 Ch.1 Sec.4.

Table 2 Terms

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>helideck</td>
<td>purpose built helicopter landing area located on a ship including all structure, firefighting appliances and other equipment necessary for the safe operation of helicopters</td>
</tr>
<tr>
<td>helicopter facility</td>
<td>helideck including any refuelling and hangar facilities</td>
</tr>
<tr>
<td>helicopter landing area</td>
<td>an area on a ship designed for emergency landing of helicopters</td>
</tr>
<tr>
<td>RAST</td>
<td>recovery, assist, secure and traverse</td>
</tr>
<tr>
<td>SHOLS</td>
<td>ship helicopter operations limitations</td>
</tr>
</tbody>
</table>

1.6 Documentation requirements

1.6.1 Class notation HELDK
Documentation shall be submitted as required by Table 3.

Table 3 Documentation requirements – class notation HELDK

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter deck arrangement</td>
<td>H050 – Structural drawing</td>
<td>deck, substructure and safety net supports including reaction forces at the hull supports</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>H050 – Structural drawing</td>
<td>tie-down points, including capacity (breaking load)</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>H050 – Structural drawing</td>
<td>steel and aluminium connections, including specification of insulation materials and bolts</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>H080 – Strength analyses</td>
<td>including specification of helicopter type, overall length with rotors running, maximum total mass and wheel load distribution</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>including location of tie-down points</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z252 – Test procedure at manufacturer</td>
<td>load test. For erected decks built up by unconventional profile</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z262 – Report from test at manufacturer</td>
<td>load test. For erected decks built up by unconventional profiles.</td>
<td>AP</td>
</tr>
<tr>
<td>Helicopter deck nets</td>
<td>Z030 – Arrangement plan</td>
<td>landing net/rope net</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>safety net, including strength</td>
<td>AP</td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information
1.6.2 Qualifier S
Documentation shall be submitted as required by Table 4.

Table 4 Documentation requirements – qualifier S

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter deck arrangement</td>
<td>M020 – Material specification, fire related properties</td>
<td>deck and insulation towards superstructure</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>escape routes, rescue equipment, firefighting equipment, hatches and drainage</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z262 – Report from test at manufacturer</td>
<td>fire test of aluminium deck</td>
<td>AP</td>
</tr>
<tr>
<td>Aeronautical communication</td>
<td>Z100 – Specification</td>
<td>details of VHF installation</td>
<td>AP</td>
</tr>
<tr>
<td>Helicopter deck foam fire extinguishing system</td>
<td>G200 – Fixed fire extinguishing system documentation</td>
<td></td>
<td>AP</td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information

1.6.3 Qualifier H
Documentation shall be submitted as required by Table 5.

Table 5 Documentation requirements – qualifier H

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter obstacle-free sector</td>
<td>Z030 – Arrangement plan</td>
<td>including height of all obstacles</td>
<td>AP</td>
</tr>
<tr>
<td>Helicopter deck daylight marks</td>
<td>Z030 – Arrangement plan</td>
<td>including details and position of wind indicator</td>
<td>AP</td>
</tr>
<tr>
<td>Helicopter deck night operation marks</td>
<td>Z030 – Arrangement plan</td>
<td>floodlights and perimeter lights</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>E170 – Electrical schematic drawing</td>
<td>including power supply</td>
<td>AP</td>
</tr>
</tbody>
</table>

AP = For approval; FI = For information

1.6.4 Qualifier F
Documentation shall be submitted as required by Table 6.

Table 6 Documentation requirements – qualifier F

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter deck arrangement</td>
<td>Z100 – Specification</td>
<td>non-skid coating on deck between landing area and hangar and in the hangar</td>
<td>AP</td>
</tr>
</tbody>
</table>
### Equipment and design features

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hangar arrangement</td>
<td>Z030 – Arrangement plan</td>
<td>including escape routes, location of equipment, drainage arrangement, rope nets and rapid securing or traversing system (recessed grid, rails and other arrangements)</td>
<td>AP</td>
</tr>
<tr>
<td>Hangar</td>
<td>H050 – Structural drawing</td>
<td>including hangar doors. Including functional loads/design information, e.g. the horizontal components of the helicopter down wash on the hangar</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>H050 – Structural drawing</td>
<td>tie down points, including capacity (breaking load)</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>tie down points</td>
<td>AP</td>
</tr>
<tr>
<td>Helicopter fuel system</td>
<td>Z030 – Arrangement plan</td>
<td>refuelling area, including position relative to accommodation and embarkation areas. Including drainage facilities</td>
<td>AP</td>
</tr>
<tr>
<td>Helicopter fuel storage tanks</td>
<td>H050 – Structural drawing</td>
<td>including inspection hatches, level indicators, ventilation and foundations</td>
<td>AP</td>
</tr>
<tr>
<td>Helicopter fuel piping system</td>
<td>S010 – Piping diagram</td>
<td>including filters, flow meters, delivery hoses, earth connections and emergency shut-down arrangement from safe location</td>
<td>AP</td>
</tr>
<tr>
<td>Hazardous area classification</td>
<td>G080 – Hazardous area classification drawing</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Structural fire protection arrangements</td>
<td>G060 – Structural fire protection drawing</td>
<td>helicopter hangar and service area, including decks, bulkheads, doors and closing appliances</td>
<td>AP</td>
</tr>
<tr>
<td>Fire detection and alarm system</td>
<td>I200 – Control and monitoring system documentation</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Hangar water spraying fire extinguishing system</td>
<td>G200 – Fixed fire extinguishing system documentation</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Ventilation systems for hangars</td>
<td>S012 – Ducting diagram</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>S030 – Capacity calculation</td>
<td></td>
<td>AP</td>
</tr>
</tbody>
</table>

**1.6.5 Qualifier CAA-N**

Documentation shall be submitted as required by **Table 7**.

**Table 7 Documentation requirements – qualifier CAA-N**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helicopter deck arrangement</td>
<td>Z300 – Declaration</td>
<td>turbulence conditions</td>
<td>FI</td>
</tr>
</tbody>
</table>

**AP = For approval; FI = For information**

For general requirements for documentation, including definition of the info codes, see **Pt.1 Ch.3 Sec.2**.
1.7 Certification requirements

1.7.1 For products that shall be installed on board, the builder shall request the manufacturers to order certification as described in Table 8.

Table 8 Certification requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard*</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage tanks and associated equipment for flammable liquids</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td>for qualifier F</td>
</tr>
<tr>
<td>Foam concentrate</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td>including physical properties and production date</td>
</tr>
<tr>
<td>Bimetallic connection flats</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td>approved manufacturer</td>
</tr>
</tbody>
</table>

*Unless otherwise specified the certification standard is the rules.

1.7.2 For general certification requirements, see Pt.1 Ch.3 Sec.4.

1.7.3 For a definition of the certification types, see Pt.1 Ch.3 Sec.5.

1.8 Testing requirements

1.8.1 Load test for erected helidecks built up of unconventional profiles
For erected helidecks built up of unconventional profiles, the capacity of the profiles shall be documented through a load test which shall be witnessed by a surveyor. A load test procedure shall be submitted for approval prior to the load test being carried out, and the results shall be documented in a test report which shall be approved by the Society. Requirements to the load test are given in [1.8.2] to [1.8.5].

1.8.2 The beams shall be load tested without any permanent deflections for a load of 3 times the fraction of the maximum take-off mass of helicopter acting on the wheel(s)/part of tubular skid having the highest load.

1.8.3 The length between the supports shall be equal to or bigger than the maximum span that is used in the applicable design.

1.8.4 The support of the beams shall reflect the worst possible situations in the applicable design.

1.8.5 The test load shall be distributed over an area equal to the contact area during landing, as specified by the helicopter manufacturer. When simulating the contact area for the helicopter wheels, rubber pads equivalent in size to the contact area shall be fitted on the steel plate onto which the force is applied.

1.8.6 Testing of landing area and hangar deck
The helicopter deck shall be hose tested for watertightness.

1.8.7 Drainage in the landing and hangar deck area shall be tested for functionality with all fire extinguishing systems in operation.

1.8.8 The coating on the landing area and in the hangar (qualifier F) shall be tested in order to check that the required coefficient of friction or more is obtained.
1.8.9 Testing of visual landing aids
The visual landing aids shall be tested for correct functionality.

1.8.10 Testing of fire protection
The fire protection system shall in accordance with approved test procedures be functionality tested. The test shall cover:
— remote control functions of foam monitor(s)
— validity of batch certificate for the foam concentrate
— correct mixing ratio of foam proportioner
— helicopter deck foam system (by means of monitors) if installed, shall include throw length of monitors (75% of throw length credited in still air) with sea water
— helicopter deck foam system (by means of pop up sprinklers) if installed, shall include function test of pop-up nozzles and their distribution pattern in accordance with system manuals with sea water
— hangar fixed fire extinguishing system complying with SOLAS 2000 II-2/10.5 shall be tested as required for water based spray/mist/foam systems for machinery category A spaces.

1.8.11 Testing of fire integrity of aluminium structure
These rules consider aluminium helicopter decks as being equivalent to steel with respect to fire integrity when tested as outlined below.

Test procedure:
— size of prototype helicopter deck 5 ×5 m
— a static load simulating actual helicopter weight to be present on the deck
— helicopter fuel shall be continuously supplied to the deck for 10 minutes, so that the deck is filled with fuel at all times during the test. At all times during the test should fuel be dripping from drainage arrangements while there is a fire on the deck.

Acceptance criteria (visual observations of the deck and sealing):
— the helicopter deck shall not collapse or be deformed
— no fuel leakage or flames shall be observed under the deck.

The test shall be witnessed by a recognized society.

Guidance note 1:
This test does not consider other aspects, for example rotor damage caused by an overturned helicopter. For qualifier S, aluminium helicopter decks are required to be tested as outlined above.

Guidance note 2:
For notation HELDK, SOLAS Ch. II-2 Reg. 18.3.2 will be used when the Society is delegated to issue SOLAS safety certificates.

1.9 Materials

1.9.1 The grades of steel and aluminium materials shall be in compliance with the requirements for hull materials given in Pt.3 Ch.3 Sec.1.

1.9.2 The extent of press weld testing as outlined in Pt.2 Ch.2 Sec.10 [1.10] need not be complied with for profiles in erected aluminium helicopter decks. For such profiles, press weld testing can be carried out on one sample per heat and batch.

1.9.3 In welded zones of rolled or extruded aluminium products (heat affected zones) the mechanical properties given for extruded products may in general be used as basis for the scantling requirements as outlined in Pt.3 Ch.3 Sec.1 [4].
1.10 Steel and aluminium connections

1.10.1 In sea exposed areas, to prevent galvanic corrosion, a non-hygroscopic insulation material shall be applied between steel and aluminium. Bolts with nuts and washers shall be of stainless steel.

Guidance note:
Stainless steel shim is considered applicable non-hygroscopic material.

1.10.2 Horizontal inertia forces in bolted connections may be required to be taken up by metal to metal stoppers with insulation tape in the gap.

1.10.3 Aluminium superstructures, which are provided with insulating material between aluminium and steel, shall be earthed to the hull. See Pt.4 Ch.8.

1.10.4 For welded connections, any bimetallic connection flats shall be delivered from approved manufacturer and with the Society’s product certificate. The bimetallic connection flats shall be approved for use in sea exposed environment.

Maximum allowable stresses in the bimetallic connection shall be included in the documentation.

Aluminium-steel transition joints (bi-metallic connections) shall not be used when exposed to tensile loads.

2 Design loads and load combinations

2.1 General

2.1.1 The scantlings of each structural element shall be based on the most unfavourable of the following loading conditions:
— landing condition
— stowed condition (helicopter lashed onboard at sea).

Guidance note:
In the stowed condition, the helicopter deck strength and its supporting structure may be checked using Pt.3 Ch.6 and the wheel loading requirements given in Pt.3 Ch.10 Sec.5.

2.1.2 Both the normal operational conditions and any identifiable accidental conditions shall be considered. The following loads are in general to be considered:
— landing impact forces
— gravity and inertia forces of the helicopter in stowed position
— hull still water loads (applicable for use of weather decks as helicopter deck)
— sea pressure.

Guidance note:
Wind loads on the helicopter in stowed condition may generally be neglected.

2.1.3 For landing platforms erected as separate structure the following loads are also to be considered:
— gravity and inertia forces of the structure with equipment
— wind forces (for erected structures)
— ice loads.
2.1.4 In the landing condition, the landing impact force shall be combined with associated environmental loads. Heel and trim need not be considered.

2.1.5 The loads in [2.2] to [2.5] shall be combined as follows:

Operational conditions:
1) Landing condition
   — landing force
   — gravity forces of the structure with equipment.
2) Stowed condition (helicopter lashed onboard)
   — gravity and inertia of the helicopter
   — gravity and inertia of the structure with equipment
   — hull bending loads (only applicable for integrated helicopter decks)
   — sea pressure
   — ice loads on erected helicopter deck and supporting structure
   — green sea on pillars supporting erected helicopter decks.
3) Wind lift forces on erected structures (no helicopter on deck).

2.2 Landing forces

2.2.1 The total vertical force from the helicopter during landing shall be taken not less than:

\[ P_v = 3 \cdot g_0 \cdot M_H \]

where:

\[ M_H = \] maximum take-off mass, in t, of helicopter.

The total force \( P_v \) shall be considered as distributed on the helicopter's landing gear in the same manner as when the helicopter is resting on a horizontal surface and the helicopter's centre of gravity is in its normal position in relation to the landing gear.

2.3 Gravity and inertia forces - due to vessel motions and accelerations

2.3.1 The dynamic design forces caused by the platform structure itself and, if applicable, by the helicopter in its stowed position are preferably to be taken either from direct calculations or model tests.

2.3.2 Worst case realistic load combinations for the static plus dynamic (S+D) design load scenarios of static and dynamic design forces shall be considered.

For ships in world-wide operation, inertia forces can be based on envelope accelerations determined from Pt.3 Ch.4 Sec.3 [3.3], and combined according to Table 9 for operational conditions.

2.4 Green sea

2.4.1 The sea pressure on helidecks shall be taken in accordance with Pt.3 Ch.4 Sec.5 [2]. Minimum sea pressure is 5 kN/m².
2.4.2 Loads from green sea on members supporting erected helicopter decks shall be included for helicopter deck positioned in the fore ship. The horizontal pressure, in kN/m², caused by green sea is given by the following equation:

\[ P = 4.1 \, C_D \, a \, (1.79 \, C_W - h_0) \]

where:

- \( C_D \) = drag coefficient
  - 1.0 for circular cross section
  - 2.0 for non-circular sections
- \( a \) = \( 2 + L/120 \), maximum 4.5
- \( h_0 \) = vertical distance in m from the waterline at draught \( T \) to the load point
- \( C_W \) = wave load coefficient, see Pt.3 Ch.4 Sec.4.

This is a horizontal load acting in the direction of the ship longitudinal axis. It shall be used on the supporting structures, and shall be combined with acceleration loads as specified in Pt.3 Ch.6 Sec.5 [2.3].

2.5 Other loads

2.5.1 For structures where wind suction forces may be of importance, e.g. bolted platforms, wind lift forces \( P_W \) in kN, shall be taken into account by:

\[ P_W = 1.2 \, A_D \]

where:

- \( A_D \) = deck area in m².

2.5.2 Ice thickness for erected structures shall be taken into account in the stowed condition as follows:

- in the North Sea 5 cm on exposed surfaces
- in Arctic waters 15 cm on exposed surfaces
- or by designers specification of maximum ice thickness.

2.5.3 The helicopter deck shall be checked for other loads as applicable.

Guidance note:
Such loads should be presented to the Society.
### Table 9 Load combinations for erected helicopter installations

<table>
<thead>
<tr>
<th>Load combinations</th>
<th>Load cases</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stowed helicopter + ice + vertical and transverse accelerations</td>
<td>Mass of structure</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Stowed helicopter + ice + vertical and longitudinal accelerations</td>
<td>Mass of equipment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Min. deck load</td>
<td>Mass of helicopter</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helicopter landing</td>
<td>Landing loads according to [2.2.1] (^3)</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind suction</td>
<td>Ice mass, acc. to [2.5.2], on both sides of helideck pancake</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind suction</td>
<td>Ice mass, acc. to [2.5.2], on the supporting structure: 100 % of the surface that get green sea loading, 50% of the surface that not get green sea loading</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. green sea pressure (5 kN/m(^2)) acc. to [2.4.1]</td>
<td>Min. green sea pressure according [2.4.1]</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Green sea load on support structure in longitudinal direction according [2.4.2]</td>
<td>Wind suction according [2.5.1]</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical accelerations times mass</td>
<td>Transverse accelerations times mass</td>
<td>m_U \cdot g</td>
<td>m_U(g + a_Z)</td>
<td>m_U \cdot g</td>
<td>m_U \cdot g</td>
<td></td>
</tr>
<tr>
<td>Longitudinal accelerations times mass</td>
<td></td>
<td>±m_U \cdot a_x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Green sea pressure in combination with longitudinal accelerations may be omitted after special consideration of the position of the helicopter installation.

2) Minimum green sea pressure for checking only the local strength of the pancake for both erected and integrated helicopter decks.

3) The landing locations for the helicopter landings shall cover the worst situations for all members and elements of the helideck and supporting structure.

Where:

\[ m_U = \text{mass of the unit, in t} \]
\[ a_X = \text{longitudinal envelope acceleration, in m/s}^2, \text{at the centre of gravity of the unit for the considered load case, to be obtained according to Pt.3 Ch.4 Sec.3 [3.3.1]} \]
\[ a_Y = \text{transverse envelope acceleration, in m/s}^2, \text{at the centre of gravity of the unit for the considered load case, to be obtained according to Pt.3 Ch.4 Sec.3 [3.3.2]} \]
3 Structural strength

3.1 General

3.1.1 Decks for helicopters supported on wheels with pneumatic tyres shall have scantlings in accordance with the requirements given in [3.2] to [3.3].

3.2 Deck plating and stiffeners

3.2.1 The minimum net thickness, in mm, of steel plating shall not be less than:

\[ t = k_1 \cdot \left(1 + \frac{b}{1000}\right) \cdot \sqrt{k} \cdot \sqrt{P_W} + 0.5 \]

The minimum gross thickness, in mm, of aluminium plating shall not be less than:

\[ t = k_1 \cdot \left(1 + \frac{b}{1000}\right) \cdot \sqrt{k} \cdot \sqrt{P_W} + 1.0 \]

where:

- \( k_1 \) = 0.6 in separate platforms
- \( k_1 \) = 0.65 in weather decks general
- \( k_1 \) = 0.7 in longitudinal framed strength deck and in weather deck hatch covers
- \( k_1 \) = 0.9 in transversely framed strength deck

\( b \) = breadth of plate panel, in mm, as defined in Pt.3 Ch.3 Sec.7 [2.1]

\( P_W \) = fraction of total landing force \( P_v \) acting on the wheel(s) considered, in kN.

The minimum net section modulus, in cm³, of stiffeners for the static plus dynamic (S+D) design load scenarios shall not be less than:

\[ Z = \frac{f_u \cdot M}{C_s \cdot R_{eff}} \]

where:

- \( M \) = bending moment, in kNm, from the most unfavourable location of landing forces point loads. In most cases half fixed beam ends will be a reasonable assumption.

- \( f_u \) = factor for unsymmetrical profiles, to be taken as:
  - 1.00 for flatbars and symmetrical profiles (T-profiles)
  - 1.03 for bulb profiles
  - 1.15 for unsymmetrical profiles (L-profiles)

- \( C_s \) = permissible bending stress coefficient for supporting members not subject to hull girder stresses, to be taken as:
  - \( C_s = 1.0 \) in general (acceptance criteria AC-II)
\[ C_s = 0.75 \text{ for class notation Offshore service vessel}(+) \text{ and weather deck hatch covers (acceptance criteria AC-I).} \]

For supporting members subject to hull girder stresses the permissible bending stress coefficient \( C_s \) shall be in accordance with Pt.3 Ch.6 Sec.5 Table 3, applying:

— acceptance criteria AC-II in general
— acceptance criteria AC-I for class notation Offshore service vessel(+).

Intersection of stiffeners and primary supporting members (PSM) shall have a net shear area, in \( \text{cm}^2 \), of not less than:

\[ A_{shr - n50} = 0.115 \cdot P_W \cdot k \]

### 3.2.2 Decks for helicopters supported on tubular skids shall have scantlings in accordance with the following.

The minimum net thickness, in mm, of steel plating shall be:

\[
t = \frac{k_1 \cdot \sqrt{P_W \cdot \sqrt{\varepsilon}}}{\sqrt[3]{\varepsilon}}
\]

where:

- \( k_1 \) = 1.3 in separate platforms
  = 1.4 in weatherdeck general
  = 1.5 in longitudinal framed strength deck and in weather deck hatch covers
  = 2 in transversely framed strength deck
- \( P_W \) = fraction of total landing force \( P_L \) acting on the skid or saddle joint considered, in kN
- \( \varepsilon \) = \( a_1/b \)
- \( a_1 \) = length of tubular line load, usually taken as 0.6 m (twice the distance from saddle joint to skid end)
- \( b \) = breadth of plate panel, in mm, as defined in Pt.3 Ch.3 Sec.7 [2.1].

If ballast tank(s) are fitted directly below the helicopter deck, corrosion addition \( \tau_c \) shall be applied as stated in Pt.3 Ch.3 Sec.3.

The minimum gross thickness, in mm, of aluminium plating shall be:

\[
t = \frac{k_1 \cdot \sqrt{P_W \cdot \sqrt{\varepsilon}}}{\sqrt[3]{\varepsilon}}
\]

where:

- \( k_1 \) = 1.4 for separate platforms
  = 1.6 for weather deck hatch covers.

\( P_W \) and \( \varepsilon \) as above.

The net section modulus of stiffeners as for wheel helicopters.

### 3.2.3 In cases where the deck is proposed to be built from sections, the connections between them will have to be documented to give the same strength as required for an intact deck and also the necessary oil and fuel (including burning fuel) tightness.
3.2.4 Unconventional deck profiles in erected helidecks shall be load tested in accordance with [1.8.1].

3.3 Primary supporting members and supporting structures of erected separate platforms

3.3.1 Yield criteria for beam analysis

The scantlings shall be based on direct stress analysis.

The calculated stresses, in N/mm², for the static plus dynamic (S+D) design load scenarios shall comply with the following criteria:

\[
\begin{align*}
\sigma & \leq C_f R_{elli} \\
\tau & \leq C_t \tau_{eH}
\end{align*}
\]

where:

- \( \tau \) = average shear stress in member, in N/mm², at the considered position, taken as: \( = \)
- \( Q \) = shear force, in kN, at the considered position
- \( A_{shr-n50} \) = net shear area, in cm², at the considered position
- \( \sigma_b \) = bending normal stress, in N/mm², at the considered position, taken as: \( = \)
- \( M \) = bending moment, in kNm, at the considered position
- \( Z_{n50} \) = net section modulus, in cm³, at the considered position.
Table 10 Beam analysis of primary supporting members, definition of $C_s$ and $C_t$

<table>
<thead>
<tr>
<th>Acceptance criteria</th>
<th>Description</th>
<th>Structural member</th>
<th>$C_s$</th>
<th>$C_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC-I</td>
<td>Applicable for: vessels with class notation <strong>Offshore service vessel(+)</strong></td>
<td>all primary supporting members</td>
<td>0.75</td>
<td>0.70</td>
</tr>
<tr>
<td>AC-II</td>
<td>In general</td>
<td>all primary supporting members</td>
<td>0.90</td>
<td>0.85</td>
</tr>
<tr>
<td>AC-III</td>
<td>Emergency landing</td>
<td>all primary supporting members</td>
<td>1.0</td>
<td>0.95</td>
</tr>
</tbody>
</table>

3.3.2 Buckling criteria for beam analysis

Column and beam-column buckling capacity calculations of supporting members shall be in accordance with DNVGL-CG-0128 Sec.3.

The structural member is considered to have an acceptable buckling strength if it satisfies the following criterion for the static plus dynamic (S+D) design load scenarios:

$$\eta = \text{maximum buckling utilisation factor based on the applied stress, as defined in DNVGL-CG-0128 Sec.3}$$

$$\eta_{all} = \text{allowable buckling utilisation factor, as defined in Table 11.}$$

Table 11 Allowable buckling utilisation factor $\eta_{all}$

<table>
<thead>
<tr>
<th>Acceptance criteria</th>
<th>Description</th>
<th>Structural member</th>
<th>$\eta_{all}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC-I</td>
<td>Applicable for: vessels with class notation <strong>Offshore service vessel(+)</strong></td>
<td>all supporting members</td>
<td>0.65</td>
</tr>
<tr>
<td>AC-II</td>
<td>In general</td>
<td>all supporting members</td>
<td>0.75</td>
</tr>
<tr>
<td>AC-III</td>
<td>Emergency landing: for notation <strong>Offshore service vessel(+)</strong></td>
<td>all supporting members</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Emergency landing: in general</td>
<td>all supporting members</td>
<td>0.85</td>
</tr>
</tbody>
</table>

3.3.3 Buckling criteria for supporting bulkheads

Bulkheads supporting decks and which are exposed to compressive forces from impact landing loads and/or gravity and inertia loads from the helicopter deck shall be checked for buckling strength. Buckling strength of bulkhead stiffeners and adjoining plates shall be checked. Compressive forces shall be based on beam analysis.

Simplified method of finding compressive axial stress, in N/mm$^2$, based on pillar force $F_{pill}$ for the static plus dynamic (S+D) design load scenarios to be taken as:

$$\sigma_a = \frac{F_{pill}}{t \cdot s + A_s}$$
where:

\[
F_{pill} = \text{compressive axial load acting on the bulkhead stiffener taken from beam analysis, in kN}
\]

\[
P_w = \text{as defined in [3.2.1], in kN}
\]

\[
t = \text{net thickness of bulkhead plating, in mm}
\]

\[
s = \text{stiffener spacing, in mm}
\]

\[
A_s = \text{net sectional area of the stiffener without attached plating, in mm}^2.
\]

The product \(t \cdot s\) may have to be considered by the Society on a case-by-case basis in way of cut outs in the bulkhead.

The structural member is considered to have an acceptable buckling strength if it satisfies the following criterion for the static plus dynamic (S+D) design load scenarios:

\[
\eta_{stiffener} \leq \eta_{all}
\]

\[
\eta_{plate} \leq \eta_{all}
\]

where:

\[
\eta_{stiffener}, \eta_{plate} = \text{maximum buckling utilisation factor based on the applied stress, as defined in DNVGL-CG-0128 Sec.3 [3.2.2] for plates and DNVGL-CG-0128 Sec.3 [3.2.3] for stiffeners}
\]

\[
\eta_{all} = \text{allowable buckling utilisation factor, as defined in Table 12.}
\]

Stresses taken from the strength assessment which are based on beam analysis and applied for buckling capacity calculation of plate panels shall be corrected as given in DNVGL-CG-0128 Sec.3 [3.2.2].

**Table 12 Allowable buckling utilisation factor \(\eta_{all}\)**

<table>
<thead>
<tr>
<th>Acceptance criteria</th>
<th>Description</th>
<th>Structural member</th>
<th>(\eta_{all})</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC-I</td>
<td>Applicable for: vessels with class notation <strong>Offshore service vessel(+)</strong></td>
<td>plates and stiffeners/stiffened panels</td>
<td>0.8</td>
</tr>
<tr>
<td>AC-II</td>
<td>In general</td>
<td>plates and stiffeners/stiffened panels</td>
<td>1.0</td>
</tr>
<tr>
<td>AC-III</td>
<td>Emergency landing</td>
<td>plates and stiffeners/stiffened panels</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Tripping brackets and local stiffening of plating shall be provided where necessary.

### 3.4 Miscellaneous

**3.4.1** In case of landing on a hatch cover section that is underlying in the packing joint, the strength and spacing of cleats shall be sufficient to keep the connection intact and tight.
4 Miscellaneous

4.1 Personnel safety

4.1.1 The landing area shall be surrounded by a safety net of not less than 1.5 m width. The safety net shall have an upward and outboard slope of about 10° from slightly below to slightly above the level of the landing area but not more than 250 mm.

**Guidance note:**
The safety net may further facilitate:

— that it can be safely secured in the upright position
— that it can be secured in the lowered position, in order to avoid being blown upright by rotor downdraft
— that it is flush with helicopter deck in the lowered position
— that the safety net webbing is installed with slack in order to contain personnel who fall over the deck edge (avoid rebounding)
— that the safety net webbing is made of flame resistant materials
— that the safety net webbing is made of material resistant to seawater
— that it can be lowered and raised in a manner that minimises the risk for personnel falling overboard during operations.

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

4.1.2 The flexibility and tightening shall be chosen to avoid rebounding. The number and shape of rails and brackets shall be chosen to minimise injuries.

4.1.3 The test load for safety net and safety net supporting structure surrounding a helicopter deck shall not be taken less than 100 kg dropped from 1 m.

**Guidance note 1:**
Approximate calculations may be based on a static load of 0.2 tons/m run of net. For soft, hammock type nets this load may be converted into $0.2 \text{ g}_0 \text{kN/m}$ acting along inner and outer rails in an inward plane $30^\circ$ below the net plane, see Figure 1.

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

**Guidance note 2:**
In rails, brackets and other details supporting safety nets, allowable stresses in approximate static calculations may be taken as given in [3.3.1].

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

**Figure 1 Safety net**

4.1.4 A 5 cm high steel coaming shall border landing platforms and landing areas in exposed positions, to assist in minimising the probability of personnel or equipment from sliding off the helicopter deck. The coaming shall not impede good drainage of water and or spilt fuel.
4.2 Tie-down points

**4.2.1** Helicopter decks shall have recessed tie-down points for lashing of the helicopter. The housing of the tie down point shall be sufficiently flush fitted and shall not exceed a total height of 25 mm above the landing area, in order to avoid hazards to helicopter operations and tripping incidents. Helicopter operators can advise on the best configuration of the tie down points on the helicopter deck.

**4.2.2** The breaking load of the tie-down points for helicopters calling at the vessel should be confirmed from helicopter operator or manufacturer. Unless otherwise provided a force \( F \), in kN, per tie-down where \( M_H \) in kNm, is given in [2.2] may be used.

\[
F = \min\left\{\frac{1.5g_0M_H}{n - 0.5}; 40\right\}
\]

where:

\( n \) = the number of active tie-down points acting in same direction.

4.3 Surface friction of helicopter deck

**4.3.1** The surface of helicopter decks and landing areas shall be of such a nature or so equipped that the static coefficient of friction between the helicopter's landing gear and the surface will be satisfactory (recommended value 0.6) in any weather condition. To prevent sliding in cold weather when there is danger for icing, the surface is either to have a grid of ribs (for wheel helicopters) or shall be arranged for fitting a rope net/ landing net, which shall be kept on board.

**4.3.2** The helicopter rope net mentioned in [4.3.1] shall have a size as given in Table 13.

<table>
<thead>
<tr>
<th>Deck diameter ( D ) according to [6.1]</th>
<th>Net size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 13 m</td>
<td>6 × 9 m</td>
</tr>
<tr>
<td>13 to 14 m</td>
<td>9 × 9 m</td>
</tr>
<tr>
<td>14 to 20 m</td>
<td>12 × 12 m</td>
</tr>
<tr>
<td>More than 20 m</td>
<td>15 × 15 m</td>
</tr>
</tbody>
</table>

**Note:**
The rope net shall be secured every 1.5 m. Mesh size and tightening shall be such as to avoid hooking of helicopter substructure.

5 Requirements for vessel safety – qualifier (S)

5.1 Fire-fighting - general

**5.1.1** The requirements in this subsection is considered to cover the requirements in SOLAS Reg. II-2/18.1-5.
5.2 Structural fire integrity

5.2.1 Escape routes from the helicopter deck shall be arranged on opposite sides. Minimum two escape routes shall be provided.

5.2.2 In general, the construction of the helicopter decks shall be of steel or other equivalent material, see also [1.8.11]. If the helicopter deck forms the deckhead of a deckhouse or superstructure, it shall be insulated to A-60 class standard.

5.2.3 Enclosed piping used in drainage systems should be made of steel, open scupper arrangement may however be made of aluminium. The drainage arrangement shall be lead directly overboard independent of any other system and shall be designed such that drainage does not fall onto any part of the ship. Drainage shall be provided at the perimeter of the helicopter decks. The deck shall be constructed so that water/liquids will not accumulate on the deck.

Guidance note:
Drainage of helicopter decks landing area can for example be achieved by cambering or slope (minimum 1:100) or by perforated surface for collecting drained fluid over board to prevent water/liquids from collecting on the deck surface.

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

5.3 Firefighting equipment

5.3.1 A fixed foam application system consisting of either monitors or pop up nozzles with a minimum capacity of at least 6 l/m²/min shall be provided. The system shall be able to cover the whole of the helicopter landing area, and with sufficient foam medium to enable the foam application rate to be maintained for at least 5 minutes.

5.3.2 In addition to the fixed foam system, two hand held foam applicators with a capacity of at least 250 l/min each shall be provided. The fire hose connection shall be suitable for both foam equipment and fire water nozzle, see [5.3.4] 3).

5.3.3 The foam shall be of an approved medium suitable for the helicopter fuel used and for use with salt water.

5.3.4 The following firefighting appliances shall be provided and stored near the means of access to the helideck:
1) At least two dry powder extinguishers having a total capacity of 45 kg.
2) CO₂ extinguishers of a total capacity of not less than 18 kg or equivalent.
3) Two fire hoses and two nozzles of an approved dual purpose type (jet/spray) sufficient to reach any part of the helicopter deck.
4) Two fire-fighter's outfits dedicated for the helicopter deck. The fire-fighter's outfit shall comply with Ch.3.2.1 of the FSS Code.
5) The following rescue equipment:
   — adjustable wrench
   — rescue axe, large (non wedge or aircraft type)
   — cutters, bolt, 60 cm
   — crowbar, large
   — hook, grab or salving
   — hacksaw, heavy duty c/w 6 spare blades
   — blanket, fire resistant
   — ladder (two-piece)
— life line, 5 mm, 15 m in length plus rescue harness
— pliers, side cutting (tin snips)
— set of assorted screwdrivers
— harness knife c/w sheath
— gloves, fire resistant
— power cutting tool.

5.4 Communication between helicopter and vessel

5.4.1 Helicopter and vessel shall communicate through a VHF installation, maritime or aeromobile.

Guidance note 1:
For helicopter decks with frequent landings an aeromobile VHF should be installed and licensed by the aviation authority of the coastal state.

Guidance note 2:
For passenger ships, the communication requirements should be in accordance with SOLAS Chapter IV, Regulation 7.5.

Guidance note 3:
For naval craft, helicopter communications should be thorough HF, V/UHF normal and VHF/UHF.

A portable VHF apparatus with earphones shall be available. Three-way communication between helicopter, helicopter deck and bridge shall be possible.

6 Requirements for helicopter safety – qualifier (H)

6.1 Size of helicopter deck

6.1.1 The diameter $D$ of the helicopter deck or landing area shall be according to Table 14.

Table 14 D-value and helicopter type criteria

<table>
<thead>
<tr>
<th>Type</th>
<th>$D$-value (m)</th>
<th>Perimeter &quot;D&quot; marking</th>
<th>Rotor diameter (m)</th>
<th>Max. weight (kg)</th>
<th>&quot;t&quot; value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolkow Bo 105D</td>
<td>12.00</td>
<td>12</td>
<td>9.90</td>
<td>2 400</td>
<td>2.4t</td>
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<tr>
<td>Bolkow 117</td>
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<td>13</td>
<td>11.00</td>
<td>3 200</td>
<td>3.2t</td>
</tr>
<tr>
<td>Agusta A109</td>
<td>13.05</td>
<td>13</td>
<td>11.00</td>
<td>2 600</td>
<td>2.6t</td>
</tr>
<tr>
<td>Dauphin SA 365N2</td>
<td>13.68</td>
<td>14</td>
<td>11.93</td>
<td>4 250</td>
<td>4.3t</td>
</tr>
<tr>
<td>EC 155B1</td>
<td>14.30</td>
<td>14</td>
<td>12.60</td>
<td>4 850</td>
<td>4.9t</td>
</tr>
<tr>
<td>Sikorsky S76</td>
<td>16.00</td>
<td>16</td>
<td>13.40</td>
<td>5 307</td>
<td>5.3t</td>
</tr>
<tr>
<td>Agusta/Bell 139</td>
<td>16.66</td>
<td>17</td>
<td>13.80</td>
<td>6 400</td>
<td>6.4t</td>
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<tr>
<td>Bell 212</td>
<td>17.46</td>
<td>17</td>
<td>14.63</td>
<td>5 080</td>
<td>5.1t</td>
</tr>
<tr>
<td>Super Puma AS332L</td>
<td>18.70</td>
<td>19</td>
<td>15.00</td>
<td>8 599</td>
<td>8.6t</td>
</tr>
<tr>
<td>Type</td>
<td>D-value (m)</td>
<td>Perimeter &quot;D&quot; marking</td>
<td>Rotor diameter (m)</td>
<td>Max. weight (kg)</td>
<td>&quot;t&quot; value</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------</td>
<td>-----------------------</td>
<td>--------------------</td>
<td>------------------</td>
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<tr>
<td>Bell 214ST</td>
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<td>15.85</td>
<td>7 936</td>
<td>8.0t</td>
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<tr>
<td>Super Puma AS332L2</td>
<td>19.50</td>
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<td>16.20</td>
<td>9 300</td>
<td>9.3t</td>
</tr>
<tr>
<td>EC 225</td>
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<td>20</td>
<td>16.20</td>
<td>11 000</td>
<td>11.0t</td>
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<tr>
<td>Sikorsky S92</td>
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<td>21</td>
<td>17.17</td>
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<td>11.9t</td>
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<tr>
<td>Sikorsky S61 N</td>
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<td>18.90</td>
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<td>9.3t</td>
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<tr>
<td>EH101/AH101</td>
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<td>Boeing BV234LR Chinook</td>
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<td>30</td>
<td>18.29</td>
<td>21 315</td>
<td>21.3t</td>
</tr>
</tbody>
</table>

6.2 Location

6.2.1 For location at ship’s ends a free approach and take-off sector of 210° is required. The whole deck or landing area shall be located within this sector.

Guidance note:
The ship end location is recommended.

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

6.2.2 For helicopter landing areas located amidships, across ship obstacle free sectors shall be provided. These sectors shall originate at the most forward and aft points on the periphery of the D reference circle and diverge at 15° forward and 15° aft relative to straight transverse lines.

6.2.3 For any helicopter landing areas amidships located adjacent to the ship’s side with one-sided approach, the obstacle free sector shall originate at the most forward and aft points on the periphery of the D reference circle and diverge to achieve 1.5 D at the ship’s side.

6.2.4 For erected helicopter decks there shall be sufficient separation between helicopter deck and underlying superstructure to ensure that air may flow freely between the deck and the underlying structure. This distance shall be minimum 1 m.

6.2.5 For naval craft, the requirements in [6.2.1] to [6.2.4] may be deviated from if so required by the navy.

Guidance note:
Vertical component of airflow from horizontal wind velocities up to 25 m/s should not exceed 0.9 m/s over the landing area at main rotor height.
Some helicopter operators may require turbulence conditions for different wind directions above the helicopter deck and information of possible exhaust emission from the ship that may have effect on the landing conditions.
Such environmental conditions are not covered by the HELDK(S, H) notation, and are considered the operators responsibility to provide as applicable.

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

6.3 Height of obstacles

6.3.1 The landing area should be as flush as possible to avoid hazards to helicopter operations and tripping incidents. Objects whose function requires that they are located on the helicopter deck, typically tie-down

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Equipment and design features

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points, landing net (where required) and marking lights, shall not exceed a height of 25 mm above the landing area.

**6.3.2** Steel or other solid construction at perimeter may extend 50 mm above deck level.

**6.3.3** In the approach sector, on and outside of perimeter, only aids essential to helicopter operations are allowed to extend up to a maximum height of 250 mm, e.g. landing lights, floodlights, foam monitors, outer edge of safety net and similar arrangements.

**6.3.4** In bow or stern located helicopter landing areas, outside the obstacle free sector, obstacle heights shall be limited to 0.05 $D$ to a distance 0.62 $D$ from the centre of the landing area and thence are required to be below a rising plane of 1:2 to a distance of 0.83 $D$ from the centre of the landing area.

**6.3.5** Forward and aft of the approach sector of a flight channel across the ship, within a length equal to helicopter overall length forward and aft of sector, obstacles are required to be below a plane with 1:5 longitudinal inclination.

**6.3.6** For helicopter landing areas located adjacent to the ship’s side, outside the obstacle free sector, obstacles shall be limited to a height of 0.05 $D$ for a distance of 0.25 $D$ from the edge of the obstacle free sector and the landing area.

**6.3.7** For naval craft, the requirements in [6.3.4] to [6.3.6] may be deviated from if so required by the navy.

**6.3.8** No loose gear that can create foreign object damage shall be stored on or in the vicinity of the helicopter deck.

### 6.4 Daylight marking

**6.4.1** Obstacles, which the helicopter operator should be especially aware of, shall be painted in diagonal stripes of contrasting colours.

**6.4.2** Wind direction indicator (windsock) shall be provided so as to indicate the clear area wind condition representative for the helicopter deck.

**6.4.3** The perimeter of the helicopter deck shall be marked with a 300 mm white line. The preferred colour of deck within perimeter line is dark grey or dark green.

**6.4.4** The name of the vessel shall be marked on the helicopter deck surface between the origin of the obstacle-free sector and the aiming circle in symbols not less than 1200 mm high and in a colour which contrasts to the helicopter deck surface.

**6.4.5** Obstacle-free sector shall be marked on the helicopter deck by a black chevron, each leg being 790 mm long and 100 mm wide. The chevron shall delineate the separation of the 210° obstacle-free sector and the 150° limited obstacle sector.

**6.4.6** The actual D-value of the helicopter deck shall be painted on the helicopter deck inboard of the chevron in alphanumeric symbols of 100 mm height and around the perimeter of the helicopter deck directly opposite and in 90° to each side of the chevron in with symbol of 600 mm height and rounded down to the nearest whole number.

**6.4.7** The maximum allowable mass shall be marked on the helicopter deck in a position that is readable from the preferred final approach direction and consist of a two-or three-digit number expressed to one decimal place rounded to the nearest 100 kg and followed by the letter t. The height of the numbers shall be 900 mm with a line width of 120 mm.
6.4.8 An aiming circle, which shall be a 1000 mm yellow line with inner diameter 0.5 \( D \). Its centre should be displaced 0.1 \( D \) from the centre of the \( D \)-circle towards the outboard edge, except for decks with a midship cross flight channel.

6.4.9 A letter H shall be painted 4 \( \times \) 3 m of 750 mm white lines located in the centre of the aiming circle with the mid-bar of the H located along the midline of the approach sector.

6.4.10 A signal flag to alert approaching helicopters that landing is prohibited in case the helicopter deck for technical reasons cannot be used shall be carried on board. This shall be a red flag 4 000 \( \times \) 4 000 mm with yellow diagonal cross that can be laid above the "H" inside of the aiming circle.

6.4.11 For naval crafts, marking shall be in accordance with naval requirements.

   Guidance note:
   A signal or light that shows Helicopter operations are going on should be installed. The indicator should be displayed on this ship’s bridge and another made clearly visible for the pilot. The indicator should be able to be switched from a go to no go mark.

6.5 Night operation marking

6.5.1 Floodlight shall be arranged for illumination of the total landing area, with care not to dazzle the pilot.

   Guidance note:
   Details of flood-lights should follow the recommendations given by ICAO's Regulation Annex 14. (ICAO = International Civil Aviation Organisation).

6.5.2 Green lights shall be fitted on the perimeter line, maximum 3 m apart. The intensity of lighting shall be 30 candela. The lighting shall not be visible below the helicopter deck level.

   Guidance note:
   Details of perimeter-lights should follow the recommendations given by ICAO's Regulation Annex 14.

6.5.3 Floodlights, perimeter lights, and obstruction lights shall have electric power fed from emergency and transitional source of power in compliance with the requirements in Pt.4 Ch.8 Sec.7 [2]. The transitional power shall last for at least 30 min.

   The system shall also have a supply circuit from main power so that a single failure in either the main electric power distribution system or the emergency power distribution system shall not render the helicopter deck lighting inoperable.

   Individual protected distribution circuits shall be arranged to:
   — floodlights
   — perimeter lights
   — obstruction lights.

6.5.4 The wind indicator shall be illuminated.

6.5.5 All obstacles, which may obstruct the landing approach shall be indicated by red obstruction lights visible from all directions, or floodlighting or a combination of both.

6.5.6 For naval craft light marking shall be in accordance with naval requirements.
6.6 Instrumentation

6.6.1 Wind velocity and direction, barometric pressure, vessel’s roll and pitch shall be recorded and communicated to helicopter before landing. Simple instruments for this purpose shall be available.

Guidance note:
For use in connection with Ship helicopter operations limitations (SHOLS), the roll and pitch information should be true values.

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

7 Requirements for helicopter refuelling and hangar facilities – qualifier (F)

7.1 Classification and application

7.1.1 The requirements in [7] apply to vessels equipped to support helicopter operations. The rules concerning refuelling is limited to handling of fuel with flame point above 60ºC.
For fuel with lower flame point, special considerations are required and the storage tank/systems shall comply with the relevant regulations as given in Sec.9 concerning transport of low flashpoint liquids.

7.1.2 A refuelling area, a hangar, or both, complying with the requirements in [7] is sufficient to qualify for the qualifier F.

7.1.3 The requirement in [7] cover permanent shipboard installations for refuelling and maintenance hangar for helicopters. The requirements in this subsection are also considered to cover the requirements in SOLAS Reg. II-2/18.7.

7.2 Helicopter refuelling area

7.2.1 The helicopter fuel storage tanks shall be constructed to suitable standards and material that is compatible with helicopter fuel and secured to the vessels structure. The tank shall have inspection hatch, level indicator and ventilation arrangement.

7.2.2 The pumping unit shall be arranged with flow meter and emergency shutdown system from safe location.

7.2.3 Drainage facilities in way of the refuelling area to be arranged with drainage to collection tank or directly overboard.

7.2.4 One 25 kg powder extinguisher and one foam applicator shall be arranged for protection of the helicopter refuelling station.

7.2.5 No smoking signboard and clear refuelling instruction shall be provided at the refuelling station.

7.3 Hangar

7.3.1 The hangar shall be designed in accordance with the requirements given for superstructures as given in Pt.3 Ch.6.
7.3.2 The deck in the hangar area shall be designed in accordance with load requirements provided for wheel loading and car deck structure.

Guidance note:
Requirements are given in Pt.3 Ch.10 Sec.5, as appropriate.

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

7.3.3 The hangar door shall be weathertight and be able to withstand the horizontal component of the helicopter down wash.

7.3.4 The hangar door shall be equipped with suitable opening and closing mechanisms of adequate strength.

7.3.5 The hangar door or the immediate surround shall be fitted with a viewing port, which permits personnel to observe operations on the flight deck. The viewing port shall be fabricated from hardened armour plate safety glass. The viewing port shall have a minimum diameter of 150 mm and be equipped with a blackout cover.

7.3.6 There shall be a minimum clearance between hangar door and the appropriate helicopter according to the traversing system.

Guidance note:
The clearance should be ≥ 0.5 m each side for rail guided traversing systems and ≥ 0.6 m each side for non-rail guided systems.

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

7.3.7 The hangar shall be equipped with a general access, in addition to the main hangar door, between the flight deck and the hangar area. The door shall open onto the flight deck area and maintain weather tightness and fire resistance of the hangar area.

7.3.8 The hangar shall be treated as a category A machinery space with regard to structural fire protection, ref SOLAS Ch. II-2.

7.3.9 The hangar shall be provided with mechanical ventilation of non-sparking type having a capacity of at least 6 air changes per hour.

7.3.10 The hangar shall be provided with fixed fire detection system.

7.3.11 The hangar shall be protected by a fixed water based fire extinguishing system with application rate of not less than 10 l/min/m² and with possibilities for injection of foam liquid for not less than 20 minutes.

7.3.12 The hangar shall be provided with drainage sufficient to handle the water spray system and also to ensure safe drainage in case of spill from the helicopter. Drainage shall be lead directly overboard at safe location.

7.3.13 Electrical equipment within the height of 450 mm above the deck shall be of ex proof certified type.

7.3.14 Personnel safety equipment
The support facility shall be equipped with:
Fire-fighters outfits:
— firefighter’s equipment as required in [5].
Other personnel safety equipment including:
— goggles
— helmets
— gloves.

7.3.15 The deck within the hangar shall be provided with tie-down points in a pattern to ensure safe mooring of the helicopter when parked. The strength of the tie down points shall comply with [4.1.4].

8 Requirements specified by the Norwegian Civil Aviation Authorities – qualifier CAA-N

8.1 Helicopter deck dimension

8.1.1 The helicopter deck shall have a dimension corresponding to a circle with a diameter not less than 1.25 x D.

8.2 Loads

8.2.1 The dimensions of the helideck shall be based on the presumption that any point on the deck may be subjected to a single impact load of 75% of the total weight of the heaviest helicopter used. The single impact load shall be evenly distributed across the contact area. The contact area between the undercarriage of the helicopter and the helideck shall be calculated in accordance with the specifications from the helicopter manufacturer.

8.2.2 The load bearing structures beneath the helideck shall be dimensioned to carry a static load up to 3.0 times the take-off weight of the heaviest helicopter used, with the normal weight distribution on the undercarriage for this type of helicopter. The helicopter shall be placed in the most adverse position on the deck.

8.3 Allowable stresses

8.3.1 With the loads of the helicopter as stated in [8.2.1] and [8.2.2], plus the mass of the structure and the wind forces, the allowable stresses shall not exceed the yield stress, $R_{eH}$, of the material, and not exceeding 2/3 of the specified minimum tensile strength of the material, $R_{m}$.

8.4 Rescue equipment

8.4.1 The rescue equipment shall in addition to [5.3.4](5) include:
— total of two 2 fire axes
— total of 3 stainless steel knives
— two explosion proof hand torches
— hammer
— jack with minimum 0.5 tonne capacity.
8.5 Marking

8.5.1 The number indicating maximum allowable mass shall be 1 000 mm height and 500 mm wide. The letter t shall be 800 mm height and 300 mm wide. Line width shall be 150 mm for both.

8.6 Location

8.6.1 Effects from turbulence shall be documented by testing in wind tunnel or simulation model.
SECTION 6 DAMAGE STABILITY FOR OFFSHORE SERVICE VESSELS - SF

1 GENERAL

1.1 Introduction
The additional class notation SF sets requirements for vessels with length of 24 m and above complying with the requirements for intact stability and damage stability.

1.2 Scope
The scope for additional class notation SF provides requirements for intact and damage stability where the stability manual, approved by the national authorities, shall be submitted as documentation of compliance with the rule requirements. Cargo ships not complying with the definition of "Offshore supply vessel", in accordance with IMO guidelines, may not use compliance with additional class notation SF, for exclusion of compliance with application of SOLAS Ch. II-1, as amended, Part B-1.

1.3 Application
The additional class notation SF applies to vessels with length of 24 m and above complying with the requirements for intact stability given in Pt.5 Ch.9 Sec.2 [5], and damage stability given in this section, may be given the additional class notation SF. Examination and approval of stability documents carried out by national authorities, having equivalent intact and damage stability requirements (i.e. Guidelines for the Design and Construction of Offshore Supply Vessels, 2006, IMO Res.MSC.235(82), alternatively with respect to damage stability as amended by Amendments to the Guidelines for the Design and Construction of Offshore Supply Vessels, 2006, IMO Res. MSC.335(90)), may be accepted as a basis for assigning the additional class notation SF.

1.4 Documentation
1.4.1 Documentation shall be submitted as required by Table 1

Table 1 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Document type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage stability</td>
<td>B070 - Preliminary damage stability</td>
<td>Calculations</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>B130 - Final damage stability</td>
<td>Calculations</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not required in case of approved limit curves, or if approved lightweight data are not less favourable than estimated lightweight data</td>
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</tr>
<tr>
<td>Internal watertight integrity</td>
<td>B030 - Internal watertight integrity plan</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td>AP = For approval; FI = For information</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For general requirements for documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2. For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

1.4.2 Detailed description of stability documentation is given in DNVGL-CG-0156.
2 Damage stability

2.1 Damage stability

2.1.1 The damage stability calculations shall contain GM or VCG limit curves for damage conditions showing the permissible area of operation.

2.1.2 The vessel shall comply with the damage stability requirements of IMO Res. MSC.235(82) (Guidelines for the Design and Construction of Offshore Supply Vessels, 2006), alternatively as amended by IMO Res. MSC.335(90) (Amendments to the Guidelines for the Design and Construction of Offshore Supply Vessels, 2006).
SECTION 7 SPECIAL PURPOSE SHIPS - SPS

1 General

1.1 Introduction
The additional class notation SPS sets requirements for ships that by virtue of their specialized nature of service are carrying special personnel who are neither crew members nor passengers as defined in the 1974 SOLAS Convention.

1.2 Scope
The scope for additional class notation SPS adds an additional level of safety in providing reference to design criteria, construction standards and other safety measures concerning special purpose ships. A passenger or cargo ship, which is converted to a special purpose ship, will be treated as a special purpose ship constructed on the date on which the contract for conversion is signed. A memo to owners should be issued stating the number of persons for which the ships complies with the SPS Code. For flag administrations that have not accepted the use of the SPS Code, their requirements will prevail whilst under that flag, only.

1.3 Application
The additional class notation SPS applies to ships that fall into the category of a passenger vessel as defined in the Code of Safety for Special Purpose Ships, 2008 (2008 SPS Code), as adopted by the Maritime Safety Committee as resolution MSC.266(84) on 13 May 2008. References to the applicable rules and SOLAS are given regarding requirements for: Stability and sub-division, fire protection, lifesaving appliances, electrical installations, dangerous goods [IMDG Code], radio communications and safety of navigation. All ships shall also comply with the additional class notation E0. The provisions of this section may upon special consideration by the Society be applied to ships of less than 500 GT.

1.4 Definitions
1.4.1 For the purpose of this section, the definitions given in Table 1 and in the SPS Code apply.

Table 1 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crew</td>
<td>all persons carried onboard the ship to provide navigation and maintenance of the ship, its machinery, systems, and arrangements essential for propulsion and safe navigation or to provide services for other persons on board</td>
</tr>
<tr>
<td>IMDG Code</td>
<td>International Maritime Dangerous Goods Code, adopted by the Maritime Safety Committee of the International Maritime Organization IMO as resolution MSC.122(75), as amended</td>
</tr>
<tr>
<td>Length</td>
<td>length as defined in the International Convention of Load Lines, 1966</td>
</tr>
<tr>
<td>LSA Code</td>
<td>International Life-Saving Appliance Code, adopted by the Maritime Safety Committee by resolution MSC.48(66), as amended</td>
</tr>
</tbody>
</table>
Passenger means every person other than:
— the master and the members of the crew or other persons employed or engaged in any capacity on board a ship on the business of that ship; and
— a child under one year of age.

SOLAS International Convention on Safety of Lives at Sea currently in force

Special personnel all persons who are not passengers or members of the crew or children of less than one year of age and who are carried on board in connection with the special purpose of that ship or because of special work being carried out aboard that ship. Wherever in this section the number of special personnel appears as a parameter it shall include the number of passengers carried on board

SPS Code Code of Safety for Special Purpose Ships, 2008 (2008 SPS code), as adopted by the Maritime Safety Committee as resolution MSC.266(84) on 13 May 2008

1.5 Documentation

1.5.1 Documentation shall be submitted as specified in [1.5.2], [1.5.3] and [1.5.4].

Stability and subdivision

1.5.2 Documentation shall be submitted as required by Table 2.

Table 2 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
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<tr>
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<td></td>
<td>FI</td>
</tr>
<tr>
<td>Stability</td>
<td>B060 - Floodable length calculation / subdivision index calculation</td>
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<td>Stability</td>
<td>B150 - Damage control plan</td>
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<tr>
<td>Stability</td>
<td>B160 - Damage control booklet</td>
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<tr>
<td>Stability</td>
<td>B070 - Preliminary damage stability calculation</td>
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<tr>
<td>Stability</td>
<td>B130 - Final damage stability calculation</td>
<td></td>
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</tr>
</tbody>
</table>

AP = For approval; FI = For information

For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.
For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

1.5.3 Fire protection

For ships operating as defined under [2.7], documentation shall be submitted as given in relevant tables in the Society’s statutory interpretations (SOLAS Ch. II-2).
1.5.4 Life-saving appliances
For ships operating as defined under [2.9], documentation shall be submitted as given in relevant tables in
the Society's statutory interpretations (SOLAS Ch. III).

2 Requirements

2.1 General

2.1.1 The ship shall comply with the 2008 SPS code.

2.2 Stability and subdivision

2.2.1 The intact stability requirements of Pt.3 Ch.15 shall be complied with.

2.2.2 The stability documentation shall include calculations of the most unfavourable loading conditions
anticipated for each intended service mode.

2.2.3 For ships carrying 240 persons or more, the supplementary intact stability requirements of Pt.5 Ch.4
Sec.4 [1.2] shall be complied with as though the ship is a passenger ship and the special personnel are
considered passengers.

Guidance note:
Unless required by the flag state a SPS ship need not be considered a passenger ship for application of SOLAS regulation II-1/5.5
on periodical lightweight surveys.

2.2.4 The subdivision and damage stability shall in general be in accordance with SOLAS II-1 as amended
where the ship is considered a passenger ship and special personnel are considered passengers, with an R-
value calculated in accordance with SOLAS regulation II-1/6.2.3 as follows:
— for ships carrying 240 persons or more, the R-value is assigned as 1.0 R
— for ships carrying not more than 60 persons, the R-value is assigned as 0.8 R; and
— for ships carrying more than 60 persons, but less than 240 persons, the R-value shall be determined by
linear interpolation between the R-values given above.

2.2.5 For ships carrying 240 persons or more, the requirements of SOLAS regulations II-1/8 and II-1/8-1
and of SOLAS chapter II-1, parts B-2, B-3 and B-4 shall be applied as though the ship is a passenger
ship and the special personnel are passengers. However, SOLAS regulations II-1/14 and II-1/18 are not
applicable.

2.2.6 Except as provided in [2.2.7] for ships carrying less than 240 persons the provisions of SOLAS chapter
II-1, parts B-2, B-3 and B-4 shall be applied as though the ship is a cargo ship and the special personnel are
crew. SOLAS regulations II-1/8, II-1/8-1, II-1/14 and II-1/18 are not applicable.

2.2.7 All ships shall comply with SOLAS regulations II-1/9, II-1/13, II-1/19, II-1/20 and II-1/21 as though
the ship is a passenger ship.

Guidance note:
In general the interpretations in the explanatory notes to SOLAS chapter II-1 subdivision and damage stability regulations,
adopted by IMO as Resolution MSC.281(85) shall be used for the application of SOLAS chapter II-1. The recommendations in
resolution MSC.245(83) should be applied if cross-flooding systems are utilised.
2.3 Machinery installations

2.3.1 All ships shall comply with Pt.5 Ch.4 as though the ship is a passenger ship.

2.3.2 All steering gear installations in special purpose ships carrying more than 240 persons shall comply with Pt.4 Ch.10 Sec.1 [2.6.2] as though the ship is a passenger ship.

2.4 Electrical installations

2.4.1 Electrical distribution systems in ships carrying more than 60 persons shall comply with Pt.5 Ch.4 Sec.3.

2.5 Emergency source of power

2.5.1 The emergency source of electrical power in special purpose ships carrying not more than 60 persons and which are more than 50 m in length shall be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for a period of half an hour if they depend on an electrical source for their operation:

1) any watertight doors required by SOLAS Reg. II-1/13 to be power operated together with their indicators and warning signals
2) the emergency arrangements to bring the lift cars to deck level for the escape of persons.

2.5.2 Installations in special purpose ships carrying more than 60 persons shall comply with Pt.5 Ch.4 Sec.3 as if the ship is a passenger ship.

2.6 Periodically unattended machinery spaces

2.6.1 All ships shall comply with the requirements contained in Ch.2 as applicable for the additional class notation E0.

2.7 Fire protection

2.7.1 For ships carrying more than 240 persons on board, the requirements of Chapter II-2 of SOLAS for passenger ships carrying more than 36 passengers shall be applied.

2.7.2 For ships carrying more than 60, but not more than 240 persons on board, the requirements of Chapter II-2 of SOLAS for passenger ships carrying not more than 36 passengers shall be applied, except that Reg. II-2/21 and 22 shall not apply.

2.7.3 For ships carrying not more than 60 persons on board, the requirements of chapter II-2 of SOLAS for cargo ships shall be applied.

Guidance note:
For further details and clarification of the basic SOLAS requirements implemented in this section please see statutory interpretations DNVGL-SI-0364 Sec.3.
2.8 Dangerous goods

2.8.1 Dangerous goods that are carried on board for shipment as cargo and are not used on board are subject to the provisions of the IMDG Code.

2.8.2 Spaces used for the carriage of any significant amount of dangerous goods as ships’ stores and intended for use on board shall comply with the provisions of the IMDG Code as far as reasonable and practicable.

2.9 Life-saving appliances

2.9.1 The requirements of chapter III of SOLAS shall be applied with the specifications given in 2.9.2 through 2.9.6.

2.9.2 Ships carrying more than 60 persons shall comply with the requirements contained in chapter III of SOLAS for passenger ships engaged in international voyages that are not short international voyages.

2.9.3 Notwithstanding the provisions of 2.9.2, a ship carrying more than 60 persons but not more than 200 persons may in lieu of meeting the requirements of regulations 21.1.1 of chapter III of SOLAS comply with the requirements of regulation 21.1.5 of chapter III of SOLAS, including the provision of at least two rescue boat(s) in accordance with regulation 21.2.1 of chapter III.

Guidance note:
The Society considers item 2.9.3 to apply only for ships with a gross tonnage of less than 500 and with a total number of persons on board less than 200.

2.9.4 Ships carrying not more than 60 persons shall comply with the requirements contained in Chapter III of SOLAS for cargo ships other than tankers. Such ships may, however, carry life-saving appliances in accordance with the passenger ship requirements in 2.9.2 if they comply with the subdivision requirements in 2.2.4 as though the ship is carrying 60 persons.

2.9.5 Regulations 2, 19.2.3, 21.1.2, 21.1.3, 31.1.6 and 31.1.7 of Chapter III of SOLAS and the requirements of paragraphs 4.8 and 4.9 of the LSA Code are not applicable to special purpose ships.

2.9.6 Where in Chapter III of SOLAS the term “passenger” is used; it should be read to mean “special personnel”.

2.10 Radio communications

2.10.1 All special purpose ships shall carry a valid Cargo Ship Safety Radio Certificate in compliance with Chapter IV of SOLAS

2.11 Safety of navigation

2.11.1 All special purpose ships shall comply with the requirements of Chapter V of SOLAS. Ships carrying not more than 240 persons on board should comply with the provisions relating to cargo ships and ships carrying more than 240 persons on board should comply with the provisions relating to passenger ships according to the gross tonnage,
SECTION 8 INERT GAS SYSTEMS - INERT

1 General

1.1 Introduction
The additional class notation Inert sets requirements for inert gas systems for tanks and void spaces within the cargo area. Inert gas systems are used to reduce the likelihood of fire and explosions on-board ships that carry crude oil, hydrocarbon gases or refined oil products.

1.2 Scope
The scope for additional class notation Inert adds additional safety requirements for oil tankers intended for the carriage of oil cargoes; all ships with crude oil washing arrangement regardless of size shall be fitted with a permanently installed inert gas systems. The inert gas system shall be designed in such a way so as to prevent hydrocarbon gases from reaching non-hazardous spaces, and prevent interconnection between tanks and spaces within the cargo area. Stored carbon dioxide systems will be the subject of special consideration, related to the risk of ignition. Inert gas systems based on other means than combustion of hydrocarbons shall comply with the requirements of the main class rules for ship types.

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

1.3.2 Oil carriers (Tanker for oil or Tanker for oil products) of 8000 dwt and above intended for the carriage of oil cargoes having a flashpoint 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) and chemical carriers less than 8000 dwt 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). For ships above 8000 dwt main class will cover requirements for oil carriers and chemical carriers.

1.3.3 Oil carriers of 8000 dwt 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%.
See also IMO Res. MSC.365(93)

1.4 Documentation
1.4.1 Documentation shall be submitted as per Pt.5 Ch.5 for inert gas plants based on flue gas and inert gas generators.
1.4.2 Documentation shall be submitted as per Pt.5 Ch.6 for inert gas systems based on nitrogen separation.

1.5 Arrangements and systems

1.5.1 To be designed as per Pt.5 Ch.5 for inert gas plants based on flue gas and inert gas generators.

1.5.2 To be designed as per Pt.5 Ch.6 for inert gas systems based on nitrogen separation.

1.5.3 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.
SECTION 9 OFFSHORE SERVICE VESSELS FOR TRANSPORTATION OF LOW FLASHPOINT LIQUIDS - LFL

1 General

1.1 Introduction

The additional class notation LFL sets requirements for vessels intended for transportation of liquids with flashpoint below 60°C in bulk, to and from offshore installations.

1.2 Scope

The scope for additional class notation LFL establishes requirements for the arrangement and location of tanks and spaces with low flashpoint, and includes related piping installations, and entrances to such spaces. Piping systems in cargo area, ventilation of cargo tanks, fire protection and extinction, electrical installations in hazardous areas and instrumentation and control systems all form part of the specification for this notation.

1.3 Application

The additional class notation LFL is mandatory for vessels intended for transportation of liquids with flashpoint below 60°C in bulk to and from offshore installations, which have not been assigned the class notations Tanker for oil or Tanker for chemicals. Vessels built and equipped in compliance with the requirements of this section for carriage of liquids with flashpoint not lower than 43°C will be given the class notation LFL(1). If the requirements for carriage of liquids with flashpoint below 43°C have been complied with, then the notation LFL(2) may be given. Cargoes intended to be carried in vessels built for class notations LFL(1) or LFL(2) shall be specified for approval by the Society. The cargoes which may be carried will be stated in the Appendix to the Classification Certificate. Vessels built to class notation LFL(1) or LFL(2) shall comply with the requirements in Pt.5 Ch.9 Sec.2 [5] and Sec.6.

1.4 Assumptions

1.4.1 The classification of the vessel is based on the assumption that cargo handling operations are carried out in accordance with the approved operational instruction manual, see [11].

1.4.2 It is assumed that dry cargo and low flashpoint liquid cargo are not carried simultaneously unless one of the following conditions is satisfied:

— the cargo has a flashpoint of not less than 43°C and is only carried within areas where it is known for certain that the ambient air temperature cannot rise to more than 10°C below the flashpoint of the cargo
— dry cargo is carried aft and low flashpoint liquid cargo forward of the superstructure, or vice versa
— the cargo tanks are kept filled with inert gas and the gas-concentration in the cofferdams is monitored by an automatic gas detection arrangement while the vessel is solely carrying dry cargo
— the cargo tanks are kept filled with inert gas and the cofferdams are filled with water while the vessel is solely carrying dry cargo
— the cargo tanks are kept filled with inert gas and the cofferdams are kept filled with inert gas and monitored by a leakage detection system while the vessel is solely carrying dry cargo.

Operational assumptions corresponding to the above will be stated in the "Appendix to the classification certificate".
1.5 Definitions

1.5.1 A hazardous area is an area in which an explosive gas atmosphere is or may be expected to be present, in such quantities that it will require special precautions for:

— the construction,
— installation and
— use of electrical apparatus.

Hazardous areas shall be defined in compliance with [8].

1.5.2 The term cargo refers generally to liquids having flashpoint below 60°C.

1.5.3 Cargo area is that part of the offshore support vessel where cargo and cargo vapours are likely to be present, (see [8]).

1.6 Documentation requirements

1.6.1 Documentation shall be submitted as required by Table 1.

**Table 1 Documentation requirements**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
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<tbody>
<tr>
<td>Cargo piping system</td>
<td>S010 - Piping system (PD)</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Inert gas system</td>
<td>S010 - Piping system (PD)</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>I200 - Control and monitoring system documentation</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Cargo heating system</td>
<td>S010 - Piping system (PD)</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Hazardous area classifications</td>
<td>G080 - Hazardous area classification drawing</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Ventilation systems</td>
<td>S012 - Ducting diagram (DD)</td>
<td>In cargo area, including capacity.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>C030 - Detailed drawing</td>
<td>Rotating parts and casings for fans and portable ventilators.</td>
<td>AP</td>
</tr>
<tr>
<td>Cargo tanks pressure-vacuum valves or high velocity vent valves</td>
<td>Z110 - Data sheet</td>
<td></td>
<td>FI</td>
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<tr>
<td>Explosion (Ex) protection Cargo tanks level monitoring system</td>
<td>Z030 - Arrangement plan</td>
<td>Electrical equipment in hazardous areas. 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).</td>
<td>AP</td>
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<tr>
<td></td>
<td>E250 - Maintenance manual</td>
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<td>AP</td>
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### Object Documentation type Additional description Info

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<tr>
<td>E170 - Electrical schematic drawing</td>
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<td>Single line diagrams for all intrinsically safe circuits, for each circuit including</td>
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<td></td>
<td></td>
<td>data for verification of the compatibility between the barrier and the field components.</td>
<td></td>
</tr>
<tr>
<td>I200 - Control and monitoring system documentation</td>
<td></td>
<td></td>
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</table>

| Cargo tanks overflow protection system        | I200 - Control and monitoring system documentation |                                                                                       | AP   |

| Cargo valves and pumps control and monitoring system | I200 - Control and monitoring system documentation |                                                                                       | AP   |

| Hydrocarbon gas detection and alarm system, fixed | I200 - Control and monitoring system documentation |                                                                                       | AP   |
|                                                  | Z030 - Arrangement plan                           |                                                                                       | AP   |

| Cargo area leakage detection system            | Z030 - Arrangement plan                           | In cofferdams.                                                                         | AP   |
|                                                | I200 - Control and monitoring system documentation |                                                                                       | AP   |

| Cargo tank deck fire extinguishing system      | G200 - Fixed fire extinguishing system documentation |                                                                                       | AP   |

| Exhaust systems                                | Z030 - Arrangement plan                           | Including spark arrestors.                                                             | FI   |

| Internal access                                 | Z030 - Arrangement plan                           | See [2.1.2].                                                                          | AP   |

**AP = For approval; FI = For information**

1.6.2 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

1.6.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

1.6.4 When flag administrations survey the vessel in accordance with the current requirements of the International Convention on Safety of Life at Sea (SOLAS), copies of the Cargo Ship Safety Construction Certificate and the Cargo Ship Safety Equipment Certificate shall be submitted by the customer or builder. This documentation shall be considered as equivalent to a survey carried out by the Society.

### 1.7 Certification requirements

1.7.1 Components shall be certified as required by Table 2.

#### Table 2 Certification requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard*</th>
<th>Additional description</th>
</tr>
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<tbody>
<tr>
<td>Inert gas control and monitoring system</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 1.8 Materials

**1.8.1** Structural materials used for tank construction, together with associated piping, valves, vents and their jointing materials, shall be suitable at the carriage temperature and pressure for the cargo to be carried. Materials used shall be presented to the Society for acceptance.

### 1.9 Surveys and testing

**1.9.1** Before assignment of class all systems covered by this section shall be function tested. This shall include testing of the nitrogen system capacity to verify that it is in accordance with [4.2.4].

### 2 Vessel arrangement

#### 2.1 Tank arrangement

**2.1.1** Cargo tanks shall not be located within the accommodation or engine room area. Engine room and accommodation shall not be located above tanks or cofferdams.

**2.1.2** Where not bounded by bottom shell plating or pump room, the cargo tanks shall be surrounded by cofferdams.

For safe access to and within tanks for low flashpoint liquids and adjacent cofferdams, horizontal hatches or openings to or within cargo tanks or cofferdams surrounding tanks for low flashpoint liquids shall have a minimum clear opening of 600 × 600mm that also facilitates the hoisting of an injured person from the bottom of the tank/cofferdam. For access through vertical openings providing main passage through the length and breadth within cargo tanks and cofferdams surrounding tanks for low flashpoint liquids, the minimum clear opening shall not be less than 600×800 mm at a height of not more than 600 mm from bottom plating unless gratings or footholds are provided. Smaller openings may be accepted provided evacuation of an injured person from the bottom of the tank/cofferdam can be demonstrated.

Minimum horizontal distance between the tank side or pipes leading from the tank and the ship's shell shall be 760 mm.

**2.1.3** Cargo tanks situated forward of the superstructure may extend to the deck plating, provided dry cargo is not handled in this area.

**2.1.4** Cargo tanks for liquids with a flashpoint of not less than 43°C may extend to the ship's shell and the deck plating.

---

**Object** | **Certificate type** | **Issued by** | **Certification standard** | **Additional description**
---|---|---|---|---
Hydrocarbon gas detection and alarm system | PC | Society |  | Only for fixed systems
Cargo tanks level monitoring system | PC | Society |  |
Cargo tanks overflow protection system | PC | Society |  |
Cargo valves and pumps control and monitoring system | PC | Society |  |

* Unless otherwise specified the certification standard is the rules
Tanks for other purposes (except freshwater and lubricating oil tanks) shall be accepted as cofferdams for these tanks.

2.1.5 The spaces forward of the collision bulkhead (forepeak) and aft of the aftermost bulkhead (afterpeak) shall not be arranged as cargo tanks nor as cofferdams.

2.1.6 Cofferdams shall be arranged for water filling. The filling system shall not be permanently connected to the cofferdams.

2.1.7 Tanks on open deck may be approved after special considerations in each particular case.

2.1.8 Cargoes, which react in a hazardous manner with other cargoes or fuel oils, shall be segregated from such by means of a cofferdam, pump room or tank containing a mutually compatible cargo.

2.2 Access and openings general

2.2.1 No accommodation, service spaces, control stations or machinery spaces shall be located within the cargo area.

2.3 Access and openings to accommodation

2.3.1 Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations shall, in general, not face the cargo area.

For vessels with cargo tanks aft of the superstructure, entrances, air inlets and openings facing the cargo area may be accepted provided they are situated at least 10 m from the nearest hazardous area.

The following provisions apply for such boundaries:

a) Doors shall be kept closed during loading/discharge operations. Signboards shall be fitted.

b) Port lights or windows shall be of a non-opening type. Inside covers of steel or equivalent material shall be fitted in the first tier on main deck.

c) Ventilation inlets shall be installed as far as practicable from the nearest hazardous area (in no case less than 10 m).

2.4 Access and openings to pump room and cargo tanks

2.4.1 Cargo tanks and cofferdams surrounding cargo tanks shall have suitable access from open deck for cleaning and gas-freeing. Where cofferdams are provided over cargo tanks, small trunks shall be arranged to penetrate the cofferdam. The trunks shall be arranged for water filling.

2.4.2 Access openings shall not be arranged from cargo tanks or cofferdams to other spaces.

2.4.3 Pump room entrances shall be from open deck.

2.4.4 Access entrances and passages shall have a clear opening of at least 600 × 600 mm.

2.5 Chain locker and windlass

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

2.5.2 Windlass cable lifters and chain pipes shall be situated outside hazardous areas.
2.6 Miscellaneous

2.6.1 Exhaust outlets from combustion equipment shall have spark arrestors.

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

3 Piping system in cargo area

3.1 General

3.1.1 Cargo piping systems shall comply with the requirements in Pt.5 Ch.6.

3.1.2 There shall be no permanent connection between piping systems in the cargo area and piping systems in the remainder of the vessel. For exemption see [3.3].

3.1.3 Where non-permanent connections between piping systems in the cargo area and piping systems in the remainder of the vessel are accepted, this separation may be achieved by the use of one of the following arrangements:
— removing spool pieces or valves and blanking the pipe ends
— blind flange valves.
Such arrangements shall not be located within a cargo tank or cofferdam.
For filling and drainage of cofferdams surrounding cargo tanks, non-permanent hose connections shall be accepted.

3.1.4 The cofferdam boundaries shall not be penetrated at a level below the top of the cargo tanks.

Guidance note:
Typically hydraulics for pumps and valves, cables for instrumentation.

3.1.5 Bulkhead penetrations shall not utilise flanges bolted through the bulkhead.

3.1.6 Deck spills shall be kept away from accommodation and service areas through suitable precautionary means, such as a permanent coaming of suitable height extending from side to side or around loading and discharge stations.

3.1.7 Cargo pump room, pipe tunnels and cofferdams shall have a separate drainage system connected to pumps or bilge ejectors situated entirely within the cargo area.

3.1.8 Bilge ejectors serving hazardous areas shall not be permanently connected to the drive water system.

3.1.9 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.

3.2 Cargo piping system

3.2.1 The complete cargo piping system shall be located within the cargo area and shall be entirely separate from all other piping systems on board.
3.2.2 Cargoes, which react in a hazardous manner with other cargoes, shall have separate pumping and piping systems. They shall not pass through other cargo tanks containing such cargoes unless encased in a tunnel.

3.2.3 Cargo piping shall not penetrate cargo tank boundaries below the top of the tank. However, penetrations below the top of the tank may be accepted provided that a remotely operated stop valve is fitted within the cargo tank served. Where a cargo tank is adjacent to a pump room, the remotely operated stop valve may be fitted on the cargo tank bulkhead on the pump room side.

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

3.2.5 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.

**Guidance note:**
Due precautions shall be taken in order to avoid cargo release on deck due to too low location of leakage check point. E.g. Expansion tank, air blow connections.

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

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

3.2.7 Means shall be provided such that pumps can be stopped the bridge or a similar position facing the cargo area.

3.2.8 The connecting coupling for the transfer hose shall be of a type which automatically closes at disconnection (self-sealing type).

Means of quick-release of the transfer hose shall be provided, e.g. by installation of a weak link assembly or by installation of a remotely controlled coupling.

Quick-release shall be capable of being effectuated from the bridge.

3.3 Cargo heating system

3.3.1 The heating medium shall be compatible with the cargo and the temperature of the heating medium shall not exceed 220°C.

3.3.2 The cargo heating system shall be arranged as a secondary system independent of other ship's services and not enter the engine room.

3.3.3 Heating or cooling systems shall be provided with valves to isolate the system for each tank.

3.3.4 For any heating system, means shall be provided to ensure that, when in any other but the empty condition, a higher pressure than the maximum pressure head exerted by the cargo tank content on the system is maintained within the system.

The heating circuit expansion tank shall be fitted with a gas detector or low level alarm and be vented to open air.

3.3.5 Cargo heating pipes shall not penetrate the cargo tank boundaries other than on the top of the tank.

**Guidance note:**
If low flashpoint liquid tanks are used as tanks for recovered oil, see also Sec.11 [5.6.3].

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
4 Gas-freeing, inerting and venting of cargo tanks

4.1 Gas-freeing of cargo tanks

4.1.1 Gas freeing operations shall be carried out such that vapour is initially discharged in one of the following ways:

1) through outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 30 m/s maintained during the gas freeing operation; or

2) through outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 20 m/s which are protected by suitable devices to prevent the passage of flame.

Guidance note 1:
When the flammable vapour concentration at the outlets has been reduced to 30% of the lower flammable limit, gas freeing may thereafter be continued at cargo tank deck level.

Guidance note 2:
Procedures to be included in the operation manual are given in [9].

4.2 Inerting of cargo tanks

4.2.1 Inerting of cargo tanks is required as per [1.4.2].

4.2.2 To prevent the return of cargo vapour to any gas safe spaces, the inert gas supply line shall be fitted with two shut-off valves in series with a venting valve in between (double block and bleed valves). In addition a closable non-return valve shall be installed between the double block and bleed arrangement and the cargo tank.

These valves shall be located outside non-hazardous spaces and shall function under all normal conditions of trim, list and ship motions.

The following conditions shall apply:

a) The operation of the valves shall be automatically executed. Signals for opening and closing shall be taken from the process directly, e.g. inert gas flow or differential pressure.

b) An alarm for faulty operation of the valves shall be provided.

4.2.3 Where the connections to the hold spaces or to the cargo piping are non-permanent, two non-return valves may substitute the non-return devices required in [4.2.2].

Guidance note:
Cargo tank connections for inert gas padding are considered as permanent for the purpose of this requirement.

4.2.4 If the cofferdams are arranged for inert gas filling, the supply lines shall be protected from the return of cargo vapour via the tank padding supply lines with a double block and bleed arrangement.

4.2.5 The cargo discharge rate from tanks being protected shall be restricted to 80% of the inert gas capacity.

4.2.6 Low-pressure alarm shall be provided in the nitrogen supply line on the cargo tank side of any double block and bleed valves and pressure reduction units.
If pressure/vacuum alarms are fitted in each cargo tank as means to comply with redundant venting requirements, a separate low-pressure alarm is not required.

4.2.7 A high oxygen content alarm shall be provided at the cargo operation console. The alarm shall be activated when the oxygen content in the inert gas supply exceeds 8%.

4.2.8 Where a nitrogen generator or nitrogen storage facilities are installed in a separate compartment, outside of the engine room, the separate compartment shall be fitted with an independent mechanical extraction ventilation system, providing 6 air changes per hour. A low oxygen alarm shall be fitted. Such separate compartments shall be treated as one of other machinery spaces, with respect to fire protection.

4.3 Cargo tank venting system

4.3.1 The cargo tanks shall have a breathing system for relief of pressure and vacuum. Such breathing shall be through P/V-valves (pressure/vacuum relief valves). The system shall comply with the requirements given in Pt.5 Ch.6 Sec.9 [2.3] except that the height specified in Pt.5 Ch.6 Sec.9 [2.3.8] may be reduced to 2 m.

4.3.2 Cargoes, which react in a hazardous manner with other cargoes, shall have separate tank venting systems.

5 Ventilation system within the cargo area

5.1 General

5.1.1 The ventilation system shall comply with the requirements given in Pt.5 Ch.6 Sec.10. The following requirements in Pt.5 Ch.6 Sec.10 [2.3.3] may be relaxed after special consideration in each case:
— the height of the exhaust outlets from cargo handling spaces
— the horizontal distance between exhaust outlets from cargo handling spaces and the ventilation inlets to non-hazardous spaces other than accommodation.

6 Fire protection and extinction

6.1 Fire protection

6.1.1 The vessel is in general to comply with the current requirements of the International convention for the safety of life at sea (SOLAS) for tankers. For vessels with cargo tanks aft of the superstructure and where the superstructure is situated at least 10 m from nearest hazardous area, compliance with the provisions of SOLAS for cargo ships shall be acceptable.

6.2 Fire extinction

6.2.1 The vessel shall have a fixed foam fire extinguishing system for protection of the cargo deck area. Deck area to be simultaneously protected:
— within 3 m radius from tank openings, cargo pipe flanges and cargo valves
— within 5 m radius from cargo breathing valves
— within 10 m radius from cargo load/unload connection(s).
The deck area defined above shall be protected by either foam monitor(s) or nozzles or a combination of both. In case of monitors, nominal length of throw for coverage of the farthest extremity of the area protected by monitors shall be used.

Application rate shall be not less than:

a) 5 litres/minute/m² with sufficient supply for at least 20 minutes, applicable for return mud or oil products for which the class notation \textit{LFL}(1) shall apply.

b) 10 litres/minute/m² with sufficient supply for at least 20 minutes, applicable for products covered by the IBC Code or methanol or oil products for which the class notation \textit{LFL}(2) shall apply.

Water supply to the fixed foam fire extinguishing system shall be in addition to the water supply required for the vessels fire main.

The foam concentrates shall be compatible with the cargo carried.

6.2.2 In addition, the vessel should carry in a readily available position, at cargo deck level, four portable foam applicator units with at least 8 portable 20 litre containers with foam concentrate, for use with water supplied by the vessels fire main.

6.2.3 Two fire fighter's outfits shall be provided in addition to those required by SOLAS Reg. II-2/10.10.

6.2.4 Cargo pump rooms shall be protected by an approved fire extinguishing system.

Fixed pressure water-spraying system and high expansion foam system may also be considered.

6.2.5 The deck foam system shall be capable of simple and rapid operation. The main control station for the system shall be suitably located outside of the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fires in the areas protected. Start of the system should be supported by automatic sequential start of the system by activation of one single button. Foam monitors requiring manual operation shall be positioned outside of the protected area and be readily available in case of fire in the protected area. For pumps that also support other services such as ballast water; valves and pumps shall be in fire mode during transport of \textit{LFL}(2) and in addition have remote control for switch-over to fire mode from the same position as the deck foam system operation controls in accommodation.

7 Electrical installations in hazardous areas

7.1 General

7.1.1 Electrical installations in hazardous areas shall comply with the requirements given in Pt.5 Ch.6 Sec.12.

7.1.2 In hazardous areas only electrical equipment suitable for the relevant zone shall be installed. Electrical equipment not suitable for the relevant zone with arrangements for disconnection shall not be accepted.

8 Area classification

8.1 General

8.1.1 In order to facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2.

8.2 Definitions

8.2.1 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.

8.2.2 Hazardous area zone 1

1) cofferdams adjacent to cargo tanks
2) hold spaces containing independent cargo tanks
3) cargo pump rooms
4) enclosed spaces above or adjacent to cargo tanks
5) areas on open deck, or semi-enclosed spaces on deck, within 3 m of any cargo tank outlet, gas or vapour outlet, 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.
6) areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of any cargo gas outlet intended for the passage of large volumes of gas or vapour mixture during cargo loading, within a vertical cylinder of unlimited height and 6 m radius centered upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet.
7) areas on open deck, or semi-enclosed spaces on deck, within 1.5 m of cargo pump room entrances, cargo pump room ventilation inlet, openings into cofferdams or other zone 1 spaces
8) 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
9) compartments for cargo hoses
10) enclosed or semi-enclosed spaces in which pipes containing cargoes are located.

Guidance note 1:
A cargo rail that is not open from above and with at least two sides may be considered as a semi-enclosed space. If gas tight doors are installed in the cargo rail this may be considered when analysing and classifying the space.

---end---of---guidance---note---

Guidance note 2:
Areas on open deck within 3 m of cargo tank access openings for vessels with cofferdams towards deck are not defined as hazardous zones. Safety precautions related to the use of such access openings in connection with gas freeing should be covered in the operation manual.

---end---of---guidance---note---

8.2.3 Hazardous areas zone 2

1) Areas within 1.5 m surrounding open or semi-enclosed spaces of zone 1 as specified in [8.2.2], if not otherwise specified.
2) Spaces 4 m beyond the cylinder and 4 m beyond the sphere defined in [8.2.2] 6).
3) The spaces forming an air-lock as defined in Pt.5 Ch.6 Sec.1 Table 6.
4) Areas on open deck over all cargo tanks and to the full breadth of the vessel 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 (the open deck over the cargo area shall not be defined as a hazardous area when cofferdams are fitted above the cargo tanks).

8.2.4 Spaces with access or opening located in hazardous area shall have the same zone classification as the hazardous area.
9 Instrumentation and control system

9.1 General

9.1.1 Control systems for cargo valves and pumps shall comply with the requirements given in Pt.5 Ch.5 Sec.9 [2].

9.2 Level gauging and level alarm

9.2.1 Each cargo tank shall be fitted with at least one level gauging device. Where only one gauging device is fitted, it shall be arranged so that any necessary maintenance can be carried out while the cargo tank is in service. If this is not possible, means for manual sounding shall be provided.

9.2.2 Each cargo tank shall be fitted with a high level alarm giving alarm at 95 % filling by volume. The alarm shall be activated by a level sensing device independent of the gauging device.

9.2.3 Cofferdams surrounding cargo tanks shall be fitted with leakage detection unless they are water filled when carrying low flashpoint liquids or fitted with gas detection. Alarms shall be provided at a manned control station.

9.3 Gas detection

9.3.1 The vessel shall have portable gas measuring equipment consisting of at least two apparatus each measuring:
— oxygen
— hydrocarbon content in the range 1 to 100 % hydrocarbon gas by volume
— low hydrocarbon gas contents (0 to 100 % LEL).

9.3.2 Cofferdams surrounding cargo tanks shall be fitted with gas detection unless they are water filled when carrying low flashpoint liquids or fitted with leakage detection. Alarm shall be provided at a manned control station.

9.3.3 Arrangements shall be made to facilitate measurement of the gas concentration in all tanks and other compartments within the cargo area. Easily accessible sampling points shall be provided for closed gas detection of cargo tanks and inerted cofferdams from open deck. Where the atmosphere in the bottom part of cofferdams cannot be reliably measured using flexible gas sampling hoses, such spaces shall be fitted with permanent gas sampling lines.

9.3.4 The cargo pump room shall be provided with a system for continuous monitoring of the concentration of hydrocarbon gases in accordance with SOLAS II-2 Reg.4.5.10.1.3.

9.3.5 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.
10 Signboards

10.1 General

10.1.1 Doors to accommodation and service spaces facing the cargo area shall be provided with signboards with the following text:
TO BE KEPT CLOSED DURING HANDLING OF FLAMMABLE CARGO

10.1.2 For signboards regarding electrical installations, see Pt.5 Ch.5 Sec.8.

11 Operational Instructions

11.1 General

11.1.1 An operation manual describing all essential procedures for handling of flammable cargoes shall be prepared. The manual is subject to approval and shall be kept on board.

11.1.2 The operation manual shall, in general, include the following items:

1) ship particulars
2) cargo system particulars
   — tank capacities
   — cargo handling system
   — inert gas N₂
   — cargo tank venting
   — cargo tank heating
   — pump room safety if applicable
   — cargo tank instrumentation
   — fire safety
   — gas detection.

3) Operations
   — assumptions
   — loading
   — voyage
   — discharging
   — cleaning and gas freeing (tank entry)
   — cofferdam safety
   — cargo area access plan
   — gas detection
   — pump room safety.

4) Reference documents
   — general arrangement
   — capacity plan
   — methanol/special product cargo system
   — pressure/vacuum valves flow curves
   — nitrogen system
   — cargo venting
— mechanical ventilation cargo area
— hazardous zones
— fire extinguishing
— P&A manual (if applicable)
— bilge cargo area.

11.1.3 The following instructions shall be included in the operation manual as applicable:
— hydrocarbon gas measurements shall be carried out regularly
— doors to accommodation and service spaces facing the cargo area shall be kept closed during cargo handling
— dry cargo shall not be handled in cargo area forward of the superstructure.

For vessels not satisfying the conditions in [1.4.2], in addition:
— dry cargo and low flashpoint liquid cargoes shall not be carried simultaneously
— before the vessel enters dry cargo service, all cargo piping, tanks and compartments in the cargo area shall be cleaned and ventilated to the extent that the hydrocarbon gas content is less than 4% of LEL.

For vessels satisfying the requirements in [4.2.1] and 8.2.2, in addition:
During carriage of dry cargo the following items shall be complied with:
— the cargo tanks and piping shall be filled with inert gas and the O<sub>2</sub>-content in the tanks shall not exceed 8% by volume
— the gas detection system in cofferdams surrounding the cargo tanks shall be function tested, or alternatively
— the cofferdams surrounding the cargo tanks shall be filled with inert gas and the O<sub>2</sub>-content shall not exceed 8% by volume and the leakage detection system shall be function tested, or alternatively
— the cofferdams surrounding the cargo tanks shall be filled with water.
SECTION 10 CARRIAGE OF DANGEROUS GOODS IN PACKAGED FORM AND SOLID BULK CARGOES – DG AND DBC

1 General

1.1 Introduction
The additional class notations DG and DBC set requirements for additional measures in providing an increased level of safety for ships carrying dangerous goods, in packaged form and or solid bulk cargoes.

1.2 Scope
The scope for additional class notation DG and DBC includes two distinct sets of requirements: one for packaged goods and one for solid bulk cargoes. The rules in [2] are considered to satisfy the requirements of SOLAS Reg.II-2/19 in respect of carriage of dangerous goods in packaged form. The requirements are not applicable if such goods are transported in limited or excepted quantities according to the IMDG Code Ch.3.4 and 3.5. Furthermore the requirements do not apply to ships' stores and equipment. For the carriage of limited amounts of hazardous and noxious liquid substances on offshore service vessels IMO Res.A.673(16), as amended shall be considered. Whereas, the rules in [3] - Requirements for the carriage of solid bulk cargoes are considered to satisfy the requirements of SOLAS Reg.II-2/19 and the technical provisions of the IMSBC code in respect of carriage of solid bulk cargoes other than grain. For the carriage of grain the requirements of the IMO International Code for the Safe Carriage of Grain in Bulk shall be observed.

1.3 Application
The additional class notations DG and DBC applies to ships complying with requirements of this section and may be given the class notation DG, DG(P), DG(B) and or DBC as described in Table 1. The requirements depend upon the type of cargo space, such as open and closed ro-ro spaces, container spaces, weather decks and barges; the class of dangerous goods, related to hazard potential, from highly explosive to inert, and any special properties of the goods carried. The rules in this section for both packaged and solid bulk requirements include: fire detection and extinguishing, sources of ignition, ventilation, bilge pumping, personnel protection, machinery boundaries and separation of ro-ro spaces.

1.4 Class notations

1.4.1 Ships complying with requirements of this section may be given the class notation DG, DG(P), DG(B) and/or DBC as described in Table 1.

Table 1 Notations

<table>
<thead>
<tr>
<th>Class notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG</td>
<td>&lt;None&gt;</td>
<td>Arranged for carriage of dangerous goods in solid bulk cargoes and packaged form in compliance with SOLAS Reg.II-2/19</td>
<td></td>
</tr>
<tr>
<td>DG(P)</td>
<td>P</td>
<td>Arranged for carriage of dangerous goods in packaged form in compliance with SOLAS Reg.II-2/19</td>
<td></td>
</tr>
</tbody>
</table>
### 1.5 Certification

#### 1.5.1 Packaged goods

On request and when authorized by the flag administration the *Document of Compliance for the Carriage of Dangerous Goods* according to SOLAS Reg.II-2/19.4 may be issued after approval and successful survey.

#### 1.5.2 Solid bulk cargoes

On request the following certificates may be issued after successful survey:

- When authorized by the flag administration the *Document of compliance for the carriage of dangerous goods* according to SOLAS Reg.II-2/19.4.
- When authorized or not by the flag administration the *Statement of compliance for the carriage of solid bulk cargoes* certifying ship’s compliance with the technical provisions of the IMSBC code.

### 1.6 Definitions and abbreviations

#### 1.6.1 Definitions

**Table 2 Definitions**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>bulk cargo shipping name</td>
<td>the bulk cargo shipping name (BCSN) identifies a solid bulk cargo the BCSN is supplemented with the United Nations (UN) number when the cargo is dangerous goods according to the IMDG Code. (IMSBC Code Sec. 1.7)</td>
</tr>
<tr>
<td>cargo spaces</td>
<td>cargo spaces are all spaces used for cargo and trunks to such spaces (SOLAS Reg.II-2/3.8)</td>
</tr>
<tr>
<td>closed ro-ro spaces</td>
<td>closed ro-ro spaces are ro-ro spaces which are neither open ro-ro spaces nor weather decks. (SOLAS Reg.II-2/3.12)</td>
</tr>
<tr>
<td>container cargo spaces</td>
<td>purpose-built container cargo spaces are cargo spaces fitted with cell guides for stowage securing of containers. (MSC/Circ.1120 and IACS UI SC84 Rev.2)</td>
</tr>
<tr>
<td>extended hazardous area</td>
<td>is an area in which an explosive 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. (IEC 60092-506 3.2)</td>
</tr>
<tr>
<td>Group A</td>
<td>solid bulk cargoes of cargo Group A consists of cargoes which may liquefy if shipped with a moisture content in excess of their transportable moisture limit. (IMSBC Code Sec.1.7)</td>
</tr>
<tr>
<td>Group B</td>
<td>solid bulk cargoes of cargo Group B consists of cargoes which possess a chemical hazard which could give rise to a dangerous situation on a ship. For classification of these cargoes see [2.1.2]. (IMSBC Code Sec.1.7)</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Group C</td>
<td>solid bulk cargoes of cargo Group C consists of cargoes which are neither liable to liquefy (Group A) nor to possess chemical hazards (Group B). (IMSBC Code Sec. 1.7)</td>
</tr>
<tr>
<td>hazardous area</td>
<td>is an area in which an explosive atmosphere is likely to occur in normal operation. The explosive atmosphere may exist due to gas and or dust. (IEC 60092-506 3.1)</td>
</tr>
<tr>
<td>not specifically designed cargo spaces</td>
<td>cargo spaces not specifically designed for the carriage of freight containers, but intended for the carriage of dangerous goods in packaged form including goods in freight containers and portable tanks (SOLAS Reg.II-2/19.2.2.1)</td>
</tr>
<tr>
<td>open roro spaces</td>
<td>are roro spaces either open at both ends or open at one end, and provided with adequate natural ventilation effective over their entire length through permanent openings distributed in the side plating or deckhead or from above, having a total area of at least 10% of the total area of the space sides. (SOLAS Reg.II-2/3.35)</td>
</tr>
<tr>
<td>ro-ro spaces</td>
<td>are spaces not normally subdivided in any way and extending to either a substantial length or the entire length of the ship in which goods (packaged or in bulk, in or on rail or road cars, vehicles, trailers, containers, pallets, demountable tanks or in or on similar stowage units or other receptacles) can be loaded and unloaded normally in a horizontal direction. (SOLAS Reg.II-2/3.41) ro-ro spaces include special category spaces and vehicle spaces. (MSC/Circ.1120 and IACS UI SC85 Rev.1)</td>
</tr>
<tr>
<td>shipborne barges</td>
<td>ships and cargo spaces intended for carriage of dangerous goods other than liquids and gases in bulk in shipborne barges. (SOLAS Reg.II-2/19.2.2.5)</td>
</tr>
<tr>
<td>weather deck</td>
<td>is a deck which is completely exposed to the weather from above and from at least two sides (SOLAS Reg.II-2/3.50) for the purposes of SOLAS Reg.II-2/19 a ro-ro space fully open above and with full openings in both ends may be treated as a weather deck. (IACS UI SC86 Rev.1)</td>
</tr>
</tbody>
</table>
### 1.6.2 Definition of hazardous areas

**Table 3 Hazardous areas (IEC 60092-506 Annex B and IACS UI SC79 Rev.3)**

<table>
<thead>
<tr>
<th>Cargo classes</th>
<th>Typical example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaged form: 1.1 to 1.6 except 1.4S, 2.1, 2.3 flammable, 4.3 liquids FP &lt; 23°C, 6.1 FP &lt;&lt; 23°C, 8 FP &lt; 23°C, and 9 evolving flammable vapour</td>
<td><img src="image" alt="Closed cargo spaces including open ro-ro spaces and permanently fixed magazines." /></td>
<td>Closed cargo spaces including open ro-ro spaces and permanently fixed magazines.</td>
</tr>
<tr>
<td>Solid form in bulk: 4.1, 4.2, 4.3, 5.1, 9, and MHB capable of creating explosive dust and/or explosive gas atmosphere</td>
<td><img src="image" alt="Pipes having open ends (e.g. ventilation ducts and bilge pipes, etc.) in a hazardous area." /></td>
<td>Pipes having open ends (e.g. ventilation ducts and bilge pipes, etc.) in a hazardous area.</td>
</tr>
<tr>
<td>Cargo classes</td>
<td>Typical example</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>-----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Packaged form: 2.1, 2.3 flammable, 3 FP &lt; 23°C,</td>
<td>![Image]</td>
<td>Enclosed or semi-enclosed space with direct opening to closed cargo space.</td>
</tr>
<tr>
<td>6.1 FP &lt; 23°C, 8 FP &lt; 23°C, and 9 evolving flammable vapour</td>
<td>![Image]</td>
<td>Enclosed or semi-enclosed space with direct opening to closed cargo space with gastight door and natural ventilation.</td>
</tr>
<tr>
<td>Solid form in bulk: 4.2, capable of creating explosive gas atmosphere</td>
<td>![Image]</td>
<td>Where a space has an opening into an adjacent hazardous space or area, it may be made into a non-hazardous space in accordance with the following requirements:</td>
</tr>
<tr>
<td>4.3, and MHB, capable of creating explosive gas atmosphere</td>
<td>![Image]</td>
<td>A minimum overpressure of 25 Pa (0.25 mbar) with respect to the adjacent hazardous space or area is provided at all points inside the space and its associated ducts at which leaks are liable to occur, all doors and windows being closed. Visual and acoustic alarm is provided at a manned position in case of loss of pressure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Space with direct opening to closed cargo space with airlock and natural ventilation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Areas on open deck, or semi-enclosed spaces on open deck, in the indicated distance from ventilation outlets of hazardous areas.</td>
</tr>
</tbody>
</table>
### Cargo classes

<table>
<thead>
<tr>
<th>Hazardous area</th>
<th>Typical example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extended hazardous area</td>
<td>Gastight self-closing door</td>
</tr>
<tr>
<td></td>
<td>Non-hazardous space</td>
<td></td>
</tr>
</tbody>
</table>

#### 1.6.3 Abbreviations

**Table 4 Abbreviations**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>EmS Guide</td>
<td>Emergency Response Procedures for Ships Carrying Dangerous Goods, as amended</td>
</tr>
<tr>
<td>FP</td>
<td>Flashpoint (closed-cup test) (IMDG Code 1.2.1)</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>ICLL</td>
<td>International Convention on Load Lines, 1966, as amended</td>
</tr>
<tr>
<td>IMDG Code</td>
<td>International Maritime Dangerous Goods Code, as amended</td>
</tr>
<tr>
<td>IMSBC Code</td>
<td>International Maritime Solid Bulk Cargoes Code, as amended</td>
</tr>
<tr>
<td>MFAG</td>
<td>Medical First Aid Guide for Use in Accidents Involving Dangerous Goods, as amended</td>
</tr>
<tr>
<td>SOLAS</td>
<td>International Convention for the Safety of Life at Sea, 1974, as amended</td>
</tr>
</tbody>
</table>

#### 1.7 Documentation requirements

**1.7.1** Documentation shall be submitted as required by **Table 5** and/or **Table 6**.

**Table 5 Documentation requirement for class notation DG and DBC**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural fire protection</td>
<td>G060 – Structural fire protection drawing</td>
<td>Bulkheads and decks separating cargo spaces from machinery spaces and accommodation.</td>
<td>AP</td>
</tr>
<tr>
<td>Fire water supply and distribution system</td>
<td>S010 – Piping diagram</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>S030 – Capacity analysis</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Fixed fire extinguishing system in cargo holds</td>
<td>G200 – Fixed fire extinguishing system documentation</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Cargo handling arrangement</td>
<td>Z330 - Cargo list</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td>Ventilation system</td>
<td>S012 – Ducting diagram</td>
<td>For cargo holds, cargo handling spaces and spaces having openings into those spaces.</td>
<td>AP</td>
</tr>
<tr>
<td>Hazardous area classification</td>
<td>G080 - Hazardous area classification drawing</td>
<td></td>
<td>AP</td>
</tr>
</tbody>
</table>
### Table 6 Additional documentation requirement for class notation DG, with qualifier P

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire detection and alarm system</td>
<td>I200 Control and monitoring system documentation</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z030 Arrangement Plan</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Fixed extinguishing system in vehicle, special category and ro/ro spaces</td>
<td>G200 Fixed fire extinguishing system documentation</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>Cargo cooling water spraying system</td>
<td>G200 Fixed fire extinguishing system documentation</td>
<td>Applicable for vessels carrying goods of class 1</td>
<td></td>
</tr>
</tbody>
</table>

**AP** = For approval; **FI** = For information

1.7.2 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

1.7.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

### 1.8 References to other rules

1.8.1
- SOLAS Reg.II-2/19, Carriage of dangerous goods
- SOLAS Ch.VI Pt.A, General provisions
- SOLAS Ch.VI Pt.B, Special provisions of solid bulk cargoes
- SOLAS Ch.VI Pt.A, Carriage of dangerous goods in packaged form
- SOLAS Ch.VI Pt.A-1, Carriage of dangerous goods in solid form in bulk
- ICLL, Annex B, Annex I, Ch.II, Reg.19, Ventilators, (3)
- EmS
- IMDG Code
- IMSBC Code
2 Requirements for the carriage of dangerous goods in packaged form

2.1 General

2.1.1 Requirements for various types of cargo space
The requirements depend on the type of cargo space, the dangerous goods class and the special properties of the goods to be carried. The requirements for the different types of cargo spaces are shown in the following tables:

- Table 7 for not specifically designed cargo spaces
- Table 8 for container cargo spaces
- Table 9 for closed ro-ro spaces
- Table 10 for open ro-ro spaces
- Table 11 for shipborne barges
- Table 12 for weather decks

2.1.2 Classification
The following classes are specified for goods in packaged form in the appendix of the “Document of Compliance for the Carriage of Dangerous goods”:

Class 1.1 to 1.6:
Explosives.
Division 1.1: Substances and articles which have a mass explosion hazard.
Division 1.2: Substances and articles which have a projection hazard but not a mass explosion hazard.
Division 1.3: Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.
Division 1.4: Substances and articles which present no significant hazard.
Division 1.5: Very insensitive substances and articles which have a mass explosion hazard.
Division 1.6: Extremely insensitive articles which do not have a mass explosion hazard.

**Class 1.4S:**
Explosives
Division 1.4, compatibility group S: Substances or articles so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder or prohibit fire-fighting or other emergency response efforts in the immediate vicinity of the package.

**Class 2.1 hydrogen and hydrogen mixtures exclusively:**
Hydrogen and hydrogen mixtures.

**Class 2.1 other than hydrogen and hydrogen mixtures:**
Flammable gases other than hydrogen and mixtures of hydrogen.

**Class 2.2:**
Non-flammable, non-toxic gases.

**Class 2.3 flammable:**
Toxic gases with a subsidiary risk class 2.1.

**Class 2.3 non-flammable:**
Toxic gases without a subsidiary risk class 2.1.

**Class 3 FP < 23°C:**
Flammable liquids having a flashpoint below 23°C closed-cup test.

**Class 3 23°C ≤ FP ≤ 60°C:**
Flammable liquids having a flashpoint between 23°C and 60°C closed-cup test.

**Class 4.1:**
Flammable solids, self-reactive substances and solid desensitized explosives.

**Class 4.2:**
Substances liable to spontaneous combustions.

**Class 4.3 liquids:**
Liquids which, in contact with water, emit flammable gases.

**Class 4.3 solids:**
Solids which, in contact with water, emit flammable gases.

**Class 5.1:**
Oxidizing substances.

**Class 5.2:**
Organic peroxides.

**Class 6.1 liquids FP < 23°C:**
Toxic liquids having a flashpoint below 23°C closed-cup test.

**Class 6.1 liquids 23°C ≤ FP ≤ 60°C:**
Toxic liquids having a flashpoint between 23°C and 60°C closed-cup test.

**Class 6.1 liquids FP > 60°C:**
Toxic liquids having a flashpoint above 60°C closed-cup test.
Class 6.1 solids:
Toxic solids.

Class 8 liquids FP < 23°C:
Corrosive liquids having a flashpoint below 23°C closed-cup test.

Class 8 liquids 23°C ≤ FP ≤ 60°C:
Corrosive liquids having a flashpoint between 23°C and 60°C closed-cup test.

Class 8 liquids FP > 60°C:
Corrosive liquids having a flashpoint above 60°C closed-cup test.

Class 8 solids:
Corrosive solids.

Class 9 goods evolving flammable vapour exclusively:
Miscellaneous dangerous substances and articles and environmentally hazardous substances evolving flammable vapour.

Class 9 other than goods evolving flammable vapour:
Miscellaneous dangerous substances and articles and environmentally hazardous substances, not evolving flammable vapour.

Guidance note:
The carriage of dangerous goods of classes 6.2 (infectious substances) and 7 (radioactive materials) is not covered by the Document of Compliance of Dangerous Goods. For the carriage of class 6.2 the IMDG Code and for the carriage of class 7 the IMDG Code and the INF Code shall be observed.

---end---of---guidance---note---

2.2 Fire-extinguishing system

2.2.1 Fixed gas fire-extinguishing system
Cargo holds shall be equipped with a fixed CO₂ fire extinguishing system.
(SOLAS Reg.II-2/10.7.2)

Guidance note:
Open top container cargo spaces should be provided with a fixed water-spraying system according to MSC/Circ.608/Rev.1.

---end---of---guidance---note---

2.2.2 Fixed pressure water-spraying system
Open ro-ro spaces having a deck above it, ro-ro spaces not capable of being sealed and special category spaces shall be equipped with a pressure water-spraying system for manual operation which shall protect all parts of any deck and vehicle platform in such space. The capacity of the system shall be sufficiently for providing at least 5 l/min/m² of the horizontal area of decks and platforms.
(SOLAS Reg.II-2/19.3.9)
Drainage and pumping arrangements shall be designed in compliance with Pt.4 Ch.6, as applicable.

2.2.3 Stowage on weather deck
The requirements of [2.2.1] and [2.2.2] apply even if the dangerous goods shall be stowed exclusively on the weather deck.
(MSC/Circ.1120)
2.3 Fire water supplies

2.3.1 Immediate supply of water
Immediate supply of water from the fire main shall be provided by remote starting arrangement for all main fire pumps from the navigation bridge or from other permanently manned control station or by permanent pressurization of the fire main and by automatic start-up of the main fire pumps.
(SOLAS Reg.II-2/19 3.1.1)

If fire water supply pumps arranged for remote starting also serve other purposes, the arrangement shall be such that the pump selected is connected to the fire water system, e.g. by automatic change-over of valves or visual signals for valves' positions at the remote starting position.

2.3.2 Quantity of water and arrangement of hydrants
The capacity of the main fire pumps shall be sufficient for supplying four jets of water at the pressure as prescribed in SOLAS Reg.II-2/10.2.1.6.
The number and position of hydrants shall be such that at least two of the required four jets of water, when supplied by single lengths of hose, may reach any part of the cargo space when empty; and all four jets of water, each supplied by single lengths of hose may reach any part of ro-ro spaces.
(SOLAS Reg.II-2/19.3.1.2, MSC/Circ.1120 and IACS UI SC168 Rev.1)

Guidance note:
The length of the water jet is generally not to be taken more than 7 m.

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Three additional hoses and nozzles shall be provided.
(SOLAS Reg.II-2/10.2.3.2.3.1)

2.4 Water cooling

2.4.1 Cargo spaces shall be fitted with arrangements for the application of water spray (deluge system). The flow rate of water required shall be determined on the basis of 5 l/min/m² of the largest horizontal cross section of the cargo space or a dedicated section of it.

2.4.2 The water may be supplied by means of the main fire pumps. The water supply shall provide for simultaneous operation of the nozzles specified in [2.3.2] and the deluge system for the largest designated cargo space.

2.4.3 The required water shall be distributed evenly over the cargo space area from above via a fixed piping system and full bore nozzles. The piping and nozzle system may be divided into sections and be integrated into the hatch covers. Connection may be via hoses with quick acting couplings. Additional hydrants shall be provided on deck for this purpose.

2.4.4 Drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces:
— the drainage system shall have a capacity of not less than 1.25 times of the capacity discharged during the simultaneous operation of the water spraying system and four fire hose nozzles,
— the valves of the drainage arrangement shall be operable from outside the protected space, and
— the bilge wells shall be of sufficient holding capacity and shall be arranged at both sides of the ship at a distance from each other of not more than 40 m in each watertight compartment.

If this is not possible, the additional weight of water and the influence of the free surfaces shall be taken into account in the ship's stability information.
(SOLAS Reg.II-2/19 3.1.3 and II-2/19.3.1.5)
Guidance note:
The water spraying system required for open top container cargo holds in paragraphs 9.2, 9.3 and 9.4 of MSC/Circ.608/Rev.1 also satisfies the requirement for dangerous goods. The water supply should provide the simultaneous operation of the four fire nozzles and the water spraying system for the largest designated cargo space.

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(MSC/Circ.1120 and IACS UI SC109 Rev.1)

2.5 Sources of ignition related to electrical equipment

2.5.1 The apparatus group and temperature class for the individual classes is specified in column "Sources of ignition" of Table 7 to Table 11. If any apparatus group or temperature class is given, explosion protection is required, and the following conditions related to electrical equipment shall be complied with.

2.5.2 Electrical equipment and wiring shall not be fitted in hazardous areas unless it is essential for the safety and operation of the ship. (IEC 60092-506, 5.1)

2.5.3 All electrical equipment in the hazardous area and being essential for the ship's operation shall be of certified safe type suitable for installation in Zone 1 for apparatus group and temperature class as shown in Table 7 to Table 11. (SOLAS Reg.II-2/19.3.2 and IEC 60092-506)

2.5.4 Electrical equipment not being essential for ship's operation need not to be of certified safe type provided it can be electrically disconnected from the power source, by appropriate means other than fuses (e.g. by removal of links, lockable switches), at a point external to the space and to be secured against unintentional reconnection.

2.5.5 The electrical equipment in extended hazardous areas shall either:
— comply with [2.5.3]; or
— be suitable for zone 2 for apparatus group and temperature class as shown in Table 7 to Table 11, see Pt.4 Ch.8 Sec.11 [3.2].

2.5.6 The hazardous area and extended hazardous areas shall be categorised in accordance with Table 3.

2.5.7 Cables shall be either
— protected by electrically continuous metal sheathing or metallic wire armour braid or tape, or
— enclosed in screwed heavy gauge steel drawn or seam-welded and galvanized conduit.

2.5.8 All metallic protective coverings of power and lighting cables passing through a hazardous area or connected to equipment in such an area, shall be earthed at least at each end. The metallic covering of all other cables shall be earthed at least at one end.

2.5.9 Cable penetrations of decks and bulkheads shall be gas tight, and of a recognised make.

2.5.10 Cable joints in cargo spaces shall be avoided where possible. Where joints are unavoidable, they shall be enclosed in metal-clad or impact strength plastic junction boxes of certified safe type, or heat shrink or encapsulated crimp sleeve cable joints.
2.6 Sources of ignition related to safety of fans

2.6.1 The fans being essential for the ship’s operation shall be of a type (non-sparking type) that prevents the possibility of the ignition of flammable gas air mixtures and shall comply with Pt.5 Ch.5 Sec.6 [1.2]. Otherwise the fans shall be capable of being disconnected from the power source, see [3.5.1].
(SOLAS Reg.II-2/19.3.4.2, IACS UI SC52.1 Rev.1 and IACS UR F29)

2.6.2 The fan openings on deck shall be fitted with fixed wire mesh guards with a mesh size not exceeding 13 mm.
The purpose of the wire mesh guards is to prevent foreign objects from entering into the fan casing.
(SOLAS Reg.II-2/19.3.4.2, IACS UI SC52.2 Rev.1 and MSC/Circ.1120)

2.6.3 The air inlets and outlets shall be placed at a safe distance from possible ignition sources. A spherical radius of 3 m around the air outlets, within which ignition sources are prohibited, is required.

2.7 Other sources of ignition

2.7.1 Other sources of ignition shall not be installed in hazardous areas and extended hazardous areas, e.g. steam or thermal oil lines.

Guidance note:
According to the IMDG Code 7.1.2 potential sources of ignition means, but is not limited to, open fires, machinery exhausts, galley uptakes, electrical outlets and electrical equipment including those on refrigerated or heated cargo transport units unless they are of certified safe type.

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2.8 Detection system

2.8.1 The cargo spaces shall be equipped with a fixed fire detection and alarm system or sample extraction smoke detection and alarm system.
(SOLAS Reg.II-2/3.3)

Guidance note:
If a cargo space or the weather deck is intended for the carriage of class 1 goods it is recommended to monitor adjacent cargo spaces, with the exception of open ro-ro spaces, by a fixed fire detection and alarm system.

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

2.9 Ventilation

2.9.1 General
Cargo hold ventilation systems shall be separated from the ventilation systems serving other spaces.
(SOLAS II-2/9.7.2.1)
If cargo holds are subdivided for reasons of stability, freeboard or fire protection (e.g. separate flooding with CO₂) this has to be taken into account for the design of the ventilation systems.

Air ducts and components of ventilation systems shall be so installed that they are protected from damage.
If adjacent spaces are not separated from cargo spaces by gastight bulkheads or decks, then they are considered as part of the enclosed cargo space and the ventilation requirements shall apply to the adjacent space as for the enclosed cargo space itself.
2.9.2 Ducting
The ducting shall be arranged for removal of gases and vapours from the upper and lower part of the cargo hold. This requirement is considered to be met if the ducting is arranged such that approximately 1/3 of the air volume is removed from the upper part and 2/3 from the lower part. The position of air inlets and air outlets shall be such as to prevent short circuiting of the air.
(SOLAS Reg.II-2/3.4.1)
For open top container holds the mechanical ventilation is interpreted to be required only for the lower part of the cargo hold for which purpose ducting is required.
(MSC/Circ.1120 and IACS UI SC110 Rev.1)

Guidance note:
For the carriage of toxic cargoes in packaged form the ventilation outlets should be located at a minimum of 3 m away from accommodation, air intakes, machinery spaces and other enclosed work areas.

2.9.3 Mechanical ventilation (six air changes/h)
A ventilation system which incorporates powered fans with a capacity of at least six air changes per hour based on the empty cargo hold shall be provided.
(SOLAS Reg.II-2/3.4.1)

2.9.4 Mechanical ventilation (two air changes/h)
The ventilation rate according to 6.2[2.9.3] may be reduced to not less than two air changes per hour, provided the goods are carried in container cargo spaces in closed freight containers or portable tanks.
(SOLAS Reg.II-2/19, Table 19.1, Footnote 1)

2.10 Bilge pumping

2.10.1 Inadvertent pumping
The bilge system shall be designed so as to prevent inadvertent pumping of flammable and toxic liquids through pumps and pipelines in the machinery space.
(SOLAS Reg.II-2/19.3.5.1)

2.10.2 Isolating valves
The cargo hold bilge lines shall be provided with isolating valves outside the machinery space or at the point of exit from the machinery space located close to the bulkhead.
The valves shall be capable of being secured in closed position (e.g. safety locking device). Remote controlled valves shall be capable of being secured in closed position. In case a computer-based system is provided, this system shall contain a corresponding safety query on the display.
(SOLAS Reg.II-2/19.3.5.3)

2.10.3 Warning signs
Warning signs shall be displayed at the isolating valve or control positions, e.g. "This valve to be kept secured in closed position during the carriage of dangerous goods in cargo hold nos. ___ and may be operated with the permission of the master only".

2.11 Additional bilge system

2.11.1 An additional fixed bilge system with a capacity of at least 10 m³/h per cargo hold shall be provided. If more than two cargo holds are connected to a common system, the capacity need not exceed 25 m³/h.
2.11.2 The additional bilge system has to enable any leaked dangerous liquids to be removed from all bilge wells in the cargo space.

2.11.3 Pumps and pipelines shall not be installed in machinery spaces.

2.11.4 Spaces containing additional bilge pumps shall be provided with independent mechanical ventilation giving at least six air changes per hour. If this space has access from another enclosed space, the door shall be of self-closing type. For the design of the electrical equipment, see [2.5].

2.11.5 Pt.4 Ch.6 Sec.4 applies analogously.

2.11.6 Water driven ejectors shall be equipped on the suction side with a means of reverse flow protection. If bilge ejectors are used driving water may be taken from a pump in the engine room provided a non-return valve is fitted in the supply line.

2.11.7 If the bilge drainage of the cargo space is arranged by gravity drainage, the drainage shall be either led directly overboard or to a closed drain tank located outside the machinery spaces, having a minimum volume sufficient to accumulate 1/3 of the drainage capacity per hour of the largest cargo space according to Pt.4 Ch.6 Sec.4 [4]. Drainage from a cargo space into bilge wells in a lower space is only permitted if that space fulfils the same requirements as the cargo space above.

2.11.8 Collecting tank
Where tanks are provided for collecting and storage of dangerous goods spillage, their vent pipes shall be led to a safe position on open deck.

Guidance note:
The bilge pumps for open top container cargo holds in paragraphs 8.2, of MSC/Circ.608/Rev.1 can also be for dangerous goods provided the arrangement satisfies the requirements under [7].

(IACS UI SC111 Rev.1)

2.12 Personnel protection

2.12.1 Full protective clothing
Four sets of full protective clothing appropriate to the properties of the cargo shall be provided.

(SOLAS Reg.II-2/19.3.6.1)
The protective clothing shall satisfy the equipment requirements specified in the EmS Guide for the individual substances.
The required protective clothing is for emergency purposes.

(MSC/Circ.1120 and IACS UI SC91 Rev.1)

2.12.2 Self-contained breathing apparatuses
Additional two sets of self-contained breathing apparatuses with spare air cylinders for at least two refills for each set shall be provided.

(SOLAS Reg.II-2/19.3.6.2 and IACS UI SC 92 Rev.1)
2.13 Portable fire extinguishers

Two additional portable fire extinguishers, each having a capacity of not less than 6 kg of dry powder or equivalent, shall be provided.
(SOLAS Reg.II-2/19.3.7 and MSC.1/Circ.1275)

**Guidance note:**
Equivalent to dry powder may be either CO\(_2\) or foam. 1 kg of dry powder is equal to either 1 kg CO\(_2\) or 1.8 litre foam.

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2.14 Machinery space boundaries

2.14.1 Bulkheads

Bulkheads between cargo spaces and machinery spaces of category A shall be provided with a fire insulation to “A-60” class standard. Otherwise the cargoes shall be stowed at least 3 m away from the machinery space bulkhead.
(SOLAS Reg.II-2/19.3.8)

2.14.2 Decks

Decks between cargo and machinery spaces of category A shall be insulated to “A-60” class standard.
(SOLAS Reg.II-2/19.3.8)

In case that a cargo space is located partly above a machinery space of category A and the deck above the machinery space is not insulated to “A-60” class standard, the goods are prohibited in the whole of that cargo space. If the uninsulated deck above the machinery space is a weather deck, the goods are prohibited only for the portion of the deck located above the machinery space.
(IACS UI SC103 Rev.1)

2.14.3 Insulation for goods of class 1

For goods of class 1, with the exception of class 1.4S, both the fire insulation of “A-60” class standard for the bulkhead between cargo space and machinery space of category A and stowage at least 3 m away from this bulkhead, is required. Stowage above machinery space of category A is not permitted in any case.
(SOLAS Reg.II-2/19Table 19.3Footnote 12)

**Guidance note:**
Machinery spaces of category A are those spaces and trunks to such spaces which contain:
1) internal combustion machinery used for main propulsion; or
2) internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of no less than 375 kW; or
3) any oil-fired boiler or oil fuel unit.

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2.15 Separation of ro-ro spaces

2.15.1 A separation, suitable to minimise the passage of dangerous vapours and liquids, shall be provided between a closed ro-ro space and an adjacent open ro-ro space. Where such separation is not provided the ro-ro space is considered to be a closed ro-ro space over its entire length and the special requirements for closed ro-ro spaces apply.
(SOLAS Reg.II-2/19.3.10.1)

2.15.2 A separation, suitable to minimise the passage of dangerous vapours and liquids, shall be provided between a closed ro-ro space and an adjacent weather deck. Where such separation is not provided the
arrangements of the closed ro-ro space shall be in accordance with those required for the dangerous goods carried on the adjacent weather deck.
(SOLAS Reg.II-2/19.3.10.2)
Table 7 Requirements for the carriage of dangerous goods in packaged form in not specifically designed cargo spaces

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### Requirements

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1) Under the provisions of the IMDG Code, as amended, stowage of class 2.3, class 4.3 liquids having a flashpoint less than 23°C as listed in the IMDG Code and class 5.2 under deck is prohibited.
2) When "mechanically ventilated spaces" are required by the IMDG Code, as amended.
3) Only applicable to dangerous goods having a subsidiary risk class 6.1.
4) When "protected from sources of heat" is required by the IMDG Code, as amended.
### Table 8 Requirements for the carriage of dangerous goods in packaged form in container cargo spaces

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<th>Apparatus group</th>
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</table>

1) Under the provisions of the IMDG Code, as amended, stowage of class 2.3, class 4.3 liquids having a flashpoint less than 23°C as listed in the IMDG Code and class 5.2 under deck is prohibited.

2) When "mechanically ventilated spaces" are required by the IMDG Code, as amended.

3) For solids not applicable to closed freight containers.

4) Only applicable to dangerous goods having a subsidiary risk class 6.1.

5) When "protected from sources of heat" is required by the IMDG Code, as amended.
### Table 9 Requirements for the carriage of dangerous goods in packaged form in closed ro-ro spaces

<table>
<thead>
<tr>
<th>Class</th>
<th>Sources of ignition 2.5-2.7</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fire-extinguishing system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water supplies</td>
<td></td>
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<tr>
<td></td>
<td>Water cooling</td>
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<tr>
<td></td>
<td>Apparatus group</td>
<td></td>
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<tr>
<td></td>
<td>Temperature class</td>
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<tr>
<td></td>
<td>Degree of protection</td>
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</tr>
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<td></td>
<td>Detection system</td>
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<td>Ventilation</td>
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<td>Bilge pumping</td>
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<td>Personnel protection</td>
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<td>Portable fire-extinguishers</td>
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<td></td>
<td>Machinery space boundaries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Separation of ro-ro spaces</td>
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<td>1.1 to 1.6</td>
<td>2.5-2.7</td>
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<td>2.1 other than hydrogen and hydrogen mixtures</td>
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<tr>
<td>3 FP &lt; 23°C</td>
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<tr>
<td>3 23°C ≤ FP ≤ 60°C</td>
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<tr>
<td>Class</td>
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<td>Water supplies</td>
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<tr>
<td>9 other than goods evolving flammable vapour</td>
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<td>2.3</td>
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</table>

1) Under the provisions of the IMDG Code, as amended, stowage of class 2.3, class 4.3 liquids having a flashpoint less than 23°C as listed in the IMDG Code and class 5.2 under deck is prohibited.
2) When "mechanically ventilated spaces" are required by the IMDG Code, as amended.
3) Only applicable to dangerous goods having a subsidiary risk class 6.1.
4) When "protected from sources of heat" is required by the IMDG Code, as amended.
5) Only applicable for ships with keel-laying on or after 1 July 1998.
### Table 10 Requirements for the carriage of dangerous goods in packaged form in open ro-ro spaces

<table>
<thead>
<tr>
<th>Class</th>
<th>Requirements</th>
<th>Fixed pressure water fire-extinguishing system</th>
<th>Water supplies</th>
<th>Water cooling</th>
<th>Sources of ignition 2.5-2.7</th>
<th>Degree of protection</th>
<th>Personnel protection</th>
<th>Portable fire extinguishers</th>
<th>Machinery space boundaries</th>
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<td>IIB</td>
<td>T4</td>
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<td>2.14.2</td>
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## Equipment and design features

### Requirements

<table>
<thead>
<tr>
<th>Class</th>
<th>Fixed pressure water fire-extinguishing system</th>
<th>Water supplies</th>
<th>Water cooling</th>
<th>Sources of ignition 2.5-2.7</th>
<th>Personnel protection</th>
<th>Portable fire extinguishers</th>
<th>Machinery space boundaries</th>
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<td>Temperature class</td>
<td>Degree of protection</td>
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<td>IIB, T4</td>
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<td>2.14.1, 2.14.2</td>
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<td>IIB, T4</td>
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<td></td>
<td>2.12</td>
<td></td>
<td>2.14.1, 2.14.2</td>
</tr>
</tbody>
</table>

1) When "protected from sources of heat" is required by the IMDG Code, as amended.
2) Applicable to goods having a flashpoint less than 23°C as listed in the IMDG Code, as amended.
### Table 11 Requirements for the carriage of dangerous goods in packaged form in shipborne barges

<table>
<thead>
<tr>
<th>Class</th>
<th>Requirements</th>
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<td>2.3 flammable 1)</td>
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<td>3 23°C ≤ FP ≤ 60°C</td>
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1) Non-ionic liquids
2) See Section 2.8.1 of the Code
3) See Section 2.8.2 of the Code
### Equipment and design features

#### Sources of ignition 2.5-2.7

<table>
<thead>
<tr>
<th>Class</th>
<th>Requirements</th>
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<tbody>
<tr>
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<tr>
<td>9 goods evolving flammable vapour exclusively</td>
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<tr>
<td>9 other than goods evolving flammable vapour</td>
<td>2.2.1</td>
</tr>
</tbody>
</table>

1) Under the provisions of the IMDG Code, as amended, stowage of class 2.3, class 4.3 liquids having a flashpoint less than 23°C listed in the IMDG Code and class 5.2 under deck is prohibited.

2) In the special case where the barges are capable of containing flammable vapours or alternatively if they are capable of discharging flammable vapours to a safe outside the barge carrier compartment by means of ventilation ducts connected to the barges, these requirements may be reduced or waived to the satisfaction of the Administration.

3) When “mechanically-ventilated spaces” are required by the IMDG Code, as amended.
Table 12 Requirements for the carriage of dangerous goods in packaged form on the weather deck

<table>
<thead>
<tr>
<th>Class</th>
<th>Fixed fire-extinguishing system</th>
<th>Water supplies</th>
<th>Personnel protection</th>
<th>Portable fire-extinguishers</th>
<th>Machinery space boundaries</th>
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</table>

1) When "protected from sources of heat" is required by the IMDG Code, as amended.
### 3 Requirements for the carriage of solid bulk cargoes

#### 3.1 General

#### 3.1.1 Requirements
The requirements depend on the dangerous goods class and special properties of the cargoes to be carried. The cargoes of Group B and the applicable provisions are shown in Table 1. For cargoes of Group A and C the requirements of [3.1.3] shall be observed.

#### 3.1.2 Classification
Dangerous goods in solid form in bulk are being classified in accordance with the IMDG Code.

- **Class 4.1: Flammable solids**
  - Readily combustible solids and solids which may cause fire through friction.
- **Class 4.2: Substances liable to spontaneous combustion**
  - Materials, other than pyrophoric materials, which, in contact with air without energy supply, are liable to self-heating.
- **Class 4.3: Substances which, in contact with water, emit flammable gases**
  - Solids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.
- **Class 5.1: Oxidizing substances**
  - Materials that, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.
- **Class 7: Radioactive material**
  - Materials containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 2.7.2.2.1 to 2.7.2.2.6 of the IMDG Code.
- **Class 9: Miscellaneous dangerous substances**
  - Materials which, during transport, present a danger not covered by other classes.

**Class MHB: Materials hazardous only in bulk**

- Materials which may possess chemical hazards when transported in bulk other than materials classified as dangerous goods in the IMDG Code.
  - The class "MHB" is supplemented with one or more notational reference(s) in brackets as listed below when the material possesses recognized chemical hazard(s) according to the IMSBC Code, 9.2.3:
    - Combustible solid: MHB (CB)
    - Self-heating solids: MHB (SH)
    - Solids that evolve flammable gas when wet: MHB (WF)
    - Solids that evolve toxic gas when wet: MHB (WT)
    - Toxic solids: MHB (TX)
    - Corrosive solids: MHB (CR)
    - Other hazards: MHB (OH)

#### 3.1.3 Documentation
- All ships intended for the carriage of solid bulk cargoes shall be provided with following documentation:
  - The IMSBC Code, as amended.
  - The approved Loading Manual.
  - The approved Stability Information.
  - The bulk cargo booklet according to SOLAS Reg.VI/7.2.
  - The MFAG. To be provided for cargoes of Group B only.
3.2 Fire-extinguishing system

3.2.1 Fixed gas fire-extinguishing system
All cargo holds of the following ships shall be equipped with a fixed CO₂ fire extinguishing system:
— ships intended for the carriage of dangerous goods in solid form in compliance with SOLAS Reg.II-2/19
— ships of 2000 GT and above intended for the carriage of cargoes of class MHB and cargoes of Group A and C.
(SOLAS Reg.II-2/10.7.1.3 and II-2/10.7.2)

Guidance note:
For ships of less than 500 GT the requirement may be dispensed with subject to acceptance by the flag administration.

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

3.2.2 Exemption certificate
A ship may be exempted from the requirement of a fixed gas fire extinguishing system if constructed and solely intended for the carriage of cargoes as specified in MSC.1/Circ.1395/Rev.2. Such exemption may be granted only if the ship is fitted with steel hatch covers and effective means of closing all ventilators and other openings leading to the cargo spaces.
(SOLAS Reg.II-2/10.7.1.4)
For cargoes according to MSC.1/Circ.1395/Rev.2, Table 2 a fire-extinguishing system giving equivalent protection shall be provided.
For fire-extinguishing systems giving equivalent protection refer to [3.3.2].
(MSC/Circ.1120)

3.3 Fire water supplies

3.3.1 Immediate supply of water
Immediate supply of water from the fire main shall be provided by remote starting arrangement for all main fire pumps from the navigation bridge or from other continuously manned control station or by permanent pressurization of the fire main and by automatic start-up of the main fire pumps.
(SOLAS Reg.II-2/19 3.1.1)
If fire water supply pumps arranged for remote starting also serve other purposes, the pump selected shall be connected to the fire water system, e.g. by automatic change-over of valves or visual signals for valves' correct positions at the remote starting position.

3.3.2 Quantity of water and arrangement of hydrants
The capacity of the main fire pumps shall be sufficient for supplying four jets of water at the pressure as prescribed SOLAS Reg.II-2/10.2.1.6).
The number and position of hydrants shall be such that at least two of the required four jets of water, when supplied by single lengths of hose, may reach any part of the cargo space when empty; and all four jets of water, each supplied by single lengths of hose may reach any part of ro-ro spaces.
(SOLAS Reg.II-2/19.3.1.2, MSC/Circ.1120 and IACS UI SC168 Rev.1)

Guidance note:
The length of the water jet is generally not to be taken more than 7 m.

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

Three additional hoses and nozzles shall be provided.
(SOLAS Reg.II-2/10.2.3.2.3.1)
3.4 Sources of ignition related to electrical equipment

3.4.1 The degree of explosion protection for the individual classes is specified in column "Sources of ignition" of Table 1. If explosion protection is required the following conditions shall be complied with.

3.4.2 Electrical equipment and wiring shall not be fitted in hazardous areas unless it is essential for the safety and operation of the ship.

(IEC 60092-506, 5.1) 5.1)

3.4.3 All electrical equipment in the hazardous area and being essential for the ship's operation shall be of certified safe type corresponding to the degree of explosion protection as shown in Table 1.

(SOLAS Reg.II-2/19.3.2)

3.4.4 Electrical equipment that are not essential to ship's operation need not to be of certified safe type provided it can be electrically disconnected from the power source, by appropriate means other than fuses (e.g. by removal of links, lockable switches), at a point external to the space and to be secured against unintentional reconnection.

3.4.5 The electrical equipment in extended hazardous areas shall either:
— be appropriate for use in the adjacent space in accordance with Table 1; or
— be suitable for zone 2, see Pt.4 Ch.8 Sec.11 [3.2].

3.4.6 The hazardous areas and extended hazardous areas shall be categorised in accordance with Table 3.

3.4.7 Cables shall be either
— protected by electrically continuous metal sheathing or metallic wire armour braid or tape; or
— enclosed in screwed heavy gauge steel drawn or seam-welded and galvanized conduit.

3.4.8 All metallic protective coverings of power and lighting cables passing through a hazardous area or connected to equipment in such an area shall be earthed at least at each end. The metallic covering of all other cables shall be earthed at least at one end.

3.4.9 Cable penetrations of decks and bulkheads shall be gas tight, and of a recognised make.

3.4.10 Cable joints in cargo spaces shall be avoided where possible. Where joints are unavoidable, they shall be enclosed in metal-clad or impact strength plastic junction boxes of certified safe type, or heat shrink or encapsulated crimp sleeve cable joints.

3.5 Sources of ignition related to safety of fans

3.5.1 The fans being essential for the ship's operation shall be of a type (non-sparking type) that prevents the possibility of the ignition of flammable gas mixtures and shall comply with Pt.5 Ch.5 Sec.6 [1.2]. Otherwise the fans shall be capable of being disconnected from the power source, see [3.4.1.3].

(SOLAS Reg.II-2/19.3.4.2, IACS UI SC52.1 Rev.1 and IACS UR F29)

3.5.2 The fan openings on deck shall be fitted with fixed wire mesh guards with a mesh size not exceeding 13 mm.

The purpose of the wire mesh guards is to prevent foreign objects from entering into the fan casing.

(SOLAS Reg.II-2/19.3.4.2, IACS UI SC52.2 Rev.1 and MSC/Circ.1120)
3.5.3 The air inlets and outlets shall be placed at a safe distance from possible ignition sources. A spherical radius of 3 m around the air outlets, within which ignition sources are prohibited, is required.

3.6 Other sources of ignition

Other sources of ignition shall not be installed in hazardous areas and extended hazardous areas, e.g. steam or thermal oil lines.

_Guidance note:_
According to the IMSBC Code Subsec.1.7 potential sources of ignition means, but is not limited to, open fires, machinery exhausts, galley uptakes, electrical outlets and electrical equipment unless they are of certified safe type.

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

3.7 Measurement equipment

3.7.1 Portable equipment required for the carriage of individual cargoes shall be available on board prior to loading.

3.7.2 Surface temperature

Means shall be provided for measuring the surface temperature of the cargo. In case of portable temperature sensors, the arrangement shall enable the measurement without entering the hold.

3.7.3 Cargo temperature

Means shall be provided for measuring the temperature inside the cargo. In case of portable temperature sensors, the arrangement shall enable the measurement without entering the hold.

_Guidance note:_
Detailed requirements on temperature measurement for the individual cargoes should be agreed with the shipper.

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

3.7.4 Gas measurement

For the quantitative measurements of the following gases in the cargo spaces and adjacent enclosed spaces suitable detectors for each gas or combination of gases shall be provided:

- a) acetylene
- b) ammonia
- c) arsine
- d) carbon dioxide
- e) carbon monoxide
- f) hydrogen
- g) hydrogen cyanide
- h) hydrogen sulphide
- i) methane
- j) oxygen (0 - 21% by volume)
- k) phosphine
- l) silane
- m) sulphur dioxide
- n) toxic gases that may be given off from the particular cargo according to shipper’s instructions/material safety data sheet
  (SOLAS Reg.VI/3.1, IMSBC Code 3.2.5 and IMSBC Code Appendix 1)
  Suitable personal gas detection equipment for crew entering cargo spaces and adjacent enclosed spaces for following gases shall be provided:
- o) carbon monoxide meters
p) oxygen meters  
(IMSBC Code Appendix 1)

3.7.5 Acidity of bilge water  
Means shall be provided for testing the acidity of the water in the bilge wells.

3.8 Ventilation  

3.8.1 General  
Cargo hold ventilation systems shall be separated from the ventilation systems serving other spaces.  
If cargo holds are subdivided for reasons of stability, freeboard or fire protection (e.g. separate flooding with CO₂) this has to be taken into account for the design of the ventilation systems.  
Air ducts and components of ventilation systems shall be so installed that they are protected from damage.  
If adjacent spaces are not separated from cargo spaces by gastight bulkheads or decks, then they shall be considered as part of the enclosed cargo space and the ventilation requirements shall apply to the adjacent space as for the enclosed cargo space itself.  
(MSC/Circ.1120 and IACS UI SC89 Rev.3)

3.8.2 Ducting  
The ducting shall be arranged such that the space above the cargo can be ventilated and that exchange of air from outside to inside the entire cargo space is provided. The position of air inlets and air outlets shall be such as to prevent short circuiting of the air.

3.8.3 Natural ventilation  
A ventilation system which does not incorporate mechanical fans is sufficient.

3.8.4 Mechanical ventilation  
A ventilation system which incorporates powered fans with an unspecified capacity shall be provided.

3.8.5 Mechanical ventilation (six air changes/h)  
A ventilation system which incorporates powered fans with a capacity of at least six air changes per hour based on the empty cargo hold shall be provided.

3.8.6 Continuous mechanical ventilation  
A ventilation system which incorporates at least two powered fans with a capacity of at least three air changes per hour each (six air changes/h in total) based on the empty cargo hold shall be provided.  
(IACS UI SC 89 Rev.3)

3.8.7 Portable fans  
If ventilation fans are required portable fans may be used instead of fixed ones. If so, suitable arrangements for securing the fans safely shall be provided. Electrical connections shall be fixed and expertly laid for the duration of the installation. Details shall be submitted for approval.

3.9 Additional provisions on ventilation  

3.9.1 Spark arresting screens  
All ventilation openings on deck shall be fitted with suitable spark arresting screens prior to loading. Spark arresting screens are considered portable equipment shall be available on board prior to loading.  
(IMSBC Code Appendix 1)
3.9.2 Openings for continuous mechanical ventilation
The ventilation openings shall comply with the requirements of the Load Line Convention, for openings not fitted with means of closure. According to ICLL, Regulation 19(3) the openings shall be arranged at least 4.50 m above deck in position 1 and at least 2.30 m above deck in position 2.
(IMSBCode Para. 3.5.4 and IACS UI SC89 Rev.3)

Guidance note:
This does not prohibit ventilators from being fitted with a means of closure as required for fire protection purposes under SOLAS Reg.II-2/5.2.1.1.

(IACS UI SC89 Rev.3)

3.9.3 Escaping gases
The ventilation outlets shall be arranged at least 10 m away from living quarters on or under deck.

3.10 Bilge pumping

3.10.1 Inadvertent pumping
The bilge system shall be designed so as to prevent inadvertent pumping of flammable and toxic liquids through pumps and pipelines in the machinery space.
(SOLAS Reg.II-2/19.3.5.1)

3.10.2 Isolating valves
The cargo hold bilge lines shall be provided with isolating valves outside the machinery space or at the point of exit from the machinery space located close to the bulkhead.
The valves shall be capable of being secured in closed position (e.g. safety locking device). Remote controlled valves shall be capable of being secured in closed position. In case a computer-based system is provided, this system shall contain a corresponding safety query on the display.
(SOLAS Reg.II-2/19.3.5.3)

3.10.3 Warning signs
Warning signs shall be displayed at the isolating valve or control positions, e.g. "This valve to be kept secured in closed position during the carriage of dangerous goods in cargo hold nos. ___ and may be operated with the permission of the master only".

3.10.4 Inspection of bilge pumping arrangements
Prior to loading, the safety of the bilge pumping arrangements for cargo holds shall be approved by the flag administration.
(IMSBC Code Appendix 1)

3.11 Personnel protection – full protective clothing

3.11.1 The protective clothing shall satisfy the equipment requirements specified in the EmS Guide for the individual substances.
The required protective clothing is for emergency purposes.
(MSC/Circ.1120 and IACS UI SC91 Rev.1)

3.11.2 Two sets of full protective clothing appropriate to the properties of the cargo shall be provided.
(IMSBC Code Appendix 1 Emergency procedures)

3.11.3 Four sets of full protective clothing appropriate to the properties of the cargo shall be provided.
3.12 Personnel protection - self-contained breathing apparatuses

3.12.1 Two sets of self-contained breathing apparatuses with spare air cylinders for at least two refills for each set shall be provided.  
(IMSBC Code Appendix 1 Emergency procedures)

3.12.2 Additional two sets of self-contained breathing apparatuses with spare air cylinders for at least two refills for each set shall be provided.  
(SOLAS II-2/19.3.6.2 and IACS UI SC92 Rev.1)

3.13 No smoking signs

“NO SMOKING” signs shall be posted in the vicinity of cargo holds and in areas adjacent to cargo holds.

3.14 Machinery space boundaries

3.14.1 A-60 insulation

Bulkheads between cargo spaces and machinery spaces of category A shall be provided with a fire insulation to "A-60" class standard. Otherwise the cargoes shall be stowed at least 3 m away from the machinery space bulkhead.

Guidance note:
The 3 m distance can be provided by a grain bulkhead, big bags or by other means of separation.

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

Decks between cargo and machinery spaces of category A shall be insulated to "A-60" class standard.  
(SOLAS Reg.II-2/19.3.8)

Guidance note:
Machinery spaces of category A are those spaces and trunks to such spaces which contain:
1) internal combustion machinery used for main propulsion; or
2) internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of no less than 375 kW; or
3) any oil-fired boiler or oil fuel unit.

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3.14.2 Gas-tightness

All boundaries between the cargo hold and the machinery space shall be gastight. Cable penetrations are not permitted.  
Interconnection of cargo hold ventilation trunks with other cargo holds, accommodation or work areas is not permitted.

3.14.3 Inspection of engine room bulkhead

Prior to loading, the bulkheads to the engine room shall be inspected and approved by the Administration as gastight.

3.15 Other boundaries

All boundaries of the cargo holds shall be resistant to fire and passage of water (at least “A-0” standard).
3.16 Gas sampling points

Two gas sampling points per cargo hold shall be arranged in the hatch cover or hatch coaming preferably one on each side, provided with threaded stubs and sealing caps according to Figure 1. The sampling points shall be located as high as possible, e.g. upper part of hatch. Fore and aft location may also be accepted if this is deemed more advantageous.

![Figure 1 Gas sampling points](image)

3.17 Weather tightness

Hatch covers, closures for all ventilators and other closures for openings leading to the cargo holds shall be inspected and tested in the presence of a surveyor (hose testing or equivalent) to verify weather-tightness.

3.18 Fuel tanks

3.18.1 Tightness

Prior to loading, fuel tanks situated under the cargo spaces shall be pressure tested in the presence of a surveyor to verify that there is no leakage of manholes and piping systems leading to the tanks.

3.18.2 Sources of heat

Stowage adjacent to sources of heat, including fuel tanks which may require heating is not permitted.

Guidance note:
For AMMONIUM NITRATE UN 1942 heating arrangements for fuel tanks should be disconnected and shall remain disconnected during the entire voyage.

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3.18.3 Sources of heat

Stowage adjacent to sources of heat and to fuel tanks heated to more than 55°C is not permitted.

Guidance note:
For BROWN COAL BRIQUETTES and COAL this requirement is considered to be met if the fuel oil temperature is controlled at less than 55°C. This temperature should not exceed for periods greater than 12 hours in any 24-hour period and the maximum temperature reached should not exceed 65°C.

---end---of---g-u-i-d-a-n-c-e---n-o-t-e---
3.18.4 Sources of heat
Stowage to sources of heat and to tanks, double bottoms or pipes containing fuel oil heated to more than 50°C is not permitted. Means shall be provided to monitor and to control the temperature so that it does not exceed 50°C

3.19 Self-unloading system

3.19.1 Types of self-unloading systems:
— Closed: The part of the system located outside the cargo hold is fully enclosed, e.g. pneumatic systems or fully enclosed chain conveyors.
— Open: Open type systems, e.g. belt conveyors and bucket conveyors.
For some cargoes the use of self-unloading systems are not permitted due to hazards involved. For other cargoes only closed systems are permitted.

3.19.2 Spaces containing self-unloading systems shall be provided with a water flushing system enabling easy cleaning/removal of dust deposits.

3.19.3 Self-unloading systems of the open type shall be arranged for emergency stop from convenient locations within the cargo handling spaces and on open deck.

3.19.4 Spaces containing self-unloading systems shall be fitted with mechanical ventilation giving at least 6 air changes per hour.

3.19.5 Electrical equipment in spaces containing self-unloading systems shall comply with the requirements under [3.4].
Conveyor belts shall be made from materials not liable to accumulate static electricity.

3.19.6 Depending on the properties of the cargoes the spaces containing self-unloading systems shall be equipped either with:

a) a fixed CO₂ fire extinguishing system; or
b) a fixed water spraying system with a of at least 5 l/min/m² of the largest horizontal area.
   Drainage and pumping arrangements shall be designed in compliance with Pt.4 Ch.6, as applicable.

Guidance note:
According to the IMSBC Code 3.1.2 regular fire safety risk assessments shall be carried out for cargo handling areas on self-unloading bulk carriers featuring internally installed conveyor systems within the ships structure. Due consideration shall be given to the fire prevention and the effective operation of fire detection systems, containment and suppression under all anticipated operating conditions and cargoes.

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Table 13 Requirements for solid bulk cargoes

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<th>Degree of protection</th>
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<th>Fire extinguishing system</th>
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## Cargo

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<tr>
<td>Zinc ashes UN 1435</td>
<td>4.3</td>
<td>3.2.2</td>
<td>IIC</td>
<td>T2</td>
<td>3.7, 4 f) n)</td>
<td>3.8.2 3.8.6</td>
<td>3.9.2</td>
<td>3.11.3 3.12.2</td>
<td>3.13</td>
<td>3.14.1</td>
<td>3.19.6 a)</td>
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<td></td>
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</tbody>
</table>

1) All electrical equipment, other than that of approved intrinsically safe type, shall be disconnected according to [3.4.3].
2) Additional requirements for DIRECT REDUCED IRON (B) and (C) shall be agreed upon with the Society.
SECTION 11 RECOVERED OIL RECEPTION AND TRANSPORTATION - OILREC

1 General

1.1 Introduction

The additional class notation OILREC sets requirements for shipboard systems and arrangements in performing occasional handling, storage and transportation of recovered oil with flash point below 60°C; hence, providing assistance in limiting environmental consequences from an oil spill at sea.

1.2 Scope

The scope for additional class notation OILREC establishes an increased level of safety concerning the requirements for the arrangement, safety and operation of a vessel, equipped and arranged for oil recovery, at sea. Safety issues covered by this class notation include: fire and explosion during handling, storage and transportation of oil recovered from an oil spill at sea, supporting structures for equipment employed during oil recovery operations, stability and floatability and available power to equipment used during oil recovery operations.

1.3 Application

The additional class notation OILREC applies to vessels equipped for the recovery of oil from an oil spill at sea. The oil recovery system covered by this class notation includes the system for transfer and pumping of recovered oil; from the oil skimmer’s connection flange up to and including the discharge delivery flange. It is assumed that the operation of the vessel during oil recovery operations will be in accordance with the approved operation manual, see [6.1]. Vessels found to be in compliance with these rules may be given the additional class notation OILREC.

1.4 Class notations

1.4.1 Vessels built and equipped in compliance with the requirements given in this section may be given the class notation OILREC.

2 Documentation and testing

2.1 Documentation

2.1.1 Documentation shall be submitted as required by Table 1.

Table 1 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil recovery piping system.</td>
<td>S010 - Piping diagram</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z160 - Operation manual</td>
<td>See [6.1].</td>
<td>AP</td>
</tr>
<tr>
<td>Heating system</td>
<td>S010 - Piping diagram</td>
<td></td>
<td>AP</td>
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</table>
### Electrical Installations in Hazardous Areas

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z030 - Arrangement plan</td>
<td>Including steam nozzle arrangements with tank penetrations</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>G080 - Hazardous area classification drawing</td>
<td></td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z030 - Arrangement plan</td>
<td>Electrical equipment in hazardous areas. 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.)</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>E090 - Table of Ex-installation</td>
<td></td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z163 - Maintenance manual</td>
<td>Electrical equipment in hazardous areas, see Pt.5 Ch.5 Sec.8 [5.1].</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>E170 Electrical schematic drawing</td>
<td>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.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>E040 - Electrical load balance</td>
<td>For oil recovery operations, if applicable.</td>
<td>AP</td>
<td></td>
</tr>
</tbody>
</table>

### Exhaust System

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z030 - Arrangement plan</td>
<td>Including spark arrestors.</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>G060 - Structural fire protection drawing</td>
<td>See however [1.3.4].</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z030 - Arrangement plan</td>
<td>At working deck, see however [1.3.4].</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>H050 - Structural drawing</td>
<td>Supporting structures and fastening arrangements, including reaction forces.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Z160 - Operation manual</td>
<td>see [6.1].</td>
<td>AP</td>
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</tbody>
</table>

**AP = For approval; FI = For information**

#### 2.1.2 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

#### 2.1.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

#### 2.1.4 If fire extinguishing equipment and structural fire protection and/or stability and floatability have been approved by a flag administration applying requirements which may be considered equivalent to those of the rules, such approval, satisfactorily documented, may be accepted as evidence of compliance with the rule requirements.

#### 2.2 Testing

#### 2.2.1

Upon completion, the procedure of changing to the vessel’s oil recovery mode shall be demonstrated and such an operation shall be simulated to verify that the vessel will be able to operate as intended and described in the operation manual.
The test need not include oil recovery equipment that will be put on board during mobilization.

3 Basic requirements

3.1 General

3.1.1 The vessel shall be provided with:
— a suitable working deck for use in oil recovery operations
— storage tanks for recovered oil
— permanently installed pumping and piping arrangement for transfer and discharge of recovered oil.

3.1.2 The vessel shall have adequate stability and floatability in all relevant operational conditions. The stability and floatability properties will be considered in each particular case.

3.1.3 The visibility from the manoeuvring station shall be such that the master can easily monitor oil recovery operations both on deck and in the water.

3.1.4 The oil tanks and the deck area, from where the operation is performed, shall be as far away from the accommodation as possible.

3.1.5 Deck spills shall be kept away from accommodation and service areas through suitable precautionary means, such as a permanent coaming of suitable height extending from side to side or around loading and discharge stations.

3.1.6 Exhaust outlets from machinery shall be located as high as practicable above the deck and shall be fitted with spark arresters.

3.2 Fire protection and extinction

3.2.1 For vessels with cargo tanks forward of the superstructure, the exterior boundaries of superstructures and deckhouses enclosing the accommodation, including any overhanging decks which support such accommodation, shall be constructed of steel and insulated to A60 fire integrity.

The whole portion which face the cargo area (up to bridge windows) and on the outward sides for a distance of 3 m from the end boundary facing the cargo area shall be protected. The distance of 3 m shall be measured horizontally and parallel to the middle line of the ship from the boundary which faces the cargo area at each deck level.

The sides of these superstructures and deckhouses, A-60 insulation shall be carried up to the underside of the bridge navigation deck.

In lieu of A-60 fire integrity, construction to A-0 fire integrity with a permanently installed water-spraying system in compliance with [2.2.4] may be accepted.

Guidance note:
The external boundaries of service spaces used as deck stores need not to be insulated provided there is no direct or indirect access to any other spaces and that they are insulated to A-60 standard towards adjacent spaces.

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

3.2.2 The requirement in [2.2.1] is also applicable to vessels with cargo tanks aft of the superstructure, provided the exterior boundaries of superstructures and deckhouses enclosing accommodation, including any overhanging decks which support such accommodation, are situated within 10 m of the nearest hazardous area seen in profile, see Figure 1.
3.2.3 The requirement in [2.2.1] is also applicable for access doors, windows and portholes fitted in such boundaries.

Windows and portholes fitted with permanently hinged inside deadlights of steel having a thickness not less than 3 mm will be accepted in lieu A-0 standard, provided the Oil Recovery Operation (ORO) manual specifies that these deadlights are closed during oil recovery operations.

Water-/weathertight doors constructed of steel will be accepted in lieu of A-0 standard. If they are fitted with windows/portholes, deadlights as mentioned above shall be fitted.

3.2.4 The water-spraying system referred to in [2.2.1] shall have a capacity of at least 10 litres/minute/m². The system shall be fully activated from bridge.

3.2.5 For protection of the working deck area two semi-portable 25 kg dry powder fire extinguishers shall be provided. They shall be stored in readily available spaces adjacent to the working deck.

In addition, the vessel should carry two portable foam applicator units with at least 4 portable 20 litre containers with foam concentrate, for use with water supplied by the vessels fire main.

3.3 Tank arrangement

3.3.1 Recovered oil shall not be stored in tanks within the accommodation and/or machinery spaces of category A.

3.3.2 Tanks intended for storage of recovered oil shall be separated from machinery spaces of category A and accommodation by means of:

— cofferdams or
— tanks for other purposes (fuel oil, ballast etc.) or
— dry compartments other than accommodation.

For easy access to all parts, the cofferdams shall have a minimum width of 600 mm.

3.3.3 Where cofferdams are impractical to arrange, tanks adjacent to the engine room may be accepted for storage of recovered oil provided the tank bulkhead is:

— accessible for inspection
— carried continuously through abutting plate panels, except that full penetration welding may be used at the top of the tank.

Figure 1 Distance from hazardous area

The diagram shows a distance of 10 m from the hazardous area.
— pressure tested at every complete periodical survey.

3.3.4 All openings to the tanks for recovered oil shall be located on open deck.

3.3.5 Tanks for recovered oil shall have suitable access hatches with minimum clear opening of 600 × 600mm from open deck for cleaning and gas-freeing. Long tanks shall have access in both ends.

3.3.6 Tanks exceeding a breadth of 0.56\(B\) or a length of 0.1\(L\) or 12 m whichever is the greater shall be provided with wash bulkheads or similar arrangement to reduce liquid sloshing in partially filled tanks.

3.3.7 The height of tanks for recovered oil shall not be less than 1.5 m. Internal obstructions in tanks for recovered oil shall be provided with adequate openings to allow a full flow of oil. The area of one single opening shall for that purpose not to be less than twice the sectional area of the discharge pipe. The openings shall be so arranged that the tanks can be effectively drained.

3.3.8 Any coating in tanks for recovered oil shall be of an oil and dispersion resistant type.

3.4 Support of heavy components

3.4.1 The strength of the supporting structures for equipment applied during oil recovery operations can be based on the assumption that the oil recovery operations will take place in moderate sea conditions.

3.4.2 For cranes intended for use during oil recovery operations, dynamic loads due to the vessel's motions shall be taken into account. In general the cranes and their supporting structures shall have scantlings based on at least twice the working load of the crane.

4 Hazardous and non-hazardous areas

4.1 Area classification

4.1.1 In order to facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2.

4.1.2 Hazardous areas zone 0:
The interiors of cargo tanks, any pipe work of pressure-relief or other venting systems for cargo tanks, pipes and equipment containing the cargo or developing flammable gases or vapours.

4.1.3 Hazardous areas zone 1:
1) Cargo pump room.
2) Enclosed or semi-enclosed spaces in which recovered oil pipe flanges and or valves are located.
3) Enclosed or semi-enclosed spaces in which oil contaminated equipment for handling of recovered oil are located.
4) Areas on the open deck or semi-enclosed spaces on the deck within a distance of 3 m from oil skimmer equipment, hoses and valves used for recovered oil handling, openings and air pipes from tanks for recovered oil and openings and ventilation outlets from hazardous areas.

Guidance note: A cargo rail that is not open from above and with at least two sides will be considered as a semi-enclosed space. If gas tight doors are installed in the cargo rail this may be considered when analysing and classifying the space.
4.1.4 Hazardous areas zone 2:
1) Cofferdams and spaces adjacent to tanks intended for storage of recovered oil, not containing pipe flanges or valves.
2) Open deck over tanks intended for storage of recovered oil and 3 m forward and aft of this area, to the full width of the ship, on the open deck up to a height of 2.4 m above the deck.

4.1.5 A space with access doors or other openings into a hazardous area shall be considered to have the same hazardous zone classification as the adjacent hazardous area. See however [3.2.1].

4.1.6 Non-hazardous areas are areas which are not defined as hazardous in the above.

4.2 Access openings between non-hazardous spaces and hazardous area

4.2.1 A non-hazardous space with access doors to hazardous area may be accepted as non-hazardous on the following conditions:
1) The non-hazardous room shall have overpressure ventilation with 20 air changes per hour in relation to the hazardous area.
2) The doors shall be gastight.
3) The doors shall be self-closing and preferably arranged to swing into the non-hazardous space so that they are kept closed by the overpressure.
4) If a door cannot be made self-closing, a second self-closing door in accordance with 2) and 3) above shall be arranged. The doors shall be arranged with sufficient spacing to allow for safe passage.
5) Self-closing doors may be used for passage, but shall not remain open during oil recovery operations. Signboards shall be fitted to this effect.
6) Emergency escape hatches to open deck that cannot be made self-closing need not be arranged with an air lock, but during oil recovery operations they can only be used for emergency escape purpose. Signboards shall be fitted to this effect.

Guidance note:
A watertight sliding door is not accepted as a self-closing door as the self-closing mode is considered too hazardous. Hence, a second self-closing door in accordance with 2) and 3) above shall be arranged. The doors shall be arranged with sufficient spacing to allow for safe passage.

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

4.2.2 Access doors to non-hazardous spaces not normally entered may be accepted without the arrangements in [3.2.1] 3) and 4) provided it is locked closed during oil recovery operations and fitted with signboards to that effect.

5 Arrangement and equipment

5.1 General

5.1.1 Systems and safety arrangements for handling of recovered oil shall be permanently installed in order to minimize the time needed to make the vessel operational for oil recovery tasks.

5.1.2 Systems and arrangements shall be such that procedures for and practical execution of filling, venting, discharge, sounding, etc. will be simple to perform.

5.1.3 All electrical and mechanical equipment for use in hazardous areas during oil recovery operations shall be certified for operation in gas contaminated atmosphere.
5.2 Ventilation system

5.2.1 Hazardous and non-hazardous spaces shall be independently ventilated.

5.2.2 Non-hazardous spaces adjacent to hazardous areas shall have mechanical ventilation with overpressure relative to hazardous areas. The inlet air shall be taken from a non-hazardous area at least 1.5 m from the boundaries of any hazardous area. The outlet air shall be led to a non-hazardous area on open deck.

5.2.3 Hazardous spaces shall have mechanical ventilation of extraction type, with 8 air changes per hour. The inlet air for hazardous enclosed spaces shall be taken from non-hazardous areas. The outlet air shall be led to an open area, which, in the absence of the considered outlet, would be of the same or lesser hazard than the ventilated space.

5.2.4 Small hazardous spaces located on or above cargo deck level (e.g. deck stores) may be accepted with natural ventilation only.

5.2.5 Spaces which normally would be regarded as zone 2 according to [3.1.4] 1) above may be accepted as non-hazardous on the condition that the following special requirements to ventilation in addition to those given in [4.2.2] above are complied with:

— the ventilation capacity shall be at least 20 changes of air per hour
— the arrangement of ventilation inlet and outlet openings in the room shall be such that the entire room is efficiently ventilated, taking special consideration to locations where gas may be released or accumulated.

5.2.6 Fans serving hazardous spaces shall be in compliance with Pt.5 Ch.5 Sec.6 [1.2].

5.2.7 For hazardous spaces or when the space is dependent on ventilation for its area classification, the following requirements apply:

1) Operation of the ventilation shall be monitored.
2) In the event of failure of ventilation, the following requirements apply;

— an audible and visual alarm shall be given at a manned location
— immediate action shall be taken to restore ventilation.

5.3 Tank venting system

5.3.1 Ventilation outlets from the tanks shall be led to open deck. The outlets shall have a minimum height of 2.4 m above deck and be located at a minimum horizontal distance of 5 m away from openings to accommodation and other non-hazardous spaces, ventilation intakes for accommodation and engine room and non-certified safe electrical equipment.

5.3.2 Portable ventilation outlet pipes intended for use during oil spill recovery operations only, may be accepted.

5.3.3 The venting arrangement shall in general comply with the requirements given for the main class.

5.4 Arrangement of piping systems

5.4.1 There shall be no permanent connection between hazardous piping systems and other piping systems in the vessel, unless specified in this section.
5.4.2 The system for pumping and transfer of recovered oil shall be permanently installed and shall be located outside machinery spaces, accommodation and other non-hazardous areas. Flexible hoses shall not be used in the system for pumping and transfer of recovered oil.

5.4.3 Oil recovery piping systems shall be of pipe class II defined in Pt.4 Ch.6 irrespective of design pressure and temperature.

5.4.4 The transfer system shall be arranged such that simultaneous filling and discharge will be possible.

5.4.5 For coupling of portable skimming equipment one filling connection with branch pipes to all tanks for recovered oil shall be arranged on deck close to the skimming equipment.

5.4.6 The filling line shall be provided with means for injection of emulsion-breaking chemicals. For tanks provided with heating the requirements may be dispensed with.

5.4.7 Piping systems for recovered oil shall be segregated from all other piping systems with blind flange valves.

Any part of a piping system not segregated from the oil recovery tanks or piping systems by blind flange valves are considered to be part of the oil recovery system. Such systems shall also be covered by the cleaning procedures in the operation manual required in [6.1.1].

5.4.8 Correct positions (open or closed) of blind flange valves shall be identified by colour marking or signboards.

5.4.9 Parts of existing cargo piping may be used for pumping and transfer of recovered oil. However, for such systems the design pressure shall be taken as the highest design pressure of any interconnected system.

Guidance note:
Temporary manipulation of displacement pump safety valves is not accepted as a means for reducing the design pressure.

5.4.10 The internal diameter of sounding pipes from tanks for recovered oil shall not be less than 50 mm. The sounding pipes shall be located on open deck.

5.4.11 Bilge drainage of the pump room and other hazardous spaces shall be independent of the bilge system in the remainder of the vessel.

5.5 Tank heating - general

5.5.1 For closed heating systems, refer to Pt.5 Ch.5 Sec.4 [4.1] and Pt.5 Ch.6 Sec.7 [1.1.3] to Pt.5 Ch.6 Sec.7 [1.1.5].

5.5.2 To prevent the return of oil or vapour to any part of the system located in non-hazardous spaces, the steam supply line shall be fitted with two shut-off valves in series with a venting valve in between (double block and bleed valves).

These valves shall be located outside non-hazardous spaces and shall function under all normal conditions of trim, list and motion of the ship. The bleed pipe for the automatic double block and bleed system shall be led to open air and in an area away from where personnel may be located. It is recommended that the outlet is located or protected to prevent water ingress.

The following conditions apply:

a) The operation of the valves shall be automatically executed. Signals for opening and closing shall be taken from the process directly, e.g. pressure sensor on steam delivery side of the double block and bleed.
b) An alarm for faulty operation of the valves shall be provided. Manual drain valves or air blowing connections may be accepted into enclosed spaces provided these are defined as hazardous zone 1.

5.5.3 Threaded connections will not be accepted for attaching the nozzles to the cargo tanks, nor as method of pipe-valve joining. I.e. flange connections are required.

5.6 Steam nozzle arrangement - Penetrations below top of tank

5.6.1 Flexible hoses shall not be incorporated in the steam system if steam nozzle penetrations are fitted below the top of the tank. Non-permanent pipe connections to steam nozzles shall be made of steel piping. Blind covers shall be fitted when steam nozzles are not permanently installed.

5.6.2 Each tank penetration below top of tank shall be fitted with a closable non-return valve or a non-return valve and a closable valve in series. Non-return valves integrated in nozzles will be specially considered.

5.6.3 If steam nozzles penetrate below top of tank in tanks otherwise used for low flashpoint liquids (LFL(1)/LFL(2)) the following apply:
   — [5.6.2] applies
   — the steam piping, non-return valves and isolation valves shall be located in cofferdams
   — the steam piping shall be led from top of cofferdam with spool piece or blind flange valve in open air at deck level
   — the arrangement is not to require access in the cofferdam for installation or operation of the system, i.e. isolation valves need to be remote operated.

5.7 Steam nozzle arrangement - Penetrations from top of tank

5.7.1 Steam lances fitted on deck shall be configured with hatch raised 760 mm above deck. (A Load Line requirement.)

5.7.2 Steam nozzles shall be fixed to the tank during oil recovery operation. This implies that at least one nozzle is required per tank. The penetration shall be gastight and compatible with steam, oil and seawater. An arrangement bolting the sealing to the hatch and the nozzle is required.

5.7.3 The steam supply system shall be permanently installed. However flexible hoses of short and rigid type may be accepted for connecting nozzles to the steam supply system. Flexible hoses and couplings shall be type approved for the relevant steam temperature.

5.8 Power supply and electrical equipment

5.8.1 Electrical installations in hazardous areas shall comply with the requirements given in Pt.4 Ch.8 Sec.10.

5.8.2 Means to disconnect the electrical supply to non-certified electrical equipment in hazardous spaces shall be arranged for. Signboards shall be fitted at the respective switches and such equipment shall be listed in the operation manual referred to in [6.1]. Electrical cables led through these spaces and electrical equipment in the machinery spaces are exempted. Systems or components supporting main functions or safety systems will not be accepted disconnected during oil recovery operations.
5.8.3 Non-certified safe electrical equipment located in hazardous areas on open deck shall be disconnected during oil recovery operation.

5.8.4 The arrangement of power supply to non-permanent oil skimming and pumping equipment shall as far as practicable be permanently installed.

For circuits with higher rating, the outlet shall be arranged from a connection box, provided with a door which is interlocked with a switch.

The supply from the main switchboard to the connection box or socket-outlet shall be permanently installed, and provided with separate switchgear with short-circuit and over current protection in each insulated phase.

5.8.5 Non-permanent oil skimming and pumping equipment and independent power-packages shall be certified as safe for operation in gas-contaminated atmosphere.

5.8.6 The socket-outlet and connection boxes mentioned in [5.8.4] shall be located at easily accessible places and in such a way that flexible cables are not carried through doors or port lights leading from working deck to machinery or accommodation spaces.

5.9 Miscellaneous requirements

5.9.1 A portable hydrocarbon gas-measuring instrument of approved type shall be provided on board.

5.9.2 The deck area where handling of hoses and equipment for recovered oil takes place shall be provided with adequate lighting.

5.9.3 If sea water cooling is provided for machinery, low sea suction shall be arranged.

5.9.4 Exhaust pipes or any other pipes with surface temperature exceeding 220°C shall not pass through hazardous areas.

5.9.5 Signboards shall be fixed by screws, rivets or equal.

6 Operational instructions

6.1 General

6.1.1 The vessel shall have an approved operation manual on board. The manual shall give information regarding the safe use of the vessel during oil recovery operations and shall have references to enclosed drawings.

6.1.2 The operation manual shall give information regarding the following:

1) Arrangement and equipment:
   — tank arrangement
   — transfer system
   — gas measuring instrument
   — various equipment

2) Mobilisation:
   — checking of all equipment taken onboard to ascertain that it is certified for use in gas-contaminated atmospheres
   — mounting and fastening of non-permanent equipment
   — blanking-off of pipes
— assembling of air pipes
— disconnection of electrical power supply
— closing of openings between non-hazardous and hazardous areas
— start of additional ventilation equipment
— change-over to low suction for cooling water pumps
— fitting of signboards regarding the use of open flame, non-certified electrical equipment etc.

3) Operation:
— guidelines regarding safe distance from an oil spill source. If gases are traced on open deck, the vessel shall be withdrawn immediately
— gas measurements during operation (on open deck and in spaces where gas might accumulate)
— actions to be taken if gases are traced in enclosed spaces (cleaning, ventilation, emptying of adjacent tanks, etc.)
— precautions against overfilling of tanks
— discharging.

4) Cleaning and gas-freeing of tanks and pipes.

5) Reference drawings.
The operations manual shall as a minimum refer to the valid stability documentation.

**Guidance note:**
Relevant additional loading conditions and/or stability instructions to be included in the stability manual.

---end-of-guidance-note---
SECTION 12 SINGLE POINT MOORINGS - SPM

1 General

1.1 Introduction
The additional class notation SPM sets requirements for tankers being moored to single point moorings.

1.2 Scope
The scope for additional class notation SPM establishes requirements for tankers being moored to single point moorings. Consideration will be given to the special bow loading and mooring arrangements for offshore loading, and as such will be included in the Appendix to the Classification Certificate. The suitability of bow mooring arrangements on shuttle tankers will be taken on a case-by-case basis.

1.3 Application
The additional class notation SPM applies to ships fitted with equipment enabling them to be moored to single point moorings. These requirements cover the parts of OCIMF’s (Oil Companies’ International Marine Forum) "Recommendations for Equipment Employed in the Bow Mooring of Conventional Tankers at Single Point Moorings" Fourth Edition May 2007 applicable for the vessel, and are supplementary to those for the ship type notation Tanker for oil. The class notation SPM may be given in combination with Bow loading. Ships built in compliance with the requirements as specified in Table 1 will be assigned the additional notation SPM.

1.4 Class notations

1.4.1 Additional class notation related to equipment and design features - SPM
Ships built in compliance with the requirements as specified in Table 1 will be assigned the additional notation SPM:

Table 1 Class notation

<table>
<thead>
<tr>
<th>Class Notation</th>
<th>Qualifier</th>
<th>Purpose</th>
<th>Application</th>
</tr>
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<tbody>
<tr>
<td>SPM</td>
<td>&lt;None&gt;</td>
<td>Single point mooring</td>
<td>Mandatory for Tanker for oil when installed 1)</td>
</tr>
<tr>
<td>Mandatory:</td>
<td>Yes</td>
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<td></td>
</tr>
<tr>
<td>Design requirements:</td>
<td>[4]</td>
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</tr>
<tr>
<td>FiS requirements:</td>
<td>Pt.7 Ch.1 Sec.2, Pt.7 Ch.1 Sec.3, and Pt.7 Ch.1 Sec.4</td>
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</table>

1) Oil carriers having a mooring and loading system in the bow for transfer of crude oil from offshore loading terminals to the ship, i.e. notation Bow loading, are not necessarily specially equipped to be moored at single point mooring buoys. In such cases, the class notation SPM is not mandatory.

1.4.2 SPM in combination with bow loading
The class notation SPM may be given in combination with Bow loading.
Guidance note 1:
Due to the special bow loading and mooring arrangements for offshore loadings, requirements in [4] may be subject to special considerations. The special considerations, with assumptions, shall be clearly stated in the ship’s appendix to classification certificate.

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

Guidance note 2:
Tanker customer/operators should check with the SPM terminal operators the suitability of bow mooring arrangements on shuttle tankers on a case-by-case basis.

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2 Procedural requirements

2.1 Certification requirements

2.1.1 General
For a definition of the certificate types see Pt.1 Ch.3 Sec.4 and Pt.1 Ch.3 Sec.5.

2.1.2 Class notation SPM
For products that shall be installed on board, the builder shall request the manufacturers to order certification as described in Table 2.

Table 2 Certification requirements - SPM

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard*</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain stopper</td>
<td>PC</td>
<td>Society</td>
<td>SWL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MC</td>
<td>Society</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bow fairlead</td>
<td>PC</td>
<td>Society</td>
<td>SWL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>Manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winch or capstan</td>
<td>MC</td>
<td>Society</td>
<td>SWL</td>
<td></td>
</tr>
<tr>
<td>Pedestal roller</td>
<td>MC</td>
<td>Society</td>
<td>SWL</td>
<td></td>
</tr>
</tbody>
</table>

* Unless otherwise specified the certification standard is the rules.

2.2 Documentation requirements

2.2.1 Class notation SPM
Documentation shall be submitted as required by Table 3.

Table 3 Documentation requirements - SPM

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single point mooring arrangement</td>
<td>Z030 – Arrangement plan</td>
<td>Fairleads, bow chain stoppers, winches, capstans, pedestal rollers and winch storage drums.</td>
<td>FI</td>
</tr>
</tbody>
</table>
2.2.2 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

2.2.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

3 Materials

3.1 General

3.1.1 The materials used in bow fairleads shall comply with the requirements specified in Pt.2 Ch.2.

3.1.2 The materials used for bow chain stopper shall comply with the requirements specified in Pt.3 Ch.11 Sec.1 [6.2].

4 Arrangement and general design

4.1 Bow chain stoppers

4.1.1 The arrangement and capacity of bow chain stoppers shall be in accordance with Table 4.

Guidance note:
Some terminals may have different requirement than those given in Table 4 due to their location and operational practices, i.e. some terminals may require ships of less than 150 000 tonnes DWT to moor using two bow chain stoppers and some terminals may elect to moor ships of more than 150 000 tonnes DWT on a single bow chain stopper.

4.1.2 A standard 76 mm stud-link chain shall be secured when the chain engaging pawl or bar is in closed position. When in open position, the chain and associated fittings shall be allowed to pass freely.

4.1.3 The structural strength of the stopper, bow fairlead and supporting structure shall be based on a safety factor of 2.0 against the yield criterion when applying a load equal to SWL.

4.1.4 Stoppers shall be located between 2.7 and 3.7 m inboard from the bow fairlead.

4.1.5 When positioning, due consideration shall be given to the correct alignment of stoppers relative to the direct lead between bow fairlead and pedestal roller or the drum end of the winch or capstan.

4.1.6 Stoppers shall be fitted as close as possible to the deck structure, however, taking due consideration to possible obstacles in order to obtain a free lead through the fairleads.

4.1.7 Upon installation bow stoppers shall be load tested to the equivalent SWL and a test certificate shall be issued. The test certificate shall be available for inspection on board the ship.
Guidance note:
The installation test required by [4.1.7] may be omitted if the actual bow stopper has been type approved, and proof load testing to the equivalent SWL was carried out for type approval. Applicable strength of the supporting structure should be documented by adequate analyses. The Society will issue a declaration confirming that evaluation of the support strength has been carried out with acceptable results. A document issued by the Society should in such cases be available onboard.

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Table 4 Arrangement and capacity for single point mooring

<table>
<thead>
<tr>
<th>Ship size (tonnes DW)</th>
<th>Chafe chain size (mm)</th>
<th>Grade</th>
<th>Number of bow fairleads</th>
<th>Number of bow stoppers</th>
<th>SWL (tonnes)</th>
<th>Minimum breaking load (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 000 or less</td>
<td>76</td>
<td>K3</td>
<td>1</td>
<td>1</td>
<td>200</td>
<td>438</td>
</tr>
<tr>
<td>Over 100 000 but not greater than 150 000</td>
<td>76</td>
<td>R3</td>
<td>1</td>
<td>1</td>
<td>250</td>
<td>498</td>
</tr>
<tr>
<td>Over 150 000</td>
<td>76</td>
<td>R4</td>
<td>2</td>
<td>2</td>
<td>350</td>
<td>612</td>
</tr>
</tbody>
</table>

Note: tonnes DW refers to the deadweight at maximum summer draught

4.2 Bow fairleads

4.2.1 Bow fairleads shall measure at least 600 × 450 mm.

4.2.2 For ships fitted with two fairleads: When practicable the fairleads shall be spaced 2.0 m apart, from centre to centre. In any event, the fairleads shall not be spaced more than 3.0 m apart.

4.2.3 For ships fitted with one fairlead: The fairlead shall be positioned on the centre line.

4.2.4 Leads shall be oval or round in shape and adequately faired when fitted in order to prevent chafe chains from fouling on the lower lip when heaving inboard. Square leads are not suitable.

Guidance note:
Adequately faired will be achieved if 3 links of chain have contact with the fairlead simultaneously at the design conditions. The design force should be established at an angle of 90° to the sides and 30° up or downwards. The same allowable design stress as for the stoppers applies.

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4.3 Position of pedestal rollers

4.3.1 Winches or capstans shall be positioned to enable a direct pull to be achieved on the continuation of the direct lead line between the bow fairleads and bow stoppers. Alternatively, if found required, a pedestal roller shall be positioned between the stopper and the winch or the capstan, in order to achieve direct pull.

Guidance note:
The use of more than one pedestal roller or a too acute change of direction of the mooring line is not recommended.

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

4.3.2 The distance between the bow stoppers and pedestal roller shall be considered so that an unrestricted line pull is achieved from the bow fairlead and through the bow stopper.
4.4 Winches or capstans

4.4.1 Winches or capstans shall be capable of lifting at least 15 tonnes.

4.5 Winch storage drum

4.5.1 If a winch storage drum is used to stow the pick-up rope, it shall be of sufficient size to accommodate 150 m rope with 80 mm in diameter.
SECTION 13 ENHANCED SYSTEM VERIFICATION - ESV

1 General

1.1 Introduction
The additional class notation ESV is a design standard that provides the framework for earlier, deeper, and broader testing and verification of selected systems by using various verification methods.

1.2 Scope
The scope for additional class notation ESV specifies the requirements for obtaining the class notation ESV. These requirements apply to marine and offshore systems and cover test and verification methods that may be utilized to assist in verification of the functionality and performance of selected systems in order to provide objective evidence of acceptable functionality and quality according to stated requirements. These verification methods are aligned with certification activities, for example; type approval, manufacturing survey, on board testing, and sea trials, in order to provide additional evidence of expected and required functionality.

1.3 Application
The additional class notation ESV applies to vessels where specified on board systems have undergone enhanced system verification (ESV). A class notation as specified in these rules may be assigned when one or more methods have been used for enhanced system verification. Application of such methods aims to provide additional objective evidence of functionality and quality during normal, abnormal and degraded system status. Application of ESV verification provides an additional broader, deeper and earlier verification of the applicable requirements, when compared to main class test activities.

In addition to the generic requirements given in these rules, functional requirements and any quality requirements for the stated system(s) shall be specified. In this context all main and additional class requirements applicable for the system(s) in question, applies.

Upon special agreement other rules and requirements may be applicable when relevant. Where rules and requirements have conflicting requirements, such conflicts should be clarified, concluded, and documented in each case.

1.4 Class notations

1.4.1 Vessels built and tested in compliance with the requirements of these rules may be assigned class notation ESV.

In addition at least one qualifier describing the target control and monitoring (TCM) system shall be selected from Table 1. For each TCM qualifier, one qualifier describing the verification method (VM) shall be selected from Table 2.

Resulting syntax: ESV(TCM1[VM1], ... TCMn[VMn])

Guidance note:
Example of the class notation for more than one TCM is ESV(DP[HIL-IS], PMS[HIL-DS]). The vessel having undergone enhanced verification of the dynamic positioning control system by use of the verification method Hardware-in-the-loop with independent test package and enhanced verification of the main electric power control and monitoring system by use of the verification method Hardware-in-the-loop with independent test program and test package report, and test simulator package provided by the supplier.

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---
The scope of target control and monitoring systems TCM defined in the table below applies for the ESV class notation unless otherwise agreed by customer and the Society.

### Table 1 Control and monitoring systems having undergone enhanced verification

<table>
<thead>
<tr>
<th>Qualifier for TCM</th>
<th>TCM system</th>
<th>Typical sub-systems and components</th>
<th>Rule reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP</td>
<td>Dynamic positioning automatic control system</td>
<td>DP control system Part of the DP control system as defined by the rules is typical not included in the target system, e.g. reference system and sensors.</td>
<td>Ch.3 Sec.2 Ch.3 Sec.1</td>
</tr>
<tr>
<td>TAM</td>
<td>Thruster assisted mooring control System</td>
<td>Thruster assisted control system Part of the thruster assisted control system as defined by the rules is typical not included in the target system, e.g. reference system and sensors.</td>
<td>DNVGL-OS-E301</td>
</tr>
<tr>
<td>PMS</td>
<td>Main electric power control and monitoring system</td>
<td>— remote control and monitoring of power generation — remote control and monitoring of power distribution — load dependent start/stop — load sharing — blackout prevention and load reduction — blackout recovery.</td>
<td>Pt.4 Ch.8</td>
</tr>
<tr>
<td>SPT</td>
<td>Steering, propulsion and thruster control and monitoring system</td>
<td>— steering control and monitoring system — propulsion control and monitoring system — thruster control and monitoring system.</td>
<td>Pt.4 Ch.10 Pt.4 Ch.5</td>
</tr>
<tr>
<td>ICS</td>
<td>Integrated control and monitoring system</td>
<td>— control and monitoring of vessel main function — control and monitoring of valves and pumps — main alarm system.</td>
<td>Pt.4 Ch.9</td>
</tr>
<tr>
<td>DRILL</td>
<td>Drilling and well control and monitoring system</td>
<td>— zone management/anti-collision system — rotation system — hoisting system — hydraulic power unit — equipment handling — vertical pipe handler — horizontal pipe handler — cranes and winches — heave compensation and tensioning system — marine riser tensioners — active compensation systems — passive compensation systems — drilling fluid circulation and cementing — mud circulation system — cementing system.</td>
<td>DNVGL-OS-E101</td>
</tr>
</tbody>
</table>
### Equipment and design features

#### Qualifier for TCM

<table>
<thead>
<tr>
<th>TCM system</th>
<th>Typical sub-systems and components</th>
<th>Rule reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOP</td>
<td>— operator panels&lt;br&gt;— choke and kill&lt;br&gt;— diverter&lt;br&gt;— emergency disconnect system&lt;br&gt;— acoustic control system&lt;br&gt;— hydraulic power unit&lt;br&gt;— stack control.</td>
<td>DNVGL-OS-E101</td>
</tr>
<tr>
<td>CRANE</td>
<td>— control and monitoring&lt;br&gt;— safety functions.</td>
<td>Pt.5 Ch.10 Sec.2&lt;br&gt;DNVGL-ST-0377&lt;br&gt;DNVGL-ST-0378</td>
</tr>
</tbody>
</table>

#### Guidance note:
For each system in Table 1 a reference to the relevant rules or offshore standards (OS) are listed. The rules or standards identified will provide more specific requirements of the systems. Pt.4 Ch.9 or DNVGL-OS-D202 provides generic common requirements to, and is applicable for, all systems listed above.

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1.4.3 The verification method signifying the method of verification is defined in Table 2.

#### Table 2 Verification method signifying the method of verification

<table>
<thead>
<tr>
<th>Qualifier for verification method (VM)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIL-IS</td>
<td>HIL test package provided by independent HIL supplier</td>
</tr>
<tr>
<td>HIL-DS</td>
<td>HIL test program package and HIL test package report provided by independent HIL supplier. HIL test simulator package provided by the organization delivering the HIL target system.</td>
</tr>
</tbody>
</table>

1.5 Definitions and abbreviations

1.5.1 General definitions can be found in the rules. Specific definitions can be found for control systems in Pt.4 Ch.9 and in the target system's specific rule reference listed in Table 1.

#### Table 3 Definitions and abbreviation

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition or abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>abnormal mode</td>
<td>unusual or exceptional</td>
</tr>
<tr>
<td>closed loop</td>
<td>a control system with an active feedback loop</td>
</tr>
<tr>
<td>Term</td>
<td>Definition or abbreviation</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>control computer system</td>
<td>a system consisting of at least one computer or processor with CPU processing and I/O</td>
</tr>
<tr>
<td></td>
<td>capacity, and one or several operator stations. The control computer system also includes</td>
</tr>
<tr>
<td></td>
<td>the network, interface, and cabling for signal communication, and the HW/SW platform with</td>
</tr>
<tr>
<td></td>
<td>the controllers containing both basic software and application specific software</td>
</tr>
<tr>
<td>Guidance note 1:</td>
<td>A control computer system also includes control and management networks and interface used</td>
</tr>
<tr>
<td></td>
<td>for integration with other control systems and decentralized command and/monitoring terminals</td>
</tr>
<tr>
<td>Guidance note 2:</td>
<td>An operator stations constitute the command and monitoring functionality of the control</td>
</tr>
<tr>
<td></td>
<td>system, consisting usually of human-machine interfaces (HMI’s), visual display unit’s</td>
</tr>
<tr>
<td></td>
<td>(VDU’s), alarm panels, joysticks, switches, printers and alike</td>
</tr>
<tr>
<td>degraded mode/condition</td>
<td>reduced in quality or value</td>
</tr>
<tr>
<td>ESV</td>
<td>enhanced system verification</td>
</tr>
<tr>
<td>failure</td>
<td>[IEEE610.12-1990] the inability of a system or component to perform its required functions</td>
</tr>
<tr>
<td></td>
<td>within specified performance requirements.</td>
</tr>
<tr>
<td>failure mode</td>
<td>[IEEE 610.12-1990] the physical or functional manifestation of a failure. For example, a</td>
</tr>
<tr>
<td></td>
<td>system in failure mode may be characterized by slow operation, incorrect outputs, or</td>
</tr>
<tr>
<td></td>
<td>complete termination of execution.</td>
</tr>
<tr>
<td>failure testing</td>
<td>to test the functions of a target system by inducing relevant failures in the system in</td>
</tr>
<tr>
<td></td>
<td>order to verify compliance with the stated requirements</td>
</tr>
<tr>
<td>Guidance note:</td>
<td>This may be done by inducing relevant failures in the system or components connected to</td>
</tr>
<tr>
<td></td>
<td>it, either simulated or real, and observing and reporting the effects of these failures</td>
</tr>
<tr>
<td></td>
<td>on the behaviour of the target system</td>
</tr>
<tr>
<td>function</td>
<td>[IEEE 610.12-1990] a defined objective or characteristic action of a system or component</td>
</tr>
<tr>
<td>functional requirements</td>
<td>a requirement that specifies a function that a system or system component shall be able to</td>
</tr>
<tr>
<td>functional testing</td>
<td>Testing functions of a system to verify compliance with the stated functional specification and requirements. The main objective is to reveal failures occurring in design, implementation, integration, and configuration</td>
</tr>
<tr>
<td>HIL</td>
<td>testing by “Hardware-In-the-Loop” simulation</td>
</tr>
<tr>
<td>HIL simulator</td>
<td>a real-time simulator constructed by hardware and software, which is configured for the</td>
</tr>
<tr>
<td></td>
<td>control system under consideration and interfaced to the target system or component through</td>
</tr>
<tr>
<td></td>
<td>appropriate I/O. During testing with an HIL simulator the target system or component will</td>
</tr>
<tr>
<td></td>
<td>not experience significant difference from being connected to the real system</td>
</tr>
<tr>
<td>HW</td>
<td>hardware (computer hardware).</td>
</tr>
<tr>
<td>SW</td>
<td>software (computer hardware).</td>
</tr>
<tr>
<td>repeatability</td>
<td>a test case is repeatable if the outcome of the specified test case for several test runs is unchanged.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition or abbreviation</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>target system</td>
<td>an identified set of equipment with hardware and software that is subject to analysis, testing and verification.</td>
</tr>
<tr>
<td>testability</td>
<td>the extent to which a test objective and feasible test can be designed to determine whether a requirement is met. Testability of a function in a system requires controllability and observability of that function:</td>
</tr>
<tr>
<td></td>
<td>Controllability: A function in a system is controllable if for each possible behaviour of the function, i.e. each possible output data value, condition, or state, there exists a set of actions that can be applied to the inputs of the system such that the corresponding behaviour is achieved.</td>
</tr>
<tr>
<td></td>
<td>Observability: A function in a system is observable if any arbitrary behaviour of the function can be determined from the outputs of the system.</td>
</tr>
<tr>
<td>replica hardware</td>
<td>the replica hardware is an identical copy of the target system hardware installed on board the vessel.</td>
</tr>
<tr>
<td>test activity</td>
<td>an activity for testing a specified target system according to a defined test scope and test program in order to partly or fully meet the overall objective of ESV. Test activities may range from testing of isolated modules or subsystems in laboratory conditions, testing of integrated modules, integration testing of complex systems consisting of equipment from many makers, to full-scale testing of an integrated control system.</td>
</tr>
<tr>
<td></td>
<td><strong>Guidance note:</strong> A test activity may be divided into one or several test sessions due to practical considerations of the availability of the target system. Typically, each test activity has a documented Test Program to be carried out in one or several test sessions.</td>
</tr>
<tr>
<td>test package</td>
<td>a test package consists of the following elements:</td>
</tr>
<tr>
<td></td>
<td>— one or several tool(s) for the specific testing or analysis to be carried out</td>
</tr>
<tr>
<td></td>
<td>— all documentation required for planning and approval of the specified testing to be carried out</td>
</tr>
<tr>
<td></td>
<td>— all documentation required for execution and reporting</td>
</tr>
<tr>
<td></td>
<td>— all analysis and test results including findings and conclusions.</td>
</tr>
<tr>
<td></td>
<td><strong>Guidance note:</strong> An HIL simulator may be the testing tool referred above.</td>
</tr>
<tr>
<td>validation</td>
<td>[ISO 9001] confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled</td>
</tr>
<tr>
<td>verification</td>
<td>[ISO 9001] confirmation, through the provision of objective evidence, that specified requirements have been fulfilled</td>
</tr>
</tbody>
</table>

1.6 Documentation requirements

1.6.1 General documentation related to enhanced system verification (ESV)

Documentation requirements are given in the specific sections describing the different ESV methods. In addition, systems subject to Enhanced System Verification shall be documented as for main class, relevant class notations and standards.
2 Hardware-in-the-loop testing

2.1 Objectives

2.1.1 The objective of a Hardware-In-the-Loop (HIL) test is to test the specified target system by means of a Hardware-In-the-Loop simulator in order to provide objective evidence of acceptable functionality (during normal, abnormal and degraded condition) according to stated or implied requirements.

2.2 Class notations

2.2.1 Ships which have undergone HIL testing in compliance with requirements in this section may be assigned the class notations as described in [1.4].

2.3 HIL test requirements

2.3.1 Functional requirements for the target system shall be referred and form the basis for the tests in the HIL test package.

2.3.2 In order to obtain an ESV notation based on HIL testing, the tests shall comprise a minimum set of specified hardware components, software programs, and system functions. Typically, this shall include, but not be limited to the sub-systems as specified in Table 1.

Guidance note:

Other system that those listed in Table 1 may be granted HIL test certificate in compliance with DNVGL-ST-0373 Hardware in the loop testing (HIL)

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2.3.3 The HIL test package consists of the following elements:

— HIL test program package including all documents required for planning and executing the specified tests to be carried out as specified in Table 5.
— HIL test simulator package including the HIL simulator and supporting documentation as specified in Table 6.
— HIL test package report including all analysis and test results including findings and conclusion as specified in Table 7.

See also [5] HIL Test Package.

2.4 Requirements for the maker of the HIL test package

2.4.1 For VM qualifier HIL-IS the company that makes the complete HIL test package shall be independent from the company delivering the target system.

In general the following issues should be addressed, in order to verify the organisational independency of the HIL test package maker:

— the company should have testing and verification as one of its main activities
— involvement in the design and development process, in terms of delivering design propositions and solutions for the target system to be HIL tested
— independency with respect to personnel and technology
— ownership and other business relationships.
2.4.2 For VM qualifier HIL-DS the company that makes the HIL test program package and the HIL test package report shall be independent from the company delivering the target system. The company that makes the HIL test simulator package may be dependent upon the company delivering the target system.

Guidance note:
In general the following issues should be addressed, in order to verify the organisational independency of the maker of the HIL test program package and HIL test package report.
— the company should have testing and verification as one of its main activities
— involvement in the design and development process, in terms of delivering design propositions and solutions for the target system to be HIL tested
— independency with respect to personnel and technology
— ownership and other business relationships.

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

2.4.3 The HIL test simulator technology shall be based on other (diverse) technology than the target system technology. This means that:
— the HIL simulator shall be implemented by means of a separate hardware unit
— the HIL simulator application software shall be sufficiently diverse from the target system application software

2.4.4 For VM qualifier HIL-IS the HIL simulator application software shall be sufficiently diverse from the target system testing tools used in design and development of the target system.

2.4.5 The maker(s) of HIL test package shall have a documented quality management system.

Guidance note:
This may be a recognized system such as e.g. ISO 9001 or equivalent.

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

2.4.6 The quality management system to the maker(s) of the HIL test package, shall have documented procedures for:
— operation as an independent maker of HIL test packages where independency is required
— verification and validation
— preparation of HIL test packages including a statement of the intended use of the test packages
— preparation of the HIL test interface to the target system
— software development and software quality assurance
— maintaining competence in the target system domain
— identification of hazards and risks related to HIL testing
— preparation of instructions for risk control measures to other involved parties
— execution of test activities including connection and disconnection of the HIL simulator
— preparation of reports, results evaluation, and retesting
— archiving of HIL test packages including reports with version control of tests carried out for specific vessels and systems during the system life cycle
— competence requirements and training for personnel involved in all phases of HIL testing
— requirements verification
— design and version control.

2.4.7 Upon request the maker(s) of the HIL test package shall demonstrate and document that the procedures in the quality management system are applied in its HIL test package deliveries.

2.4.8 The Society shall be informed about organisational and technical dependencies. The Society may request documentation to verify independency.
2.5 HIL type approval

2.5.1 The target system can be HIL type approved.

2.5.2 For an HIL type approval to be valid, the delivered hardware and software shall be covered by the HIL type approval certificate.

Guidance note:
This means that the HIL type approval certificate should specify the hardware components and the software versions. Note that the HIL type approval certificate does not imply that the hardware in itself is type approved and tested according to DNVGL-CG-0339 or other standards stating environmental requirements. However, relevant environmental requirements should always apply.

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

3 Documentation

3.1 Documentation requirements

3.1.1 Each target control and monitoring system subject to HIL testing, documentation shall be submitted as required by Table 4:

Table 4 Documentation requirement

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target control and monitoring system</td>
<td>I240 - HIL test program package</td>
<td>See Table 5</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>I241 - HIL test simulator package</td>
<td>See Table 6</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>I250 - HIL test package report</td>
<td>See Table 7</td>
<td>AP</td>
</tr>
<tr>
<td>AP = For approval</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.1.2 For qualifier HIL-DS the following documentation shall, in addition, be submitted to the maker of the HIL test program package for information:
— I241 – HIL test simulator package.

3.1.3 For general requirements concerning documentation, see Pt.1 Ch.3 Sec.3.

Table 5 Content of I240 - HIL test program package

<table>
<thead>
<tr>
<th>Applicable system</th>
<th>Description of documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel</td>
<td>Vessel system design intention and philosophy (e.g. redundant thrusters, power generation, and control systems)</td>
</tr>
<tr>
<td>Control system</td>
<td>Operational vessel system intention and philosophy (e.g. related to operational modes, redundancy, operational boundaries, and limitations)</td>
</tr>
</tbody>
</table>
Control system

Test Plan.
Test project overview.
Test Package objective and intended use.
Overview of target system hardware, software and functions to be tested.
Specification or reference to functional requirements (e.g. reference to classification rules, configuration and technical specifications for the vessel, end user requirements, etc.).
Test activity schedule.
Risk assessment of planned testing including emergency procedures for handling critical situations during testing.
Responsibilities, resources and approvals:
— list of involved companies, name of contact person/title, contact information
— identification of test package and test activity
— references to other test plans and reports
Procedures for the testing, verification, validation and for handling of findings.
If use of replica hardware; procedures for handling of software changes and transfer of software from target system hardware to replica hardware and return.

Control system

Test programs (one for each test activity) including listing of functions and failure modes to be tested and corresponding test cases.
Based upon the functional description, each test case shall be described specifying:
— test purpose
— test setup
— test method
— expected results and acceptance criteria
— space for notes and conclusions
— signature from the tester
— space for additional signature(s)

Table 6 Content of I241 - HIL test simulator package

<table>
<thead>
<tr>
<th>Applicable system</th>
<th>Description of documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel</td>
<td>Vessel system design intention and philosophy (e.g. redundant thrusters, power generation, and control systems)</td>
</tr>
<tr>
<td><strong>Applicable system</strong></td>
<td><strong>Description of documentation</strong></td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Control system</td>
<td>Operational vessel system intention and philosophy (e.g. related to operational modes, redundancy, operational boundaries, and limitations)</td>
</tr>
<tr>
<td>HIL simulator</td>
<td>HIL simulator configuration report (one for each HIL simulator to be used) including:</td>
</tr>
<tr>
<td></td>
<td>— identification of HIL simulator hardware and software versions</td>
</tr>
<tr>
<td></td>
<td>— specification of the HIL simulator functionality</td>
</tr>
<tr>
<td></td>
<td>— HIL simulator configuration</td>
</tr>
<tr>
<td></td>
<td>— HIL simulator verification results.</td>
</tr>
<tr>
<td>HIL simulator</td>
<td>HIL simulator operator manual (one for each HIL simulator to be used) including:</td>
</tr>
<tr>
<td></td>
<td>— user interface functionality</td>
</tr>
<tr>
<td></td>
<td>— operation modes</td>
</tr>
<tr>
<td></td>
<td>— operation instruction</td>
</tr>
<tr>
<td></td>
<td>— presentation of trends and test log</td>
</tr>
<tr>
<td>HIL simulator</td>
<td>Procedures for HIL simulator interfacing, test start-up, and test closure (one for each test activity)</td>
</tr>
<tr>
<td></td>
<td>Description of test system configuration and test simulation methods.</td>
</tr>
<tr>
<td></td>
<td>Specification of test interface of HIL simulator.</td>
</tr>
<tr>
<td></td>
<td>Identification of HIL simulator hardware components and software versions.</td>
</tr>
<tr>
<td></td>
<td>Identification of target system hardware components and software versions.</td>
</tr>
</tbody>
</table>

**Table 7 Content of I250 - HIL test package report**

<table>
<thead>
<tr>
<th><strong>Applicable system</strong></th>
<th><strong>Description of documentation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Control system</td>
<td>Test report (one for each test activity) shall include recorded results of each test case with signatures by tester and attending Society surveyor. The finding shall be described in a template containing the following information elements:</td>
</tr>
<tr>
<td></td>
<td>— reference to the approved test package/plan and specific item (system, ship, version, date, test activity)</td>
</tr>
<tr>
<td></td>
<td>— description of the finding, including an explanation of why it is a finding</td>
</tr>
<tr>
<td></td>
<td>— recommended action or follow up</td>
</tr>
<tr>
<td></td>
<td>— responsible party for following up corrective action</td>
</tr>
<tr>
<td></td>
<td>— deadline for completion of the action.</td>
</tr>
<tr>
<td>Control system</td>
<td>Test summary report including:</td>
</tr>
<tr>
<td></td>
<td>— a summary of test activities, test results, and findings</td>
</tr>
<tr>
<td></td>
<td>— validation results of test package with respect to intended use of the test package.</td>
</tr>
<tr>
<td>Control system</td>
<td>HIL test notation document. When testing is completed and all findings are concluded an HIL test notation document shall be prepared.</td>
</tr>
<tr>
<td></td>
<td>This shall contain a specification of:</td>
</tr>
<tr>
<td></td>
<td>— the target system identification (hardware and software components, parts, serial numbers and software versions</td>
</tr>
<tr>
<td></td>
<td>— reference to the functional requirements applied.</td>
</tr>
</tbody>
</table>
4 Tests

4.1 General

4.1.1 HIL testing shall be carried out at the manufacturer’s works. The HIL testing shall assure that the target system has been configured and completed according to relevant functional specifications and requirements.

Guidance note:
HIL testing at the manufacturer’s works is the main site where witnessing of the tests are assumed. However, upon agreement, other sites may be accepted. This implies that e.g. tests planned at the manufacturers works could upon agreement be carried out at the dock, on board or at a dedicated test laboratory.

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

4.1.2 All tests shall be according to test programs approved by the Society upfront the HIL test.

4.1.3 Before the HIL test session commences, an opening meeting shall be arranged between the responsible parties. The following items should be clarified:

— responsibilities related to the HIL test session
— emergency procedures and responsibilities for potential hazardous situations during the HIL test session
— the test setup and objectives of the HIL tests to be carried out
— the schedule and sequence for carrying out the HIL testing.

4.1.4 The tests shall be performed according to the approved test programs in the HIL test package. The test results for each test shall be recorded. The conclusion of each single test shall be documented in the HIL test report.

4.1.5 Testing, as described in [4.1.4], shall be witnessed by a surveyor. Upon special agreement, parts of the testing may be carried out without present or available surveyor. Each single test outcome shall be presented to the surveyor, if requested. Due to this, the HIL test simulator shall not be disconnected before the surveyor has confirmed that no more testing will be requested to be witnessed in the current test session.

Guidance note 1:
To provide support, to ensure that the system under test is performing properly and to clarify issues, it is recommended that a representative of the manufacturer is present during testing.

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Guidance note 2:
To gain knowledge of the system under test and to clarify issues, it is recommended that a representative of the end user is present during testing.

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

4.1.6 After an HIL test activity is completed, the complete set of results shall be documented in the HIL test report package. Each test and each conclusion shall be documented and signed. In the case where some tests have become not applicable or are not possible to carry out or it has been decided to postpone the tests to a later HIL test activity, then such conclusions shall also be documented.

4.1.7 After the HIL test activity, a closing meeting shall be arranged between the responsible parties. The purpose of the meeting is to agree upon the findings from the testing. For each finding a responsible party for follow up within a set deadline shall be agreed, documented, and signed as applicable.
4.1.8 The finding shall as a minimum be categorised into class-related and non-class related. The categorization shall be approved by the Society.

Guidance note:
Class-related findings may be given as comments and/or conditions as found necessary.
Non-class-related findings may be required to be finally concluded before the ESV notation is issued. These conclusions may e.g. be void, or no action. However, in case the conclusions imply changes to the system, these changes should be approved.

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

4.1.9 The conclusions from the closing meeting shall be documented in an HIL test summary report as described in Table 7. The HIL test summary report shall be distributed to all parties involved in the HIL test activity and the agreed actions shall be followed up.

4.1.10 After completion of an HIL test activity, the HIL test report shall be prepared by the maker of the HIL test package report. The HIL test report shall be submitted to the Society.

4.1.11 The personnel responsible for performing the HIL testing shall be qualified according to the quality requirements in [2.4.6]. Documentation of completed training shall be available on the Society’s request.

Guidance note:
The HIL testing may be carried out by personnel from e.g. the maker of the HIL test package, the system manufacturer, the yard, the vessel customer, or a marine consultant.

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

4.1.12 The HIL test shall as a minimum consist of two HIL test activities:
— test at manufacturing
— test upon completion.

Guidance note:
The HIL test activities may, upon agreement, consist of more than two activities.

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

4.1.13 The HIL testing may be limited in test scope or omitted when the target system is HIL Type Approved.

Guidance note 1:
The requirement to the scope of the HIL testing may be based on the total system functionality and the degree of configuration and customisation for the specific target system delivery.

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

Guidance note 2:
The certification requirements according to main class and other class notations may not be omitted based on HIL Type Approval.

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

4.2 Test at manufacture’s works

4.2.1 HIL testing at the manufacturer’s works shall be carried out based on an approved HIL test package.

4.2.2 The HIL testing at the manufacturer’s works shall verify closed loop functionality and response of the target system when connected to the HIL simulator. Normal, degraded and abnormal operation shall be simulated.
4.2.3 The HIL testing at the manufacture works shall be done before delivery from manufacture.

Guidance note:
The HIL testing at the manufacturer’s works may, upon agreement, be combined with other certification activities.

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

4.2.4 The HIL testing at the manufacture’s works may be carried out on replica hardware.

4.3 Test upon completion

4.3.1 HIL testing upon completion shall be carried out based on an approved HIL test package.

4.3.2 The HIL testing upon completion shall include retest of findings from the test at the manufacture’s works. In addition, a verification of what was done after the test, including modification, adjustments and parameterization.

4.3.3 The HIL testing upon completion shall be done after commissioning and before the ESV notation is assigned.

Guidance note:
The HIL testing upon completion may, upon agreement, be combined with other activities.

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

4.3.4 The HIL testing upon completion can be carried out on board or on replica hardware.

4.4 Onboard test

4.4.1 Testing on board the vessel shall be carried out based on an approved test package in order to assure that the target system has been configured, and installed according to relevant functional specifications and requirements for the vessel.

Guidance note:
The on board test may be omitted upon agreement.

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

4.4.2 The on board testing shall verify normal closed loop functionality and response of the total system upon normal, degraded and abnormal operation.

4.4.3 The target system and other possible influenced systems shall be reinstated and set back to normal operational mode after completion of the testing. Successfully reinstatement of the systems shall be verified.

4.4.4 For the notations ESV(DP[HIL-IS]) and ESV(DP[HIL-DS]), onboard test shall be carried out.
5 HIL test package

5.1 General

5.1.1 A HIL test package is a test package including HIL simulator(s) as testing tools and all documentation required for description and reporting of the HIL testing.

Guidance note:
The required documentation for the HIL test package can be found in Table 5, Table 6 and Table 7.

5.1.2 The HIL test package shall refer to the specific functional requirements related to the target system which has formed the basis for the HIL test scope. Reference to these functional requirements shall be stated in the HIL test notation document.

5.1.3 The applicable parts of the HIL test package documentation shall be prepared for serving as working documents during the HIL tests.

5.1.4 The intended use of the HIL test package shall also be stated. The intended use statement shall give directions for the HIL test scope.

Guidance note:
The intended use of the HIL test package may be to verify specific functional requirements for a specified type of future vessel operation. The intended use may also include statements of methods for selection of the verification and test scope.

5.1.5 The HIL test package shall describe the target system and possible interfaced systems as necessary.

5.1.6 The package shall contain test cases related to the normal, degraded and abnormal operation of the target and simulated systems. Normally single and common failure modes and common components should be extensively analysed and tested. Multiple failures should be tested if found relevant.

Guidance note 1:
Operation in all normal modes and transfer between operational modes and the corresponding functional requirements, should be the basis for establishing the HIL test scope. In addition, failure testing is also to be included in the test scope. General types of failures to be simulated could be, but not limited to:

— sensors or input devices failure modes (dropout, noise, calibration errors, drift, bias, signal freeze, wild point, ...)
— failure mode of actuators, drives, power system components or other electro-mechanical components
— feedback from sensors on actuator failure modes
— failure modes in computer networks
— failure modes related to overload of networks
— failures affecting weighting and voting mechanisms
— failures affecting protective safety functions
— failures affecting alarms, monitoring, and analysis functions
— failures causing and/or otherwise affecting switch-over in redundant systems
— common mode failures affecting several components and/or signals
— emergency handling (special emergency functions required during emergency handling could be tested)
— reconstruction of relevant reported failures/incidents related to the system and/or operation.
Guidance note 2:
When establishing the HIL test scope, verification planned to be carried out by other methods (e.g. FMEA), should be considered. The purpose should be to give input to the HIL test scope and to align the execution of the tests in an efficient manner.
---end of guidance note---

5.1.7 Testing shall be performed for all relevant operational modes of the target system. The need for testing in different operational modes of relevant equipment and systems connected to the target systems shall also be evaluated.

5.1.8 The Society shall approve the relevant parts of the HIL test package upfront each HIL test activity. In addition to these rules, the approval will also be based on the specified functional requirements for the target system.

5.2 Risk assessment

5.2.1 A risk assessment for each test activity shall be a part of the HIL test package.

Guidance note:
The intention is to ensure that the responsible parties have identified possible hazards and risks related to HIL testing and that sufficient overall actions for emergency handling have been planned and agreed. Items which typically should be considered if appropriate:
- specification of equipment to be tested
- specification of personnel required for the HIL testing
- specification of required environmental conditions during the HIL test
- hazard identification for the equipment during the HIL test operation
- hazard identification (personnel safety) for the personnel during HIL testing
- hazard identification for the vessel and the vessel environment
- availability of an emergency procedure for handling possible hazardous situation.
---end of guidance note---

5.3 Verification and validation

5.3.1 The HIL test package shall contain procedures for verification and validation of the configured HIL simulator. The scope of verification and validation shall be based on the specific intended use of the HIL testing.

5.3.2 Functional suitability and accuracy of the simulator shall be documented according to procedures [5.3.1] in order to ensure sufficiently accurate and valid test results. This shall as a minimum include:
- verification tests to document that the simulator functions are correct and sufficiently accurate
- validation tests to document that the functional suitability of the simulator is according to the intended use of the HIL testing.

Verification and validation activities and/or assessments shall be documented as required in [3].
Guidance note:

The key element for planning the validation activities is to analyse the intended use statement and identify possible critical factors/elements in the simulator/test package which may leave the test results not representative. A set of relevant validation activities for the HIL simulator and HIL test package should be identified and measures for limiting possible inaccuracies and uncertainties should be described.

In case the objective of the HIL testing is to test the qualitative behaviour of functions and failure handling, it should be validated that the accuracy of the simulator is sufficient to obtain testability of the target functions.

If, on the other hand, the objective of the HIL testing is to test both the qualitative and quantitative behaviour of functions in the target system, it should be validated that the performance of the simulator is sufficiently accurate and realistic to assess the target system performance. It is recognized that some validation tests can only be carried out by full-scale trials. In order to collect information supporting the correctness of the simulator, such validation tests are advised.

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SECTION 14 GAS BUNKER VESSELS - GAS BUNKER

1 General

1.1 Introduction

1.1.1 Objective
The objective of this section is to outline requirements for carriers and barges intended for the transport of liquefied gas with dedicated gas fuel transfer equipment for supply of bunker for gas fuelled ships on regular basis.

1.1.2 Scope
This section covers safety of the gas bunker vessel, its gas bunker related equipment and installations on-board. It outlines requirements for design, construction and required operational procedures with regard to connection and disconnection of transfer arrangements, bunker transfer and vapour return.

1.1.3 Application
This section applies to the vessels built in compliance with Pt.5 Ch.7.
This section provides requirements for features that are relevant for a bunkering vessel due to its particular operations and which are not covered by Pt.5 Ch.7. Arrangement and equipment of vessels operating in restricted areas or vessels for inland waterways not in compliance with Pt.5 Ch.7 and Pt.5 Ch.11 will be assessed on a case to case basis.

1.1.4 Class notation
A ship complying with relevant parts of this section may be given the additional class notation Gas bunker, with qualifiers as given in [1.1.5] below may be added to the notation.

1.1.5 Special features

1.1.5.1 A ship equipped for handling of excess vapour return from the receiving ship in compliance with [7.1.1] may have the qualifier VR x (vapour recovery with capacity x kW) added to the notation.

1.1.5.2 A ship equipped for enhanced positioning by means of controllable thrust vectors (fixed or direction controlled thrusters) in compliance with [7.1.2] may have qualifier EPC (enhanced positioning control) added to the class notation.

1.1.5.3 A ship equipped with enhanced transfer control system in compliance with [7.1.3] may have the qualifier TC added to the class notation.

Guidance note:
An example of a class notation for a bunkering vessel with qualifiers for vapour return and for enhanced transfer control can be as follows: 1A Tanker for liquefied gas (-163°C, 500 kg/m3, 0.7 bar) Gas bunker (VR 500, TC).

1.1.6 Terms and definitions
Except where expressly provided otherwise, the following definitions apply to this section:

Table 1 Terms and definitions

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>automatic identification system (AIS)</td>
<td>an automatic tracking system used on ships and by vessel traffic services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites</td>
</tr>
<tr>
<td>Terms</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>boiling point</td>
<td>the temperature at which a product exhibits a vapour pressure equal to the atmospheric pressure</td>
</tr>
<tr>
<td>bunker (transfer) connections</td>
<td>liquid and vapour connections between ships used for liquid product transfer to receiving ship and product vapour return to the bunker vessel</td>
</tr>
<tr>
<td>bunker operation control position</td>
<td>position where continuous watch is maintained during bunker transfer, such position may be a cargo (bunker) control room or a station in the cargo area</td>
</tr>
<tr>
<td>cargo (bunker) control room (station)</td>
<td>a space used in the control of cargo (bunker) handling operations</td>
</tr>
<tr>
<td>compressed natural gas tank (CNG tank)</td>
<td>this term describes cargo containment system for natural gas where the cargo is carried in gaseous form under high pressure with or without refrigeration</td>
</tr>
<tr>
<td>emergency shutdown (ESD)</td>
<td>complex of measures that safely and effectively stops all cargo related operations and equipment, terminates the transfer and brings cargo system in safe state</td>
</tr>
<tr>
<td>emergency release coupling (ERC)</td>
<td>device to provide a means of quick release of the transfer connections by excessive force applied to the coupling when such action is required as an emergency measure</td>
</tr>
<tr>
<td></td>
<td>May be also referred to as a “MBC” – marine breakaway coupling.</td>
</tr>
<tr>
<td>emergency release system (ERS)</td>
<td>ERC system that provides a positive means of quick release of transfer connections and safe isolation of bunker vessel and receiving ship gas fuel systems</td>
</tr>
<tr>
<td>flammability limits</td>
<td>the conditions defining the state of fuel-oxidant mixture at which application of an adequately strong external ignition source is only just capable of producing flammability in a given test apparatus</td>
</tr>
<tr>
<td>inert gas</td>
<td>a gas or mixture of gases containing insufficient oxygen to support combustion</td>
</tr>
<tr>
<td>manifold</td>
<td>the flanged pipe assembly mounted onboard ship to which the presentation flange of the transfer arm or spool piece connects</td>
</tr>
<tr>
<td>manifold valve</td>
<td>presentation valve or valves fitted at the manifold</td>
</tr>
<tr>
<td>operational envelope</td>
<td>room in which the presentation flanges of bunker vessel and receiving ship can operate safely without applying excessive strain, compression, bending or shear forces to the bunker connections</td>
</tr>
<tr>
<td>pendant</td>
<td>a hand held portable unit for controlling a specified function</td>
</tr>
<tr>
<td>presentation flange</td>
<td>flange at the manifold assembly or spool piece adapter used for bunker connections</td>
</tr>
<tr>
<td>pressure surge</td>
<td>in the context of this rule section effect of strong, wavelike, cyclic increase of pressure in the pipeline transporting liquid due to sudden flow interruption or rapid change in flow rate or direction</td>
</tr>
<tr>
<td>powered emergency release coupling (PERC)</td>
<td>type of ERC where a stored energy is used for release to ensure breakout through any ice build-up</td>
</tr>
<tr>
<td>purging (inerting)</td>
<td>process of displacement of air or product gas with inert atmosphere</td>
</tr>
</tbody>
</table>
### Terms and Definition

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>quick connect/disconnect coupler (QC/DC)</strong></td>
<td>Manual or hydraulic mechanical device used to clamp the transfer arrangement presentation flange to manifold of receiving ship without use of bolted connections. QC/DC is used in context of this rule section for routine connect and disconnect operations.</td>
</tr>
<tr>
<td><strong>quick release coupling</strong></td>
<td>Group of couplings for emergency disconnection of the line, parting it to two sections in predictable, safe manner. Unlike QC/DC the quick release coupling is an emergency device not intended for regular duty.</td>
</tr>
<tr>
<td><strong>redundancy</strong></td>
<td>The ability of a component or system to maintain its function when one failure has occurred. Redundancy can be achieved, for instance, by installation of multiple components, systems or alternative means of performing a function.</td>
</tr>
<tr>
<td><strong>safe working load (SWL)</strong></td>
<td>Static load which can be safely applied to the accessory without risk of damage or breaking it. SWL is typically 80% of the design load.</td>
</tr>
<tr>
<td><strong>ship shore link (SSL)</strong></td>
<td>Means of communicating shut-down signals, data and voice communications between ship and shore.</td>
</tr>
</tbody>
</table>

### 1.2 Documentation

#### 1.2.1 Documentation requirements

**1.2.1.1** Documentation shall be submitted as required by Table 2.

#### Table 2 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Qualifiers</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosion (Ex) protection</td>
<td>E170 – Electrical schematic drawing</td>
<td>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</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z030 – Arrangement plan</td>
<td>Electrical equipment in hazardous areas. 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).</td>
<td></td>
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<td></td>
<td>E250 – Explosion protected equipment maintenance manual</td>
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<td>Object</td>
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<td>G130 – Cause and effect diagram</td>
<td>Including interconnection with other systems that gives alarm and trigger automatic shutdown</td>
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<td>Fire and gas detection and alarm systems</td>
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<td>For the bunkering installation</td>
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<td></td>
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<td>Location of gas detector, lines, valves and sampling points on board</td>
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<tr>
<td>Cargo piping system</td>
<td>S011 – Piping and instrumentation diagram (P&amp;ID)</td>
<td>Bunker transfer system</td>
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<td>H080 – Strength analysis</td>
<td>Supporting structures and foundations for transfer arm</td>
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<td>Z030 – Arrangement plan</td>
<td>Bunker manifold including protection against low-temperature cargo leaks</td>
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<td></td>
<td>Z030 – Arrangement plan</td>
<td>Transfer arms, transfer hoses including hose supports and suspension systems as applicable</td>
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<td>Z030 – Arrangement plan</td>
<td>Working envelope diagram for the transfer arm</td>
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<td>Z100 – Specification</td>
<td>Transfer arms and transfer hoses</td>
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<td>Z141 – Commissioning procedure</td>
<td>Bunker equipment</td>
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<td>Z160 – Operation manual</td>
<td>Bunker operations</td>
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<td>Z100 – Specification</td>
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<td>QC/DC</td>
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<td>Permissible manifold loads for the nominal diameter of the transfer arm connection.</td>
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<td>Vapour handling Cargo system</td>
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<td></td>
<td>S030 – Capacity analysis</td>
<td>Capacity calculations for additional vapour management system</td>
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<td>Mooring arrangement</td>
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<td>Z100 – Specification</td>
<td>Quick release hooks/quick mooring release device</td>
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<td>Z030 – Arrangement plan</td>
<td>Fenders</td>
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<td>Offshore cranes</td>
<td>H080 – Strength analysis</td>
<td>Supporting structure for hose handling cranes</td>
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<td>Hose handling cranes including suspension system</td>
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<td>Z100 – Specification</td>
<td>Suspension system for cargo transfer hoses</td>
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<td>Independent joystick control system</td>
<td>I020 – Control system functional description</td>
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<td>I030 – System block diagram (topology)</td>
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<td>I040 – User interface documentation</td>
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<td>I050 – Power supply arrangement</td>
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<td></td>
<td>I070 – Instrument and equipment list</td>
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<td>I140 – Software quality plan</td>
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<td></td>
<td>Z252 – Test procedure at manufacturer</td>
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<td></td>
<td>Z253 – Test procedure for quay and sea trial</td>
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<td>Z160 – Operation manual</td>
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<td>Z110 – Data sheet</td>
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<td>Thruster control mode selection system</td>
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<td>I070 – Instrument and equipment list</td>
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<td>Z253 – Test procedure for quay and sea trial</td>
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<td>Z161 – Operation manual</td>
<td>EPC</td>
<td>FI</td>
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<td>Vapour handling system</td>
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<td>VR</td>
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<td>Z100 – Specification</td>
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<td>S010 – Piping diagram (PD)</td>
<td>VR</td>
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<td>I200 – Control and monitoring system documentation</td>
<td>VR</td>
<td>AP</td>
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<td>S010 – Piping diagram (PD)</td>
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<td>I260 – Field instruments periodic test plan</td>
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<td>TC</td>
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</table>

1.2.1.2 For general documentation requirements, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

1.2.1.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.

1.3 Certification

1.3.1 Certification requirements

1.3.1.1 Components shall be certified according to requirements given in Pt.5 Ch.7. In addition, the following components shall be certified as given in Table 3.
**Table 3 Certification requirements**

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard*</th>
<th>Additional description Parameter</th>
<th>Rule requirements</th>
</tr>
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<tbody>
<tr>
<td>Quick release mooring arrangement</td>
<td>PC</td>
<td>Manufacturer</td>
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<td>[3.1.9]</td>
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<tr>
<td>Hose Crane</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
<td>[3.1.7]</td>
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<tr>
<td>Bunker (transfer) hoses</td>
<td>PC</td>
<td>Society</td>
<td>EN1474</td>
<td></td>
<td>[3.1.6] and Pt.5 Ch.7 Sec.5 [11.6]</td>
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<tr>
<td>Bunker (transfer) arms</td>
<td>PC</td>
<td>Society</td>
<td>EN1474</td>
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<td>[3.1.8]</td>
</tr>
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<td>ERC</td>
<td>PC</td>
<td>Society</td>
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<td>[3.1.4]</td>
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<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
<td>[3.1.4]</td>
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<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
<td>[3.1.3]</td>
</tr>
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<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
<td>[7] and Pt.4 Ch.9</td>
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<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
<td>Pt.4 Ch.9</td>
</tr>
<tr>
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<td>Society</td>
<td></td>
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<td>Pt.4 Ch.9</td>
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<td></td>
<td>DNVGL-CG-0042</td>
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<td>Society</td>
<td></td>
<td></td>
<td>[5.1.2] and Pt.4 Ch.9</td>
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<tr>
<td>Hydrocarbon gas detection and alarm system, fixed</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
<td>[5.1.1] and Pt.5 Ch.7 Sec.13</td>
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<td>Vapour handling system</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
<td>Pt.5 Ch.7 Sec.13</td>
</tr>
</tbody>
</table>

*Unless otherwise specified the certification standard is DNV GL rules.

**Notes**

1.3.1.2 For general certification requirements, see Pt.1 Ch.3 Sec.4.

1.3.1.3 For a definition of the certification types, see Pt.1 Ch.3 Sec.5

**1.3.2 Standards**

1.3.2.1 Recognized standards given in Table 4 that can be used and will be considered in each case.

**Table 4 Typical standards/codes suitable for assessment of components**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
</table>
1.4 Survey and testing

1.4.1 Testing and commissioning

1.4.1.1 All indicators, alarms and safety functions related to the gas fuel transfer equipment shall be tested before the bunker vessel is taken in service.

1.4.1.2 Correct operation of ESD, ERS, their sequence of operation and interlock shall be tested. See [5.1.2].

1.4.1.3 Correct operation of gas detection system to be verified including measuring scale zero and span readings, alarm activation level and sampling sequence as stated in Pt.5 Ch.7 Sec.13 [6] and [5.1.1.2] and [5.1.1.3].

1.4.1.4 Vapour management system mentioned in [1.1.3.1] shall be tested. The initial testing shall be part of gas trials program to the scope of conventional re-liquefaction equipment test described in Pt.5 Ch.7 Sec.1 [6.1.5]. The overall capacity and performance of such arrangements shall be verified for compliance with design parameters during actual gas fuel transfer with vapour return to bunker vessel.

1.4.1.5 Manoeuvring and positioning system described in [7.1.2] shall be tested including quick mooring lines release where fitted.

1.4.1.6 Equipment fitted for purging with inert gas including the supply system, connection to the cargo system, instrumentation and back flow prevention arrangement to be tested to ensure correct installation, operation and where applicable - alarms.

1.4.1.7 Equipment installed for gas fuel transfer its instrumentation, control and alarm systems.

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<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 1474-1</td>
<td>Installation and equipment for liquefied natural gas – Design and testing of marine transfer systems – Part 1: Design and testing of transfer arms</td>
</tr>
<tr>
<td>EN 1474-2</td>
<td>Installation and equipment for liquefied natural gas – Design and testing of marine transfer systems – Part 2: Design and testing of transfer hoses</td>
</tr>
<tr>
<td>EN ISO 28460</td>
<td>Petroleum and natural gas industries – Installation and equipment for liquefied natural gas – Ship-to-shore interface and port operations</td>
</tr>
<tr>
<td>ISO/TS 18683</td>
<td>Guidelines for systems and installations for supply of LNG as fuel to ships</td>
</tr>
<tr>
<td>ISO 17357</td>
<td>Floating pneumatic rubber fenders</td>
</tr>
<tr>
<td>OCIMF</td>
<td>Design and Construction Specification for Marine Loading Arms</td>
</tr>
<tr>
<td>OCIMF</td>
<td>Mooring Equipment Guidelines</td>
</tr>
<tr>
<td>OCIMF</td>
<td>Information Paper - Marine Breakaway Couplings (MBC)</td>
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<tr>
<td>SIGTTO</td>
<td>ESD Arrangements &amp; Linked Ship/Shore Systems for Liquefied Gas Carriers</td>
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<tr>
<td>DNVGL-RP-G105</td>
<td>Development and operation of liquefied natural gas bunkering facilities</td>
</tr>
<tr>
<td>DNV Classification Notes No.61.2</td>
<td>LNG Boil-off Re-Liquefaction Plants and Gas Combustion Units</td>
</tr>
</tbody>
</table>
1.4.1.8 Where the gas fuel main component is liquefied natural gas, the class surveyor shall witness first bunkering operation.

1.4.1.9 The fenders shall be manufactured, tested and maintained in accordance with ISO 17357. Number and size of the fenders shall meet recommendations of OCIMF/SIGTTO/ICS Ship to ship transfer guide.

1.4.1.10 After completed installation on board, functional testing of the crane for hose support shall be carried out as specified in DNVGL-ST-0377 Standard for shipboard lifting appliances.

2 Materials

2.1 General

2.1.1 Material requirements

2.1.1.1 Requirements for materials, documentation and testing are covered in Pt. 5 Ch. 7.

Guidance note:
Where mixtures of hydrocarbon gases are used as gas fuel, the material should be selected with following assumption: for a design temperature of \(-165^\circ C\) when methane is used as main component for the gas fuel, however for other hydrocarbon mixtures higher design temperature may be considered depend on intended gas fuel composition.

---end---of---guide---note---

2.1.1.2 For CNG tanks, the use of materials not covered by Pt. 5 Ch. 7 shall be specially considered and approved by the Society.

3 Arrangement and system design

3.1 General

3.1.1 Bunker manifold area

3.1.1.1 Bunker manifold area and escape routes shall have safe access for crew engaged in operation. It shall have unrestricted natural ventilation and be sufficiently illuminated.

Guidance note 1:
Unrestricted natural ventilation presumes an open bunker station located above the open deck. Alternative arrangement may be accepted on a case by case basis.

---end---of---guide---note---

Guidance note 2:
Two floodlights per bunker station will be considered as sufficient illumination when they are located wide apart to minimise shadow areas on deck and high enough to minimise dazzle effect to personnel involved in handling of transfer connections.

---end---of---guide---note---

3.1.1.2 Bunker manifold platforms arranged for access to bunker connection shall have sufficient strength to provide support points for hoses where applicable, transfer arms and other bunker connection and manifold arrangements.

3.1.1.3 Arrangement of work platforms in areas where liquid spill may occur shall exclude liquid spill accumulation at the platform surface. Gratings used in this location shall be suitable for low temperatures and correspond to boiling point of gas bunker. Area under the gratings shall be equipped with spill collecting...
trays with drainage arrangements suitable for draining the accumulated spill overboard. The drain shall be fitted with a valve.

 Guidance note:
The spill collecting tray, drain pipe and valve fitted to the drain has to be suitable for carried product. This valve is not considered to be part of the cargo system therefore the manufacturer’s work certificate for material and work product certificate will be accepted.

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

3.1.1.4 When bunker boiling point is lower than design temperature of the hull steel, the hull in the manifold area shall be effectively protected from low temperature in case of a major bunker spill. Where water curtain is used for hull protection, the pumps shall be arranged with redundancy.

3.1.1.5 The bunker connections shall be clearly visible from the navigation bridge and bunker operation control position where continuous watch is kept during the transfer. CCTV can be accepted as substitute for the direct view when it provides unobstructed view of the bunker connections.

3.1.1.6 The area shall be clear of obstructions which may interfere with quick release described in Pt.5 Ch.7 Sec.13 [3.1.4].

3.1.2 Cargo tanks filling

3.1.2.1 Bunker vessel shall be able to abort bunkering operation at any stage in case of emergency. Cargo tanks on bunker vessel therefore shall not have restrictions on intermediate filling. However, internal transfer between cargo tanks within short period of time to leave dangerous sloshing zone may be accepted upon special considerations.

3.1.2.2 For assessment of membrane cargo tanks, reference is made to DNVGL-CG-0158.

3.1.3 Bunker transfer arrangement

3.1.3.1 Possibility to perform tightness test of the bunker connections between bunker vessel and receiving ship prior to operation shall be provided. Such procedure shall be described in the operation manual as required in Sec.6.

3.1.3.2 Suitable arrangements for inerting of the lines before filling them with the bunker vapour and for safe displacement of bunker liquid and vapour from bunker lines prior to disconnection shall be provided.

3.1.3.3 Sections of the line where liquid may remain after the bunker transfer shall be equipped with drain system leading back to the cargo tanks. Means to ensure that section of the transfer line outboard of manifold valve is free of liquid shall be provided. Where such arrangement is a control valve with drain opened to atmosphere, this control valve bore has to be limited to maximum 1.5 mm.

3.1.3.4 The section of the line between cross-over valve and presentation flange shall be equipped with pressure gauge visible from the drain valve position.

3.1.3.5 Bunker transfer piping system for products with boiling point below -55°C shall be thermally insulated to minimise heat leaks to transferred gas bunker and protect personnel from direct contact with cold surfaces.

3.1.3.6 Arrangement for control of distance between the bunker vessel and receiving ship manifolds in transverse and longitudinal directions shall be fitted. Exceeding of permitted working distance shall trigger alarm followed by automatic stop of transfer and closing of manifold valves.

3.1.3.7 Where quick connect/disconnect couplings (QC/DC) are used they shall be equipped with mechanical locking device to prevent inadvertent release. Powered QC/DC shall stay in “as is” position at loss of power.
3.1.4 Emergency release for bunker connection

3.1.4.1 The bunker vessel shall have arrangement for quick release of bunker connections in case of emergency.

3.1.4.2 Emergency release couplings (ERC) used in bunker connection shall be of “dry-break” type and be capable to self-disconnect upon application of force at any direction of vessel’s relative motion which exceeds design loads and at pressure surge exceeding the coupling design pressure. ERC fitted in lines for transfer of gas fuel at temperature below zero degrees Celsius shall be capable to break-away through the ice accumulated on the coupling during the transfer.

3.1.4.3 In addition to ERC, the bunker connections shall be equipped with powered emergency release system (ERS) operational in all conditions. The actuating ERS power shall have reserve storage of energy sufficient for disconnection of all transfer lines in case the main source of actuating power becomes unavailable (for example in case of cargo area black-out). Where ERS is fitted outboard the insulating flange described in [3.1.12], the insulation flange shall not be shorted by use of electrically continuous hydraulic hoses.

**Guidance note:**
Where the ERS is the dual-mode coupling and, in addition to positive means of quick release, can be parted by excessive forces applied to the coupling or disengage when the distance between the supplying and receiving vessels flanges exceeds safe operational envelope, the ERC fitting required in [3.1.4.2] may be omitted.

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

3.1.4.4 The ERS shall not disconnect the coupling at accidental black-out.

**Guidance note:**
Requirements of [3.1.4.3] is referred to an actuator device which positively disconnects the coupling (for example a hydraulic servo motor), requirement [3.1.4.4] is referred to the control circuits which shall not trigger disconnection at accidental loss of electrical power to the ERS control circuits.

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

3.1.4.5 Activation of ERS or ERC shall not impose excessive pressure surge effect in the system. Pressure surge effect for different flow rates and closing time of valves in transfer system shall be documented. Operational restrictions caused by closing time of valves on receiving ship shall be reflected in the vessel’s cargo plant operation manual.

3.1.4.6 Where the bunker connections are supported by hose crane, the quick release couplings shall be fitted at the receiving ship end (outward of the hose crane suspension point). Alternatively, the quick release couplings may be fitted at bunker vessel end when the hose suspension point has arrangements for automatic release synchronized with the quick release coupling.

3.1.4.7 When ERS is activated it shall release in two steps: first the ESD shall be triggered to stop the transfer and then release the ERS flanges.

3.1.4.8 Testing of ERS circuits shall be possible without disconnecting the ERS coupling.

3.1.4.9 Where hoses are used for transfer, release of ERC or ERS may potentially lead to hard impact of the hoses ends against the ships structures. Arrangements preventing the impact have to be provided. Release of the hoses shall not impose excessive stress to the manifold valves of the vessel.

3.1.4.10 Where rigid transfer arms are used for gas fuel transfer, the part of the transfer arm inboard of the quick release coupling shall retract automatically toward bunker vessel to avoid contact with other part and receiving vessel due to vessels motion.
3.1.4.11 ERS shall be capable to be activated by manual controls situated in at least two remote locations on bunker vessel. One of these locations should be the bunker operation control position.

3.1.4.12 Excessive pressure in bunker connections shall activate alarm and automatic stop of transfer. Capability to adjust the activation set point has to be provided, but it shall not exceed design pressure of the transfer lines.

3.1.5 Bunker manifold

3.1.5.1 The manifold for transfer of liquid shall be fitted with manually operated stop valve and a remotely/automatically operated valve (ESD valve) fitted in series.

  Guidance note:
  The two valves requirements should be applicable irrespective of design pressure of cargo tanks fitted at the bunker vessel to make the transfer connection suitable for operation with different MARVS setting at supply and receiving vessels.

---end---of---guidance---note---

3.1.5.2 The vapour return manifold shall be fitted with a remotely/automatically operated stop valve. Manual local operation of the valve shall be possible, e.g. by portable means.

3.1.5.3 Safe working load (SWL) of the manifold shall meet the recommendations of Manifold recommendations for liquefied gas carriers (OCIMF, 2011) and be capable to accommodate forces occurring due to vessel’s relative motion, ERC self-release force and following it dynamic forces.

3.1.5.4 Information about maximum safe working load (SWL) of bunker connection shall be available onboard and posted at the bunker station.

3.1.6 Bunker hoses

3.1.6.1 Hoses for gas fuel transfer shall be certified in accordance with requirements for cargo hose in Pt.5 Ch.7 Sec.5 [11.6].

3.1.6.2 Hoses for transfer of liquid shall be protected by relief valves fitted outboard manifold valve.

3.1.6.3 Hoses used for liquid transfer shall be single length hoses from export manifold to import manifold and provide sufficient allowance for vessel’s relative motion (including rolling) within operation envelope.

  Guidance note:
  Combination of hoses connected in series may be accepted for gas fuel transfer when effective control of the connections integrity can be arranged and when such connections will not impose excessive stress to the hoses flexible part or change hose radius beyond acceptable limits.

---end---of---guidance---note---

3.1.6.4 Arrangements for support of the hoses at critical points such as: hose rails, handrails, hose suspension points, etc. shall be provided to avoid excessive local stress and for maintaining of acceptable bending radius of the hoses. Such arrangements shall not constrain emergency release function described in [3.1.4].

3.1.6.5 Sufficient space for hose stowage after disconnection from receiving ship shall be available. The stowage arrangement shall consider permitted bending radius for the hoses.

3.1.6.6 Where the stowed hoses may contain residues of liquid with boiling temperature below the hull steel design temperature, the ship hull structure shall be protected from the low temperature effect in the way of the bunker hoses stowage location.
3.1.6.7 The arrangement of the hoses when they are connected for the gas fuel transfer shall consider possible direct contact or close proximity with hull structures. The hull in such locations shall be effectively protected from the effect of low temperatures.

3.1.7 Hose handling cranes

3.1.7.1 Bunker vessel shall be fitted with deck crane or cranes for handling of transfer hoses, reducers, spool pieces and other equipment used for transfer, including transfers at sea.

3.1.7.2 Where the crane is used for hose support during the transfer, it shall be delivered with DNV GL Certificate of compliance with DNV Standard for certification No.2.22 "Lifting Appliances". The crane certification by other recognized standard may be accepted based on special considerations.

3.1.7.3 Arrangements to maintain hose bend radius within limits shall be provided. Where cradles are used for support they have to be able to handle all hoses used for bunkering.

3.1.8 Rigid transfer arms

3.1.8.1 Rigid transfer arms and transfer systems based on foldable arms intended for use as gas fuel transfer arrangement will be specially considered. 

Guidance note: 
Acceptance criteria may be based on assessment of acceleration forces acting on the transfer arm, permissible manifold loads for the nominal diameter of the transfer arm connection, transfer arm location on bunker vessel and working envelope considering allowance for fenders, transfer arm support arrangements in operational and stowed positions, effect of the hull vibration on the transfer arm, maintenance of the transfer arm and testing program.

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

3.1.8.2 Standard EN1474 for design and construction shall be applied.

3.1.9 Mooring equipment

3.1.9.1 Bunker vessel shall be equipped with sufficient number of closed type fairleads for safe mooring to receiving ship. Mooring fittings and arrangements shall have their safe working load (SWL) corresponding to wind and current forces acting on the bunker vessel with allowance for dynamic forces occurring due to vessel's relative movement. 

Guidance note: 
Reference to is made to OCIMF Mooring equipment guidelines.

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

3.1.9.2 Steel mooring wires shall not be used unless the synthetic tails are fitted at the wire ends.

3.1.9.3 Provisions shall be made for emergency cast-off of mooring lines. 

Guidance note: 
Where fixed or portable quick release mooring hooks are used they should comply with a recognised standard.

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

3.1.9.4 Sufficient number of fittings shall be available for primary (parallel body length) and secondary (bow and stern quarters and superstructures) fenders.

3.1.9.5 The fenders shall be sized to provide sufficient energy absorption for the size of the vessel at approach velocities and sea mooring conditions.
Guidance note:
Number and size of the fenders should meet recommendations of OCIMF/SIGTTO/ICS Ship to ship transfer guide.

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

3.1.10 Communication equipment

3.1.10.1 The bunker vessel shall be equipped with effective communication means for internal purpose (onboard communications), for communication between the bunker vessel and receiving vessel and for external communications.

3.1.10.2 Where portable radios are used for communication with receiving ship, they shall be of approved type suitable for gas-hazardous areas. The bunker vessel shall have sufficient set of spare radios with the same operating frequencies table for the receiving vessel duty personnel. Minimum two portable radios shall be available for receiving vessel. Where the ships have wired communication link the number of portable radios can be reduces to one.

3.1.10.3 To reduce risk of current induction in hose cranes or rigid transfer arms, high power transmitting equipment such as MF/HF radios shall be provided with capability to be earthed manually and equipment with low transmitting power such as VHF radios, AIS transceivers shall have low power operation mode with transmission power not exceeding 1W.

3.1.11 Inert gas system/nitrogen supply

3.1.11.1 Bunker vessel shall have onboard source of suitable inert gas for inerting, purging of gas fuel transfer lines and for testing of the bunker connection for tightness prior to transfer.

3.1.11.2 Installed onboard inert gas production plant shall comply with requirements of Pt.5 Ch.7 Sec.9.[2].

3.1.11.3 The inert gas stored or produced on board for purging of gas fuel transfer lines shall have dewpoint sufficiently low to eliminate risk of water condensate accumulation in the piping system.

3.1.11.4 Where boiling point of the gas fuel is below -55°C the vessel shall be equipped with nitrogen supply system for gas fuel transfer lines inerting/purging. For fuel gas with warmer boiling point, inert gas produced by combustion of fuel or gas may be used.

3.1.11.5 Suitable arrangement to prevent back-flow of hydrocarbons from cargo system into the inert gas system shall be provided. When the source of inert gas is located outside the cargo area, the line shall be equipped with removable spool piece located on the open deck of cargo area.

3.1.11.6 When the back flow preventer consists of non-return valves installed in series, the spool piece [3.1.11.5] shall be removed after every inerting/purging operation. A warning sign shall be posted at the valves location and corresponding instruction included into the cargo plant operation manual.

3.1.11.7 Where a double block and bleed device is fitted to prevent the back-flow, it shall be equipped with alarms prescribed with Sec.9[4.2.2].

3.1.11.8 The inert gas supply connections to cargo system shall be equipped with shut off valves and have a branch connection to supply the inert gas to receiving ship through a flexible hose of sufficient length for cases when inert gas source is not available on the other ship.

3.1.12 Static electrical charge and galvanic currents

3.1.12.1 To reduce risk of high energy spark between bunker vessel and receiving ship due to hulls’ electrical potential difference, electrical insulation between ships shall be maintained at any stage of gas fuel transfer. Each transfer connection including connection bunker vessel and receiving ship shall have insulation flange.
3.1.12.2 Bonding wires shall not be used between ships unless required by the national administration. In this case the connection shall be mechanically and electrically sound and be fitted with suitable for hazardous area switch. Warning shall be posted stating that the switch shall be in “off” position before connecting and disconnecting the bonding cable.

3.1.12.3 Insulation flange shall have resistance of at least 1 kΩ but less than 1 MΩ to dissipate static charge.

3.1.12.4 Insulated section of the bunker hose or rigid transfer arm shall have possibility to be stowed without electrical contact with hull upon disconnection.

4 Fire safety

4.1 General

4.1.1 Fire protection

4.1.1.1 Fire protection and fire extinction arrangements of gas bunker vessel shall meet requirements of Pt.5 Ch.7 Sec.11.

4.1.1.2 Spark arresting arrangements shall be provided at exhaust outlets of internal combustion engines and boilers using oil as fuel and at incinerators exhaust outlets. Spark arrestors fitted in the exhaust outlets shall meet a recognized standard

4.1.1.3 Use of vapour oxidising equipment not in compliance with [7.1.1.6] shall be restricted during bunker operations.

5 Safety, control and monitoring systems

5.1 General

5.1.1 Gas detection

5.1.1.1 Installed onboard gas detection system shall be capable to measure gas concentration in the manifold connections area in addition to location described in Pt.5 Ch.7 Sec.13 [6.1.2] and have arrangement to provide a remote gas detection point for receiving ship.

Guidance note:
This additional gas detector may be part of gas detection system required by Pt.5 Ch.7 Sec.13 [6] if requirements of [5.1.1.2] are met.

5.1.1.2 Gas detecting equipment at the manifold connection shall provide continuous monitoring and activate alarm when concentration of hydrocarbons reaches 30% of lower flammable limit (LFL).

5.1.1.3 Audible and visible alarm from the permanently installed gas detection equipment shall be located on the navigation bridge, in the bunkering operation control position and at the gas detector readout location.

5.1.2 Emergency shutdown system

5.1.2.1 An emergency shutdown system (ESD) pendant with manual activation button shall be available for receiving ship.
Guidance note:
If a bunker vessel has capability to connect own ESD system to receiving vessel ESD system this arrangement can replace the pendant requirement.

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5.1.2.2 In addition to Pt.5 Ch.7 requirements for ESD, the ESD function shall be initiated in following circumstances:
— automatically, if the distance of connection on receiving ship from the connection on bunker vessel exceeds safe operational envelope for transfer arrangement
— by activating manual ESD button on ESD pendant
— automatically at ERS activation.

5.1.2.3 Opening of main transfer valves shall not be possible unless ERS is re-assembled.

6 Operations

6.1 General

6.1.1 Operation manual

6.1.1.1 Operation manual shall be provided for crew and contain instructions and guidance for the following:
— preparation before the bunkering including restriction of activities/operations during gas fuel transfer
— information to be exchanged between bunker vessel and receiving ship prior to operation
— hose handling guidelines reflecting specific hose manufacturer instructions for the hose handling
— procedures for connection including line inerting and tightness test
— preparations for start of bunkering, i.e. preparedness of fire-fighting, tightness testing, establishing communications, allocation of personnel/responsibilities
— pre-cooling of transfer connection(s) and transfer procedures
— draining of the pipeline, purging and disconnection on completion of the transfer
— operational restrictions to prevent dangerous pressure surge effect in the pipes
— fire safety during the transfer
— procedures for raising alarms
— procedures in case of communications failure
— suspension of operation during emergencies
— procedures for authorization of ERS activation
— emergency procedures for: gas fuel leakage, termination of the bunkering and emergency disconnection, response in case of unintentional disconnection of ERS, etc.

6.1.1.2 Cargo system piping diagram, function flowchart or cause and effect (C&E) diagram for ESD and related systems shall be available in the bunker/cargo control room where such room is established.

7 Special features(optional qualifiers)

7.1 General

7.1.1 Vapour management

7.1.1.1 Arrangements for handling excess vapour from receiving ship shall be provided with capacity sufficient to prevent venting of gas fuel vapour to the atmosphere.
7.1.1.2 Such additional arrangements and systems may be built on the following principles:

— re-liquefaction of vapours by means of mechanical refrigeration
— thermal oxidation of excess vapours
— a system allowing accumulation of the vapour in compressed state
— by other means acceptable to the Society
— a combination of the above.

7.1.1.3 Such arrangement and systems shall meet design conditions stated in Pt.5 Ch.7 Sec.7 unless other ambient conditions are specially agreed.

7.1.1.4 Redundancy requirements in Pt.5 Ch.7 Sec.7 are not applicable for this optional system.

7.1.1.5 Process piping for handling excess vapour from receiving ship shall be adequately separated to avoid over-pressurising cargo system on bunker vessel.

7.1.1.6 If vapour disposal is by means of oxidation, the installation shall comply with DNV Classification notes No. 61.2 except that the exhaust gas shall have a maximum exit temperature of 250°C. Exhaust outlet for such system shall be located on the side opposite to receiving vessel and directed outward.

7.1.1.7 When the system is based on accumulation of compressed vapour on bunker vessel, due considerations shall be made for safe operational margin. Additional pressure control systems with capacity to maintain cargo pressure/temperature within the limits shall be fitted.

7.1.1.8 Compressor installed for vapour extraction from receiving ship shall be fitted with automatic pressure and flow control, and be provided with surge protection and provisions for emergency stop.

7.1.2 Manoeuvring and positioning

7.1.2.1 The bunker vessel shall have longitudinal and transverse trust capabilities at approach and departure speed and retain sufficient manoeuvrability at speed vector alterations.

7.1.2.2 Control positions locations shall provide unobstructed view in the approach sector.

7.1.2.3 Independent system shall be available to provide information about vessel heading, speed vector and acceleration, rudder angle, vessel’s rate of turn, engine RPM and propeller pitch and thruster vectors at mooring control position. Failure of a sensor, system or equipment shall trigger alarm.

7.1.2.4 The vessel shall be equipped with independent joystick control system for positioning and manoeuvring which shall comply with Ch.3 Sec.1 [6.2].

7.1.2.5 The instruments [7.1.2.3] readings shall be clearly visible from the control positions in any ambient light conditions including bright Sun and do not constrain view due to scatter of own light at night.

7.1.3 Enhanced transfer control

7.1.3.1 The transfer control system shall have provisions of automatic control of flow rate and limiting pressure in the transfer system. Parameters of the control system critical for the safe transfer shall have adjustable settings.

7.1.3.2 Deviations from set values mentioned in [7.1.3.1] shall activate audible and visual alarms at the bunker operations control position and on the navigation bridge.

7.1.3.3 The transfer control system for liquid shall automatically reduce the liquid transfer rate when set values for pressure in the vapour return/vapour recovery system is exceeded.
7.1.3.4 If the transfer rate exceeds a maximum value, alarm and automatic stop of transfer shall be activated and manifold valves closed.

7.1.3.5 The receiving vessel shall have possibility to control transfer flow rate by means of a ship-to-ship link, e.g. flexible cable and pendant with means of control.
SECTION 15 TRANSPORTATION OF TOXIC CHEMICALS FOR OFFSHORE SERVICE VESSELS - CHEM

1 Introduction
The rules in this chapter are taking into account requirements proposed for the coming International code for the transport and handling of hazardous and noxious liquid substances in bulk in offshore support vessels, (IOSVC code) for the carriage of cargoes which are required to meet the requirements for toxic products in section 15.12 of the international code for the construction and equipment of ships carrying dangerous chemicals in bulk (IBC code).

1.1 Background
This rule chapter is to provide criteria for the arrangement and systems for the carriage of hazardous and noxious substances subject to the IBC code but not covered by the existing IMO resolution A.673(16). These rules are considered to provide an acceptable level of safety and pollution prevention compared to that which can be achieved on chemical tankers carrying the same substances in accordance with the IBC code and MARPOL annex II.

1.2 Scope
This rule chapter includes requirements to the ship’s cargo handling system, covering all aspects of the installation, from the ship’s cargo containment system and up to and including the cargo loading manifold. The chapter has requirements for arrangement and location of cargo tanks, associated piping systems, including requirements to access to such spaces. Requirements to survival capability are included. Hazardous areas and spaces due to the cargo handling installation are defined in terms of crew safety hazards. Requirements for control, monitoring and safety systems for the cargo handling systems are included.

Guidance note:
For cargoes deemed non-toxic and having flashpoint exceeding 60°C, IMO Res. A.673(16) should be applied.
In addition, for safety hazard substances; entrances, air inlets and openings to accommodation, service and machinery spaces and control stations may be accepted in bulkheads facing the cargo deck area if they are spaced outside the cargo area defined in A.673(16).

1.2.1 The rules in this chapter apply to arrangements and systems for the carriage of hazardous and noxious substances in bulk, which are required to meet the requirements for toxic products in section 15.12 of the IBC code.

The flag administration as well as the port state in which operation is intending to take place are responsible for accepting carriage of chemicals covered by these rules. Compliance with the requirements set forth in this chapter may be used as basis for such applications.

1.2.2 It is a pre-requisite that any cargo to be carried has been approved for carriage in accordance with the IBC code and MARPOL annex II.

1.2.3 These rules are intended for ships carrying the cargo to and from mobile offshore drilling units, fixed and floating platforms and other similar offshore installations.

1.2.4 These rules apply only in the case hazardous and noxious liquids are transferred to or from its containment system which forms part of the vessel or remains on board. The carriage of hazardous and noxious liquids in portable tanks which are only lifted on and off the ship, is covered by the international maritime dangerous goods (IMDG) code.
1.2.5 Other requirements for cargoes listed in “Specific and operational requirements (column o)” in the IBC code, in addition to 15.12, shall be complied with.

1.2.6 The classification of the vessel is based on the assumption that cargo handling operations are carried out in accordance with the approved instruction manual, see 15.

1.2.7 These rules are created to reflect the coming IOSVC code. This code may set forth stricter requirements than stated in this rule chapter.

2 Application

2.1

2.1.1 These rules have been developed for the design, construction and operation of offshore support vessels which transport substances in bulk that have significant hazardous and noxious properties, for the servicing and resupplying of offshore platforms, mobile offshore drilling units and other offshore installations, including those employed in the search for and recovery of hydrocarbons from the sea-bed.

2.1.2 Ships built to carry hazardous and noxious liquid substances in accordance with the requirements in this section will be given class notation: CHEM.

2.2 Relation to other DNV GL documents

2.2.1 Cargoes having LFL(1)/LFL(2) properties in addition to 15.12 requirements in the IBC code, shall also fulfil Sec.9.

3 References

3.1 Terminology and definitions

3.1.1 Cargo handling spaces are pump rooms and other enclosed spaces which contain fixed cargo handling equipment.

3.1.2 Cargo tank is the liquid tight shell designed to be the primary container of the cargo.

3.1.3 Cofferdam is the isolating space between two adjacent steel bulkheads or decks. This space may be a void space or a ballast space.

3.1.4 Hose handling area is a designated area for where the loading/offloading hose is to rest during cargo transfer. See [8.1.6].

An open deck is a deck which is either open at both ends or have an opening at one end, and is provided with adequate natural ventilation effective over the entire length through permanent openings distributed in the side plating or deckhead or from above, having a toala area of at least 10% of the total area of the space sides.

3.1.5 Service spaces are 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.
3.1.6 Toxic hazardous area, also referred to as cargo area means an area in which a toxic gas is or may be expected to be present in quantities such as to require special precautions in terms of crew safety. Ref. [11.2.1].

4 Procedural requirements

4.1 Documentation requirements

Documentation shall be submitted as required by Table 1.

Table 1 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
</table>
| Cargo handling arrangements general        | Z030 – Arrangement plan | Including:  
  - Machinery and boiler spaces, accommodation, service and control station spaces  
  - Main deck lay-out with hose landing area  
  - Bunkering stations with shore connections  
  - Tank hatches, ventilation pipes and any other openings to the cargo tanks and cofferdams  
  - Ventilating pipes, doors and openings to hazardous areas  
  - Entrances, air inlets and openings to accommodation, service and control station spaces. | FI   |
| Cargo piping system                         | S010 – Piping diagram (PD) |                                                                                     | AP   |
|                                             | Z160 – Operational manual |                                                                                     | AP   |
| Cargo tank venting and gas freeing arrangements | S010 – Piping diagram (PD) |                                                                                     | AP   |
| Cargo compartment cleaningsystem            | S010 – Piping diagram (PD) |                                                                                     | AP   |
| Cargo heating system                        | S010 – Piping diagram (PD) |                                                                                     | AP   |
| Cargo area                                  | G080 – Hazardous area classification drawing |                                                                                     | AP   |
| Ventilation systems in cargo area           | S012 – Ducting diagram (DD) | Including capacity and location of fans                                              | AP   |
| Cargo tanks pressure/vacuum valves or high velocity vent valves | Z110 – Data sheet |                                                                                     | AP   |
| Cargo tanks level monitoring system         | I200 – Control and monitoring system documentation |                                                                                     | AP   |
| Cargo tanks overflow protection system      | I200 – Control and monitoring system documentation |                                                                                     | AP   |
4.1.1 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.1.

4.1.2 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.2.

4.1.3 When national authorities survey the vessel in accordance with the current requirements of the international convention on safety of life at sea (SOLAS), copies of the cargo ship safety construction certificate and the cargo ship safety equipment certificate shall be submitted by the ship-owner or building yard. This documentation will be considered as equivalent to a survey carried out by the Society.

### 4.2 Certification

#### Table 2 Certification requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard*</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas detection and alarm system, fixed</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cargo tanks level monitoring system</td>
<td>PC</td>
<td>Society</td>
<td></td>
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<tr>
<td>Cargo tanks overflow protection system</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cargo valves and pumps control and monitoring system</td>
<td>PC</td>
<td>Society</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Unless otherwise specified the certification standard is the rules.
5 Materials
Structural materials used for tank construction, together with associated piping, valves, vents and their jointing materials, shall be suitable at the carriage temperature and pressure for the cargo to be carried, to the satisfaction of the Society.

6 Vessel arrangement

6.1 Tank arrangement

6.1.1 Cargo tanks shall not be located within the accommodation or engine room area. Engine room and accommodation shall not be located above tanks or cofferdams.

6.1.2 Where not bounded by bottom shell plating or pump room, the cargo tanks shall be surrounded by cofferdams.

For safe access to and within the cargo tanks and adjacent cofferdams, horizontal hatches or openings to or within cargo tanks or cofferdams surrounding such tanks are to have a minimum clear opening of 600 × 600 mm that also facilitates the hoisting of an injured person from the bottom of the tank/cofferdam. For access through vertical openings providing main passage through the length and breadth within cargo tanks and cofferdams surrounding such tanks, the minimum clear opening shall not be less than 600 × 800 mm at a height of not more than 600 mm from bottom plating unless gratings or footholds are provided. Smaller openings may be accepted provided evacuation of an injured person from the bottom of the tank/cofferdam can be demonstrated.

6.1.3 Tanks carrying ship type 3 cargoes shall have minimum horizontal distance between the tank side and the ship's shell of minimum 760 mm. Other tanks shall have distances according to IBC code chapter 2.6.1

6.1.4 The spaces forward of the collision bulkhead (forepeak) and aft of the aftermost bulkhead (afterpeak) shall not be arranged as cargo tanks nor as cofferdams.

6.1.5 Cofferdams shall be arranged for possible water filling. The filling system shall not be permanently connected to the cofferdams. Reactivity with the cargo shall always be considered. If cofferdams are not water filled, there shall be a leakage detection system installed.

6.1.6 Cargoes, which react in a hazardous manner with other cargoes or fuel oils, shall be segregated from such other cargoes or oil fuel by means of a cofferdam, pump room or tank containing a mutually compatible cargo.

7 Volumes to be carried
It will be up to the flag state administration to define the maximum cargo volumes and stability requirements that will apply for the vessel.

7.1 Access and openings general

7.1.1 No accommodation, service spaces, control stations or machinery spaces shall be located within the cargo area.
7.2 Access and openings to accommodation

7.2.1 Entrances, air inlets and openings to accommodation, service and machinery spaces, control stations and other non-toxic spaces are in general, not to face the cargo area.

For vessels with cargo tanks aft of the superstructure, entrances, air inlets and openings facing the cargo area may be accepted provided they are situated at least 10 m away from the cargo area.

The following provisions apply for such boundaries:
— Doors shall be kept closed during loading/discharge operations. Signboards shall be fitted.
— Port lights or windows shall be of a non-opening type.
— Ventilation inlets shall be fitted as far as practicable from the nearest cargo area (in no case less than 10 m).

7.3 Access and openings to pump room and cargo tanks

7.3.1 Cargo tanks and cofferdams surrounding cargo tanks shall have suitable access from open deck for cleaning and gas-freeing. Where cofferdams are provided over cargo tanks, small trunks are to be arranged to penetrate the cofferdam. The trunks shall be arranged for water filling.

7.3.2 Access openings are not to be arranged from cargo tanks or cofferdams to other spaces.

7.3.3 Pump rooms shall have access directly from open deck. No access shall be arranged between spaces in the cargo area and other spaces.

Access entrances and passages shall have a clear opening of at least 600 by 600 mm.

8 Piping system in cargo area

8.1 General

8.1.1 There shall be no permanent connection between piping systems in the cargo area and piping systems in the remainder of the vessel.

8.1.2 Where non-permanent connections between piping systems in the cargo area and piping systems in the remainder of the vessel are accepted, this separation may be achieved by the use of one of the following arrangements:
— Removing spool pieces or valves and blanking the pipe ends
— Blind flange valves.

Such arrangements shall not be located within a cargo tank or cofferdam.

8.1.3 The cofferdam boundaries shall not be penetrated at a level below the top of the cargo tanks.

Guidance note:
Hydraulic power supply to pumps/valve actuators, and cables for instrumentation would be acceptable cofferdam penetrations above the top of the cargo tanks.

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8.1.4 Bulkhead penetrations shall not utilise flanges bolted through the bulkhead.
8.1.5 Deck spills shall be kept away from accommodation and service areas by suitable precautionary means, such as a permanent coaming of suitable height extending from side to side or around loading and discharge stations.
In addition, there shall be a designated hose landing area. The area shall be limited by spill coamings or gutter bars leading any major leakage overboard.

8.1.6 Cargo pump room, pipe tunnels and cofferdams shall have a separate drainage system connected to pumps or bilge ejectors situated entirely within the cargo area.

8.1.7 Bilge ejectors serving cargo areas shall not be permanently connected to the drive water system.

8.1.8 Cofferdams shall be provided with sounding pipes lead to open deck.

8.1.9 Cofferdams shall be provided with air pipes lead to the open deck.

8.1.10 Bilge system
Bilge pumping systems serving spaces within the cargo area are to be independent from systems serving spaces outside the cargo area subject to this chapter and are to be entirely situated within the cargo area.

8.2 Cargo piping system

8.2.1 The complete cargo piping system shall be located within the cargo area and shall be entirely separate from all other piping systems on board. The requirements in Pt.5 Ch.6 are to be followed for the piping system.

8.2.2 Cargoes, which react in a hazardous manner with other cargoes, shall have separate pumping and piping systems, which shall not pass through other cargo tanks containing such cargoes unless encased in a tunnel.

8.2.3 Cargo piping shall not penetrate cargo tank boundaries below the top of the tank. Penetrations below the top of the tank may be accepted provided that a remotely operated stop valve is fitted within the cargo tank served. Where a cargo tank is adjacent to a pump room, the remotely operated stop valve may be fitted on the cargo tank bulkhead on the pump room side.

8.2.4 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.

8.2.5 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. The detection shall be of automatic type.

**Guidance note:**
Due precautions shall be taken in order to avoid cargo release on deck due to too low location of leakage check point.

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

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

8.2.7 Cargo pumps shall be provided with remote shut down devices capable of being activated from a dedicated cargo control location which is manned at the time of cargo transfer. Remote shut down shall also to be capable of being activated from at least one other location outside the cargo area and at a safe distance from it.

8.2.8 The connecting coupling for the transfer hose shall be of a type which automatically closes at disconnection (self-sealing type).
Means of quick-release of the transfer hose shall be provided, e.g. by installation of a weak link assembly or by installation of a remotely controlled coupling. If a remote controlled coupling is arranged, the quick-release shall be capable of being effectuated from the bridge.

8.2.9 The minimum distance in [6.1.3] is also in general to be complied with for cargo piping. Remotely controlled isolation valves may be used in order to accommodate routing of cargo pipes closer to ship side. It will not be accepted for the vent pipes.

8.3 Cargo heating system

8.3.1 The heating medium shall be compatible with the cargo and the temperature of the heating medium shall not exceed 220°C.

8.3.2 The cargo heating system shall be arranged as a secondary system independent of other ship’s services and not enter the engine room.

8.3.3 Where provided, heating or cooling systems shall be provided with valves to isolate the system for each tank.

8.3.4 For any heating system, means shall be provided to ensure that, when in any other but the empty condition, a higher pressure is maintained within the system than the maximum pressure head exerted by the cargo tank content on the system. The heating circuit expansion tank shall be fitted with a gas detector or low level alarm and be vented to open air.

8.3.5 Cargo heating pipes shall not penetrate the cargo tank boundaries other than from top of the tank.

Guidance note:
If cargo tanks are used as tanks for recovered oil, see also Sec.11

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

8.4 Cargo tank washing

8.4.1 There shall be installed permanent tank washing arrangements so that personnel need not be subjected to cargo vapours during cleaning operations.

8.4.2 Slop tanks and associated systems shall fulfill the requirements to cargo tank and its associated systems, except for requirements to tank location.

8.5 Ballast tanks

8.5.1 Filling or discharge of tanks within cargo area with ballast shall be carried out from the cargo pump room, a similar hazardous space or from inside ballast tanks, except as permitted by [8.5.2].

8.5.2 Pumps, ballast lines, vent lines and other similar equipment serving permanent ballast tanks should be independent of similar equipment serving cargo tanks and from cargo tanks themselves. Discharge arrangements for permanent ballast tanks sited immediately adjacent to cargo tanks should be outside engine room and accommodation spaces. Filling arrangements may be in the engine room provided that such arrangements ensure filling from tank deck level and non-return valves are fitted.

8.5.3 Filling of ballast in cargo tanks may be arranged from deck level by pumps serving permanent ballast tanks, provided that the filling line has no permanent connection to cargo tanks or piping and that non-return valves are fitted.
8.5.4 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.

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

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

8.5.5 Lines from engine room to ballast tanks outside of cargo area shall be carried outside cargo tanks.

## 9 Gas-freeing, inerting and venting of cargo tanks

### 9.1 Gas-freeing of cargo tanks

**9.1.1** Gas freeing operations shall be carried out such that vapour is initially discharged in one of the following ways:

1) Through outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 30 m/s maintained during the gas freeing operation; or

2) Through outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 20 m/s through outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 20 m/s which are protected by suitable devices to prevent the passage of flame

**Guidance note:**
Procedures to be included in the operation manual in 15.

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

**9.1.2** Fixed gas freeing pipes with approved gas-freeing covers shall be provided (using fixed or portable fans from deck level). Location of gas freeing outlets shall be arranged in accordance with requirements for P/V-valve outlets.

**Guidance note:**
Cofferdams, ballast tanks adjacent to toxic cargo tanks shall be arranged for portable mechanical ventilation to open deck.

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### 9.2 Cargo tank venting system

**9.2.1** The cargo tanks shall have a breathing system for relief of pressure and vacuum. Such breathing shall be through P/V-valves (pressure/vacuum relief valves). The system shall comply with the requirements given in Pt.5 Ch.6 Sec.9 [2.3].

**9.2.2** Cargoes, which react in a hazardous manner with other cargoes, shall have separate tank venting systems.

**9.2.3** The set point of the pressure side of the P/V-valves shall be set at minimum 0.6 bar.

**9.2.4** Cargo tanks shall be provided with a vapour return line to enable loading with vapour return to shore.

**9.2.5** Pressure audible and visual alarms at cargo control station and cargo area shall be installed, and to be activated at 70% of P/V-valve opening to warn crew of imminent vapor release.

**9.2.6** P/V-valve outlets and gas freeing shall be located outlets min. 3 m above deck or gangway/access way for personnel. This implies that the cargo rail top cannot be used as gang way on the side where P/V valve outlets are located.
9.3 Inerting

9.3.1 There shall be a possibility to connect inert gas to the cargo tanks. The requirements for the inert gas system are given in Sec.9 [4]. The cofferdams need not have such a connection unless required by Sec.9.

10 Ventilation system within the cargo area

10.1 General

10.1.1 The ventilation system shall comply with the requirements given in Pt.5 Ch.6 Sec.10. The following requirements may be relaxed after special consideration in each case:

— the height of the ventilation exhaust outlets from cargo handling spaces
— requirements for Ex-equipment and spark generation will only be applicable when required by LFL-notations.

10.1.2 The working deck shall be arranged for natural ventilation as follows:
— the stern of the ship shall have a bulwark with a height of no more than 1.5 m towards the sea.
— deck cargo shall be located forward of cargo area (toxic hazardous area).

For ships having superstructure aft of the cargo area, arrangement will be considered on a case-by-case basis.

11 Fire extinction

11.1 Fire extinction

11.1.1 If carrying flammable chemicals, the vessel shall have a fixed foam fire extinguishing system for protection of the cargo deck area.
11.2 Cargo area definitions

11.2.1 Toxic cargo area
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 toxic vapours. In addition, the following is also considered as toxic areas:

1) Cofferdams adjacent to cargo tanks.
2) Hold spaces containing independent cargo tanks.
3) Cargo handling spaces.
4) Enclosed spaces above or adjacent to cargo tanks.
5) Areas on open deck, or semi-enclosed spaces on deck, within 4.5 m of any cargo tank outlet, gas or vapour outlet, 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.
6) Areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of any cargo gas outlet intended for the passage of large volumes of gas or vapour mixture during cargo loading, within a vertical cylinder of unlimited height and 15 m radius cantered upon the centre of the outlet, and within a hemisphere of 15 m radius below the outlet.
7) Areas on open deck, or semi-enclosed spaces on deck, within 1.5 m of cargo pump room entrances, cargo pump room ventilation inlet, openings into cofferdams or other hazardous spaces.
8) 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.
9) Compartments for cargo hoses.
10) Designated hose landing area on deck, as described in [8.1.5]
11) Enclosed or semi-enclosed spaces in which pipes containing cargoes are located.

Guidance note:
Areas on open deck within 3 m of cargo tank access openings for ships with cofferdams towards deck are not defined as hazardous zones. Safety precautions related to the use of such access openings in connection with gas freeing are to be covered in the operation manual.

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11.2.2 Spaces with access or opening located in hazardous area shall be considered as hazardous area.

12 Instrumentation and control system

12.1 General

12.1.1 Control systems for cargo valves and pumps shall comply with the requirements given in Pt.5 Ch.5 Sec.9 [2].

12.2 Level gauging and level alarm

12.2.1 Each cargo tank shall be fitted with at least one level gauging device.
Where only one gauging device is fitted, it shall be arranged so that any necessary maintenance can be carried out while the cargo tank is in service. If this is not possible, means for manual sounding shall be provided.
All means of level gauging shall of closed type as described in Pt.5 Ch.6 Sec.13 [2].
12.2.2 In addition each cargo tank shall be fitted with a high level alarm giving alarm at 95% filling by volume. The alarm shall be activated by a level sensing device independent of the gauging device.

12.2.3 Cofferdams surrounding cargo tanks shall be fitted with leakage detection unless they are water filled when carrying cargo or fitted with gas detection. Alarms shall be provided at a manned control station.

12.2.4 Independent 95% alarm and 98% alarm will be required for cargoes requiring compliance with IBC code 15.19.7.

12.3 Gas detection

12.3.1 Cofferdams surrounding cargo tanks shall be fitted with gas detection unless they are water filled or fitted with leakage detection. Alarm shall be provided at a manned control station.

12.3.2 The ship shall be equipped with at least two instruments designed and calibrated for testing for the specific vapours in question.

12.3.3 Vapour-detection instruments may be portable or fixed. If a fixed system is installed, at least one portable instrument shall be provided.

12.3.4 When toxic-vapour-detection equipment is not available for some products which require such detection, as indicated in column k in the table of chapter 17 in the IBC code, the administration may exempt the ship from the requirement, provided an appropriate entry is made on the international certificate of fitness for the carriage of dangerous chemicals in bulk. When granting such an exemption, the administration shall recognize the necessity for additional breathing-air supply and an entry shall be made on the international certificate of fitness for the carriage of dangerous chemicals in bulk drawing attention to the provisions of 14.2.4 and 16.4.2.2 in the IBC code.

13 Personnel protection

13.1 Protective equipment

13.1.1 For the protection of crew members who are engaged in loading and discharging operations, the ship shall have on board suitable protective equipment consisting of large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical-resistant material, and tight-fitting goggles or face shields or both. The protective clothing and equipment shall cover all skin so that no part of the body is unprotected.

13.1.2 Work clothes and protective equipment shall be kept in easily accessible places and in special lockers. Such equipment shall not be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. The Administration may, however, approve storage rooms for such equipment within accommodation spaces if adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc.

13.1.3 Protective equipment shall be used in any operation, which may entail danger to personnel.

13.2 Safety equipment

13.2.1 There shall be available sufficient but not less than three complete sets of safety equipment, each permitting personnel to enter a gas-filled compartment and perform work there for at least 20 min. Such equipment shall be in addition to that required by SOLAS regulation II-2/10.10.
13.2.2 One complete set of safety equipment shall consist of:
1) one self-contained air-breathing apparatus (not using stored oxygen),
2) protective clothing, boots, gloves and tight-fitting goggles,
3) fireproof lifeline with belt resistant to the cargoes carried; and
4) explosion-proof lamp.

13.2.3 For the safety equipment required in [13.2.1], all ships shall carry either:
1) one set of fully charged spare air bottles for each breathing apparatus,
2) a special air compressor suitable for the supply of high-pressure air of the required purity,
3) a charging manifold capable of dealing with sufficient spare air bottles for the breathing apparatus; or
4) fully charged spare air bottles with a total free air capacity of at least 6,000 l for each breathing apparatus on board in excess of the requirements of SOLAS regulation II-2/10.10.

13.2.4 A cargo pump-room on ships carrying cargoes which are subject to the requirements of 15.18 or cargoes for which in column k in the table of the IBC code chapter 17 toxic-vapour-detection equipment is required but is not available shall have either:
1) a low-pressure line system with hose connections suitable for use with the breathing apparatus required by [13.2.1]. This system shall provide sufficient high pressure air capacity to supply, through pressure-reduction devices, enough low pressure air to enable two men to work in a gas-dangerous space for at least 1 h without using the air bottles of the breathing apparatus. Means shall be provided for recharging the fixed air bottles and the breathing apparatus air bottles from a special air compressor suitable for the supply of high-pressure air of the required purity; or
2) an equivalent quantity of spare bottled air in lieu of the low-pressure air line.

13.2.5 At least one set of safety equipment as required by [13.2.2] shall be kept in a suitable clearly marked locker in a readily accessible place near the cargo pump-room. The other sets of safety equipment shall also be kept in suitable, clearly marked, easily accessible places.

13.2.6 The breathing apparatus shall be inspected at least once a month by a responsible officer, and the inspection recorded in the ship's log-book. The equipment shall be inspected and tested by an expert at least once a year.

13.3 Emergency equipment

13.3.1 Ships carrying cargoes, for which "Yes" is indicated in column n of chapter 17 of the IBC code, shall be provided with suitable respiratory and eye protection sufficient for every person on board for emergency escape purposes, subject to the following:
1) filter-type respiratory protection is unacceptable
2) self-contained breathing apparatus shall have at least a duration of service of 15 min
3) emergency escape respiratory protection shall not be used for fire-fighting or cargo handling purposes and shall be marked to that effect.

13.3.2 The ship shall have on board medical first-aid equipment, including oxygen resuscitation equipment and antidotes for cargoes to be carried, based on the guidelines developed by the IMO*.
* Reference is made to the Medical First Aid Guide for use in accidents involving dangerous goods (MFAG) which provides advice on the treatment of casualties in accordance with the symptoms exhibited as well as equipment and antidotes that may be appropriate for treating the casualty.

13.3.3 A stretcher which is suitable for hoisting an injured person up from spaces such as the cargo pump-room shall be placed in a readily accessible location.
13.3.4 Suitably marked decontamination showers and an eyewash shall be available on deck in convenient locations. The showers and eyewash shall be operable in all ambient conditions.

14 Lifeboat

In general, SOLAS III requirements as for a chemical tanker are to be followed for the ship in question.

Guidance note:
Other equivalent arrangements need to be agreed upon with applicable flag state.

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15 Signboards

15.1 General

15.1.1 Doors to accommodation and service spaces facing the cargo area shall be provided with signboards with the following text:
TO BE KEPT CLOSED DURING HANDLING OF TOXIC CARGOES

16 Operational instructions

16.1 General

16.1.1 An operation manual describing all essential procedures for handling of chemical cargoes shall be prepared. The manual is subject to approval and shall be kept on board.

16.1.2 Ship particulars
Cargo system:
   — tank capacities
   — cargo handling system
   — cargo tank venting
   — cargo tank heating
   — pump room safety if applicable
   — cargo tank instrumentation
   — fire safety
   — gas detection.

Operations:
   — assumptions
   — loading
   — voyage
   — discharging
   — cleaning and gas freeing (tank entry)
   — cofferdam safety
   — cargo area access plan
   — gas detection
   — cargo handling spaces safety.
Reference documents:

— general arrangement
— capacity plan
— cargo system
— pressure/vacuum valves flow curves
— cargo venting
— mechanical ventilation cargo area
— hazardous zones
— fire extinguishing
— bilge cargo area.

16.1.3 The following instructions shall be included in the operation manual as applicable:

— gas measurements shall be carried out regularly
— doors to accommodation and service spaces facing the cargo area shall be kept closed during cargo handling
— dry cargo shall not be handled in cargo area forward of the superstructure
— no simultaneous handling of dry cargo or liquid cargo not covered by this section shall be performed while loading/unloading of the chemicals covered by these rules.
SECTION 16  OFFSHORE GANGWAY INSTALLATIONS - WALK2WORK

1 General

1.1 Introduction
The additional class notation Walk2work set out requirements for offshore gangways installed on vessels.

1.2 Scope
The additional class notation Walk2work provides requirements for offshore gangway systems with respect to:
— safety and functionality
— device for:
   — locking the gangway in a parked position (vessel at sea)
   — supporting the gangway structure.
The offshore gangway shall be identified in the appendix to the classification certificate.

1.3 Application
The additional class notation Walk2work applies to a specific offshore gangway system permanently installed on a vessel. See Pt.3 regarding requirements for the supporting structure. Vessels found to be in compliance with the requirements in this section may be assigned the additional class notation Walk2work.
Four different types of offshore gangways are defined in DNVGL-ST-0358 Sec.1. Notation Walk2work is relevant for vessels with offshore gangways of type 1 and 2, while the notation is not feasible for vessels with offshore gangways of types 3 and 4.

1.4 Certification requirements

1.4.1 For offshore gangways covered by class notation Walk2work, the builder shall request the manufacturers to order certification as described in Table 1.

Table 1 Certification requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore gangway</td>
<td>PC</td>
<td>Society</td>
<td>DNVGL-ST-0358</td>
</tr>
</tbody>
</table>

1.4.2 For definition of certification types, see Pt.1 Ch.3.

1.5 Documentation requirements

1.5.1 Documentation shall be submitted as required by Table 2.
### Table 2 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z030 - Arrangement plan</td>
<td>Including: — main dimensions — limiting positions of movable parts — location onboard during operation and in parked position — design loads during operation and in parked position — operational limitations including significant wave height (Hs), wind etc.</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td>H050 - Structural drawing</td>
<td>Showing: — support of gangway within the vessel — securing devices for the gangway when it is in parked position — design loads.</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>H080 - Strength analysis</td>
<td>Calculations documenting acceptable stresses in the supporting structures and the sea fastening arrangement.</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td>E050 - Single line diagrams/consumer lists for switchboards</td>
<td>Description covering all switchboards and their consumers, providing information on switchboard connections, consumer ratings, cable dimensions and settings of protective devices.</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>E170 - Electrical schematic drawing</td>
<td>Showing the configuration of the electrical circuits. Information on protection, interlocks, undervoltage trips, remote control circuits etc. shall be included if relevant.</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td>E220 - Electrical system philosophy</td>
<td>— configuration of the system in all operating modes and subsequent power distribution philosophy for different vessel systems — interlocks — system behavior in relevant failure modes.</td>
<td></td>
<td>AP</td>
</tr>
</tbody>
</table>

**AP** = For approval; **FI** = For information

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**Guidance note:**

Documentation requirements to electrical power supply are covered in Pt.4 Ch.8.

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1.5.2 For general requirements to documentation, including definition of the info codes, see Pt.1 Ch.3 Sec.2.

1.5.3 For a full definition of the documentation types, see Pt.1 Ch.3 Sec.3.
Part 6 Chapter 5 Section 16

2 Hull

2.1 Support within the vessel

2.1.1 The gangway shall be secured to the hull structures when in parked position during transit.

2.1.2 The supporting structures within the vessel shall be designed to withstand the load combinations specified in DNVGL-ST-0358 Table 4-4 and DNVGL-ST-0358 Table 4-5.

2.1.3 For the operational load combinations (LC 1 and LC 2 in DNVGL-ST-0358 Table 4-4 and DNVGL-ST-0358 Table 4-5) the acceptance criteria shall be as given in Pt.3 Ch.11 Sec.2 [4.6].

2.1.4 The maximum operational accelerations shall either be taken according to Pt.3 Ch.4 Sec.3 or, for restricted sea conditions, to be agreed in advance (e.g. based on a wave load analysis).

2.1.5 For the emergency disconnection load combination (LC 3 in DNVGL-ST-0358 Table 4-4 and DNVGL-ST-0358 Table 4-5) acceptance criteria AC-III in Pt.3 Ch.6 Sec.6 shall be applied.

2.1.6 For the parked/transit load combination (LC 4 in DNVGL-ST-0358 Table 4-4 and DNVGL-ST-0358 Table 4-5) acceptance criteria AC-II in Pt.3 Ch.6 Sec.6 shall be applied (provided the loads are at $10^{-8}$ probability level).

2.1.7 The maximum transit/parked accelerations (i.e. for unrestricted sea conditions) shall not be taken less than given in Pt.3 Ch.4 Sec.3.

2.1.8 Due concern shall be taken with respect to horizontal forces and uplift forces at the connection between the gangway and the vessel. Doublers shall be avoided where uplift forces may occur.

3 Testing

3.1 General

After completed installation onboard, functional testing and load testing of the gangway and its supporting structures shall be carried out as specified in DNVGL-ST-0358 in presence of DNV GL surveyor.

4 Stability

4.1 Application

The intact and damage stability criteria applicable to the ship shall be complied with at all times when the gangway is in use. This includes the main class requirements in Pt.3 Ch.15, the statutory intact and damage stability requirements and optional class notations when applicable. The stability shall be assessed when the gangway is in the most unfavorable position with respect to transverse heeling moment.

5 Station keeping

5.1 General

The vessels shall have station keeping ability by dynamic positioning systems or position mooring systems. For vessels with dynamic positioning system, class notation **DPS(1)** or higher is mandatory.
Guidance note:
For relevant dynamic positioning class notations, see Ch.2. DPS(1) is equivalent to IMO MSC/Circ 645 Guidelines for vessels with dynamic positioning systems, equipment class 1.

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5.2 Capability
The position keeping ability of the vessel shall be documented according to DNVGL-ST-0111 Assessment of station keeping capability of dynamic positioning vessels.
CHANGES – HISTORIC

July 2016 edition
This document supersedes the January 2016 edition.

Main changes July 2016, entering into force 1 January 2017

- Sec.5 Helicopter installations - HELDK
  - Sec.5 [8]: The requirements for loads and allowable stresses is aligned with the Norwegian Civil Aviation Authorities.

- Sec.8 Inert gas systems - Inert
  - The requirements in the section have been replaced with references to Pt.5 Ch.5 and Pt.5 Ch.6 for requirements to documentation, arrangements and systems.
  - Sec.8 [1.5.3] has been added regarding maximum oxygen content.

January 2016 edition
This document supersedes October 2015 edition.

Main changes January 2016, entering into force 1 July 2016

- Sec.8 Inert gas systems - Inert
  - [1.3]: New and revised text.
  - Table 3: New table.

- Sec.15 Transportation of toxic chemicals for offshore service vessels - CHEM
  - New section.

October 2015 edition
This is a new document.
The rules enter into force 1 January 2016.
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16 000 professionals are dedicated to helping our customers make the world safer, smarter and greener.