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# RULES AND REGULATIONS FOR THE CONSTRUCTION AND CLASSIFICATION OF **STEEL SHIPS**

# RULES CHANGE NOTICE NO. 1

September 2024

## General Information

This Rules Change Notice gives amendments to the 'Rules and Regulations for the Construction and Classification of Steel Ships'.

These amendments are to be read in conjunction with the requirements given in the July, 2024 edition of the Rules.

The Part / Chapters where amendments are made and their effective dates are indicated in **TABLE 1**. The actual requirements, arranged in the order of Part / Chapter / Section / Sub-section / Clause, have been given subsequently.

Corrigenda issued with this Rules Change Notice are given in **TABLE 2.**

For ease of reference, the newly added text has been highlighted by underlining and the deleted text by striking through.

# RULES AND REGULATIONS FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS – July 2024

## RULES CHANGE NOTICE No. 1 – September 2024

## TABLE 1 – AMENDMENTS INCORPORATED IN THIS NOTICE

***These amendments will come into force as indicated in the Table***

| Section / Clause | Subject/ Amendments |
|---|---|
| **Part 1 Chapter 1: General**<br><br>*The amendments are applicable from 1 January 2025.* | |
| Appendix 1 | Additional Class Notation '**For Occasional Carriage of Dry Bulk Cargo**' is added to the list of notations. |
| **Part 1 Chapter 2: Periodical Surveys**<br><br>*The amendments are applicable to surveys carried out on or after 1 January 2025.* | |
| 6/ 6.8(new) | Periodical survey requirements for ships assigned additional class notation, 'For Occasional Carriage of Dry Bulk Cargo', are specified. |
| **Part 2 Chapter 4: Steel Castings**<br><br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 4/ 4.10 | The definitions for non-linear and linear indication have been revised to correctly reflect the length-to-width ratio. |
| 4/ Fig. 4.10.1 | The figure representing the criteria for non-linear and linear indications is updated in line with 4.10.1. |
| 4/ 4.12.7 | The amendment clarifies that the requirements in this clause are applicable to martensitic steels. |
| 4/ Fig. 4.15.2.1 | The amendment modifies the dimensions for the test piece for the welding repair procedure, specifically updating the minimum value of dimension "b" from 350 mm to 300 mm. |
| **Part 2 Chapter 8: Copper Alloys**<br><br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 3/ Fig 3.7.1 | Mathematical symbols are corrected in the figure. |
| 3/ 3.10.1 | The definitions for non-linear and linear indications have been revised to correctly reflect the length-to-width ratio. |
| 3/ Fig. 3.10.1 | The figure representing the criteria for non-linear and linear indications is updated in line with 3.10.1. |
| 3/ 3.11.3 a) | The requirement regarding acceptance of a modified zone A based on technical documentation is deleted. |
| 3/ 3.11.4 | The text specifying that defects deeper than a certain depth are to be repaired by welding has been modified by deleting reference to the minimum local rule thickness. |
| 3/ 3.12.2 | Title heading, "Preparation of welding repair", is provided for the sub-section |
| 3/ Table 3.12.3(b) | The applicability of stress relief temperatures (550°C and 600°C) is clarified for different types of alloy grades. |
| 3/ 3.14.2.1 | Editorial changes are made for better clarity. |
| **Part 3 Chapter 3: General Arrangement and Structural Design Principles**<br><br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 2/ Table 2.7.4 a) and b) | Tables have been completely revised to align with revised SOLAS regulations. |
| 2/ 2.7.4.1 b) | Requirements for opening and closing doors in port, for those that are to be kept permanently closed at sea, are revised. |

| Section / Clause | Subject/ Amendments |
|---|---|
| 2/ 2.7.4.2 | Requirements for various categories (B, C & D) of watertight doors in passenger ships are added. |
| 2/ 2.7.4.3 | References to tables 2.7.4 a) and b) have been updated. |
| 2/ 2.7.4.3 to 2.7.4.7 and 2.7.5 | References to tables 2.7.4 a) and b) and other cross references are updated. |
| **Part 4 Chapter 2: Piping Design Requirements**<br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 1/ 1.1.1 | Cross-reference is provided to the Clause related to piping systems not covered by this Chapter. |
| 1/ 1.1.2 | Piping systems excluded from this Chapter are clarified. |
| 1/ Table 1.2.1 | Note 2 is added to clarify that Class II pipes are not to be used for toxic media. Note 6 is added to clarify the requirements for urea in SCR systems. Piping material standards for urea in SCR systems are also specified. |
| 2/ 2.5.1 | The Clause is updated to specify that threaded sleeve joints are to conform with the requirements of a recognized standard such as ASME B31.1 and ASME B31.3. |
| 2/ 2.5.2 | Editorial changes are made for better clarity. |
| 2/ 2.5.3 (new) | Requirements for threaded sleeve joints used for connecting small bore instrumentation equipment to piping systems are better clarified. |
| 2/ Table 2.5.1 (Deleted) | The table 2.5.1 is deleted as it is superfluous. |
| 2/ 2.7.11.6 | It is clarified that pressure pulsation test is mandatory for mechanical joints in Class I and II piping systems. The test is also to be used in Class III systems where pressure pulsation other than water hammer is expected. |
| 2/ Table 2.7.2 | The OD restriction of 60.3 mm for compression couplings (sage type, bite type, typical compression type and flared type) is removed, as it is already covered in Cl. 2.5.5. |
| 7/ 7.2.1 | Requirement for testing of gas fuel piping is deleted here to align with other requirements in this Chapter. |
| 7/ 7.2.5 | Pneumatic leak testing is specified as an alternative to hydrostatic pressure tests for water sensitive systems. |
| **Part 4 Chapter 8: Electrical Installations**<br>*The amendments are applicable to ships contracted for construction on or after 1 July 2025.* | |
| 2/ 2.9.1 | The amendments clarify the application of UPS units for providing independent, continuous power supply to emergency and essential services, deleting redundant references to transitional power sources. |
| 2/ 2.9.2 | The amendments refine the definitions of UPS systems, focusing on their components, functionality, and operational topologies, while aligning with the latest IEC standards. |
| 2/ 2.9.3 | The amendments update the design and construction requirements for UPS units, ensuring compliance with the latest IEC standards and emphasizing appropriate configuration to meet the power supply needs of connected equipment. |
| 2/ 2.9.4 | The amendments clarify the location requirements for UPS units, particularly for emergency services, and specify the conditions under which UPS units should be installed and operated. |
| **Part 4 Chapter 11: Spare Gear**<br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 2/ 2.1 (new) | A risk assessment approach to determine the minimum spare parts to be carried onboard is introduced. |
| 2/ 2.2 | Updated to indicate that in cases where a risk assessment approach has not been adopted, spare parts may be provided according to traditional methods as indicated in the relevant tables (Table 2.2.1 to Table 2.2.6). |
| | |

| Section / Clause | Subject/ Amendments |
|---|---|
| **Part 5 Chapter 1: Dry Bulk Cargo Carriers**<br><br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 1/ 1.1.3.8 (new) | A new clause is introduced to clarify the requirements for ships which occasionally carry dry bulk cargo. |
| **Part 5 Chapter 2: Oil Tankers**<br><br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 6/ 6.2.8 | The phrase “not glands” is deleted to avoid possible misunderstanding. Definitions for “heavy flanges joints” and “expansion bends” are added for better clarity in Notes 1 and 2 respectively. |
| Table 6.2.8 | Title heading for the Table is introduced. |
| 13/ 13.1 (new) | New Clause is added to clarify that the section applies to tankers where crude oil or slops are used as fuel for boilers, with an exception noted for cases where low flash point crude oil is used, and the design complies with SOLAS II-1/55.<br>Succeeding Clauses are renumbered accordingly with minor editorial changes made for better clarity. |
| **Part 5 Chapter 4: Liquefied Gas Carriers**<br><br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 5/ 5.13.1.3 (new) | The testing requirements for cargo pumps and gas reliquefication/ refrigeration compressors are better detailed. Additionally, requirements for material testing, installation testing and unit production testing are also updated. |
| **Part 5 Chapter 8: Offshore Support Vessels**<br><br>*The amendments are applicable to ships contracted for construction on or after 1 January 2025.* | |
| 3/ 3.4.2.2 | It is specified that all loose gear in use with anchor handling winches and associated equipment are to have documentary evidence of a proof test and be retested after repairs, modifications or major alterations. Further marking requirements for loose gear are also specified. |
| 3/ 3.4.4.1.2 | It is specified that the anchor handling winches are to be capable of hoisting and lowering in a controlled manner and should be provided with adjustable speed control between the minimum and maximum speeds. |
| 3/ 3.4.4.1.3 | It is clarified that the winch is to be equipped with tension controls that automatically engage, when necessary, especially in emergency situations. Requirements for periodic calibration of tension control and maintenance of records thereon are stipulated. |
| 3/ 3.4.4.1.6 | It is clarified that anchor handling winches should be equipped with remotely operated spooling devices. |
| 3/ 3.4.4.1.7 | Requirements for emergency release are better elaborated including provisions for operability in normal, dead ship conditions, controls, unintentional activation, pay-out speed of the wire, etc. |
| 3/ 3.4.4.4 (new) | It is specified that anchor handling vessels are to be fitted with audible alarm equipped chain stoppers. Other safety precautions for chain stoppers are also detailed. |
| 3/ 3.4.4.5 | Amendments are made to provide maintenance and operational guidelines for anchor handling equipment, emphasizing the need for comprehensive manuals, routine inspections, proper record-keeping, and testing to maintain safety and functionality. |
| 3/ 3.5.1 (new) | Detailed requirements for commissioning tests are specified. Tests to be carried out post major repairs, modifications or alterations are also indicated. |

## TABLE 2 – CORRIGENDA INCORPORATED IN THIS NOTICE

| Section / Clause | Subject/ Corrigenda |
|---|---|
| **Part 3 Chapter 6: Hull Girger Strength** | |
| 3/3.4.1 | Cross reference corrected. |
| 3/3.5.1.3 & 3.5.2.3 | The 'title' of the subject IRS Guidelines is updated. |
| **Part 3 Chapter 13: Rudders** | |
| 1/1.3.1 | Cross reference corrected. |

# Part 1

# Regulations

# Chapter 1

# General

| **Appendix 1**<br>**Table of characters of class and type notations of IRS, their expanded form and significance** | |
|---|---|
| **Class Notations - Hull** | |
| For Occasional Carriage of Dry Bulk Cargo | This notation will be assigned to ships which occasionally carry dry cargoes in bulk, in compliance with relevant requirements of IMO Res. MSC 277(85). |

***End of Chapter***

# Part 1

# Regulations

# Chapter 2

# Periodical Surveys

# Section 6

# Surveys - Other Ship Types

**6.8 Surveys of ships with notation 'For Occasional Carriage of Dry Bulk Cargo'**

**6.8.1 General**

6.8.1.1 In addition to the other applicable survey requirements in section 6, the requirements in 6.8.2 are to be complied with.

**6.8.2 Annual Surveys**

6.8.2.1 An examination and test at random of the water ingress detection system and their alarms is to be carried out

6.8.2.2 An examination and a test, of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces, any part of which extends forward of the foremost cargo hold, and of their controls, is to be carried out.

***End of Chapter***

# Part 2

# Inspection and Testing of Materials

# Chapter 4

# Steel Castings

# Section 4

# Steel Castings for Propellers

**4.10 Acceptance criteria for liquid penetrant testing and magnetic particle testing**

4.10.1 Definitions of liquid penetrant indications

4.10.1.3 **Non-linear indication:** indication having a length less than or equal to three times its width (i.e. l ≤ 3w). ~~an indication with a largest dimension less than three times its smallest dimension (i.e. l < 3 w).~~

4.10.1.4 **Linear indication:** indication having a length greater than three times its width ~~an indication with a largest dimension three or more times its smallest dimension~~ (i.e. l ≥ 3 w).

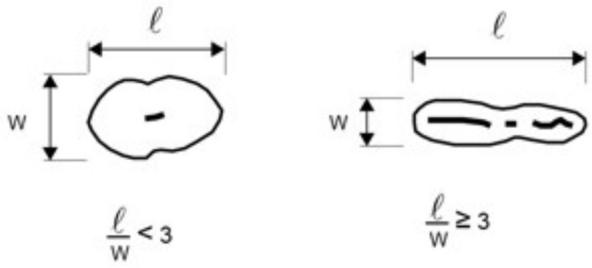
4.10.1.5 **Aligned indications**:

a) Non-linear indications form an alignment when the distance between indications is less than 2 [mm] and at least three indications are aligned. An alignment of indications is considered to be a unique indication and its length is equal to the overall length of the alignment.

b) Linear indications form an alignment when the distance between two indications is smaller than the length of the longest indication.

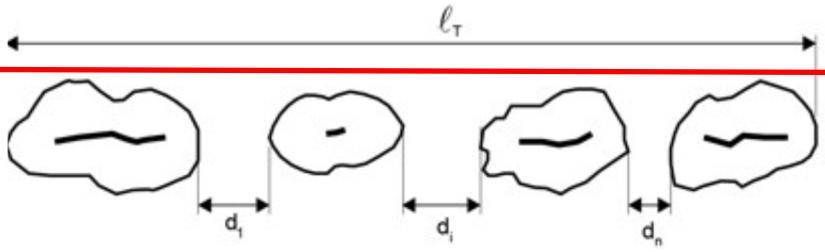
Illustration of liquid penetrant indications is given in Fig. 4.10.1.

**Non-linear** **Linear**



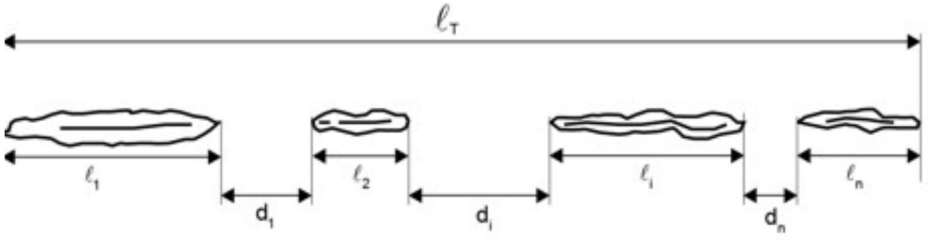

**Aligned**

Alignement of non-linear indications




$0 < d_i \leq 2$ mm

Alignement of linear indications




$d_i \leq Max[\ell_i]$

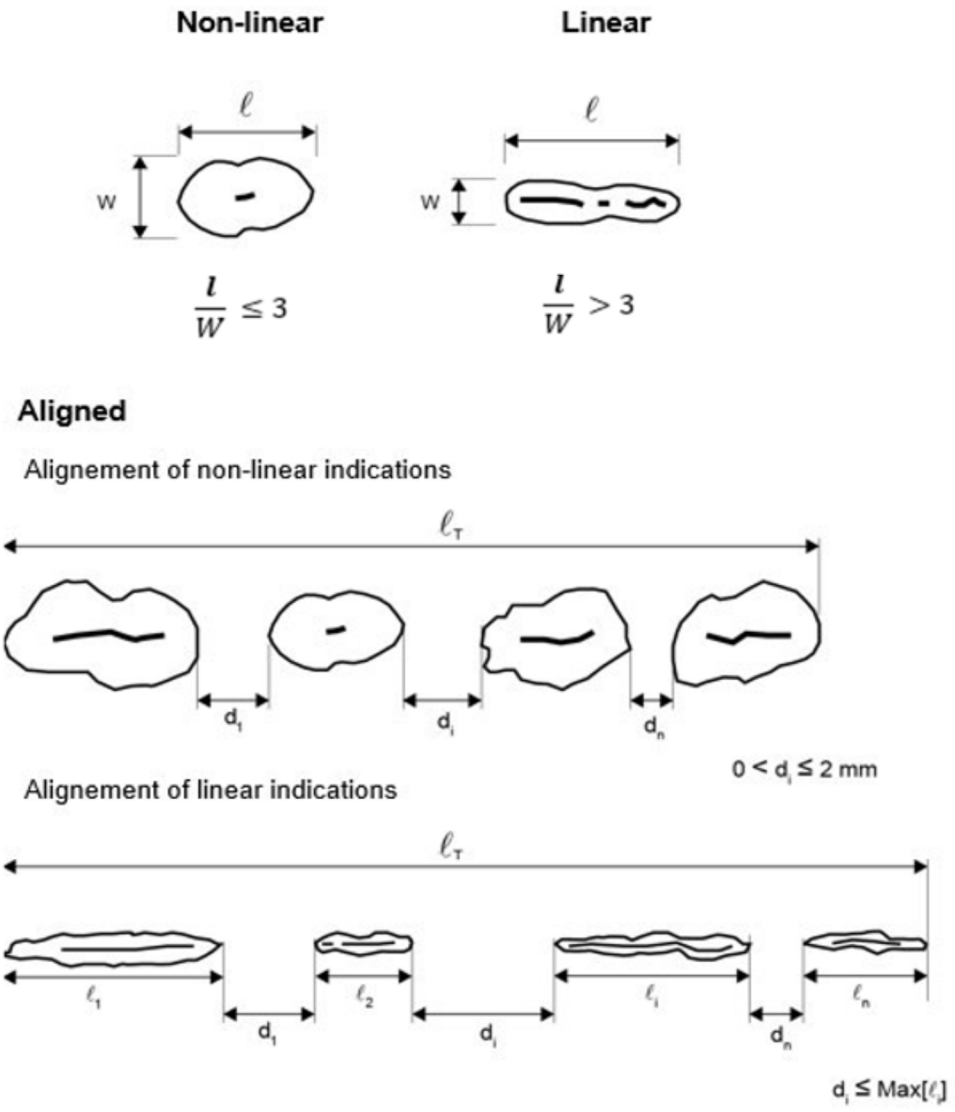



**Fig.4.10.1 : Shape of indications**

**4.12 Welding repair procedure**

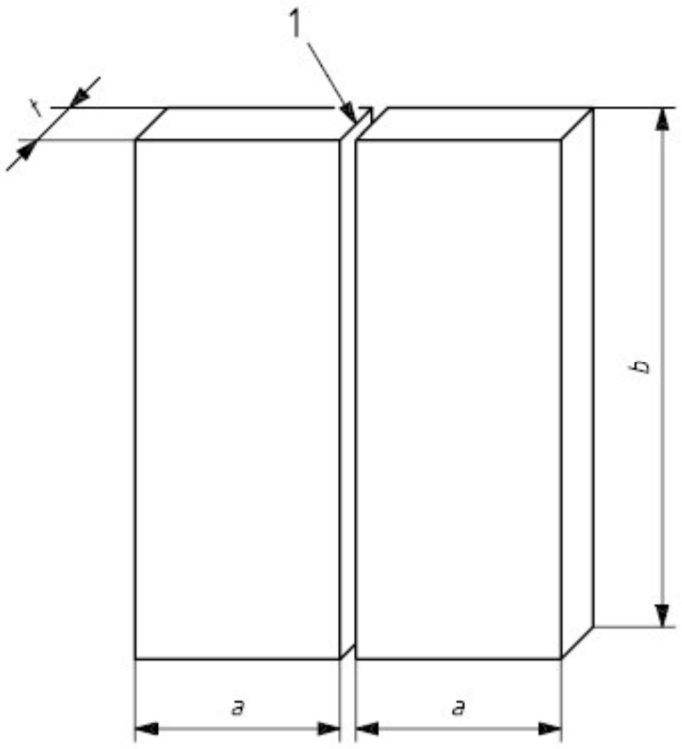
4.12.6 The martensitic steels are to be furnace re-tempered after weld repair. Subject to prior approval, however, local stress relieving may be considered for minor repairs.

4.12.7 On completion of heat treatment of martensitic steels the weld repairs and adjacent material are to be ground smooth. All weld repairs are to be liquid penetrant tested.

**4.15 Welding procedure qualification test for repair of cast steel propeller**

4.15.2 Test piece and welding of sample

4.15.2.1 The test assembly, consisting of cast samples, is to be of a size sufficient to ensure a reasonable heat distribution and according to Fig. 4.15.2.1 with the minimum dimensions. The dimensions and shape of the groove is to be representative of the actual repair work.




1: Joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification
a: minimum value 150mm
b: minimum value ~~350~~300mm
t: material thickness

**Fig.4.15.2.1 : Test piece for welding repair procedure**

***End of Chapter***

# Part 2

# Inspection and Testing of Materials

# Chapter 8

# Copper Alloys

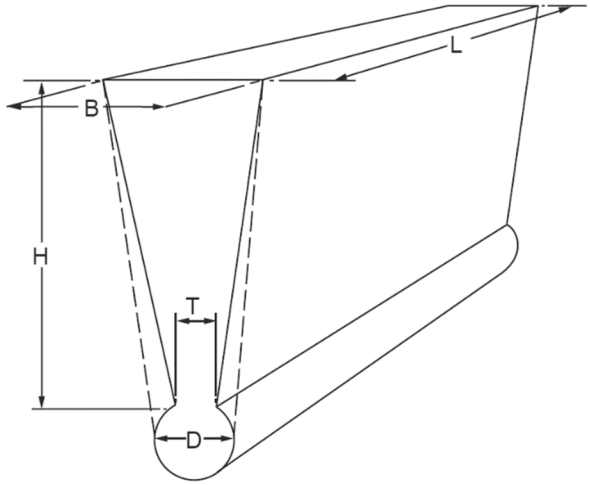
# Section 3

# Castings for Propellers

**3.7 Mechanical properties and tests**

3.7.1 The mechanical properties are to comply with the values in Table 3.7.1. These values are applicable to test specimens taken from separately cast samples in accordance with Figure 3.7.1 or with a recognised standard.

Note : These properties are a measure of the mechanical quality of the metal in each heat and they are generally not representative of the mechanical properties of the propeller casting itself which may be upto 30% lower than that of a separately cast test coupon. For integrally cast test specimens the requirements are to be specially agreed with IRS.




H=≥ 100 mm, B=≥50 mm, L>150 mm, T=≥15 mm and D =≥ 25 mm

**Fig.3.7.1 : Test sample casting**

**3.10 Acceptance criteria for liquid penetrant testing**

**3.10.1 Definitions of liquid penetrant indications**

**Non-linear indication:** indication having a length less than or equal to three times its width (i.e. l ≤ 3 w). ~~an indication with a largest dimension less than three times its smallest dimension (i.e. l < 3 w).~~

**Linear indication:** indication having a length greater than three times its width (i.e. l > 3 w). ~~an indication with a largest dimension three or more times its smallest dimension (i.e. l ≥ 3 w).~~

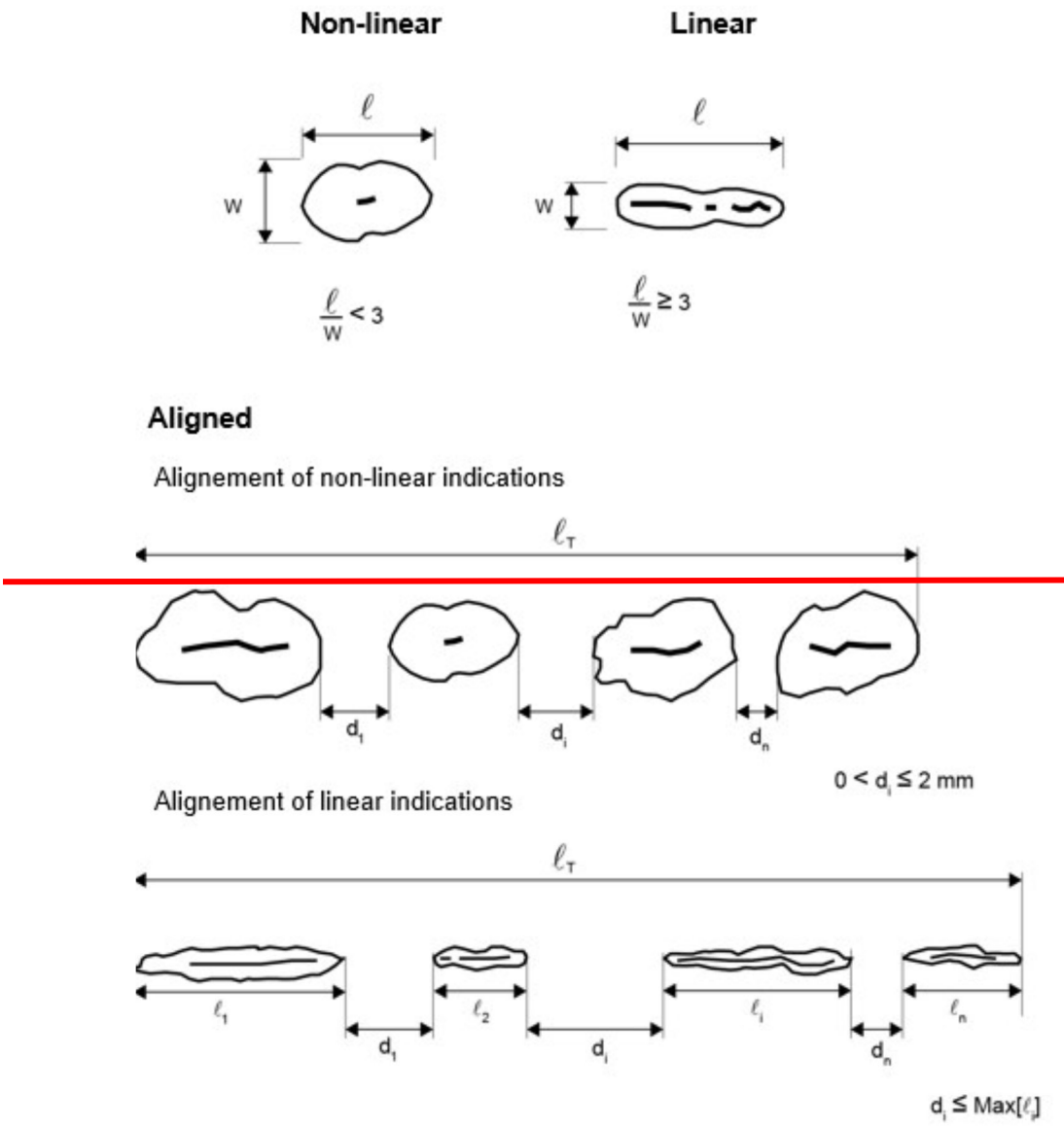
**Aligned indications:**

a) Non-linear indications form an alignment when the distance between indications is less than 2 [mm] and at least three indications are aligned. An alignment of indications is considered to be a unique

indication and its length is equal to the overall length of the alignment.

b) Linear indications form an alignment when the distance between two indications is smaller than the length of the longest indication.

Illustration of liquid penetrant indication is given in Fig. 3.10.1.



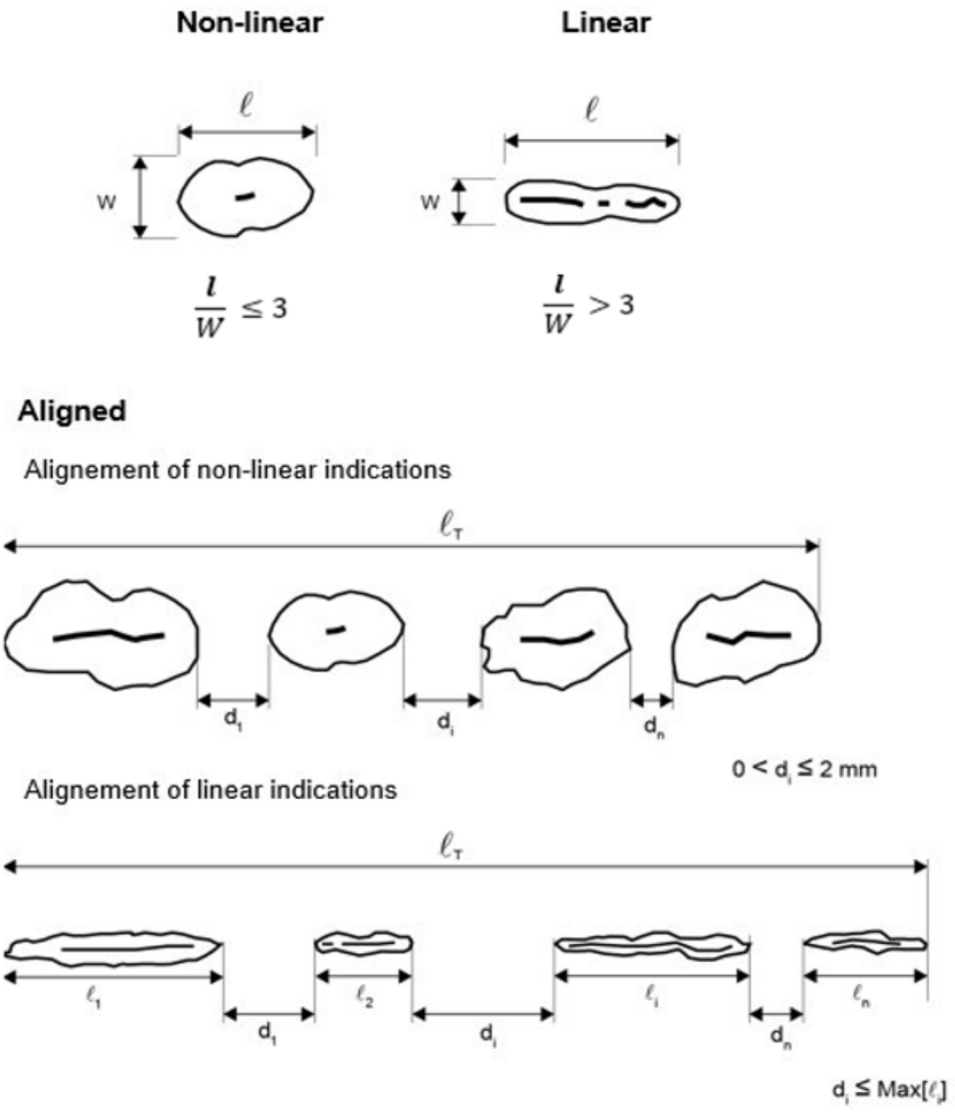



**Fig.3.10.1 : Shape of indications**

**3.11 Repair of defects**

3.11.3 **Repair of defects in zone A**

a) In zone A, repair welding will generally not be allowed unless specially approved by IRS. ~~In some cases the propeller designer may submit technical documentation to propose a modified zone A based on detailed hydrodynamic load and stress analysis for consideration by IRS.~~

b) Grinding may be carried out to an extent which maintains the blade thickness of the approved drawing.

c) The possible repair of defects which are deeper than those referred to above will be specially considered by IRS.

3.11.4 **Repair of defects in zone B**

a) Defects that are not deeper than dB (depth in zone B) = (t/40) [mm] (t = minimum local rule thickness [mm]) or 2 [mm] (whichever is greater) ~~below minimum local rule thickness~~ is to be removed by grinding.

b) Those defects that are deeper than allowable for removal by grinding may be repaired by welding.

**3.12 Welding repair procedure**

3.12.1 General requirements

3.12.1.1 Before welding is started, manufacturer is to submit to IRS a detailed welding procedure specification covering the weld preparation, welding parameters, filler metals, preheating, ~~and~~ post weld heat treatment and inspection procedures.

3.12.2 Preparation of welding repair

3.12.2.1 Defects to be repaired by welding are to be ground to sound material according to 3.11.2.

3.12.2.2~~1~~ The welding grooves are to be prepared in such a manner which will allow a good fusion of the groove bottom. The resulting ground areas are to be examined in the presence of the Surveyor by liquid penetrant testing in order to verify the complete elimination of defective material.

3.12.3 Welding repair procedure

3.12.3.5 The soaking times for stress relief heat treatment of copper alloy propellers is to be in accordance with Table 3.12.3(b). The heating and cooling is to be carried out slowly under controlled conditions. The cooling rate after any stress relieving heat treatment is not to exceed 50°C/hr until the temperature of 200°C is reached.

**Table 3.12.3(b) : Soaking times for stress relief heat treatment of copper alloy propellers**

| Stress relief temp.°C | Alloy grade CU1 and CU2 | | Alloy grade CU3 and CU4 | |
|---|---|---|---|---|
| | Hours per 25 [mm] thickness | Max. recommended total time hours | Hours per 25 [mm] thickness | Max. recommended total time hours |
| 350 | 5 | 15 | - | - |
| 400 | 1 | 5 | - | - |
| 450 | 1/2 | 2 | 5 | 15 |
| 500 | 1/4 | 1 | 1 | 5 |
| 550 | 1/4 1) | 1.2 1) | 1/2 2~~1~~) | 2 2~~1~~) |
| 600 | - | - | 1/4 2~~1~~) | 1 2~~1~~) |

Note:

1) ~~-~~550°C only applicable for CU2 alloys

~~1)~~2) 550°C and 600°C only applicable for CU4 alloys

**3.14 Identification and marking**

3.14.2 Marking

3.14.2.1 Each finished casting propeller is to be marked by the manufacturer at least with the following particulars:

a) Grade of cast material or corresponding abbreviated designation

b) Manufacturer's mark

c) Heat number, casting number or another identification ~~mark~~ enabling the manufacturing process to be traced back

d) Date of final inspection

e) IRS certificate number

f) Ice class symbol, where applicable

g) Skew angle for high skew propellers.

***End of Chapter***

# Part 3

# General Hull Requirements

# Chapter 3

# General Arrangement and Structural Design Principles

# Section 2

# Subdivision Arrangement

**2.7 Doors in watertight bulkheads for ships where subdivision / damage stability requirements are applicable**

2.7.4 Operation mode, location and outfitting

Doors are to be fitted in accordance with all requirements regarding their operation mode, location and outfitting, i.e. provision of controls, means of indication etc. as shown in Table 2.7.4 a) and b).

For passenger ships, in addition to the requirements given in the Table 2.7.4 a) and b) the watertight doors and their controls are to be located in compliance with the following:

(a) The door is to be located inboard of the damage zone B/5 on P&S as per SOLAS II- 1 Regulation.13.7.

(b) The door controls including hydraulic piping and electric cables are to be kept as close as practicable to the bulkhead in which the doors are fitted in order to minimize the likelihood of them being involved in any damage to the ship. The positioning of doors and controls is to be such that if the ship sustains damage within damage zone B/5 as mentioned above, the operation of the doors clear of the damaged portion of the ship is not impaired.

~~**Table 2.7.4: Doors in Internal Watertight bulkheads and External Watertight Boundaries in Passenger ships and Cargo ships**~~

| ~~**A. Door in Internal Watertight Bulkheads**~~ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ~~**Position relative to bulkhead or freeboard deck**~~ | ~~**1. Regulation**~~ | ~~**2. Frequency of use while at sea**~~ | ~~**3. Type**~~ | ~~**4. Remote Closure**~~ | ~~**5. Remote Indication**~~ | ~~**6. Audible or Visual Alarm**~~ | ~~**7. Notice**~~ | ~~**8. Comments**~~ |
| ~~**I. Passenger Ships**~~ | | | | | | | | |
| ~~(1)Below~~ | ~~SOLAS II-1/10, 13.4, 13.5.1, 13.5.2,13.6, 13.7.1,13.8.1, 13.8.2, 16.2, 22.1, 22.3 and 22.4~~ | ~~Used~~ | ~~POS~~ | ~~Yes~~ | ~~Yes~~ | ~~Yes (local)~~ | ~~No~~ | ~~For doors that are used, see SOLAS II-1/22.3 and IMO MSC.1/Circ.1564~~ |
| | ~~SOLAS II-1/10, 13.9.1, 13.9.2, 14.2, 16.2, 22.2 and 22.5~~ | ~~Perm. Closed~~ | ~~S, H~~ | ~~No~~ | ~~No~~ | ~~No~~ | ~~Yes~~ | ~~See Notes 3, 4 & 6~~ |
| ~~(2)At or above~~ | ~~SOLAS II-1/10, 16.2, 17.1 and 22.3~~ | ~~Used~~ | ~~POS, POH~~ | ~~Yes~~ | ~~Yes~~ | ~~Yes (local)~~ | ~~No~~ | ~~See Note 7~~ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | SOLAS II-1/17-1.1, 17-1.2, 17-1.3, 23.6 and 23.8 | | S, H | No | Yes | No | Yes | See Note 1 |
| | SOLAS II-1/17-1.1.1, 17-1.1.2, 17-1.1.3, 23.6 and 23.8 | | S, H | No | Yes | Yes (remote) | Yes | Doors giving access to below Ro-Ro Deck |
| | SOLAS II-1/17-1.1.1, 17-1.1.2, 17-1.1.3, 22.7 and 23.3 to 23.5 | Perm. Closed | S, H | No | Yes | Yes (remote) | Yes | See Notes 1, 3 & 4 |
| **II. Cargo Ships** | | | | | | | | |
| (1) Below | SOLAS II-1/10, 13-1.2, 16.2 and 22.3 MARPOL I/28.3 ICLL66+A.320 1988 Protocol to ICLL66, IBC, and IGC | Used | POS | Yes | Yes | Yes (local) | No | |
| | SOLAS II-1/10, 13-1.3, 16.2, 22.3 and 24.4 | Norm. Closed | S, H | No | Yes | No | Yes | See Note 1 |
| | SOLAS II-1/10, 13-1.4, 16.2, 24.3, and 24.4 | Perm. Closed | S, H | No | No | No | Yes | See Notes 3 & 4 |
| | SOLAS II-1/10, 13-1.4, 13-1.5, 16.2, 22.2, 24.3 and 24.4 | | | | | | | |
| (2)At or above | SOLAS II-1/10, 13-1.2, 16.2 and 22.3 MARPOL I/28.3 ICLL66+A.320 1988 Protocol to ICLL66, IBC, and IGC | Used | POS | Yes | Yes | Yes (local) | No | See Notes 2 & 5 |
| | SOLAS II-1/10, 13-1.3, 16.2, 22.3 and 24.4 | Norm. Closed | S, H | No | Yes | No | Yes | See Note 1 |
| | SOLAS II-1/10, 13-1.4, 13-1.5, 16.2, 24.3 and 24.4 | Perm. Closed | S, H | No | No | No | Yes | See Notes 3 & 4 |

Notes:

1. If hinged, this door is to be of quick acting or single action type.
2. Under ICLL66, doors separating a main machinery space from a steering gear compartment may be hinged quick acting type provided the lower sill of such doors is above the Summer Load Line and the doors remain closed at sea whilst not in use.
3. The time of opening such doors in port and closing them before the ship leaves port is to be entered in the logbook, in case of doors in watertight bulkheads subdividing cargo spaces.
4. Doors are to be fitted with a device which prevents unauthorized opening.
5. Under MARPOL, hinged watertight doors may be acceptable in watertight bulkhead in the superstructure.
6. Passenger ships which have to comply with SOLAS II-1/14.2 require an indicator on the navigation bridge to show automatically when each door is closed and all door fastenings are secured.
7. Refer to the Explanatory Note to Regulation 17.1 of Res.MSC.429 (98) regarding sliding watertight doors with a reduced pressure head and sliding semi-watertight doors.

| **B. Door in External Watertight Boundaries below equilibrium or intermediate waterplane** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Position relative to bulkhead deck or freeboard deck** | **1. Regulation** | **2. Frequency of use while at sea** | **3. Type** | **4. Remote Closure** | **5. Remote Indication** | **6. Audible or Visual Alarm** | **7. Notice** | **8. Comments** |
| **I. Passenger Ships** | | | | | | | | |
| (1) Below | SOLAS II-1/15.9, 22.6 and 22.12 | Perm. Closed | S, H | No | No | No | Yes | See Notes 2 & 3 |
| (2) At or above | SOLAS II-1/17.1 and 22.3 MSC.Circ.541 | Norm. Closed | S, H | No | Yes | No | Yes | See Note 1 |
| | SOLAS II-1/17.1.1,17-1.2, 17-1.3, 23.6 and 23.8 | | S, H | No | Yes | Yes (remote) | Yes | Doors giving access to below Ro-Ro Deck |
| | SOLAS II-1/17.1.1, 17-1.2, 17-1.3, 23.3 and 23.5 | Perm. Closed | S, H | No | Yes | Yes (remote) | Yes | See Notes 2 & 3 |
| **II. Cargo Ships** | | | | | | | | |
| (1) Below | SOLAS II-1/15.9,15-1.2, 15-1.3, 15-1.4, 22.6, 22.12 and 24.1 | Perm. Closed | S, H | No | Yes | No | Yes | See Notes 2 & 3 |
| (2) At or above | SOLAS II-1/15-1.2 | Norm. Closed | S, H | No | Yes | No | Yes | See note 1 |
| | SOLAS II-1/15-1.2 and 15-1.4 | Perm. Closed | S, H | No | Yes | No | Yes | See Notes 2 & 3 |

Notes:
1. If hinged, this door is to be of quick acting or single action type.
2. The time of opening such doors in port and closing them before the ship leaves port is to be entered in the logbook.
3. Doors are to be fitted with a device which prevents unauthorized opening.

| Table 2.7.4 a) : Doors in Internal Watertight bulkheads in Passenger ships and Cargo ships | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Position** | **1. Regulation** | **2. Category** | **3. Type** | **4. Remote Closure** | **5. Remote Indication** | **6. Audible or Visual Closing Alarm** | **7. Notice** | **8. Comments** |
| **I. Passenger Ships** | | | | | | | | |
| (1) Below Bulkhead Deck | SOLAS II-1/10, 13.4, 13.5.1, 13.5.2, 13.6.1 to 13.6.8, 13.7.1, 13.7.3, 13.7.4, 16.2, 22.1 and 22.3 | B, C | POS | Yes | Yes | Yes (local) | No | For guidance regarding watertight doors on passenger ships which may be opened during navigation, see IMO MSC.1/Circ.1564. |
| | SOLAS II-1/10, 13.8.1, 13.8.2, 16.2, 22.2, 22.5 and 22.13 | D | S, H | No | No | No | Yes | |
| | SOLAS II-1/10, 13.9, 22.2 and 22.4 | D | POS | Yes | Yes | Yes (local) | No | |
| | SOLAS II-1/10 and14.2 | D | S, H | No | Yes | No | Yes | |
| (2) At or above bulkhead deck and below the worst intermediate or final equilibrium waterline | SOLAS II-1/10, 16.2, 17.2, 22.1, and 22.3 | B, C | POS | Yes | Yes | Yes (local) | No | For guidance regarding watertight doors on passenger ships which may be opened during navigation, see IMO MSC.1/Circ.1564.<br><br>See Explanatory Note to Regulation 17.2 in Res.MSC.429(98)/Rev.2. |

**(Contd.)**

| Position | 1. Regulation | 2. Category | 3. Type | 4. Remote Closure | 5. Remote Indication | 6. Audible or Visual Closing Alarm | 7. Notice | 8. Comments |
|---|---|---|---|---|---|---|---|---|
| (3) At or above bulkhead deck, and above the worst intermediate and final equilibrium waterlines, but immersed in the required range of positive stability. | SOLAS II-1/17.3 | N/A | POS, POH | Yes | Yes | Yes (local) | No | May remain open, but is to always be ready to be immediately closed.<br><br>See Explanatory Note to Regulation 17.3 in Res.MSC.429(98)/Rev.2. |
| | SOLAS II-1/17.3 | N/A | S, H | No | Yes | No | Yes | Normally closed.<br>If hinged, this door is to be of single action type.<br><br>See Explanatory Note to Regulation 17.3 in Res.MSC.429(98)/Rev.2. |
| (4) At or above bulkhead deck on ro-ro passenger ships. | SOLAS II-1/17-1.1.1 to 17-1.1.3, 22.8, 23.3 to 23.9 | N/A | S, H | No | Yes | Yes (remote/local) | Yes | Permanently closed. The Administration may permit some accesses to be opened in accordance with SOLAS Reg. II-1/23.6 and 23.8. |

**(Contd.)**

| **II. Cargo Ships** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Position relative to freeboard deck** | **1. Regulation** | **2. Frequency of Use while at sea** | **3. Type** | **4. Remote Closure** | **5. Remote Indication** | **6. Audible or Visual Closing Alarm** | **7. Notice** | **8. Comments** |
| (1) Below | SOLAS II-1/10, 13-1.2, 16.2 and 22.1, 22.3<br>MARPOL I/28.3<br>ICLL66+A.320<br>1988 Protocol to ICLL66<br>IBC and IGC | Used | POS | Yes | Yes | Yes (local) | No | |
| | SOLAS II-1/10, 13-1.3,16.2 and 24.4,<br>MARPOL I/28.3,<br>ICLL66+A.3201988 Protocol to ICLL66, IBC and IGC | Norm. Closed | S, H | No | Yes | No | Yes | If hinged, this door is to be of single action type. Under ICLL66, hinged doors separating a main machinery space from a steering gear compartment must have the lower sill above the Summer Load Line. |
| | SOLAS II-1/10, 13-1.4, 13-1.5, 16.2, 22.2, 22.13, 24.3, and 24.4,<br>MARPOL I/28.3,<br>ICLL66+A.3201988 Protocol to ICLL66, IBC and IGC | Perm. Closed | S, H | No | No | No | Yes | |

**(Contd.)**

| Position relative to freeboard deck | 1. Regulation | 2. Frequency of Use while at sea | 3. Type | 4. Remote Closure | 5. Remote Indication | 6. Audible or Visual Closing Alarm | 7. Notice | 8. Comments |
|---|---|---|---|---|---|---|---|---|
| (2) At or above | SOLAS II-1/10, 13-1.2, 16.2 and 22.1, 22.3 MARPOL I/28.3 ICLL66+A.320 1988 Protocol to ICLL66 IBC and IGC | Used | POS | Yes | Yes | Yes (local) | No | |
| | SOLAS II-1/10, 13- 1.3, 16.2 and 24.4, MARPOL I/28.3, ICLL66+A.3201988 Protocol to ICLL66, IBC and IGC | Norm. Closed | S, H | No | Yes | No | Yes | If hinged, this door is to be of single action type.<br><br>Under MARPOL I/28.4.3, hinged watertight doors may be acceptable in watertight bulkhead in the superstructure. |
| | SOLAS II-1/10, 13-1.4, 13-1.5, 16.2, 22.8, 24.3 and 24.4, MARPOL I/28.3, ICLL66+A.3201988 Protocol to ICLL66, IBC and IGC | Perm. Closed | S, H | No | No | No | Yes | |

| Table 2.7.4 b) : Doors in External Watertight boundaries below equilibrium or intermediate waterplane in Passenger ships and Cargo ships | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Position relative to bulkhead deck or freeboard deck** | **1. Regulation** | **2. Frequency of Use while at sea** | **3. Type** | **4. Remote Closure** | **5. Remote Indication** | **6. Audible or Visual Closing Alarm** | **7. Notice** | **8. Comments** |
| **I. Passenger Ships** | | | | | | | | |
| (1) Below | SOLAS II-1/15.10, 16.2, 22.7 and 22.13 | Perm. Closed | S, H | No | Yes | No | Yes | |
| (2) At or above | SOLAS II-1/16.2, 17.6, 22.8 to 22.13 | Norm. Closed / Perm. Closed | S, H | No | Yes | No | Yes | If hinged, normally closed door is to be of single action type. |
| | SOLAS II-1/16.2, 17-1, 23.3, 23.5, 23.6 and 23.8 | Norm. Closed / Perm. Closed | S, H | No | Yes | Yes (remote/ local) | Yes | |
| **II. Cargo Ships** | | | | | | | | |
| (1) Below | SOLAS II-1/15.10, 15- 1.2 to 15-1.4, 16.2, 22.7, 22.12, 22.13 and 24.1 | Perm. Closed | S, H | No | Yes | No | Yes | |
| (2) At or above | SOLAS II-1/15-1.2 and 16.2 | Norm. Closed | S, H | No | Yes | No | Yes | If hinged, normally closed door is to be of single action type. |
| | SOLAS II-1/15-1.2 to 15-1.4, 16.2, 22.8 and 24.1 | Perm. Closed | S, H | No | Yes | No | Yes | |

2.7.4.1 Frequency of use whilst at sea

*a) Normally closed*
Kept closed at sea but may be used if authorised. To be closed again after use.

*b) Permanently closed*
~~The time of opening such doors in port and of closing them before the ship leaves port shall be entered in the log-book. Should such doors be accessible during the voyage, they shall be fitted with a device to prevent unauthorised opening.~~Such doors are to remain closed at sea. The time of opening such doors in port and of closing them before the ship leaves port is to be authorized by the Master and entered in the log-book. Should such doors be accessible during the voyage, they are to be fitted with a device to prevent unauthorized opening.

*c) Used*
Kept closed at sea, but may be opened during navigation to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened as per SOLAS II-1/22.3. The door is to be immediately closed after use. This is subject to prior approval by the Administration.

2.7.4.2 Category of watertight doors for passenger ships

(a) Category B

A watertight door that may be opened during navigation when work in the immediate vicinity of the door necessitates it being opened, according to SOLAS regulation II-1/22.3. The door is to be immediately closed when the task which necessitated it being open is finished.

(b) Category C

A watertight door that may be opened during navigation to permit the passage of passengers or crew, according to SOLAS regulation II-1/22.3. The door is to be immediately closed when transit through the door is complete.

(c) Category D

1. A watertight door of a width of more than 1.2 m in machinery spaces as permitted by SOLAS regulation II-1/13.9. The door is to remain closed during navigation except in case of urgent necessity at the discretion of the master according to SOLAS regulation II-1/22.4.

2. Additionally, watertight doors fitted in watertight bulkheads dividing cargo between deck spaces in accordance with SOLAS regulation II-1/13.8.1 or dividing cargo spaces in accordance with SOLAS regulation II-1/14.2, are to be closed before the voyage commences and are to be closed during navigation according to SOLAS regulation II-1/22.5.

2.7.4.3~~2~~ Types of doors in Table 2.7.4 a) and b)

| | |
|---|---|
| • Power operated, sliding or rolling | POS |
| • Power operated, hinged | POH |
| • Sliding or rolling | S |
| • Hinged | H |

2.7.4.4~~3~~ Control

(b) Remote

Where indicated in Table 2.7.4 a) and b), doors are to be capable of being remotely closed by power from the bridge* for all ships, and by hand also from a position above the bulkhead deck for passenger ships as required by SOLAS II-1/Regulation ~~13-7.1.4~~13.6.1.4. Where it is necessary to start the power unit for operation of the watertight door, means to start the power unit is also to be provided at remote control stations. The operation of such remote control is to be in accordance with Part 5, Chapter 6, Section 4, Cl 4.4.1.18 to Cl 4.4.1.21~~Part 4, Chapter 8, Cl.10.1.9 to Cl.10.1.12~~. For tankers, where there is a permanent access from a pipe tunnel to the main pump room, in accordance with SOLAS II-2/Reg.4.5.2.4 the watertight door is to be capable of being manually closed from outside the main pump room entrance in addition to the requirements above.

(* - Arrangements are to be in accordance with SOLAS II-1/ Regulation 13.67.1.5 for passenger ships and 13-1.2 for cargo ships.)

2.7.4.54 Indication*

(a) Where shown in Table 2.7.4 a) and b), position indicators are to be provided at all remote operating positions for all ships and provided locally on both sides of the internal doors for cargo ships, to show whether the doors are open or closed and if applicable, with all dogs/cleats fully and properly engaged.

2.7.4.76 Notices

As shown in Table 2.7.4 a) and b), doors which are normally closed at sea but not provided with means of remote closure, are to have notices fixed to both sides of the doors stating, 'To be kept closed at sea'. Doors which are to be permanently closed at sea are to have notices fixed to both sides stating, 'Not to be opened at sea'.

2.7.5 Fire doors

Watertight doors may also serve as fire doors but need not be fire-tested notwithstanding the fire resistance of the division in which the watertight doors are fitted. However, such doors fitted above the bulkhead deck on passenger ships are to be tested to the FTP Code in accordance with the division they are fitted. If it is not practicable to ensure self-closing, means of indication on the bridge showing whether these doors are open or closed and a notice stating ‘To be kept closed at sea’ can be alternative of the self-closing.

Where a watertight door is located adjacent to a fire door, both doors are to be capable of independent operation, remotely if required by SOLAS II-1/ Regulation 13.78.1 to 13.78.3 and from both sides of each door.

***End of Chapter***

# Part 3

# General Hull Requirements

# Chapter 6

# Hull Girder Strength

# Section 3

# Hull Girder Yield Check

3.4 Equivalent stress

3.4.1 The equivalent stress, in [N/mm2], related to the hull girder longitudinal and shear stresses, $\sigma_{hg}$ and $\tau_{hg}$, defined in Cl.3.3.1 and ~~Cl.3.3.3~~Cl.3.3.2 respectively, at any point being considered is obtained from the following formula:

3.5 Definitions of hull girder stress components

3.5.1.3 Longitudinal warping stresses induced by wave and still water hull girder torsion

~~Refer to the IRS Guideline for "Evaluation of Warping Stresses in Ships with Wide Hatch Openings Due To Torsion Moments" for the calculations.~~

Refer to the IRS Guideline "Assessment of Hull Girder Stresses due to Torsion in Ships with large deck openings" for the calculations.

3.5.2.3 Warping shear stresses induced by wave and still water hull girder torsion

~~Refer to the IRS Guideline for "Evaluation of Warping Stresses in Ships with Wide Hatch Openings Due To Torsion Moments" for the calculations.~~

Refer to the IRS Guideline "Assessment of Hull Girder Stresses due to Torsion in Ships with large deck openings" for the calculations.

***End of Chapter***

# Part 3

# General Hull Requirements

# Chapter 13

# Rudders

# Section 1

# General

**1.3 Testing**

1.3.1 Bodies of the rudders are to be tested in accordance with the requirements given in Ch.~~18~~17.

***End of Chapter***

# Part 4

# Main And Auxiliary Machinery

# Chapter 2

# Piping Design Requirements

# Section 1

# General

**1.1 Scope**

1.1.1 The requirements of this Chapter apply to the design and construction of piping systems, including pipe fittings and valves forming parts of such systems for the following services:

Air, vapour, gas (excluding ~~liquefied gas cargo and process piping~~ that mentioned in 1.1.2), water, lubricating oil, fuel oil, hydraulic fluid systems for steering gear, toxic gas and liquids, cargo oil and tank cleaning piping and open ended lines such as drains, overflows, vents and boiler escape pipes.

1.1.2 The requirements of this Chapter do not cover the following piping systems:

1.1.2.1 Chemical cargo piping systems of ships subject to the Pt.5, Ch. 3 (IBC Code) and shipboard hydrocarbon/chemical process piping system.

1.1.2.2 Gas cargo/fuel and process piping systems of ships, subject to the Pt.5, Ch.4 (IGC Code) and gas fuel piping systems of ships subject to the Pt.5, Ch.35 (IGF Code).

1.1.2.3 Piping systems for other low flashpoint fuels defined in SOLAS II-1/2.29.

Exhaust pipes from internal combustion engines and gas turbines, and pipes forming integral part of a boiler.

**Table 1.2.1 : Classes of piping systems [3,4]**

| Piping system | Class I | Class II | Class III |
|---|---|---|---|
| Toxic or corrosive media | Without special safeguards | ~~Not to be used~~with special safeguards[1,2] | Not to be used |
| a) Flammable media heated above flash point[2]<br>b) Flammable media having flash point below 60°C[2]<br>~~i) Liquefied gas~~ | Without special safeguards | With special safeguards[1] | Not to be used |
| Steam | P > 16 or T > 300 | 16 ≥ P > 7 and 300 ≥ T > 170 | P ≤ 7 and T ≤ 170 |
| Thermal Oil | P > 16 or T > 300 | 16 ≥ P > 7 and 300 ≥ T > 150 | P ≤ 7 and T ≤ 150 |
| Fuel oil + Lubricating oil + Flammable hydraulic oil | P > 16 or T > 150 | 16 ≥ P > 7 and 150 ≥ T > 60 | P ≤ 7 and T ≤ 60 |
| Other media[5,6] ~~including water, air, gases, non-flammable hydraulic oil~~ | P > 40 or T > 300 | 40 ≥ P > 16 and 300 ≥ T > 200 | P ≤ 16 and T ≤ 200 |

Notes:

1 Safeguards for reducing leakage possibility and limiting its consequences will be specially considered e.g. leading pipes in positions where leakage of internal fluids will not cause a potential hazard or damage to surrounding areas or by the usage of pipe ducts, shielding, screening etc.
~~1~~2 Class II pipes are not to be used for toxic media
~~2~~3 Cargo oil pipes belong to Class III piping systems.
~~3~~4 P = Design pressure in bar as defined in 1.3
5 T = Design temperature in °C as defined in 1.4.
~~4~~6 Including water, air, gases, non-flammable hydraulic oil, Urea for SCR systems*
~~5~~7 For open ended pipes (drains, overflow, vents, exhaust gas lines, boiler escape lines, etc.) irrespective of the temperature, Class III pipes may be used.
* When piping materials selected according to ISO 18611-3:2014 for Urea in SCR systems.

# Section 2

# Carbon and Low Alloy Steel Pipes and Fittings

**2.5 Slip-on ~~T~~threaded ~~sleeve~~ joints**

2.5.1 Slip-on ~~T~~threaded ~~sleeve~~ joints having pipe threads where ~~requiring~~ pressure-tight joints~~,~~ are made on the threads ~~having~~ parallel or tapered threads are to comply with the requirements of ~~in accordance with~~ a recognised national and/or ~~other established~~international standard~~s~~ (such as ASME B3.1.1 and ASME B3.1.3).~~, may be used with carbon steel pipes within the limits given in Table 2.5.1 and~~

2.5.2 Slip-on threaded joints may be used for outside diameters as stated in 2.5.5 except for ~~services other than~~ pipinge systems conveying ~~combustible~~flammable or toxic ~~fluids~~media or services where fatigue, severe erosion or crevice corrosion is expected to occur.

2.5.3 Slip-on threaded joints may be used for connecting small bore instrumentation equipment (e.g., pressure/temperature sensors) to piping systems conveying flammable media if such connections comply with a recognized national and/or international standard(such as ASME B3.1.1 and ASME B3.1.3). The use of such threaded joints is to be limited to outside diameters of maximum 25mm.

2.5.4 Threaded joints in $CO_2$ systems ~~shall be~~are allowed only inside protected spaces and in $CO_2$ cylinder rooms.

2.5.5 Threaded joints for direct connections of pipe lengths with tapered threads are to be allowed for

a) Class I piping having outside diameter not more than 33.7 [mm].

b) Class II and Class III piping having outside diameter not more than 60.3 [mm].

Threaded joints with parallel threads are to be allowed for Class III piping having outside diameter not more than 60.3 [mm].

In particular cases, sizes in excess of those mentioned above may be accepted by IRS if in compliance with a recognized national and/or international standard.

~~**Table 2.5.1 : Limiting design conditions for threaded sleeve joints**~~

| ~~**Nominal bore [mm]**~~ | ~~**Maximum pressure in bar**~~ | ~~**Maximum temp.°C**~~ |
|---|---|---|
| ~~≤ 25~~ | ~~12~~ | ~~260~~ |
| ~~> 25 ≤ 40~~ | ~~10~~ | ~~260~~ |
| ~~> 40 ≤ 80~~ | ~~8.5~~ | ~~260~~ |
| ~~> 80 ≤ 100~~ | ~~7~~ | ~~260~~ |

**2.7 Mechanical joints**

2.7.3 Mechanical joints including pipe unions, compression couplings, slip-on joints and similar joints are to be of approved type for the pressure ratings, service conditions and the intended application. The construction and type are to conform to the examples shown in Fig.2.7. Application of mechanical joints and their acceptable use for each service is indicated in Table 2.7.1. The relevant requirements of the flag Administration are also to be complied with. In case exposure time ($t_T$) for fire endurance test is greater than 30 minutes, the dry-wet test conditions are 8 minutes dry and, accordingly, the wet period $t_T$-8 minutes. Application of mechanical joints depending upon the class of piping and pipe dimensions is indicated in Table 2.7.2. (For approval refer Classification Notes “Type Approval of Mechanical Joints used in Piping”).

2.7.4 Where the application of mechanical joints results in reduction in pipe wall thickness due to the use of bite type rings or other structural elements, this is to be taken into account in determining the minimum wall thickness of the pipe to withstand the design pressure.

2.7.10 In particular cases, sizes in excess of those mentioned in Table 2.7.2 may be accepted if in compliance with a recognised national and/or international standard.

2.7.11 Mechanical joints are to be subjected to the following tests:

.1 leakage test
.2 vacuum test
.3 vibration (fatigue) test
.4 fire endurance test
.5 burst pressure test at 4 times the design pressure (for design pressures above 200 bar, the burst pressure will be specially considered by IRS)
.6 pressure pulsation test (mandatory for all Class I and II systems and for use in Class III systems where pressure pulsation other than water hammer is expected.)
.7 assembly test
.8 pull out test.

NOTE : For details of tests refer classification notes, “Type Approval of Mechanical Joints used in Piping”.

| **Table 2.7.2 : Application of mechanical joints depending upon the class of piping** | | | |
|---|---|---|---|
| **Types of joints** | **Classes of piping systems** | | |
| | **Class I** | **Class II** | **Class III** |
| **Pipe Unions** | | | |
| Welded and brazed type | + (OD ≤ 60.3 mm) | + (OD ≤ 60.3 mm) | + |
| **Compression Couplings** | | | |
| Swage type | + | + | + |
| Bite type | + ~~(OD ≤ 60.3 mm)~~ | + ~~(OD ≤ 60.3 mm)~~ | + |
| Typical compression type | + ~~(OD ≤ 60.3 mm)~~ | + ~~(OD ≤ 60.3 mm)~~ | + |
| Flared type | + ~~(OD ≤ 60.3 mm)~~ | + ~~(OD ≤ 60.3 mm)~~ | + |
| Press type | - | - | + |
| **Slip-on joints** | | | |
| Machine grooved type | + | + | + |
| Grip type | - | + | + |
| Slip type | - | + | + |
| Abbreviations:<br>+ Application is allowed<br>- Application is not allowed | | | |

# Section 7

# Hydraulic Tests on Pipes and Fittings

**7.2 Testing after assembly on board**

7.2.~~2~~1 In general, all the piping systems covered by this chapter are to be checked for leakage under operational conditions and, if necessary, using other techniques other than hydraulic testing. In particular, ~~H~~heating coils in tanks and liquid ~~or gas~~ fuel ~~oil~~ piping are to be tested by hydraulic pressure, after installation on board, to 1.5 times the design pressure but in no case to less than 4 bar.

7.2.5 Pneumatic leak testing may be carried out on water sensitive systems, in lieu of hydrostatic testing. In certain circumstances, a combined hydrostatic – pneumatic strength test may also be applied, where the system is partially filled with water and the free space above is pressurized with a test gas (typically air or nitrogen). When pneumatic tests cannot be avoided, appropriate safety precautions are to be taken.

***End of Chapter***

# Part 4

# Main and Auxiliary Machinery

# Chapter 8

# Electrical Installations

# Section 2

# System Design

**2.9 Requirements for uninterrupted power system (UPS) units ~~as alternative and/or transitional source of power~~**

**2.9.1 ~~Scope~~Application**

2.9.1.1 These requirements apply to UPS units, in the following cases:

.1 when providing an alternative power supply as an accumulator battery in terms of being an independent power supply for the emergency services defined in 2.8.8.1c) or 2.8.9.1d);

.2 when providing an alternative power supply or transitional power supply to any other emergency services as defined in 2.8.8 and 2.8.9;

.3 where required, constituting a means of continuous and uninterruptible power supply to essential services as defined in Section 1, 1.5.

.4 when providing power supply in accordance with conditions specified and mandated by Part 6, Chapter 8, Section 9, Cl. 9.2.2.2 to 9.2.2.5 for fixed fire detection and fire alarm systems.

2.9.1.2 These requirements may be applied to UPS units for cases other than in 2.9.1.1 above, as considered necessary by IRS.
~~These requirements to UPS units, as defined in IEC 62040-3:2011, apply when providing an alternative power supply or transitional power supply to services as defined in 2.8.8 and 2.8.9.~~
~~A UPS unit complying with these requirements may provide an alternative power supply as an accumulator battery in terms of being an independent power supply for services defined in 2.8.8.1c) and 2.8.9.1d).~~

**2.9.2 Definitions**

**.1 Uninterruptible Power System (UPS)**

~~– c~~Combination of converters, switches and energy storage ~~means~~devices (such as batteries), ~~for example batteries,~~ constituting a power system for maintaining continuity of load power in case of AC input power failure (IEC 62040-3:~~2011~~2021).

**~~Off-line UPS unit~~.2 Double Conversion topology**

~~– a~~ A UPS ~~unit~~ topology comprises an AC to DC converter, generally a rectifier, and a DC to AC converter, generally an inverter as shown in Fig.2.9.2.2. When the AC input power is out of UPS pre-set tolerances, the UPS enters stored energy mode.(Refer to Annex B of IEC 62040-3:2021) ~~where under normal operation the output load is powered from the bypass line (mains) and only transferred to the inverter if the bypass supply fails or goes outside preset limits. This transition will invariably result in a brief (typically 2 to 10 milli-seconds) break in the load supply.~~

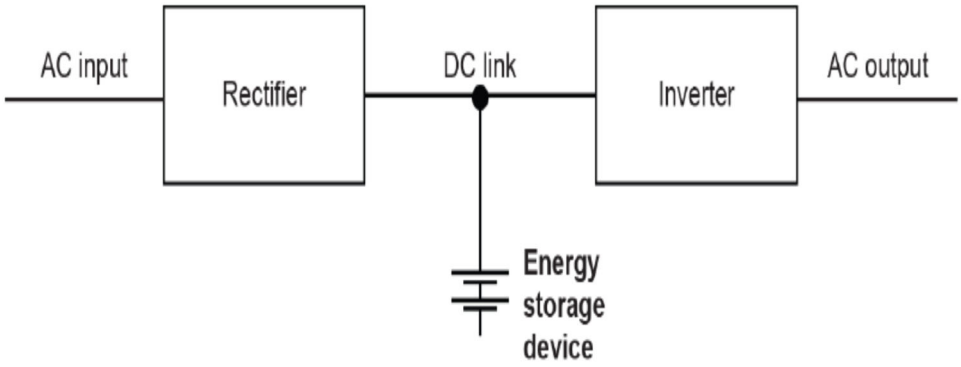



**Fig. 2.9.2.2 : Double conversion topology**

**.3 Line interactive ~~UPS unit~~topology**

~~– an off-line~~A UPS ~~unit~~topology comprises bidirectional AC to DC power conversion, generally through a bidirectional converter and an AC power interface as shown in Fig. 2.9.2.3. When AC input power voltage or frequency is out of UPS pre-set tolerances, the UPS runs in stored energy mode. (Refer to Annex B of IEC 62040-3:2021)~~where the bypass line switches to stored energy power when the input power goes outside the preset voltage and frequency limits.~~

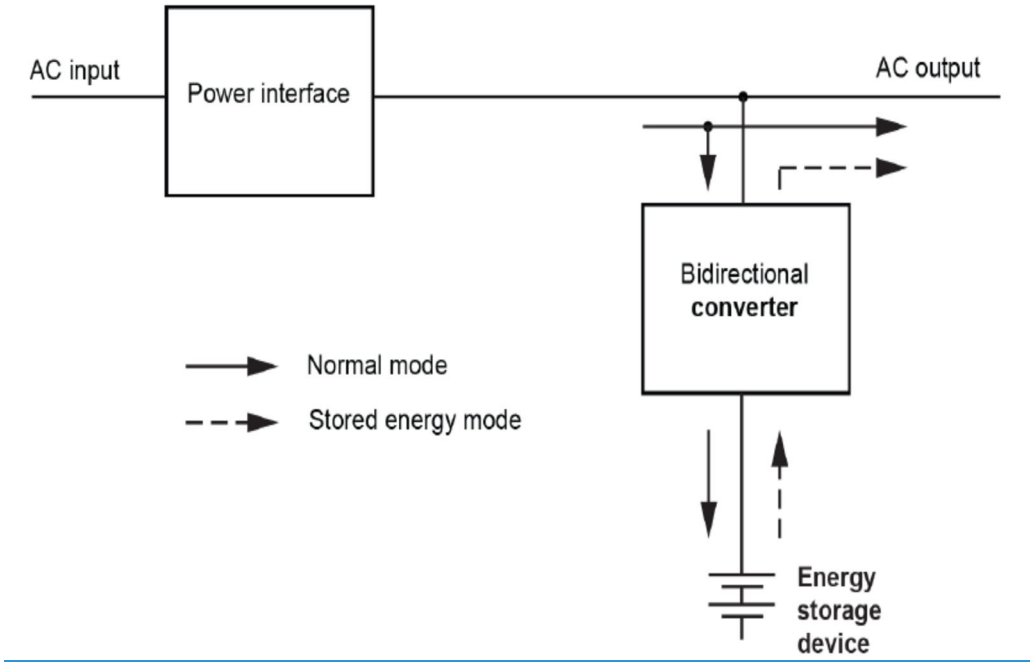



**Fig. 2.9.2.3 : Line interactive topology**

**.4 Standby topology**

~~– a~~A UPS ~~unit~~ topology comprises a battery charger, a DC to AC converter, generally a unidirectional inverter and a UPS switch as shown in Fig. 2.9.2.4. When the AC input power is out of UPS pre-set tolerances, the UPS operates in stored energy mode. (Refer to Annex B to IEC 62040-3:2021)~~where under normal operation the output load is powered from the inverter and will therefore continue to operate without break in the event of the supply input failing or going outside preset limits.~~

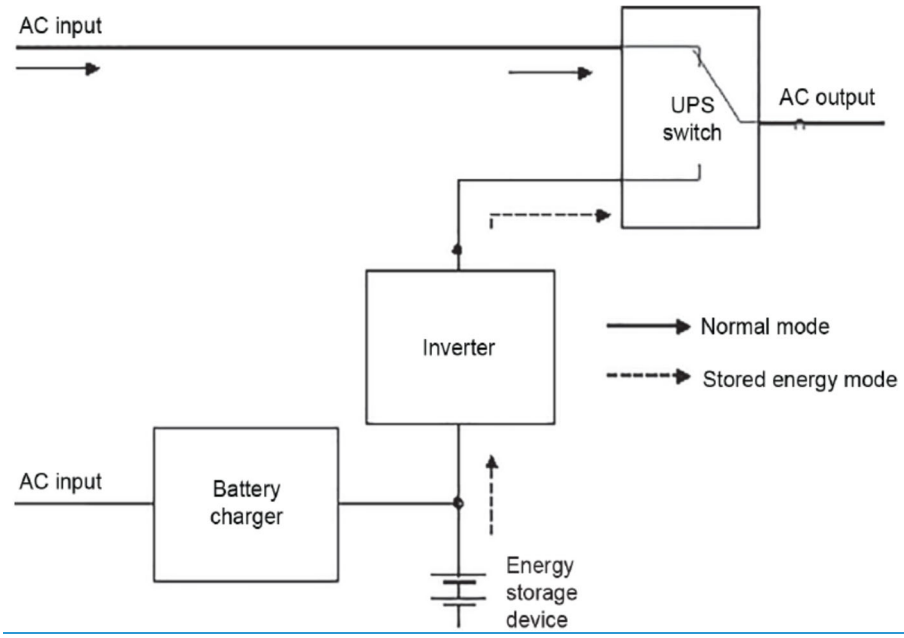



**Fig. 2.9.2.4 : Standby topology**

**.5 Energy storage device**

System consisting of a single or multiple devices designed to provide power to the UPS inverter/converter. (IEC 62040-3:2021)

**.6 AC input power failure**

Variation in the AC input power which could cause the UPS to operate in stored energy mode. (IEC 62040-3:2021)

**.7 Bidirectional converter**

Converter which has the functions of both a rectifier and an inverter, and which can reverse the flow of power from AC to DC and vice-versa. (IEC 62040-3:2021)

**2.9.3 Design and construction**

a) UPS units are to be constructed in accordance with IEC 62040-1:2017+AMD1:2021+AMD2:2022, IEC 62040-2:2016, IEC 62040-3:~~2011~~2021, IEC 62040-4:2013 and/or IEC 62040-5:2016, as applicable, or an acceptable and relevant national or international standard.

b) The operation of the UPS is not to depend upon external services.

c) The ~~type~~ configuration and topology of UPS unit employed~~, whether off-line, line interactive or on-line,~~ is to be appropriate to the power supply requirements of the connected load equipment.

d) When external bypass is provided, bypass transfer switch is to be arranged to protect the load against power disturbances or interruption arising from inrush or fault current. (Refer to Annex C to IEC 62040-3:2021)~~An external bypass is to be provided.~~

e) The UPS unit is to be monitored and audible and visual alarm is to be given in ~~a normally attended location~~continuously manned station(s) for –

- Power supply failure (voltage and frequency) to the connected load,
- Earth fault,
- Operation of battery protective device,
- When the battery is being discharged, and
- When the bypass is in operation in case an external bypass is provided, and ~~for on-line UPS units.~~
- any other fault and abnormal conditions of the UPS unit, as applicable.

**2.9.4 Location**

a) The UPS unit for emergency services in 2.9.1.1.1 and 2.9.1.1.2 is to be suitably located for use in an emergency.

b) UPS units utilizing valve regulated sealed batteries may be located in compartments with normal electrical equipment, provided the ventilation arrangements are in accordance with the requirements to IEC 62040-1:2017+AMD1:2021+AMD2:2022, IEC 62040-2:2016, IEC 62040-3:~~2011~~2021, IEC 62040-4:2013 and/or IEC 62040-5:2016, as applicable, or an acceptable and relevant national or international standard.

**2.9.6 Testing and survey**

a) UPS units of 50 kVA and over are to be surveyed during manufacturing and testing, in accordance with b) below.

b) Appropriate testing is to be carried out to demonstrate that the UPS unit is suitable for its intended environment. This is expected to include as a minimum the following tests:

- Functionality, including operation of alarms in 2.9.3 e);
- Temperature rise;
- Ventilation rate
- Battery capacity.

c) Where the supply is to be maintained without a break following a power input failure, this is to be verified after installation by an appropriate test.

***End of Chapter***

# Part 4

# Main and Auxiliary Machinery

# Chapter 11

# Spare Gear

## Section 1

## General Requirements

**1.1 General**

1.1.1 Adequate spare parts for propelling and essential auxiliary machinery together with the necessary tools for maintenance and repair are to be readily available for use.

1.1.2 The spare parts to be supplied and their location is the responsibility of the Owners but must take into account the design and arrangements of the machinery and the intended service and operation of the ship. Account should also be taken of the recommendations of the manufacturers and any applicable statutory requirements of the country of registration of the ship.

## Section 2

## Spare Parts Recommended for Main and Auxiliary Machinery Installations

**2.1 Risk assessment approach to determining spare parts provision**

**2.1.1 Main internal combustion engines**

2.1.1.1 Main internal combustion engines refer to engines providing propulsion power (irrespective of the configuration of the propulsion system e.g. direct drive, geared, hybrid etc.) and includes their control systems, both local and remote, their alarm systems and their safety systems.

2.1.1.2 Identification of essential engine components

.1 A risk assessment (e.g. FMEA) is to be undertaken for each type of engine to identify components, failure of which, could potentially result in engine damage, unsafe engine operation or a reduction in engine power output.

.2 The risk assessment is to consider each fuel on which the engine is designed to operate independently and therefore, for the purposes of determining spare parts, fuel changeover is not to be considered a mitigation for component failure.

.3 The risk assessment is to be carried out in accordance with recognised national or international standards, such as IEC 31010.

.4 The risk assessment report is to be included in the documentation submitted for Type Approval of the engine.

2.1.1.3 Determination of recommended spare parts

.1 Determination of recommended spare parts for each type of engine is to take into account the results of the risk assessment together with any evidence of component reliability e.g. relevant service history, MTBF (mean time between failure) data etc.

.2 The recommended spare parts are to be parts (or sets of parts) suitable for exchange onboard by the ship's crew.

.3 The recommended spare parts are to be listed and included in the engine user documentation e.g. operating and/or maintenance manual, project guide etc.

.4 The recommended spare parts list is to be included in the documentation submitted for Type Approval of the engine.

2.1.1.4 Recommended number of spare parts to be supplied

.1 For each type of engine, at least one recommended spare part (or set of spare parts) is to be supplied for each different type of part determined by 2.1.1.3 above, unless the risk assessment concludes otherwise.

.2 For spare parts periodically exchanged in normal operation (e.g. exhaust valves), at least two spare parts (or sets of spare parts) are to be supplied for each type of part determined by 2.1.1.3 above, unless the risk assessment concludes otherwise.

.3 Spare parts supplied are to be verified and documented by means of Society Certificate (SC), Work Certificate (W) or Test Report (TR), in accordance with IRS Classification Notes *"Approval of I.C. Engines"*.

2.1.1.5 Spare parts inventory to be carried onboard

.1 For determination of the spare parts inventory to be carried onboard, a ship specific risk assessment is to be undertaken (e.g. HAZID) to establish any need to supplement the inventory of engine spare parts supplied with additional spare parts.

.2 The risk assessment is to establish the numbers of each type of spare parts (or sets of spare parts) required, the types of spare parts required and the scope of spare parts required taking into account the following considerations:

- ship type and operational profile
- number and types of engines installed, their arrangement and any redundancy
- engine and component service experience and service history
- maintenance policy and maintenance regime
- manufacturers recommendations for maintenance and/or repair
- tools required for fitting spare parts
- spare parts required to be carried by statutory regulations

**2.1.2 Other machinery, equipment, and systems**

2.1.2.1 A risk-based approach is described in 2.1.1 for internal combustion engines, however the approach described is equally relevant to other machinery, equipment, and systems.

**2.~~1~~2 Traditional approach to determining spare parts provision**
**~~List of minimum required spare parts~~**

2.~~1~~2.1 In cases where a risk assessment approach has not been adopted, spare parts for main and auxiliary machinery may be provided in accordance with the typical minimum recommended spares list, as indicated in Tables 2.2.1 to 2.2.6. The table is not intended to replace any guidance provided by the engine manufacturers with respect to recommended spares for their equipment.~~The spare parts recommended for main and auxiliary machinery installations are shown in the following Tables~~:-

Table 2.~~1~~2.1 : Spare parts for main internal combustion engines;

Table 2.~~1~~2.2 : Spare parts for main steam turbines;

Table 2.~~1~~2.3 : Spare parts for auxiliary steam turbines;

Table 2.~~1~~2.4 : Spare parts for auxiliary internal combustion engines driving electric generators for essential services;

Table 2.~~1~~2.5 : Spare parts for main and auxiliary boilers;

Table 2.~~1~~2.6 : Spare parts for auxiliary machinery.

2.~~1.2~~2.2 In ships with multi-engine installations, spare parts need only be carried for one main engine.

2.~~1~~2.3 Where additional units of adequate capacity are fitted, for auxiliary machinery of each type required for essential services, no spare parts are required.

**Table 2.~~1~~2.1 : Spare parts for main internal combustion engines**

| Sr. No. | Item | Spare parts | Number required | |
|---|---|---|---|---|
| | | | Ships for unrestricted service | Ships for restricted service |
| 1 | Main bearings | Main bearings or shells for one bearing of each size and type fitted, complete with shims, bolts and nuts | 1 | - |
| 2 | Main thrust block | Pads for one face of Michell type thrust block, or | 1 set | 1 set |
| | | Complete white metal thrust shoe of solid ring type, or | 1 | 1 |
| | | Inner and outer race with rollers, where roller thrust bearings are fitted | 1 | 1 |
| 3 | Connecting rod bearings | Bottom end bearings or shells of each size and type fitted, complete with shims, bolts and nuts, for one cylinder | 1 set | - |
| | | Top end bearings or shells of each size and type fitted, complete with shims, bolts and nuts, for one cylinder | 1 set | - |
| 4 | Cylinder liner | Cylinder liner, complete with joint rings and gaskets | 1 | - |
| 5 | Cylinder cover | Cylinder cover, complete with valves, joint rings and gaskets. For engines without covers the respective valves for one cylinder unit | 1 | - |
| | | Cylinder cover bolts and nuts for one cylinder | Half set | - |
| 6 | Cylinder valves | Exhaust valves, complete with casings, seats, springs and other fittings for one cylinder | 2 sets | 1 set |
| | | Air inlet valves, complete with casings, seats, springs and other fittings for one cylinder | 1 set | 1 set |
| | | Starting air valve, complete with casing, seat, springs and other fittings | 1 | 1 |
| | | Cylinder overpressure sentinel valve, complete | 1 | 1 |
| | | Fuel valves of each size and type fitted complete with all fittings, for one engine | 1 set see foot note 1 | 1/4 set |
| 7 | Pistons | Crosshead type: Piston of each type fitted, complete with piston rod, stuffing box, skirt, rings, studs and nuts | 1 | - |
| | | Trunk piston type: Piston of each type fitted, complete with skirt, rings, studs, nuts, gudgeon pin and connecting rod | 1 | - |
| 8 | Piston rings | Piston rings, for one cylinder | 1 set | - |
| 9 | Piston cooling | Telescopic cooling pipes and fittings or their equivalent, for one cylinder unit | 1 set | - |
| 10 | Cylinder lubricators | Lubricator complete, of the largest size, with its chain drive or gear wheels | 1 | - |
| 11 | Fuel injection pumps | Fuel pump complete, or when replacement at sea is practicable, a complete set of working parts for one pump (plunger, sleeve, valves springs etc). | 1 | - |
| 12 | Fuel injection piping | High pressure fuel pipe of each size and shape fitted, complete with couplings | 1 | - |
| 13 | Scavenge blowers (including turbochargers) | Rotors, rotor shafts, bearings, nozzle rings and gear wheels or equivalent working parts of other types | 1 set see foot note 2 | - |

| | | | | |
|---|---|---|---|---|
| 14 | Scavenging system | Suction and delivery valves for one pump of each type fitted | 1 set | - |
| 15 | Reduction and/or reverse gear | Complete bearing bush, of each size fitted in the gear case assembly | 1 set | - |
| | | Roller or ball race, of each size fitted in the gear case assembly | 1 set | - |
| 16 | Main engine driven air compressors | Piston rings of each size fitted | 1 set | - |
| | | Suction and delivery valves complete of each size fitted | Half set | - |
| 17 | Special gaskets and packing of each size and type fitted for cylinder cover and cylinder liner for one cylinder | | 1 set | - |
| 18 | Control, alarm and safety system | | Parts essential for safe engine operation | 1 set |

Footnotes :

1 (a) Engines with one or two fuel valves per cylinder: one set of valves, complete.
(b) Engines with 3 or more fuel valves per cylinder : two fuel valves complete per cylinder and a sufficient number of valve parts, including the body, to form with those fitted in the complete valves, a full engine set.

2 The spare parts may be omitted where it has been demonstrated, at the builder's test bench for one engine of the type concerned that the engine can be maneuvered satisfactorily with one blower out of action.
The requisite blanking and blocking arrangements for running with the blower out of action are to be available on board.

Notes

1 The availability of other spare parts, such as gears and chains for camshaft drive, should be specially considered and decided upon by the Owner~~s~~/ ship operator.
2 When the spare parts are utilized, new spare parts are to be supplied as soon as possible.

**Table 2.2~~1~~.2 : Spare parts for steam turbines for main propulsion**

| Sr. No. | Item | Spare parts | Number required | |
|---|---|---|---|---|
| | | | Ships for unrestricted service | Ships for restricted service |
| 1 | Main bearing | Bearing bushes, of each size and type fitted for the rotor, pinion and gear wheel shafts, for one engine | 1 | - |
| 2 | Turbine thrust | Pads of each size for one face of Michell type thrust or rings for turbine adjusting block, or each size fitted for one engine. Assorted liners for 1 block where fitted | 1 set | 1 set |
| 3 | Main thrust block | Pads for one face of Michell type thrust block, or | 1 set | 1 set |
| | | Complete white metal thrust shoe of solid ring type, or | 1 | 1 |
| | | Inner and outer race with rollers where roller thrust bearings are fitted | 1 | 1 |
| 4 | Turbine shaft | Carbon sealing rings, where fitted, with springs for each size of sealing rings and type of gland | 1 set | 1 set |
| 5 | Oil filters | Strainer baskets or inserts for filters of special design of each type and size | 1 set | 1 set |
| 5 | Control, alarm and safety system | Parts essential for safe turbine operation | 1 set | 1 set |

Notes

1 The availability of other spare parts should be specially considered and decided upon by the Owner~~s~~/ ship operator.
2 When the spare parts are utilized, new spare parts are to be supplied as soon as possible.

| **Table 2.~~1~~2.3 : Spare parts for auxiliary steam turbines** | | | | |
|---|---|---|---|---|
| **Sr. No.** | **Item** | **Spare parts** | **Number required** | |
| | | | **Ships for unrestricted service** | **Ships for restricted service** |
| 1 | Main bearings | Bearing bushes or roller bearings of each size and type fitted for the shafts of the turbine rotor and of the reduction gearing, if any, for one engine | 1 | 1 |
| 2 | Turbine thrust | Pads of each size for one face of Michell type thrust or rings for turbine adjusting block, or each size fitted for one engine. Assorted liners for 1 block where fitted | 1 set | 1 set |
| 3 | Turbine shaft | Carbon sealing rings, where fitted, with springs, for each size of sealing rings and type of gland, for one engine | 1 set | 1 set |
| 4 | Oil filters | Strainer baskets or inserts, for filters of special design, of each type and size | 1 set | 1 set |
| 5 | Control, alarm and safety system | Parts essential for safe turbine operation | 1 set | 1 set |
| Notes<br>1 The availability of other spare parts should be specially considered and decided upon by the Owner~~s~~/ ship operators.<br>2 When the spare parts are utilized, new spare parts are to be supplied as soon as possible. | | | | |

| **Table 2.~~1~~2.4 : Spare parts for auxiliary internal combustion engines driving electric generators for essential services** | | | | |
|---|---|---|---|---|
| **Sr. No.** | **Item** | **Spare parts** | **Number required** | |
| | | | **Ships for unrestricted service** | **Ships for restricted service** |
| 1 | Main bearings | Main bearings or shells for one bearing of each size and type fitted, complete with shims, bolts and nuts | 1 | - |
| 2 | Cylinder valves | Exhaust valves, complete with casings, seats, springs and other fittings for one cylinder | 2 sets | - |
| | | Air inlet valves, complete with casings, seats, springs and other fittings for one cylinder | 1 set | - |
| | | Starting air valve, complete with casing, seat, springs and other fittings | 1 | - |
| | | Cylinder overpressure sentinel valve, complete | 1 | - |
| | | Fuel valves of each size and type fitted complete with all fittings, for one engine | Half set | - |
| 3 | Connecting rod bearings | Bottom end bearings or shells of each size and type fitted, complete with shims, bolts and nuts, for one cylinder | 1 set | - |
| | | Top end bearings or shells of each size and type fitted, complete with shims, bolts and nuts, for one cylinder | 1 set | - |
| | | Trunk piston type : gudgeon pin with bush for one cylinder | 1 set | - |
| 4 | Piston rings | Piston rings, for one cylinder | 1 set | - |
| 5 | Piston cooling | Telescopic cooling pipes and fittings or their equivalent, for one cylinder unit | 1 set | - |
| 6 | Fuel injection pumps | Fuel pump complete, or when replacement at sea is practicable, a complete set of working parts for one pump (plunger, sleeve, valves springs etc). | 1 | - |
| 7 | Fuel injection piping | High pressure fuel pipe of each size and shape fitted, complete with couplings | 1 | - |
| 8 | Gaskets and packings | Special gaskets and packings of each size and type fitted, for cylinder covers and cylinder | 1 set | - |
| 9 | Control, alarm and safety system | Parts essential for safe engine operation | 1 set | 1 set |
| Notes<br>1 The availability of other spare parts should be specially considered and decided upon by the Owner/ ship operators.<br>When the spare parts are utilized, new spare parts are to be supplied as soon as possible. | | | | |

**Table 2.~~1~~2.5 : Spare parts for boilers (main and auxiliary)**

| Sr. No. | Item | Spare parts | Number required | |
|---|---|---|---|---|
| | | | Ships for unrestricted service | Ships for restricted service |
| 1 | Tube stoppers or plugs | Tube stoppers or plugs, of each size used, for boiler superheater and economiser tubes | 20 | 10 |
| 2 | Fire bars | Fire bars for one boiler, where coal fired | 1 set | Half set |
| 3 | Oil fuel burners | Oil fuel burners complete, for one boiler | 1 set | 1 set |
| 4 | Gauge glasses | Gauge glasses of round type | 2 sets per boiler | 2 sets per boiler |
| | | Gauge glasses of flat type | 1 set for every two boilers | 1 set for every two boilers |

**Table 2.~~1~~2.6 : Spare parts for auxiliary machinery**

| Sr. No. | Item | Spare parts | Number required | |
|---|---|---|---|---|
| | | | Ships for unrestricted service | Ships for restricted service |
| **Pumps** | | | | |
| **1** | **Reciprocating pumps** | | | |
| 1.1 | Valves | Valve with seats and springs, each size fitted | 1 set | 1 set |
| 1.2 | Piston rings | Piston rings, each type and size for one piston | 1 set | 1 set |
| **2** | **Centrifugal pumps** | | | |
| 2.1 | Bearings | Bearing of each type and size | 1 | 1 |
| 2.2 | Rotor | Rotor sealing of each type and size | 1 | 1 |
| **3** | **Gear type pumps** | | | |
| 3.1 | Bearing | Bearing of each type and size | 1 | 1 |
| 3.2 | Rotor | Rotor sealing of each type and size | 1 | 1 |
| **Air compressor** | | | | |
| 1 | Piston rings | Rings of each size fitted for one piston | 1 set | 1 set |
| 2 | Valves | Suction and delivery valves, complete, of each size fitted | Half set | Half set |

Notes

1 The availability of other spare parts should be specially considered and decided upon by the Owner~~s~~/ ship operators.

2 When the spare parts are utilized, new spare parts are to be supplied as soon as possible.

3 When a sufficiently rated standby pump is available, spare part for the pump may be dispensed with.

***End of Chapter***

# Part 5

# Special Ship Types

# Chapter 1

# Dry Bulk Cargo Carriers

## Section 1

## General

**1.1.3 Class notations**

1.1.3.8 This Chapter does not apply to ships that occasionally carry dry bulk cargo. For ships that occasionally carry dry bulk cargo, the design loads in Pt.3, Ch.5, 5.4 are to be applied. Such ships will be assigned notation **For Occasional Carriage of Dry Bulk Cargo**, upon compliance with the relevant requirements of IMO MSC Res.277(85).

***End of Chapter***

# Part 5

# Special Ship Types

# Chapter 2

# Oil Tankers

# Section 6

# Pumping and Piping Systems

**6.2 Piping systems for bilge, ballast, oil fuel etc.**

6.2.8 Ballast piping is not to pass through cargo tanks as far as possible and is not to be connected to cargo oil piping. Provision may, however, be made for emergency discharge of water ballast by means of a portable spool connection to a cargo oil pump and where this is arranged, a non-return valve is to be fitted in the ballast suction to the cargo oil pump. The portable spool piece is to be mounted in a conspicuous position in the pump room and a permanent notice restricting its use is to be prominently displayed adjacent to it. Shut-off valves shall be provided to shut-off the cargo and ballast lines before the spool piece is removed.

The ballast pump is to be located in the cargo pump room, or a similar space within the cargo area not containing any source of ignition.

Ballast piping passing through cargo tanks and cargo oil pipes passing through segregated ballast tanks, as permitted by Reg.19.3.6 of MARPOL Annex I, are to be of heavy gauge steel of minimum wall thickness according to the ~~table hereunder~~Table 6.2.8 with welded or heavy flanged joints (Note 1) the number of which is to be kept to a minimum. ~~Only e~~Expansion bends(Note 2) only ~~(not glands)~~ are permitted in these lines within cargo tanks for serving the ballast tanks and within the ballast tanks for serving the cargo tanks.

Note 1: Heavy flanges joints means welded flange joints rated at least PN10 or one pressure rating higher than required design pressure, whichever is greater.

Note 2: Expansion bends means expansion loops such as an omega bend (' Ω ') in piping system to counteract excessive stresses or displacement caused by thermal expansion or hull deformation which could be fabricated from straight lengths of pipe.

**Table 6.2.8 : Minimum wall thickness of carbon steel pipes**

| Nominal diameter [mm] | Minimum wall thickness of carbon steel pipes mm] |
|---|---|
| 50 | 6.3 |
| 100 | 8.6 |
| 125 | 9.5 |
| 150 | 11.0 |
| 200 and above | 12.5 |

Thickness for intermediate sizes may be calculated by interpolation.

# Section 13

# Requirements Concerning use of Crude Oil or Slops as Fuel for Tanker Boilers

13.1 This section applies to tankers where crude oil or slops are used as fuel for boilers except when low flash point crude oil is used and design is in accordance with SOLAS II-1 /55 “Alternative Design and Arrangements”.

13.2 In tankers crude oil or slops may be used as fuel for main or auxiliary boilers according to the following requirements. For this purpose all arrangement drawings of a crude oil installation with pipeline layout and safety equipment are to be submitted for approval in each case.

13.32 Crude oil or slops may be taken directly from cargo tanks or from slop tanks or from other suitable tanks. These tanks are to be fitted in the cargo tank area and are to be separated from non-gas-dangerous areas by means of cofferdams with gas-tight bulkheads.

13.43 The construction and workmanship of the boilers and burners are to be proved to be satisfactory in operation with crude oil. The whole surface of the boilers are toshall be gas-tight separated from the engine room. The boilers themselves are to be tested for gas-tightness before being used. The whole system of pumps, strainers, separators and heaters, if any, are toshall be fitted in the cargo pump room or in another room, to be considered as dangerous and separated from engine and boiler room by gas-tight bulkheads. When crude oil is heated by steam or hot water the outlet of the heating coils should be led to a separate observation tank installed together with above mentioned components. This closed tank is to be fitted with a venting pipe led to the atmosphere in a safe position according to the rules for tankers and with the outlet fitted with a suitable flame proof wire gauze of corrosion resistant material which is to be easily removable for cleaning.

13.54 Electric, internal combustion and steam (when the steam temperature is higher than 220°C) prime movers of pumps, of separators (if any), etc., are toshall be fitted in the engine room or in another non-dangerous room. Where drive shafts pass through pump room bulkhead or deck plating, gas-tight glands are to be fitted. The glands are to be efficiently lubricated from outside the pump room.

13.65 Pumps shall are to be fitted with a pressure relief bypass from delivery to suction side and it is toshall be possible to stop them by a remote control placed in a position near the boiler fronts or machinery control room and from outside the engine room.

13.76 When it is necessary to preheat crude oil or slops, their temperature is to be automatically controlled and a high temperature alarm is to be fitted.

13.87 The piping for crude oil or slops and the draining pipes for the tray defined in 13.109 are to have a thickness as follows:

External diameter of pipes, $d_e$ thickness, t

| OD [mm] | Thickness [mm] |
|---|---|
| $d_e \leq$ 82.5 | $t \geq$ 6.3 |
| 88.9 $< d_e \leq$ 108 | $t \geq$ 7.1 |
| 114.3 114.3 $< d_e \leq$ > 139.7 | $t \geq$ 8.0 |
| 152.4 $\leq d_e$ | $t \geq$ 8.8 |

Their connections (to be reduced to a minimum) are to be of the heavy flange type. Within the engine room and boiler room these pipes are to be fitted within a metal duct, which is to be gas-tight and tightly connected to the fore bulkhead separating the pump room and to the tray. This duct (and the enclosed piping) is to be fitted at a distance from the ship's side of at least 20% of the vessel's beam amidships and be at an inclination rising towards the boiler so that the oil naturally returns towards the pump room in the case of leakage or failure in delivery pressure. It is to be fitted with inspection openings with gas-tight doors in way of connections of pipes within it, with an automatic closing drain-trap placed on the pump room side, set in such a way as to discharge leakage of crude oil into the pump room. In order to detect leakages, level position indicators with relevant alarms are to be fitted on the drainage tank defined in 13.109. Also a vent pipe is to be fitted at the

highest part of the duct and is to be led to the open in a safe position. The outlet is to be fitted with a suitable flame proof wire gauze of corrosion resistant material which is to be easily removable for cleaning.

The duct is to be permanently connected to an approved inert gas system or steam supply in order to make possible:

- injection of inert gas or steam in the duct in case of fire or leakage

- purging of the duct before carrying out work on the piping in case of leakage.

13.98 In way of the bulkhead to which the duct defined in 13.87 is connected, delivery and return oil pipes are to be fitted on the pump room side, with shut-off valves remotely controlled from a position near the boiler fronts or from the machinery control room. The remote control valves should be interlocked with the hood exhaust fans (defined in 13.110) to ensure that whenever crude oil is circulating the fans are running.

13.109 Boilers are toshall be fitted with a tray or gutter way of acceptable height and be placed in such a way as to collect any possible oil leakage from burners, valves and connections.

Such a tray or gutter way is toshall be fitted with a suitable flame proof wire gauze, made of corrosion resistant material and easily dismountable for cleaning. Delivery and return oil pipes are toshall pass through the tray or gutterway by means of a tight penetration and are toshall then be connected to the oil supply manifolds.

A quick closing master valve is to be fitted on the oil supply to each boiler manifold. The tray or gutterway is toshall be fitted with a draining pipe discharging into a collecting tank in pump room. This tank is to be fitted with a venting pipe led to the open in a safe position and with the outlet fitted with wire gauze made of corrosion resistant material and easily dismountable for cleaning. The draining pipe is to be fitted with arrangements to prevent the return of gas to the boiler or engine room.

13.110 Boilers are toshall be fitted with a suitable hood placed in such a way as to enclose as much as possible of the burners, valves and oil pipes, without preventing, on the other side, air inlet to burner register. The hood, if necessary, is to be fitted with suitable doors placed in such a way as to enable inspection of and access to oil pipes and valves placed behind it. It is to be fitted with a duct leading to the open in a safe position, the outlet of which is to be fitted with a suitable flame wire gauze, easily dismountable for cleaning. At least two mechanically driven exhaust fans having spark proof impellers are to be fitted so that the pressure inside the hood is less than that in the boiler room. The exhaust fans are to be connected with automatic change over in case of stoppage or failure of the one in operation. The exhaust fan prime movers are toshall be placed outside the duct and a gas-tight bulkhead penetration is toshall be provided for shaft.

Electrical equipment installed in gas dangerous areas or in areas which may become dangerous (i.e. in the hood or duct in which crude-oil piping is placed) is to be of certified safe type.

13.121 When using fuel oil for delivery to and return from boilers fuel oil burning units in accordance with the Rules shall be fitted in the boiler room. Fuel oil delivery to, and returns from, burners are toshall be effected by means of suitable mechanical interlocking devices so that running on fuel oil automatically excludes running on crude oil or vice versa.

13.132 The boiler compartments are to be fitted with a mechanical ventilation plant and are toshall be designed in such a way as to avoid the formation of gas pockets.

Ventilation is to be particularly efficient in way of electrical plants and machinery and other plants which may generate sparks. These plants are toshall be separated from those for service of other compartments.

13.143 A gas detector plant is toshall be fitted with intakes in the duct defined in 13.87, in the hood duct (downstream of the exhaust fans in way of the boilers) and in all zones where ventilation may be reduced. An optical warning device is to be installed near the boiler fronts and in the machinery control room. An acoustical alarm, audible in the machinery space and control room, is to be provided.

13.154 Means are to be provided for the boiler to be automatically purged before firing.

13.165 Independent of the fire extinguishing plant as required by the Rules, an additional

fire extinguishing plant is to be fitted in the engine and boiler rooms in such a way that it is possible for an approved fire extinguishing medium to be directed on to the boiler fronts and on to the tray defined in 13.10~~9~~. The emission of extinguishing medium should automatically stop the exhaust fan of the boiler hood.

13.17~~6~~ A warning notice must be fitted in an easily visible position near the boiler front. This notice must specify that when an explosive mixture is signalled by the gas detector plant defined in 13.14~~3~~ the watch keepers are to immediately shut off the remote controlled valves on the crude oil delivery and return pipes in the pump room, stop the relative pumps, inject inert gas into the duct defined in 13.8~~7~~ and turn the boilers to normal running on fuel oil.

13.18~~7~~ One pilot burner in addition to the normal burning control is required.

***End of Chapter***

# Part 5

# Special Ship Types

# Chapter 4

# Liquefied Gas Carriers

# Section 5

# Process Pressure Vessels and Liquid, Vapour and Pressure Piping Systems

**5.13 Testing requirements**

**5.13.1 Testing of piping components**

**5.13.1.3 Cargo Pumps and Gas/ Reliquefication/ Refrigeration Compressors**

Pumps and Compressors are to be suitable for their intended purpose. All equipment and machinery are to be adequately designed to ensure suitability within a marine environment with due consideration to IRS Classification Notes *"Type Approval of Electrical Equipment used for Control, Monitoring, Alarm and Protection Systems for use in Ships"* and Part 4, Chapter 1, Section 1, 1.7 of the Rules. Such aspects to be considered would include, but not be limited to:

a) environmental conditions;
b) shipboard vibrations and accelerations;
c) effects of pitch, heave and roll motions, etc.; and
d) physical and chemical properties of product

The manufacturer is to submit documentation indicating that the equipment has been designed to comply with the above criteria.

5.13.1.3.1 Cargo Pumps

.1 Each size and type of pump is to be approved through design assessment and prototype testing. Prototype testing is to be witnessed by the Surveyor.

.2 Standards such as ISO 13709:2009 and ISO 24490:2016 may be used for design assessment of the pumps.

a) Material Testing: Tests for pump materials need not be witnessed by the Surveyor except for the boundary components, which are in direct contact with the medium and for a design temperature below –55ºC, in accordance with Chapter 4, Section 6, 6.2.2.

   Note: As an example, the following compressor components may be considered as boundary components:

   - For centrifugal type compressor: impeller, inducer, guide vane, casing, shaft and coupling.

   - For reciprocating type compressor: cylinder cover, valve cover, cylinder liner, piston and piston rod, crankshaft, crank case.

b) Prototype Testing: Prototype testing is to include hydrostatic test of the pump body equal to 1.5 times the design pressure and a capacity test. For submerged electric motor driven pumps, the capacity test is to be carried out with the design medium or with a medium below the minimum working temperature. For shaft driven

deep well pumps, the capacity test may be carried out with water. In addition, for shaft driven deep well pumps, a spin test to demonstrate satisfactory operation of bearing clearances, wear rings and sealing arrangements is to be carried out at the minimum design temperature. The full length of shafting is not required for the spin test but must be of sufficient length to include at least one bearing and sealing arrangement. After completion of tests, the pump is to be opened out for examination.
The vibration criteria of machinery and equipment are to be provided by the pump manufacturer. These are to be compared against an applicable internationally recognized standard (such as Part3 of ISO 7919-3:2009/AMD 1:2017, Part3 of ISO 10816-3:2009/AMD 1: 2017, Part 7 of ISO 10816-7:2009, Part 8 of ISO 10816-8:2014, Part 1 of ISO 20816-1:2016, Part 8 of ISO 20816-8:2018), as applied to the design, and are to be acceptable to IRS.

c) Unit Production Testing: All pumps are to be tested at the manufacturer's plant in the presence of Surveyor. Testing is to include hydrostatic test of the pump body equal to 1.5 times the design pressure and a capacity test. For submerged electric motor driven pumps, the capacity test is to be carried out with the design medium or with a medium below the minimum working temperature. For shaft driven deep well pumps, the capacity test may be carried out with water.

As an alternative to the above, if so, requested by the relevant manufacturer, the certification of a pump may be issued subject to the following:

- The pump has been approved as required by 5.13.1.3.1.2 (a) and (b), and

- The manufacturer has a recognized quality system that has been assessed and certified by IRS subject to periodic audits, and

- The quality control plan contains a provision to subject each pump to a hydrostatic test of the pump body equal to 1.5 times the design pressure and a capacity test. The manufacturer is to maintain records of such tests.

5.13.1.3.2 Gas Cargo and Reliquefication/ Refrigeration Compressors

.1 Each size and type of compressor is to be approved through design assessment and prototype testing. Prototype testing is to be witnessed by the Surveyor.

.2 API standards 617:2014 (w. Errata 1:2016), 618:2016 or 619:2010, as applicable, may be used for design assessment of the gas compressors.

a) Material Testing: Tests for compressor materials need not be witnessed by the Surveyor except for the boundary components, which are in direct contact with the medium and for a design temperature below – 55ºC, in accordance with Chapter 4, Section 6, 6.2.2.

Note: As an example, the following compressor components may be considered as boundary components:

- For centrifugal type compressor: impeller, inducer, guide vane, casing, shaft and coupling.

- For reciprocating type compressor: cylinder cover, valve cover, cylinder liner, piston and piston rod, crankshaft, crank case.

b) Prototype Testing: Prototype testing is to be consistent with the applicable standard as applied for design assessment and is to include hydrostatic test of the compressor pressure boundary components, mechanical running test and a performance test. The hydrostatic test is to be carried out at a pressure equal to 1.5 times the design pressure (or 1.25 times the design pressure where the test fluid is compressible) and for, at least, 30 minutes. The mechanical

running test and performance tests should include recording of the gas used, temperatures, pressures, testing of alarms and shut down, pressure relief devices and vibration measurements to ensure that the limits do not exceed those proposed by the manufacturer and that other features relating to the performance of the equipment are in accordance with the specification. Similarly, during the performance test, power consumption and the gas loads are to be recorded.

The vibration criteria of machinery and equipment are to be provided by manufacturers, consistent with the applicable recognized standard (such as Part3 of ISO 7919-3:2009/AMD 1:2017, Part3 of ISO 10816-3:2009/AMD 1: 2017, Part 7 of ISO 10816-7:2009, Part 8 of ISO 10816-8:2014, Part 1 of ISO 20816-1:2016, Part 8 of ISO 20816-8:2018) as applied to the design. Otherwise, when the data on the vibration criteria are not available, justification is to be submitted for criteria used as reference in terms of overall Root Mean Square (RMS) vibrational velocity value for normal operation conditions.
Alternative limits, demonstrated by fatigue calculations, may be accepted by IRS.

c) Unit Production Testing: Each compressor is to be tested at the plant of manufacture in the presence of Surveyor. Testing is to include hydrostatic test of the compressor pressure boundary components. The hydrostatic test is to be carried out at a pressure equal to 1.5 times the design pressure (or 1.25 times the design pressure where the test fluid is compressible) and for, at least, 30 minutes.
As an alternative to the above, if so, requested by the relevant manufacturer, the certification of a compressor may be issued subject to the following:

- The compressor has been approved as required by 5.13.1.3.2.2 (a) and (b), and
- The manufacturer has a recognized quality system that has been assessed and certified by IRS subject to periodic audits, and
- The quality control plan contains a provision to subject each compressor to the hydrostatic test of the compressor body equal to 1.5 times the design pressure (or 1.25 times the design pressure where the test fluid is compressible) for, at least, 30 minutes, and a mechanical running and performance test. The manufacturer is to maintain records of such tests.

d) Installation: The complete compressor assembly connected to the vessel systems is to be subjected to a leak test using air or other suitable medium, to a pressure depending on the leak detection method applied. The test is to be performed in presence of Surveyor and considered satisfactory when no joint leaks are observed.

~~IR5.13.1.3 Cargo pumps~~
~~IR5.13.1.3.1 Prototype testing~~
~~Each size and type of pump is to be approved through design assessment and prototype testing. Prototype testing is to be witnessed by the Surveyor. Consideration may be given to acceptance of satisfactory in service experience report submitted by the manufacturer, for a class approved existing pump design.~~

~~Prototype testing is to include hydrostatic test of the pump body equal to 1.5 times the design pressure and a capacity test. For submerged electric motor driven pumps, the capacity test is to be carried out with the design fluid or with a fluid below the minimum working temperature. For shaft driven deep well pumps, the capacity test may be carried out with water. In addition, for shaft driven deep well pumps, a spin test to demonstrate satisfactory operation of bearing clearances, wear rings and sealing arrangements is to be carried out at the minimum design temperature. The full length of shafting is not required for the spin test, but must be of sufficient length to include at least one bearing and sealing arrangements. After completion of~~

~~tests, the pump is to be opened out for examination.~~

~~IR5.13.1.3.2 Unit production testing~~

~~All pumps are to be tested at the plant of manufacturer in the presence of the Surveyor. Testing is to include hydrostatic test of the pump body equal to 1.5 times the design pressure and a capacity test. For submerged electric motor driven pumps, the capacity test is to be carried out with the design fluid or with a fluid below the minimum working temperature. For shaft driven deep well pumps, the capacity test may be carried out with water.~~
~~As an alternative to the above, the certification of a pump may be carried out subject to the following:~~

- ~~The pump has been approved as required by IR5.13.1.3.1, and~~
- ~~The manufacturer has a recognized quality system that has been assessed and certified by IRS subject to periodic audits, and~~
- ~~The quality control plan contains a provision to subject each pump to a hydrostatic test of the pump body equal to 1.5 times the design pressure and a capacity test. The manufacturer is to maintain records of such tests.~~

**5.13.2 System testing requirements**

5.13.2.1 The requirements of this sub-section ~~shall~~ are apply to piping inside and outside the cargo tanks.

***End of Chapter***

# Part 5

# Special Ship Types

# Chapter 8

# Offshore Support Vessels

# Section 3

# Offshore Support Vessels (Anchor Handling)

**3.4 Anchor Handling Gear**

**3.4.2 Arrangement**

3.4.2.1 Work Deck

.1 Safe havens and escape routes for personnel from the work deck are to be properly marked and kept clear at all times. A crash barrier (cargo rail) fitted along each side of the deck and/or aft may be the method of providing a safe haven.

3.4.2.2 Loose Gear

.1 All loose gear in use with anchor handling winches and associated equipment are to have documentary evidence of a proof test and be retested after repairs, modifications or alterations of major character. Loose gear is to be thoroughly examined after any proof test.

.2 Loose gear is to be clearly and permanently marked with its unique identification (serial no.), safe working load (SWL) and any additional marks required for safe use. If there is insufficient space for the marking on the loose gear other than the SWL, the omitted information is to be included in the certificate or be provided by other suitable means.

.3 All anchor handling related gears are to be located as low as practicable.

.4~~2~~ Guide pins and wire stoppers are to be arranged so as to contain the anchor handling line within the design limits of its sweep and slack. Means are to be provided to lead and spool the line on the winch drum in a controlled manner under all foreseeable conditions and direction of the line.

**3.4.4 Anchor Handling Winch and associated equipment~~Accessories~~**

3.4.4.1 Anchor Handling Winch

3.4.4.1.2 Speed Control and Handling

.1 ~~The hoisting or lowering speed of the winch is to be adjustable between stop and maximum speed.~~ The anchor handling winches are to be capable of hoisting and lowering in a controlled manner, and should be provided with adjustable speed control between the minimum and maximum speeds.

.2 The winch operating controls ~~for hoisting/lowering of the anchor should~~is to be designed to pay out the wire~~anchor~~ by moving the control lever away from the winch operator and ~~hoist the anchor~~heave in by pulling the ~~handle~~control level towards the operator. All ~~winch~~ operating controls are to be permanently marked with signs indicating their purpose and the operating direction.

.3 The winch operating controls are to be of the "hold-to run" type which will cause the hoisting or lowering motion to automatically stop when the control lever is released by the operator.

3.4.4.1.3 Tension Control

.1 Anchor handling winches are to be equipped with tension control ~~in order~~ to ensure that the system is not overloaded in the event that ~~cases of~~ the anchor being handled gets~~is~~ stuck, ~~or~~ entangled or is exposed to similar situations. Accuracy of the tension control is to be established through calibration at least once in five years and records are to be maintained.

3.4.4.1.4 Overload Alarm and monitoring

.1 Winches are to be provided with continuous load monitors. Such monitors are to be fitted with an audible and visual overload alarm.

3.4.4.1.5 Control stations~~Panel~~

.1 The main control station~~panel~~ is to be placed in a position on the bridge which has a clear view of the deck area. Operators are to be able to visually monitor anchor handling winches and associated equipment and, if the view is obstructed, cameras or video monitoring devices may be used for this purpose.

.2 The anchor handling winch may be controlled from more than one position ~~remote from the winch~~ provided that an arrangement to prevent more than one position from exercising control at any one time is fitted.

.3 Each control station is to be provided with:

.1 means for two-way communication with the main control station;

.2 an arrangement to prevent inadvertent actuation;

.3 adequate protection of personnel; and

.4 sufficient illumination(at least 320 Lux).

3.4.4.1.6 Spooling Devices

.1 ~~Where necessary, a~~Anchor handling winches should be equipped with remotely~~automatically~~ operated ~~automatic~~ spooling devices. ~~except in cases where the winch can maintain the fleet angle within manufacturer specified limits without the use of spooling gear~~.

3.4.4.1.7 Emergency Release

~~.1 Emergency release of wire is to be provided on the bridge and at local stations. Control handles, buttons, etc. for emergency release are to be protected against unintentional activation.~~

~~.2 Emergency release is to be operable in all conditions and be independent of the main source of power.~~

.1 Anchor handling winches are to be designed to facilitate emergency release of the load on the wire in a safe and controlled manner, both under normal as well as dead-ship conditions.

.2 The controls for actuation of the emergency release are to be placed at the main control station. Emergency release function may also be made available at the local control station.

.3 Emergency release control is to be protected against unintentional activation.

.4 The design and operation of the emergency release is to take into consideration restrictions on the pay-out speed of the wire due to inertia and any restrictions due to onboard arrangements.

.5 Instructions for the operation of the emergency release are to be clearly displayed at the navigation bridge and locally at the winch.

.6 After an emergency release, the complete anchor handling winch system should be inspected by the crew/ shipboard personnel for signs of damage or deterioration. Any identified damage or deterioration should be rectified before the anchor handling winch is put back into service.

3.4.4.4 Chain stopper

.1 Anchor handling vessels are to be equipped with chain or wire stoppers (hereafter referred to as chain stoppers).

.2 A chain stopper is to be equipped with an audible alarm which is activated when the stopper is either being engaged or disengaged.

.3 A chain stopper is to be equipped with an emergency release that is functional in all conditions, including dead-ship situations.

.4 Emergency release of chain stopper is to include disengaging of pins and other equipment that may prevent releasing the wire or cause the wire to get stuck/entangled during release.

.5 Emergency release of the chain stopper is to be designed for remote operation in order to minimize the risk of injury to personnel.

.6 The emergency release mechanism of the chain stopper is to be protected against unintentional activation.

.7 Instructions for the operation of the emergency release is to be clearly displayed at the navigation bridge and locally at the emergency release control mechanism.

.8 After an emergency release, the chain stopper system is to be inspected for signs of damage or deterioration. Any identified damage or deterioration is to be rectified before the chain stopper is put back into service.

3.4.4.54 Maintenance and Operations

.1 A maintenance manual for an anchor handling winch is to be provided by the manufacturer.

.2 The maintenance manual, as a minimum, is to include the following for each anchor handling winch:

a) description of the required inspection regime and maintenance schedules specific to the anchor handling winch, checklists and a list of key tools or other items for use when carrying out inspections and maintenance;

b) instructions for routine repairs/maintenance;

c) technical maintenance information;

d) information on recommended lubricants, oil and filter change;

e) information on bearing maintenance, if applicable;

f) lists of replaceable parts/components, as well as the inspection/ maintenance/replacement procedures for these parts/components;

g) lists of sources of spare parts;

h) model forms for records of inspections and maintenance;

i) operational test procedures, as well as the pre/post-operational test inspection procedures;

j) list of components requiring particular attention during inspections, as well as the inspection/maintenance procedures for these components;

k) recommended intervals for replacement and overhaul of components and equipment;

l) information on the preservation of the coating and corrosion protection system; and

m) information regarding special inspection and maintenance in cases where the anchor handling winch is not operated for long periods of time.

.3 An operations manual for the anchor handling winches should be provided by the manufacturer. The operations manual should, as a minimum, include the following for each anchor handling winch:

a) design, operational and environmental limitations;

b) compatible loose gear, if any;

c) safety instructions; and

d) operating procedures, including emergency procedures, if any.

.14 For anchor handling winches and associated equipment, the inspection and maintenance is to be in compliance with the manufacturer's recommendations with applicable national standards of the Administration.

.25 Records of the routine inspection and maintenance of anchor handling winches should be maintained on board and made available to the Surveyor during surveys.

**3.5 Tests**

~~**3.5.1 Load test**~~

~~3.5.1.1 Load test is to be performed at the manufacturer workshop, for hoisting operation, and witnessed by the Surveyor.~~

~~3.5.1.2 Winches are to be tested at design load, as defined in 3.3.1.1. However, in case the winch is not of novel design, it is sufficient to perform load test at the design bollard pull BP. In this case, it may be performed on board during commissioning trials and is to be witnessed by the Surveyor.~~

**3.5.1 Commissioning test**

3.5.1.1 A commissioning test is to be carried out according to the manufacturer's instructions and the following requirements. The commissioning test should include the following:

.1 Function tests at light load to verify the correct working of the winch and its controls over the full operating range.

.2 An overload test to verify the capacity and integrity of the anchor handling winch, the attachment of the winch to ship and the adequacy of the ship's supporting structure.

.3 Test of emergency release and residual holding force in the wire. The test should be performed with the wire attached to an onshore strong point, or an anchor on the seabed or a similar arrangement.

.4 Residual brake holding force after emergency release should be verified by test.

.5 Function test of the whole winch system including static bollard pull test and brake holding capacity test. Where it is not practicable to verify the brake holding capacity by testing, the same may be demonstrated through calculations.

3.5.1.2 After repairs, modifications or alterations of a major character, anchor handling winches are to be tested in accordance with 3.5.1.1.1, 3.5.1.1.2 and 3.5.1.1.5. If the emergency release system is affected by these repairs, modifications or alterations of a major character, the anchor handling winches are to be additionally tested in accordance with 3.5.1.1.3 and 3.5.1.1.4.

3.5.1.3 Repairs, modifications or alterations of a major character are those which:

.1 change the rated wire pull of the anchor handling winch;

.2 affect the strength or service life of the anchor handling winch;

.3 affect the primary load bearing structure of the anchor handling winch; or

.4 modify the functionality of the anchor handling winch or any part thereof which may affect its strength or safety or structural integrity.

3.5.1.4 Anchor handling winches that are not designed for towing do not need to undergo the bollard pull test in 3.5.1.1.5. However, functional testing other than the static bollard pull test is still required.

~~**3.5.2 Functional test**~~

~~3.5.2.1 The tests are performed to check the proper:~~

~~.1 operation of the equipment within the specified limitations~~

~~.2 arrangement of the towline sectors and the towline paths, as shown on the arrangement drawing~~

~~.3 functioning under the normal operation modes~~

~~.4 functioning under the emergency operation modes, including the emergency release and the dead ship operations. In particular, the emergency quick-release systems are to be function tested at the design bollard pull BP.~~

~~**3.5.3 Bollard Pull Test**~~

~~3.5.3.1 The bollard pull test procedure is to be submitted for review by the attending Surveyor in advance of the test.~~

~~3.5.3.2 The bollard pull is to be measured with the vessel at the maximum continuous rpm and at or near the maximum towing depth. The bollard pull is the pull that is recorded over the state of equilibrium without any tendency to decline.~~

~~3.5.3.4 The depth of water under the keel in the testing area should be at least two times the vessel draft at amidships.~~

~~3.5.3.5 For additional test criteria, refer MSC/Circ.884~~.

***End of Chapter***