



RULES FOR  
CLASSIFICATION OF  
**SHIPS**

NEWBUILDINGS

SPECIAL SERVICE AND TYPE  
ADDITIONAL CLASS

PART 5 CHAPTER 7

# TUGS, SUPPLY VESSELS AND OTHER OFFSHORE/HARBOUR VESSELS

JULY 2007

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DET NORSKE VERITAS

Veritasveien 1, NO-1322 Høvik, Norway Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11

# CHANGES IN THE RULES

## General

The present edition of the rules includes additions and amendments decided by the Board as of June 2007 and supersedes the July 2005 edition of the same chapter, including later amendments.

The rule changes come into force as indicated below.

This chapter is valid until superseded by a revised chapter. Supplements will not be issued except for an updated list of minor amendments and corrections presented in Pt.0 Ch.1 Sec.3. Pt.0 Ch.1 is normally revised in January and July each year.

Revised chapters will be forwarded to all subscribers to the rules. Buyers of reprints are advised to check the updated list of rule chapters printed Pt.0 Ch.1 Sec.1 to ensure that the chapter is current.

## Main changes coming into force 1 July 2007

- **Sec.4 Additional Class Notation SF. Damage Stability for Offshore Service Vessels**

- The Guidelines for the Design and Construction of Offshore Supply Vessels has been amended by IMO Res. MSC.235(82), and this section has been adjusted accordingly.

- **Sec.7 Crane Vessels**

- A new item A103 has been added covering requirements for the class notation **Crane Barge**.

## Main changes coming into force 1 January 2008

- **Sec.3 Supply Vessels**

- Under item C101, the rule reference to the piping system rules has been corrected. Further, a paragraph has been added to clarify that redundancy of cargo pumps is not required.
- Under item C102, the piping requirements have been deleted, moved to Pt.4 Ch.6 and replaced by a new requirement for remote stop of cargo pumps.
- Under sub-section element C400, the requirements for certification of cargo pumps for non-flammable liquid and hydraulic pumps used to drive cargo pumps have been deleted.

- **Sec.5 Fire Fighters**

- Under item A602, the test requirements have been split in two parts in order to harmonize with a realistic fire fighter situation.
- Under item F305, F404 and F405, a new and better requirement (net positive suction head) have been introduced in order to ensure good working conditions for the pump. The modification has been based on experience feedback.

- **Sec.10 Offshore Service Vessels for Transportation of Low Flashpoint Liquids**

- Under item A202, the assumptions related to simultaneous carriage of dry cargo and low flashpoint liquid have been revised and clarified.
- Under item A301, the definition of hazardous areas has been revised to be in line with IEC standard publication 60092-502 (1999 issue).
- Under item A303, a definition of cargo area in line with IMO Res. A.673(16) has been introduced.
- Under item A403, text has been revised to be in accordance with

Sec.11.

- Under item A406, documentation requirements have been revised to be in accordance with Ch.4.
- Under item B108, a requirement related to cargo segregation in line with IMO Res. A.673(16) has been introduced.
- Under sub-section element B200, the requirements related to ventilation openings for non-hazardous spaces have been revised and clarified.
- Under sub-section element B300, requirement related to entrance to pump room made less strict.
- Under item C103, a requirement related to cargo segregation in line with IMO Res. A.673(16) has been introduced.
- Under item C105, the requirement for separate drainage system for spaces in the cargo area has been clarified in line with IMO Res. A.673(16).
- Under item C106, a requirement related to drive water for bilge ejectors in the cargo area has been introduced.
- Under sub-section element D100, the requirements related to inert gas system have been deleted and moved to sub-section element D200.
- Under sub-section element D200, all relevant requirements related to inert gas system on supply vessels have been included to improve user-friendliness.
- Under sub-section element D300, a requirement related to cargo segregation in line with IMO Res. A.673(16) has been introduced.
- Under item E101, the requirement for ventilation system within the cargo area has been revised to be in line with IMO Res. A.673(16).
- Under sub-section element G100, the requirements related to electrical installations have been revised to be in line with IEC standard publication 60092-502 (1999 issue).
- Under item H201, the requirements related to tank level gauging have been revised and clarified.
- Under item H301, the requirement for portable gas measuring equipment has been revised and clarified to be in line with IMO Res. A.673(16).
- Under item I103, the requirements related to the instruction manual has been revised and clarified.

- **Sec.11 Recovered Oil Reception and Transportation**

- Under items A401, A402 and A403 (new item), documentation requirements have been revised to be in accordance with Ch.3.
- Under item B204, the requirement is revised as A-0 window are now available in the marked.
- Under item B205, the equipment are now compatible with the requirements for class notation **LFL**, Sec.10 F302.
- Under sub-section element C100, the definition of hazardous areas has been revised to correspond with the terminology in the IEC standard publication 60092-502 (1999 issue).
- Under sub-section element D200, the requirements related to ventilation systems have been revised to be in line with IEC standard publication 60092-502 (1999 issue).
- Under sub-section element D500, the requirements related to electrical equipment have been revised to be in line with IEC standard publication 60092-502 (1999 issue).

## Corrections and Clarifications

In addition to the above stated rule requirements, a number of corrections and clarifications have been made in the existing rule text.

Comments to the rules may be sent by e-mail to [rules@dnv.com](mailto:rules@dnv.com)

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## SECTION 1 GENERAL REQUIREMENTS

### A. Classification

#### A 100 Application

**101** The rules in this chapter apply to vessels intended for towing and pushing, offshore support and other specialised offshore and harbour services. The requirements shall be regarded as supplementary to those given for the assignment of main class.

#### A 200 Class notations

**201** Vessels complying with relevant additional requirements of this chapter will be assigned one of the following class notations:

<b>Tug</b>	(See Sec.2)
<b>Supply Vessel (SF)</b>	(See Sec.3)
<b>Supply Vessel Basic</b>	(See Sec.3)
<b>SF</b>	(See Sec.4)
<b>Fire Fighter I (or II or III)</b>	(See Sec.5)
<b>Pipe Laying Vessel</b>	(See Sec.6)
<b>Crane Vessel</b>	(See Sec.7)
<b>Dredger</b>	(See Sec.8)
<b>Well Stimulation Vessel</b>	(See Sec.9)
<b>LFL and LFL*</b>	(See Sec.10)
<b>OILREC</b>	(See Sec.11)
<b>Pusher</b>	(See Sec.12)
<b>Pusher and Pusher/Barge Unit</b>	(See Sec.13)
<b>Barge</b> <b>Barge for Deck Cargo</b> <b>Barge for Oil</b> <b>Barge for Liquefied Gas</b>	(See Sec.14)
<b>Escort (n,V) or (n,8,n,10)</b>	(See Sec.15)
<b>Cable Laying Vessel</b>	(See Sec.16)
<b>Standby Vessel or Standby Vessel (S)</b>	(See Sec.17)

**202** Vessels equally intended for more than one special duty may be assigned a combination of the class notations mentioned in 201.

### B. Definitions

#### B 100 General

##### 101 Symbols

- L = rule length (m) <sup>1)</sup>
- B = rule breadth (m) <sup>1)</sup>
- D = rule depth (m) <sup>1)</sup>
- T = rule draught (m) <sup>1)</sup>
- C<sub>B</sub> = rule block coefficient <sup>1)</sup>
- V = service speed (knots) <sup>1)</sup>
- s = stiffener spacing (m)
- s<sub>s</sub> = standard frame spacing (m)
- = 0.48 + 0.002 L
- = maximum 0.61 m forward of collision bulkhead and aft of the afterpeak bulkhead
- l = stiffener span (m)
- f<sub>1</sub> = material factor depending on material strength group.

<sup>1)</sup> For details see Pt.3 Ch.1.

### C. Documentation

#### C 100 General

**101** Details related to additional classes regarding design, arrangement and strength are in general to be included in the plans specified for the main class.

**102** Additional documentation not covered by the main class is specified in appropriate sections of this chapter.

## SECTION 2 TUGS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels specially intended for towing.

**102** Vessels built in compliance with the requirements in this section may be given the class notation **Tug**.

**103** The bollard pull of the vessel shall be obtained by a special test approved by the Society. Based upon the results of the test a Bollard Pull Certificate will be issued.

The bollard pull testing procedure shall be as given in D500, inserted at end of this chapter.

Measured bollard pull will be entered into the "Register of vessels classed with DNV", as information.

#### A 200 Documentation

**201** The following plans and particulars shall be submitted for approval:

- structural drawings, including material specifications, of the winch and/or towing hook or chain stopper
- structural drawings, including material specifications, of the attachments to the hull structure
- bollard pull test programme.

**202** The following plans and particulars shall be submitted for information:

- arrangement of the towing equipment including towline path and towline minimum breaking strength
- calculation of the towing design force and expected bollard pull
- strength calculation of the winch and/or hook (drum with flanges, shafts with couplings, framework, brakes and pawl wheels, chain stoppers as relevant).

**203** DNV certificates will be required for:

- towing hook with attachment
- steel wire rope towline for winch (WC)
- winch drum and flanges
- shafts for drum
- coupling
- winch framework (WC)
- brake components (including pawl wheels and chain stoppers)
- gear shaft and wheels (WC).

For items referred with (WC) work's certificate from approved manufacturer will normally be accepted.

#### A 300 Materials

**301** Towing hook with attachment shall be made of forged or cast steel in accordance with Pt.2 Ch.2 Sec.5 and Sec.7.

**302** Towing winch materials shall comply with relevant specifications given in Pt.2. For forged and cast steel strength higher than 600 N/mm<sup>2</sup> specifications of chemical composition and mechanical properties shall be submitted for approval for the equipment in question.

Plate material in welded winch structures shall be of the grades as given in Pt.3 Ch.3 Sec.3 F200 Table F3.

**303** Towline materials shall be in accordance with Pt.3 Ch.3 Sec.3 G.

**304** For items given in 201 DNV's certification or inspection

report will be required and a DNV product certificate is required issued for hooks and winches (see Pt.1 Ch.1 Sec.4).

#### A 400 Anchoring and mooring equipment

**401** Tugs shall have anchoring and mooring equipment corresponding to its equipment number, see Pt.3 Ch.3 Sec.3 C100. The term 2 B H in the formula may, however, be substituted by:

$$2 (a B + \sum h_i b_i)$$

where:

$b_i$  = breadth (m) of the widest superstructure or deckhouse of each tier having a breadth greater than B/4.

### B. Hull Arrangement and Strength

#### B 100 Draught for scantlings

**101** For determining the scantlings of strength members based on the ship's draught, the latter shall not be taken less than 0.9 D.

#### B 200 Fore peak structures

**201** Forward of the collision bulkhead horizontal girders (stringers) shall be arranged on the ship's side not more than 2 m apart. The girders shall be connected to the collision bulkhead by brackets forming gradual transition to the bulkhead.

**202** The dimensions of the girders shall not be less than:

- mean depth =  $250 + 2.5 / L$  (mm)
- thickness =  $6.5 + 0.03 L$  (mm)
- flange area =  $0.15 / L$  (cm<sup>2</sup>)

**203** The frames shall be connected to the girders by lugs and flat bar stiffeners at every frame.

**204** For ships with large flare in the forebody and only intended for towing, the general requirements given in Pt.3 Ch.2 Sec.6 + 25% may be applied.

#### B 300 Fenders

**301** A substantial fender for the protection of the vessel's sides shall be fitted at deck level, extending the whole length of the vessel. Alternatively, an arrangement with loose fenders may be approved, if the upper part of the vessel's sides is additionally stiffened.

#### B 400 Machinery casing and emergency exit

**401** For exposed casings the scantlings of plating and stiffeners shall be at least 20% in excess of the requirements for main class.

**402** Skylights on uppermost continuous deck shall be arranged on a coaming not less than 900 mm in height. The scantlings shall be as for exposed casings.

**403** Emergency exit shall be arranged from engine room to weather deck. The emergency exit shall be capable of being used at extreme angles of heel. The escape hatch on deck shall have a coaming height not less than 600 mm. The hatch cover shall have hinges arranged athwartships, and shall be capable of being opened and closed (watertight) from either side.

#### B 500 Companionways

**501** Companionways to spaces below deck shall have sill heights not less than 600 mm, and shall have watertight steel doors which can be opened and closed (watertight) from either side.



**B 600 Side scuttles**

**601** Side scuttles are not allowed in the vessel's sides unless the distance from the lower edge of side scuttles to the design waterline is at least 750 mm. Side scuttles in the vessel's sides and in sides of any superstructures shall be provided with internally fitted, hinged deadlights and shall satisfy the requirements to Type A (heavy) according to ISO Recommendation 1751. Fixed lights in skylights etc. shall have glasses of thickness appropriate to their position as required for side scuttles, and fitted with hinged deadlights which may be arranged on the weather side.

**C. Sternframe, Rudder and Steering Gear****C 100 Rudder force**

**101** The design rudder force on which scantlings shall be based, shall be calculated as indicated for the main class. The speed of the ship, however, shall not be taken less than  $V = 10$  knots.

**C 200 Steering gear**

**201** The steering gear shall be capable of bringing the rudder from  $35^\circ$  on one side to  $30^\circ$  on the other side in 20 s, when the vessel is running ahead at maximum service speed.

**D. Towing Arrangement****D 100 General**

**101** The towing hook or towing winch shall be located as near as possible to the mid length of the vessel. The arrangement shall be such that the heeling moment arising when the towline is running in the athwartships direction, will be as small as possible.

**102** Design and scantlings of the towing hook with attachment shall be capable of withstanding a load of minimum 2.5 times the maximum continuous bollard pull ( $BP_{cont}$ ) without permanent deformations.

**103** The design and scantlings of the towing winch with support shall be capable of withstanding the breaking load of the winch towline without permanent deformations.

**104** The winch towline shall have a minimum breaking strength as given in Table D1.

Table D1 Minimum breaking strength of winch towline	
Design load	Bollard pull (tonnes)
$3.0 BP_{cont}$	$BP_{cont} < 40$
$(3.64 - 0.8 BP_{cont}/50) BP_{cont}$	$40 \leq BP_{cont} \leq 90$
$2.2 BP_{cont}$	$BP_{cont} > 90$
$BP_{cont}$ = Specified maximum continuous bollard pull.	

**D 200 Towing hook arrangement**

**201** Towing hooks shall be provided with reliable release arrangement, so that in case of a critical situation, the towline can be immediately released regardless of angle of heel and of direction of towline. The releasing device shall be operable from the bridge.

**D 300 Towing winch**

**301** The winch shall be designed to allow drum release in an emergency, and in all operational modes. The end attachment of the towline to the winch barrel shall be of limited strength making a weak link in case the towline has to be run out.

**302** The action to release the drum shall be possible locally at the winch and from a position at the bridge with full view

and control of the operation. Identical means of equipment for the release operation to be used on all release stations.

**303** After an emergency release the winch brakes shall be in normal function without delay.

**304** It is always to be possible to carry out the emergency release sequence (emergency release or application of brake), even during a black-out.

**305** Control handles, buttons etc. for emergency release shall be protected against unintentional operation.

**D 400 Testing**

**401** The towing winch and the total towing arrangement shall be function tested.

The emergency release systems shall be tested.

**D 500 Bollard pull testing procedure**

**501** The following test procedure shall be adhered to:

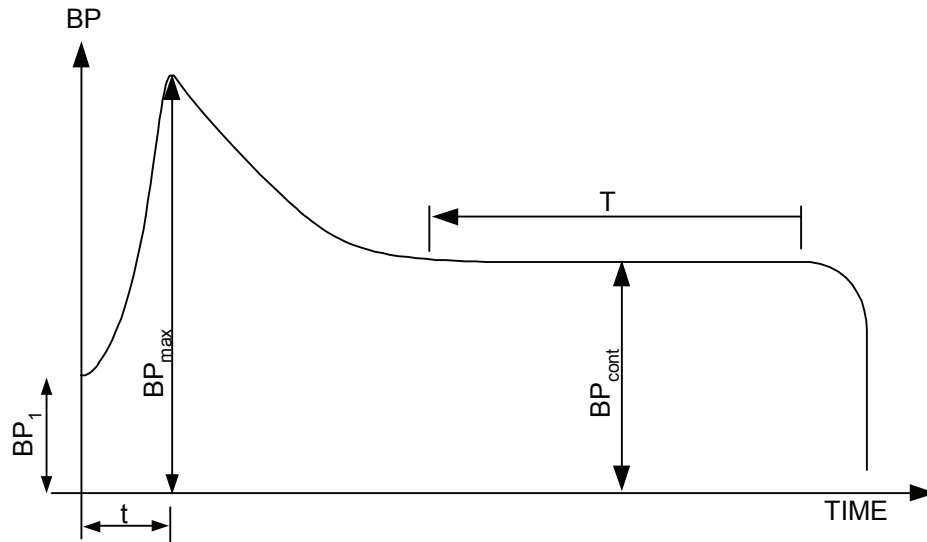
- 1) A proposed test programme shall be submitted prior to the testing.
- 2) During testing of continuous bollard pull  $BP_{cont}$  the main engine(s) shall be run at the manufacturer's recommended maximum continuous rating (MCR).
- 3) During testing of overload pull, the main engines shall be run at the manufacturer's recommended maximum rating that can be maintained for a minimum of 1 hour. The overload test may be omitted.
- 4) The propeller(s) fitted when performing the test shall be the propeller(s) used when the vessel is in normal operation.
- 5) All auxiliary equipment such as pumps, generators and other equipment, which are driven from the main engine(s) or propeller shaft(s) in normal operation of the vessel shall be connected during the test.
- 6) The length of the towline shall not be less than 300 m, measured between the stern of the vessel and the shore.
- 7) The water depth at the test location shall not be less than 20 m within a radius of 100 m of the vessel.
- 8) The test shall be carried out with the vessel's displacement corresponding to full ballast and half fuel capacity.
- 9) The vessel shall be trimmed at even keel or at a trim by stern not exceeding 2% of the vessel's length.
- 10) The vessel shall be able to maintain a fixed course for not less than 10 minutes while pulling as specified in items 2 or 3 and 6 above.
- 11) The test shall be performed with a wind speed not exceeding 5 m/s.
- 12) The current at the test location shall not exceed 1 knot in any direction.
- 13) The load cell used for the test shall be approved by Det Norske Veritas and be calibrated at least once a year. The accuracy of the load cell shall be  $\pm 2\%$  within a temperature range of  $-10^\circ\text{C}$  to  $+40^\circ\text{C}$  and within the range of 25 to 200 tonnes tension.
- 14) An instrument giving a continuous read-out and also a recording instrument recording the bollard pull graphically as a function of the time shall both be connected to the load cell. The instruments shall be placed and monitored ashore, or on board if measurements are transmitted by radio link.
- 15) The load cell shall be fitted between the eye of the towline and the bollard.
- 16) The figure certified as the vessel's continuous bollard pull shall be the towing force recorded as being maintained without any tendency to decline for a duration of not less

than 10 minutes (T on Fig.1).

- 17) Certification of bollard pull figures recorded when running the engine(s) at overload, reduced r.p.m. or with a reduced number of main engines or propellers operating can be given and noted on the certificate.
- 18) A communication system shall be established between the vessel and the person(s) monitoring the load cell and the recording instrument ashore, by means of VHF or tele-

phone connection, for the duration of the test.

- 19) The test results shall be made available to the DNV surveyor immediately upon conclusion of the test programme.
- 20) For mean breaking strength of the towline, see Sec.2 D102 and D104.



**Fig. 1**  
**Bollard Pull Testing**

## E. Stability and Watertight Integrity

### E 100 General requirements

**101** The vessel's stability shall be assessed when the towing line is not in line with the vessel's longitudinal centre line. The towing heeling moment shall be calculated based on the assumption in 102. The criterion in 103 shall be complied with.

#### Guidance note:

It is acceptable that compliance is demonstrated for actual loading conditions only. The approval will then be limited to the present loading conditions.

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### 102 Towing heeling moment

The transverse heeling force from the towline shall be based on the maximum transverse bollard pull. For conventional propeller propulsion the transverse force shall not be taken less than 60% of the maximum continuous bollard pull (BP<sub>cont</sub>) ahead.

The towing heeling arm 'a' shall be taken as the vertical distance between the centre of propeller(s) and the fastening point of the hawser.

### 103 Criterion

The towing heeling lever, calculated as:

$$0.6 \text{ BP}_{\text{cont}} a / \text{displacement},$$

shall not exceed 0.5 times the maximum GZ corresponding to maximum allowable VCG.

If the maximum GZ occurs after 30°, the GZ at 30° shall be used instead of the maximum GZ.

### 104 Documentation

Additional information in the stability manual on the maximum bollard pull, position, heeling force and moment as well as plotting the towing heeling lever on the GZ diagram of the most unfavourable loading conditions.

Detailed description of stability documentation is given in Classification Note No. 20.1.

## SECTION 3 SUPPLY VESSELS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels designed specially for supply services to offshore installations.

**102** Vessels built in compliance with the relevant requirements in A, B, C, and D may be given the class notations **Supply Vessel Basic**. Vessels fitted with cargo systems covered in this section shall comply with C. Vessels strengthened and arranged according to additional requirements in E will be given the class notation **Supply Vessel**.

##### Guidance note:

The notation **Supply Vessel** is recommended for offshore supply vessels intended primarily for operation in the North Sea offshore oil fields.

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**103** If the damage stability requirements in Sec.4 are satisfied in addition to the general requirements in D, then the additional notation **SF** may be given.

#### A 200 Documentation

**201** Plans and particulars for the following shall be submitted for approval:

- separate cargo tanks with foundations
- towing arrangement
- foundation and support of any towing winch and/or towing bollard. Maximum braking force of winch and breaking strength of the towline shall be stated
- scantlings for support of stern roller. The maximum load on the stern roller, during anchor handling operation, shall be stated
- scantlings of towing bollard
- scantlings and support of stow racks
- arrangement of windows with information on type of glass and deadlights where applicable.
- for notation **SF**:
  - preliminary damage stability calculations
  - final damage stability calculations. Not required in case of approved limit curves, or if approved lightweight data are not less favourable than estimated lightweight data.

**202** The following documentation related to class notation **SF** shall be submitted for information:

- internal watertight integrity plan

**203** Detailed description of stability documentation is given in Classification Note No. 20.1.

#### A 300 Towing arrangement

**301** If the vessel is arranged for towing operation, the arrangement shall satisfy the requirements given for tugs in Sec.2 regarding design and testing.

#### A 400 Steering gear

**401** The steering gear shall be capable of bringing the rudder from 35° on one side to 30° on the other side in 20 s, when the vessel is running ahead at maximum service speed.

#### A 500 Safety precaution

**501** Exhaust outlets from diesel engines shall have spark arrestors.

#### A 600 Anchoring equipment

##### 601 Guidance note:

For vessels with class notation **Supply Vessel** or **Supply Vessel Basic** without means for dynamic positioning, but intended for anchoring close to offshore installations/fields, it should be considered to increase the diameter and length of the chain cables above the minimum class requirements given in Pt.3 Ch.3 Sec.3. In such case, for operation in the North Sea or areas with similar environmental conditions, it is recommended to have the diameter of chain cables based on an equipment letter at least two steps higher than the corresponding vessel's equipment number and length of the chain cables 85% greater than the table value corresponding to the increased diameter.

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### B. Hull Arrangement and Strength

#### B 100 Ship's sides and stern

**101** Longitudinal fenders are normally to be fitted on the ship's sides at upper deck and fore-castle deck. The fenders at fore-castle deck shall extend not less than 0.02 L forward of the section where the deck has its full breadth.

In the forebody additional fenders shall be arranged aslope between the longitudinal fenders. The fenders may be omitted if the side shell scantlings are increased as specified in 102.

**102** The thickness of side plating including bilge strake is generally not to be less than:

$$t = \left( \frac{4.5 + 0.05L}{\sqrt{f_1}} \right) \frac{s}{s_s} + 2 \text{ (mm)}, \text{ minimum } 9 \text{ mm}$$

The ratio  $s/s_s$  shall not be taken as less than 1.0, and L does not need to be taken more than 90 m. Requirements given for side plating in Pt.3 Ch.1 and Pt.3 Ch.2 are also to be complied with as applicable.

Where fenders are omitted the thickness of the side plating at upper deck and fore-castle deck shall not be less than twice that required above for a breadth not less than 0.01 L.

**103** Section modulus of frames or side longitudinals shall not be less than 1.15 Z (cm<sup>3</sup>).

Z = general requirement as given in Pt.3 Ch.2 Sec.6.

All frames shall have brackets. Scallop welds shall not be used in connections between side frames and shell plating.

**104** Flat part of bottom in way of stern shall be efficiently stiffened.

**105** Where subjected to heavy loads when handling anchors for drilling rigs, the stern shall be strengthened. The plate thickness shall not be less than twice the basic requirement stated in 102. The deck adjacent to the stern shall be strengthened accordingly. If a substantial sheathing is fitted on the deck, the requirement may be modified.

#### B 200 Weather deck for cargo

**201** The deck shall have scantlings based on a minimum cargo load of 1.5 t/m<sup>2</sup>, in combination with 80% of the design sea pressure as specified for the main class. If the deck scantlings

are based on cargo load exceeding 1.5 t/m<sup>2</sup>, the notation **DK(+)** may be added. The design cargo load in t/m<sup>2</sup> will be given in the "Appendix to the classification certificate". Cargo loads exceeding 4 t/m<sup>2</sup> need not be combined with sea pressure. For intermediate loads the percentage of the design sea pressure to be added shall be varied linearly.

**202** The deck plating thickness shall not be less than 8 mm.

**203** In deck areas for heavy cargo units (e.g. drilling rig anchors) the deck structure shall be adequately strengthened.

**204** Stow racks for deck cargo shall be provided. The stow racks shall be efficiently attached and supported.

The scantlings of the stow racks shall be based on a load not less than 0.6 A tonnes, assumed to be evenly distributed on the stow rack on one side of the vessel.

A = total deck area between the stow racks.

Acceptable stress levels for the stow rack scantlings and respective supporting structure resulting from bending moments and shearing forces calculated for the load given above are:

$$\begin{aligned}\sigma_b &= 160 f_1 \text{ (N/mm}^2\text{)} \\ \tau &= 90 f_1 \text{ (N/mm}^2\text{)} \\ \sigma_e &= (\sigma_b^2 + 3 \tau^2)^{1/2} \\ &= 200 f_1 \text{ (N/mm}^2\text{)}\end{aligned}$$

**205** Bulwark plating thickness shall not be less than 7 mm. Bulwark stays shall have a depth not less than 350 mm at deck. The spacing of bulwark stays shall not exceed 1.3 m. Open rails shall have ample scantlings and efficient supports.

**206** Air pipes, valves, smaller hatches etc. shall be located outside stow racks, and shall be protected and adequately strengthened.

**207** Scantlings of flush hatch covers in the cargo deck area shall be based on a load not less than the specific design cargo load.

**208** Scantlings of foundations and supports of towing winch and towing bollard shall be based on the breaking strength of the towline.

Scantlings of foundations and supports of stern roller shall be based on 2 times the working load.

Acceptable stress levels for the scantlings of the supporting structure resulting from bending moments and shearing forces calculated for the load given above are:

$$\begin{aligned}\sigma_b &= 210 f_1 \text{ (N/mm}^2\text{)} \\ \tau &= 120 f_1 \text{ (N/mm}^2\text{)} \\ \sigma_e &= (\sigma_b^2 + 3 \tau^2)^{1/2} \\ &= 235 f_1 \text{ (N/mm}^2\text{)}\end{aligned}$$

**209** The scantlings of supports for stern roller shall be based on the maximum forces occurring during anchor handling operations.

### B 300 Weathertight doors

**301** The arrangements and sill heights of weathertight doors are in general to comply with Pt.3 Ch.3 Sec.6. Unprotected doors in exposed positions on a weather deck for cargo shall be made of steel.

**302** For doors located in exposed positions in sides and front bulkheads, the requirements to sill heights apply one deck higher than given by Pt.3 Ch.3 Sec.6 B.

**303** Doorways to the engine room and other compartments below the weather deck are, as far as is practicable, to be located at a deck above the weather deck.

**304** Where necessary, an arrangement for protecting the doors against deck cargo shall be provided.

### B 400 Freeing ports and scuppers

**401** The area of the freeing ports in the side bulwarks on the cargo deck are at least to meet the requirements of Pt.3 Ch.3 Sec.6 M.

The disposition of the freeing ports shall be carefully considered to ensure the most effective drainage of water trapped in pipe deck cargoes and in recesses at the after end of the fore-castle. In such recesses appropriate scuppers with discharge pipes led overboard may be required.

## C. Cargo Handling Arrangement

### C 100 General

**101** Systems and arrangements shall in general comply with the relevant requirements for main class given in Pt.4 Ch.6.

Redundancy requirements for cargo pumps as specified in Ch.3 Sec.4 C102 and Ch.4 Sec.6 B201 are not applicable.

**102** Cargo pumps shall be provided with remote shut down devices capable of being activated from a dedicated cargo control location which is manned at the time of cargo transfer. Remote shut down shall also to be capable of being activated from at least one other location outside the cargo area and at a safe distance from it.

**103** Segregation between cargo piping systems where cross-contamination causes safety hazards or marine pollution hazards shall be by means of spectacle flanges, spool pieces or equivalent. Valve segregation is not considered equivalent.

**104** Vessels intended for transportation of liquids with flash-point below 60°C shall comply with Sec.10. Vessels that occasionally handle, store and transport recovered oil from a spill shall comply with Sec.11.

### C 200 Cement and dry mud systems

**201** Cement and dry mud tanks and piping systems are as far as practicable to be separated from the engine room.

Where cement and dry mud tanks are situated in way of engine room, at least the upper parts of the tanks with hatches, pipe connections and other fittings, shall be segregated from the engine room by steel deck and bulkhead.

**202** Where cement and dry cargo piping is led through the engine room, the wall thicknesses of the pipes shall not be less than given in Table C1. Pipe connections located in the engine room shall be welded as far as practicable. Necessary detachable connections shall be of such design that blow-out is prevented. The arrangement will be specially considered in each particular case.

**203** Access doors between the engine room and spaces in which cement and dry mud systems are located, shall be provided with signboard stating that the doors shall be kept closed while the system is under pressure.

**204** Cement and dry mud tanks shall be certified in accordance with the requirements for pressure vessels given in Pt.4 Ch.7.

**Table C1 Pipes for cement and dry mud. Minimum nominal wall thickness for steel pipes in engine room**

<i>External diameter (mm)</i>	<i>Wall thickness (mm)</i>
38 - 82.5	6.3
88.9 - 108	7.1
114.3 - 139.7	8.0
152.4 - 273	8.8

### C 300 Liquid mud systems

**301** Liquid mud carried onboard supply vessels shall have a flash point not lower than 60°C.



**302** Means for relief of overflow shall be provided, e.g. through a non-return valve fitted in a branch connection to the air pipe.

The sectional area of the overflow pipe shall be at least twice that of the filling pipe.

#### C 400 Certification of components

**401** Cargo pumps for flammable liquids shall be delivered with the Society's certificate (e.g. pumps for transfer of liquid mud, fuel oil and base oil).

##### Guidance note:

Other pumps in the cargo systems, including hydraulic power systems, need not be delivered with the Society's certificate.

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**402** For valves in cargo systems manufacturers certificate may be accepted.

### D. Intact Stability

#### D 100 Stability manual

**101** The stability information as presented in the required stability manual shall enable the master to assess with ease and certainty the stability of the vessel in different service conditions.

**102** The stability manual shall contain the following information:

- report on inclining test and determination of light ship data
- capacities and centres of gravity of all tanks and spaces intended for cargo and consumables
- free surface particulars for all tanks
- information on types, weights, centres of gravity and distribution of deck cargoes that can be carried within the limits as set out in Pt.3 Ch.3 Sec.9 D. Possible restrictions, such as plugging of pipes, shall be clearly stated
- where applicable, instructions related to the vessel when towing shall be included
- hydrostatic data
- cross curves of stability
- loading conditions including righting lever curves and calculation of metacentric height GM including free surface corrections
- curves for limiting VCG (centre of gravity above keel) or GM values for intact conditions and a curve showing the permissible area of operation.

#### D 200 Loading conditions

**201** The following loading conditions shall be presented:

- vessel in fully loaded departure condition with cargo distributed below deck and with deck cargo specified by position and weight, with full stores and fuel, corresponding to the worst service condition in which all stability criteria are met
- vessel in fully loaded arrival condition with cargo as specified, but with 10% stores and fuel
- vessel in ballast departure condition, without cargo but with full stores and fuel
- vessel in ballast arrival condition, without cargo but with 10% stores and fuel
- vessel in the worst anticipated operating condition
- if the vessel is equipped with towing gear, vessel in a typical condition ready for towing.

**202** Assumptions for calculating loading conditions:

- if a vessel is fitted with cargo tanks, the fully loaded conditions as described in 201 shall be modified, assuming

- first the cargo tanks full and then the cargo tanks empty
- if in any loading condition water ballast is necessary, additional diagrams shall be calculated and shown in the stability manual
- in all cases when deck cargo is carried a realistic stowage weight shall be assumed and stated in the stability information, including the height of the cargo and its centre of gravity
- where pipes are carried on deck, a quantity of trapped water equal to a certain percentage of the net volume of the pipe deck cargo shall be assumed in and around the pipes. The net volume shall be taken as the internal volume of the pipes plus the volume between the pipes. This percentage shall be 30 if the freeboard amidships is equal to or less than 0.015 L and 10 if the freeboard amidships is equal to or greater than 0.03 L. For intermediate values of the freeboard amidships the percentage may be obtained by linear interpolation
- free surface for each type of consumable liquid shall be assumed for at least one transverse pair of tanks or a single centre line tank. The tank(s) to be considered are those where the effect of free surface is the greatest. The actual free surface effect may be applied.

**203** If the vessel is intended to operate in zones where icing is expected, this shall be included in the calculation of the stability. The vessel must in any service condition satisfy the stability criteria set out in Pt.3 Ch.3 Sec.9 including the additional weight imposed by the ice. Weight distribution shall be taken as at least 30 kg/m<sup>2</sup> for exposed weather decks, passageways and fronts of superstructures and deckhouses, and at least 15 kg/m<sup>2</sup> for projected lateral planes on both sides of the vessel above the waterline. The weight distribution of ice on uncomposite structures such as railings, rigging, posts and equipment shall be included by increasing the total area for the projected lateral plane of the vessel's sides by 5%. The statical moment of this area shall be increased by 10%.

#### D 300 Intact stability

**301** The intact stability criteria as given for the main class are generally to be complied with.

**302** For the towing condition referred to under 201, the vessel is in addition to complying with the criteria under 301, to have a maximum righting lever GZ which is 50% in excess of the heeling lever produced by the most unfavourable pull in the towing line. In the case the maximum righting lever GZ occurs at an angle of heel greater than 30°, the righting lever GZ at 30° shall be 50% in excess of the above heeling lever.

**303** VCG or GM limiting values calculated on the basis of the vessel's characteristics in relation to the intact stability criteria shall be presented in the form of a curve or diagram.

**304** Where anti-rolling devices are installed the Society shall be satisfied that the stability criteria under 301 are maintained with the devices in operation. Free surface effects from stabilizing tanks shall be considered where appropriate.

#### D 400 Stability requirements for heavy lift operations

**401** Vessels, for which the lifting operation is the main, or one of the main functions, shall be checked with respect to stability requirements given in Sec.7 D200.

### E. Notation Supply Vessel

#### E 100 Ship's sides and stern

**101** Section modulus of frames or side longitudinals to comply with:

*In way of fender regions*

$$Z_1 = \frac{1.5 L l s}{f_1} (\text{cm}^3)$$

*In way of regions without fenders*

$$Z_1 = \frac{2.5 L l s}{f_1} (\text{cm}^3)$$

However, the section modulus of main frames and 'tween deck frames shall not be less than  $Z_{\min} = 1.25 Z$  ( $\text{cm}^3$ ).

$Z$  = general requirement as given in Pt.3 Ch.1 Sec.7 C and Pt.3 Ch.2 Sec.6 C.

$L$  = rule length (m)

$l$  = span (m)

$s$  = spacing (m).

The requirement for  $Z_1$  given above refers to frames, which have an inclination to the vertical (along the ship's depth) less than  $20^\circ$ . For greater inclinations the requirement given for  $Z_{\min}$  shall be applied.

All frames shall have brackets. Scallop welds shall not be used in connections between side frames and shell plating.

## E 200 Support of heavy components

**201** Pillars and girders supporting deck cargo and equipment, foundations for separate cargo tanks, as well as supports of other heavy components, shall have scantlings based on the supported mass. The design loads shall not be less than:

$p = 16 q$  ( $\text{kN/m}^2$ ), for  $L < 100$  m

$p = (g_0 + a_v) q$  ( $\text{kN/m}^2$ ), for  $L \geq 100$  m

*Vertical mass alone*

$P_v = 16 M_k$  (kN), for  $L < 100$  m

$P_v = (g_0 + a_v) M$  (kN), for  $L \geq 100$  m

$q$  = deck cargo load ( $\text{t/m}^2$ ) as specified

$M$  = mass of equipment, heavy components, etc. in tonnes

$a_v$  = combined vertical acceleration as given in Pt.3 Ch.1 Sec.4 B600.

Acceptable stress level for the above mentioned girders are:

$\sigma_b = 160 f_1$  ( $\text{N/mm}^2$ )

$\tau = 90 f_1$  ( $\text{N/mm}^2$ )

$\sigma_e = (\sigma_b^2 + 3 \tau^2)^{1/2} = 200 f_1$  ( $\text{N/mm}^2$ ).

## E 300 Deckhouses and end bulkheads of superstructures

**301** The section modulus of stiffeners and beams shall not be less than:

$$Z = \frac{0.7 l^2 s p}{f_1} (\text{cm}^3)$$

$p$  = design pressure in  $\text{kN/m}^2$

=  $a p_2$  for exposed decks and bulkheads

minimum  $20 \text{ kN/m}^2$  for front bulkheads

minimum  $13 \text{ kN/m}^2$  for sides and aft end bulkheads

minimum  $10 \text{ kN/m}^2$  for weather decks

minimum  $5 \text{ kN/m}^2$  for top of the wheelhouse

=  $8 \text{ kN/m}^2$  for accommodation decks

$a$  = 2 for front bulkheads

= 1.2 for sides, aft end bulkheads and weather decks

$p_2$  = design sea pressure as given in Pt.3 Ch.2 Sec.6 B100 and Pt.3 Ch.2 Sec.7 B100 as applicable.

**302** Stiffeners shall have end connections. Beams and stiffeners shall be connected by brackets. Stiffeners on front bulkheads shall have brackets at their lower ends.

**303** The plate thickness in deckhouses and end bulkheads of superstructures shall not be less than:

$$t = \left( \frac{t_0 + 0.02L}{\sqrt{f_1}} \right) c \text{ (mm)}$$

$t_0$  = 6 for front bulkheads and weather deck forward of the lowest tier of the front bulkhead

= 5 for sides and aft end bulkheads and weather decks elsewhere

= 4.5 for deckhouse decks (in way of accommodation).

$c = \frac{s}{0.65}$ , minimum 1.0

For bulkhead stiffeners and deck beams with spacing exceeding 650 mm, the thickness requirement is increased in proportion to the increased spacing.

## E 400 Windows and side scuttles

**401** Typical arrangements complying with the requirements given below are shown in Fig.2 and Fig.3. In locations not mentioned in 402 side scuttles only will be accepted.

**402** In the after end bulkhead of deckhouses and superstructures, in sides of deckhouses and of superstructures that are not part of the shell plating, windows will be accepted in second tier and higher, above the freeboard deck. In front bulkheads of deckhouses and superstructures, windows will normally be accepted in third tier and higher, above the freeboard deck. In the first tier of the front bulkhead above the weather deck (forecastle deck) side scuttles only will be accepted.

**403** Hinged deadlights shall be fitted to:

- side scuttles in the vessel's hull (shell plating)
- windows and side scuttles in the sides of deckhouses and superstructures up to and including the third tier above the freeboard deck
- all side scuttles in front bulkheads of superstructures and deckhouses
- windows and side scuttles in the after end of bulkheads of superstructures and deckhouses, casings and companionways in the first and second tier above the freeboard deck
- windows and side scuttles in all bulkheads of the first tier on the weather deck.

**404** In the second tier above the freeboard deck and higher, deadlights on windows may be hinged externally, provided there is easy and safe access for closing.

**405** Deadlights shall be available for each type of window sited on the front of a wheelhouse that is located on the forward part of the vessel. For externally fitted deadlights an arrangement for easy and safe access shall be provided (e.g. gangway with railing). The deadlights of portable type shall be ganged adjacent to the window for quick mounting. For the wheelhouse front windows, at least two deadlights shall have means for providing a clear view.

**406** Deadlights for side scuttles and for windows not mentioned in 404 or 405 shall be internally hinged.

**407** The strength of side scuttles with internally hinged deadlights and toughened glass panes shall comply with International Standard ISO 1751 as follows:

*Type A (heavy):* In the hull, in the sides of superstructures and in the front of superstructures and deckhouses (weather deck tier).

*Type B (medium):* In the after end of superstructures and in the sides and ends of deckhouses (except front in weather deck tier).

**408** For vessels to be assigned with class notation **Supply Vessel** windows shall have toughened safety glass panes of



thickness determined as given below.

$$t = \frac{b}{S} \sqrt{p \beta} \quad (\text{mm})$$

- $\beta$  = factor obtained from the Fig.1  
 $S$  = safety factor obtained from the Table E1  
 $b$  = smaller dimension of the glass pane (mm)  
 $p$  = local sea pressure as given in 301 (kN/m<sup>2</sup>)

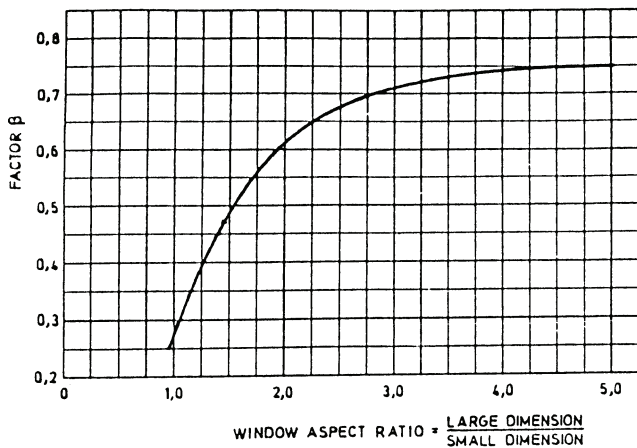


Fig. 1  
Curve for factor  $\beta$  based on window size ratio

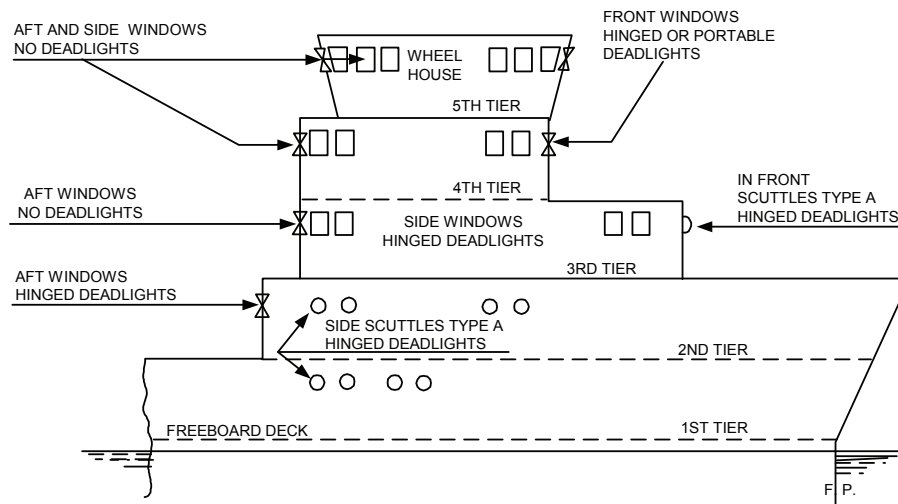


Fig. 2  
Side scuttles and windows in supply vessel with complete superstructure and uppermost forecastle

Furthermore, the thickness of windows should not be taken less than 10 mm.

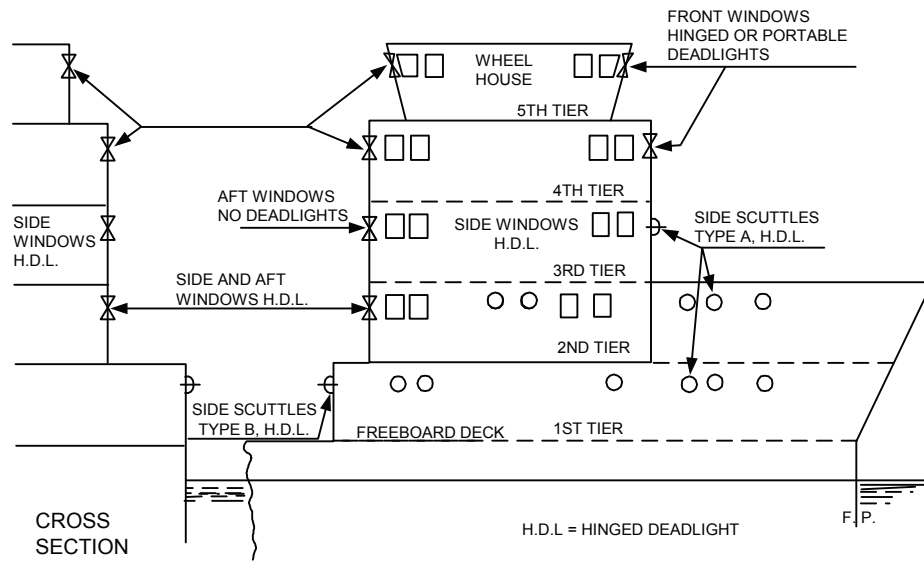
When laminated glass panes are used, to obtain the total thickness of the laminated panes, the calculated glass thickness according to the formula above shall be multiplied by 1.4.

Table E1 Safety factor (S)

Window and tier	2nd	3rd	4th	5th and above
Front or side	70	75	100	125
Aft	90	95	145	145

409 Windows of design not in accordance with recognised international standards shall be especially approved by the Society. Drawings showing details of the frame design, its fixation and material specification shall be submitted for approval.

410 For large windows with the lower edge positioned at or less than 900 mm above the deck, provision of handrails at a level approximately 1 m above the deck shall be considered when applicable.



**Fig. 3**  
Side scuttles and windows in supply vessel with forecastle only

## SECTION 4

### ADDITIONAL CLASS NOTATION **SF**. DAMAGE STABILITY FOR OFFSHORE SERVICE VESSELS

#### A. General

##### A 100 Classification

**101** The rules given below apply to vessels designed especially for services to offshore installations, but not necessarily complying with the requirements given in Sec.3 A, B and C for the class notation **Supply Vessel**.

**102** Vessels complying with the requirements for intact stability given in Sec.3 D and damage stability given in this section may be given the additional class notation **SF**, provided the Society upon consideration in each case finds these requirements to be appropriate for the vessel.

**103** Examination and approval of stability documents carried out by National Authorities having equivalent intact and damage stability requirements (i.e. Guidelines for the Design and Construction of Offshore Supply Vessels, 2006, IMO Res.MSC.235(82)) may be accepted as a basis for assigning the additional class notation **SF**.

In such cases the stability manual approved by the National Authorities shall be submitted as documentation of compliance with the rule requirements.

**104** Cargo ships not complying with the definition of "Offshore supply vessel" as set out in paragraph 1.2.1 of the IMO guidelines may not use compliance with additional class notation **SF** for exclusion of compliance with application of SOLAS Ch. II-1, Part B-1.

#### B. Damage Stability

##### B 100 Damage stability manual

**101** The damage stability manual shall contain the following information:

- curves for limiting VCG (centre of gravity above keel) or GM values for both intact and damage conditions and the resultant curve showing the permissible area of operation.

##### B 200 Damage stability

**201** The following damage assumptions apply:

- damage shall be assumed anywhere in the vessel's length between transverse watertight bulkheads
- the longitudinal extent of damage shall be assumed as follows: vessels with the length ( $L_F$ ) greater than 43 m, 3 m plus 3% of the vessels length. For those with length not greater than 43 m, 10% of the vessel's length
- the vertical extent of damage shall be assumed from the underside of the cargo deck or the continuation thereof, for the full depth of the vessel
- the transverse extent of damage shall be assumed as 760 mm, measured inboard from the side of the vessel perpendicularly to the centre line at the level of the summer load waterline
- a transverse watertight bulkhead extending from the vessel's side to a distance inboard of 760 mm or more at the level of the summer load line joining longitudinal watertight bulkheads may be considered as a transverse watertight bulkhead for the purpose of the damage calculations
- if damage of a lesser extent than that specified above results in a more severe condition, such lesser extent shall be assumed

- where a transverse watertight bulkhead is located within the transverse extent of assumed damage and is stepped in way of a double bottom or side tank by more than 3.05 m, the double bottom or side tanks adjacent to the stepped portion of the transverse watertight bulkhead shall be considered as flooded simultaneously
- as far as practicable, tunnels, ducts or pipes which may cause progressive flooding in case of damage, shall be avoided in the damage penetration zone. If this is not possible, arrangements shall be made to prevent progressive flooding to volumes assumed intact. Alternatively, these volumes shall be assumed flooded in the damage stability calculations
- the scantlings of tunnels, ducts, pipes, doors, staircases, bulkheads and decks, forming watertight boundaries, shall be adequate to withstand pressure heights corresponding to the deepest equilibrium waterline in damaged condition.

##### Guidance note:

The length of the vessel,  $L_F$ , is defined in Pt3 Ch.1 Sec.1 B.

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**202** The permeability of compartments assumed to be damaged shall be taken as given in Table B1.

Table B1 Permeabilities	
Spaces	Permeability
Appropriated to stores	0.60
Occupied by accommodation	0.95
Occupied by machinery	0.85
Void spaces	0.95
Intended for dry cargo	0.95

The permeability of tanks shall be consistent with the amount of liquid carried, as shown in the loading conditions specified in Sec.3 D200. The permeability of empty tanks shall be assumed not less than 0.95.

**203** The following damage stability criteria shall be complied with for all relevant damage cases and loading conditions:

- the final waterline, taking into account sinkage, heel and trim, shall be below the lower edge of any opening through which progressive flooding may take place. Such openings shall include air pipes and those which are capable of being closed by means of weathertight doors or hatch covers and may exclude those openings closed by means of watertight manhole covers and flush scuttles, small watertight cargo tank hatch covers which maintain the high integrity of the deck, remotely operated watertight sliding doors and side scuttles of the non-opening type
- in the final stage of flooding, the angle of heel due to unsymmetrical flooding shall not exceed 15°. This angle may be increased to 17° if no deck immersion occurs
- the stability in the final stage of flooding shall be investigated and may be regarded as sufficient if the righting lever curve has at least a range of 20° beyond the position of equilibrium in association with a maximum residual righting lever of at least 100 mm within this range. Unprotected openings shall not become immersed at an angle of heel within the prescribed minimum range of residual stability unless the space in question has been included as a floodable space in calculations for damage stability. Within this

range, immersion of any of the openings referred to above and any other openings capable of being closed weather-tight may be authorised

- VCG or GM limiting values calculated on the basis of the vessel's characteristics in relation to the damage stability criteria shall be presented in the form of a curve or diagram
- the stability during intermediate stages of flooding, if relevant, shall be to the satisfaction of the Society.

**Guidance note:**

Hinged watertight doors equipped with quick acting closing and indication to the bridge may be accepted in lieu of remotely operated watertight sliding doors under the provision that they are kept closed at sea. Ref. also Pt.3 Ch.3 Sec.6 G

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## SECTION 5 FIRE FIGHTERS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels intended for fighting fires onboard ships and on offshore and onshore structures. It is intended that these types of vessel shall act as additional fire-fighting stations, by providing water to combat fire and in support of ongoing rescue operations.

##### Guidance note:

Arrangements for survivor rescue and recovery is not part of the Fire Fighter notations.

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**102** Vessels built in compliance with the relevant requirements specified in this section may be given the class notation **Fire Fighter I** or **Fire Fighter II** or **Fire Fighter III**.

**103** The class notation **Fire Fighter I** implies that the vessel has been built for early stage fire fighting and for support of rescue operations onboard or close to structures or ships on fire. The vessel shall be designed with passive and active protection, giving it the capability to withstand higher heat radiation loads from external fires.

**104** The class notation **Fire Fighter II** or **Fire Fighter III** implies that the vessel has been built for continuous fighting of large fires from a safe distance and for the cooling of structures on fire.

**105** The class notation **Fire Fighter III** requires a larger water pumping capacity and more comprehensive fire fighting equipment when compared to the class notation **Fire Fighter II**.

**106** If a vessel has been fitted with fire fighting systems and equipment in accordance with the class notation **Fire Fighter II** or **Fire Fighter III** and has also been designed with passive and active heat radiation protection in accordance with the class notation **Fire Fighter I**, then the combined class notation **Fire Fighter I** and **Fire Fighter II** or **Fire Fighter I** and **Fire Fighter III** may be given.

#### A 200 Scope

**201** The fire fighter class notations encompass the following:

- the vessel's fire fighting capability
- the vessel's stability and its ability to keep its position when the fire fighting water monitors are in operation
- the vessel's passive and active heat radiation protection against external fires.

#### A 300 Assumptions

**301** Granting of fire fighter class notations will be based on the assumption that the following has been complied with when operating the vessel as a fire fighter:

- the instructions laid down in the Operation Manual for fire fighting are being followed
- the vessel will carry a sufficient quantity of fuel oil for continuous fire fighting operations, with all fixed water monitors in use for a period of not less than: 24 hours for class notation **Fire Fighter I**, and 96 hours for class notation **Fire Fighter II** or **Fire Fighter III**
- foam-forming liquid for at least 30 minutes continuous foam production for the fixed foam monitors is stored onboard vessels with class notation **Fire Fighter III**
- foam-forming liquid for at least 30 minutes continuous foam production by the mobile generator is stored in suit-

able containers onboard vessels with class notation **Fire Fighter II** or **Fire Fighter III**

- the crew operating the fire fighting systems and equipment has been trained in such operations, including the use of air breathing apparatus.
- the skill of the crew is maintained by exercises (drills).

#### A 400 Documentation

**401** The following plans and particulars shall be submitted for approval:

- manual for the operation of the fire fighting installation and the manoeuvring of the vessel during fire fighting
- location of adjustable floodlights for illumination when the vessel is operating in darkness
- location of the high pressure compressor for filling the cylinders of the air-breathing apparatus
- location and arrangement of stations for fireman's outfits
- arrangement and location of the fire fighting pumps, their prime movers and the water monitors including data for the monitors
- foundations for the fire fighting pumps, their prime movers and the water monitors
- arrangement and design of seawater inlets for the water monitor system
- fire fighting piping systems with specification of pump characteristics, water flow velocities and corrosion protection in the pipelines
- system for remote control of the water monitors
- location of hose connections and hose stations for the mobile fire fighting equipment.

For class notation **Fire Fighter I** only:

- structural fire integrity of outer boundaries, including external doors and windows
- water-spraying piping system with location of the nozzles, pumps and valves etc., internal and external corrosion protection of the pipelines.

For class notation **Fire Fighter II** or **Fire Fighter III**:

- particulars of foam generator and containers for storing of foam-forming liquid.

For class notation **Fire Fighter III** only:

- arrangement of foam monitors including data for the monitors
- foundations for the foam monitors
- arrangement of foam concentrate tank, foam-mixing unit and piping to the monitors
- system for remote control of the foam monitors.

**402** The following calculations shall be submitted for approval:

- calculation showing the point of balance between the reaction forces from the water monitors and the forces from the vessel's propulsion machinery and its side thrusters
- calculation proving satisfactory stability of the vessel when all monitors are in operation at full capacity in the most adverse direction for the stability
- report on inclining test determining the centre of gravity and the light weight of the completed vessel.

#### A 500 Certification

**501** Certificates shall be required for the components shown in Table A1:

Table A1 Required certificates			
Components	DNV product certificate	Works certificate	Test report
Fire fighting pumps and their prime movers	X		
Compressors for filling the cylinders of air-breathing apparatus	X		
Pipes and valves		X	
Foam liquid suitable for its intended use			X

**Guidance note:**

The definition of the certificates is given in Pt.1 Ch.1 Sec.4

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## A 600 Testing

**601** Testing shall be carried out to verify that the vessel, fitted with fire fighting systems and equipment, is able to operate as intended and has the required capacities. The height and length of throw of the water monitors shall be demonstrated. The angle of list, with water monitors in operation, shall also be measured.

**602** For notation **Fire Fighter I**, fire main capacities shall be tested as follows:

- The static pressure measured at the fire hydrant manifold shall be not less than 0.25 N/mm<sup>2</sup> with four (4) jets of water from hoses simultaneously engaged to one of the fire hydrant manifolds required in G100.
- In a separate test, both water monitors shall be tested in operations simultaneously with the active heat radiation protection system in operation for not less than one (1) hour or until the temperature of the dedicated fire fighter pumps' prim-movers are stabilised.

**603** For notation **Fire Fighter II**, the number of hoses simultaneously engaged shall be not less than six (6) and for notation **Fire Fighter III** not less than eight (8) for the test specified in 602.

## B. Basic Requirements

### B 100 Operation manual

**101** The following information shall be included in an approved operation manual kept onboard:

- line of responsibility and delegation of tasks
- description of each fire fighting system and the equipment covered by the classification
- safety precautions and start-up procedures
- instructions for use, testing and maintenance of the fire fighting installations and the equipment (or may be only referred to)
- instructions for operation of the vessel during fire fighting
- plan and records for periodically testing and drills.

### B 200 Manoeuvrability

**201** The vessel shall have side thrusters and propulsion machinery of sufficient power for adequate manoeuvrability during fire fighting operations.

**202** Side thruster(s) and main propeller(s) shall be able to keep the vessel at a standstill in calm waters at all combinations of capacity and direction of throw of the water monitors,

and the most unfavourable combination shall not require more than 80% of the available propulsion force in any direction.

**203** If the system design is such that, in any operating combination, it will be possible to overload the power supply, a power management system shall be arranged. This system shall include alarm at 80% of available power and automatic action at 100% available power.

**204** The operation of the side thruster(s) and the main propeller(s) shall be simple and limited to the adjustment of:

- resultant thrust vector for the vessel
- possible adjustment of the turning moment
- possible adjustment of heading (gyro stabilised).

Operation shall be arranged at the workstation where the monitors are controlled.

**205** It shall be visually indicated when this workstation has control. Failure in the control system shall initiate an alarm.

### B 300 Floodlights

**301** As an aid for operations in darkness, at least two adjustable floodlights shall be fitted onboard, capable of providing an illumination level of 50 lux in clear air, within an area not less than 10 m diameter, to a distance of 250 m. The floodlights shall be of high pressure sodium vapour type or equivalent.

## C. Protection of the Vessel against External Heat Radiation (Class Notation Fire Fighter I)

### C 100 Passive fire protection against external heat radiation

**101** Hull and superstructure shall be constructed of steel. External doors and hatches shall be of steel. Windows in boundary of superstructure, including bridge shall comply with A-0 class. External platforms and exposed piping systems shall be of steel.

### C 200 Active fire protection against external heat radiation

**201** The vessel shall be protected by a permanently installed water-spraying system. Water shall be applied by means of sprinkler nozzles, monitor nozzles and water shield nozzles or a combination thereof. Vertical sides of superstructures shall be protected by spray nozzles.

**202** The fixed water-spraying system shall provide protection for all outside vertical areas of hull, superstructures and deckhouses including foundations for water monitors, essential external equipment for fire fighting operations and external life rafts and lifeboats and rescue boats. Water spray may be omitted for bulwark and rails.

**203** The arrangement for the water-spraying system shall be such that necessary visibility from the wheelhouse and the control station for remote control of the fire fighting water monitors can be maintained during the water spraying.

**204** The pipelines and nozzles shall be so arranged and protected that they will not be exposed to damage during the operations for which the vessel is intended.

**205** The fixed water-spraying system shall have a capacity not less than 10 litres per minute per m<sup>2</sup> of the areas to be protected. For areas internally insulated to class A-60, however, a capacity of 5 litres per minute per m<sup>2</sup> may be accepted.

**206** The pumping capacity for the fixed water-spraying system shall be sufficient to deliver water at the required pressure for simultaneous operation of all nozzles in the total system.

**207** The pumps for the fire fighting water monitors may also serve the water-spraying system, provided the pump capacity



is increased by the capacity required for the water spraying system. A connection with shut-off valve is then to be fitted between the fire main for the monitors and the main pipeline for the water spraying system. Such arrangements shall allow for separate as well as simultaneous operation of both the fire fighting water monitors and the water spray system.

**208** All pipes for the fixed water-spraying systems shall be protected against corrosion both externally and internally, by hot galvanizing or equivalent. Drainage plugs shall be fitted to avoid damages by freezing water.

**209** The spray nozzles shall provide an effective and even

distribution of water spray over the areas to be protected. The spray nozzles are subject to the Society's approval for their purpose.

## D. Water Monitor System

### D 100 Capacities

**101** The requirements for the various class notations are given in Table D1.

Table D1 Water monitor system capacities						
Class notation	Fire Fighter I		Fire Fighter II		Fire Fighter III	
Number of monitors	2	2	3	4	3	4
Capacity of each monitor (m <sup>3</sup> /h)	1 200	3 600	2 400	1 800	3 200	2 400
Number of pumps	1-2		2-4		2-4	
Total pump capacity (m <sup>3</sup> /h)	2 400		7 200		9 600	
Length of throw (m) <sup>1)</sup>	120	180	150		180	150
Height of throw (m) <sup>2)</sup>	50	110	80		110	90
Fuel oil capacity in hours <sup>3)</sup>	24		96		96	
1) Measured horizontally from the mean impact area to the nearest part of the vessel when all monitors are in satisfactory operation simultaneously.						
2) Measured vertically from sea level to mean impact area at a horizontal distance of at least 70 m from the nearest part of the vessel.						
3) Capacity for continuous operation of all monitors, to be included in the total capacity of the vessel's fuel oil tanks.						

### D 200 Arrangement

**201** The monitors shall play either forward or aft. The horizontal angular movement of each monitor shall be at least 90°, with minimum play across the vessels centre line of 30°. The necessary angular movement in the vertical direction is determined by the required height of throw of the water jet.

The monitors shall be so positioned that they will have a free line for the water jet over the horizontal area covered.

**202** At least two of the water monitors shall have a fixed arrangement making dispersion of the water jet possible.

**203** The monitors shall be so arranged that the required length and height of throw can be achieved with all monitors operating simultaneously along the centre line of the vessel.

### D 300 Monitor control

**301** The activating and the manoeuvring of the monitors shall be remotely controllable. The remote control station shall be arranged in a protected control room with a good general view.

The valve control shall be designed to avoid water hammer.

**302** As a minimum, there shall be arranged two independent control systems such that a single failure will not disable more than 50% of the monitors installed. Failure in any remote control system shall initiate an alarm at the workstation from where the monitors are controlled.

**303** Open and closed indication of remotely controlled valves, if fitted, shall be indicated at the remote control station.

**304** Where an electrical control system is applied, each control unit shall be provided with overload and short-circuit protection, giving selective disconnection of the circuit in case of failure.

Where a hydraulic or pneumatic control system is applied, the control power units shall be duplicated.

**305** In addition to the remote control, local and manual control of each monitor shall be arranged.

#### Guidance note:

It is advised that the local and manual control devices are automatically disconnected when remote operation is applied.

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**306** All shut-off and control equipment shall be clearly marked.

### D 400 Design and support of monitors

**401** The monitors and their foundations shall be capable of withstanding the loads to which they may be subjected on the open deck, dynamic loads resulting from the vessel's movement at sea, as well as the reaction forces from the water jet.

**402** The monitors shall be able to give a solid water jet, so that the impact area will be concentrated and limited. The materials applied shall be selected with due regard to the corrosive properties of seawater and saline air. The monitors shall be of a design approved by the Society.

## E. Foam Monitor System. (Class notation III)

### E 100 Capacities

**101** In addition to the water monitors, the vessel shall be equipped with 2 foam monitors, each of a capacity not less than 5000 litres/minute with a foam expansion ratio of maximum 15 to 1.

**102** The foam system, together with the arrangement and location of the monitors, shall give a height of throw at least 50 m above sea level when both monitors are used simultaneously with maximum foam generation.

**103** The foam concentrate tank shall have capacity for at least 30 minutes of maximum foam generation from both foam monitors. When determining the necessary quantity of foam concentrate, the admixture is assumed to be 5%.

### E 200 Arrangement

**201** The arrangement shall comply with the same principles as given under D201.

**202** The foam generating system shall be of a fixed type with separate foam concentrate tank, foam-mixing unit and pipelines to the monitors. The water supply to the system may be taken from the main pumps for the water monitors. In such cases it may be necessary to reduce the main pump pressure to ensure correct water pressure for maximum foam generation.

### E 300 Monitor control

**301** The foam monitors shall be remotely controllable. This also concerns the operation of the valves necessary for control of water and foam concentrate. The remote control of the foam monitors shall be arranged from the same control room as the control of the water monitors and the control system shall comply with the same principles as given in D302 to D304. Local/manual control of each monitor is also to be arranged.

**302** All shut-off and remote control equipment shall be clearly marked.

### E 400 Monitor design

**401** The foam monitors shall be of a design approved by the Society.

## F. Pumps and Piping

### F 100 General

**101** The arrangement shall be such that the water monitors will be able to deliver an even jet of water without pulsations of significance.

**102** The requirements for pumping and piping systems given for systems covered by the main class, as well as the requirements for standard water extinguishing appliances and appliances for fire extinguishing on open decks given for main class, shall be complied with as far as applicable to systems fighting fires outside the vessel.

### F 200 Pumps

**201** The pumps for the fire fighting system and the machinery driving the pumps shall be adequately protected, and shall be so located that they will be easily accessible during operation and maintenance.

### F 300 Seawater inlets and sea chests

**301** Seawater suctions for fire fighting pumps shall not be arranged for other purposes. The seawater suction valve, the pressure valve and the pump motor shall be operable from the same position. Valves with nominal diameter exceeding 450 mm shall be power actuated as well as manually operable.

**302** An interlock shall prevent start or engagement of the gear for the fire fighting pumps when the water inlet valve is closed and the pressure valve is open.

Alternatively, warning by means of audible and visual alarm shall be given if starting of the fire fighting pumps or engaging gears for the pumps is carried out with the inlet valve closed and the pressure valve open. This alarm shall be given at all control positions for the start or engagement of the gear for the fire fighting pumps.

**303** Suitable means for filling the water monitors' supply piping downstream of the pressure valves and up through the monitors whilst the pressure valves are in the closed position, shall be arranged.

**304** Seawater inlets and sea chests shall be of a design ensuring an even and sufficient supply of water to the pumps. The location of the seawater inlets and sea chests shall be such that the water supply is not impeded by the ship's motions or by the water flow to and from bow thrusters, side thrusters, azimuth thrusters or main propellers.

**305** Strums shall be fitted to the sea chest openings in the shell plating. The design maximum water velocity through the strum holes is not to exceed 2 m/s.

### F 400 Piping systems

**401** The piping system from the pumps to the water monitors shall be separate from the piping system to the hose connections required for the mobile fire fighting equipment.

**402** The piping systems shall have arrangements to avoid overheating of the pumps at low delivery rates.

**403** Suctions lines shall be designed to avoid cavitations in the water flow. The lines are to be as short and as straight as practicable. Pump shall preferably be located below the water line.

In any case shall the net positive suction head (NPSH) for the pump system be designed according to the following formula:

$$\text{NPSH available} - 1 \text{ meter water column} > \text{NPSH required}$$

For pumps located above water line an approved self priming system shall be provided.

#### Guidance note:

NPSH available is the ship specific available net suction head (expressed in meter water column - mwc) as function of the elevation of the pump in relation to the waterline deduced for the pressure losses in the sea chest and supply piping up to the inlet flange of the pump

NPSH required is the net suction head (expressed in mwc) required by the pump in question in order to prevent cavitation

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**404** All piping from seawater inlets to water monitors shall be internally protected against corrosion to a degree at least corresponding to hot galvanizing. Paint is accepted as external corrosion protection of piping exposed to weather.

The part of pipes passing through fuel oil tanks shall have thickness as for ballast pipes passing through fuel oil tanks in accordance with Pt.4 Ch.6 Sec.6 Table A2. The corrosion protection of the pipes within the tank shall be to the same level as the internal tank structure, while internal corrosion protection may be excluded for this part. A system for drainage the pipes within the fuel tank shall be arranged. Instruction shall be included in the operation manual for draining of these pipes upon completion of a fire fighting operation.

**405** The piping layout shall be in accordance with good marine practice with large radius bends, and shall be satisfactorily protected against damage.

## G. Mobile Fire Fighting Equipment

### G 100 Fire hydrants manifolds and hoses for external use

**101** In addition to the fire hydrants required for onboard use, fire hydrant manifolds shall be provided on the port and starboard sides of the weather deck. The hose connections shall therefore point outwards.

**102** Vessels with class notation **Fire Fighter I** shall have one fire hydrant manifold arranged on the port side and one on the starboard side, each with at least 4 hose connections.

**103** For class notation **Fire Fighter II** the number of additional hose connections at each of the fire hydrant manifolds positioned on the port and starboard sides shall be not less than six (6) and for class notation **Fire Fighter III** not less than eight (8).

**104** In addition to the required number of hoses for onboard use, at least 8 x 15 m fire hoses of 50 mm diameter and 4 combined 16 mm jet and water spray nozzles shall be kept onboard in a readily available positions for class notation **Fire Fighter I**. For class notation **Fire Fighter II**, the number shall be increased to 12 hoses and 6 nozzles and for class notation **Fire Fighter III** to 16 hoses and 8 nozzles.

**Table G1 Overview of additional hydrant manifolds, hose connections and nozzles**

	<i>Number of fire hydrant manifolds</i>		<i>Number of hose connections at each manifold</i>	<i>Total number of hose connections</i>	<i>Number of additional hoses <sup>1)</sup></i>	<i>Number of additional nozzles <sup>2)</sup></i>
<b>Fire Fighter I</b>	Port	Starboard	4	8	8	4
	1	1				
<b>Fire Fighter II</b>	1 or 2	1 or 2	6	12	12	6
			3	12	12	6
<b>Fire Fighter III</b>	1 or 2	1 or 2	8	16	16	8
			4	16	16	8
1) Length 15 m, diameter 50 mm						
2) Combined 16 mm spray/jet						

**105** The pressure in the fire hydrant manifold shall be not less than 2.5 bar and maximum 5 bar when tested as described in A600 with one length of hose fitted with a standard 16 mm nozzle fully open on each hose connection on one fire hydrant manifold.

**106** The pumps for monitors and or water spray system may be used for supply of water to the fire hydrant manifolds required by 101 providing the capacity is increased so that all connected consumers can be simultaneously served. In such case connections with shut-off valves shall be fitted between the fire main for the monitors and or water spray system in order to allow for separate as well as simultaneously operation of fire fighting water monitors and/or the water spray system as well as hoses connected the fire hydrant manifolds.

Further, valves to be arranged for independent supply to the fire hydrant manifolds without having the monitor and or the water spray in use.

**107** Hoses and nozzles shall be of a design approved by the Society.

## **G 200 Foam generator**

**201** Vessels with class notation **Fire Fighter II** or **Fire Fighter III** shall have a mobile high expansion foam generator with a capacity of not less than 100 m<sup>3</sup>/minute for fighting of external fires.

**202** Foam-forming liquid shall be stored in containers, each of about 20 litres, suitable for mobile use. The total storing capacity of foam-forming liquid shall be sufficient for 30 minutes continuous foam production.

## **H. Firefighter's Outfit**

### **H 100 Number and extent of the outfits**

**101** Vessels with class notation **Fire Fighter I** shall have at least 4 sets of firefighter's outfits.

**102** Vessels with class notation **Fire Fighter II** shall have six (6) fire-fighter's outfits, and vessels with class notation **Fire Fighter III** shall have eight (8) fire-fighter's outfits.

**103** The extent of the fire fighter's outfits shall be as specified for main class. Each breathing apparatus shall have a total air capacity of at least 3600 litres including the spare cylinders.

### **H 200 Location of the firefighter's outfits**

**201** The firefighter's outfits shall be placed in at least two separate fire stations of which one shall have access from the

open deck. The entrance to the fire station shall be clearly marked. The room shall be arranged for ventilation and heating.

**202** The arrangement of the fire station shall be such that all equipment will be easily accessible and ready for immediate use.

## **H 300 Compressed air supply**

**301** A high pressure compressor with accessories suitable for filling the cylinders of the breathing apparatuses, shall be installed onboard in the safest possible location. The capacity of the compressor shall be at least 75 litres/minute. The air intake for the compressor shall be equipped with a filter.

## **I. Stability and Watertight Integrity**

### **I 100 General requirements**

**101** The vessel's stability shall be assessed when the water monitor(s) is (are) in the most unfavourable direction with respect to stability.

The monitor heeling moment shall be calculated based on the assumption in 102. The criterion in 103 shall be complied with.

#### **102 Monitor heeling moment**

The heeling force 'F' from the water monitor(s) shall be assumed in the transverse direction, based on full capacity as given in Table D1.

The monitor heeling arm 'a' shall be taken as the vertical distance between the centre of side thruster(s) and the centre line of the monitor(s).

#### **103 Criterion**

The monitor heeling lever, calculated as F·a/displacement, shall not exceed 0.5 times the maximum GZ corresponding to maximum allowable VCG.

If the maximum GZ occurs after 30 degrees, the GZ at 30 degrees shall be used instead of the maximum GZ.

#### **104 Documentation**

— Additional information in the stability manual on the monitor capacity, position, heeling force and moment as well as plotting the monitors' heeling lever on the GZ diagram of the most unfavourable loading conditions.

Detailed description of stability documentation is given in Classification Note No. 20.1.

## SECTION 6 PIPE LAYING VESSELS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels specially intended for laying pipelines on the sea bottom.

**102** Vessels built in compliance with the requirements in this section may be given the class notation **Pipe Laying Vessel**.

#### A 200 Scope

**201** The following matters are covered by the classification:

- hull structural details related to the pipe laying operations
- supporting structures for equipment applied in the pipe laying operations
- equipment for anchoring and mooring
- equipment and installations for pipe laying
- equipment for positioning during pipe laying
- stability and floatability.

#### A 300 Documentation

**301** The following plans and particulars are in general to be submitted for approval:

- fender arrangement or other protection of side plating
- pipe support arrangement on the pipe ramp. Maximum forces to be stated
- tensioner arrangement and supporting structures. Tensioner capacities to be stated
- plans showing fastening of stinger to hull. Maximum forces to be stated
- plans showing location and supports of cranes and davits. Reaction forces to be stated
- plans showing supporting structures for stowed pipes. Maximum weight of stored pipes to be stated
- plans showing supporting structures for the reel(s) when piping is stored on reel(s). Information on maximum weight of reel with pipe, including water if the pipe shall be hydraulically tested on board
- information on the vessel's stability and floatability in all operating modes
- stability and floatability calculations.

**302** Plans to be submitted for approval if anchoring system is installed for positioning during pipe laying:

- general arrangement of anchoring system. Cable forces and limiting cable angles to be stated
- plan of supporting structures for winches
- plan of force transmitting structures at points where the cables change direction.

**303** Plans to be submitted for approval for barge intended for being pulled by tugs during pipe laying:

- general arrangement of pulling system. Cable forces and limiting cable directions to be stated
- plan of structures transmitting the pulling forces to the hull.

### B. Hull Arrangement and Strength

#### B 100 General

**101** The hull structural strength shall be as required for the main class taking into account necessary strengthening of supporting structures for equipment applied in the pipe laying operations.

**102** For catamarans, semi-submersibles and other special hull configurations, the hull structural strength will be specially considered.

### C. Anchoring and Mooring Equipment

#### C 100 General

**101** The equipment for mooring and anchoring, i.e. anchors, chain cables, windlass, mooring ropes etc., are in general to be as required for the main class.

**102** For catamarans, semi-submersibles and other special hull configurations, the equipment will be specially considered.

**103** Equipment for positioning during pipe laying will be specially considered.

### D. Pipe Laying Equipment and Installations

#### D 100 General

**101** The equipment and installations will be specially considered.

### E. Stability and Floatability

#### E 100 General

**101** All vessels shall comply with the intact and damage stability requirements as given in Pt.3 Ch.3 Sec.9.

**102** Vessels having a subdivision length (Ls) of less than 80 m and where special personnel are engaged in the special work carried out, shall comply with IMO Res. A.534(13) Code of Safety for Special Purpose Ships.

#### Guidance note:

Vessels above 80 m should normally comply with the damage stability and subdivision requirements as applicable for cargo ships. However, if required by the flag authority, IMO Res. A.534(13) Code of Safety for Special Purpose Ships may be applied as an alternative.

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## SECTION 7 CRANE VESSELS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels specially intended for lifting operations, and which for that purpose are equipped with crane(s) or similar lifting appliance(s).

**102** Vessels built in compliance with the requirements in this section may be given the class notation **Crane Vessel**.

**103** Vessels complying with the requirements for the class notation **Barge** (see Sec.14) and which comply with the requirements of this section, may be given the class notation **Crane Barge**.

#### A 200 Scope

**201** The following matters are covered by the classification:

- hull structural details related to the lifting operations
- supporting structures for the crane
- devices for locking the crane in parked position (vessel at sea)
- the crane itself with respect to structural strength, safety equipment and functioning
- stability and floatability.

#### A 300 Documentation

**301** The following plans and particulars shall be submitted for approval:

- plans showing location of the crane during operation and in parked position, with information of forces which will be transferred to the hull
- plans showing supporting structures and strengthening of hull (deck) in way of supports
- arrangement plan of rack bar (toothed bar) with details of supports
- plans showing devices for locking the parked crane to the hull (vessel at sea)
- plans of electrical installations for the crane
- dynamic load charts for the crane.

For documentation related to stability requirements for heavy lift operations, see D200.

**302** The following plans and particulars shall be submitted for information:

- assembly plan showing principal dimensions of the crane and limiting positions of its movable parts.

**303** Documentation of control and monitoring systems shall be submitted for design assessment.

Pt.4 Ch.9 Sec.1 of these rules indicates the extent of required documentation.

### B. Hull Arrangement and Strength

#### B 100 General

**101** The hull structural strength is in general to be as required for the main class taking into account necessary strengthening for supporting the crane during operation and in parked position at sea.

### C. Crane with Substructure

#### C 100 General

**101** The crane shall be delivered with Det Norske Veritas' certificate in compliance with the "Rules for Certification of Lifting Appliances".

**102** Devices for locking the crane in parked position at sea will be specially considered taking into account environmental load conditions as indicated for the main class of the vessel.

**103** After completed installation on board, functional testing of the crane shall be carried out as specified in the "Rules for Certification of Lifting Appliances".

### D. Stability and Watertight Integrity

#### D 100 General

**101** The intact and damage stability criteria applicable to the ship shall be complied with at all times including when the crane is in use, except for the conditions with operational and or environmental limitations as described in D300 and D400.

This includes the main class requirements in Pt.3 Ch.3 Sec.9, voluntary class notations and D102 when applicable.

The accidental load drop criterion in D200 shall be investigated in all cases when counter ballasting is utilised.

For lifting conditions carried out within clearly defined limitations as set forth by D302 and D303, the alternative intact and damage stability criteria as set forth in D304 and D400 may be applied, subject to prior consent by the Society.

##### Guidance note:

Operational limitations may include environmental operation criteria, operation reference period (i.e. planned operation time plus contingency time), traffic control etc.

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**102** Vessels having a subdivision length (Ls) of less than 80 m and where special personnel are engaged in the special work carried out, shall comply with IMO Res. A.534(13) Code of Safety for Special Purpose Ships.

##### Guidance note:

Vessels above 80 m should normally comply with the damage stability and subdivision requirements as applicable for cargo ships. However, if required by the flag authority, IMO Res. A.534(13) Code of Safety for Special Purpose Ships may be applied as an alternative.

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**103** The following additional documentation is to be included in the stability manual:

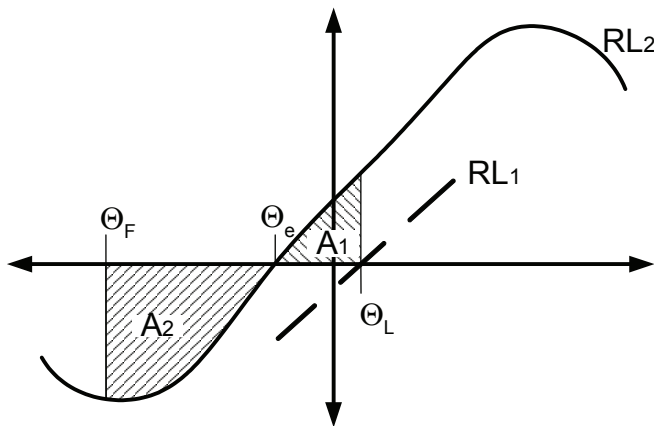
- Maximum crane heeling moment as a function of crane boom direction as well as the corresponding counter ballast moment, if used, at each draught as a function of the vertical centre of gravity.
- Loading conditions at maximum, minimum and intermediate draught(s) with maximum permissible crane load. The righting lever (GZ) curves before and after the load drop are to be presented for each loading condition where applicable.
- Limitations on crane operation, including permissible heeling angles, if provided.
- Instructions related to normal crane operation, including those for use of counter ballast.

- Instructions such as ballasting/de-ballasting procedures to righting the vessel following an accidental load drop.

#### D 200 Accidental load drop

**201** The effect of accidental drop of crane load shall be investigated and shall meet the following criteria:

- The restoring energy represented by area A2 in Fig.1 is to be at least 40% in excess of the potential energy represented by area A1.
- The angle of static equilibrium  $\Theta_e$  after loss of crane load shall not be more than 15 degrees from the upright.



**Fig. 1**  
Stability with loss of crane load

RL1 = Net righting lever (GZ) curve for the condition before loss of crane load, corrected for crane heeling moment and for the righting moment provided by the counter ballast if applicable.

RL2 = Net righting lever (GZ) curve for the condition after loss of crane load, corrected for the transverse moment provided by the counter ballast if applicable.

$\Theta_L$  = Static angle of equilibrium before loss of crane load.

$\Theta_L$  may alternatively be determined by the equation

$$\Theta_L = \arctan (TCG/GMt)$$

if this results in a small angle of heel.

TCG is then to be taken as the vessel's transverse centre of gravity before loss of crane load, and GMt is the corrected transverse metacentric height in the same condition.

$\Theta_e$  = Static angle of equilibrium after loss of crane load

$\Theta_F$  = Angle of down flooding as defined in Pt.3 Ch.3 Sec.9.

#### Guidance note:

Net righting lever implies that the calculation of the GZ curve includes the vessel's true transverse centre of gravity as function of the angle of heel.

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#### D 300 Alternative intact stability criteria during heavy crane lift

**301** The criteria given in 304 may be applied in lieu of the intact stability criteria according to Pt.3 Ch.3 Sec.9 for the crane loading conditions when operational and environmental limitations are imposed.

**302** The environmental limitation shall at least be specified as follows:

- maximum wind speed (1 minute sustained at 10 m above sea level)

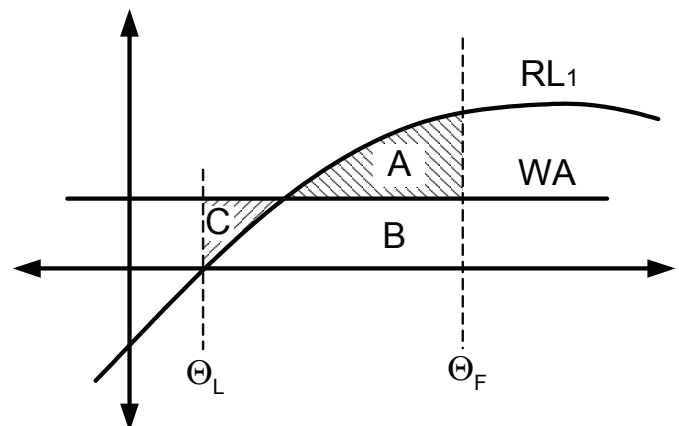
- maximum significant wave height.

**303** The operational limitations shall at least be specified as follows:

- maximum duration of the lift (operation reference period)
- limitations in vessel speed
- limitations in traffic/traffic control.

**304** The following criteria shall be met when the crane load is at the most unfavourable position:

- the deck edge shall not be submerged
- with the wind superimposed from the most unfavourable direction the area  $(A+B) \geq 1.4(B+C)$  in accordance with Fig.2
- the area under the GZ curve measured from the equilibrium position  $\Theta_L$  and to the down flooding angle  $\Theta_F$ , or 20 degrees, whichever is less shall be at least 0.03 mrad.



**Fig. 2**  
Alternative intact criteria

WA = The heeling arm due to wind forces (for wind speed see 302).

RL1 = Net righting lever (GZ) curve for the condition, corrected for crane heeling moment and for the righting moment provided by the counter ballast if applicable.

$\Theta_L$  = Static angle of equilibrium.

$\Theta_F$  = Angle of down flooding as defined in Pt.3 Ch.3 Sec.9.

#### Guidance note:

Net righting lever implies that the calculation of the GZ curve includes the vessel's true transverse centre of gravity as function of the angle of heel.

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#### D 400 Alternative damage stability criteria during heavy crane lift

**401** The flooding scenario given in 402 and survival criteria given in 403 may be applied in lieu of the damage stability criteria according to Pt.3 Ch.3 Sec.9 and additional class notations for the crane loading conditions when operational and environmental limitations as listed in D302 and D303 are imposed.

**402** Accidental flooding of any one compartment bounded by the shell or which contains pipe systems leading to the sea shall be investigated for the relevant loading conditions.

**403** In the flooded condition the following criteria shall be complied with:

- the maximum angle of heel shall be less than 15 degrees
- no immersion of openings through which progressive flooding may occur
- the area under the GZ-curve shall be greater than 0.015 mrad.



## SECTION 8 DREDGERS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels specially intended for dredging.

**102** Vessels built in compliance with the requirements in this section may be given the class notation **Dredger**.

#### A 200 Scope

**201** The following matters are covered by the classification:

- hull structural details related to the dredging operations
- supporting structures for the dredging equipment.

**Guidance note:**

The Society may on request supervise the construction and testing of the following items not covered by the classification:

- equipment for anchoring and mooring during dredging
- equipment and installations for dredging.

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#### A 300 Documentation

**301** The following plans and particulars shall be submitted for information or approval:

- arrangement plan for the dredging equipment and installations
- plans showing supporting structures and hull strengthening.

### B. Hull Arrangement and Strength

#### B 100 General

**101** The hull structural strength shall be as required for the main class taking into account necessary strengthening of supporting structures for equipment applied in the dredging operations.

## SECTION 9 WELL STIMULATION VESSELS

### A. Classification

#### A 100 Application

**101** The rules in this section apply to vessels arranged and equipped for stimulation of wells for production of oil and or gas.

The requirements are supplementary to those given for assignment of main class.

#### A 200 Class notation

**201** Vessels built and equipped according to the rules in this section may be given the additional class notation **Well Stimulation Vessel** or **Well Stimulation Barge**, whichever is relevant.

#### A 300 Scope

**301** The following matters will be covered by the additional class:

- tanks, pumping and piping arrangement, equipment and instrumentation related to the storage and handling of well stimulation fluids
- personnel protective equipment
- intact and damage stability of the vessel.

#### Guidance note:

Arrangements involving return of fluids from the well are not covered by the present rules.

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#### A 400 Documentation

**401** In 403 to 407 plans and particulars and operation manual to be submitted for approval are specified. Other plans, specifications or information may be required depending on the arrangement and the equipment provided in each case.

**402** For general requirements for documentation of instrumentation and automation, including computer based control and monitoring, see Pt.4 Ch.9 Sec.1.

**403** Plans and particulars for arrangements and equipment:

- arrangement of tanks
- pumping arrangements
- arrangement of ventilation pipes from acid tanks
- mechanical ventilation arrangement of closed and semi-enclosed spaces containing acid tanks, pipes, pumps and mixing units
- drawings showing location of all electrical equipment in areas with installations for uninhibited acid
- single line diagram for intrinsically safe circuits
- list of explosion protected equipment, with reference to drawings, together with certificates.

**404** Plans with the following particulars for tanks:

- drawing of acid tanks including information of non-destructive testing of welds, strength and tightness testing of tanks and specification of lining
- drawing of support and staying of independent tanks
- documentation for liquid nitrogen tanks as required by Ch.5 for liquefied gas carriers.

**405** Plans and particulars of pumping and piping:

- diagrams of piping for acid, nitrogen and liquid additives including details such as flange connections and securing of pipes

- drawings of pumps and mixers
- specification and information on high pressure flexible hoses with end connections
- stress analysis of piping for liquid nitrogen
- drawings and particulars for nitrogen vapouriser
- stress analysis of high pressure piping
- drawings and particulars including stress analysis of nitrogen heat exchangers.

**406** Operation manual for well stimulation procedures shall be submitted for approval, see I.

**407** Documentation for the control and monitoring system for the following shall be submitted for approval:

- cargo tank level measurement system
- cargo tank overflow protection system
- emergency shut-down system
- hydrogen indication equipment
- hydrogen chloride indication equipment
- oxygen indication equipment.

For requirements to documentation types, see Pt.4 Ch.9.

#### A 500 Certification of control and monitoring system

**501** The following control and monitoring system shall be certified according to Pt.4 Ch.9:

- cargo tank level measurement system
- cargo tank overflow protection system
- emergency shut-down system.

### B. Arrangement

#### B 100 Tanks and pumping arrangement

**101** Tanks for acid and liquefied nitrogen shall be located at a minimum distance of 760 mm from the vessel's side and bottom.

**102** Tanks and pumping arrangements shall not be located within accommodation areas or machinery spaces.

**103** Tanks and piping systems for the well stimulation plant shall be separated from the machinery and ship piping systems.

**104** Remote control of the well stimulation processing plant shall be arranged from a position outside the area where the well stimulation systems are located.

**105** Tanks and pumping arrangements for liquid additives having flashpoint below 60°C shall comply with relevant requirements of Sec.10.

Arrangement of pump room for **LFL** (low flashpoint liquids) substances adjacent to the **LFL** tanks and without separating cofferdams may be considered in each case.

**106** Requirements for tanks and pumping arrangements for chemicals other than acids dealt with under F will be considered in each case with due regard to the properties of the chemicals and applicable requirements of Ch.4.

#### B 200 Tank venting

**201** Outlets from safety valves of nitrogen tanks shall be lead to open deck. Outlet pipes shall be arranged and supported in order to allow thermal expansion during release of cold gas. Penetrations of decks or bulkheads shall be such that the structures are thermally isolated from the cold pipes.

**202** Vent outlets from acid tanks shall be lead to open deck.

The outlets shall have a minimum height of 4 m above the deck and located at a minimum horizontal distance of 5 m from openings to accommodation and service spaces.

**203** Vent outlets from acid tanks shall have pressure/vacuum valves. The outlets shall be provided with flame screens.

### **B 300 Access openings**

**301** Enclosed spaces containing tanks, piping, pumps and blenders for uninhibited acid shall have entrances direct from open deck or through air locks from other spaces. The air lock shall have independent mechanical ventilation.

### **B 400 Acid spill protection**

**401** Floors or decks under acid storage tanks and pumps and piping for uninhibited acid shall have a lining of corrosion resistant material extending up to a minimum height of 500 mm on the bounding bulkheads or coamings. Hatches or other openings in such floors or decks shall be raised to a minimum height of 500 mm above.

**402** Flanges or other detachable pipe connections shall be covered by spray shields.

**403** Portable shield covers for connecting flanges of loading manifold shall be provided. Drip trays of corrosion resistant material shall be provided under loading manifold for acid.

### **B 500 Drainage**

**501** Spaces housing tanks and pumping and piping for acids or additives shall have a separate drainage system not connected to the drainage system for other areas.

**502** Drainage arrangement for acids shall be of corrosion resistant materials.

## **C. Ventilation**

### **C 100 Ventilation of spaces containing installations for storage or handling of acid**

**101** The spaces shall have an independent mechanical ventilation with a capacity of minimum 30 air changes per hour.

### **C 200 Ventilation of other spaces containing equipment for well stimulation**

**201** Spaces containing installations for liquid nitrogen and liquids containing inhibited acid shall have a mechanical ventilation system with a minimum capacity of 20 air changes per hour. The ventilation system shall be independent of the ventilation system for the accommodation.

**202** Ventilation of spaces for storage and handling of dry and liquid additives will be considered in each case depending on the flammability, toxicity and reactivity properties of the additives to be used.

## **D. Electrical Equipment, Instrumentation and Emergency Shutdown System**

### **D 100 Electrical equipment or other ignition sources in enclosed spaces containing acid tanks and acid pumping arrangements**

**101** Only equipment certified as safe for operation in hydrogen/air atmosphere shall be used.

### **D 200 Vapour detection**

**201** Vapour detection and alarm systems for hydrogen or hydrogen chloride gas shall be provided in enclosed or semi-enclosed spaces containing installations for uninhibited acid.

**202** Spaces containing tanks and piping for liquid nitrogen shall be equipped with oxygen deficiency monitoring.

### **D 300 Gauging and level detection**

**301** Tanks for liquefied nitrogen shall have gauging and level detection arrangements in accordance with Ch.5 Sec.13.

**302** Tanks for hydrochloric acid shall have a closed gauging system. A high level alarm shall be provided. The alarm shall be activated by a level sensing device independent of the gauging system.

**303** Spaces containing equipment and storage tanks for the well stimulation system shall be provided with detection and alarm system for liquid leakages.

### **D 400 Emergency shutdown system**

**401** Emergency stop of all pumps in the oil well stimulation system shall be arranged from one or more positions located outside the area accommodating the system.

**402** Emergency shut-off valves shall be provided in liquid nitrogen outlet lines from each nitrogen tank. The shut off valves shall be remotely controlled from one or more positions outside the area accommodating the oil well stimulation system.

**403** Emergency depressurising and disconnection of the transfer hose shall be arranged from the central control position and from the bridge.

## **E. Liquid Nitrogen System**

### **E 100 Materials**

**101** The materials shall be in accordance with Ch.5 Sec.2.

### **E 200 Storage tanks**

**201** The design and testing of the tanks for liquid nitrogen shall be in accordance with Ch.5 Sec.5 as required for independent tanks type C.

### **E 300 Pumping and piping**

**301** The requirements of Ch.5 Sec.6 apply.

## **F. Acid System**

### **F 100 Materials**

**101** In general Ch.4 Sec.2 applies.

**102** Storage tanks, pumping and piping for uninhibited acid shall be of corrosion resistant material or shall have internal lining of corrosion resistant material.

### **F 200 Storage tanks**

**201** The rules in Ch.4 Sec.5 apply.

### **F 300 Pumping and piping**

**301** The rules in Pt.4 Ch.6 apply.

**302** The flexible hose with end connectors shall be in accordance with a recognised standard.

## **G. Personnel Protection**

### **G 100 Decontamination showers and eye washes**

**101** Decontamination showers and eye washes shall be fitted in convenient locations.

**102** The showers and eye washers shall be operable also un-

der freezing conditions. Temperature control of the water shall be provided in order to avoid excessive temperatures.

#### **G 200 Personnel protective equipment**

**201** Protective equipment shall be kept onboard in suitable locations as required by the IMO “International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk” (IBC Code) Res. MSC.4(48) as amended, for carriage of hydrochloric acid.

### **H. Intact and Damage Stability**

#### **H 100 General**

**101** The vessel shall comply with the requirements for intact and damage stability given in Sec.3 D and Sec.4.

### **I. Operation Manual**

#### **I 100 General**

**101** The vessel shall have an approved operation manual readily available on board. The manual shall give instructions and information on safety aspects related to well stimulation processing.

**102** The operation manual shall give particulars on:

- protective equipment
- storage and handling of fluids and dry additives
- transfer operations
- emergency shut-down and disconnection.

## SECTION 10 OFFSHORE SERVICE VESSELS FOR TRANSPORTATION OF LOW FLASHPOINT LIQUIDS

### A. General

#### A 100 Classification

**101** The rules in this section apply to vessels intended for transportation of liquids with flashpoint below 60°C in bulk to and from offshore installations.

The rules apply to vessels not assigned the class notations **Tanker for Oil** or **Tanker for Chemicals**.

**102** Vessels built and equipped in compliance with the requirements of this section for carriage of liquids with flashpoint not lower than 43°C may be given the class notation **LFL** (Low Flashpoint Liquids).

If the requirements for carriage of liquids with flashpoint below 43°C are complied with the notation **LFL\*** may be given.

**103** Cargoes intended to be carried in vessels to be built for class notation **LFL** or **LFL\*** shall be specified for approval by the Society. The cargoes which may be carried will be stated in the "Appendix to the classification certificate".

**104** Vessels built for class notation **LFL** or **LFL\*** are also to comply with requirements for class notation **SF** in Sec.4.

#### A 200 Assumptions

**201** The classification of the vessel is based on the assumption that cargo handling operations are carried out in accordance with the approved instruction manual, see I.

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

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

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

#### A 300 Definitions

**301** Hazardous areas shall be defined in compliance with Ch.4 Sec.1 B100 and Ch.4 Sec.12 C except that the open deck over the cargo area normally will not be defined as a hazardous area when cofferdams are fitted above the cargo tanks.

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

**303** Cargo area is that part of the offshore support vessel where cargo and cargo vapours are likely to be present and includes cargo tanks, cargo pump rooms, hold spaces in which independent tanks are located, cofferdams surrounding integral tanks and the following deck areas:

- within 3 m of a cargo tank installed on deck
- within 3 m of a cargo tank outlet in case of independent tanks installed below deck
- within 3 m of a cargo tank outlet in case of integral tanks installed below deck and separated from the weather deck by a cofferdam
- the deck area above an integral tank without an overlaying cofferdam plus the deck area extending transversely and longitudinally for a distance of 3 m beyond each side of the tank
- within 3 m of any cargo liquid or vapour pipe, flange, cargo valve, gas or vapour outlet, or entrance or ventilation opening to a cargo pump room.

#### A 400 Documentation

**401** Details related to the additional class regarding design, arrangement and strength are in general to be included in the plans specified for the main class.

**402** For general requirements for documentation of instrumentation and automation, including computer based control and monitoring, see Pt.4 Ch.9 Sec.1.

**403** A general arrangement shall be submitted for approval giving locations of:

- hazardous areas
- cargo tanks with adjacent cofferdams
- cargo hatches and any other openings to cargo tanks
- doors, hatches and any other openings to pump rooms and other hazardous spaces
- ventilating pipes and openings to pump rooms and other hazardous spaces
- doors, air locks, hatches, hinged scuttles which can be opened, and other openings to non-hazardous spaces adjacent to the cargo area
- cargo pipes over the deck with loading and discharge connections
- venting pipes for cargo tanks.

**404** Plans of the following pumping and piping arrangements shall be submitted for approval:

- cargo piping system including drawings of details such as expansion elements and flange connections
- bilge piping systems in pump room, cofferdams and pipe tunnels within cargo area.

**405** Plans showing the following equipment and systems shall be submitted for approval as applicable:

- arrangement of cargo heating systems
- pressure-vacuum valves or high velocity vent valves (or reference to possible type approval)
- arrangement and capacity of ventilation system in the cargo area
- fan rotating parts and casing
- portable ventilators
- arrangement of inert gas supply.

**406** Plans of electrical installations giving the following particulars shall be submitted for approval:

- drawing(s) showing location of all electrical equipment in hazardous areas
- list of explosion protected equipment with reference to drawings. See also Pt.4 Ch.8 Sec.11 Table B1
- single line diagram for intrinsically safe circuits and data



for verification of the compatibility between the barrier and the field component

- maintenance manual as specified in Ch.4 Sec.12 E101, for electrical installations in hazardous areas shall be submitted for approval.

**407** For documentation regarding:

- fire protection, see F
- instruction manual, see I.

**408** Documentation for the control and monitoring system for the following shall be submitted for approval:

- cargo tank level measurement system
- cargo tank overflow protection system
- cargo valves and pumps control and monitoring system
- inert gas control and monitoring system.

For requirements to documentation types, see Pt.4 Ch.9.

### **A 500 Materials**

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

### **A 600 Surveys and testing**

**601** Before assignment of class all systems covered by this section are as far as possible to be function tested under working conditions to the satisfaction of the surveyor.

### **A 700 Certification of control and monitoring system**

**701** The following control and monitoring system shall be certified according to Pt.4 Ch.9:

- cargo tank level measurement system
- cargo tank overflow protection system
- cargo valves and pumps control and monitoring system
- inert gas control and monitoring system.

## **B. Vessel Arrangement**

### **B 100 Tank arrangement**

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

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

For easy access to all parts, the minimum distance between bulkheads shall be 600 mm. Minimum horizontal distance between the tank side or pipes leading from the tank and the ship's shell shall be 760 mm.

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

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

Tanks for other purposes (except freshwater and lubricating oil tanks) will be accepted as cofferdams for these tanks.

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

**106** Cofferdams shall be arranged for water filling.

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

**108** Cargoes, which react in a hazardous manner with other

cargoes or fuel oils, shall be segregated from such other cargoes or oil fuel by means of a cofferdam, pump room or tank containing a mutually compatible cargo.

### **B 200 Access and openings to accommodation and non-hazardous spaces**

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

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

The following provisions apply for such boundaries:

- a) Doors shall be kept closed during loading/discharge operations. Signboards shall be fitted.
- b) Port lights or windows shall be of a non-opening type. Inside covers of steel or equivalent material shall be fitted in the first tier on main deck.
- c) Ventilation inlets shall be fitted as far as practicable from the nearest hazardous area (in no case less than 10 m).

**202** For non-hazardous spaces such as cargo control rooms, stores and other spaces not covered by 201, entrances are not to be arranged in hazardous area. If air locks are arranged such entrances may however be accepted.

### **B 300 Access and openings to pump room and cargo tanks**

**301** Cargo tanks shall have suitable access from open deck for cleaning and gas-freeing.

Access openings are normally not to be arranged from cargo tanks to other spaces.

**302** Pump room entrances shall be from open deck. Air lock access may be accepted upon special consideration. As a minimum, continuous gas detection and ventilation of the space will be required.

**303** Access entrances and passages shall have a clear opening of at least 600 by 600 mm.

### **B 400 Chain locker and windlass**

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

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

### **B 500 Miscellaneous**

**501** Exhaust outlets from diesel engines shall have spark arrestors.

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

## **C. Piping System in Cargo Area**

### **C 100 General**

**101** Cargo piping systems shall comply with the requirements in Ch.4.

**102** There shall be no permanent connection between piping systems in the cargo area and piping systems in the remainder of the vessel. For exemption see 300.

**103** Cargoes, which react in a hazardous manner with other cargoes, shall have separate pumping and piping systems, which shall not pass through other cargo tanks containing such cargoes unless encased in a tunnel.



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

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

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

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

### C 200 Cargo piping system

**201** The complete cargo piping system shall be located within the cargo area and shall be entirely separate from all other piping systems on board.

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

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

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

**205** Means shall be provided for stopping the pumps from the bridge or a similar position facing the cargo area.

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

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

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

### C 300 Cargo heating system

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

**302** Condensate from cargo heating systems shall be led into an observation tank placed in an easily accessible, well ventilated and well illuminated position where it can easily be observed whether the condensate is contaminated or not.

**303** Cooling water from machinery in the engine room shall not be used directly for heating of the cargo. A secondary system outside the engine room shall be provided.

## D. Gas-freeing, Inerting and Venting of Cargo Tanks

### D 100 Gas-freeing of cargo tanks

**101** Gas-freeing equipment is not required to be installed or stored onboard. The tank hatches are, however, to be arranged so as to facilitate the use of portable gas-freeing equipment.

### D 200 Inerting of cargo tanks

**201** For vessels with cargo tanks aft of the superstructure and which are intended for simultaneous carriage of dry cargo and liquid cargo, an arrangement for protecting the tank atmosphere by inert gas or similar effective means shall be provided. However, see A202.

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

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

The following conditions apply:

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

**203** Where the connections to the hold spaces or to the cargo piping are non-permanent, two non-return valves may substitute the non-return devices required in D202.

#### Guidance note:

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

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

**205** Where a nitrogen generator or nitrogen storage facilities are installed in a separate compartment, outside of the engine room, the separate compartment shall be fitted with an independent mechanical extraction ventilation system, providing 6 air changes per hour. A low oxygen alarm shall be fitted.

Such separate compartments shall be treated as one of *other machinery spaces*, with respect to fire protection.

### D 300 Cargo tank venting system

**301** The cargo tanks shall have a breathing system for relief of pressure and vacuum. Such breathing shall be through P/V-valves (pressure/vacuum relief valves). The system shall comply with the requirements given in Ch.3 Sec.5 B200.

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

## E. Ventilation System within the Cargo Area

### E 100 General

**101** The ventilation system shall comply with the requirements given in Ch.4 Sec.10. The following requirements in Ch.4. Sec.10 B303 may be relaxed after special consideration in each case:

- the height of the exhaust outlets from cargo handling spaces
- the horizontal distance between exhaust outlets from cargo handling spaces and the ventilation inlets to non-hazardous spaces other than accommodation.

## F. Fire Protection and Extinction

### F 100 Documentation

**101** The following documentation shall be submitted for approval:

- arrangement and specification of fixed fire extinguishing systems.

**102** When national authorities survey the vessel in accordance with the current requirements of the International Convention on Safety of Life at Sea (SOLAS), copies of the Cargo Ship Safety Construction Certificate and the Cargo Ship Safety Equipment Certificate shall be submitted by the shipowner or building yard. This documentation will be considered as equivalent to a survey carried out by the Society.

#### **F 200 Fire protection**

**201** The vessel is in general to comply with the current requirements of the International Convention for the Safety of Life at Sea (SOLAS) for tankers. For vessels with cargo tanks aft of the superstructure and where the superstructure is situated at least 10 m from nearest hazardous area compliance with the provisions of SOLAS for cargo ships will be acceptable.

#### **F 300 Fire extinction**

**301** The vessel shall have a fixed foam fire extinguishing system for protection of the cargo deck area. Deck area to be simultaneously protected:

- within 3 m radius from tank openings, cargo pipe flanges and cargo valves
- within 5 m radius from cargo breathing valves
- within 10 m radius from cargo load/unload connection(s).

The deck area defined above shall be protected by either foam monitor(s) or nozzles or a combination of both. In case of monitors, nominal length of throw for coverage of the farthest extremity of the area protected by monitors shall be used.

Application rate shall be not less than:

- a) 5 litres/minute/m<sup>2</sup> with sufficient supply for at least 20 minutes, applicable for return mud or oil products for which class notation **LFL** will apply.
- b) 10 litres/minute/m<sup>2</sup> with sufficient supply for at least 20 minutes, applicable for products covered by the IBC Code or methanol or oil products for which class notation **LFL\*** will apply.

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

The foam concentrates shall be compatible with the cargo carried.

**302** In addition, the vessel should carry in a readily available position, at cargo deck level, two portable foam applicator units with at least 4 portable 20 litre containers with foam concentrate, for use with water supplied by the vessels fire main.

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

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

### **G. Electrical Installations**

#### **G 100 General**

**101** Electrical installations in hazardous areas shall comply with the requirements given in Ch.4 Sec.12.

### **H. Instrumentation and Control System**

#### **H 100 General**

**101** Control systems for cargo valves and pumps shall comply with the requirements given in Ch.3 Sec.9 A.

#### **H 200 Level gauging and level alarm**

**201** Each cargo tank shall be fitted with at least one level gauging device.

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

**202** In addition each cargo tank shall be fitted with a high level alarm giving alarm at 95% filling by volume. The alarm shall be activated by a level sensing device independent of the gauging device.

#### **H 300 Gas detection**

**301** The vessel shall have portable gas measuring equipment consisting of at least two apparatus each measuring:

- oxygen
- hydrocarbon content in the range 1-100% hydrocarbon gas by volume
- low hydrocarbon gas contents (0-100% LEL).

**302** For vessels with cargo tanks aft of the superstructure and which are intended for simultaneous carriage of dry cargo and liquid cargo, cofferdams surrounding the cargo tanks shall be equipped with an approved automatic gas detection system with alarm. However, see A202.

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

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

### **I. Signboards and Instructions**

#### **I 100 General**

**101** Doors to accommodation and service spaces facing the cargo area shall be provided with signboards with the following text:

TO BE KEPT CLOSED DURING  
HANDLING OF FLAMMABLE CARGO

**102** Signboards regarding electrical installations, see Ch.3 Sec.8.

**103** An instruction manual describing all essential procedures for handling of flammable cargoes shall be prepared.

The following instructions shall be included as applicable:

- hydrocarbon gas measurements shall be carried out regularly
- cleaning and gas-freeing are not permitted during service
- doors to accommodation and service spaces facing the cargo area shall be kept closed during cargo handling
- dry cargo shall not be handled in cargo area forward of the superstructure.

For vessels not satisfying the conditions in A202, in addition:

- dry cargo and low flashpoint liquid cargoes shall not be carried simultaneously
- before the vessel enters dry cargo service, all cargo piping, tanks and compartments in the cargo area shall be cleaned and ventilated to the extent that the hydrocarbon gas content is less than 4% of LEL.

For vessels satisfying the requirements in D201 and H302, in addition:

Before loading of dry cargo commences the following items shall be complied with:

- the cargo tanks and piping shall be filled with inert gas and the O<sub>2</sub>-content in the tanks shall not exceed 8% by volume
  - the gas detection system in cofferdams surrounding the cargo tanks shall be function tested, or alternatively
  - the cofferdams surrounding the cargo tanks shall be filled with inert gas and the O<sub>2</sub>-content shall not exceed 8% by volume and the leakage detection system shall be function tested, or alternatively
  - the cofferdams surrounding the cargo tanks shall be filled with water.
- The manual is subject to approval and shall be kept on board.

## SECTION 11

### RECOVERED OIL RECEPTION AND TRANSPORTATION

#### A. General

##### A 100 Classification

**101** The requirements in this section apply to vessels for occasionally handling, storage and transportation of oil with flash point below 60°C, recovered from a spill of oil, in emergency situations.

The requirements are given for vessels not also assigned the class notation **Tanker for Oil**.

**102** Vessels built and equipped in compliance with the requirements given in this section may be given the class notation **OILREC**.

##### A 200 Scope

**201** The following matters are covered by the classification:

- safety against fire and explosion during handling, storage and transportation of oil recovered from a spill on sea
- supporting structures for equipment applied during oil recovery operations
- stability and floatability
- available power for supply to equipment used during oil recovery operations.

##### A 300 Assumption

**301** The classification of the vessel is based on the assumption that the operation of the vessel during oil recovery operation will be in accordance with the approved operation manual, see E100.

##### A 400 Documentation

**401** General arrangement plan(s) showing the following particulars shall be submitted for approval:

- hazardous areas
- location of equipment for reception and handling of oil such as pumps, skimmer, winches, etc.
- tanks intended for storage of recovered oil with accesses
- oil tank venting arrangement
- doors, hatches, ventilation openings and any other openings to hazardous spaces and adjacent non-hazardous spaces
- ventilation arrangement for hazardous spaces and adjacent non-hazardous spaces
- exhaust outlets from machinery
- fire extinguishing equipment and structural fire protection, see however 403

**402** The following plans and particulars shall be submitted for approval:

- diagrammatic plan of piping system for handling of oil
- plan showing supporting structures and fastening arrangements for equipment applied during oil recovery operations. Reaction forces to be stated
- stability and floatability calculation of the vessel in the operating mode, however, see 403
- operation manual.

**403** Plans of electrical installations giving the following particulars shall be submitted for approval:

- drawing(s) showing location of all electrical equipment in hazardous areas
- single line diagram for intrinsically safe circuits and data for verification of the compatibility between the barrier

- and the field component
- list of explosion protected equipment with reference to drawings. See also Pt.4 Ch.8 Sec.11, Table B1
- maintenance manual as specified in Ch.3 Sec.8 E101, for electrical installations in hazardous areas shall be submitted for approval
- diagrammatic plan of power supply system for equipment used during oil recovery operations
- electric power balance for oil recovery operations, if applicable.

**404** In the case that fire extinguishing equipment and structural fire protection and/or stability and floatability have been approved by a National administration applying requirements which may be considered equivalent to those of the class, such approval, satisfactorily documented, may be accepted as evidence of compliance with the class requirements.

##### A 500 Testing

**501** Upon completion, the procedure for transfer to oil recovery operation of the vessel shall be demonstrated and such operation shall be simulated to verify that the vessel will be able to operate as intended.

#### B. Basic Requirements

##### B 100 General

**101** The vessel shall be provided with:

- a suitable working deck for use in oil recovery operation
- storage tanks for recovered oil
- pumping and piping arrangement for transfer and discharge of recovered oil.

**102** The vessel shall have adequate stability and floatability in all relevant operational conditions. The stability and floatability properties will be considered in each particular case.

**103** The visibility from the manoeuvring station shall be such that the Master can easily monitor oil recovery operations both on deck and in the water.

**104** The oil tanks and the deck area, from where the operation is performed, shall be as far away from the accommodation as possible.

**105** Exhaust outlets from machinery shall be located as high as practicable above the deck and shall be fitted with spark arresters.

##### B 200 Fire protection and extinction

**201** For vessels with cargo tanks forward of the superstructure, exterior boundaries of superstructures and deckhouses enclosing accommodation and including any over hanging decks which support such accommodation, shall be insulated to A-60 standard for the whole of the portions which face the hazardous areas and for 3 m aft or forward of these, whichever is relevant. The requirement is also applicable for access doors in such boundaries. Alternatively insulation to A-0 standard with a permanently installed water-spraying system in compliance with 204 may be accepted.

Aluminium bulkheads will not be accepted in these boundaries.

**202** The requirement in 201 is also applicable for vessels with cargo tanks aft of the superstructure, provided exterior boundaries of superstructures and deckhouses enclosing ac-



commodation and including any over hanging decks which support such accommodation, are situated within 10 m of the nearest hazardous area.

**203** Portholes or windows in the area specified in 201 or 202 shall have the same fire rating as the bulkhead in which they are fitted. The requirement does not apply to wheelhouse windows. Portholes or windows which have lower fire rating than the required, or that shall be protected by a water-spray system in accordance with 204, shall be fitted with permanently installed inside deadlights of steel having a thickness equal to the steel in the bulkhead in which they are fitted.

**204** Windows in area specified in 201 shall have A-60 integrity or be protected by deadlights during oil recovery operations. Navigation bridge windows in area specified in 201 shall have A-0 fire integrity.

**205** For protection of the working deck area two semi-portable 25 kg dry powder fire extinguishers shall be provided, stored in readily available spaces adjacent to the working deck.

In addition, the vessel should carry two portable foam applicator units with at least 4 portable 20 litre containers with foam concentrate, for use with water supplied by the vessels fire main.

### **B 300 Tank arrangement**

**301** Tanks within the accommodation and/or engine room area of the vessel are in general not to be used for storage of recovered oil.

**302** Tanks intended for storage of recovered oil are normally to be separated from the engine room and accommodation by means of cofferdams, tanks for other purposes (fuel oil, ballast etc.) or dry compartments other than accommodation.

For easy access to all parts, the cofferdams shall have a minimum width of 600 mm.

**303** Where cofferdams are impractical to arrange, tanks adjacent to the engine room may be accepted for storage of recovered oil provided the tank bulkhead is:

- accessible for inspection
- carried continuously through abutting plate panels, except that full penetration welding may be used at the top of the tank
- pressure tested at every complete periodical survey.

**304** A tank arrangement requiring removable manhole covers shall be avoided. Open manholes between a maximum of 3 tanks may be accepted, provided the manhole covers are removable from ballast or fresh water tanks.

**305** All openings to the tanks (sounding pipes, hatches for placing of portable pumps and hoses) for recovered oil shall be located on open deck.

**306** Tanks for recovered oil shall have suitable access from open deck for cleaning and gas-freeing. Long tanks shall have access in both ends.

**307** Tanks exceeding a breadth of 0.56 B or a length of 0.1 L or 12 m whichever is the greater are normally to be provided with wash bulkheads or similar arrangement to reduce liquid sloshing in partially filled tanks.

**308** The height of tanks for recovered oil shall not be less than 1.5 m. Internal obstructions in tanks for recovered oil shall be provided with adequate openings to allow a full flow of oil. The area of one single opening is for that purpose not to be less than twice the sectional area of the discharge pipe.

The openings shall be so arranged that the tanks can be effectively drained.

**309** Any coating in tanks for recovered oil shall be of an oil and dispersion resistant type.

### **B 400 Support of heavy components**

**401** The strength of the supporting structures for equipment applied during oil recovery operations can be based on the assumption that the oil recovery operations will take place in moderate sea conditions.

**402** For cranes intended for use during oil recovery operations, dynamic loads due to the vessel's motions shall be taken into account. In general the cranes and their supporting structures shall have scantlings based on at least twice the working load of the crane.

## **C. Hazardous and Non-Hazardous Areas**

### **C 100 Definitions**

#### **101 Hazardous zone 0:**

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

#### *Hazardous zone 1:*

- a) Cargo pump room.
- b) Enclosed or semi-enclosed spaces in which recovered oil pipe flanges and or valves are located.
- c) Enclosed or semi-enclosed spaces in which oil contaminated equipment for handling of recovered oil are located.
- d) Areas on the open deck or semi-enclosed spaces on the deck within a distance of 3 m from oil skimmer equipment, hoses and valves used for recovered oil handling, openings and air pipes from tanks for recovered oil and openings and ventilation outlets from hazardous areas.

#### *Hazardous zone 2:*

- a) Cofferdams and spaces adjacent to tanks intended for storage of recovered oil, not containing pipe flanges or valves.
- b) Enclosed or semi-enclosed spaces having access or opening into other hazardous area.
- c) Open deck over tanks intended for storage of recovered oil and 3 m forward and aft of this area on the open deck up to a height of 2.4 m above the deck.

**102** Safe areas are areas which are not defined as hazardous in the above.

### **C 200 Access and other openings**

**201** There are normally not to be access doors or other openings between a non-hazardous room and hazardous area.

Access doors may, however, be accepted between such spaces on the following conditions:

- the non-hazardous room shall have ventilation overpressure in relation to the hazardous area
- the doors are normally to be self-closing and arranged to swing into the non-hazardous space so that they are kept closed by the overpressure
- signboards shall be fitted warning that the doors shall be kept closed during oil recovery operations.



## **D. Arrangement and Equipment**

### **D 100 General**

**101** The vessel shall be arranged and equipped so as to minimize the time needed to make it operational. This implies that systems and equipment for handling of recovered oil as far as practicable shall be permanently installed.

**102** Systems and arrangements shall be such that procedures for and practical execution of filling, venting, discharge, sounding, etc. will be simple to perform.

**103** All electrical and mechanical equipment for use in hazardous areas during oil recovery operations shall be certified for operation in gas contaminated atmosphere.

### **D 200 Ventilation system**

**201** There shall be independent ventilation for hazardous and non-hazardous spaces.

**202** Non-hazardous spaces adjacent to hazardous areas are normally to have mechanical ventilation with overpressure relative to hazardous areas. The inlet air shall be taken from a non-hazardous area at least 1.5 m from the boundaries of any hazardous area. Also the outlet air shall be led to a non-hazardous area on open deck.

**203** Hazardous spaces are normally to have mechanical ventilation of extraction type, giving at least 8 changes of air per hour.

The inlet air shall be taken from an area which, in the absence of the considered inlet, would be non-hazardous.

The outlet air shall be led to an open area which, in the absence of the considered outlet, would be of the same or lesser hazard than the ventilated space/footpad

**204** Spaces which normally would be regarded as Zone 2 according to C102 above may be accepted as non-hazardous on the condition that the following special requirements to ventilation in addition to those given in 202 above are complied with:

- the ventilation capacity shall be at least 20 changes of air per hour
- the arrangement of ventilation inlet and outlet openings in the room shall be such that the entire room is efficiently ventilated, taking special consideration to locations where gas may be released or accumulated.

### **D 300 Tank venting system**

**301** Ventilation outlets from the tanks shall be led to open deck.

The outlets shall have a minimum height of 2.4 m above deck and be located at a minimum horizontal distance of 5 m away from openings to accommodation and other non-hazardous spaces, ventilation intakes for accommodation and engine room and non-certified safe electrical equipment.

**302** Portable ventilation outlet pipes intended for use during oil spill recovery operations only, may be accepted.

**303** The venting arrangement is in general to comply with the requirements given for the main class.

### **D 400 Arrangement of piping systems**

**401** The system for pumping and transfer of recovered oil shall be located outside engine room and accommodation.

**402** The transfer system shall be arranged such that simultaneous filling and discharge will be possible.

**403** For coupling of portable skimming equipment one or maximum two filling connections with branch pipes to all tanks for recovered oil shall be arranged on deck.

**404** The filling line shall be provided with means for injection of emulsion-breaking chemicals. The arrangement shall be so as to facilitate efficient mixing with recovered oil, e.g. by injection to the suction side of a pump.

For tanks provided with heating coils the requirements may be dispensed with.

**405** Where permanently installed oil recovery piping is incompatible with the normal cargo system, suitable blanking arrangements shall be provided.

**406** Parts of existing piping and pumping systems may be used if found to satisfy the general safety principles. Such arrangements will be evaluated in each case.

**407** The internal diameter of sounding pipes from tanks for recovered oil shall not be less than 50 mm. The sounding pipes shall be located on open deck.

**408** For all piping connections other than mentioned above, blanking-off before oil is loaded into the tanks shall be possible. The blanking device shall be fitted to the nearest detachable pipe connection at the tank.

### **D 500 Power supply and electrical equipment**

**501** Electrical installations in hazardous areas shall comply with the requirements given in Ch.3 Sec.8.

**502** Means for disconnection of electrical supply to non-certified electrical equipment in hazardous spaces shall be arranged. Signboards shall be fitted at the respective switches.

Electrical cables led through these spaces and electrical equipment in the machinery spaces are exempted.

**503** Non-certified safe electrical equipment located in hazardous areas on open deck shall be disconnected during oil recovery operation.

**504** The arrangement of power supply to non-permanent oil skimming and pumping equipment is as far as practicable to be permanently installed.

For circuits with higher rating, the outlet shall be arranged from a connection box, provided with a door which is interlocked with a switch.

The supply from the main switchboard to the connection box or socket-outlet shall be permanently installed, and provided with separate switchgear with short-circuit and overcurrent protection in each insulated phase.

**505** Non-permanent oil skimming and pumping equipment and independent power-packages shall be certified as safe for operation in gas-contaminated atmosphere.

**506** The socket-outlet and connection boxes mentioned in 504 shall be located at easily accessible places and in such a way that flexible cables are not carried through doors or portlights leading from working deck to machinery or accommodation spaces.

### **D 600 Miscellaneous requirements**

**601** A portable hydrocarbon gas-measuring instrument of approved type shall be provided on board.

**602** The deck area where handling of hoses and equipment for recovered oil takes place shall be provided with adequate lighting.

**603** A low sea suction shall be arranged for cooling water pumps for machinery.

**604** Exhaust pipes or any other pipes with surface temperature exceeding 220°C shall not pass through gas-dangerous spaces.

**605** Signboards shall be fixed by screws, rivets or equal.

## E. Operational Instructions

### E 100 General

**101** The vessel shall have an approved operation manual on-board. The manual shall give information regarding the safe use of the vessel during oil recovery operations and shall have references to enclosed drawings.

**102** The operation manual is in general to give information regarding the following:

#### 1) Arrangement and equipment

- tank arrangement
- transfer system
- gas measuring instrument
- various equipment

#### 2) Mobilisation

- checking of all equipment taken onboard to ascertain that it is certified for use in gas-contaminated atmospheres
- mounting and fastening of non-permanent equipment
- blanking-off of pipes

- assembling of air pipes
- disconnection of electrical power supply
- closing of openings between non-hazardous and hazardous areas
- start of additional ventilation equipment
- change-over to low suction for cooling water pumps
- fitting of signboards regarding the use of open flame, non-certified electrical equipment etc.

#### 3) Operation

- guidelines regarding safe distance from an oil spill source. If gases are traced on open deck, the vessel shall be withdrawn immediately
- gas measurements during operation (on open deck and in spaces where gas might accumulate)
- actions to be taken if gases are traced in enclosed spaces (cleaning, ventilation, emptying of adjacent tanks, etc.)
- precautions against overfilling of tanks
- discharging

#### 4) Cleaning and gas-freeing of tanks and pipes

#### 5) Stability in all relevant operational conditions.

## SECTION 12 PUSHERS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels specially intended for pushing.

**102** Vessels built in compliance with the relevant requirements to main class and the additional requirements in this section may be given the class notation **Pusher**.

When a pusher vessel is intended for operation in combination with a number of barges specially designed to accommodate the pusher and built also in compliance with Sec.13, the class notation **Pusher** and **Pusher/Barge Unit** may be given.

**103** For a pusher/barge combination the identification numbers of the barges associated with the pusher will be given in the class certificate.

#### A 200 Documentation

**201** The following additional plans shall be submitted for approval:

— forebody plans showing reinforcements.

If the pusher is designed for firm connection to barges, details regarding connection points and supporting structures shall be shown.

If the pusher is designed for flexible connection, details regarding the connection equipment and contact structures shall be shown.

**202** An arrangement drawing showing the pushing arrangement shall be submitted for information.

**203** The drawings shall state all relevant reaction forces in the connection points which may occur during the pushing operation.

If the connection between the pusher and the pushed vessel is fixed, i.e. the connection shall be able to transmit shearing forces and or bending moments, calculations of these forces shall be submitted. See also Sec.13 C200.

If the connection is flexible, calculations of forces in the connection equipment and on contact areas shall be submitted.

### B. Hull Strength

#### B 100 Draught for scantlings

**101** For determining the scantlings of strength members based on the vessel's draught, the latter shall not be taken less than 0.9 D.

#### B 200 General requirements

**201** The pusher shall be regarded as a separate unit and when relevant also as an integrated part of a combination of pusher and barge, see Sec.13.

**202** When regarded as a separate unit, the pusher is subject to all main class requirements.

**203** When the pusher is connected as an integrated part of a combined system, the hull scantlings of exposed parts of the pusher shall satisfy the main class rules for aft structures as calculated for the combined unit.

**204** Regarding strengthening for ice, see Sec.13 C400.

**205** Pushers being part of a flexible system Type II (see Sec.13 A100) shall be equipped also for towing the barge.

#### B 300 Structure in the forebody

**301** The structure in the forebody shall be satisfactorily reinforced to sustain the reaction forces occurring during the pushing operation. For complex structures stress analysis shall be carried out to show that the stress level will be within acceptable limits.

In combined pusher/barge systems the connection forces and allowable stresses shall comply with the requirements given in Sec.13 C.

**302** In combined pusher/barge systems the deflections of the structure during operation shall be limited to avoid hammering when pusher/barge units are heeled.

### C. Rudder and Steering Gear

#### C 100 Rudder force

**101** The design rudder force on which scantlings shall be based, shall be calculated as indicated for the main class. The speed of the vessel is however not to be taken less than  $V = 10$  knots.

**102** Guidance for rudder area. Reference is made to Pt.3 Ch.3 Sec.2 C106. If the pusher is dedicated for a pusher/barge unit, the parameters T, L and B in the formulae shall refer to this unit.

#### C 200 Steering gear

**201** The steering gear shall be capable of bringing the rudder from 35 degrees on one side to 30 degrees on the other side in 20 s, when the vessel is running ahead at maximum service speed. For the combined pusher/ barge unit, the requirement is 28 s.

### D. Equipment

#### D 100 General

**101** Pushers shall have anchoring and mooring equipment corresponding to their equipment number, see Pt.3 Ch.3 Sec.3 C100. The term  $2 B H$  in the formula may, however, be substituted by:

$$2 (a B + \sum h_i b_i)$$

$b_i$  = breadth (m) of the widest superstructure or deckhouse of each tier having a breadth greater than  $B/4$ .

## SECTION 13 PUSHER/BARGE UNITS

### A. General

#### A 100 Definitions

**101** A combined pusher barge unit may be of the following types:

*Type I.* The connection between the pusher and the barge is assumed to be rigid, i.e. it should be designed to transmit the static and dynamic shearing forces and bending moments in such a manner that the combination behaves like one integrated structure.

*Type II.* The connection between the pusher is free to heave and/or pitch relatively to the barge. This type of connection will normally not be applicable under severe sea conditions or in ice-infested waters.

#### A 200 Classification

**201** The requirements in the section apply to the combined pusher/barge unit.

**202** Combined units built in compliance with relevant requirements for main class and the additional requirements in this section may be given the combination class notation specified in Sec.12 A102. In addition each barge may be given the class notation **Barge** or **Barge for Oil** on the separate class certificate.

#### A 300 Documentation

**301** The following additional plans shall be submitted for approval:

- 0 of barge and forward part of pusher showing details of connecting points with supporting structures
- details of connecting system.

**302** An arrangement drawing of the pusher/barge unit with information about the connecting system and the reaction forces and/or bending moments in the connection shall be submitted, see also Sec.12 A200.

#### A 400 Certificates

**401** Det Norske Veritas' certificates will be required for:

- locking devices in Type I connection system
- steel wires or other means of flexible connections (works' certificate from approved manufacturer will normally be accepted).

### B. Arrangement

#### B 100 Number and position of watertight transverse bulkheads

**101** The barge is at least to have a collision bulkhead between 0.05 L and 0.08 L from F.P. and an after peak bulkhead at a suitable distance forward of the connection area. The pusher shall have a number of transverse bulkheads corresponding to its own length, as given in Pt.3 Ch.1 Sec.3 Table A1.

### C. Hull Strength

#### C 100 Longitudinal strength

**101** The longitudinal strength shall comply with the require-

ments given in Pt.3 Ch.1 Sec.5. For the combined pusher/barge unit of Type I the longitudinal strength of the barge shall be based on a length L as given in Pt.3 Ch.1 Sec.1 measured between the bow of the barge and the stern of the pusher.

#### C 200 Connection pusher/barge

**201** The pusher and the aft part of the barge shall be so designed as to allow the pusher to interact with the stern area of the barge. The mutual forces between the two structures shall be transferred by a system of contact surfaces. The connection of Type I shall be secured by at least one mechanical locking device. For Type II a flexible connection shall be provided.

**202** The connection forces shall be based on the most severe load conditions to be expected in service. Wave-induced loads shall be determined according to accepted theories, model tests or full scale measurements.

The loads shall be referred to extreme wave conditions, which should be based upon wave statistics for the expected route or service area, in case of restricted service. For unlimited world wide service North Atlantic wave statistics shall be used. The resulting loads shall be given as long term values corresponding to  $10^8$  wave encounters (most probable largest loads at a probability of exceedance equal to  $10^{-8}$ ).

Realistic conditions with respect to speed and navigation in heavy weather shall be considered, also taking into account the general assumption of competent handling.

**203** Direct calculations shall be made in order to evaluate the stresses in all relevant strength members of the connection between barge and pusher. Shearing forces and or longitudinal bending moments in the sections in question are found from direct calculations for barge and pusher in still water and in waves. Preloading from locking devices is also to be taken into account.

Permissible stresses in the connection are:

*Normal stresses:*  $225 f_1 \text{ N/mm}^2$

*Shearing stresses:*  $120 f_1 \text{ N/mm}^2$

$$f_1 = \left( \frac{\sigma_f}{240} \right)^{0.75} \quad \text{for forged and cast steel parts.}$$

**204** All relevant strength members shall have effective continuity, and details which may cause stress concentration shall have gradual transitions.

**205** Deflections of the structural parts in the connection structure and the necessary preloading shall be considered in order to avoid hammering when the most unfavourable reaction forces occur. Calculations of these deflections shall be submitted.

**206** Locking devices and or other connection equipment are subject to approval. If based on hydraulic operation the connecting system shall be mechanically lockable in closed position with remote indication on the bridge.

#### C 300 Local strength

**301** Structural members are in general to comply with the rule requirements for hull structures Pt.3 Ch.1 based on the rule length of the combined unit.

**302** Scantlings of the afterbody of the barge are in no case to be less than required for the barge in unconnected condition.

#### **C 400 Ice strengthening**

**401** Pusher/barge units with Type I connection system may be given an ice class notation provided relevant requirements given in Ch.1 regarding machinery and hull strengthening are complied with.

**402** The requirements to machinery (in the pusher) and hull strengthening shall be based on a displacement which is the sum of the displacements of barge and pusher.

**403** The hull strengthening of the exposed part of the pusher shall comply with the requirements for the aft end of the combined pusher/barge unit.

#### **D. Equipment**

##### **D 100 General**

**101** The pusher/barge unit shall have equipment corresponding to an equipment number which shall be calculated for the combined pusher/barge unit according to Pt.3 Ch.3 Sec.3.

#### **E. Machinery, Bilge System, Fire Extinguishing Plant**

##### **E 100 General**

**101** Machinery, pumps, piping systems, fitting, materials, bilge system and fire extinguishing plant shall comply with Pt.4, as relevant for barges.



## SECTION 14 BARGES

### A. General

#### A 100 Definitions

**101** Barges and pontoons are defined as vessels without sufficient means of self propulsion for their service area. Assistance from another vessel during transit or transportation service is assumed.

##### Guidance note:

In vessels with limited means of self propulsion an upper limit for barges/pontoons may normally be taken as machinery output giving a maximum speed less than  $V = 3 + L/50$  knots, L not to be taken greater than 200 m.

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**102** A barge may be towed or pushed. For barge to be pushed, see Sec.13.

#### A 200 Classification

**201** A barge which is built and equipped, surveyed and tested in compliance with the requirements in this section, may be given the additional class notation **Barge**.

**202** The barge may be given the additional class notation **Barge for Oil** if relevant requirements given in Ch.3 are satisfied, and **Barge for Liquefied Gas** if requirements in Ch.5 are satisfied.

**203** A barge built for deck load only may be given the additional class notation **Barge for Deck Cargo**.

#### A 300 Documentation

**301** In addition to the plans mentioned in Pt.3 Ch.1 Sec.1 or Pt.3 Ch.2 Sec.1 the following plans should be submitted for approval:

— towing winch or brackets with supporting structure. Towing force to be stated.

The following drawing should be submitted for information:

— arrangement of towing line.

### B. Arrangement

#### B 100 Transverse bulkheads

**101** Barges shall have a collision bulkhead and an after end bulkhead.

#### B 200 Bow height

**201** The requirement for minimum bow height given in Pt.3 Ch.1 Sec.3 A900 or Pt.3 Ch.2 Sec.3 A900 may be dispensed with.

### C. Hull Strength

#### C 100 Longitudinal strength

**101** The midship section modulus requirements within 0.4 L amidships about the horizontal neutral axis based on cargo or ballast condition is given by:

$$Z = \frac{M_s + M_W}{\sigma_l} 10^3 \quad (\text{cm}^3)$$

$\sigma_l$  = 184  $f_1$  for seagoing condition with  $M_W$  as below  
 = 140  $f_1$  for special conditions as mentioned in 102  
 $M_S$  = still water bending moment (kNm)  
 $M_W$  = - 0.11  $C_W L^2 B (C_B + 0.7)$  (kNm) sagging  
 = 0.19  $C_W L^2 B C_B$  (kNm) hogging

$C_W$  as given in Fig. 1

$C_W$  need not be taken greater than D/1.4

$f_1$  = material factor as given in Pt.3 Ch.1 Sec.2  
 = 1.0 for NV-NS.

**102** For special harbour conditions (e.g. transient states when moving heavy structures on board from end of barge) or when the wave heights are considered to be negligible, the wave bending moment may be taken zero when calculating Z in 101. Correspondingly the most unfavourable  $M_S$  should be used in 101. If  $M_S$  should occur outside 0.4 L amidships the actual section shall be considered.

**103** The midship section modulus shall not be less than:

$$Z = 0.95 \frac{C_{WO}}{f_1} L^2 B (C_B + 0.7) \quad (\text{cm}^3)$$

$C_{WO}$  as given in Fig. 1.

**104** For ordinary barge construction the section modulus outside 0.4 L amidship will normally be satisfactory. In other cases it may be necessary to consider the section modulus in more detail along the ship length. In such cases the distribution of bending moments may be taken as outlined in Pt.3 Ch.1 Sec.5. Acceptable bending stresses at ends may be 85  $f_1$  N/mm<sup>2</sup> and 65  $f_1$  N/mm<sup>2</sup> for ordinary seagoing and special conditions, respectively.

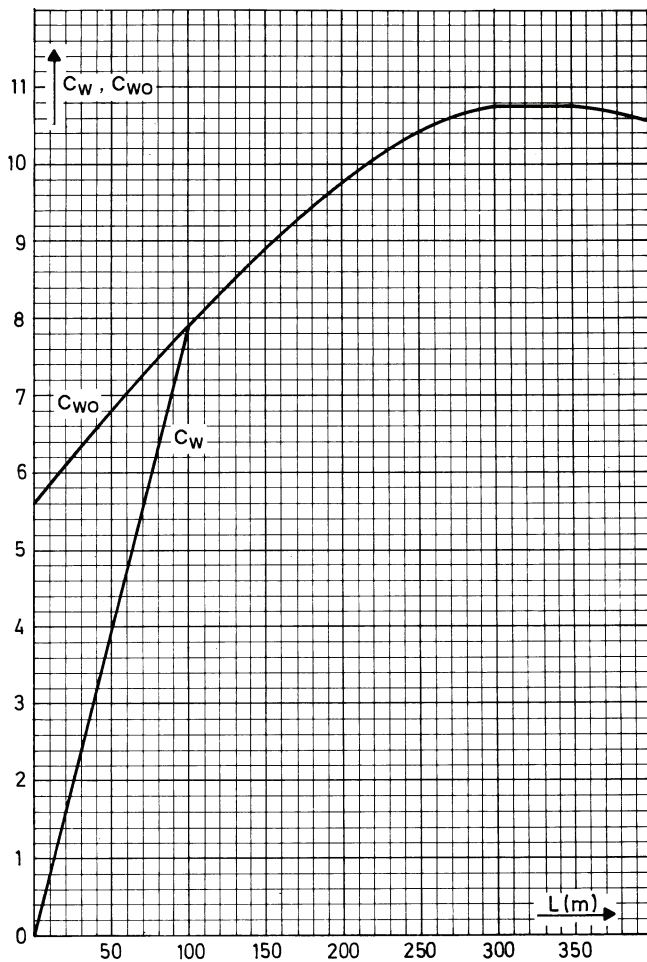


Fig. 1  
Wave coefficients

**105** For barges with restricted service  $C_W$  and  $C_{WO}$  may be reduced as given in Table C1.

Table C1 Values of $C_W$ and $C_{WO}$		
Class notation	Reduction	
	$C_W$	$C_{WO}$
<b>R0</b>	none	none
<b>R1</b>	none	none
<b>R2</b>	10%	5%
<b>R3</b>	25%	13%
<b>R4</b>	40%	20%

Note: Regarding **R0 - R4**, see Pt.1 Ch.2 Sec.1

### C 200 Shear strength

**201** The shear stresses in ship sides and longitudinal bulkheads shall not exceed  $110 f_1 \text{ N/mm}^2$ . The corresponding requirements to plating thickness of sides and longitudinal bulkheads may be found in Pt.3 Ch.1 Sec.5 D.

**202** As an alternative to the calculation of plating thickness as outlined in 201 the following approximate formula may be used:

$$\Sigma A \geq 0.1 (Q_S + Q_W) \text{ (cm}^3\text{)}$$

$\Sigma A$  = sum of effective shear areas of ship sides and bulkheads

$Q_S$  = still water shear force in kN

$Q_W$  = wave shear forces in kN. Values and distribution of  $Q_W$  may be found in Pt.3 Ch.1 Sec.5 B 200.

For special harbour conditions as outlined in 102 it may be accepted to use  $Q_W = 0$ .

**203** Within 0.6 L amidships or in special areas due to conditions as referred to in 102 the value of  $\Sigma A_S$  shall not be less than:

$$\Sigma A_s \geq \frac{2,7(LB)^{\frac{1}{3}}}{f_1} + \Sigma t_k$$

### C 300 Local strength

**301** The thickness requirement for bottom, side and deck plating due to lateral pressure is given by:

$$t = ks \sqrt{\frac{p}{f_1}} + t_k \text{ (mm)}$$

$k$  = 1.5 for bottom and deck plating within 0.4 L when transverse stiffening

= 1.3 otherwise

$t_k$  = corrosion addition, see Pt.3 Ch.1 Sec.2.

$p$  as given in Table C2.

**302** The thickness of bottom, side and deck plating shall not be less than:

$$t = 5 + \frac{0.04L}{f_1} + t_k$$

**303** The thickness of stiffeners and web plates shall not be less than:

$$t = 5 + \frac{0.02L}{f_1} + t_k$$

**304** For buckling control of plating, see Pt.3 Ch.1 Sec.13 or Pt.3 Ch.2 Sec.12.

**305** The section modulus requirement to local stiffeners and girders is given by:

$$Z = \frac{83 l^2 s p}{\sigma} k \text{ (cm}^3\text{)}$$

$l$  = stiffener or girder span (m)

$s$  = stiffener or girder spacing (m)

$k$  =  $1 + 0.08 t_k$ .

$p$  as given in Table C2.

$\sigma$  may be taken from relevant sections in Pt.3 Ch.1 or Pt.3 Ch.2.

**306** The web area of girder ends is given by:

$$A = 0.06 l s p + 10 h t_k \text{ (cm}^2\text{)}$$

The web area at the middle of the span shall not be less than 0.5 A.

Table C2 Design pressures		
		$p \text{ (kN/m}^2\text{)}$
Bottom		$10 T + (k_s - 1.5) C_W$
Sides	Below waterline	$10h_0 + \left(k_s - \frac{1.5h_0}{T}\right) C_W$
	Above waterline	$k_s (C_W - 0.67 h_0)$ , minimum 10
Deck	Sea pressure	$0.8 k_s (C_W - 0.67 h_0)$ , minimum 10
	Cargo	$10 \left(1 + k \left(0.35 - \frac{0.6 L}{1000}\right)\right) q$
<p><math>k</math> = 1.3 at ends  = 0.8 within 0.7 L midships. Linear interpolation at intermediate positions  <math>k_s</math> = 5 at aft end  = 3 between 0.2 L and 0.7 L from aft end  = 8 at forward end  <math>h_0</math> = vertical distance (m) from the waterline at full draught to the load point  <math>q</math> = deck loading in <math>t/m^2</math>. <math>q</math> shall not be taken less than 0.7 T. If restricted service <math>k</math> may be reduced by the same percentage as <math>C_W</math> given in Table C1. Reduction of <math>C_W</math> and <math>k</math> may also be considered if transportation shall take place under specified fair weather conditions.</p>		

#### Guidance note:

If liquid cargo or ballast shall be carried, the structure should also be considered as tank structure.

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### C 400 Bottom structure

**401** The bottom structure may be built as single or double bottom.

**402** The height of a double bottom shall give good access to all internal parts. The height should not be less than 650 mm.

**403** The bottom structure shall be considered as a grillage system being supported by ship sides and/or bulkheads.

The structure is generally to be calculated for a net loading corresponding to  $p$  (bottom) given in Table C2. Acceptable stress levels may be as given for stiffeners in Pt.3 Ch.1 Sec.13 D.

**404** If the arrangement of the barge is such that the net loading specified in 403 is considered to be unrealistic, reduced net loadings (i.e. sea pressure-cargo) according to specified loading conditions may be accepted. The reduced net loading should not be less than 50% of the full net loading given in 403.

**405** The bottom in barges with  $L > 100$  m shall be strengthened against slamming, see Pt.3 Ch.1 Sec.6 H. In the formula for  $C_2$  the ballast draught  $T_{BF}$  may be substituted by full draught  $T$ .

### C 500 Deck structure

**501** If the deck girders constitute a grillage system, direct calculations of the grillage shall be made to verify that the structure comply with the loading specified in Table C2 or other specified loadings and the stress levels given in Pt.3 Ch.1 Sec.8 or Pt.3 Ch.2 Sec.7.

**502** If the deck will be subject to heavy point loads, plans shall be submitted showing the arrangement and position of loads as well as their magnitude.

It shall be specified if all loading points will be subject to loads simultaneously, or if there will be some alternative groupings of the loads. For reduction of dynamic loads, see notes to Table C2, factor  $k$ .

**503** Heavy point loads should preferably be supported directly by bulkheads.

### C 600 Towing arrangement

**601** Towing hooks, winches pins or brackets with their supporting structure shall be capable of withstanding the breaking load  $P_b$  of the towline.

**602** The breaking load shall not be taken less than:

$$P_b = 10 L \text{ (kN)}$$

**603** Acceptable stress levels in the supporting structure resulting from bending moments and shearing forces calculated for the load  $P_b$  given in 601 or 602 are:

$$\sigma_b = 210 f_1 \text{ (N/mm}^2\text{)}$$

$$\tau = 130 f_1 \text{ (N/mm}^2\text{)}$$

$$\sigma_{comb} = \sqrt{\sigma_b^2 + 3\tau^2} = 235 f_1 \text{ (N/mm}^2\text{)}$$

## D. Hatches and Deck Openings

### D 100 General

**101** Deck openings in barges for unrestricted service shall have hatch coamings and covers as given in Pt.3 Ch.3 Sec.6.

**102** The closing arrangement of deck openings for barges with restricted service and high freeboard will be specially considered.

## E. Steering Arrangement

### E 100 General

**101** If rudder is installed, the rudder and steering arrangement shall comply with the requirement given in Pt.3 Ch.3 Sec.2 as far as these rules are relevant for barges.

When calculating the rudder force, the speed shall not be taken less than 8 knots.

## F. Equipment

### F 100 General

**101** For equipment, see Pt.3 Ch.3 Sec.3.

## G. Machinery and Electrical Installations

### G 100 General

**101** Machinery and electrical installations are generally not required. However, if such installations are made, they shall comply with relevant requirements given in Pt.4.

## H. Drainage

### H 100 General

**101** For drainage of barges, see Pt.4 Ch.6 Sec.4 G.

## I. Stability

### I 100 Stability requirements

**101** All vessels shall comply with the intact stability requirements according to Pt.3 Ch.3 Sec.9.

**102** The alternative stability criteria as given in 103 and 104 may be applied for vessels with class notation **Barge for Deck Cargo**, under the following provisions:

- the vessel is unmanned
- the block coefficient is 0.9 or greater
- the breadth to depth ratio is greater than 3.0
- the vessel has no hatchways in the deck except small man-holes closed with gasketed covers.

**103** The calculations should be based on the following (corresponding to IMO Res. A.749(18) Ch. 4.7):

- no account should be taken of the buoyancy of deck cargo (unless buoyancy credit for adequately secured timber)
- consideration should be given to such factors as water absorption (e.g. timber), trapped water in cargo (e.g. pipes) and ice accretion
- when performing wind heel calculations:
  - the wind pressure should be constant and for general operations be considered to act on a solid mass extending over the length of the cargo deck and to an assumed height above the deck
  - the centre of gravity of the cargo should be assumed at a point mid-height of the cargo
  - the wind lever arm should be taken from the centre of

the deck cargo to a point at one half the draught

- calculations should be performed covering the full range of operating draughts
- the downflooding angle should be taken as the angle at which an opening through which progressive flooding may take place is immersed. This would not be an opening closed by a watertight manhole cover or a vent fitted with an automatic closure.

**104** The following criteria shall be complied with:

- the area under a righting lever curve up to the angle of maximum righting lever, or the downflooding should not be less 0.08 metre-radians
- the static angle of heel due to a uniformly distributed wind load of 0.54 kPa (wind speed 30 m/s) should not exceed an angle corresponding to half the freeboard for the relevant loading condition, where the lever of wind heeling moment is measured from the windage area to half the draught
- the minimum range of stability should be:

For $L \leq 100$ m:	20°
For $L \geq 150$ m:	15°
For intermediate lengths	by interpolation

## SECTION 15 ESCORT VESSELS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels specially intended for escort service.

**102** Vessels built in compliance with the requirements in this section may be given the class notation **Escort (n,V)**, where **n** indicates maximum transverse steering pull (FS in Fig.1) exerted by the escort tug on the stern of assisted vessel, and **V**, the speed at which this pull may be attained.

**103** The escort rating number (**n,V**) shall be determined by approved full scale trials. A test certificate indicating the escort rating number (**n,V**) may be issued on completion of approved full scale trials.

**104** The requirements for **Tug** notation given in Sec.2 shall be complied with.

#### A 200 Definitions

**201** The term *Escort service* includes steering, braking and otherwise controlling the assisted vessel. The steering force is provided by the hydrodynamic forces acting on the tug's hull. See Fig.1.

##### Guidance note:

As the hydrodynamic forces acting on the tug's hull increases approximately with the square of the speed, the steering ability increases more than proportionally with the speed. Escort service should therefore normally be undertaken in the speed range of 8 to 10 knots.

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**202** The term *Escort test speed* is understood to be the speed at which the full scale measurements shall be carried out, namely 8 knots and or 10 knots.

**203** The term *Escort tug* is understood to be the tug performing the escort service.

**204** The term *Assisted vessel* is understood to be the vessel being escorted.

**205** The *Escort rating number (n,V)* is defined as the steering force, **n** in tonnes determined according to C100 acting on the stern of assisted ship in tonnes, at **V** knots. If **n** is determined at both 8 and 10 knots the escort rating number will consist of 4 digits.

#### A 300 Documentation

**301** The following plans and particulars shall be submitted for information:

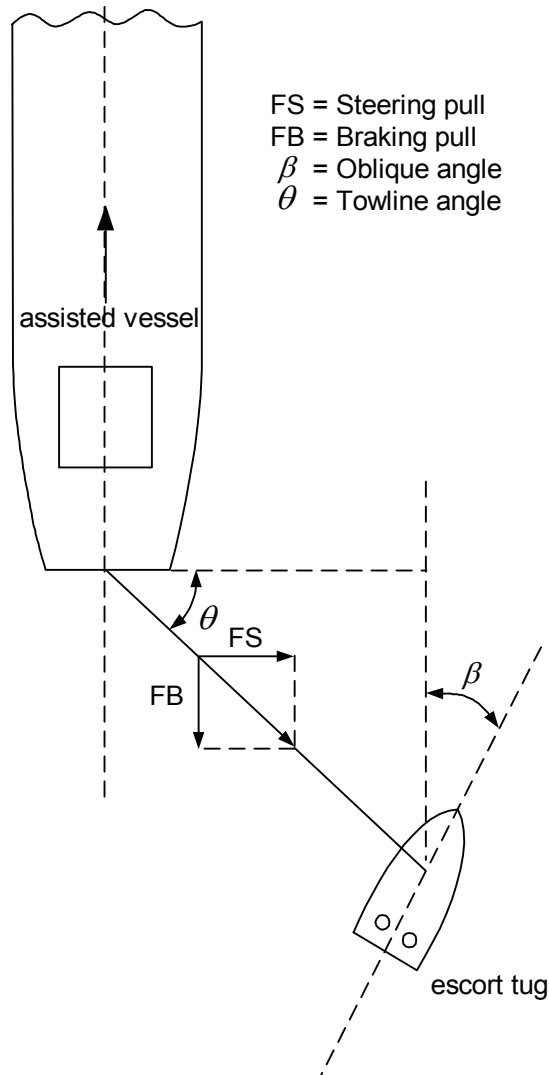
- towing arrangement plan including towline path and minimum breaking strength of towing line components
- preliminary calculation of steering pull at 10 knots including propulsion components for balancing of oblique angular position of tug
- preliminary stability calculations.

### B. Arrangement and Design

#### B 100 Arrangement

**101** The hull of the tug shall be designed to provide adequate

hydrodynamic lift and drag forces when in indirect towing mode. Due attention shall be paid to the balance between hydrodynamic forces, towline pull and propulsion forces. Freeboard shall be arranged so as to avoid excessive trim at higher heeling angles. Bulwark shall be fitted all around exposed weather deck.



**Fig. 1**  
**Typical Escort configuration**

**102** The towing winch shall have a load reducing system in order to prevent overload caused by dynamic oscillation in the towing line. Normal escort operation shall not be based on use of brakes on the towing winch. The towing winch shall be able to pay out towing line if the pull exceeds 50% of the breaking strength of towing line. The towing line shall have a breaking strength of at least 2.2 times the maximum mean towing pull as measured during the test.

**103** The propulsor shall be able to provide ample thrust for manoeuvring at higher speeds for tug being in any oblique angular position.



## C. Steering Force and Manoeuvring

### C 100 Escort rating number

**101** The escort rating number, **(n,V)**, to be based on full scale measurements at 8 and or 10 knots.

$n$  = FS·C (tonnes)

FS = steering force from tug

$C = \frac{k \cdot 28}{t}$  or 1, whichever is less

$k = 1.1$

(28 s is the manoeuvring time required by Pt.4 Ch.14 Sec.1 B400)

$t$  = Manoeuvring time in s from maintained oblique position of tug giving maximum steering force on one side of assisted vessel to mirror position on the other side. Towline angle  $\theta$  need not to be taken less than 30°.

### C 200 Manoeuvring

**201** The vessel shall be designed so that forces are in equilibrium with a minimum use of propulsive force except for providing forward thrust and balancing transverse forces during escorting service.

**202** In case of loss of propulsion, the remaining forces shall be so balanced that the resulting turning moment will turn the escort tug to a safer position with reduced heel.

#### Guidance note:

Due attention should be paid to sudden loss of thrust which may be experienced beyond certain angles of water inflow to propulsion units at higher speeds. Prediction of forces acting on the tug when escorting is necessary for scantling, manoeuvrability and preliminary stability calculations. Model testing may indicate hydrodynamic forces for indirect towing.

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## D. Stability

### D 100 Stability

**101** The general stability criteria in Sec.2 E shall be complied with. In addition, the stability criteria given in 201 and 203 shall be satisfied.

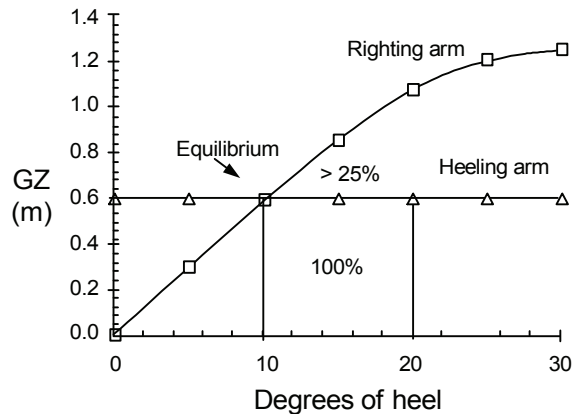
### D 200 Stability criteria

**201** The area under the righting arm curve and heeling arm curve shall satisfy the following ratio:

$$R_{ABS} \geq 1.25$$

$R_{ABS}$  = Ratio between righting and heeling areas between equilibrium and 20° heeling angle. Equilibrium is obtained when maximum steering force is applied from tug.

**202** Heeling arm shall be derived from the test. The heeling arm shall be kept constant from equilibrium to 20°, see Fig.2.



**Fig. 2**  
Equilibrium to 20 degrees

#### Guidance note:

Possible model testing to include heeling angle measurements as to predict dynamic stability margin. This requires a high degree of accuracy in determining light ship weight and centre of gravity.

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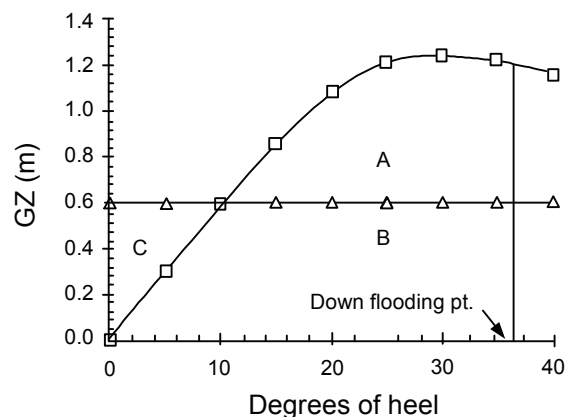
**203** The following requirement shall be satisfied:

$$A + B \geq 1.4 (B + C)$$

$A + B$  = area under the GZ curve

$B + C$  = area under the heeling moment curve.

The areas are taken from 0° heel to the angle of down flooding or 40°, whichever is less. See Fig.3.



**Fig. 3**  
Total area requirements

## E. Full Scale Testing

### E 100 Procedures

**101** A plan with documentation covering the full scale trials shall be approved prior to the trials being undertaken.

**102** The documentation shall include a towing arrangement plan showing different components in towing gear including the load cell. Verification of SWL of strong points onboard the assisted vessel shall be submitted.

**103** The escort test speed is 8 knots and or 10 knots. The speed should be taken relative to the sea. Estimates of current during the trials may be required.

**Guidance note:**

The current may be estimated by logging speed by GPS and relative log in separate runs while proceeding with and against the current.

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**E 200 Recordings during full scale trials**

**201** At least the following data shall be recorded continuously in real time mode during trials for later analysis:

- position of assisted vessel and escort tug shall be recorded by differential GPS equipment
- speed of assisted vessel by differential GPS
- speed of assisted vessel by log relative to the sea
- heading of both vessels from gyro compasses

- rudder angle on assisted vessel
- heeling angle on tug
- towline tension
- length of tow line
- angle of tow line.

Weather condition and sea state shall be noted. Manual measurements shall be read as back up to continuous readings. Bearing from tug to assisted vessel shall be recorded. Suitable test forms shall be used.

**Guidance note:**

Assisted vessel shall sail on auto pilot during trials. Size of vessel shall be sufficient as to withstand steering forces from tug without using too large angles.

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## SECTION 16 CABLE LAYING VESSELS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels specially intended for laying cables on the sea bottom.

**102** Vessels built in compliance with the requirements in this section may be given the class notation **Cable Laying Vessel**.

#### A 200 Scope

**201** The following matters are covered by the classification:

- hull structural details related to the cable laying operation
- equipment and installations for cable laying
- supporting structures for equipment applied in the cable laying operations
- equipment for anchoring and mooring related to the cable laying operations
- equipment for positioning during cable laying.

#### A 300 Documentation

**301** The following plans and particulars are in general to be submitted for approval:

- plans showing location and supports of equipment related to cable laying. Reaction forces to be stated
- plans showing the structure of loadbearing parts of the equipment as well as calculations documenting satisfactory structural strength
- plans showing supporting structures for stowed cables. Maximum weight of stored cables shall be stated.

**302** Plans to be submitted for approval if anchoring system is installed for positioning during cable laying:

- general arrangement of anchoring system. Anchor line forces and limiting anchor line angles shall be stated
- plan of supporting structures for winches
- plan of force-transmitting structures at points where the anchor lines change direction.

**303** The following plans and particulars are in general to be submitted for information:

- arrangement drawings of the cable laying equipment
- estimated load on components of cable laying equipment
- description of operational features.

### B. Hull Arrangements and Strength

#### B 100 General

**101** The hull structural strength is in general to be as required for the main class taking into account necessary strengthening of supporting structures for equipment applied in the cable laying operations.

ing operations.

**102** For catamarans, semisubmersibles and other special hull configurations, the hull structural strength will be specially considered.

### C. Anchoring and Mooring Equipment

#### C 100 General

**101** The equipment for mooring and anchoring, i.e. anchors, chain cables windlass, mooring ropes, etc., are in general to be as required for the main class.

**102** For catamarans, semisubmersibles and other special hull configurations, the equipment will be specially considered.

**103** Equipment for positioning during cable laying will be specially considered.

### D. Cable Laying Equipment and Installations

#### D 100 General

**101** Equipment - to be specified in each case - taking part in the cable laying operation is subject to approval with respect to mechanical and structural strength and material quality.

**102** For documentation to be submitted, see A300.

#### D 200 Requirements

**201** Structural and mechanical elements shall comply with Rules for Certification of Lifting Appliances, as far as relevant.

**202** Transmission gears shall comply with Pt.4 Ch.4 Sec.2, as required for auxiliary gears.

### E. Stability and Watertight Integrity

#### E 100 General

**101** All vessels shall comply with the intact and damage stability requirements as given in Pt.3 Ch.3 Sec.9.

**102** Vessels having a subdivision length (Ls) of less than 80 m and where special personnel are engaged in the special work carried out, shall comply with IMO Res. A.534(13) Code of Safety for Special Purpose Ships.

#### Guidance note:

Vessels above 80 m should normally comply with the damage stability and subdivision requirements as applicable for cargo ships. However, if required by the flag authority, IMO Res. A.534(13) Code of Safety for Special Purpose Ships may be applied as an alternative.

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## SECTION 17 STANDBY VESSELS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels especially designed to carry out rescue and standby services to off-shore installations.

**102** Vessels built in compliance with the requirements in A, B, C, D and E may be given the class notation **Standby Vessel**.

**Guidance note:**

The flag administration may have requirements for the same items found in these rules. The stricter one is expected to prevail.

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**103** If in addition the vessel complies with requirements on strengthening of the superstructure and deckhouses given in F, the notation may be extended to **Standby Vessel (S)**.

**Guidance note:**

The notation **Standby Vessel (S)** is recommended for vessels primarily to operate in harsh weather conditions, e.g. the North Sea.

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#### A 200 Documentation

**201** Plans and particulars for the following shall be submitted for approval:

- arrangement of rescue areas
- rescue and safety equipment plan, showing position and quantity of safety and rescue equipment on board (see C)
- towing arrangement (if applicable)
- foundation and support of any towing hook or towing winch. Maximum braking force of winch and breaking strength of the towline shall be stated (if applicable)
- scantlings of towing hook (if applicable)
- arrangement of windows with information on type of glass, frames, including references to standards, and dead-lights where applicable.

#### A 300 Towing arrangement

**301** When the vessel is fitted with means for emergency towing, the towing winch and or towing hook shall satisfy the requirements given in Sec.2 D101, D201, D301 and D302.

**302** The towing wire and all connected parts shall have a minimum breaking load of  $0.04 P_s$  tonnes, where  $P_s$  is the total power of the propulsion engines in kW.

**303** All loose gear of the towing equipment, like shackles, rings, wire and ropes shall be delivered with a work's test certificate.

#### A 400 Safety precaution

**401** Exhaust outlets from diesel engines shall have spark arrestors.

### B. Hull arrangement and strength

#### B 100 General

**101** The section modulus of the main and 'tween deck frames shall not be less than:

$$Z_1 = 1.25 Z \text{ (cm}^3\text{)}$$

$Z$  = general requirement as given in Pt.3 Ch.2 Sec.6. All frame ends shall have brackets.

**102** The breadth of sheer strake at the strength deck shall not be less than  $b = 800 + 5 L$ . In way of fenders, the sheer strake thickness shall not be less than:

$$t = (6 + 0.05 L) s / s_s \text{ (mm)}$$

Where fenders are omitted, the above minimum thickness shall be increased by 50%.

**103** The plating thickness of main weather deck shall not be less than:

$$t = 6 + 0.02 L + t_k \text{ (mm)}$$

**104** Bulwark plating thickness shall not be less than 7 mm. On the main weather deck the bulwark stays shall have a depth not less than 350 mm at deck and positioned at every second frame. Open rails shall have ample scantlings and efficient supports.

**105** Scantlings of foundations and supports of towing winch and towing hook shall withstand a load  $0.04 P_s$  tonnes, where  $P_s$  is the total power of the propulsion engines in kW. Acceptable stress levels in the supporting structure resulting from bending moments and shearing forces calculated for the load given above are:

$$\sigma_b = 210 f_1 \text{ (N/mm}^2\text{)}$$

$$\tau = 120 f_1 \text{ (N/mm}^2\text{)}$$

$$\sigma_e = (\sigma_b^2 + 3 \tau^2)^{1/2} = 235 f_1 \text{ (N/mm}^2\text{)}$$

#### B 200 Freeing ports and scuppers

**201** The area of the freeing ports in the side bulwarks on the cargo deck are at least to meet the requirements of Pt.3 Ch.3 Sec.6 M. The arrangement of the freeing ports shall be carefully considered to ensure the most effective drainage of water trapped on the weather deck.

### C. Rescue Arrangement, Survivors' Accommodation and Safety Equipment

#### C 100 Rescue zone arrangement, equipment and facilities

**101** The vessel shall be arranged on each side with a rescue zone with minimum 8 m length. The area shall be clearly marked on the ship's side. Its location shall be sufficiently far away from the propellers and clear of any ship side discharges up to 2 m below the loaded waterline.

**102** Access routes from the rescue zones to survivors' accommodation and to helicopter winch zone if provided shall have slip-resistant deck coating or wooden lining with surface treatment giving equivalent properties.

**103** The ship's side in way of the rescue zone shall be free of any obstruction, like for example, fenders.

**104** Satisfactory lighting shall be available along the rescue zone capable of providing minimum illumination level of 150 lux at the rescue zone and 50 lux at 20 m from the vessel.

**105** Deck area in way of the rescue zone should preferably be free from air pipes, valves, smaller hatches etc. However, when this becomes impractical, proper arrangement shall be provided as protection against personnel injury.

**106** Bulwarks or railings in way of the rescue zone shall be of a type easy to open or remove, to enable direct boarding on the deck.

**107** A searchlight shall be available on each side and operated from the navigation bridge. The searchlights should be able to provide an illumination level of 50 lux in clear air, within an area not less than 10 m diameter, to a distance of 250 m.

**108** Each rescue zone shall be provided with a scrambling net made of corrosion resistant and non-slip material.

**109** The vessel shall be provided with power assisted means capable of ensuring careful recovery of disabled persons from the sea.

## **C 200 Survivors spaces**

**201** The vessel shall have a treatment room for casualties, sanitary rooms and an enclosed space with fixed seats to accommodate survivors. These spaces shall be provided with lighting and means to control temperature and humidity suitable for the area of operation. Each space intended for survivors shall have an emergency exit

All spaces intended for survivors, including corridors used for access, shall have slip-resistant deck coating.

Corridors and doors shall be dimensioned to allow adequate transport of survivors by stretchers.

**202** Sanitary facilities shall be available exclusively for the survivors. At least one installation comprising a toilet, a wash basin and shower shall be provided for each group of 50 survivors.

## **C 300 Safety equipment**

**301** The vessel shall be equipped with at least one fast rescue boat of type complying with IMO MSC/Circ.809, arranged and maintained to be permanently ready for use under severe weather conditions. The launching arrangement shall be a SOLAS approved type.

**302** The following minimum safety equipment shall be provided when the vessel has a gross tonnage less than 500:

- one line-throwing appliance with not less than four projectiles and four lines
- one daylight signalling lamp
- six lifebuoys, 4 being with a self-igniting light and buoyant line (SOLAS approved type)
- one SOLAS type approved immersion suit for each crew member
- one SOLAS type approved lifejacket for each crew member plus 25% of the number of survivors for which the vessel is intended to carry.

## **D. Care of Personal**

### **D 100 General**

**101** The treatment room shall have adequate equipment and medical supplies.

#### **Guidance note:**

Treatment room equipment and medical stores should be arranged as required by local regulations or based on recognised standards.

The vessel shall be provided with blankets in sufficient quantity for the number of survivors for which the vessel is intended to carry

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## **E. Intact and Damage Stability**

### **E 100 General**

**101** The vessel shall comply with intact stability requirements as given in Sec.3 D and damage stability requirements as given in Sec.4.

#### **Guidance note:**

A detailed description of stability documentation is given in Classification Note No. 20.1.

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## **F. Steel Deckhouses and Superstructures (Class Notation Standby Vessel (S))**

### **F 100 Scantling for superstructures and deckhouses**

**101** The section modulus of stiffeners and beams shall not be less than:

$$Z = 0.7 l^2 s p \text{ (cm}^3\text{)}$$

- $p$  = design pressure in kN/m<sup>2</sup>  
= a  $p_2$  for exposed decks and bulkheads  
= minimum 20 kN/m<sup>2</sup> for front bulkheads  
= minimum 13 kN/m<sup>2</sup> for sides and aft end bulkheads  
= minimum 10 kN/m<sup>2</sup> for weather decks  
= minimum 5 kN/m<sup>2</sup> for top of the wheelhouse  
= 6 kN/m<sup>2</sup> for accommodation decks.
- $a$  = 2 for front bulkheads  
= 1.2 for sides, aft end bulkheads and weather decks.
- $p_2$  = design sea pressure as given in Pt.3 Ch.1 Sec.4 C201
- $l$  = span (m)
- $s$  = spacing (m).

**102** Stiffeners shall have effective end connections. Stiffeners on front bulkheads of the lowest tier shall have brackets at both ends.

**103** The plate thickness in deckhouses and end bulkheads of superstructures shall not be less than:

$$t = t_0 + 0.02 L \text{ (mm)}$$

- $t_0$  = 6 for front bulkheads and weather deck forward of the lowest tier of the front bulkhead  
= 5 for sides and aft end bulkheads and weather decks elsewhere  
= 4.5 for deckhouse decks (in way of accommodation).

For bulkhead stiffeners and deck beams with spacing exceeding 650 mm, the thickness requirement is increased in proportion to the increased spacing.

### **F 200 Weathertight doors**

**201** The arrangement and sill heights of weathertight doors are in general to comply with Pt.3 Ch.3 Sec.6 B. Doors in exposed positions on the lowest weather deck and in lowest unprotected fronts and sides shall be of steel.

**202** For doors located in exposed positions in sides and front bulkheads, the requirements to sill heights apply one deck higher than given by Pt.3 Ch.3 Sec.6 B.

**203** Doorways to engine room and direct access to compartments below the freeboard deck are, as far as practicable, to be located at a deck above the weather deck.

### **F 300 Windows and side scuttles**

**301** Arrangement of windows and scuttles shall comply with the requirements given in Sec.3 E500.