RULES FOR CLASSIFICATION OF

Ships

PART 5 CHAPTER 7

NEWBUILDINGS
SPECIAL SERVICE AND TYPE – ADDITIONAL CLASS

Offshore Service Vessels, Tugs and Special Ships

JULY 2011

DET NORSKE VERITAS AS

FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

The Rules lay down technical and procedural requirements related to obtaining and retaining a Class Certificate. It is used as a contractual document and includes both requirements and acceptance criteria.

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Computer Typesetting (Adobe Frame Maker) by Det Norske Veritas

CHANGES

General

The present edition of the rules includes amendments and additions approved by the Executive Committee as of June 2011 and supersedes the January 2011 edition of the same chapter.

The rule changes come into force as described below.

Text affected by the main rule changes is highlighted in red colour in the electronic pdf version. However, where the changes involve a whole chapter, section or sub-section, only the title may be in red colour.

This chapter is valid until superseded by a revised chapter.

Main changes coming into force 1 July 2011

- **General**

— References to documentation type “Z030 – System arrangement plan” and “Z020 – Local arrangement plan” have been amended to read “Z030 – Arrangement plan”.

- **Sec.10 Recovered Oil Reception and Transportation**

— E102: List item 4. has been amended and a new Guidance note has been added.

- **Sec.12 Tugs**

— Previous E104 (Now E106) has been amended.

- **Sec.22 Wind Turbine Installation Vessels**

— A401: Text made more precise and included Table A1 with better description of additional class notation.
— A501: Text made more precise and corrected reference.
— B301: Text made more precise to avoid misunderstanding.
— B303: Text made more specific.

- **New Sec.23 Windfarm Maintenance has been added**

Main changes coming into force 1 January 2012

- **Sec.2 Offshore Service Vessels**

— B100: Text made more precise.
— B102: More precise description of location.
— B302: Requirement aligned with other requirements related to scuttles and windows.
— D101: Added length limitation.
— E204: Requirement aligned with other requirements related to scuttles and windows for notation **Offshore Service Vessel +**.
— E301: Unit added.
— E607: Reference added related to equivalent thickness for laminated glass.

- **Sec.3 Offshore Service Vessels for Anchor Handling and Towing**

— C304 and 305: Stress criteria specified.

- **Sec.5 Damage Stability for Offshore Service Vessels**

— Previous item A101 has been deleted and previous A102 (now A101) has been amended regarding added length limitation.
— In sub-section element B200 the rule text has been replaced with reference to corresponding IMO resolution.

- **Sec.6 Standby Vessels**

— A302: Reference to notation **AHTS** added.
— A501: The word *propellers* are replaced with *propulsion systems*.
— B102, F103 and F203: Text made more precise to avoid misunderstanding.

- **Sec.7 Fire Fighters**

— I101: Added length limitation.

- **Sec.11 Special Purpose Ships**

— A103: Reference to **E0** removed - as it is not relevant.

- **Sec.12 Tugs**

— A505: Updated Bollard Pull test procedure. Some items removed from checklist (See scope for proposal).
— B601: More precise description of location.
— D401 and 503: Load and stress criteria specified.
— New E101 and E102: Added length limitation and allowing for alternative stability requirements for smaller tugs.

- **Sec.13 Escort Vessels**

— A104 and D101: Corrected references.

- **Sec.14 Barges**

— A108: Class notations and references for Barge updated. Barge for “C” added. “C” denotes the type of chemical liquids. Update in class notation overview, Pt.1 Ch.2 is necessary.
— A301: Table with required technical documentation.
— C301: Rules made more specific and taking into account operation in fresh water.
— C306: Reference to direct calculation alternative.
— C401, C504, C505 and C701: References to Ship Rules added in order to make Barge requirements clearer.
— D101: Minimum design pressure for barge hatch covers.
— Sub-section I:
  — Introduced lower length limitation of 24 m for application of main class requirements to intact stability
  — Removed class requirements to damage stability.
— Sub-section J:
  Added requirements for:
  — Life Saving appliances
  — Fire safety
  — Power supply
  — Radio communication.

- **Sec.15 Pushers**

— B101: Minimum scantling draught changed and aligned with other Class Societies and other sections in DNV Rules.

- **Sec.17 Crane Vessel**

— New D101: Added length limitation.
— Previous D102 with reference to Code of Safety for Special Purpose Ships has been deleted.

- **Sec.18 Dredgers**

— A301: DocReq made more specific, design load to be included in drawing.

- **Sec.19 Cable Laying Vessels**

— Sub-section E. Stability and Watertight Integrity has been deleted.

- **Sec.20 Pipe laying Vessels**

— Sub-section E. Stability and Watertight Integrity has been deleted.

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.

CONTENTS

SECTION 1
INTRODUCTION

A. General

A 100 Introduction

The rules in this chapter apply to vessels intended for offshore service, towing and pushing, and other specialised offshore and harbour services.

101 *Scope*

The scope of this chapter includes requirements regarding hull strength, system and equipment, stability and the relevant procedural requirements for the vessels as introduced.

In addition, this chapter describes additional requirements on strength, stability and specific functions relevant for these vessels.

102 *Objective*

The objective of this chapter is to define additional vessel design requirements supporting safe and reliable operation.

103 *Application*

The requirements shall be regarded as supplementary to those given for the assignment of main class.

Vessels complying with the different requirements of this chapter will be assigned class notations as described in Table A1.

Table A1

Notation	*Section reference*
Offshore Service Vessel or **Offshore Service Vessel +**	Sec.2
Anchor Handling	Sec.3
Towing	Sec.3
Supply	Sec.4
AHTS	Sec.3 & 4
SF	Sec.5
Standby Vessel or **Standby Vessel (S)**	Sec.6
Fire Fighter I (or **II** or **III**)	Sec.7
LFL and **LFL***	Sec.8
Well Stimulation Vessel	Sec.9
OILREC	Sec.10
SPS	Sec.11
Tug	Sec.12
Escort(n,V) or **(n,8,n,10)**	Sec.13
Barge **Barge for Deck Cargo** **Barge for Oil** **Barge for Liquefied Gas** **Barge for C**	Sec.14
Pusher	Sec.15
Pusher and Pusher/Barge Unit	Sec.16
Crane Vessel	Sec.17
Dredger	Sec.18
Cable Laying Vessel	Sec.19
Pipe Laying Vessel	Sec.20
Semi-Submersible Heavy Transport Vessel	Sec.21
Wind Turbine Installation Vessel or **Wind Turbine Installation Barge**	Sec.22
Windfarm Maintenance	Sec.23

104 In addition to the listing above, notations **Anchor Handling**, **Towing**, **Supply**, **AHTS** and **Windfarm Maintenance** shall comply with the requirements of Sec.2.

105 Vessels equally intended for more than one special duty may be assigned a combination of the class notations mentioned in Table A1.

B. Definitions

B 100 General

101 *Symbols*

L = rule length [m] 1)
B = rule breadth [m] 1)
D = rule depth [m] 1)
T = rule draught [m] 1)
C_B = rule block coefficient 1)
V = service speed (knots) 1)
s = stiffener spacing [m]
s_s = standard frame spacing [m]
= 0.48 + 0.002 L
= maximum 0.61 m forward of collision bulkhead and aft of the after peak bulkhead
l = stiffener span [m]
f_1 = material factor depending on material strength group.2)

1) For details see Pt.3 Ch.1
2) For details see Pt.3 Ch.1 Sec.2.

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
OFFSHORE SERVICE VESSELS

A. General

A 100 Introduction

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

102 *Scope*

This section contains requirements to hull arrangement, systems and equipment, strength and stability applicable to offshore service vessels.

103 *Objective*

— provide a design standard enabling safe and reliable offshore service operation
— provide additional requirements enabling operations in harsh weather conditions.

104 *Application*

Vessels built in compliance with the relevant requirements in A, B, C and D may be given the class notation **Offshore Service Vessel**.

If in addition the vessel complies with the additional requirements given in E, the notation may be extended to **Offshore Service Vessel +**.

Guidance note:
The extended notation **Offshore Service Vessel +** is recommended for vessels primarily to operate in harsh weather conditions, e.g. the North Sea.

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105 Vessels built in compliance with the requirements in this section and requirements specified in Table A1 may be assigned the additional notations, as follows:

Table A1 Additional Class Notations

Additional Notation	*Services*	*Requirements*
Anchor Handling	Offshore service vessels intended for towing of floating objects in open waters and objects on sea bed in addition to subsurface deployment and lifting of anchoring equipment.	Sec.3
Towing	Offshore service vessels intended for towing of floating objects in open waters.	Sec.3
Supply	Offshore service vessels intended for supply services to offshore units or installations.	Sec.4
AHTS	Multipurpose Offshore Service Vessels intended for towing of floating objects in open waters and objects on sea bed, subsurface deployment and lifting of anchoring equipment and supply services.	Sec.3 & Sec.4
Windfarm Maintenance	Offshore service vessels intended for maintenance and service of offshore wind farms	Sec.23

106 Compliance with notations **Anchor Handling** and Supply qualifies for notation **AHTS**.

107 If the damage stability requirements in Sec.5 are satisfied in addition to the general requirements in D, then the additional notation **SF** may be given.

A 200 Documentation requirements

201 Plans and particulars for the following shall be submitted:

Table A2 Documentation Requirements				
Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*	*Rule Ref. Sec.2*
Independent cargo tanks and their supporting structures	H050 Structural drawing	Including design loads and reaction forces	AP	E
Stow racks and their supporting structures	H050 Structural drawing		AP	B
Windows	Z030 Arrangement plan	Including information on type of glass and deadlights	AP	E

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 freeboard cargo deck and second deck above. The fenders shall extend not less than 0.02 L forward of the section where the deck has its full breadth.

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, up to second deck above freeboard deck, is generally not to be less than:

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

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.

In way of fender area described in 101, fenders can be omitted when the side plating is at least twice that required above, for a breadth not less than 0.01 L, along the level of the freeboard deck and the second deck above.

103 Section modulus of frames or side longitudinals shall not in any region be less than 1.15 Z [cm^3].

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

All frames up to second deck above freeboard deck, and forward of 0.2 L from F.P. up to forecastle deck, shall have end connections with 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.

B 200 Weather deck for cargo

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

For vessels less than 100 meters, the k factor given in Pt.3 Ch.2 Sec.7 B101, shall be:

Aft of 0.2 L from A.P. and forward 0.2 L from F.P. = 1.5, otherwise 1.3.

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 6 A [kN], 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:

$\sigma_b = 160\ f_1\ [N/mm^2]$
$\tau = 90\ f_1\ [N/mm^2]$
$\sigma_e = (\sigma_b^2 + 3\tau^2)^{1/2}$
$= 200\ f_1\ [N/mm^2]$

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

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

B 300 Weathertight doors

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

302 For scuttles or windows fitted in weathertight doors, they shall comply with Pt.3 Ch.3 Sec.6 L.

B 400 Freeing ports and scuppers

401 The area of the freeing ports in the side bulwarks on the cargo deck is 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 forecastle. In such recesses appropriate scuppers with discharge pipes led overboard may be required.

If an emergency exit is located in a recess, freeing ports should be located nearby.

C. Systems and Equipment

C 100 Steering gear

101 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.

C 200 Exhaust outlets

201 Exhaust outlets from diesel engines shall have spark arrestors.

C 300 Anchoring equipment

301 For vessels without means for dynamic positioning, but intended for anchoring close to offshore installations/fields, safety precautions have to be considered.

Guidance note:

Safety precautions may consist of increasing 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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D. Intact Stability

D 100 Stability manual

101 The requirements of this sub-section are applicable to vessels with a length L_F of 24 m and above.

102 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.

103 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.
— stillwater bending moment and shear force limit curves

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^2 for exposed weather decks, passageways and fronts of superstructures and deckhouses, and at least 15 kg/m^2 for projected lateral planes on both sides of the vessel above the waterline. The weight distribution of ice on un-composite 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 static moment of this area shall be increased by 10%.

D 300 Intact stability

301 In addition to the stability criteria for main class the vessel shall comply with the requirements in Sec.12 E in all towing conditions.

302 The freeboard at the stern in the upright condition shall not be less than 0.005 L in any loading condition.

E. Enhanced Strength

E 100 Bulwark

101 Bulwark plating thickness shall not be less than 7 mm. Bulwark stays shall have a depth not less than 350 mm at deck. Stays shall be fitted on every second frame. Open rails shall have ample scantlings and efficient supports.

E 200 Weathertight doors

201 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.

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 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. Alternatively, two weathertight doors in series may be accepted.

204 For scuttles or windows fitted in weathertight doors, they shall comply with E600.

E 300 Ship's sides and stern

301 Where subjected to heavy loads when handling anchors for offshore floating units drilling rigs, the stern shall be adequately strengthened. The plate thickness adjacent to the stern roller and shark jaw shall not be less than:

$$t = 10 + 0.2\ L\ (mm)$$

The deck adjacent to the stern shall be strengthened accordingly. If a substantial sheathing is fitted on the deck, the requirement may be modified.

302 The thickness of the side plating up to forecastle deck shall not be less than as given in B102.

303 Section modulus of frames or side longitudinals up to second deck above the freeboard deck shall not be less than:

$$Z_1 = \frac{1.5\ L\ l s}{f_1}\ [cm^3]$$

If fenders are omitted

$$Z_1 = \frac{2.5\ L\ l s}{f_1}\ [cm^3]$$

The section modulus of main frames or tween deck frames shall, however, not in any region be less than:

$$Z_{min} = 1.25\ Z\ [cm^3].$$

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], but not greater than 90 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 15°. For greater inclinations the requirement given for Z_{min} shall be applied.

All frames up to second deck above freeboard deck, and frames forward of 0.2 L from F.P. up to forecastle deck, shall have end connections with brackets. Scallop welds shall not be used in connections between side frames and shell plating up to second deck above the freeboard deck.

304 In the ship sides up to second deck above freeboard deck, the section modulus of web frames and stringers shall not be less than:

$$Z_2 = \frac{1.5 L S}{f_1}$$

If fenders are omitted

$$Z_2 = \frac{2.5 L S}{f_1}$$

However, it shall not be less than

Z_{min} = 1.25 Z [cm^3]
Z = general requirement in Pt.3 Ch.1 Sec.7 D and Pt.3 Ch.2 Sec.6 D
S = span [m].

The web frames are assumed to have substantial end connections at both ends.

E 400 Support of heavy components

401 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:

For L < 100 m

aft of 0.2 L from A.P. and forward of 0.2 L from F.P.

$p = 20\ q$ [kN/m^2]

between 0.2 L and 0.8 L from A.P. $p = 16\ q$ [kN/m^2]

For L > 100 m

$p = (g_0 + a_v)\ q$ [kN/m^2]

Vertical force alone

For L < 100 m

aft of 0.2 L from A.P. and forward of 0.2 L from F.P.

$P_v = 20\ M$ [kN],

between 0.2 L and 0.8 L from A.P, $P_v = 16\ M$ [kN],

For L > 100 m

$P_v = (g_0 + a_v)\ M$ [kN]

Transverse force alone

For L < 100 m

$P_T = 7.5\ M$ [kN]

For L > 100 m

$P_T = a_t\ M$ [kN]

Vertical force to be combined with transverse force

For L < 100 m

$P_{VC} = 10\ M$ [kN]

For L > 100 m

$P_{VC} = g_0\ M$ [kN]

Longitudinal force alone

For L < 100 m

$P_L = 6.0\ M$ [kN]

For L > 100 m

$P_L = a_l\ M$ [kN]

Vertical force to be combined with longitudinal force

For L < 100 m

$P_{VC} = 20\ M$ [kN]

For L > 100 m

$P_{VC} = (g_0 + a_v)\ M$ [kN]

q = deck cargo load [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
a_t = combined vertical acceleration as given in Pt.3 Ch.1 Sec.4 B700
a_l = combined vertical acceleration as given in Pt.3 Ch.1 Sec.4 B800

Acceptable stress level for the above mentioned girders are:

$\sigma_b = 160\ f_1$ [N/mm^2]
$\sigma_e = 90\ f_1$ [N/mm^2]
$\sigma_e = (\sigma_b^2 + 3\ \tau^2)^{1/2} = 200\ f_1$ [N/mm^2].

E 500 Deckhouses and end bulkheads of superstructures

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

$$Z = \frac{0.7\, l^2\, s\, p}{f_1} \quad [cm^3]$$

p = design pressure in kN/m^2
= a p_2 for exposed decks and bulkheads
minimum 10 kN/m^2 for weather decks
minimum 5 kN/m^2 for top of the wheelhouse
= 8 kN/m^2 for accommodation decks, aft of 0.2 L from A.P. and forward of 0.2 L from F.P.
6.5 kN/m^2 elsewhere
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.7 B100 and Pt.3 Ch.2 Sec.10 C100 as applicable.

502 Beams and stiffeners shall have end connections. Stiffeners on lower front bulkhead on weather deck forward shall have brackets at lower end.

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

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

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

E 600 Windows and side scuttles

601 Typical arrangements complying with the requirements given below are shown in Fig.2 and Fig.3. Side scuttles will normally not be accepted in the ship sides below 3rd tier forward of 0.1 L from forward perpendicular.

Guidance note:
Side scuttles below 3rd tier forward of 0.1 L from forward perpendicular may be accepted upon special consideration with respect to strength and position.

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602 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.

603 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 windows and 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.

604 Deadlights fitted in the side of third tier may be portable if they are stored near by

For tier four and above, unless it is the first tier above the forward weather deck, the deadlights may be portable if they are stored near by.

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

Other deadlights shall be internally hinged.

605 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, unless the wheelhouse is located on fifth tier (or above) and is at least two decks above the forward weather deck. 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 stowed adjacent to the window for quick mounting. For the wheelhouse front windows, at least two deadlights shall have means for providing a clear view.

606 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).

607 Windows shall have toughened safety glass panes of thickness determined as given below.

$$t = \frac{b}{S}\sqrt{p\,\beta} \quad [mm]$$

β = factor obtained from the Fig.1

S = safety factor obtained from the Table D1

b = smaller dimension of the glass pane [mm]

p = local sea pressure as given in 501 [kN/m^2]

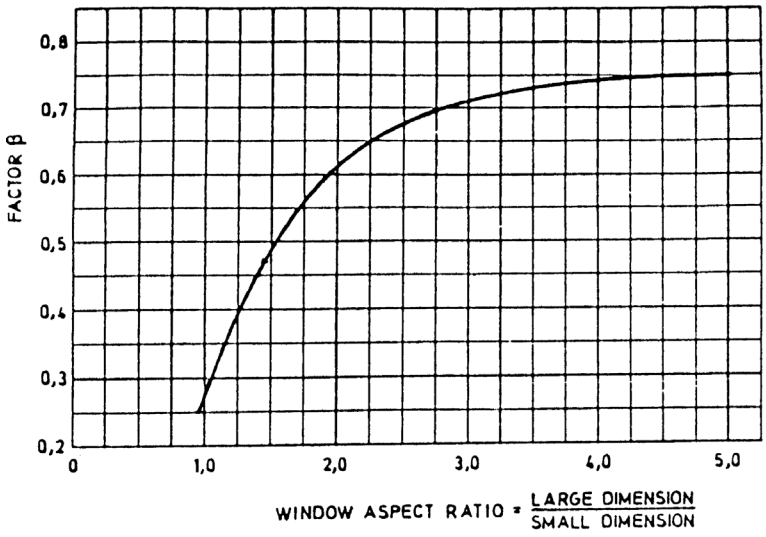

Fig. 1
Curve for factor β based on window size ratio

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

When laminated glass panes are used, equivalent thickness according to formula given in Pt.3 Ch.3 Sec.6 L203 is to be applied.

Table D1 Safety factor (S)			
Window and tier	*2nd*	*3rd*	*4th and above*
Front or side	100	100	150
Aft	100	150	200

608 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.

609 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 s shall be considered when applicable.

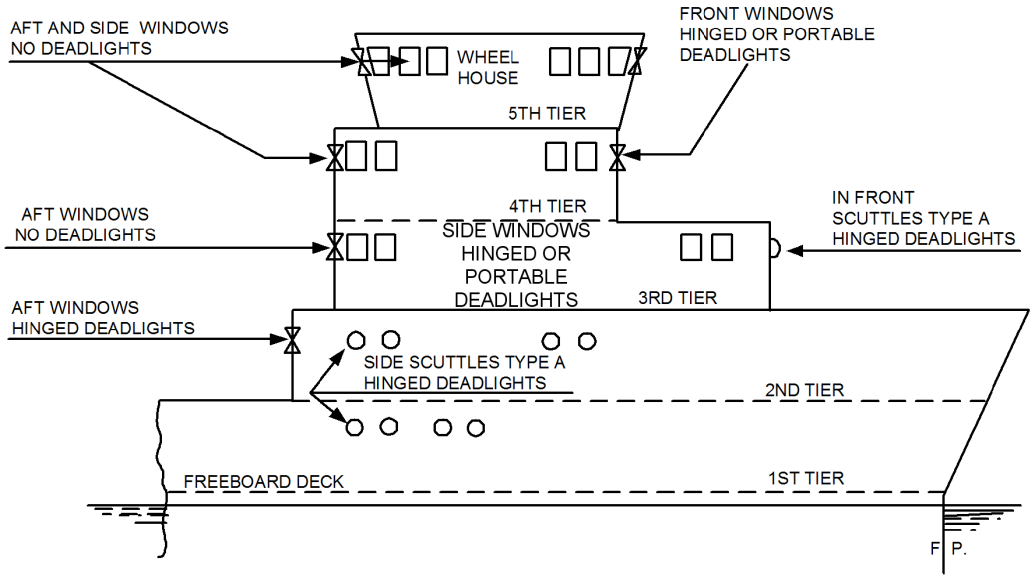

Fig. 2
Side scuttles and windows in supply vessel with complete superstructure and uppermost forecastle

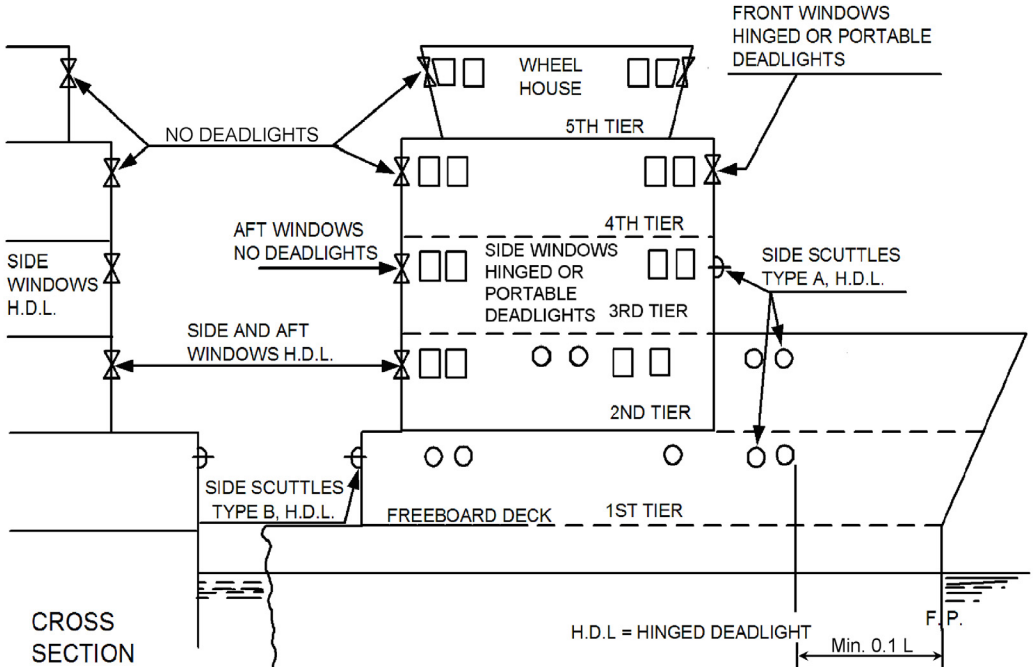

Fig. 3
Side scuttles and windows in supply vessel with forecastle only

SECTION 3
OFFSHORE SERVICE VESSELS FOR ANCHOR HANDLING AND TOWING

A. General

A 100 Introduction

101 The requirements in this section apply to vessels intended for anchor handling and towing operations offshore.

102 Anchor handling operations implies towing of floating objects in open waters and objects on sea bed in addition to subsurface deployment and lifting of anchoring equipment.

103 Towing operations implies towing of floating objects in open waters.

104 *Scope*

The following is covered by this section:

— design and testing requirements to towing and anchor handling equipment
— hull arrangement and supporting structure
— stability and watertight integrity.

Basic requirements for anchor handling/ towing vessels are given in Sec.2.

105 *Objective*

The objective of this section is to provide a design standard for safe and reliable towing and anchor handling operation. The rules enable partially the user to specify the capacities of the equipment. Safety is maintained by enhanced focus on the actual performance and limitations.

106 *Application*

Vessels with class notation **Offshore Service Vessel** intended for anchor handling operations built in compliance with the requirements in this section may be given the class notation **Anchor Handling**.

Vessels with class notation **Offshore Service Vessel** intended for towing operations built in compliance with relevant requirements in this section may be given the class notation **Towing**.

A 200 Definitions

201 *Anchor handling winch* means winch used for towing and anchor handling as described in A102. The towing and anchor handling functions may be covered/fulfilled by dedicated drums on the winch(es).

202 *Towing winch* means winch used for towing as described in A103.

203 *Towline* means rope used for towing. When used in the context anchor handling it means work rope or any wire rope, rope, or chain.

204 *Shark jaw* means equipment for temporary securing the inboard end of towline

205 *Towing pins* means equipment for leading and restraining the towline to the intended path.

206 *Stern roller* means rollers, fairleads or other equipment at the towline exit on the vessel (irrespective of location onboard), supporting the towline during lifting to avoid chafing and excessive bending, and arranged to facilitate the launch and recovery of rig anchors etc.

207 *Bollard pull (BP)* is the maximum continuous pull obtained at static pull test on sea trial. Reference is made to test procedure in Sec.12 A 500.

208 *Reference load (RL)* is defined as the value obtained from Table A1:

Table A1 Reference load

Reference load	*Bollard pull (tonnes)*
3.0 BP	BP < 40
(3.80 – BP/50) BP	40 ≤ BP ≤ 90
2.0 BP	BP > 90

A 300 Documentation requirements

301 The following plans and particulars shall be submitted:

Table A2 Documentation Requirements

Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*	*Rule Ref.* Sec.3
Anchor handling/towing arrangement	Z030 Arrangement plan	Including: — towline paths showing extreme sectors and wrap on towing-equipment — towline points of attack — maximum expected BP — maximum design loads for each component — emergency release capabilities	FI	C
Bollard pull	Z140 Test procedure for quay and sea trial		AP	A
Winch and other equipment	Z140 Test procedure for quay and sea trial		AP	A
Anchor Handling/ Towing winch	C010 Design criteria	Including: — RL and the expected maximum BP — hoisting capacity, rendering and braking force of the winch — release capabilities (response time and intended remaining holding force after release)	FI	C
	C020 Assembly or arrangement drawing		FI	C
	C030 Detailed drawing		AP	C
	C040 Design analysis	Strength calculation of the drum with flanges, shafts with couplings, framework and brakes.	FI	C
	C050 Non-destructive testing (NDT) plan		AP	A
Shark Jaw	C010 Design criteria	Including: — Maximum design load — Emergency release capabilities in operational and dead ship condition	FI	C
	C020 Assembly or arrangement drawing		FI	C
	C030 Detailed drawing		AP	C
	C040 Design analysis		FI	C
	C050 Non-destructive testing (NDT) plan		AP	A

Table A2 Documentation Requirements (Continued)				
Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*	*Rule Ref.* Sec.3
Towing pins	C010 Design criteria	Including: — Maximum design load — Emergency release capabilities in operational and dead ship condition	FI	C
	C020 Assembly or arrangement drawing		FI	C
	C030 Detailed drawing		AP	C
	C040 Design analysis		FI	C
	C050 Non-destructive testing (NDT) plan		AP	A
Foundation and support for stern roller, shark jaw, towing pins	H050 Structural drawing	Maximum applicable design loads to be included	AP	B
Foundation and support for anchor handling/ towing winch	H050 Structural drawing	The maximum force acting on the anchor handling winch shall be stated The maximum force acting on the towing winch shall be stated	AP	B

A 400 Certification requirements

401 DNV product certificates will be required for the following items:

— anchor handling/towing winch
— towing hook
— shark jaw
— towing pins.

402 DNV material certificates will be required for the following items:

— shark jaw and towing pins with attachment
— winch drum and flanges
— shafts for drum
— brake components.

403 Works material certificates is required for the following items:

— coupling
— winch framework
— gear shaft and wheels.

A 500 Testing requirements

501 The winch and other equipment made mandatory in this Section shall be function tested according to approved procedure in order to verify;

— the ability for the arrangement and equipment to operate within the specified limitations, towline paths, towline sectors etc specified by the arrangement drawing
— the correct function of the normal operation modes
— the correct function of the emergency operation modes, including emergency release and dead ship operations.

502 The winch shall be load tested during hoisting, braking, and pay out. Design loads to be applied. However, a maximum load equal to BP may be accepted if the winch is not of novel design or complex structure.

503 The BP testing shall comply with applicable requirements in Sec.12 A500.

B. Hull Strength

B 100 Deck structure

101 Scantlings of foundations and supports of towing pins shall be based on 2 times the specified maximum static working load.

102 Scantlings of foundations and supports of winches intended for towing functions shall be based on minimum 2.2 times the maximum BP of the vessel.

103 Scantlings of foundations and supports of winches intended for anchor handling functions shall be based on 1.5 times the specified maximum hoisting capacity or the maximum braking capacity of the winch whichever is the greater.

104 Scantlings of foundations and supports of stern roller shall be based on 2 times the maximum static working load as specified by the designer or 2 times the specified maximum hoisting capacity of the anchor handling winch whichever is the greater.

105 Scantlings of foundations and supports of shark jaws shall be based on 2 times the maximum static working load as specified by the designer.

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

$\sigma_b = 210\ f_1\ [N/mm^2]$
$\tau = 120\ f_1\ [N/mm^2]$
$\sigma_e = (\sigma_b^2 + 3\ \tau^2)^{1/2}$
$= 235\ f_1\ [N/mm^2].$

B 200 Ship's sides and stern

201 Where subjected to heavy loads when handling anchors, the stern shall be adequately strengthened. The plate thickness shall not be less than twice the basic requirement stated in Sec.2 B102. The deck adjacent to the stern shall be strengthened accordingly. If a substantial sheathing is fitted on the deck, the requirement may be modified.

C. Anchor Handling and Towing Arrangement

C 100 General

101 The equipment shall meet the requirements in this Section. Alternatively, equipment complying with a recognized standard may be accepted upon special considerations provided such standard gives a reasonable equivalence to the requirements of this section and fulfils the intention.

102 Arrangement drawing for anchor handling and towing with the content listed under Documentation Requirement in this Section shall be posted on the bridge.

103 Structural elements (e.g. cargo rails, bulwarks, etc) that may support the towline during normal operation, are to have a radius of bend sufficient to avoid damage to the towline.

104 The arrangement shall be such that the heeling moment arising when the towline is running in the athwart ships direction, will be as small as possible.

105 Vessel with notation Anchor Handling shall be fitted with the following items:

— anchor handling winch
— shark jaw
— towing pins
— stern roller.

106 Vessel with notation Towing shall be fitted with the following items:

— towing winch or towing hook.

107 The arrangement shall be such that the towline is led to the winch drum in a controlled manner under all foreseeable conditions (directions of the towline) and provide proper spooling on drum.

C 200 Materials for equipment

201 Shark jaw and towing pins with attachment shall be made of rolled, forged or cast steel in accordance with Pt.2 Ch.2 Sec.1, Sec.5 or Sec.7.

202 For anchor handling and towing winch materials shall comply with relevant specifications given in Pt.2.

203 For forged and cast steel with minimum specified tensile strength above 650 N/mm^2, specifications of chemical composition and mechanical properties shall be submitted for approval for the equipment in question.

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

205 When minimum specified yield is above 0.8 times the minimum specified tensile strength, 0.8 times

minimum tensile strength shall be used as minimum specified yield in calculations for structural strength as given in C300.

206 Fabrication of items in A401 is generally to be in accordance with DNV Standard for Certification 2.22 – Lifting Appliances, Ch2. Sec.2. J. Crane Manufacturing and Construction.

C 300 Anchor handling/Towing winch

301 *Control system*

The control stands shall provide a safe and logical interface to the operator with operating levers returning to stop position when released and in addition provide a clear view to the drums.

The anchor handling winch shall be capable of controlled operation during lowering and hoisting of anchors etc. both submerged and over the Stern Roller.

302 *Monitoring system*

Device for measuring tension in towrope should be fitted.

303 *Emergency release*

The winch shall be designed to allow drum release in an emergency, and in all operational modes.

The release capabilities shall be as specified on arrangement drawing as required in C102.

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.

After an emergency release the winch brake shall be in normal function without delay.

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

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

304 *Structural strength of winch for anchor handling function*

Winch for anchor handling function shall be capable of withstanding the maximum forces from hoisting, rendering and braking, including dynamic effects, without exceeding the following stress levels:

- hoisting including dynamic effect at relevant layer: 0.67 × minimum specified yield
- braking at relevant layer as specified in C310: 0.67 × minimum specified yield
- rendering load/load in towline when drum starts to rotate in the opposite direction of the applied driving torque: 0.85 × minimum specified yield.

Buckling and fatigue to be considered according to recognized standard or code of practice.

305 *Structural strength for winch for towing function*

The design and scantlings shall be capable of withstanding the RL without permanent deformations at relevant layer.

Buckling and fatigue to be considered according to recognized standard or code of practice.

306 Winch intended for both functions shall meet requirements both in C304 and C305

307 *Drums*

The drum design shall be carried out with due consideration to the relevant operations.

The drum diameter for steel wire rope should not be less than 14 times the maximum intended diameter of the rope. However, for all rope types, the rope bending specified by the rope manufacturer should not be exceeded.

308 *Towline attachment*

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.

At least 3 dead turns of rope are assumed on the drum under normal operation to provide proper attachment.

309 *Brake on drum intended for towing:*

The brake is normally to act directly on drum and should be capable of holding the RL at inner layer. It shall be arranged for manual operation or other means for activation during failure of the power supply.

310 *Brake on drum intended for anchor handling:*

The brake is normally to act directly on drum. It shall be capable of holding at least 1.25 times the maximum torque created from towline pull including dynamic effect. In addition, the brake shall be capable of stopping the rotation of the drum from its maximum speed.

The holding load of the winch shall not be affected by failure in the power supply and the brake shall be

actuated at power failure if the load is not controlled by the winch motors or similar. Means shall however be provided for overriding such systems at any time.

311 Brake on drums intended for both functions shall meet requirements both in C309 and C310.

C 400 Other equipment

401 The shark jaw shall be capable of sustaining the load defined on the arrangement drawing given in C102 without exceeding a stress level of 0.67 × minimum specified yield. Dynamic effect to be included.

402 The Towing Pins shall withstand forces and towline sectors defined on the arrangement drawing given in C102 without exceeding a stress level of 0.67 ×minimum specified yield. Dynamic effect to be included.

403 If emergency release on shark jaw and towing pins is arranged, shall the capabilities be as specified on the arrangement drawing given in C102.

404 When towing hook is fitted, applicable requirements in Sec.12 shall be complied with.

C 500 Marking

Equipment shall be marked to enable them to be readily related to their specifications and manufacturer. When a DNV product certificate is required, the equipment shall be clearly marked by the society for identification.

D. Stability and Watertight Integrity

D 100 General requirements

101 For towing operations, stability to comply with applicable requirements in Sec.12 E.

SECTION 4
PLATFORM SUPPLY

A. General

A 100 Introduction

101 The requirements in this section apply to vessels designed specially for platform supply services.

102 *Scope*

The section contains additional requirements to cargo handling arrangement and certification. Basis requirements for platform supply vessels are given in Sec.2.

103 *Objectives*

This section's objective is to provide a vessel design standard ensuring a safe and reliable platform supply to offshore installations.

104 *Application*

Vessels with class notation **Offshore Service Vessel** built in compliance with the relevant requirements in this section may be given the class notation **Supply**.

A 200 Documentation requirements

201 The following plans and particulars shall be submitted:

Table A1 Documentation Requirements

Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info. (FI) or approval (AP)*	*Rule Ref.* Sec.4
Cement and dry mud systems	S010 Piping diagram		AP	B
Liquid mud systems	S010 Piping diagram		AP	B

A 300 Certification requirements

301 Cargo pumps for flammable liquids shall be certified by the Society. This include typically 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 to be delivered with the Society's certificate.

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302 Cargo system valves shall be certified. A manufacturer's certificate can be accepted.

B. Cargo Handling Arrangement

B 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 flashpoint below 60°C shall comply with Sec.8. Vessels that occasionally handle, store and transport recovered oil from a spill shall comply with Sec.10.

B 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 B1. 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 B1 Pipes for cement and dry mud. Minimum nominal wall thickness for steel pipes in engine room

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

B 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.

SECTION 5
DAMAGE STABILITY FOR OFFSHORE SERVICE VESSELS

A. General

A 100 Classification

101 Vessels with a length L_F of 24 m and above complying with the requirements for intact stability given in Sec.2 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.

102 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**.

103 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 as amended, Part B-1.

A 200 Documentation

201 Plans and particulars for the following shall be submitted. See Table A1.

Table A1 Documentation Requirements

Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info. (FI) or approval (AP)*	*Rule Ref.* Sec.5
Damage stability	B070 Preliminary damage stability calculations		AP	B
Damage stability	B130 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	AP	B
Internal watertight integrity	B030 Internal watertight integrity plan		FI	B

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

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 vessel shall comply with the damage stability requirements of IMO Res. MSC.235(82) (Guidelines for the Design and Construction of Offshore Supply Vessels, 2006)

SECTION 6
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 offshore 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. See Table A1.

Table A1 Documentation Requirements

Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*	*Rule Ref.*
Rescue areas	Z030 Arrangement plan		AP	C
Rescue and safety equipment	G050 Safety Plan	Including rescue equipment	AP	C & D
Towing arrangement	Z030 Arrangement plan		FI	A
Towing hook and towing winch supporting structures	H050 Structural drawing	Maximum braking force of winch and breaking strength of the towline shall be stated (if applicable)	AP	B
Towing hook and its release system	C030 Detailed drawing		AP	B
Windows	Z030 Arrangement plan	With information on type of glass, frames, including references to standards, and deadlights where applicable (for notation **Standby Vessel (S)** only)	AP	F
Spaces for survivors	Z030 Arrangement plan		AP	C
Spaces for survivors	Z240 Calculation report	Capacity	AP	C

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.12 D202, D402 and D502.

302 For ships which are not built according to the Rules for **Tug**, **Towing**, **Anchor Handling** or **AHTS** notation, 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.

A 500 Propulsion

501 The vessel shall be fitted with 2 propulsion systems or similar capable of moving the vessel in the forward/aft direction.

B. Hull arrangement and strength

B 100 General

101 The section modulus of the main and 'tween deck frames shall not be less than:

$$Z_1 = 1.25\ Z\ (cm^3)$$

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

All frames up to second deck above freeboard deck, and forward of 0.2 L from F.P. up to forecastle deck, shall have end connections with brackets.

102 Longitudinal fenders are normally to be fitted on the ship´s sides at freeboard cargo deck and second deck above. The fenders shall extend not less than 0.02 L forward of the section where the deck has its full breadth.

The breadth of the sheer strake at freeboard cargo deck shall not be less than:

$$b = 800 + 5\ L\ (mm).$$

In way of fenders, the sheer strake thickness shall not be taken less than:

$$t = (6 + 0.05\ L)\ s/s_s\ (mm)$$

The ratio s/s_s shall not be taken as less than 1.0. If fenders are omitted, as for instance within the rescue zone, the above minimum thickness shall be increased by 50%, for a breadth not less than 0.01 L, along the level of the freeboard cargo deck and the second deck above.

If the vessel is not assigned with class notation **Offshore Service Vessel**, the side plating above the bilge, in way of the rescue zone, shall not be less than:

$$t = (6 + 0.04\ L)\ s/s_s\ (mm),\ \text{minimum } 8.0\ mm$$

103 The plating thickness of the exposed weather deck at the rescue zone, within at least 1.0 m from the ship side, is not to be less than:

$$t = 6 + 0.02\ L + t_k\ (mm)$$

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:

$\sigma_b = 210\ f_1\ (N/mm^2)$
$\tau = 120\ f_1\ (N/mm^2)$
$\sigma_e = (\sigma_b^2 + 3\ \tau^2)^{1/2} = 235\ f_1\ (N/mm^2)$.

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.

110 A decontamination area equipped with a shower system shall be arranged for cleaning survivors and crew before entering the superstructure.

C 200 Survivors spaces

201 The vessel shall have a treatment room for casualties, a recovery room with berths, and enclosed space to accommodate survivors. These spaces shall be provided with lighting and means to control temperature and humidity suitable for the area of operation. The survivors may be accommodated in crew spaces, excluding sanitary rooms, treatment rooms, galley, wheelhouse, radio room, cabins for captain and two crew members.

The designed capacity of survivors shall be determined considering 0.75 m^2 per person. This includes free floor space and floor space with loose furniture, fixed seating and/or fixed beds. Other fixed furniture, toilets and bathrooms shall be excluded.

Corridors and doors giving access to the treatment room for casualties and recovery room 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.

102 Treatment room equipment and medical stores should be arranged as required by local regulations or based on recognised standards.

Guidance note:

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.2 D and damage stability requirements as given in Sec.5.

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:

$$Z = 0.7\, l^2\, s\, p\ (cm^3)$$

p = design pressure in kN/m^2
= a p_2 for exposed decks and bulkheads
= minimum 10 kN/m^2 for weather decks
= minimum 5 kN/m^2 for top of the wheelhouse
= 8 kN/m^2 for accommodation decks, aft of 0.2 L from A.P and forward of 0.2 L from F.P.
6.5 kN/m^2 elsewhere
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.7 B100 and Pt.3 Ch.2 Sec.10 C100 as applicable
l = span [m]
s = spacing [m].

102 Stiffeners shall have effective end connections. Beams and stiffeners shall be connected by brackets. Stiffeners on lower front bulkhead on weather deck forward shall have brackets at lower end.

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

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

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).

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

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 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. Alternatively, two weathertight doors in series may be accepted.

F 300 Windows and side scuttles

301 Arrangement of windows and scuttles shall comply with the requirements given in Sec.2 E600.

SECTION 7
FIRE FIGHTERS

A. General

A 100 Classification

101 Vessels built in compliance with the relevant requirements specified in this section may be given the class notation **Fire Fighter** with one or more of the following qualifiers **I**, **I+**, **II** or **III**.

102 Vessels not fully in compliance with this section or not specifically built for the services intended to be covered by this section but which have special fire fighting capabilities in addition to their regular service, may be specially considered and reviewed under the intent of this section as they relate to fire fighting. Such vessels, complying as a minimum Part I of this section, may be given the class notation **Fire Fighter Capability**. The standard applied, with relevant data on the extent of this special fire fighting capability will be entered into the "Appendix to the Class Certificate" and such special fire fighting systems will be subject to annual surveys.

A 200 Objectives

201 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.

202 The qualifiers **I** and **I+** imply 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.

203 To meet its objectives, a **Fire Fighter I** vessel shall be designed with active protection, giving it the capability to withstand higher heat radiation loads from external fires. In addition, the vessel includes a sufficient set of fire fighting equipment.

204 Qualifier **I+** differentiates itself from **I** with a higher reliability and capability. In addition to active protection as named in 202, the vessel shall have passive protection, giving it the capability to withstand the higher heat radiation loads also when the active protection fails. In addition, the vessel incorporates a longer throw length.

205 The qualifiers **II** and **III** imply that the vessel has been built for continuous fighting of large fires from a safe distance and for the cooling of structures on fire.

206 Qualifier **III** requires a larger water pumping capacity and more comprehensive fire fighting equipment when compared to the **II**.

207 If a vessel has been fitted with a fire fighting systems and equipment in accordance with the qualifiers **II** or **III** and has also been designed with passive and/or active heat radiation protection in accordance with the class notation **I+** or I, then a combination of the two notations may be given.

A 300 Scope

301 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.

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

303 A detailed scope for the different qualifiers follows from the content of this chapter by an indication or a statement in wording to which qualifier the requirements applies to. Without such an indication or statement, the requirement is applicable for any qualifier.

Guidance note:
C100 'Active fire protection (Qualifiers **I** and **I+**)' indicates that the applicable paragraph is applicable for qualifiers **I** and **I+** only.

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A 400 Assumptions

401 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 qualifiers **I** and **I+**, and 96 hours for qualifiers **II** and **III**
- foam-forming liquid for at least 30 minutes continuous foam production for the fixed foam monitors is stored onboard vessels with qualifier **III**
- foam-forming liquid for at least 30 minutes continuous foam production by the mobile generator is stored in suitable containers onboard vessels with qualifiers **II** or **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 500 Documentation requirements

501 Documentation shall be submitted for approval as required by Table A1.

502 For general requirements to documentation, see Pt.0 Ch.3 Sec.1.

503 For a full definition of the documentation types, see Pt.0 Ch.3 Sec.2.

Table A1 Documentation Requirements

Function	*Documentation type*	*Additional description*	*Relevance for qualifier*
Sea chest	I100 - System diagram	For fire fighting monitors.	All
Structural fire protection arrangements	G060 - Structural fire protection drawing	Outer boundaries, including external doors and windows.	**I+**
Fire fighting arrangements	Z160 - Operation manual Z180 - Maintenance manual	FIFI operation. FIFI operation.	All
Fire water supply and distribution arrangement	S010 - Piping diagram S030 - Capacity analysis Z030 - Arrangement plan		All
External surface protection water spraying fire extinguishing system	G200 - Fixed fire extinguishing system documentation		**I**, **I+**
Fire fighting vessel fire extinguishing system	H050 - Structural drawing	Supporting structure for pumps, pump drivers and monitors.	All
Fire fighting vessel monitor water spraying fire extinguishing system	G200 - Fixed fire extinguishing system documentation	Including specification of height and length of throw. Including location of pumps, pump drivers, monitors, hose connections and hose stations	All
Portable foam generator	Z100 - Specification	Foam generator and containers for storage of foam-forming liquid.	**II**, **III**
Fire-fighter's outfit	Z030 - Arrangement plan		All
Breathing air compressor unit	Z030 - Arrangement plan		All
Flood light	Z030 - Arrangement plan Z100 - specification		All
Stability	B120 - Final stability manual	For details, see Classification Note No. 20.1.	All

A 600 Certification

601 Certificates shall be required for the components shown in Table A2:

Table A2 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 700 Testing

701 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 in the most unfavourable position, shall also be measured.

702 For qualifiers **I** and **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^2 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.

703 For qualifier **II**, the number of hoses simultaneously engaged shall be not less than six (6) and for qualifier **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

C 100 Active fire protection (Qualifiers **I** and **I+**)

101 The vessel shall be protected by a permanently in stalled 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.

102 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.

103 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.

104 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.

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

106 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.

107 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.

108 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.

109 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.

C 200 Passive fire protection (Qualifier **I+** only)

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

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** and **I+**	**Fire Fighter II**			**Fire Fighter III**	
Number of monitors	2	2	3	4	3	4
Capacity of each monitor (m^3/h)	1200	3600	2400	1800	3200	2400
Number of pumps	1-2	2-4			2-4	
Total pump capacity (m^3/h)	2400	7200			9600	
Length of throw (m) [1]	120	180		150	180	150
Height of throw (m) [2]	50	110		80	110	90
Fuel oil capacity in hours [3]	24	96			96	

1) For qualifier **I**, measured horizontally from the monitor outlet to the mean impact area. For **I+**, **II** and **III**, 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 (Qualifier lll)

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:

NPSH available – 1 meter water column > 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 qualifiers **I** and **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 vessels with qualifier **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). For vessels with qualifier **III** the number is not less than eight (8).

104 In addition to the required number of hoses for onboard use, at least 8 × 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 vessels with qualifiers **I** and **I+**. For those with qualifier **II**, the number shall be increased to 12 hoses and 6 nozzles and for qualifier **III** to 16 hoses and 8 nozzles.

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

Qualifier	Number of fire hydrant manifolds		Number of hose connections at each manifold	Total number of hose connections	Number of additional hoses [1]	Number of additional nozzles [2]
	Port	Starboard				
I, I+	1	1	4	8	8	4
II	1 or 2	1 or 2	6	12	12	6
			3	12	12	6
III	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 A700 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 qualifier **II** and **III** shall have a mobile high expansion foam generator with a capacity of not less than 100 m^3/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 qualifiers **I** and **I+** shall have at least 4 sets of firefighter's outfits.

102 Vessels with qualifier **II** shall have six (6) fire-fighter's outfits, and vessels with qualifier **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 For vessels with a length L_F of 24 m and above, the stability shall be assessed when the water monitors are in operation at full capacity in the most unfavourable direction with respect to stability. A 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 shall be presented.

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.

Additional information 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 shall be included in the stability manual.

SECTION 8
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 the requirements in Sec.2 D and Sec.5.

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.

409 The following documentation related to class notation **LFL**/**LFL*** shall be submitted for approval:

— access plan

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

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

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.

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

303 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.

304 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:

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

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

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^2 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^2 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_2-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_2-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 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 vaporiser
— 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.8.

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 under 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.2 D and Sec.5.

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
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
— 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 accommodation 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. The permanently installed water-spraying system shall have a capacity of at least 10 litres/minute/m2. The system shall be fully activated by opening of one valve on the bridge.

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 pipe work 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 over current 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 port lights 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 onboard. 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.*

The operations manual shall as a minimum refer to the valid stability documentation.

Guidance note:

Relevant additional loading conditions and/or stability instructions to be included in the stability manual.

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SECTION 11
SPECIAL PURPOSE SHIPS

A. Classification

A 100 Scope and application

101 The requirements in this section are intended for ships that by virtue of the specialized nature of the service undertaken, are carrying special personnel who are neither crew members nor passengers as defined in the 1974 SOLAS Convention.

102 The requirements of this section refer to the Code of Safety for Special Purpose Ships (SPS Code), as defined in A200.

103 A ship that has been found to be in compliance with the requirements of this section may be assigned the class notations **SPS**, denoting Special Purpose Ship.

Guidance note:

A Memo to owners will be issued stating number of persons for which the vessels complies with the SPS code. (13 to 60, 61 to 240, 241 plus)

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104 The provisions of this section may be applied to ships of lesser tonnage than 500 upon separate consideration by the Society.

105 A passenger or cargo ship, whenever built, which is converted to a special purpose ship will be treated as a special purpose ship constructed on the date on which the contract for conversion is signed.

106 For flags that have not accepted the use of the SPS Code, flag requirements will prevail whilst under that flag, i.e. SOLAS Ch.III for cargo ships to be applied.

A 200 Definitions

201 For the purpose of this section, the definitions given hereunder and in the SPS Code apply.

202 *Crew* means all persons carried on board the ship to provide navigation and maintenance of the ship, its machinery, systems, and arrangements essential for propulsion and safe navigation or to provide services for other persons on board.

Guidance note:

These rules are not intended for ships used to accommodate industrial personnel that are not working onboard.

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IMDG Code means the International Maritime Dangerous Goods Code, adopted by the Maritime Safety Committee of the International Maritime Organization IMO as resolution MSC.122(75), as amended.

Length means the length as defined in the International Convention of Load Lines, 1966.

LSA Code means the International Life-Saving Appliance Code, adopted by the Maritime Safety Committee by resolution MSC.48(66), as amended.

Passenger means every person other than:

— the master and the members of the crew or other persons employed or engaged in any capacity on board a ship on the business of that ship; and
— a child under one year of age.

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

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

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

A 300 Documentation

301 Except as specified in 302, 303 and 304 documentation shall be submitted according to table A1 as though the ship is a dry cargo ship.

302 *Stability and subdivision*

The documentation requirements of Pt.3 Ch.3 Sec.9 A300 shall be complied with as though the ship is a passenger ship.

303 *Fire protection*

Ships operating as defined under B700 shall comply with requirements for passenger ships (when relevant) with respect to fire safety and escape.

304 *Life-saving appliances*

For ships carrying more than 60 persons muster list and emergency instructions shall be submitted.

Table A1 Documentation to be submitted

Hull & Structure or Applicable system, function or component	*Document type*	*Detailed description given in Pt.0 Ch.3 under item*	*Documentation submitted for information (FI) or approval (AP)*
Stability and subdivision	Lines plan and offset tables	B010	FI
	External watertight integrity plan	B020	FI
	Internal watertight integrity plan	B030	FI
	Stability analysis	B040	AP
	Preliminary stability manual	B050	AP
	Subdivision index calculation	B060	AP
	Inclining test and lightweight survey procedure	B100	FI
	Inclining test or lightweight survey report	B110	AP
	Final stability manual	B120	AP
	Damage control plan	B150	AP
	Damage control booklet	B160	AP
Life-saving appliances	Muster list and emergency instructions	G140	AP

B. Requirements

B 100 General

101 The ship shall comply with the SPS Code.

102 Relevant requirements for general cargo ships given in Ch.2 Sec.4 and which are not covered by the requirements of this section shall also be complied with.

B 200 Stability and subdivision

201 The intact stability requirements of Pt.3 Ch.3 Sec.9 shall be complied with.

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

203 For ships carrying 240 persons or more, the supplementary intact stability requirements of Ch.2 Sec.2 F300 shall be complied with as though the ship is a passenger ship and the special personnel are considered passengers.

Guidance note:

Unless required by the Flag State a SPS ship need not be considered a passenger ship for application of SOLAS regulation II-1/5.5 on periodical lightweight surveys.

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204 The subdivision and damage stability shall in general be in accordance with SOLAS II-1 as amended where the ship is considered a passenger ship and special personnel are considered passengers, with an R-value calculated in accordance with SOLAS regulation II-1/6.2.3 as follows:

— for ships carrying 240 persons or more, the R-value is assigned as 1.0 R
— for ships carrying not more than 60 persons, the R-value is assigned as 0.8 R; and
— for ships carrying more than 60 persons, but less than 240 persons, the R-value shall be determined by linear interpolation between the R-values given above.

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

206 Except as provided in B207 for ships carrying less than 240 persons the provisions of SOLAS chapter II-1, parts B-2, B-3 and B-4 shall be applied as though the ship is a cargo ship and the special personnel are crew. SOLAS regulations II-1/8, II-1/8-1, II-1/14 and II-1/18 are not applicable.

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

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

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B 300 Machinery installations

301 All ships shall comply with Ch.2 Sec.2 C101 as though the ship is a passenger ship

302 All steering gear installations in special purpose ships carrying more than 240 persons shall comply with Pt.4 Ch.14 Sec.1 B602 as though the ship is a passenger ship.

B 400 Electrical installations

401 Electrical distribution systems in ships carrying more than 60 persons shall comply with Ch.2 Sec.2 C102.

B 500 Emergency source of power

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

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

502 Installations in special purpose ships carrying more than 60 persons shall comply with Ch.2 Sec.2 D as though the ship is a passenger ship.

B 600 Periodically unattended machinery spaces

601 All ships shall comply with the requirements in Pt.6 Ch.3 for additional class notation **E0**

B 700 Fire protection

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

702 For ships carrying more than 60, but not more than 240 persons on board, the requirements of chapter II-2 of SOLAS for passenger ships carrying not more than 36 passengers shall be applied.

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

Guidance note:
For further details and clarification of the basic SOLAS requirements implemented in this section please see “DNV Statutory Interpretations SOLAS Interpretations Ch.II-2”.

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B 800 Dangerous goods

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

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

B 900 Life-saving appliances

901 The requirements of chapter III of SOLAS shall be applied with the specifications given in B902 through B906.

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

903 Notwithstanding the provisions of B902, a ship carrying more than 60 persons but not more than 200 persons may in lieu of meeting the requirements of regulations 21.1.1 of chapter III of SOLAS comply with the requirements of regulation 21.1.5 of chapter III of SOLAS, including the provision of at least two rescue boat(s) in accordance with regulation 21.2.1 of chapter III.

Guidance note:

DNV considers item 903 to apply only for ships with a gross tonnage of less than 500 and with a total number of persons on board less than 200.

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904 Ships carrying not more than 60 persons shall comply with the requirements contained in Chapter III of SOLAS for cargo ships other than tankers. Such ships may, however, carry life-saving appliances in accordance with the passenger ship requirements in B902 if they comply with the subdivision requirements in B204 as though the ship is carrying 60 persons.

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

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

B 1000 Radio communications

1001 All special purpose ships shall carry a valid Cargo Ship Safety Radio Certificate in compliance with Chapter IV of SOLAS

B 1100 Safety of navigation

1101 All special purpose ships shall comply with the requirements of Chapter V of SOLAS.

SECTION 12
TUGS

A. General

A 100 Introduction

101 The requirements in this section apply to vessels intended for towing services in harbour and open waters and pushing of floating structures.

102 *Scope*

The following subjects are covered in this section:

— design and testing requirements to towing equipment
— hull arrangement and supporting structure
— stability and watertight integrity.

103 *Objective*

The objective of this section is to provide a design standard for safe and reliable towing operation.

104 *Application*

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

A 200 Definitions

201 *Towline* means rope used for towing.

202 *Bollard pull (BP)* is the maximum continuous pull obtained at static pull test on sea trial. Reference is made to test procedure in A 500 in this section.

203 *Reference load (RL)* is defined as value obtained from table A1:

Table A1 Reference load

Reference load	*Bollard pull (tonnes)*
3.0 BP	BP < 40
(3.80 – BP/50) BP	40 ≤ BP ≤ 90
2.0 BP	BP > 90

A 300 Documentation Requirements

301 The following plans and particulars shall be submitted. See Table A2.

Table A2 Documentation Requirements

Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*	*Rule Ref.* Sec.12
Towing arrangement	Z030 Arrangement plan	Including: — towline paths showing extreme sectors and wrap on towing equipment towline points of attack — maximum expected BP — maximum design load for each component — emergency release capabilities	FI	D
Bollard pull	Z140 Test procedure for quay and sea trial		AP	A
Winch and other equipment	Z140 Test procedure for quay and sea trial		AP	A

Table A2 Documentation Requirements (Continued)				
Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*	*Rule Ref.* Sec.12
Towing winch	C010 Design criteria	Including: — RL and the expected maximum BP — hoisting capacity, rendering and braking force of the winch — release capabilities (response time and intended remaining holding force after release)	FI	D
	C020 Assembly or arrangement drawing		FI	D
	C030 Detailed drawing		AP	D
	C040 Design analysis	Strength calculation of the drum with flanges, shafts with couplings, framework and brakes.	FI	D
	C050 Non-destructive testing (NDT) plan		AP	A
Towing hook	C010 Design criteria	The expected maximum BP to be stated	FI	D
	C020 Assembly or arrangement drawing		FI	D
	C030 Detailed drawing	Including emergency release mechanism	AP	D
	C040 Design analysis		FI	D
	C050 Non-destructive testing (NDT) plan		AP	A
Foundation and support of towing winch, hook, etc.	H050 Structural drawing	The RL and the expected maximum BP shall be stated Including footprint. Applicable for equipment with static force > 50 kN or bending moment > 100 kNm	AP	Sec.3 B & Sec.12 D

A 400 Certification requirements

401 DNV product certificates will be required for the following items:

— towing winch
— towing hook.

402 DNV material certificates will be required for the following items:

— towing hook with attachment
— winch drum and flanges
— shafts for drum
— brake components.

403 Works material certificates is required for the following items:

— coupling
— winch framework
— gear shaft and wheels.

A 500 Testing requirements

501 The winch and other equipment made mandatory in this Section shall be function tested according to approved procedure in order to verify:

— the ability for the arrangement and equipment to operate within the specified limitations, towline paths, towline sectors etc specified by the arrangement drawing
— the correct function of the normal operation modes
— the correct function of the emergency operation modes, including emergency release and dead ship operations.

502 The winch shall be load tested during hoisting, braking, and pay out. Design loads to be applied. However, a maximum load equal to BP may be accepted if the winch is not of novel design or complex structure.

503 Towing hook to be load tested with a load equal to BP.

504 *Bollard pull*

The BP of the vessel shall be verified by a special test approved by the Society. Based upon the results of the test a Bollard Pull Certificate will be issued.

The BP testing procedure shall be as given in A505.

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

The expected BP may be preliminarily applied for design approval purposes prior to sea trial. If sea trial reveals that the expected pull is significantly exceeded, such design approvals may have to be re-considered.

505 The following test procedure should be adhered to and possible deviations shall be recorded in the Bollard Pull Certificate:

1) A proposed test programme shall be submitted prior to the testing.
2) During testing of continuous static BP 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 vessel shall be trimmed at even keel or at a trim by stern not exceeding 2% of the vessel's length.
7) 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 above.
8) The test shall be performed with a fair wind speed not exceeding 5 m/s.
9) The co-current at the test location shall not exceed 1 knot.
10) 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 ± 2% within a temperature range and a load range relevant for the test.
11) 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.
12) The arrangement of bollard, towline and load cell shall ensure a force reading in horizontal direction by means of minimizing the influence from friction and force components in vertical direction.
13) The figure certified as the vessel's continuous static BP shall be the towing force recorded as being maintained without any tendency to decline for a duration of not less than 10 minutes.
14) Certification of BP figures recorded when running the engine(s) at overload, reduced r.p.m. or with a reduced or an increased number of engines or propellers operating can be given and noted on the certificate. The angular position of turn able propulsion devices shall be recorded.
15) Both the load cell reading, engine power, and other essential parameters shall be continuously available to the DNV surveyor.
16) The recorded load cell readings shall be made available to the DNV surveyor immediately upon completion of the test.

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 0.85 D.

B 200 Fore peak structures

201 For tugs designed to use the bow for pushing floating structures additional strength in the fore peak shall be in accordance with B202, B203 and B204.

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

203 The dimensions of the stringers shall not be less than:

— mean depth = 250 + 2.5 l L [mm]
— thickness = 6.5 + 0.03 L [mm]
— flange area = 0.15 l L [cm^2].

204 The frames shall be connected to the stringers by lugs or brackets at every frame.

205 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 ship 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 athwart ships, and shall be capable of being opened and closed (weathertight) from either side.

B 500 Companionways

501 Companionways to spaces below deck shall have sill heights not less than 600 mm, and shall have weathertight steel doors which can be opened and closed (weathertight) 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 on freeboard deck 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.

B 700 Deck structure

701 Scantlings of foundations and supports of towing pins shall be based on 2 times the specified maximum static working load.

702 Scantlings of foundations and supports of towing winches shall be based on minimum 2.2 times the BP of the vessel.

703 Scantlings of foundations and supports of towing hook shall be based on minimum 2.5 times the BP of the vessel

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

$\sigma_b = 210\ f_1$ [N/mm^2]
$\tau = 120\ f_1$ [N/mm^2]
$\sigma_e = (\sigma_b^2 + 3\tau^2)^{1/2}$
$= 235\ f_1$ [N/mm^2].

C. Systems and Equipment

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° on one side to 30° on the other side in 20 s, when the vessel is running ahead at maximum service speed.

C 300 Anchoring and mooring equipment

301 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:

$$2\,(a\,B + \Sigma h_i\,b_i)$$

where:

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

D. Towing Arrangement

D 100 Design standard

The equipment shall meet the requirements in this section. Alternatively equipment complying with recognized standard may be accepted upon special considerations provided such specifications give reasonable equivalence to the requirements of this section and is fulfilling the intension.

101 Towing arrangement drawing with the content listed under Documentation Requirement in this Section shall be posted on bridge.

D 200 General

201 Structural elements (e.g. cargo rails, bulwarks, etc) that may support the towline during normal operation, are to have a radius of bend sufficient to avoid damage to the towline.

202 The vessel shall be fitted with towing hook or towing winch suitable for its purpose. The towline point of attack is recommended to be located near the mid length of the vessel or other position suitable for the manoeuvrability. The arrangement shall be such that the heeling moment arising when the towline is running in the athwart ships direction, will be as small as possible.

203 The arrangement shall be such that the towline is led to the winch drum in a controlled manner under all foreseeable conditions (directions of the towline) and provide proper spooling on drum.

D 300 Materials for equipment

301 Towing hook with attachment shall be made of rolled, forged or cast steel in accordance with Pt.2 Ch.2 Sec.1, Sec.5 or Sec.7.

302 Towing winch materials shall comply with relevant specifications given in Pt.2.

303 For forged and cast steel with minimum specified tensile strength above 650 N/mm^2, specifications of chemical composition and mechanical properties shall be submitted for approval for the equipment in question.

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

305 When minimum specified yield is above 0.8 times the minimum specified tensile strength, 0.8 times minimum tensile strength shall be used as minimum specified yield in calculations for structural strength as given in D500.

306 Fabrication of items in A401 is generally to be in accordance with DNV Standard for Certification 2.22 – Lifting Appliances, Ch2. Sec2. J. Crane Manufacturing and Construction.

D 400 Towing hook

401 Design and scantlings of the towing hook with attachment shall be capable of withstanding a load of minimum 2.5 times the BP without permanent deformations.

402 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 500 Winch

501 *Control system*

The control stands for winches shall provide a safe and logical interface to the operator with operating levers returning to stop position when released and in addition provide a clear view to the drums.

502 *Emergency release*

The winch shall be designed to allow drum release in an emergency, and in all operational modes.

The release capabilities shall be as specified on towing arrangement drawing.

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.

After an emergency release the winch brakes shall be in normal function without delay. It shall always be possible to carry out the emergency release sequence (emergency release and/or application of brake), even during a black-out.

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

503 *Structural strength*

The design and scantlings of the towing winch shall be capable of withstanding the RL without permanent deformations at relevant layer.

Buckling and fatigue to be considered according to recognized standard or code of practice.

504 *Drum*

The drum design shall be carried out with due consideration to the relevant operations.

The drum diameter for steel wire rope should not be less than 14 times the maximum intended diameter of the rope. However, for all rope types, the rope bending specified by the rope manufacturer should not be exceeded.

505 *Towline attachment*

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.

At least 3 dead turns of rope are assumed on the drum under normal operation to provide proper attachment.

506 *Drum brake*

The brake is normally to act directly on drum and should be capable of holding the RL at inner layer. It shall be arranged for manual operation or other means for activation during failure of the power supply or control system.

D 600 Marking

Equipment shall be marked to enable them to be readily related to their specifications and manufacturer. When a DNV product certificate is required, the equipment shall be clearly marked by the society for identification.

E. Stability

E 100 General requirements

101 The requirements in this section apply to vessels with length L_F of 24 metres and above.

102 Vessels with a length L_F less than 24 meters should as far as practicable comply with the requirements in this section. Other stability requirements may however be applied provided the Society upon consideration in each case finds these requirements to be appropriate for the vessel.

103 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 104. The criterion in 105 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. These initial conditions shall also comply with the relevant intact and damage stability criteria before applying the heeling moment.

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104 *Towing heeling moment*

A transverse heeling moment generated by the rudder and propulsion system with maximum thrust and rudder(s) hard over is assumed to act horizontally on the towline as a static transverse force derived from the

maximum bollard pull. No vertical force is assumed.

A heeling lever curve as a function of the heeling angle shall be calculated as

$$HL_\theta = \frac{F_{thr} \cdot h \cdot \cos\theta}{g \cdot \Delta}$$

where:

F_{thr} is taken as $BP \cdot C_T$ in kN

BP is the maximum continuous bollard pull measured in accordance with Sec.12 A500

C_T is a transverse thrust and rudder force reduction factor depending on the propulsion arrangement:

C_T shall be taken as not less than 0.6 for conventional single or twin propeller propulsion systems with rudders and fixed or no propeller nozzles. This value is increased to 0.7 for ships fitted with moveable nozzles.

For single azimuth thrusters ('Z-drives') acting normal to the centreline and for cycloidal drives a value of 1.0 is to be applied.

For two azimuth thrusters C_T is taken as $(1 + \cos \gamma) / 2$, where γ is the offset angle that occurs between the thruster jets when one unit is directed at a right angle to the ship's centreline and the other is directed so that its thrust jet tangentially intersects the nozzle of the first.

Other values for C_T may be accepted if substantiated by calculations

h is the towing heeling arm taken as the vertical distance between the centre of propeller(s) and the fastening point of the towline

g = 9.81 m/s^2

Δ is the displacement of the loading condition in tonnes. The displacement, LCG and VCG for the initial loading condition is assumed to remain unchanged.

[If the vessel is intended to operate with additional transverse thrusters the heeling lever generated by the propulsion system shall be increased in proportion to the heeling moment generated by such thrusters.]

105 *Stability criterion for tugs*

The residual area between the righting lever curve and the heeling lever curve calculated in accordance with 104 shall not be less than 0.09 metre-radians. The area is determined from the first interception of the two curves to the angle of the second interception or the angle of down flooding, whichever is less.

Alternatively, the area under the righting lever curve shall not be less than 1.4 times the area under the heeling lever curve calculated in accordance with 104. The areas are determined between 0° and the angle of the second interception or the angle of down flooding, whichever is less.

106 *Stability criteria for ocean towing*

For ships intended only for towing operations where the towline is secured against transverse movement near the aft perpendicular the following criteria may be applied in lieu of D103:

The residual area between the righting lever curve and the heeling lever curve calculated in accordance with 104 shall not be less than 0.055 metre-radians. The area is determined from the first interception of the two curves to the angle of the second interception or the angle of down flooding, whichever is less.

The static angle at the first interception shall not be more than 15 degrees.

107 *Additional information*

The vessel's stability manual shall contain additional information in on the maximum bollard pull, the assumed location of the fastening point of the towline, heeling force and moment and identification of critical flooding points. The heeling lever curve shall be plotted on the GZ curve for all intended towing conditions.

SECTION 13
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.12 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.

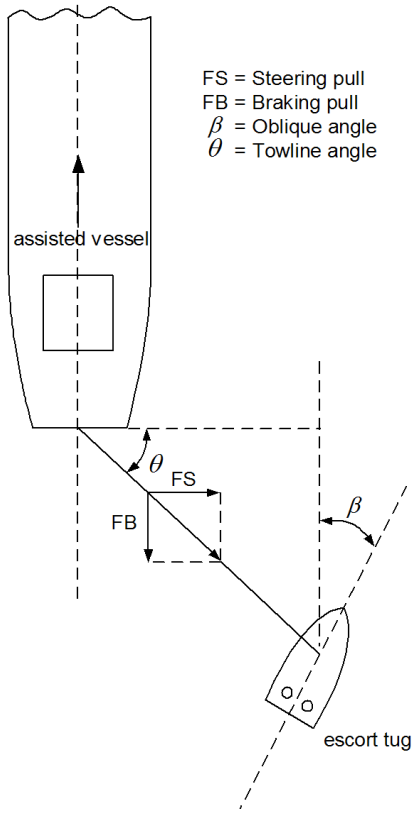

Fig. 1
Typical Escort configuration

102 The towing winch shall have a load reducing system in order to prevent overload cause 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 = $\frac{k28}{t}$ 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 sec. 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 θ 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.12 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.

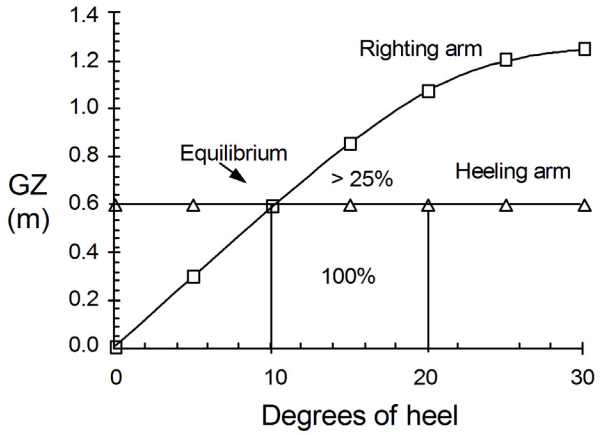

Fig. 2
Equilibrium to 20 degrees

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.

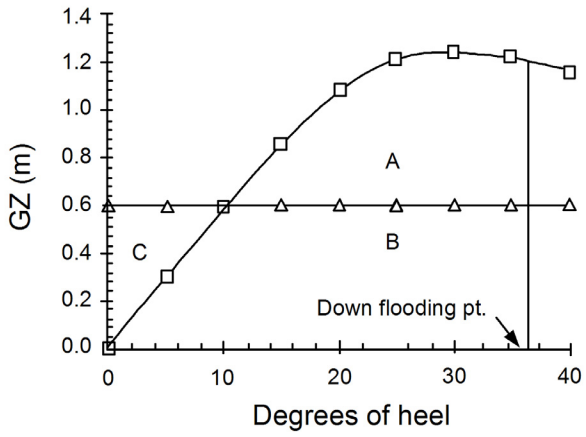

Fig. 3
Total area requirements

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 14
BARGES

A. General

A 100 Introduction

101 *Objective*

The objective of this section is to define a minimum technical standard for barges.

102 *Scope*

Scope includes arrangement, hull strength, hatches and deck openings, steering arrangement, equipment, machinery and electrical installations, drainage, and stability.

103 For barges intended to carry personnel, the scope also covers basic safety requirements. This includes fire safety, life saving appliances, power supply, and radio communication.

104 *Application*

Barges are to be built and equipped, surveyed and tested in compliance with the requirements in sections B-J, and will be given the additional class notation **Barge**.

105 A barge may be towed or pushed. For barge to be pushed, see Sec.15.

106 If relevant requirements given in Pt.5 Ch.3 are satisfied the barge may be given the class notation **Barge for Oil**.

107 If relevant requirements in Pt.5 Ch.5 are satisfied the barge may be given the class notation **Barge for Liquefied Gas**.

108 If relevant requirements in Pt.5 Ch.4 are satisfied the barge may be given the class notation **Barge for "C"**, referring to specific type of liquid chemicals. **"C"** denotes the type of cargo for which the barge is classified.

109 A barge built for deck load only may be given the additional class notation **Barge for Deck Cargo**. A barge built for loading or unloading cargo by submerging the cargo deck shall satisfy relevant requirements given in Sec.21.

110 *Relation to other DNV documents*

DNV Rules for Ships Pt.2 and Pt.4 applies unless otherwise specified. Pt.3 is replaced by the requirements of this section.

A 200 Definitions

201 Barges are vessels without sufficient means of self-propulsion for transit. 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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A 300 Documentation requirements

301 In addition to the plans mentioned in Pt.3 Ch.1 Sec.1 or Pt.3 Ch.2 Sec.1 the following documentation shall be submitted as required in Table A1:

Table A1 – Documentation requirements

Object	*Documentation type*	*Additional description*	*Info*
Foundation of towing brackets or winch with supporting structure	H050 – Structural drawing	Towing force, including design loads, to be stated, and/or winch load foot-prints	AP
Towing arrangement	Z030 – Arrangement plan	Arrangement of towing line Fastening arrangement and details	FI

302 For Barges carrying 36 persons or more the following additional following documentation shall be submitted as required in Table A2:

Table A2 – Documentation requirements

Object	*Documentation type*	*Additional description*	*Info*
Fire Control Plan	G040 – Fire control plan	Equipment as described in SOLAS Ch.II-2/Reg.15.2.4	AP
Structural fire protection plan	G060 – Structural fire protection drawing	— Method of construction — Categories of spaces — Details of fire insulation and specification of materials and doors — Application of fire rated divisions for all areas and spaces — Draught stops	AP
Ventilation system drawing	V010 – Ducting diagram (DD) V050 – Duct routing sketch	— Duct layout and construction details — Specification of fire insulated ducts — Position, dimension and details of fire dampers — Arrangement of means of control for closure of openings and stop of ventilation fans	AP
Penetration details	V060 – Penetration drawings	— Details of ventilation duct penetrations through fire divisions — Details of cable penetrations through fire divisions — Details of pipe penetrations through fire divisions	AP
Escape route plan	G120 – Escape route drawing	— Arrangement of primary and secondary escape routes including stairways, escape trunks and escape ladders — Width of escape routes including doors — Inclination of stairways/ ladders	AP
Fire main system drawing	S010 – Piping diagram S030 – Capacity analysis Z030 – Arrangement plan	— Fire pumps including emergency fire pump — Arrangement and construction details of fire main and isolating valves — Number and positions of hydrants and hoses — Fire pump capacity calculations	AP
Arrangement drawings of fixed fire-extinguishing system in machinery spaces	S010 – Piping diagram S030 – Capacity Z030 – System arrangement plan Z160 – Operation manual	— Specification and location of all equipment — Reference to equipment certificates — Calculations for the quantity of the media used and the proposed rates of application — Release instructions Control and monitoring system	AP

Table A2 – Documentation requirements (Continued)

Object	*Documentation type*	*Additional description*	*Info*
Arrangement drawings for fixed local-application fire-extinguishing system in machinery spaces	S010 – Piping diagram S030 – Capacity Z030 – System -arrangement plan Z160 – Operation manual	— Reference to equipment certificates — Specification and location of all equipment — Calculations for the quantity of the media used and the proposed rates of application — Release instructions Control and monitoring system	AP
Arrangement drawings of fixed fire-extinguishing system in cargo spaces (if relevant)	S010 – Piping diagram S030 – Capacity Z030 – System arrangement plan Z160 – Operation manual	— Specification and location of all equipment — Reference to equipment certificates — Calculations for the quantity of the media used and the proposed rates of application — Release instructions Control and monitoring system	AP
Arrangement drawings of each fixed fire-extinguishing system in service spaces, accommodation spaces and other spaces (if relevant)	S010 – Piping diagram S030 – Capacity Z160 – Operation manual	— Specification and location of all equipment — Reference to equipment certificates — Calculations for the quantity of the media used and the proposed rates of application — Release instructions Control and monitoring system	AP
Arrangement drawings of automatic sprinkler, fire detection and fire alarm system (if relevant)	S010 – Piping diagram S030 – Capacity Z160 – Operation manual	— Sprinklers grouped into sections — Specification and location of, pumps, tanks, alarms and activators Relevant information as specified for arrangement drawings for fixed fire detection and fire alarm system	AP
Arrangement drawings of fixed fire detection and alarm systems	I200 – Control and monitoring system documentation Z030 – Arrangement plan	— Specification of control panel (central unit), indication units, detectors, alarm devices and manual call points — Location of equipment including cable routing and loops — Power supply arrangement Details of smoke extraction system (where relevant)	AP
Safety, general	G050 – Safety plan		AP
Lifesaving arrangements	G160 – Lifesaving arrangement plan		AP

303 For general requirements to documentation, including definition of the Info codes, see Pt.0 Ch.3 Sec.1.

304 For a full definition of the documentation types, see Pt.0 Ch.3 Sec.2.

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.

Guidance note:
For manned barges the requirements to bow height should be clarified with the respective Administration.

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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:

$$Z = \frac{M_s + M_W}{\sigma_l} 10^3 \quad (cm^3)$$

σ_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:

$$Z = 0.95 \frac{C_{WO}}{f_1} L^2 B (C_B + 0.7) \quad (cm^3)$$

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^2 and 65 f_1 N/mm^2 for ordinary seagoing and special conditions, respectively.

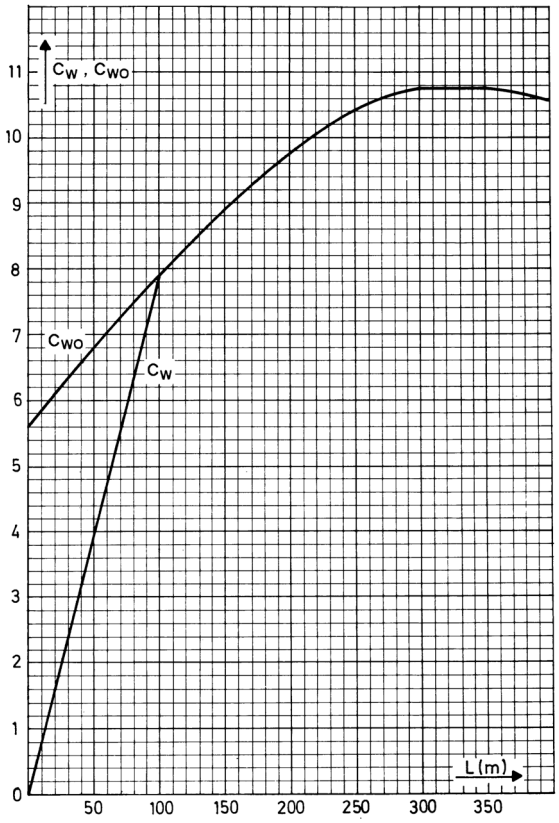

Fig. 1
Wave coefficients

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}
R0	none	none
R1	none	none
R2	10%	5%
R3	25%	13%
R4	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 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:

$$\Sigma A \geq 0.1 (Q_S + Q_W) \ (cm^2)$$

ΣA = 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 B200.
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 ΣA_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:

$$t = ks\sqrt{\frac{p}{f_1}} + t_k \quad (mm)$$

k = 1.5 for bottom and deck plating within 0.4 L when transverse stiffening and for longitudinally stiffened deck plating in way of cargo area of vessels with class notation ESP.
= 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:

$$Z = \frac{83\, l^2\, s\, p}{\sigma}\, k \quad (cm^3)$$

l = stiffener or girder span (m)
s = stiffener or girder spacing (m)
k = $1 + 0.08\, t_k$.
p as given in Table C2.
σ 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:

$A = 0.06\, l\, s\, p + 10\, h\, t_k$ (cm^2)

The web area at the middle of the span shall not be less than 0.5 A. Alternatively the web area can be determined with basis on direct strength calculations. Ref. Pt.3 Ch.1 Sec.12.

307 Corrosion addition for internal members inside ballast tanks using fresh water from rivers and lakes:

t_k = 2.0 mm within 1,5 m below weather deck tank or cargo hold top
t_k = 1.0 mm otherwise.

Table C2 Design pressures		
		p (kN/m^2)
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	$10\left(1 + k\left(0.35 - \frac{0.6\ L}{1000}\right)\right)\ q$

K = 1.3 at ends
= 0.8 within 0.7 L midships. Linear interpolation at intermediate positions
k_s = 5 at aft end
= 3 between 0.2 L and 0.7 L from aft end
= 8 at forward end
h_0 = vertical distance in m from the waterline at full draught to the load point
q = deck loading in t/m^2. q is not to be taken less than 0.7 T.
If restricted service k may be reduced by the same percentage as C_W given in Table C1. Reduction of C_W and k may also be considered if transportation is to take place under specified fair weather conditions.

See Guidance note below.

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. In case the barge is arranged with a double bottom refer to requirements given in Pt.3 Ch.1 Sec.6 or Pt.3 Ch.2 Sec.5.

402 The height of a double bottom shall give good access to all internal parts. The height shall 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 C.

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 strength calculations shall be made to verify that for the loading specified in Table C2 or other specified design loadings, the stresses comply with the 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.

504 Decks subject to wheel loads shall have scantlings complying with requirements given in Pt.5 Ch.2 Sec.4 C in the Rules.

505 Dry cargo barges where the cargo holds and the main deck are supported by cantilevers are to comply with requirements given in Pt.5 Ch.2 Sec.4.

C 600 Towing arrangement

601 Towing hooks, winches, 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 the towline minimum breaking strength given in Equipment Table, i.e. Pt.3 Ch.3 Sec.3 Table C1.

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:

$\sigma_b = 210\ f_1\ (N/mm^2)$
$\tau = 130\ f_1\ (N/mm^2)$

$$\sigma_{comb} = \sqrt{\sigma_b^2 + 3\tau^2} = 235\ f_1\ (N/mm^2)$$

C 700 Deckhouse

701 Scantlings of deckhouses shall comply with Pt.3 Ch.1 Sec.10 or Pt.3 Ch.2 Sec.10.

D. Hatches and Deck Openings

D 100 General

101 Deck openings in barges shall normally have hatch coamings and covers as given in Pt.3 Ch.3 Sec.6. Minimum design pressure for hatch covers in dry cargo barges is 3.5 kN/m^2.

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 steering arrangement shall comply with the requirements given in Pt.3 Ch.3 Sec.2 as far as these rules are found to be relevant for barges.

When calculating the rudder force, the speed shall not be taken less than 8 knots.

F. Equipment

F 100 General

101 Unmanned barges are not required to carry equipment according to Pt.3 Ch.3 Sec.3 Table C1.

102 Manned barges are required to carry equipment according to Pt.3 Ch.3 Sec.3 Table C1. However, the required total length of anchor chain cable may be reduced by 50%, based upon a special consideration of the intended service area of the vessel. In such cases a B will be given in brackets after the equipment letter for the vessel. e.g. F(B).

G. Machinery and Electrical Installations

G 100 General

101 If the barge is arranged with machinery and electrical installations, relevant requirements given in Pt.4. shall be complied with.

H. Drainage

H 100 General

101 Barges are normally to be provided with means for drainage of cargo holds, engine rooms and watertight compartments and tanks which give major contribution to the vessel's buoyancy and floatability.

102 As far as applicable and with the exemptions specified in the following, the rules and principles for drainage of ship with propulsion machinery shall be complied with.

103 Manned barges shall be provided with a permanently installed bilge system with power bilge pumps. The bilge system shall have suctions in rooms mentioned in 101.

An additional emergency bilge suction shall be provided in engine rooms.

Dry compartments in fore- and after peaks may be drained by effective hand pumps. Rooms situated on deck may be drained directly overboard.

104 Manned barges for unlimited service shall be equipped with two permanently installed bilge pumps.

Manned barges with restricted service may have one bilge pump.

Ballast pumps may be used as bilge pumps. Where only one permanently installed bilge pump is installed, this pump shall not serve as fire pump.

105 Ballast systems shall comply with the requirements for ballast systems in ships. However, one ballast pump may be accepted.

Alternative methods for emptying ballast tanks, e.g. by means of compressed air and bottom valves, may be accepted upon consideration in each case.

106 Unmanned barges shall be provided with drainage facilities for compartments rooms mentioned in 101.

For cargo holds the facilities shall be so arranged that drainage can be performed in loaded conditions, for instance by arranging ducts for portable pumps to bilge wells or piping from the connection point of the bilge pump to the bilge wells.

Other compartments which shall be drained by portable equipment shall be provided with suitable access openings for such equipment.

Any engine room or pump room shall have bilge suctions to available pumps.

107 Unmanned barges may have portable bilge pumping equipment only, arranged with their own power supply.

For barges for unlimited service such equipment shall be permanently installed.

For barges for restricted service the rules are based on the assumption that suitable bilge pumping equipment is available on board the barge or on board the towing / pushing vessel. This assumption will be included in the Appendix to the Classification Certificate to be issued for the barge.

I. Stability

I 100 Stability requirements

101 Barges with a length of 24 m and above shall comply with the intact stability requirements according to Pt.3 Ch.3 Sec.9.

102 The alternative stability criteria as given in 2008 IS Code Part B Ch.2.2 may be applied for barges with class notation **Barge for Deck Cargo**.

J. Safety

J 100 General requirements

101 For barges designed to carry 36 persons or more the topics in this sub-section are to be taken into consideration.

102 The yard or builder shall submit evidence of these topics being accepted by the respective Administration, in which the same will be also be acceptable to the Society

103 For manned barges with less than 36 persons, the requirements herein will be reviewed on a case by case basis.

J 200 Fire safety

201 The barge is to comply with the cargo ship fire safety requirements of Ch.II-2 of SOLAS 1974 as amended.

J 300 Life saving appliances

301 The barge is to comply with the requirements given in Part A and Section I of Part B of Ch.III of SOLAS 1974, as amended, and with the applicable provisions of the International Life-Saving Appliance (LSA) Code.

302 The barge shall carry one or more lifeboats complying with the requirement of section 4.6, 4.7, 4.8 and 4.9 of the LSA Code of such aggregate capacity on each side of the ship as will accommodate the at least 50% of all persons onboard.

303 In addition, inflatable or rigid liferafts complying with the requirement of section 4.2 and 4.3 of the LSA Code, of such aggregate so that there will be survival craft on each side of the barge to accommodate all persons onboard.

304 In lieu of the requirement in 302 and 303, barges of less than 85 m in length or barges with appropriate damage stability as per SOLAS SPS Code, may carry on each side of the barge one or more liferafts complying with the requirement of section 4.2 and 4.3 of the LSA Code of such aggregate as will accommodate all persons onboard.

305 The barge shall carry at least one rescue boat complying with the requirement of section 5 of the LSA Code.

306 Personal life-saving appliances are to comply with requirements given in SOLAS Reg.III/32

307 Survival craft embarkation and launching arrangement is to comply with requirements given in SOLAS Reg.III/33.

J 400 Power supply

401 At least two main generator sets are to be provided. The capacity shall be sufficient to maintain the barge in normal operational conditions with any one main generator out of operation.

402 A self contain emergency source of power shall be provided. The emergency source of power and its associated equipment shall be located on or above the freeboard deck, and independent of the main electrical power required by 401.

403 The requirements for a separate emergency source of power may be omitted for installations with two independent engine rooms when compliant with Pt.4 Ch.8 Sec.2 C 104

404 In case of failure in the main source of electrical power, the emergency source of power shall be automatically connected to the emergency switchboard unless a transitional source of power is provided.

The emergency source of power shall be capable of supplying simultaneously the services listed for at least 18 hours

— Emergency lighting for machinery spaces, control stations, alleyways, stairways, exits and elevators
— Emergency lighting for embarkation stations on decks and over sides
— Emergency lighting for stowage position(s) for firemen's outfits
— Emergency lighting for helicopter landing decks
— Navigation and special purpose lights and warning systems including helicopter landing lights
— General alarm and communications systems
— Fire detection and alarm systems
— Fire extinguishing systems.

405 The transitional source of power, if required, shall be capable of supplying the services listed for at leased minutes 30 minutes:

— Emergency lighting
— General alarm and communications systems
— Fire detection and alarm systems.

406 The electrical installation shall in general comply with relevant requirements given in Pt.4 Ch.8.

J 500 Radio communication

501 Each barge is to be provided with a radiotelephone station complying with the provision of Chapter IV of SOLAS 1974 as amended and at least one emergency position-indicating radio beacon (EPIRB).

502 The radio station is to be subject to survey by the administration which issue the licence or its authorised representative before the radio station is put into service

503 The radio station shall be surveyed once every 12 months, carried out by an officer of the Administration or its authorised representative, or by a qualified radio service engineer from a DNV approved local radio firm.

SECTION 15
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 0.85 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 Pt.5 Ch.1.

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.

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

303 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.

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 sec., when the vessel is running ahead at maximum service speed. For the combined pusher/barge unit, the requirement is 28 sec.

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:

$$2\,(a\,B + \Sigma\, h_i\, b_i)$$

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

SECTION 16
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 notations **Barge**, **Barge for Deck Cargo**, or **Barge for Oil**, **Barge for Liquified gas** or **Barge for C** 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 requirements 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 exceedence 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: $225\ f_1$ N/mm^2
Shearing stresses: $120\ f_1$ N/mm^2

$$f_1 = \left(\frac{\sigma_f}{240}\right)^{0.75}$$ 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 after body 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 17
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 DNV Standard for Certification No. 2.22 “Lifting Appliances”. In agreement with the society the crane may be certified based on other internationally recognised standards. Cranes certified by other societies may be accepted based on special consideration.

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 DNV Standard for Certification No. 2.22 “Lifting Appliances”.

D. Stability and Watertight Integrity

D 100 General

101 The requirements in this section apply to vessels with length L_F of 24 metres and above.

102 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, statutory damage stability requirements and voluntary class notations 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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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 Θ_e after loss of crane load shall not be more than 15 degrees from the upright.

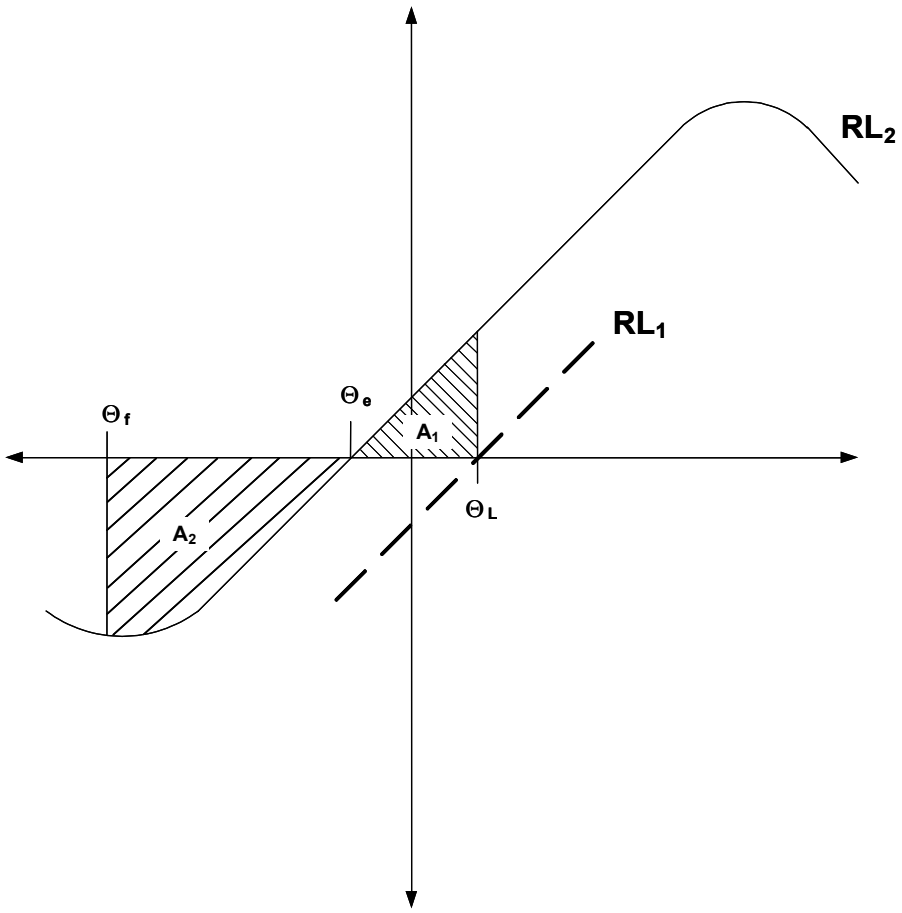

Fig. 1
Stability with loss of crane load

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.

Θ_L = Static angle of equilibrium before loss of crane load.

Θ_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.

Θ_e = Static angle of equilibrium after loss of crane load

Θ_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) ≥ 1.4(B+C) in accordance with Fig.2
— the area under the GZ curve measured from the equilibrium position Θ_L and to the down flooding angle Θ_f, or 20 degrees, whichever is less shall be at least 0.03 mrad.

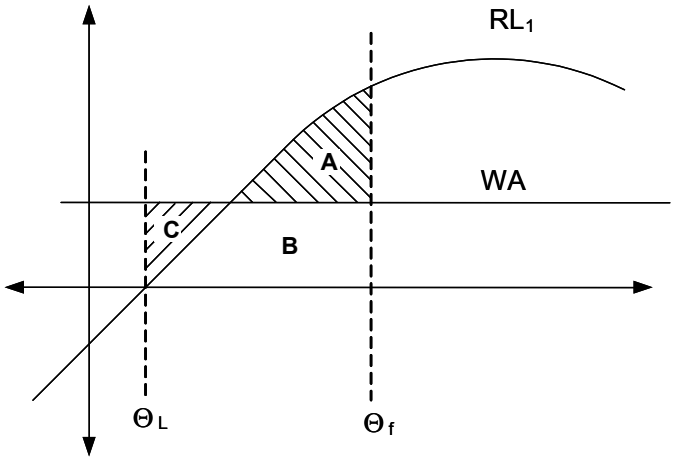

Fig. 2
Alternative intact criteria

WA = The heeling arm due to wind forces (for wind speed see 302).
RL_1 = 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.
Θ_L = Static angle of equilibrium.
Θ_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 18
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:

Table A1 Documentation Requirements

Object	*Document type Ref Pt0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*	*Rule Ref.* Sec.18
Foundation and support for dredging equipment	H050 Structural drawing	Including design loads	AP	B
Dredging arrangement plan	Z030 Arrangement plan	Including dredging equipment and installations	FI	A

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 19
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**.

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 **Cable Laying Barge**.

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 load bearing 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.

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 DNV Standard for Certification No. 2.22 “Lifting Appliances”, as far as relevant.

202 Transmission gears shall comply with Pt.4 Ch.4 Sec.2, as required for auxiliary gears.

SECTION 20
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**.

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 **Pipe Laying Barge**.

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

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.

SECTION 21
SEMI-SUBMERSIBLE HEAVY TRANSPORT VESSELS

A. General

A 100 Classification

101 The requirements in this section apply to vessels intended for loading or unloading of deck cargo by submerging the cargo deck through ballast operations.

102 Ships intended for loading or unloading of deck cargo by submerging the cargo deck shall be built in accordance with the requirements in this section, and will be assigned the mandatory ship type notation **Semi-Submersible Heavy Transport Vessel**.

103 The additional notation **DK+** is mandatory for vessels assigned the notation **Semi-Submersible Heavy Transport Vessel**.

A 200 Scope

201 The following is covered by the classification:

— hull structure
— reserve freeboard and reserve buoyancy
— stability and floatability in transit and submerged conditions
— fire safety
— lifesaving appliances
— navigation and nautical safety.

A 300 Definitions

301 The following definitions are used:

Semi-Submersible Heavy Transport Vessel: A vessel designed to load and unload deck cargo by temporarily submerging its freeboard deck through ballast operations.

Temporarily Submerged Condition: Any ballasting or de-ballasting with the load line mark submerged.

Transit Condition: The condition from when the vessel has completed loading, with the cargo properly secured, to when the vessel has reached its intended destination and preparation for unloading can commence.

Cargo Deck: The deck being submerged for carrying the cargo, as well as its horizontal extension.

Maximum Submerged Draught: The maximum draught to which the vessel is allowed to be submerged.

Exposed Surfaces: Superstructures, casings and other buoyant volumes above the cargo deck, or its horizontal extension, that may become damaged if coming in contact with the cargo at any stage during loading or unloading operations. The cargo deck is also to be considered as an “exposed surface.”

ICLL 1966: The International Convention on Load Lines 1966 as amended 1988 and 2000.

A 400 Documentation

401 Documentation shall be submitted as required by Table A1.

Table A1 – Documentation requirements

Object/ Function	*Documentation type*	*Additional description*	*For approval (AP) or For information (FI)*
Ship	Z010 – General arrangement plan	Including maximum submerged draught, maximum transit draught and minimum transit draught with cargo.	FI
Ship hull	H020 – Design load plan		FI
Intact and damage stability	B050 – Preliminary stability manual	Including the following: - intact and damage stability calculations for typical transit conditions, sufficient to demonstrate stability of the vessel with the cargoes it is intended to carry, including the most onerous combination of weight, VCG and wind moment - intact and damage stability calculations for typical temporarily submerged conditions, sufficient to demonstrate stability of the vessel during ballasting and de-ballasting with and without the cargoes it is intended to load/unload; cargo without buoyancy is also to be checked; maximum trim for the maximum submerged draught is to be shown, if relevant - limit curves based on intact and damage stability according to IACS UI LL65 (i.e. SOLAS Ch.II-1) shall be developed for general use in transit conditions; such limit curves shall not take into account the buoyancy of the deck cargo, but shall include a maximum windage moment representative of the intended cargoes.	AP
	B070 – Preliminary damage stability calculation		AP
	B120 – Final stability manual		AP
	B130 – Final damage stability calculation		AP
External watertight integrity	B200 – Freeboard plan		AP
	Z240 – Calculation report	Reserve buoyancy calculations.	FI
Escape	G120 – Escape route drawing		AP
Fire main system drawing	S010 – Piping diagram	Number and position of hydrants and hoses.	AP
	S030 – Capacity analysis		AP
	Z030 – Arrangement plan		AP
Fire extinguishing system	G200 – Fixed fire extinguishing system documentation		AP
	I200 – Control and monitoring system documentation		AP
Navigation	N010 – Bridge design drawing	Covering all navigation bridges.	AP
	N020 – Vertical field of vision drawing		AP
	N030 – Horizontal field of vision drawing		AP
	Z090 – Equipment list		AP
Internal communication	Z030 – Arrangement plan		AP
Submersion operation	Z250 – Procedure	Including generic ballasting sequence during submersion and re-emersion.	FI

402 For general requirements to documentation, see Pt.0 Ch.3 Sec.1.

403 For a full definition of the documentation types, see Pt.0 Ch.3 Sec.2.

B. Hull Arrangement and Strength

B 100 Global strength

101 During cargo handling operations, the global wave loads given in Pt.3 Ch.1 Sec.5 B200 may be reduced in accordance with a) to c).

a) Temporarily submerged conditions may be treated as harbour conditions, i.e., a and b may be taken equal to 0.5.

b) During non-submerged loading and unloading with the vessel moored to the quay, a and b may be taken equal to 0.25, provided that the operation is carried out in conditions with a significant wave height equal to or less than 0.5 m. This condition will be stated in the Appendix to Classification Certificate.

c) If the conditions in b) are fulfilled, further reduction of a and b may be accepted provided that the hull girder loads are closely monitored throughout the loading/unloading sequence. In such cases the method used for monitoring the loads will be subject to special consideration.

102 Due to the low depth of the hull girder, special attention should be paid to the requirement to moment of inertia given in Pt.3 Ch.1 Sec.5 C400. This requirement shall be satisfied over a minimum of 0.25 L in the midship area.

B 200 Local strength

201 External hull boundaries and sea chest boundaries shall be able to withstand the sea pressure at maximum submerged draught. In temporarily submerged conditions, the dynamic part of the sea pressure may be reduced by 50%.

202 The design pressure for internal watertight bulkheads, including doors, hatches, pipe penetrations and other piercings, shall be based on the deepest equilibrium waterline in damaged transit or damaged submerged condition, as applicable, depending on relevant damage scenario. Damage stability requirements in transit and submerged conditions are given in D100 and D300, respectively.

203 Bolted connections between buoyancy towers and hull are subject to special consideration.

C. Load Line

C 100 Freeboard assignment transit draught

101 Freeboard will be calculated and assigned according to ICLL 1966 and standard procedures. Compliance with requirements to weathertight and watertight closing appliances shall be documented with a freeboard plan.

C 200 Temporarily submerged conditions

201 Requirements to reserve buoyancy and water- and weathertight integrity given in C300 and C400 shall be complied with in the maximum submerged draught condition.

Guidance note:

International load line exemption certificate

Independent of class approval, an exemption from ICLL 1966, Article 12 “Submersion” will have to be applied for as the load line mark will be submerged during cargo operations. This exemption may only be granted by the Flag Administration and is to be based on an application from the owner. The Flag Administration will normally require the classification society to give their comments to the application. Normally DNV will recommend to the Flag that an exemption be granted, provided that the requirements in this section are fulfilled.

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C 300 Reserve buoyancy

301 The ratio of reserve buoyancy shall not be less than:

— 4.5% for the vessel
— 1.5% for the forward and aft end buoyancy structures considered separately.

302 The reserve buoyancy requirements in 301 shall be documented by a calculation according to the principles given in a) to d).

a) Ratio of reserve buoyancy is the reserve buoyancy divided by the volume displacement of the vessel at maximum submerged draught with no trim.

b) Reserve buoyancy is defined as the volume providing buoyancy, positioned above the waterline with no trim at maximum submerged draught. In the calculation of the total reserve buoyancy for the vessel, no buoyancy shall be assumed above the lowest of the zero trim waterlines corresponding to:

— the position of the lowest opening which can not be closed and secured to prevent water from entering the buoyant volume
— the uppermost point of the deck limiting the buoyancy structure forward
— the uppermost point of the deck limiting the buoyancy structure aft.

c) Calculations for end structures considered separately need only take account of openings and decks in the end under consideration. Trim shall be taken into account if it is consistent with practice to operate the vessel with trim and the maximum draught at the perpendicular is larger than the mean maximum submerged draught. Reserve buoyancy is then defined as the volume providing buoyancy for the end under consideration, above the waterline with no trim at maximum perpendicular draught.

d) Openings which can not be closed and secured to prevent water from entering the buoyant volume are to be considered as down flooding points in the reserve buoyancy calculation. These openings shall include all air pipes, but need not include weathertight doors, hatches, ventilators, side scuttles and small windows with deadlights. This is provided that the relevant opening will be closed and secured during submerged stages, and that the closing appliance has been found to be adequate and of at least the same strength as the bulkhead or deck where it is fitted.

The calculation shall be submitted as a separate document and not be part of the stability documentation.

303 As an alternative to the requirements in 301, the reserve buoyancy may be evaluated based on real intact and flooded scenarios with the intact vessel at maximum submerged draught, including trim when relevant. In intact scenarios, ship movements shall be evaluated to determine the risk of submergence of decks limiting buoyancy structures. In flooded scenarios, the freeboard to a deck limiting a buoyancy structure shall not be less than 1 m.

Guidance note:

Intact scenarios should consider ship movements in defined worst operating sea condition(s) and as the result of forces transferred from cargo.

Flooded scenarios should at least cover the effect of filling additional tank space by mistake and the effect of tanks and dry spaces being flooded due to valve failure. Simultaneous occurrence of at least two events should be considered in such scenarios. The possibility of spaces being flooded progressively should be taken into account where necessary. Partial flooding stages should be considered where this may give a more severe waterline.

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C 400 Requirements to water- and weathertight integrity

401 All openings below the first deck above the maximum submerged draught shall be arranged with watertight closing appliances.

402 Access openings which are submerged at the maximum submerged draught are to be protected by two watertight doors or hatches in series. A leakage detection device shall be provided in the compartment between the two doors or hatches. Drainage of this compartment to bilges controlled by a readily accessible screw-down valve shall be arranged.

403 A watertight closing appliance shall be provided for any internal opening leading to the compartment required by 402.

404 The effect of flooding the watertight compartment required by 402 shall be investigated in the stability calculations for all stages where the outer door or hatch is submerged.

405 Bulkheads bounding the compartment required by 402 shall be of sufficient strength to withstand the water pressure that could occur after flooding. Doors and hatches shall be approved and pressure tested.

406 All openings between the first and second deck above the maximum submerged draught shall comply with ICLL 1966 position 2 requirements to weathertight closing.

407 Scuppers are to be of substantial thickness below the first deck above the maximum submerged draught.

C 500 Miscellaneous requirements

501 On-board instruction manuals and checklists containing operating procedures for submerging shall list the closing appliances which have to be closed before operation commences. Examples are watertight doors and hatches, closing appliances as given in 402 and 403, and closing valves in sanitary discharges. Signboards shall be fitted at the relevant closing appliance.

502 Guard rails must be arranged so that they do not interfere with cargo operations. Removable guard rails with steel wire rope may be acceptable, provided that the arrangement is according to ICLL 1966 and scantlings are found sufficient. Wires should have steel cores of not less than 10 mm in diameter and be plastic coated.

503 In order to provide access to the ends of the vessel when deck cargo covers the whole breadth of the vessel, an under-deck passage way in compliance with Pt.3 Ch.3 Sec.8 A202 a) shall be provided.

D. Stability

D 100 Stability requirements in transit condition

101 The intact stability requirements of The International Code on Intact Stability (2008 IS Code) Part A, Ch. 2.2 and 2.3 apply. The windage area in loading conditions shall include deck cargo.

102 If the vessel's characteristics render compliance with The International Code on Intact Stability (2008 IS Code) Part A, Ch. 2.2 impracticable, then the criteria of Part B, Ch.2.4.5 may be used.

103 For intact stability the buoyancy provided by a part of large deck cargo such as semi-submersible units, jack-up units, barges or ships may be taken into account, provided that the securing arrangement is separately approved. The watertight integrity of the cargo is to be defined and taken into account in the calculations.

104 The damage stability standard shall be in accordance with SOLAS Ch.II-1 or ICLL 1966 Reg.27, including IACS UI LL65, as applicable.

105 *Ships with B-60 or B-100 freeboard:*

B-60 freeboard requires one-compartment damage, while B-100 requires two-compartment damage in accordance with Reg.27 of the ICLL 1966. The calculations are to be carried out assuming the damaged tanks empty and for representative loads, such as a semi-submersible unit and a jack-up unit, as far as applicable. Damage extent is to be taken according to ICLL Reg. 27. The buoyancy of watertight volumes of the deck cargo not located within the damage extent for each damage case may be taken into account. In all cases, transverse penetration shall be taken from the ship’s side.

Ships with ordinary B freeboard:

If, in addition to the SOLAS limit curves, it is desired to take the buoyancy of the deck cargo into account, calculations as for ICLL Reg. 27 corresponding to B-60 damage may be considered equivalent (same approach as the case of ships with reduced freeboard).

Guidance note:

As there are no international rules or interpretations regarding whether the buoyancy of deck cargo may be taken into account in order to make these operations feasible, the Flag state must be approached for acceptance of the application of the requirements given in D103 and D105 for statutory purposes.

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D 200 Intact stability criteria in temporarily submerged conditions

201 The owner must ensure that the loading and unloading sequences be so planned that the stability is sufficient during all phases of the sequence. The buoyancy provided by a part of large deck cargo such as semi-submersible units, jack-up units, barges or ships may be taken into account, provided that proper environmental limitations have been separately defined.

202 The GM at equilibrium shall not be less than 0.3 m. The positive range of the GZ curve shall be minimum 15 degrees in conjunction with a height of not less than 0.1 m within this range. The maximum righting arm shall occur at an angle of heel not less than 7 degrees. Unprotected openings shall not be immersed within this range. It may be required to calculate the stability about additional axis to determine the most onerous result.

203 Whenever free liquid surface exists in a tank, the effect shall be considered. The calculations shall account for the real filling of the tanks, i.e., in particular the location of air pipes needs to be carefully considered. If the complete filling of the tanks is dependent on certain trim or heel during the submerging sequence this needs to be clearly stated in the stability manual.

D 300 Damage stability in temporarily submerged conditions

301 The risks of accidental flooding of any one compartment on the ship shall be considered. Damage to be considered is that which might occur following an uncontrolled movement of the deck cargo during loading or offloading leading to puncture of exposed surfaces. This study shall cover all relevant phases of the loading/ offloading sequence as required by D201.

302 The permeability μ of a damaged compartment shall be assumed to be 0.95 except for full ballast tanks, where $\mu = 0$. For machinery spaces, $\mu = 0.85$.

303 In the final stage of flooding after damage, the positive range of the GZ curve shall be minimum 7 degrees in conjunction with a height of not less than 0.05 m within this range. Unprotected openings shall not be immersed within this range unless the space concerned is assumed to be flooded. The angle of heel after flooding shall not exceed 15 degrees. The final waterline after flooding is to be below the lower edge of any weathertight opening through which progressive flooding may take place unless the space concerned is assumed to be flooded. It may be required to calculate the stability about additional axis to determine the most onerous result.

304 The stability at intermediate stages of flooding after damage shall not be significantly less than in the final stage.

305 The flooding of any damaged compartment shall not render vital safety functions inoperative.

306 For the purpose of damage stability calculations, a damage extent of 5 m horizontally along the surface shall be assumed for all exposed surfaces except the cargo deck. Watertight bulkheads may be considered to remain intact provided that the distance between adjacent bulkheads exceeds 5 m. The damage penetration into the structure shall be assumed to be equal to 0.76 m and the vertical extent of damage is assumed to be from the cargo deck or its horizontal extension upwards without limit. For the cargo deck a damage extent of 5×5 m shall be assumed. Watertight bulkheads may be considered to remain intact provided that the distance between adjacent bulkheads exceeds 5 m. The damage penetration into the cargo deck shall be assumed to be equal to 0.76 m.

E. Fire Safety

E 100 Fire extinguishing equipment

101 The cargo deck shall be protected by fixed fire-fighting equipment consisting of water monitors or fire hydrants with hoses, or a combination thereof.

102 If water monitors are selected in lieu of fire hydrants, then the monitors shall be capable of covering the cargo deck area and may be positioned fore and/or aft of the cargo area, as applicable. The fire monitors shall also comply with 103-106.

103 The main control station for the system shall be suitably located outside the cargo deck area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected. For monitors arranged at the end of the cargo area opposite to the accommodation spaces, remote control of the monitor(s) from the bridge will be required. Alternatively, these monitors shall be of oscillating type capable of sweeping the protected area.

104 The protected area shall be within 75% of the water monitor throw in still air conditions taking into account the distance from the monitor to the farthest extremity of the protected area forward of that monitor.

105 The capacity of each monitor shall not be less than 1250 litres/minute. The additional water supply to the monitors shall be based on one monitor operated at a time, and shall be in addition to the requirements given in SOLAS Reg. II-2/10.2.2.4.

106 Fixed arrangement for possible dispersion of the monitor water jet shall be delivered as part of each monitor.

107 Fire hydrants arranged with two hydrants at both port and starboard side just aft and forward of the cargo area, with sufficient number of hoses to reach the entire cargo area with two hoses from these hydrants, will be accepted as equivalent to the position of hydrants required by SOLAS Reg. II-2/10.2.1.5. These will ensure flexibility during fire-fighting operations, and will cover areas screened from the monitors.

E 200 Escape ways

201 The under-deck passage way required by C503 shall not be used as an escape way in submerged conditions.

202 If buoyancy towers are manned during cargo handling operations, then these shall be provided with escape ways, which will be subject to special consideration, depending on the vessel design.

F. Life Saving Appliances

F 100 Location of survival craft

101 If buoyancy towers are manned during cargo handling operations, then these shall be fitted with life saving appliances, such as life buoys or rafts. The type and arrangement of such appliances will be subject to special consideration, depending on the vessel design.

Guidance note:

Survival craft forward of wide deck cargo should be specially considered by the body approving the life saving arrangement, to ensure that they are positioned in a way such as to avoid damage from the cargo.

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G. Nautical Safety and Communication

G 100 Navigation

101 In cases where the cargo is partially blocking the view from the bridge, a secondary look-out point (crows nest) shall be arranged. Unless the secondary look-out point is fully duplicated, manning of both wheel house and look-out point will be required during transport. Equipment in the secondary look-out point shall at least include:

— conning position with unobscured view to the sea surface over an arc of 225 degrees (Ref. SOLAS Reg. V/22)
— a gyro bearing repeater
— rudder, propeller, thrust, pitch and operational mode indicators
— external communication system – one VHF
— internal communication system for communication with main bridge.

Guidance note:
Acceptance of alternative solutions may be granted by the Flag Administration.

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H. Miscellaneous Requirements

H 100 Watertight seals for propeller axle and rudder stock

101 Watertight seal on propeller axle and rudder stock shall be approved for the maximum submerged draught.

H 200 Integrated high-pressure tanks

201 Ballast tanks emptied by means of overpressure are subject to special consideration.

Guidance note:
In designs where overpressure is applied for emptying integrated ballast tanks, exemptions from the rules for pressure vessels in Pt.4 Ch.7 may be granted on a case-by-case basis, provided that satisfactory alternative safety measures are presented. Examples of such safety measures are increased safety margin by lowering the allowable stress levels, installation of cofferdams, pressure monitoring systems, increased NDT during construction, and more thorough inspections in the operation phase.

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H 300 Additional anchors

301 Anchors and associated equipment in excess of that required in Pt.3 Ch.3 Sec.3 Table C1 need not be certified.

H 400 Sea trial

401 A sea trial including submersion to maximum submerged draft and function testing of all equipment related to submersion shall be performed before final certificates are issued.

SECTION 22
WIND TURBINE INSTALLATION VESSELS

A. General

A 100 Introduction

101 This section provides principles, technical requirements and guidance for the design and construction of vessels built to satisfy subject service notation.

A 200 Scope

201 This service notation defines requirements in addition to Pt.2 through Pt.4 relevant to meet the objective. In case of conflicting requirements, the specific details in this section apply.

202 Coastal State and/or statutory regulations may include requirements in excess of the provisions of this standard depending on the size, type, location and intended service of the unit/installation. These requirements are excluded from this section.

A 300 Objectives

301 The objective of this section is to define the standard as relevant for wind turbine installation - from a vessel or barge.

A 400 Application

401 Vessels built in compliance with this section may be given the class notation, including one mandatory qualifier, as defined in Table A1

Table A1 Class Notation

Additional Notation	*Description*	*Qualifier*	*Description*
Wind Turbine Installation	Vessels intended for wind turbine installations	**Vessel**	With means for self-propulsion
		Barge	Without means for self-propulsion and compliance with Sec.14

A 500 References

501 For wind turbine installation vessels other than barges and ships, refer to the offshore standard DNV-OS-J301.

A 600 Documentation

601 For further document requirement in additional to those for main class, refer to the specific sections and certification standards specified under B.

B. Technical requirements

B 100 Hull arrangement and strength

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 installation operations.

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

103 All load effects caused by deck cargo and heavy equipment shall be accounted for in the design calculations for all operational phases.

B 200 Dynamic Positioning (DP) System

201 If a dynamic positioning system is installed, class notation **DYNPOS** or **DPS** is mandatory.

B 300 Crane Arrangements

301 If a crane is used for heavy lift purposes, the requirements of the service notation **Crane Vessel** shall apply.

302 The crane shall be delivered with Det Norske Veritas' certificate in compliance with the DNV Standard

for Certification No. 2.22 “Lifting Appliances”. In agreement with the Society the crane may be certified based on other internationally recognised standards. Cranes certified by other Societies may be accepted based on special considerations.

303 After completed installation on board, functional testing of the cranes to be used for installation of wind turbines shall be carried out as specified in the DNV Standard for Certification No. 2.22 “Lifting Appliances”.

SECTION 23
WINDFARM MAINTENANCE

A. General

A 100 Introduction

101 The requirements in this section apply to vessels intended for maintenance of offshore wind farms.

102 Wind farm maintenance may include:

— being a mother craft for smaller craft transferring technicians to and from offshore wind turbines
— transferring technicians directly to the wind turbine
— transferring supplies to the wind turbine
— perform smaller lifting operations onto the wind turbine.

A 200 Scope

201 This section contains requirements to hull arrangement, strength, and equipment.

202 Coastal State and/or statutory regulations may include requirements in excess of the provisions of these rules depending on the size, type, location and intended service of the unit/installation. These requirements are excluded from this section.

A 300 Objectives

301 The objective of this section is to define a standard supporting safe and reliable operations for offshore service vessels performing maintenance of offshore windfarms.

A 400 Application

401 Vessels with class notation Offshore Service Vessel intended for maintenance of offshore wind farms built in compliance with the requirements in this section may be given the class notation **Windfarm Maintenance**.

A 500 Documentation Requirements

501 Plans and particulars for the following shall be submitted:

Object	*Document type Ref Pt.0 Ch.3*	*Additional description*	*For info.(FI) or approval (AP)*
Dynamic positioning system	C040 – Design analysis	Capability plot	AP
Work Boat Davit and Winch for Work Boat Davit	C010 – Design criteria	Safe Working Load, heel/trim if applicable, dynamic factor if above 1.5	FI
	C020 – Assembly or arrangement drawing		FI
	C030 – Detailed drawing		AP
	C040 – Design analysis		FI
	Z160 – Operation manual		FI
	Z170 – Installation manual		FI
	Z180 – Maintenance manual		FI
Foundations and supporting structures	H050 Structural drawing	Design loads, footprint loads, fastening details (welding details etc.)	AP

A 600 Certification Requirements

601 DNV Product Certificates (NV) will be required for the following items:

— Work Boat Davit
— Winch for Work Boat Davit.

602 3.1 material certificates (EN 10204) will be required for the following items:

— Work Boat Davit
— Winch for Work Boat Davit.

B. Technical Requirements

B 100 Hull arrangement and strength

101 The hull structural strength shall be as required for the main class taking into account necessary strengthening of supporting structures for equipment applied during the maintenance and service of offshore wind farms.

102 All load effects caused by deck cargo and heavy equipment shall be accounted for in the design calculations for all operational phases.

B 200 Dynamic Positioning and Capability Plots

201 The vessel shall be built, as a minimum, according to class notation **DYNPOS-AUTR**, **DPS 2** or **DYNPOS-ER** with the additional requirement explained in sub section B500.

202 The position keeping ability of the vessel shall be calculated and presented in form of capability plots as outlined in these rules. The capability plots shall be kept onboard.

Guidance note:
The International Marine Contractors Association (IMCA) document M 140 "Specification for DP Capability Plots" may be used as a guideline for making capability plots.

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203 The capability plots shall be produced in polar form, as a static analysis with coincident forces of wind, waves, and current. In the analysis the vessel shall maintain fixed position and heading, and shall be exposed to forces from a fixed current speed corresponding to the intended location of operation but in any case not less than 1.5 m/s with correlating wind and waves. The fixed current speed applied shall be specified in the Appendix to Classification Certificate.

204 Thus there shall at the same time be a balance of forces and a balance of moments, i.e. including all moments generated by the thrusters, and those caused by environmental forces.

205 The limiting wind speed where the current, wind and wave forces equals the maximum available thruster forces shall be plotted at least every 15° around the vessel. Linear interpolation between points is acceptable.

206 The environmental forces caused by wind, waves, and current shall be calculated by recognised methods. Alternatively, environmental forces established by model testing can be used. The correlation between wind and waves used for ERN is given in Pt.6 Ch.7 Sec.6 Table A1 or Pt.6 Ch.26 Sec.7 Table B1.

207 The capability plots shall be based upon available power and the thrust output that is under control, in the most efficient control mode.

208 A minimum of four plots is required:

— Case 1 shall represent optimal use of all thrusters
— Case 2 shall represent minimum effect of single-thruster failure
— Case 3 shall represent the maximum effect single-thruster failure
— Case 4 shall represent the worst case failure modes. There shall be one plot for failure of each redundancy group.

All plots shall be produced on the same scale.

Guidance note:
It is recommended that the wind speed scale is 15 mm = 10 m/s and with range 0 to 50 m/s.

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B 300 Cranes

301 For wind farm maintenance vessels equipped with cranes, the class notation **CRANE** shall be complied with.

302 The crane shall be delivered with DNV product certificate to confirm compliance with the DNV Standard for Certification No. 2.22 "Lifting Appliances".

303 After completed installation on board, load- and functional testing of the crane shall be carried out as specified in the DNV Standard for Certification No. 2.22 "Lifting Appliances".

B 400 Offshore Transfer Systems

401 If the vessel is equipped with an offshore transfer system to transfer technicians from the ship to the wind turbine, the following requirements shall be complied with.

402 The offshore transfer system shall be delivered with a DNV product certificate.

403 The offshore transfer system shall be designed and manufactured in accordance with relevant parts of the following standards:

— DNV's Standard for Certification No. 2.22 “Lifting Appliances”
— ISO 7061 “Shipbuilding - Aluminium shore gangways for seagoing vessels”
— ISO 5488 “Shipbuilding - Accommodation ladders”.
— IMO MSC.1/Circ.1331 “Guidelines for construction, installation, maintenance and inspection/survey of means of embarkation and disembarkation”.

B 500 Work Boat Davits

501 Where fitted, work boat davits and winches are to comply with SOLAS 1974 and the LSA Code with the exceptions given in 202-205.

502 Functional and operational requirements:

— No requirements to heel or trim unless specified by operator
— Stored mechanical power not required, however lowering in dead ship condition shall be possible
— No requirements to hoisting or lowering speed unless specified by flag administration
— If estimated dynamic factor exceed 1.5, shock damper arrangement is required.

503 In addition to strength requirements given in above regulations, fatigue according to a recognised standard to be considered.

504 Testing at factory and after installation on board shall be performed in line with IMO MSC. 81(70) part 2.

B 600 Work Boats

601 All work boats fitted onboard are to be certified by DNV according to DNV Certification standard 2.21 “Craft”.

602 The ship side in way of the work boats shall be equipped with fenders to reduce the impact during launch and recovery of the craft.