



RULES FOR  
CLASSIFICATION OF  
**SHIPS**

NEWBUILDINGS

SPECIAL EQUIPMENT AND SYSTEMS  
ADDITIONAL CLASS

PART 6 CHAPTER 1

# MISCELLANEOUS NOTATIONS

JANUARY 2006

*This booklet includes the relevant amendments and corrections  
shown in the July 2008 version of Pt.0 Ch.1 Sec.3.*

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DET NORSKE VERITAS

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

# CHANGES IN THE RULES

## General

The present edition of the rules includes amendments and additions decided by the Board as of November 2005 and supersedes the July 2005 edition of the same chapter.

The rule changes come into force 1 July 2006.

This chapter is valid until superseded by a revised chapter.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

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

## Main changes

### • Sec.4 Diving Systems

- **DSV** class notation nomenclature has been changed.
- Reference has been made throughout to the new certification rules DNV-OSS-305 "Rules for Certification and Verification of Diving Systems" with accompanying standards DNV-OS-E402 "Offshore Standard for Diving Systems". Also, reference to other DNV Offshore codes has been included, where relevant.
- Requirements for hyperbaric evacuation systems have been de-

leted since they are included in DNV-OS-E402.

- Requirements for periodic surveys have also been made applicable to transferable diving systems.
- Requirements for a survey planning document have been added.
- Testing of pressure vessels has been specified in greater detail.
- Inclusion of reference to a new standard, ASME PVHO-2, gives guidance on inspection of windows.
- Survey of diving systems that are "out of commission" has now been included.
- Renewal surveys must now be carried out before the due date. The interval is thereby reduced in line with the interval requirements for renewal of main class and for the IMO "Diving System Safety Certificate".

### • Sec.6 Additional Oil Pollution Prevention Measures - Fuel Oil Systems

- The rules for the class notation **OPP-F** have been updated to reflect the recent IMO proposal requiring double hull in way of oil fuel tanks.

## Corrections and Clarifications

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

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

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## SECTION 1 GENERAL REQUIREMENTS

### A. Classification

#### A 100 Application

**101** The rules in this chapter apply to vessels with various special equipment and or arrangements not covered by chapters dealing with particular equipment or types of vessel. The requirements shall be regarded as supplementary to those given for the assignment of main class.

#### A 200 Class notations

**201** Vessels with equipment and or arrangements complying with relevant additional requirements of this chapter will be assigned one of the class notations given in Table A1.

Table A1 Class notations	
<b>HELDK, HELDK-S, HELDK-SH or HELDK-SHF</b>	equipped with helicopter deck (See Sec.2)
<b>CRANE</b>	equipped with shipboard crane (See Sec.3)
<b>DSV-SURFACE, DSV-BOUNCE or DSV-SAT</b>	equipped with diving systems (See Sec.4)
<b>DEICE or DEICE-C</b>	equipped with de-icing / anti-icing systems (See Sec.5)
<b>OPP-F</b>	arranged and equipped with additional oil pollution prevention measures - fuel oil systems (See Sec.6)

### B. Definitions

#### B 100 Symbols

**101** The following symbols are used:

L	= rule length (m)
B	= rule breadth (m)
D	= rule depth (m)
T	= rule draught (m)
f <sub>l</sub>	= material factor
	= 1.0 for NV-NS steel
	= 1.08 for NV-27 steel
	= 1.28 for NV-32 steel
	= 1.39 for NV-36 steel
	= 1.47 for NV-40 steel

For details see Pt.3 Ch.1 Sec.2 B for normal steel and Pt.3 Ch.1 Sec.2 C for alternative materials. Note remark on reduced yield stress in heat affected zones for aluminium.

### C. Documentation

#### C 100 General

**101** Plans and particulars to be submitted for approval or information are specified in the respective sections of this chapter.

## SECTION 2 HELICOPTER INSTALLATIONS

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels with an erected landing platform for helicopters or a landing area arranged directly on the weather deck or on the top of deckhouse. These requirements shall be regarded as supplementary to those given for the assignment of main class.

**Guidance note:**

For general requirements for helicopter facilities for ships, see Pt.4 Ch.10.

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**102** Provisions for helicopter facilities shall be in accordance with SOLAS Ch. II-2/18.8 and resolution A.855(20).

**103** Vessels equipped in compliance with the requirements given in A, B, C and D may be given the class notation **HELDK**.

**Guidance note:**

It will be necessary also to comply with statutory vessel safety regulations of the state in which the vessel is registered and helicopter safe operation demands by the operators or guidance in this respect by helicopter registry authorities or aviation authorities. This applies to for example:

- size, location and marking of helicopter deck
- obstacle free approach and take-off sectors
- rescue and fire-fighting (RFF) equipment.

If requested by national authorities, DNV will undertake supervision related to items as mentioned above.

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**Guidance note:**

For Norwegian flagged vessels equipped with a helicopter landing area, the notation **HELDK** or corresponding strength requirements are mandatory.

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**104** If the requirements given in A, B, C, D and E are satisfied, the notation may be extended to **HELDK-S**.

**Guidance note:**

**HELDK-S** requirements represent minimum shipboard safety requirements.

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**105** If the requirements given in A, B, C, D, E and F are satisfied, the notation may be extended to **HELDK-SH**.

**Guidance note:**

**HELDK-SH** requirements represent a minimum extract of North Sea standards for safe helicopter operation considered ample for worldwide use.

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**106** If the requirements given in A, B, C, D, E, F and G are satisfied, the notation may be extended to **HELDK-SHF**.

**Guidance note:**

**HELDK-SHF** provides requirements for on-board helicopter service facilities.

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#### A 200 Definitions

**201** The following terms and abbreviations are used:

— *Helideck* is a purpose built helicopter landing area located

on a ship including all structure, fire-fighting appliances and other equipment necessary for the safe operation of helicopters.

- *Helicopter facility* is a helideck including any refuelling and hangar facilities.
- *Helicopter landing area* means an area on a ship designed for emergency landing of helicopters.
- *HIFR* means helicopter in flight re-fuelling.
- *Limited service facilities* means that the vessel is not equipped with nitrogen service, servicing fluids and hydraulic servicing.
- *RAST* means recovery assist, secure and traverse.
- *SCBA* means self contained breathing apparatus.
- *STANAG* means standardisation agreement (NATO).
- *VERTREP* means vertical replenishment.
- *VOA* means vertical replenishment operating area.
- *SHOLS* means ship helicopter operations limitations.

#### A 300 Documentation

**301** Plans showing arrangement, structural design and details with scantlings and particulars of materials to be applied shall be submitted for approval. Strength calculations are also to be submitted, including information on all design loads. Type and maximum total mass of helicopter shall be specified. Helicopter substructure description with fore-and-aft mass distribution shall be attached. Details of steel and aluminium connections as given in 400 shall be submitted for approval.

**302** Documentation of the hydraulic system for the operation of any movable flaps in helicopter decks shall be submitted for approval.

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

**304** For supplementary documentation covering areas such as:

- piping systems
- electric power generation and transfer
- control and monitoring
- fire safety
- safety of personnel and other areas.

See Pt.2, Pt.3, Pt.4 and Pt.5 as appropriate.

**305** For class notation **HELDK-S** a general arrangement plan showing escape routes, the adjacent compartments including openings and closing appliances and adjacent deck equipment shall be submitted for approval with respect to fire safety.

**306** For class notation **HELDK-S** details and capacity calculations for the fixed foam fire extinguishing system shall be submitted for approval.

**307** For class notation **HELDK-SH** the helicopter's overall length, with rotors running, shall be stated for each helicopter using the facility. A helicopter safety plan showing fulfilment of the various safety requirements shall be submitted including variations for each proposed helicopter. A general arrangement plan showing helicopter deck safety installations, including markings and obstacles shall be submitted for approval.

**308** For class notation **HELDK-SHF** plans showing the following arrangement shall be submitted for approval:

- helicopter deck and hangar layout with drainage arrangements and safety nets and rapid securing or traversing system (recessed grid, rails and other arrangements)

- particulars about non skid coating on the helicopter deck and in the hangar
- tie-down points, type and location on helicopter deck and in hangar
- hangar layout, location of equipment
- particulars in regard to the hangar door
- specification and location of fixed fire extinguishing arrangements in the hangar, including equipment and calculation of discharge capacities
- specification and location of fire detectors, alarm devices and call points
- cable routing layout drawings
- escape routes from the hangar or helicopter deck
- escape routes from the hangar
- principles and location of fuel storage and refuelling system, including facilities for de-fuelling and fire protection in the helicopter fuel pump room
- VERTREP area, location and marking
- HIFR arrangement, location and marking
- explosion safety
- location of ammunition magazine (naval vessels) and ready service lockers in the vicinity of the helicopter operating area
- fire rating of bulkheads, doors and closing appliances, particulars about ammunition hoist and similar arrangements
- principles of visual landing aids
- particulars about support, service and maintenance facilities.

The documentation shall clearly show that these requirements are fulfilled.

**309** For class notation **HELDK-SHF** the specifications and calculations to be submitted shall, as applicable, contain:

- specification of design information and design data used in the analysis and other functional loads and design mass of helicopters
- significant operational loads, comprising elements such as helicopter undercarriage and footprints, with fore-and-aft mass distribution shall be attached
- resultant overall and local forces, moments and stresses due to relevant loading conditions.

#### A 400 Materials

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

**402** Composite materials, when accepted, shall be in compliance with the requirements for hull materials given in Rules for Classification of High Speed, Light Craft and Naval Surface Craft Pt.2 Ch.4 and Pt.3 Ch.4.

All composite surface material in decks, hangars and other areas where a helicopter can be hoisted shall be protected against fire so it can withstand a helicopter fuel fire for at least 15 minutes without catching fire and without degradation of the structural strength.

#### A 500 Steel and aluminium connections

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

**502** In high shear exposed bolt connections, when located in reasonably dry areas (not exposed to sea spray), a friction connection is preferred. The bolts, nuts and washers shall be of stainless steel. Provisions shall be made to accommodate periodic examination of such connections.

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

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

**505** For welded connections, any bimetallic connection flats shall be delivered from approved manufacturer and with DNV certificate.

## B. Design Loads and Load Combinations

### B 100 General

**101** The scantlings of each structural element shall be based on the most unfavourable of the following loading conditions:

- landing condition
- stowed condition (helicopter lashed onboard at sea).

#### Guidance note:

In the stowed condition, the helicopter deck strength and its supporting structure may be checked using Pt.3 Ch.1 and the wheel loading requirements given in Pt.5 Ch.2 Sec.4.

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**102** Both the normal operational conditions and any identifiable accidental conditions shall be considered. The following loads are in general to be considered:

- landing impact forces
- gravity and inertia forces of the helicopter in stowed position
- hull still water loads (applicable for use of weather decks as helicopter deck)
- sea pressure.

#### Guidance note:

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

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**103** For landing platforms erected as separate structure the following loads are also to be considered:

- gravity and inertia forces of the structure with equipment
- wind forces (for erected structures)
- ice loads.

**104** In the landing condition, the landing impact force shall be combined with associated environmental loads. Heel and trim need normally not be considered.

**105** The loads in 200 to 500 shall be combined as follows:

Operational conditions:

#### 1) Landing condition

- landing force
- gravity and inertia forces of the structure with equipment
- still water hull bending loads
- ice loads on erected structural elements.

#### 2) Stowed condition (helicopter lashed onboard)

- gravity and inertia of the helicopter
- gravity and inertia of the structure with equipment
- hull bending loads
- sea pressure
- ice loads on erected structural elements.

#### 3) Wind lift forces on erected structures (no helicopter on deck)

#### 4) Explosion loads or fire below the deck, if applicable.

## B 200 Landing forces

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

$$P_v = 2 g_0 M_H \text{ (kN)}$$

$M_H$  = maximum take-off mass in t of helicopter.

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

## B 300 Gravity and inertia forces (due to vessel motions and accelerations)

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

**302** Worst case realistic load combinations of static and dynamic design forces shall be considered.

### Guidance note:

For a ship shaped unit in world-wide operation, inertia forces can be determined from Pt.3 Ch.1 Sec.4, and combined according to Pt.3 Ch.1 Sec.4 C500 for operational conditions.

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## B 400 Sea pressure

**401** The sea pressure for superstructure deck and top of houses shall be taken in accordance with Pt.3 Ch.1 Sec.4 C200. For elevated platforms with free water passage below, the reduction  $4 h_0$  in the formula may be substituted by  $4h_0 + k_0$  where  $k_0$  = height of free water passage below in m. Minimum sea pressure is 2.5 kN/m<sup>2</sup>.

## B 500 Other loads

**501** For structures where wind suction forces may be of importance, e.g. bolted platforms, wind lift forces  $P_w$  shall be taken into account by:

$$P_w = 1.2 A_D \text{ (kN)}$$

$A_D$  = deck area (m<sup>2</sup>).

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

- in the North Sea 5 cm each side
- in Arctic waters 15 cm each side

or by designers specification of maximum ice thickness.

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

### Guidance note:

Such loads should be presented to DNV.

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## C. Structural Strength

### C 100 General

**101** Decks for helicopters supported on wheels with pneumatic tyres shall have scantlings in accordance with the requirements given in 200 to 300.

### C 200 Deck plating and stiffeners

**201** The minimum thickness of steel plating shall be:

$$t = \frac{k(1+s)\sqrt{P_W}}{\sqrt{f_1}} + 2 \text{ (mm)}$$

The minimum thickness of aluminium plating shall be:

$$t = \frac{k(1+s)\sqrt{P_W}}{\sqrt{f_1}} + 1 \text{ (mm)}$$

- $k$  = 0.6 in separate platforms
- = 0.65 in weather-decks general
- = 0.7 in longitudinal framed strength deck and in weather deck hatch covers
- = 0.9 in transversely framed strength deck
- $s$  = beam spacing (m)
- $P_W$  = fraction of total landing force  $P$  acting on the wheel(s) considered (kN)
- $f_1$  = see Sec.1.

The minimum section modulus of stiffeners shall be:

$$Z = 1000 \frac{M}{\sigma} \text{ (cm}^3\text{)}$$

- $M$  = bending moment (kNm) from the most unfavourable location of landing forces point loads. In most cases half fixed beam ends will be a reasonable assumption
- $\sigma$  = 180  $f_1$  N/mm<sup>2</sup> in general
- Reduced by still water longitudinal hull stress in strength deck longitudinals
- = 160  $f_1$  N/mm<sup>2</sup> in weather deck hatch covers.

Support of stiffeners to girders shall have a shear area of not less than:

$$A = 0.125 \frac{P_W}{f_1} \text{ (cm}^2\text{)}$$

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

The minimum thickness of steel plating shall be:

$$t = \frac{k\sqrt{P_W}}{\sqrt{f_1} \sqrt[3]{\varepsilon}} + 1.5 \text{ (mm)}$$

- $k$  = 1.3 in separate platforms
- = 1.4 in weatherdeck general
- = 1.5 in longitudinal framed strength deck and in weather deck hatch covers
- = 2 in transversely framed strength deck
- $P_W$  = fraction of total landing force  $P$  acting on the skid or saddle joint considered (kN)
- $f_1$  = as in 201
- $\varepsilon$  =  $a/s$
- $a$  = length of tubular line load, usually taken as 0.6 m (twice the distance from saddle joint to skid end)
- $s$  = beam spacing (m).

### Guidance note:

If ballast tank(s) are fitted directly below the helicopter deck, corrosion addition  $t_k$  and section modulus corrosion factor  $W_k$  shall be applied as stated in Pt.3 Ch.1 Sec.2 D and Pt.3 Ch.1 Sec.3 C1000.

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The minimum thickness of aluminium plating shall be:

- $k$  = 1.4 for separate platforms

$$t = \frac{k\sqrt{P_W}}{\sqrt{f_1^3 \epsilon}} \quad (\text{mm})$$

= 1.6 for weather deck hatch covers.

$f_1$ ,  $P_W$  and  $\epsilon$  as above.

Section modulus of stiffeners as for wheel helicopters.

**203** In cases where the deck is proposed to be built from sections, the connections between them will have to be documented to give the same strength as required for an intact deck and also the necessary oil and fuel (including burning fuel) tightness.

### C 300 Girders and supporting structures of separate platforms

**301** The scantlings are normally to be based on direct stress analysis. Allowable stresses are:

- normal stress:  $\sigma = 160 f_1 \text{ N/mm}^2$
- shear stress:  $\tau = 90 f_1 \text{ N/mm}^2$ .

**302** The cross sectional area of supporting steel members in compression shall not be less than:

$$A = k P_p \quad (\text{cm}^2)$$

$k$  is given in Fig.1.

- $P_p$  = pillar force or bulkhead stiffener force (kN)
- $l$  = length (m) of pillar or bulkhead stiffener
- $i$  =  $\sqrt{I/A}$  = radius of gyration (cm)
- $I$  = moment of inertia about the axis perpendicular to the expected direction of buckling ( $\text{cm}^4$ )
- $A$  = cross-sectional area ( $\text{cm}^2$ ).

When calculating  $I$  and  $A$  for bulkhead stiffeners a plate flange with breadth equal to  $40 t$ , where  $t$  = thickness of bulkhead, may be included.

The critical buckling stress of plating acting as girder flange shall not be less than:

$$\sigma_c = \frac{\sigma_a}{0.67} \quad (\text{N/mm}^2)$$

$\sigma_a$  = calculated compressive design stress.

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

#### Guidance note:

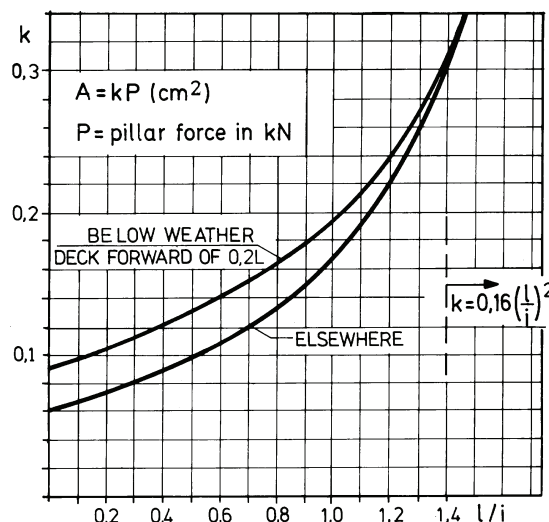
The part of  $P_p$  caused by the helicopter can be reduced by 20% in the landing case.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

#### Guidance note:

Buckling strength of aluminium pillars and stiffeners should be calculated according to Pt.3 Ch.1 Sec.14 C.

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**Fig. 1**  
**k values**

### C 400 Miscellaneous

**401** In cases where the deck is proposed to be built from sections, the connections between them shall have the same strength as required for an intact deck and also the necessary oil and fuel (including burning fuel) tightness.

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

## D. Miscellaneous

### D 100 Personnel safety nets and tie-down points

#### 101 Personnel safety nets

The landing area shall be surrounded by a safety net of not less than 1.5 m height. The safety net shall have an upward and out-board slope of about  $10^\circ$  from slightly below to slightly above the level of the landing area but not more than 250 mm.

#### Guidance note:

The safety net may further facilitate:

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

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

**103** The test load for safety net and safety net supporting structure surrounding a helicopter deck shall not be taken less than 75 kg dropped from 1 m. For naval craft the load should be increased to 100 kg.

#### Guidance note:

Approximate calculations may be based on a static load of 0.2 tons/m run of net. For soft, hammock type nets this load may be

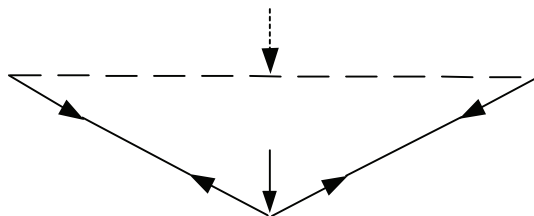
converted into 0.2 g<sub>0</sub> kN/m acting along inner and outer rails in an inward plane 30° below the net plane, see Fig 2.

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#### Guidance note:

In rails, brackets and other details supporting safety nets, allowable stresses in approximate static calculations may be taken as given in C301.

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**Fig. 2**  
**Tie-down points**

**104** The breaking load of the tie-down points for helicopters calling at the vessel should be confirmed from helicopter operator or manufacturer. Unless otherwise provided a value  $F$ , per tie-down where  $M_H$  is given in B200 may be used.

$$F = \frac{1.5 g_0 M_H}{n - 0.5}$$

$n$  = the number of active down points acting in same direction

$F_{\min} = 40$  kN.

**105** Tie-down points located on helicopter decks shall be flush fitted.

## E. Requirements for Vessel Safety (HELDK-S)

### E 100 Securing of helicopter onboard

**101** Helicopter decks shall have tie-down points for lashing of the helicopter. The tie-down points shall not protrude above the level of the helicopter deck. Helicopter operators can advise on the correct configurations.

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

**103** The helicopter safety net mentioned in 102 shall have a size as given in Table E1.

Table E1 Minimum rope net size	
Deck diameter $D$ according to F100	Net size
Less than 14 m	6 x 9 m
14 to 17 m	9 x 9 m
17 to 22 m	12 x 12 m
More than 22 m	15 x 15 m

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

#### Guidance note:

For naval craft see APP (2)E APP 2(E) - Helicopter operations from ships other than aircraft carriers (HOSTAC).

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### E 200 Personnel safety

**201** A 5 cm high steel coaming shall border landing platforms and landing areas in exposed positions, to assist in minimising the probability of personnel or equipment from sliding off the helicopter deck. The coaming shall not impede good drainage of water and or spilt fuel. Alternative solutions may be agreed with DNV.

**202** Escape routes from the helicopter deck shall be arranged on the embarkation side and the rear side. The strength of stair- and walkways shall comply with the standard for walkways to and from the vessel.

#### Guidance note:

For operation in the North Sea UK sector a third route for escape may be required in relation to the British CAA regulations.

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### E 300 Communication between helicopter and vessel

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

#### Guidance note:

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

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#### Guidance note:

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

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#### Guidance note:

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

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

### E 400 Guidance related to ships with class notation Tanker for Oil

**401** For operation on oil tankers the following guidance is given:

#### Guidance note:

Only multi-engine, single or twin rotor helicopters should be used. The helicopter load should be limited to one engine inoperative.

Pressure/vacuum valves should be lifted or closed less than half an hour before helicopter operations, also for vessels with class notation **INERT**.

All openings to cargo tanks should be closed.

The rotor(s) should be kept running all time during the stay on the vessel. If the rotor(s) should stop or have to be stopped, a gas-dangerous zone will re-occur and the helicopter has to be shut-down, all electrical equipment switched off and batteries disconnected. Batteries shall only be reconnected when the deck area is declared gas free, and only in connection with an immediate start-up of the rotor.

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## F. Requirements for Helicopter Safety (HELDK-SH)

### F 100 Size of helicopter deck

**101** The diameter D of the helicopter deck or landing area for single main rotor helicopters shall not be less than the overall length of helicopter including main and tail rotors running.

**102** For helicopter decks installed as a part of a main deck, the length L of the helicopter deck or landing area for single main rotor helicopters shall not be less than the overall length of helicopter including main and tail rotors running + 1.25 m. The width of the deck should generally not be less than the diameter of the main rotor + 1.25 m.

### F 200 Location

**201** A helicopter deck shall be located such that the obstacle free approach and take-off sector get the most efficient direction in connection to the prevailing wind conditions. This in order to ensure that the approach and take-off sector and the landing area are as little as possible affected by turbulence from the structures. In any case an evaluation should be performed in order to evaluate the level of turbulence for different wind conditions. In this context any high temperature from turbine exhaust, hydrocarbon emissions, other gas exhausts or vents shall be minimised and remain acceptable for all wind directions.

#### Guidance note:

Vertical component of airflow from horizontal wind velocities up to 25 m/s should not exceed  $\pm 0.9$  m/s over the landing area at main rotor height.

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**202** For location at ship's ends a free approach and take-off sector of  $210^\circ$  is required. The whole deck or landing area shall be located within this sector.

#### Guidance note:

The ship end location is recommended.

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

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

**205** For naval craft, the requirements in 202 to 204 may be deviated from if so required by the navy.

### F 300 Height of obstacles

**301** The landing area should be as flush as possible to avoid damage on skids, wheels or pontoons.

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

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

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

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

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

**307** For naval craft, the requirements in 304 to 306 may be deviated from if so required by the navy.

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

### F 400 Daylight marking

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

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

**403** An aiming circle, which shall be a 1000 mm yellow line with inner diameter  $0.5$  D, shall also be painted with location according to regulations of national authorities.

#### Guidance note:

Norwegian CAA requirement: In deck centre.

British CAA requirement:  $0.1$  D from centre towards outboard edge, except for a midship cross flight channel.

Both or intermediate locations will be accepted for classification.

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

**405** Painted information regarding maximum gross mass has been proposed by authorities from 1993, provided a non-ambiguous value may be established for the deck.

#### Guidance note:

To make the painted value(s) non-ambiguous it may still be necessary to add one or more descriptive words, such as "wheel", "skid" or "twin wheel", "single wheel".

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#### Guidance note:

The advised information will consist of two figures followed by the letter "t". E.g. maximum 8000 and 8500 kg are both to be represented by "08 t". Figures may be painted:

- 1000 mm high of 150 mm lines (Norwegian CAA requirement)
- 1500 mm high of 200 mm lines (British CAA requirement) in a contrasting colour to the deck.

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**406** The maximum helicopter D value in m, see 101, used for the approval shall be inserted in the perimeter at mid-line of approach sector and, except for a midship cross flight or vessel side landing area,  $90^\circ$  to each side. Figures shall be 600 mm high and in a contrasting colour to the deck.

**407** For naval craft marking shall be in accordance with naval requirements.

#### Guidance note:

For naval craft see APP (2)E APP 2(E) - Helicopter operations from ships other than aircraft carriers (HOSTAC).

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#### Guidance note:

A signal or light that shows "Helicopter operations are going on" should be installed. The indicator should be displayed on this

ship's bridge and another made clearly visible for the pilot. The indicator should be able to be switched from a go to no go mark.

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## F 500 Night operation marking

**501** A floodlight shall be arranged, with care not to dazzle the pilot.

**502** Yellow lights shall be fitted on the perimeter line, maximum 3 m apart. The intensity of lighting shall be 25 candela. The lighting shall not be visible below the helicopter deck level.

**503** Electric supply to floodlight and perimeter lights shall be from separate circuits.

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

**505** A lighted horizon bar and a glide slope indicator shall be installed unless otherwise agreed with the operator.

**506** For naval craft light marking shall be in accordance with naval requirements.

### Guidance note:

For naval craft see APP (2)E APP 2(E) - Helicopter operations from ships other than aircraft carriers (HOSTAC).

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## F 600 Instrumentation

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

### Guidance note:

For use in connection with Ship Helicopter Operations Limitations (SHOLS), the roll and pitch information must be true values.

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## F 700 National requirements

**701** The helicopter landing area, marking and associated instrumentation shall, as appropriate, comply with national requirements.

# G. Requirements for Helicopter Facilities (HELDK-SHF)

## G 100 Classification and application

**101** The requirements in G apply to vessels equipped to support helicopter operations.

**102** This subsection presents supplementary and or divergent requirements for those given in A, B, C, D, E, and F.

**103** Vessels equipped in compliance with the requirements given in G may be given the class notation **HELDK-SHF**, provided the conditions given in A to F are fulfilled.

**104** The requirement in G cover shipboard installations such as:

### Support facilities

- landing area
- visual landing aids
- tie down points and mooring aids
- securing or traversing system
- fire protection, including escape routes, crash rescue tools
- VERTREP facilities
- personnel safety equipment.

### Servicing facilities

- fuel storage and re-fuelling
- electrical power supply
- nitrogen service or compressed air
- wash-down provisions
- servicing fluids storage
- hydraulic servicing
- HIFR facility
- support facilities for helicopter operations.

### Maintenance facilities

- hangar
- work area
- office
- major component stowage
- spare part stowage
- de-fuelling.

### Guidance note:

These rules do not cover equipment and systems for Instrument Flight Rules as expressed in the NATO terms of "LEVELS". Equipment and systems corresponding to NATO "LEVELS" will be installed in accordance with national requirements.

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## G 200 Helicopter deck service area

**201** The loads and structural strength of the helicopter deck service area shall be in accordance with relevant parts of B and C.

**202** The helicopter deck shall be arranged to secure at least a 180° obstruction free zone aft of the fore end of the helicopter deck or aft of the hangar.

## G 300 Hangar

**301** The hangar shall be designed in accordance with the requirements given for superstructures as given in Pt.3.

**302** The deck in the hangar area shall be designed in accordance with load requirements provided for wheel loading and car deck structure.

### Guidance note:

Requirements are given in Pt.5 Ch.2, as appropriate.

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**303** The hangar door shall be weathertight and be able to withstand the horizontal component of the helicopter down wash. Helicopter operator can advice on the wash down pressure.

**304** The hangar door shall be equipped with suitable opening and closing mechanisms to facilitate easy operations.

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

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

### Guidance note:

The clearance should be  $\geq 0.5$  m each side for rail guided traversing systems and  $\geq 0.6$  m each side for non-rail guided systems.

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

## **G 400 Support facilities**

### **401 Securing or traversing system**

To safeguard the helicopter immediately after landing, a securing or traversing system shall be installed in addition to tie-down fittings.

#### **Guidance note:**

A securing traversing system could be of the following types:

- harpoon deck lock or landing grid
- RAST or similar.

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### **402 VERTREP facilities**

VERTREP facilities shall be installed and in accordance with national regulations.

#### **Guidance note:**

For naval craft, applicable NATO STANAG:

- STANAG 1277 HOS, VERTREP Equipment and Procedures.

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**403** The VERTREP area shall be marked in accordance with national regulations.

**404** Escape routes from the VERTREP area shall be arranged for. Control stations with normal and direct access from only the VERTREP area shall have two separate egress routes.

**405** The VERTREP area shall be protected by guard rails, bulwarks or safety nets.

### **406 Personnel safety equipment**

The support facility shall be equipped with:

#### *Grounding wand*

- for discharging static electricity from the helicopter in connection with HIFR, VERTREP or hoist operations.

#### *Fire-fighters outfits*

- fire-fighter's equipment as required in E.

#### *Other personnel safety equipment including:*

- goggles
- helmets
- sound attenuators.

## **G 500 Service facilities**

**501** If a fuel storage tank is situated inside the ship's hull and shall carry fuel with a flash point below 60°C:

- The fuel tank shall be made of stainless steel and entirely surrounded by a gas tight steel tank. The distance between the gas tight tank and the fuel tank shall be at least 400 mm.
- The space between the fuel tank and the gas tight tank shall have:
  - a separate mechanical ventilation providing at least 6 air changes per hour
  - a combustible gas detector connected to a control panel and an alarm on the navigation bridge
  - a level gauge indicating leakage connected to a control panel and an alarm on the navigating bridge.

## **G 600 Maintenance facilities**

### **601 Hangar**

The hangar dimensions shall be decided on the basis of the following factors:

- permit independent hangaring, free entry and exit of the designated helicopters

- provide lifting height for change of rotor head and change of engine if so required, and be strengthened for this purpose
- be of sufficient size in order to carry out required level of maintenance
- provide space for equipment as appropriate
- designated cabinets for pilot suits, fire-fighters ensemble, portable fire-fighting equipment, servicing gear, major spare part stowage, fuelling station and similar needs.

**602** The deck within the hangar shall be provided with tie-down points in a pattern to ensure safe mooring of the helicopter when parked.

**603** Tie downs in decks shall preferably be flush mounted.

**604** Bulkhead fittings for high level securing of the helicopter shall be installed if required. The loads shall be in accordance with the customer's specification.

**605** The deck within the hangar shall be painted with a non-skid coating that provides a surface with a satisfactory static coefficient of friction between the helicopter's landing gear and the surface (recommended value 0.6) in any weather condition.

**606** Flammable liquids, paints, lubricating oils, hydraulic fluid, and fuels of any kind, and highly combustible materials shall not be stored in the hangar.

**607** The hangar deck shall be constructed to prevent liquids from spilling into lower and adjacent compartments and to lower and adjacent deck areas.

#### **Guidance note:**

This can be obtained by drains, scuppers, dams, seals, coaming or shear camber.

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**608** Deck drains and scuppers shall discharge directly overboard, or into a collective manifold, which may be collected and drained to a safe location.

**609** If a pressure water-spraying system is installed, the following requirements apply:

- the sprinkler system shall deliver low-expansion foam
- the distribution of the foam shall at least be 10 l/m<sup>2</sup>/minute
- the system shall be capable of continuous operation for at least 30 minutes
- the foam liquid system shall be of an approved type
- foam concentrate shall be delivered with a product certificate
- the foam proportioner and foam nozzles shall be of approved types.

**610** A fire detection and alarm system shall be installed in the hangar. The detectors shall be type approved for use in explosive petrol and air mixture.

### **611 Communication and control**

Communication facilities shall be installed to provide support and co-ordination of helicopter operations.

**612** The communication shall cover both an internal communication system and external radio communication system.

**613** An aircraft crash alarm shall be installed. The switch shall be a stand-alone item and shall be clearly identified "CRASH ALARM".

#### **Guidance note:**

The alarm shall sound at all essential positions for crash rescue operations.

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**614** Instrumentation essential instrumentation to accommodate flight operations shall be installed on the vessel.

**Guidance note:**

Such instrumentation will generally include:

- wind direction and speed
- vessels course and speed
- pitch and roll indicators.

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## **H. Certification and Testing**

### **H 100 General**

**101** Test procedures shall be submitted for approval.

### **H 200 Certification**

**201** NV certificates are required for:

- lifting and hoisting equipment
- storage tanks and associated equipment for flammable liquids
- securing and traversing systems.

### **H 300 Testing of landing area and hangar deck**

**301** The helicopter deck shall be hose tested for watertightness.

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

**303** The coating on the landing area and in the hangar shall be tested in order to check that the required coefficient of friction or more is obtained.

**Guidance note:**

For naval craft see APP (2)E APP 2(E) - Helicopter operations from ships other than aircraft carriers (HOSTAC).

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### **H 400 Testing of visual landing aids**

**401** The visual landing aids shall be tested for correct functionality.

### **H 500 Testing of fire protection**

**501** The fire protection system shall in accordance with approved test procedures be functionality tested.

The test shall cover:

- remote control functions of foam monitor(s)
- compliance to IMO res. A.855(20) of throwing length of foam from monitors and other foam making equipment
- capacity of foam solution delivered in l/minute
- correct water/foam concentrate ratio by means of an approved method
- hangar fixed fire extinguisher system (if installed), with control of water/foam concentrate ratio by means of an approved method
- testing of sprinkler system capacity of foam solution delivered in l/minute
- helicopter deck foam covering system (by means of pop up sprinklers) if installed, including control of water/foam concentrate ratio.

## SECTION 3 SHIPBOARD CRANES

### A. General

#### A 100 Classification

**101** The requirements in this section apply to vessels with permanent cranes.

**102** Vessels equipped in compliance with the following requirements may be given the class notation **CRANE**.

For vessels intended for lifting as their main purpose reference is also made to the requirements for crane vessels given in Pt.5 Ch.7.

**103** The crane shall be delivered with DNV's certificate in compliance with the *Rules for Certification of Lifting Appliances*.

#### A 200 Scope

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

- supporting structure for the crane
- devices for locking the crane in parked position (vessel at sea)
- the crane itself with respect to safety and functioning.

#### A 300 Documentation

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

- plan showing location of the crane during operation and in parked position
- 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
- information on the vessel's stability for conditions with the crane in operation.

**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 indicates the extent of required documentation.

### B. Design Loads

#### B 100 General

**101** In addition to the specific design loads given in the *Rules*

for *Certification of Lifting Appliances* loads due to ship motions shall be considered. Design values of linear and angular accelerations are given in Pt.3 Ch.1 Sec.4.

### C. Overturning and Sliding

#### C 100 Overturning

**101** Devices shall be provided for all cranes in parked position (vessel at sea) to be anchored to the hull structure. The anchoring devices shall be designed to withstand inertia forces due to ship motions and loads due to «out of service» winds. The strength calculations shall be based on accepted principles of statics and strength of materials, applying the safety factors as stipulated for Load Case III in the *Rules for Certification of Lifting Appliances*.

#### C 200 Sliding

**201** In parked position (vessel at sea) sliding is normally to be prevented by means of anchoring devices. See 100. If sliding is prevented by friction between rail and wheels the coefficient of friction shall not be taken greater than 0.15.

**202** For crane in operation sliding is normally not to take place unless the forces parallel to rails exceed 1.3 times the values for Load Case II in the *Rules for Certification of Lifting Appliances*. If this requirement is not satisfied, sliding shall be prevented by some device for locking the crane in position. The strength of this device shall be based on the safety factors for Load Case II.

### D. Testing

#### D 100 General

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

### E. Stability

#### E 100 Stability requirements for heavy lift operations

**101** The stability for vessels for which lifting operations are the main or one of the main functions shall also be in compliance with the crane criteria given in Pt.5 Ch.7 Sec.7.

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

## SECTION 4 DIVING SYSTEMS

### A. General

#### A 100 Classification

**101** Vessels arranged for support of diving operations applying rope and/or umbilical connection between the submerged bell and the vessel may be given the class notation:

**DSV-SURFACE** or  
**DSV-BOUNCE** or  
**DSV-SAT**

as applicable, when the vessel is equipped with a diving system certified by the Society in compliance with DNV-OSS-305 and DNV-OS-E402.

Diving systems defined in these rules as **DSV-BOUNCE** or **DSV-SAT**, in use on DNV classified support vessels, shall be certified and maintained in class with DNV or a classification society recognised by DNV.

For diving systems defined in these rules as **DSV-SURFACE** the following minimum requirements apply when in use:

- all pressure components requiring certification shall be certified by a recognised authority
- certified pressure components shall be tested according to schedules defined in these rules.

For diving systems classified and/or certified by other classification societies, compliance shall be verified by DNV on a case by case basis.

##### Guidance note:

These requirements ensure that those given in the IMO Code of Safety for diving systems adopted 23 November 1995 as res. A.831(19), are met.

Requirements given in IMCA guidelines are also taken into consideration when applying these rules.

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##### Guidance note:

Requirements for surveying of diving systems in operation are given in Pt.7 Ch.1 Sec.6 I.

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**102** The various class notations are related to positioning class **DYNPOS-AUTR** or **POSMOOR-V**, and the intact and damage stability class **SF**, to the maximum operation depth  $d_{max}$  and maximum operation time  $T_{OP}$  as given in Table A1.

Table A1 Class notations			
Class	DSV-SURFACE	DSV-BOUNCE	DSV-SAT
Re- stric- tions	$d_{max} \leq 60$ m $T_{OP} \leq 8$ hours	$d_{max} \leq 125$ m $T_{OP} \leq 24$ hours	None, except those imposed by the rule requirements

In the DNV-OSS-305 and DNV-OS-E402 the major differences between **DSV-SURFACE**, **DSV-BOUNCE** and **DSV-SAT** diving systems are specified.

**103** The main particulars of the diving system will be entered in the "Register of vessels classed with DNV".

**104** Cranes and other lifting appliances for diving bell handling systems shall be certified according to DNV *Rules for Certification of Lifting Appliances* as far as applicable, and the additional requirements for handling systems given in DNV-OSS-305 and DNV-OS-E402.

#### A 200 Scope

**201** Classification will cover the following matters:

- the vessel's ability to keep its position during diving operations
- the hull structural arrangements related to the diving system, e.g. moonpool (launching and recovery well for bell)
- the arrangement and installation of the diving system
- the complete diving system with respect to safety and functioning
- stability and floatability.

#### A 300 Documentation

**301** Plans shall be submitted for approval as given in DNV-OSS-305 and DNV-OS-E402.

### B. Position Keeping

#### B 100 General

**101** The vessel shall be able to keep its position safely during diving operations. This implies a system with built in redundancy for keeping position. The position keeping system may be a mooring system with anchors or a dynamic positioning system.

**102** The requirements for mooring systems with anchors shall, as a minimum, comply with the notation **POSMOOR-V** or equivalent.

**103** Diving support vessels utilising dynamic positioning systems (**DYNPOS**) shall comply with DNV rule requirements as stated in these rules and in DNV-OSS-305 and DNV-OS-E402.

Normative references in the above rules include DNV-OSS-101 and IMO MSC/Circ.645 of 6 June 1994.

##### Guidance note:

'Guidelines relating to specification and operation of dynamically positioned diving support vessels' published by the Norwegian Petroleum Directorate and Petroleum Engineering Division of UK Department of Energy 1 May 1983 and/or IMCA D 010 Rev.2 issued July 2000 'Diving operations from vessels operating in dynamically positioned mode', and/or IMCA M 103 'Guidelines for the design and operation of Dynamically Positioned Vessels' issued February 1999, may be referred to.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

### C. Diving System Arrangement Layout and Location

#### C 100 General

**101** Diving systems shall be arranged, laid out and located in accordance with DNV-OS-E402 Sec.2 E.

### D. Electrical Systems

#### D 100 General

**101** Electrical systems shall comply with requirements given in DNV-OSS-305 and DNV-OS-E402.

Normative references in these rules include DNV-OS-D201.

## **E. Fire Prevention, Detection and Extinction**

### **E 100 General**

**101** Fire prevention, detection and extinction systems shall comply with requirements given in DNV-OSS-305 and DNV-OS-E402.

Normative references in these rules include DNV-OS-D301.

## **F. Sanitary Systems for DSV-BOUNCE and DSV-SAT systems**

### **F 100 General**

**101** Sanitary systems shall comply with requirements given in DNV-OSS-305 and DNV-OS-E402.

## **G. Testing**

### **G 100 General**

**101** After completing installation, the diving system shall be tested in compliance with an approved test program in the pres-

ence of a surveyor. The required tests are stated in DNV-OSS-305 and DNV-OS-E402.

## **H. Stability and Floatability**

### **H 100 General**

**101** The requirements for stability and floatability as given in Pt.5 Ch.7 Sec.3 D and Sec.4 B for additional class notation **SF**, shall be met as far as these requirements are applicable.

## **I. Hyperbaric Evacuation Systems**

### **I 100 General**

**101** Hyperbaric evacuation systems shall comply with requirements given in DNV-OSS-305 and DNV-OS-E402.

#### **Guidance note:**

These requirements ensure that the requirements given in IMO Guidelines and Specifications for Hyperbaric Evacuation Systems - Resolution A.692(17), are met.

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## SECTION 5 DEICING AND ANTI-ICING SYSTEMS

### A. General

#### A 100 Application

**101** The requirements in this section apply to vessels intended for operation in cold climate areas.

**102** The requirements are supplementary to those given for the main class.

#### A 200 Assumption

**201** The icing as caused by sea spray and or atmospheric water (snow, rain and fog) is assumed to be moderate, corresponding to an ice layer accretion of between 3 and 6 cm per day, depending on ship size.

#### A 300 Classification

**301** Vessels with systems and equipment complying with the relevant requirements specified in the following may be given the class notation **DEICE** or **DEICE-C** as appropriate.

#### A 400 Scope

**401** The requirements for the class notation **DEICE** are aimed at maintenance of the following functions and properties of the vessel and its equipment under icing conditions:

- main functions (see Pt.1 Ch.1 Sec.1 A200)
- manoeuvrability
- stability
- crew safety (rafts, lifeboats, gangways, etc.).

**402** The requirements for the class notation **DEICE-C** have the same basic scope as given in 401. In addition, it is aimed at facilitation of deck cargo handling under icing conditions.

#### A 500 Definitions

**501** The equipment and areas requiring measures against ice accretion are divided into the two categories:

- category I
- category II.

**502** Category I equipment areas are defined as equipment or areas necessary for:

- navigation
- steering
- propulsion
- anchoring
- lifesaving.

**503** Category II equipment or areas are defined to comprise:

- decks and superstructures
- helicopter decks
- railings
- cargo deck area (class notation **DEICE-C**).

#### A 600 Documentation

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

- arrangement of anti-icing and deicing equipment for the various areas. Heating capacities shall be specified
- diagram of compressed air supply to important consumers outside machinery space
- electrical single line distribution diagrams for anti-icing and deicing equipment with information about:

- full load
- cable type and cross section
- make, type and rating of fuse and switch gear
- make, type and rating of heating cable
- electrical schematic diagram, for all control and instrumentation circuits, with information on make, type and rating of all equipment
- fastening arrangement and spacing of electrical cables and fluid pipes for heating purposes
- mechanical deicing arrangements, methods and location
- storage facilities and specification of hand tools for manual ice removing, protective clothing, lines, etc., to be carried onboard
- test program for anti-icing and deicing systems.

**602** The following manuals shall be submitted for approval and shall be kept onboard:

- manual for anti-icing precautions and deicing procedures
- stability manual (see also B) including load conditions with ice accretion.

#### A 700 Testing

**701** After completed installation the anti-icing and deicing systems shall be tested to the satisfaction of the Society. A test program shall be proposed by the builders for approval by the Society.

### B. Stability and Watertight Integrity

#### B 100 General

**101** The vessels are in any intended service condition, including additional weights due to accretion of ice as specified in 200, to be able to satisfy intact and damage stability criteria.

#### B 200 Icing stability

**201** The ice load as calculated according to 202 to 203 shall be included in the loading conditions.

Loading conditions including ice load shall satisfy the applicable stability requirements.

**202** The ice weigh distribution shall as a minimum be as calculated from the following:

$$W = \frac{300}{K} (1 - C) \quad (\text{kg/m}^2)$$

where

W = the weight distribution over the horizontally projected area of the ship

K and C shall be taken from the following table:

Summer freeboard:	K:	Ship length:	C:
FB ≤ 2 m	1	L <sub>pp</sub> < 50 m	0
2 m < FB ≤ 6 m	1.25	50 m ≤ L <sub>pp</sub> < 100 m	0.075
6 m < FB ≤ 9 m	1.5	100 m ≤ L <sub>pp</sub> < 200 m	0.2
FB > 9 m	1.75	L <sub>pp</sub> ≥ 200 m	0.25

For ships with length above 100 m, the weight distribution W aft of L/2 can be set to 100 kg/m<sup>2</sup> of the horizontally projected area.

**203** The weight of ice on vertical surfaces has been taken into account and included in 202 and need not be calculated separately.

## C. Anti-icing and Deicing Arrangements and Equipment

### C 100 General

**101** Arrangements and methods for anti-icing and deicing will be considered for approval in each case. Manual deicing may be accepted to a limited extent when such procedure is found to be capable of serving its purpose satisfactorily.

Guidance with more detailed requirements for different parts of the ship and equipment is found in C200, C300 and at the end of this section.

**102** For category I equipment or areas anti-icing arrangements are required with sufficient capacity to keep the equipment or areas free from ice (generally by means of heating or cover) at all times in the service areas and under icing conditions specified (see A100 and A200).

**103** For category II equipment or areas deicing arrangements are required with sufficient capacity for removal of accreted ice within a reasonable period of time (normally 4 to 6 hours) under the icing conditions specified.

**104** Heating power capacity for anti-icing and deicing shall not be less than:

- 300 W/m<sup>2</sup> for open deck areas, helicopter decks, gangways, stairways, etc.
- 200 W/m<sup>2</sup> for superstructures
- 50 W/m for railings with inside heating.

Heating capacities for other areas will be considered in each individual case.

**105** In arrangements with electric heating cables or heating pipes with fluids as heating medium, special attention shall be paid to the heat transfer from the cables or pipes to the equipment or structure to be heated. The spacing of cables or pipes shall be appropriate for efficient heating. The fastening of cables or pipes shall be such that the heat will be readily dissipated to the equipment or structure to be heated.

**106** Switchboard for anti-icing and deicing shall be arranged as required for distribution switchboards. A wattmeter or amperemeter, indicating the total load shall be installed on the switchboard. Marking on the switchboard shall state the load on each circuit, as well as the total load.

All circuits shall have earth failure monitoring with alarm. Energized circuits shall be indicated by means of a signal lamp for each circuit.

Heating cables shall be short circuit and overload protected as required by Pt.4 Ch.8. However, self regulated cables do not require overload protection.

Motors on open deck, being part of category I or category II equipment, shall be naturally cooled, i.e. without external fan.

The electrical installation shall also comply with the rule requirements in Pt.4 Ch.8.

**107** For anti-icing and deicing arrangements applying heating by fluids in pipes, the valves shall be marked with equipment or area to be heated, and open and closed position of the valves shall be indicated. Pumps applied for anti-icing purposes (category I equipment or areas) shall be arranged with redundancy. The piping systems for anti-icing and deicing purposes are also to comply with the rules in Pt.4 Ch.6.

Due regard shall be paid to the piping arrangements to avoid that the heating fluid freezes.

### Guidance note:

Insulation of piping simultaneously with circulation of the heating medium is one way to ensure that the heating medium is not freezing.

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**108** Supply of compressed air to category I consumers outside machinery space, shall be provided with air drying sufficient to lower the dew point to not warmer than -30°C.

### C 200 Class notation DEICE - general

**201** The specified equipment and or areas, which by definition (see A500) are of category I, shall have anti-icing arrangements, normally by heating or cover. Other means of anti-icing may be accepted upon special consideration. Alternative means of providing anti-icing shall not interfere with the proper functioning of the vessel.

Specified equipment and or areas for anti-icing:

- communication equipment (i.e. antennae)

### Guidance note:

Whip type antennae may not need heating arrangements.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

- scanning equipment (radar)

### Guidance note:

Rotating radar antennae may not need heating arrangements.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

- navigation lights

### Guidance note:

Normally, the navigation lights develop sufficient heat to avoid ice deposit, except for forward lower light.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

- windows in the wheelhouse, within the required field of vision, shall be provided with appropriate heating arrangements. Wheelhouse windows shall comply with the appropriate ISO standards

### Guidance note:

Reference is made to ISO 3434 and ISO 8863. The heating capacity should be designed for an outdoor air temperature of -20°C or less.

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### Guidance note:

When a field of vision larger than defined by SOLAS is required by a class notation, e.g. **NAUT-AW**, this should be taken into account.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

- window wipers, where arranged

### Guidance note:

Reference is made to ISO 17899 for marine electric window wipers.

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- equipment necessary for maintaining propulsion (i.e. cooling water sea chests)

### Guidance note:

A sea water arrangement similar to that required for ice class **ICE-C** is generally considered sufficient, i.e. a full capacity return of cooling water to a sea chest situated close to the centre line.

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- special equipment essential for safety, depending on type of vessel
- fire fighting lines and monitors (if arranged for fighting

fires in other vessels and offshore structures, e.g., class notation **Fire Fighter**)

- anchors including windlass, chain and hawse pipe

**Guidance note:**

For large vessels not occupied in coastal operations the anchor windlass can be accepted to be so arranged that a short time for ice removal is necessary, and a combination of deicing and anti-icing may give an acceptable availability.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

- air pipe vent heads for tanks

**Guidance note:**

As a minimum this should be applied to ballast and fresh water tanks, as well as pressure relief valves for cargo tanks if relevant.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

- air horns
- lifeboats with davits
- pick-up boats including launching area
- rafts
- EPIRBs (emergency position-indicating radio beacons)
- escape exits
- storage facilities for lifesaving outfit, e.g., rescue suits, lines, picks and similar equipment for de-icing purposes
- ventilation inlets to spaces where ventilation is essential for the safe operation of the ship
- scuppers and drains.

**202** The equipment or areas specified below, which by definition (see A500) are of category II, shall have deicing arrangements:

- open deck areas
- gangways and stairways
- helicopter deck if any
- superstructure
- railings
- outdoor piping
- winches
- shark jaw and guide pins
- stern roller
- deck lighting equipment.

In addition to the above, other operational equipment may be required to have deicing arrangements as found necessary.

**203** Spaces containing piping or components with water shall have arrangements to prevent freezing of the water.

**Guidance note:**

Assessment of heating need shall be based on an outdoor temperature of  $-20^{\circ}\text{C}$ .

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**204** Equipment and areas in connection with additional class notations are not required to be fitted with deicing or anti-icing measures unless this is safety related.

**Guidance note:**

Rescue arrangements in a vessel with class notation Standby should be regarded as category I equipment/ area.

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**C 300 Class notation DEICE- additional measures for tankers (gas, oil, chemical)**

**301** For tankers the following ship type specific equipment

shall be considered as category I equipment:

- Cargo tank ventilation arrangement (e.g. P/V valves, safety valves, flame arresters, P/V breakers).
- ESD valves (gas tankers).
- Emergency towing arrangement.

**302** Safe access to bow should as far as possible and practicable be located in an under-deck or on-deck tunnel. If this is not fulfilled, personal safety equipment suitable for safe walking on iced surfaces must be readily available for use close to the entrance to cargo deck.

**303** For large vessels not occupied in coastal operations a longer ice removal period than defined in C103 may be considered for some of the category II equipment and areas, depending on an evaluation of the effect on the vessel's safety.

**C 400 Class notation DEICE-C for supply vessels**

**401** The requirements given in 200 shall be complied with as applicable. In addition, the cargo deck area shall be arranged for proper handling of cargo under icing conditions.

**402** The arrangement for deicing may be by heating or by appropriate removable or sliding covers for the cargo, or other suitable means. The cargo deck-lighting shall also be provided with deicing facilities.

**C 500 Class notation DEICE-C for tankers**

**501** The requirements given in 200 and 300 shall be complied with as applicable. In addition, the cargo deck area shall be arranged for proper handling of cargo under icing conditions.

**502** The arrangement for deicing may be by heating or by appropriate permanent or removable covers for the cargo manifold area, or other suitable means. The cargo deck-lighting shall also be provided with deicing facilities. The cargo valves shall be so arranged that they can be operated also under icing conditions.

**503** The cargo manifold shall be of cold resistant steel.

**C 600 Special equipment**

**601** Protective clothing, safety lines, hand tools, crampons for shoes and similar equipment for deicing purposes shall be kept onboard. The quantity of the equipment shall be sufficient for the assumed extent of manual deicing.

**602** The equipment for manual deicing shall be kept in storage facilities and at locations protected from accretion of ice by covers or other anti-icing arrangements.

**C 700 Power generator capacity**

**701** For calculation of required electric generator capacity (see Pt.4 Ch.8), the power requirements for the heating arrangements shall be included as specified below:

- 100% of electric power needed for anti-icing purposes
- 50% of electric power needed for deicing purposes.

**702** For anti-icing and deicing arrangements applying heating by fluids in pipes, additional capacity of steam plants or thermal oil heaters must be calculated, taking 100% of the power consumption for category I equipment and areas, and 50% of the power consumption for category II equipment and areas into consideration.

## SECTION 6

### ADDITIONAL OIL POLLUTION PREVENTION MEASURES - FUEL OIL SYSTEMS

#### A. General

##### A 100 Application

**101** The requirements in this section apply to vessels arranged and equipped with additional oil pollution prevention measures for the fuel oil system.

**102** The requirements in this section are supplementary to those given for the main class.

##### A 200 Classification

**201** Vessels arranged and equipped as required in the following may be given the class notation **OPP-F**.

##### A 300 Documentation

**301** Information concerning control positions for fuel oil bunkering and transfer operations shall be submitted.

**302** The drawings required for approval in connection with the main class shall include details confirming compliance with the requirements of this section.

##### A 400 Definitions

**401** For the purpose of this section, fuel oil means any oil used as fuel in connection with propulsion and auxiliary machinery of the ship.

#### B. Arrangement of Fuel Oil Tanks

##### B 100 General

**101** Tanks for fuel oil including overflow tanks and tank capacity exceeding 30 m<sup>3</sup> for waste oils, sludge etc. shall be located above the moulded line of the bottom shell plating, but not less than the distance  $h$  as specified below:

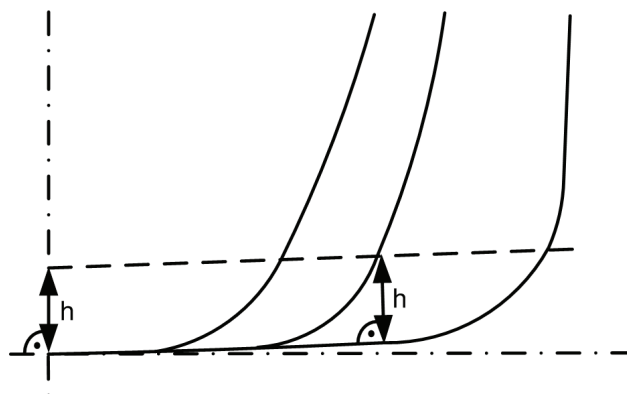
$$h = B/20$$

or

$h = 2.0$  m, whichever is the lesser

The minimum value of  $h = 0.76$  m

In the curved area of the bilge and at locations without a clearly defined curve of the bilge, the oil fuel boundary line shall run parallel to the line of the midship flat of bottom as shown in Fig.1.



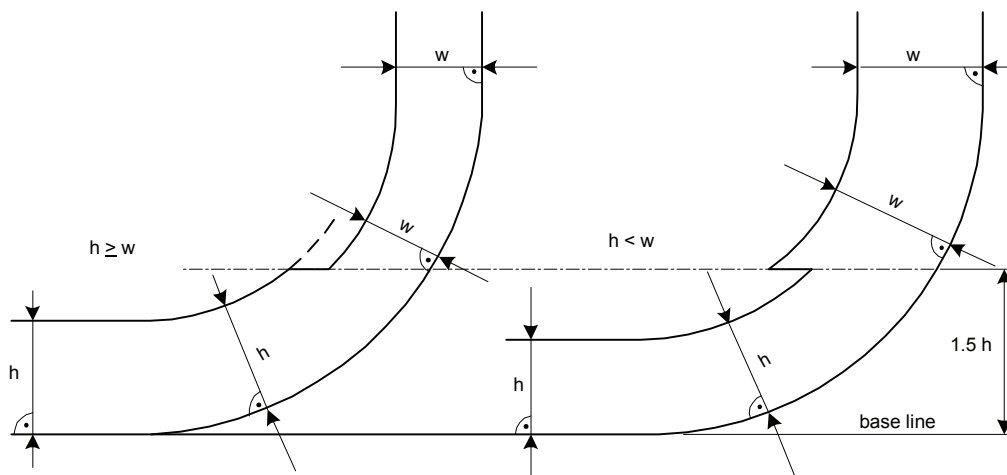
**Fig.1**

**102** For ships having an aggregate fuel oil capacity below 5 000 m<sup>3</sup> tanks for fuel oil including overflow tanks shall be located inboard of the moulded line of the side shell plating, but not less than the distance  $w$  which, as shown in Fig.2, is measured at any cross-section at right angles to the side shell, as specified below:

$$w = 0.4 + 2.4 C/20\,000 \text{ m}$$

Where  $C$  is the vessels total volume of fuel oil, in m<sup>3</sup>, at 98% tank filling.

The minimum value of  $w = 1.0$  m, however for individual tanks with an fuel oil capacity of less than 500 m<sup>3</sup> the minimum value is 0.76 m.



**Fig.2**

**103** For ships with an aggregate fuel oil capacity of 5 000 m<sup>3</sup> and over, fuel oil tanks including overflow tanks shall be located inboard of the moulded line of the side shell plating, but not less than the distance *w* which, as shown in Fig.2, is measured at any cross-section at right angles to the side shell, as specified below:

$$w = 0.5 + C/20\,000 \text{ m}$$

or

$$w = 2.0 \text{ m, whichever is the lesser.}$$

The minimum value of *w* = 1.0 m.

**104** Individual fuel oil tanks shall not have a capacity of over 2 500 m<sup>3</sup>.

**105** Combined fuel oil and water ballast tanks shall not be arranged.

## C. Sundry

### C 100 General

**101** Lines of fuel oil piping located at a distance from the ship's bottom less than *h*, as defined in B101, or from the ship's side less than *w*, as defined in B102 and B103 shall be fitted with valves or similar closing devices within or immediately adjacent to the fuel oil tank.

These valves shall be capable of being brought into operation from a readily accessible enclosed space, the location of which shall be accessible from the navigation bridge or the propulsion machinery control position, without traversing exposed freeboard or superstructure decks.

The valves shall close in case of remote control system failure (fail to close), and shall be kept closed at sea at any time when the tank contains fuel oil, except when they may be opened during fuel oil transfer operations.

**102** Suction wells in fuel oil tanks may protrude into the double bottom below the boundary line defined by the distance *h* provided that such wells are as small as practicable and the distance between the well bottom and the bottom shell shall not be less than 0.5 *h*.

**103** All fuel oil bunker tanks shall be fitted with a high level alarm which shall be activated before the tank is overfilled. The alarm signal shall be given where the person in charge of

the bunkering or transfer operation will normally be located. High level alarms need not be fitted to fuel oil bunker tanks that are provided with an overflow line to another fuel oil tank, which is fitted with a high level alarm.

**104** All bunkering lines shall be fitted with a remotely operated closing valve. Closing of the valve shall be possible from where the person in charge of the bunkering operation will normally be located.

**105** On the open decks of the vessel all bunkering and filling manifolds as well as all vent and overflow pipes to/from fuel oil tanks and lubricating oil tanks shall be fitted with permanent drip trays or coamings with capacity not less than 80 litres (0.5 US barrels) for vessels between 300 GT and 1 600 GT and not less than 160 litres (1.0 US barrels) for vessels of 1 600 GT and above.

**106** A bilge water holding tank arranged for pre-separation of oily bilge water before it is processed through the bilge water separating or filtering equipment shall be installed. The capacity of the bilge water holding tank shall be as given in Table C1.

Table C1 Capacity of bilge water holding tank	
Main engine rating (kW)	Capacity (m <sup>3</sup> )
Up to 1000	1.5
Above 1000 up to 20 000	$1.5 + \frac{P - 1000}{1500}$
Above 20 000	$14.2 + 0.2 \frac{P - 20000}{1500}$
P = main engine rating in kW.	

For high speed short range vessels and other vessels with an unusually high main engine rating the capacity of the bilge water holding tank shall be especially considered.

For vessels operating with fuel oil with relative density at 15°C greater than 0.94 and viscosity at 37.8°C greater than 220 centistokes, the bilge water holding tank shall be fitted with heating facilities.

**107** On vessels operating with heavy fuel oil the tank(s) for sludge from the fuel oil purifiers shall be built without internal structures.