RULES FOR
CLASSIFICATION OF

SHIPS

NEWBUILDINGS

SPECIAL EQUIPMENT AND SYSTEMS
ADDITIONAL CLASS

PART 6 CHAPTER 1

MISCELLANEOUS NOTATIONS

JANUARY 2003
This booklet includes the relevant amendments and corrections shown in the January 2004 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

This booklet is a reprint of the previous edition and apart from clarifications of text and the inclusion of amendments and corrections, published in the July 2002 edition of Pt.0 Ch.1 Sec.3, no other changes have been made.

This chapter is valid until superseded by a revised chapter.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

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

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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 are to 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

HELDK, HELDK-S, **HELDK-SH** or **HELDK-SHF**	equipped with helicopter deck (See Sec.2)
CRANE	equipped with shipboard crane (See Sec.3)
DSV-I SF, DSV-II SF or **DSV-III SF**	equipped with diving systems (See Sec.4)
DEICE or **DEICE-C**	equipped with de-icing / anti-icing systems (See Sec.5)
OPP-F	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_1 = 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
= 1.43 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.3 Ch.3 Sec.10.

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102 Provisions for helicopter facilities shall be in accordance with SOLAS Reg. 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 are to 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 are to 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 are to 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:

$P_v = 2\ g_0\ M_H$ (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 it's 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 are to 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^2.

B 500 Other loads

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

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

A_D = deck area (m^2).

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:

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

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
σ = 180 f_1 N/mm^2 in general
Reduced by still water longitudinal hull stress in strength deck longitudinals
= 160 f_1 N/mm^2 in weather deck hatch covers.

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

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

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
ε = 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 is to 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:

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

k = 1.4 for separate platforms
= 1.6 for weather deck hatch covers.

f_1, P_W and ε 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: $\sigma = 160\ f_1$ N/mm^2
— shear stress: $\tau = 90\ f_1$ N/mm^2.

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

$$A = kP_P \ (cm^2)$$

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 (cm^4)
A = cross-sectional area (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 is not to be less than:

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

σ_a = calculated compressive design stress.

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

Guidance note:

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

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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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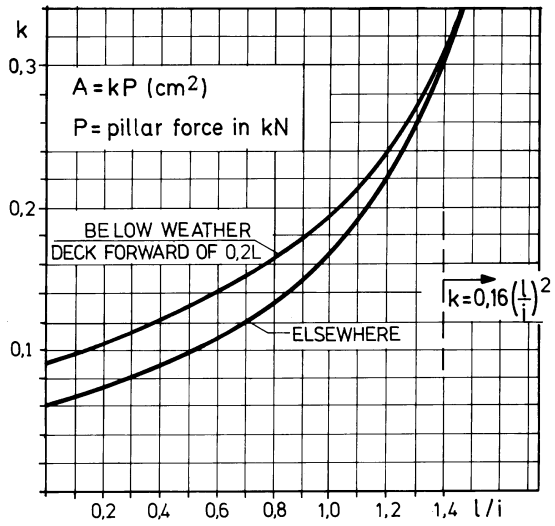

Fig. 1
k values

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 Safety nets and tie-down points

101 *Safety nets*

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

Guidance note:

The safety net may further facilitate:

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

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

103 The test load for safety net and safety net supporting structure surrounding a helicopter deck is not to 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_0 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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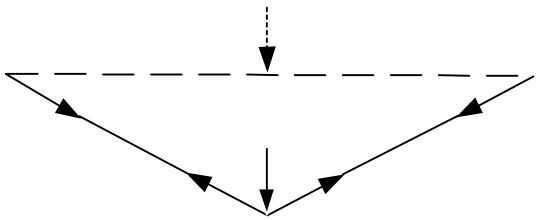

Fig. 2
Tie-down points

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.

106 The safety net mentioned in 103 shall have a size as given in Table D1.

Table D1 Minimum rope net size	
Deck diameter D according to F100	*Net size*
Below 14 m	6 x 9 m
14 to 17 m	9 x 9 m
17 to 22 m	12 x 12 m
Above 22 m	15 x 15 m

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

E. Requirements for Vessel Safety (HELDK-S)

E 100 Securing of helicopter onboard

101 Helicopter decks are to have tie-down points for lashing of the helicopter. The tie-down points are not to 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.

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 is not to 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 is not to 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 ±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° is required. The whole deck or landing area is to 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 are to be provided. These sectors are to originate at the most forward and aft points on the periphery of the D reference circle and diverge at 15° forward and 15° aft relative to straight transverse lines.

204 For any helicopter landing areas amidships located adjacent to the ships side with one-sided approach, the obstacle free sector is to 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.

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 are to 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 are to 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 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 x 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° 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.

F 800 Additional requirements

801 *Approach and take-off sector*

For location at the vessel's end, a free approach and take-off sector of 210° is required. The whole deck or landing area is to be located within this sector.

Guidance note:

The vessel end location is recommended.

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

803 For any helicopter landing areas amidships located adjacent to the vessel's side with one-sided approach, the obstacle free sector is to 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 vessel's side.

804 Obstacles

For landing areas located in the bow or stern area outside the obstacle free sector, obstacle heights are to be limited as follows:

— 0.05 D to a distance 0.62 D from the centre of the landing area and thence required to be below a rising plane of 1:2 to a distance of 0.83 D from the centre of the landing area.

805 For helicopter landing areas located adjacent to the vessel's side, outside the obstacle free sector, obstacles are to 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.

806 For naval craft the requirements in 801 to 805 may be deviated from, if so required by the navy.

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 ≥ 0.5 m each side for rail guided traversing systems and ≥ 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^2/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 is to 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 are to 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 are to 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 are to 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 are to be provided for all cranes in parked position (vessel at sea) to be anchored to the hull structure. The anchoring devices are to be designed to withstand inertia forces due to ship motions and loads due to «out of service» winds. The strength calculations are to 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 is not to 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 is to be prevented by some device for locking the crane in position. The strength of this device is to 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 is to be carried out as specified in the *Rules for Certification of Lifting Appliances*.

E. Stability

E 100 Stability requirements for heavy lift operations

101 Vessels, for which the lifting operation is the main, or one of the main functions, are to be checked with respect to stability requirements given in the Rules for Classification of Ships Pt.5 Ch.7 Sec.8 D200.

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-I SF** or **DSV-II SF** or **DSV-III SF** as applicable, when the vessel is equipped with a diving system certified by the Society in compliance with the Society's *Rules for Certification of Diving Systems*.

102 The various class notations are related to 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-I SF**	**DSV-II SF**	**DSV-III SF**
Restrictions	$d_{max} \leq 125$ m $T_{OP} \leq 12$ hours	$d_{max} \leq 200$ m $T_{OP} \leq 48$ hours	None, except those imposed by the rule requirements

In the *Rules for Certification of Diving Systems* the major differences between class **I SF**, **II SF** and **III SF** diving systems appear as requirements to:

- physical size of the chambers
- the life support system
- control stand
- communication system
- capacity of emergency power supply.

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 are to comply with the Society's *Rules for Certification of Lifting Appliances* as far as applicable, and the additional requirements for handling systems given in the *Rules for Certification of Diving Systems.*

A 200 Scope

201 The 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 showing the following are to be submitted for approval:

- hull structural arrangements and scantlings related to the diving system, e.g. moonpool for diving bell
- seatings and supporting structures for lifting appliances, chambers and other heavy components
- arrangement and particulars of any system for position keeping during diving operations
- seatings for supporting structures for anchoring devices.
- electrical power supply and distribution to the diving system
- fire protection arrangement and materials, detection and extinction systems and equipment in diving system areas
- for stability and floatability, see the Rules for Classification of Ships Pt.5 Ch.7 Sec.3 A201 for notation **SF**.

302 Plans showing the following are to be submitted for information:

- general arrangement of the complete diving system as installed on board, showing the location of all essential parts of the system.

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

304 The following control and monitoring systems shall be approved by the Society:

- breathing gas control and monitoring system
- closed circuit breathing control and monitoring system
- diving bell depth measurement system
- diving bell communication system
- environmental control and monitoring system
- diving bell communication system
- oxygen indication system
- trace contaminant analysing system.

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

B. Position Keeping

B 100 General

101 The vessel is to 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 will be especially considered.

103 A dynamic positioning system shall, as a minimum, comply with the notation **DYNPOS-AUTR** or equivalent.

Guidance note:

In this context, the minimum requirement is equipment class 2 in accordance with IMO MSC/Circ.645 of 6 June 1994 "Guidelines for Vessels with dynamic positioning systems" as this is considered equivalent to **DYNPOS-AUTR**. It should be noted that certain geographic regions will require, as a minimum, **DYNPOS-AUTRO** (IMO MSC/Circ.645 equipment class 3) for diving operations inside structures, habitats etc.

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104 The dynamic positioning control system is to initiate an alarm:

- if one of the thrusters exceeds defined power consumption, in relation to its maximum, for more than a brief and isolated period
- if the total power consumption to all thrusters exceeds a certain higher level.

The setting of these alarm levels is to be such that a single failure in power systems or thrusters will not result in a remaining thruster capacity, which is insufficient to keep the vessel in position.

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.

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105 Between the operation centre for the dynamic positioning system and the dive operation centre there is to be:

— a communication system
— a manually operated alarm system.

C. Arrangement

C 100 General

101 Class **III SF** diving systems are to be located in safe areas on board with regard to fire hazards. Safe areas are in this context areas which are not defined as hazardous zones by the *International Electrotechnical Commission's Publication No. 60079-10,* as follows:

Zone 0: in which an explosive gas-air mixture is continuously present or present for long periods.
Zone 1: in which an explosive gas-air mixture is likely to occur in normal operation.
Zone 2: in which an explosive gas-air mixture is not likely to occur, and if it occurs it will only exist for a short time.

Upon special consideration in each case, however, class **III SF** diving systems may be located in spaces which normally would be defined as Zone 2, see also E.

102 The diving system is to be so located that diving operations will not be affected by propellers, thrusters or anchors.

103 The layout of the diving system on board is to ensure protection from accidental damage and accessibility for:

— safe operation
— maintenance
— inspection.

104 Foundations for chambers and pressure vessels for gas storage are to allow for expansions due to pressure and temperature variations. The foundations are to be of sufficient stiffness, so that occasional local deformation of the support will not cause significant additional stresses in any pressure vessel, connections between pressure vessels or connected pipes.

D. Electrical Systems

D 100 Power supply, general

101 *Service definitions*

a) Essential services are herein defined as those services that need to be in continuous operation for maintaining the diving system's functionality with regard to sustaining the safety, health and environment of the divers in a hyperbaric environment. This includes services required by the crew monitoring the divers.
Essential services are to be maintained for the period required by safely terminating the diving operation, including time for decompression of the divers.

Guidance note:

For services supporting divers in the water, all are essential and 20 minutes is considered to be the minimum time required to ensure that the divers are safely recovered in the bell or basket or to the surface.

For services supporting divers in a bell, all are essential and 24 hours is considered to be the minimum time required to ensure that the divers are safely recovered in the decompression chambers or to the surface.

For services supporting divers in the decompression chambers, all are essential and the normal decompression schedule is considered to be the minimum time required to ensure that the divers are safely brought to the surface.

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b) Emergency services are herein defined as those services that are essential for safety in an emergency condition. Examples of equipment and systems for emergency services include:

— emergency lighting
— emergency communication
— emergency life support systems
— emergency heating systems
— emergency handling of the bell(s) or basket(s) or diver(s) (if electrical)
— alarm systems for the above emergency services.

Guidance note:

For services supporting divers in the water, all the above may be considered emergency services and 20 minutes is considered to be the minimum time required to ensure that the divers are safely recovered in the bell or basket or to the surface.

For services supporting divers in a bell, all the above may be considered emergency services and 24 hours is considered to be the minimum time required to ensure that the divers are safely recovered in the decompression chambers or to the surface.

For services supporting divers in the decompression chambers, with the exception of handling systems, all the above may be considered emergency services and the capacities given in 402 apply.

Services to the hyperbaric evacuation system are considered separately in accordance with the IMO guidelines given in I.

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c) Non-important services are those which are not essential according to the above.

102 The electrical systems or installations serving essential functions related to the divers and/or the diving operation, are to be supplied from a main and an emergency source of power.

103 *Source of power*

a) The supply from the main source of power may be via the ship main switchboard or directly from a self-contained source of power. The supply shall be independent of the ship emergency source of power and associated switchboard(s).

b) If the main power is supplied via a distribution board, this board shall have two separate supply circuits from different sections of the main switchboard.

c) The supply from the emergency source of power may be via the ship emergency switchboard or directly from a self-contained and independent source of power. The supply shall be independent of the ship main source of power and associated switchboard(s).

Guidance note:

Independent supplies to a dedicated main diving system switchboard are considered acceptable. For emergency services, see 200.

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104 *Loss of main power*

a) Upon loss of main power, there shall be an automatic change over to the emergency supply.

b) An alarm is to be initiated at the dive control station upon such change over.

D 200 Source of power, capacity

201 *Supply of normal services*

a) Capacity of main source of power:
All services for normal operations shall be included in the services to be supplied as described in Pt.4 Ch.8.

b) Capacity of emergency source of power:
The capacity of the emergency source of power with respect to normal services shall be in accordance with 402.

202 *Supply of emergency services*

The capacity of the emergency source of power shall be in accordance with 403.

D 300 Emergency services

301 The emergency services are to be separately supplied by the emergency source of power.

Guidance note:

The supply is to be independent of any main power system, including a dedicated main diving system switchboard as accepted by the 102. The use of a dedicated emergency diving system switchboard is accepted.

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D 400 Emergency source of power

401 The emergency source of power is to be a self-contained, independent source of power, and is to be either a generator, driven by a suitable prime mover, or an accumulator battery.

402 The capacity of the emergency source of power shall be sufficient to supply all essential services normally powered by the main source of power, for the same periods as given in 403.

403 The emergency source of power shall be capable of supplying the emergency services for the following periods:

— class **I SF** diving system: 12 hours.
— class **II SF** and class **III SF** diving systems: 48 hours.

404 The location and arrangement of the emergency source of power and associated switchboard(s) or transforming equipment, is to be in accordance with Pt.4 Ch.8.

405 The emergency generator, if any, shall be equipped for automatic starting and connection to the emergency distribution system.

E. Fire Prevention, Detection and Extinction

E 100 Fire protection

101 Class **III SF** diving systems are to be located in safe areas as defined in C101.

102 Enclosed spaces for diving systems are to be:

— separated from adjacent rooms or spaces by bulkheads and deck with fire resistance defined as A-60 division
— fitted with mechanical ventilation with minimum 8 air changes per hour.

103 Oxygen dumped from the diving system is to be ducted for dumping at a safe place.

104 Control rooms for class **I SF** and **II SF** diving systems located in hazardous Zone 1 or 2 are to be pressurized by air supplied from a safe area. Possible loss of overpressure is to be indicated by alarm.

E 200 Fire detection

201 Enclosed spaces for diving systems are to be equipped with automatic fire detection and alarm system.

202 Provisions are to be made for warning of faults, e.g. voltage failure, broken line, earth fault etc. in the alarm and detection system.

E 300 Fire extinction

301 Enclosed spaces for diving systems are to be equipped with a manually actuated extinction system, with such a layout as to cover the whole system. For rooms intended for pressurised gas storage containers, the extinction system is to be a fixed pressure water-spraying system.

302 Open deck areas where diving systems are located, are to be provided with fire extinction equipment, which will be considered in each case.

F. Sanitary Systems for Class II SF and III SF Diving Systems

F 100 General

101 Fresh water supply to the chambers is to be arranged.

102 The sanitary system of the chambers is to be connected to a sewage system.

G. Testing

G 100 General

101 After completed installation, the diving system is to be tested in compliance with an approved test program in presence of the surveyor. The required tests are stated in the *Rules for Certification of Diving Systems.*

H. Stability and Floatability

H 100 General

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

I. Hyperbaric Evacuation Systems

I 100 General requirements and preamble

101 The requirements in I are in compliance with the IMO Resolution A.692(17) "Guidelines and Specifications for Hyperbaric Evacuation Systems" - in the following referred to as the 'IMO Guidelines'. The IMO text is all written in *italics*. If any parts of the rules are subject to discussion or misunderstanding, the IMO text shall prevail.

102 Hyperbaric evacuation units that are permanently connected to a certified diving system will be regarded as deck decompression chambers and are to be certified as such although the minimum size requirements given in the Rules for Certification of Diving Systems, 1988 Sec.3 B102 shall be considered in each case.

Guidance note:

For split level diving and diving operations deeper than 200 m, two hyperbaric evacuation systems may be required to cover the various pressure levels.

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

I 200 Introduction

201 These Guidelines and Specifications for Hyperbaric Evacuation Systems have been developed with a view to promoting the safety of all divers in saturation and achieving a standard of safety for divers which corresponds, so far as is practicable, to that provided for other seagoing personnel, and which will satisfy chapter 3 of the Code of Safety for Diving Systems (resolution A.536(13), as amended by resolution A.583(14)).

I 300 Hyperbaric evacuation methods

301 It is recognized that there are various methods available for evacuating divers in an emergency and that the suitability of the various options for a safe hyperbaric evacuation depends on a number of factors including the geographical area of operation, environmental conditions, and any available offshore or onshore medical and support facilities. Options available to diving contractors will include:

.1 hyperbaric self-propelled lifeboats;
.2 towable hyperbaric evacuation units;
.3 hyperbaric evacuation units which may or may not be towable suitable for offloading on to an attendant vessel;
.4 transfer of the diving bell to another facility;
.5 transfer of the divers from one diving bell to another when in the water and under pressure;
.6 negatively buoyant unit with inherent reserves of buoyancy, stability and life support capable of returning to the surface to await independent recovery.

The Guidelines and Specifications do not therefore attempt to specify which particular type of hyperbaric evacuation system should be employed and recommend that clients and diving contractors examine and identify the option most suited for the area and type of operation in which they are engaged. Consideration may have to be given to the provision of separate evacuation facilities for divers in saturation at significantly different depths.

I 400 Contingency planning and emergency instructions

401

3.1 A potentially dangerous situation can arise if a floating unit, from which saturation diving operations are being carried out, has to be abandoned with a diving team under pressure. While this hazard should be reduced by preplanning, under extreme conditions consideration may have to be given to hyperbaric evacuation of the divers. The hyperbaric evacuation arrangements should be studied prior to the commencement of the dive operation and suitable written contingency plans made. Where, in the event of diver evacuation, decompression would take place in another surface compression chamber the compatibility of the mating devices should be considered.

3.2 Once the hyperbaric evacuation unit has been launched, the divers and any support personnel may be in a precarious situation where recovery into another facility may not be possible and exposure to seasickness and accompanying dehydration will present further hazards. It is, therefore, necessary that diving contractors ensure that any such contingency plans include appropriate solutions. It should be emphasised that hasty or precipitate action may lead to a premature evacuation situation which could be more hazardous in the final analysis.

3.3 In preparing the contingency plans, the various possible emergency situations should be identified taking into consideration the geographical area of operation, the environmental conditions, the proximity of other vessels, and the availability and suitability of any onshore or offshore facilities. The facilities for rescue, recovery and subsequent medical treatment of divers evacuated in such circumstances should be considered as part of the contingency plan. In the case of unattended hyperbaric evacuation units, consideration should be given to providing equipment to transfer the towline to an attendant vessel before launch of the evacuation unit. Such an arrangement would enable the unit to be towed clear immediately after launching. Copies of contingency plans should be available on board the parent vessel, ashore and in the hyperbaric evacuation unit.

I 500 Purpose

501 The purpose of these Guidelines and Specifications is to recommend design and construction criteria, equipment, survey standards and contingency planning for the evacuation systems referred to in chapter 3 of the Code of Safety for Diving Systems (resolution A.536(13)).

I 600 Application

601 The Guidelines and Specifications apply to new hyperbaric evacuation units which are constructed more than twelve months after the date on which the Assembly of the International Maritime Organization adopts these guidelines and specifications for units which can be mated to a surface compression chamber. However, any existing system which complies with the provisions of these Guidelines and Specifications may be considered for endorsement of the safety equipment certificate in accordance with 4.2. (I2502).

I 700 Definitions

701 "Self-propelled hyperbaric lifeboats" are in this text understood to mean hyperbaric evacuation units installed in self-propelled lifeboats operated by crew members/life support technicians located outside the hyperbaric environment.

702

(3) Definitions

For the purpose of these Guidelines and Specifications the terms used have the meanings defined in the following paragraphs unless expressly provided otherwise:

3.1 "Administration" means the Government of the State whose flag a ship or floating structure which carries a diving system is entitled to fly or in which the ship or floating structure is registered.

3.2 "Bottle" means a pressure container for the storage and transport of gases under pressure.

3.3 "Breathing mixture" means air or any other mixture of gases used for breathing during evacuation and, if applicable, during decompression.

3.4 "Depth means" the pressure, expressed in metres of seawater, to which the diver is exposed at any time during a dive or inside a surface compression chamber or a diving bell.

3.5 "Diving bell" means a submersible compression chamber, including its ancillary equipment, for transfer of divers under pressure between the work location and the surface compression chamber, and vice versa.

3.6 "Diving system" means the whole plant and equipment necessary for the conduct of diving operations using transfer-under-pressure techniques.

3.7 "Hyperbaric evacuation system" means the whole plant and equipment necessary for the evacuation of divers in saturation from a surface compression chamber to a place where decompression can be carried out. The main components of a hyperbaric evacuation system include the hyperbaric evacuation unit, handling system and life-support system.

3.8 "Hyperbaric evacuation unit" means a unit whereby divers under pressure can be safely evacuated from a ship or floating structure to a place where decompression can be carried out.

3.9 "Handling system" means the plant and equipment necessary for raising, lowering and transporting the hyperbaric evacuation unit from the surface compression chamber to the sea or on to the support vessel, as the case may be.

3.10 "Hazardous areas" means those locations in which an explosive gas-air mixture is continuously present, or present for long periods (zone 0); in which an explosive gas-air mixture is likely to occur in normal operation (zone 1); in which an explosive gas-air mixture is not likely to occur, and if it does it will only exist for a short time (zone 2).

3.11 "Life-support system" means the gas supplies, breathing gas system, decompression equipment, environmental control system, heating or cooling and other equipment required to provide a safe environment for the divers in the hyperbaric evacuation unit under all ranges of pressure that they may be exposed to during evacuation and, if applicable, during the decompression stages.

3.12 "Mating device" means the equipment necessary for connecting and disconnecting a hyperbaric evacuation unit and a surface compression chamber.

3.13 "Maximum operating depth" of the diving system is the depth in metres of seawater equivalent to the maximum pressure for which the diving system is designed to operate.

3.14 "Pressure vessel" means a container capable of withstanding an internal maximum working pressure greater than or equal to 1 bar.

3.15 "Compression chamber" means a pressure vessel for human occupancy with means of controlling the differential pressure between the inside and outside of the chamber.

I 800 Design and construction principles

801

5.1 The design and construction of the hyperbaric evacuation system should be such that it is suitable for the environmental conditions envisaged, account being taken of the horizontal or vertical dynamic snatch loads that may be imposed on the system and its lifting points particularly during evacuation and recovery.

5.2 The hyperbaric evacuation unit should be capable of being recovered by a single point lifting arrangement and means should be provided on the unit to permit a swimmer to hook on or connect the lifting arrangement.

5.3 In the design of pressure vessels including accessories such as doors, hinges, door landings, closing mechanisms, penetrators and viewports, the effects of rough handling should be considered in addition to design parameters such as pressure, temperature, vibration, operating and environmental conditions. In general, piping penetrations through the chamber should have isolating valves on both sides.

5.4 Materials used in the construction of hyperbaric evacuation systems should be suitable for their intended use.

5.5 Component parts of a hyperbaric evacuation system should be designed, constructed and tested in accordance with standards acceptable to the Administration.

5.6 Components in the hyperbaric evacuation system should be so designed, constructed and arranged as to permit easy inspection, maintenance, cleaning and, where appropriate, disinfection.

5.7 The hyperbaric evacuation system should be provided with the necessary control equipment to ensure its safe operation and the well-being of the divers.

5.8 Special arrangements and instructions should be provided externally to enable the hyperbaric evacuation unit to be recovered safely. The instructions should be located where they will be legible when the hyperbaric evacuation unit is floating.

5.9 Hyperbaric evacuation systems should not be located in zone 0 or zone 1; hazardous areas and high fire risk areas should be avoided as far as is reasonably practicable.

I 900 Equipment for connection to support or rescue vessels (HEU)

901 The hyperbaric evacuation unit is to have an arrangement for a possible connection of an umbilical to the support vessel. The umbilical connection is to enable maintenance of proper environmental conditions in the chamber for an unlimited time, and contain aids for communication.

I 1000 Crew facilities (HEU)

1001 The chamber is to be equipped with one seat and one seatbelt for each diver.

I 1100 Hyperbaric evacuation units (HEU)

1101

6.1 The hyperbaric evacuation unit is to be designed for the rescue of all divers in the diving system at the maximum operating depth. The compression chamber should provide a suitable environment and adequate facilities, including, where appropriate, seat belts, for the maximum number of persons for which the unit is designed. The seating or other arrangements provided should be designed to provide an adequate degree of protection to the divers from impact collisions during launch and while the unit is afloat. Where the chamber is intended to be occupied for more than 12 h, arrangements for the collection or discharge of human waste should be provided. Where discharge arrangements are provided they should be fitted with suitable interlocks.

6.2 The means provided for access into the compression chamber should be such as to allow safe access to or from the surface compression chambers. Interlocks should be provided to prevent the inadvertent release of the hyperbaric evacuation unit from the surface compression chamber while the access trunking is pressurised. The mating flange should be adequately protected from damage at all times including during the launch and recovery stages.

6.3 Arrangement should be provided to enable an unconscious diver to be taken into the unit.

6.4 Compression chamber doors should be so designed as to prevent accidental opening while pressurised. All doors should be so designed that, where fitted, the locking mechanisms can be operated from both sides.

6.5 Arrangements should be provided to allow the occupants to be observed. If viewports are provided they should be situated so that risk of damage is minimised.

6.6 Where it is intended to carry out decompression of the divers after hyperbaric evacuation in another surface compression chamber, then consideration must be given to the suitability of the mating arrangements on that surface compression chamber. Where necessary, a suitable adapter and clamping arrangements should be provided.

6.7 A medical lock should be provided and be so designed as to prevent accidental opening while the compression chamber is pressurised. Where necessary, interlock arrangements should be provided for this purpose. The dimensions of the medical lock should be adequate to enable essential supplies, including CO2 scrubber canisters, to be transferred into the compression chamber, and be of such dimensions as to minimize the loss of gas when the lock is being used.

I 1200 Life-support system

1201

8.1 Means should be provided to maintain all the occupants in thermal balance and in a safe and breathable atmosphere for all environmental conditions envisaged - air temperature, sea temperature and humidity - and with the maximum and minimum number of divers likely to be carried. In determining the duration and amount of life support necessary, consideration should be given to the geographical and environmental conditions, the O2 and gas consumption and CO2 generation under such conditions, the heat input or removal and the emergency services that may be available for the decompression of the divers. Gas losses as a result of using toilet facilities which discharge to outside the hyperbaric evacuation unit and medical lock operation should be taken into account in determining the amount of gases required. The effects of hypothermia should be considered and the effectiveness of the arrangements provided should be established as far as is reasonable and practicable under all conditions envisaged. However, in no such case should the duration of the unit's autonomous life-support endurance be less than 72 h.

8.2 In addition to any controls and equipment fitted externally, compression chambers should be provided with adequate controls within for supplying and maintaining the appropriate breathing mixtures to the occupants, at any depth down to the maximum operating depth. The persons operating the chamber, whether they are within or outside it, should be provided with adequate controls to provide life support. As far as practicable, the controls should be capable of operation without the person who operates them having to remove his/her seat belt.

8.3 Two separate distribution systems should be provided for supplying oxygen to the compression chamber. Components in the system should be suitable for oxygen service.

8.4 Adequate equipment should be provided and be suitably situated to maintain oxygen and carbon dioxide levels and thermal balance within acceptable limits while the life-support equipment is operating.

8.5 In addition to any instrumentation necessary outside the compression chamber, suitable instrumentation should be provided within the chamber for monitoring the partial pressures of oxygen and carbon dioxide and be capable of operation for the duration of the available life-support period.

8.6 Where it is intended that divers may be decompressed within the hyperbaric evacuation unit, provision should be made for the necessary equipment and gases, including therapeutic mixtures, to enable the decompression process to be carried out safely.

8.7 An adequate supply of food and water should be provided within the hyperbaric evacuation unit. In determining, in particular, the amount of water to be provided, consideration should be given to the area of operation and the environmental conditions envisaged.

8.8 A breathing system should be provided with a sufficient number of masks for all the occupants under pressure.

8.9 Provision should be made external to the hyperbaric evacuation unit, and in a readily accessible place, for the connection of emergency hot or cold water and breathing therapeutic mixture. The dimensions of the connections provided should be as follows:

3/4 in. NPT (female) - hot or cold water

1/2 in. NPT (female) - breathing mixture

The connections should be clearly and permanently marked and be suitably protected.

8.10 In hyperbaric evacuation units designed to pass through fires, the breathing gas bottles and piping systems and other essential equipment should be adequately protected. In addition, thermal insulation should be non-toxic and suitable for this purpose.

8.11 First-aid equipment, sickness bags, paper towels, waste disposal bags and all necessary operational instructions for equipment within the compression chamber should be available within the chamber, on board the parent vessel and ashore.

I 1300 Electrical systems and arrangements

1301

10.1 All electrical equipment and installation, including the power supply arrangements, should be designed for the environment in which they will be required to be operated and designed to minimize the risk of electrical capacity depletion as a result of a fault, fire or explosion, electric shock, the emission of toxic gases and galvanic action. Electrical equipment within the compression chamber should be designed for hyperbaric use, high humidity levels and marine application.

10.2 Power supplies required for the operation of life-support systems and other essential services should be sufficient for the life-support duration. The battery charging arrangements should be designed to prevent overcharging under normal or fault conditions. The battery storage compartment should be provided with means to prevent over-pressurisation and any gas released be vented to a safe place.

10.3 Each compression chamber should be provided with a source of lighting sufficient for the life-support time and of sufficient luminosity to allow the occupants to read gauges and operate essential systems within the chamber.

I 1400 Fire protection and extinction

1401

9.1 Materials used in the construction and installation should so far as is possible be non-combustible and non-toxic.

9.2 A fire-extinguishing system should be provided in the hyperbaric evacuation unit which should be suitable for exposure to all depths down to the maximum operating depth.

9.3 In hyperbaric evacuation units that are designed to float and may be used to transport divers through fires, consideration should be given, where practicable, to providing an external water spray system for cooling purposes (see 7.5).

7.5 Hyperbaric evacuation units on ships required to be provided with fire-protected lifeboats should be provided with a similar degree of fire protection.

I 1500 Launch and recovery systems general

1501 The launching system is to comply with a recognised national code.

1502 An interlock system is to be fitted to the mating system between the evacuation unit and the evacuation-tunnel with functions as stated in *Rules for Certification of Diving Systems*, Sec.3 B304 and Sec.7 B109.

I 1600 Launch and recovery of hyperbaric evacuation units

1601 *Where appropriate:*

11.1 Means should be provided for the safe and timely evacuation and recovery of the unit and due consideration should be given to the environmental and operating conditions and the dynamic snatch and impact loadings that may be encountered. Where appropriate, the increased loadings due to water entrainment should be considered. Where the primary means of launching depends on the ship's main power supply, then a secondary and independent launching arrangement should be provided.

11.2 If the power to the handling system fails, brakes should be engaged automatically. The brake should be provided with manual means of release.

11.3 The launching arrangements provided should be designed to ensure easy connection or disconnection of the hyperbaric evacuation unit from the surface compression chamber and for the transportation and removal of the unit from the ship under the same conditions of trim and list as those for the ship's other survival craft.

11.4 Where a power-actuated system is used for the connection or disconnection of the hyperbaric evacuation unit and the surface compression chamber, then a manual or stored power means of connection or disconnection should also be provided.

11.5 The means provided for release of the falls or lift wire after the unit is afloat should provide for easy disconnection, particular attention being given to units not provided with an attendant crew.

11.6 Where the hyperbaric evacuation unit is designed to be recovered from the sea, or from a ship in a seaway, consideration should be given to the mode of recovery. Adequate equipment to enable a safe recovery of the unit should be provided on the unit. Permanently marked clear instructions should be provided adjacent to the lifting equipment as to the correct method for recovery, including the total weight of the hyperbaric evacuation unit. Consideration should be given to the effect which entrained water and any bilge water may have on the total weight to be lifted by the recovery vessel. Consideration should also be given to any means that can be provided for the absorption of the dynamic snatch loads imposed during the recovery of the hyperbaric evacuation unit from the sea.

I 1700 Fittings

1701 Fittings are to comply with the *Rules for Certification of Diving Systems*.

I 1800 Communications

1801

12.1 If breathing mixtures containing helium or hydrogen are used, a self-contained primary communication system fitted with an unscrambler device should be arranged for direct two-way communication between the divers and those outside the compression chamber. A secondary communication system should also be provided.

12.2 In addition to the communication system referred to in 12.1, a standard bell emergency communication tapping code should be provided which meets the requirements of that specified in the amendments to the Code of Safety for Diving Systems (resolution A.583(14)). Copies of the tapping code should be permanently displayed inside and outside the hyperbaric evacuation unit.

I 1900 Location systems

1901

12.3 Hyperbaric evacuation units designed to be waterborne should be provided with a strobe light and radar reflector.

12.4 Hyperbaric evacuation units designed to be placed on the sea-bed to await independent recovery should be provided with an acoustic transponder. .;The transponder should be suitable for operation with a diver-held interrogator-receiver which will be retained on board the parent ship. The equipment provided should meet the requirements specified in the amendments to the Code of Safety for Diving Systems (resolution A.583(14)).

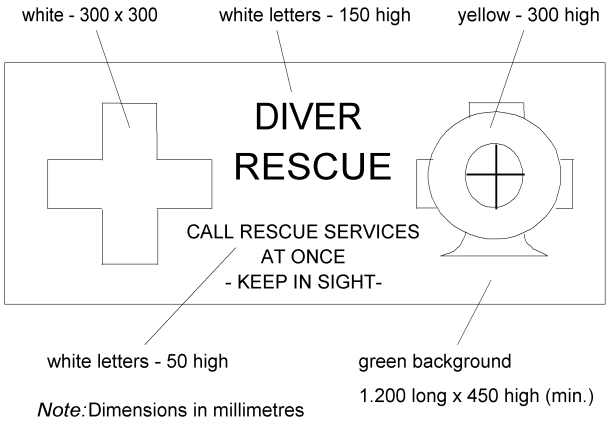

Fig. 1
Marking of hyperbaric evacuation units

I 2000 Markings

2001

13.1 Dedicated hyperbaric evacuation units should be coloured orange and be provided with retro-reflective material to assist in their location during hours of darkness.

13.2 Each hyperbaric evacuation unit designed to be waterborne should be marked with at least three identical signs as shown in Fig.1. One of these markings should be on top of the unit and be clearly visible from the air and the other two be mounted vertically on either side

and as high as possible and be capable of being seen while the unit is afloat.

13.3 Where applicable, the following instructions and equipment should be clearly visible and be kept readily available while the unit is afloat:

.1 towing arrangements and buoyant towline;

.2 all external connections, particularly for the provision of emergency gas, hot/cold water and communications;

.3 maximum gross weight of unit in air;

.4 lifting points;

.5 name of the parent ship and port of registration; and

.6 emergency contact telephone, telex and facsimile numbers.

13.4 Warning instructions

Where appropriate, the following instructions should be permanently displayed on every hyperbaric evacuation unit in two separate locations so as to be clearly visible while the unit is afloat:

"Unless specialised diving assistance is available:

.1 do not touch any valves or other controls;

.2 do not try to get occupants out;

.3 do not connect any gas, air, water or other supplies;

.4 do not attempt to give food, drinks or medical supplies to the occupants; and

.5 do not open any hatches".

I 2100 Stability and buoyancy

2101

7.1 Hyperbaric evacuation units designed to float should be provided with adequate stability for all envisaged operating and environmental conditions and be self-righting. In determining the degree of stability to be provided, consideration should be given to the adverse effects of large righting moments on the divers. Consideration should also be given to the effect which equipment and rescue personnel, required to be placed on the top of the system to carry out a recovery from the sea, may have on the stability of the hyperbaric evacuation unit.

7.2 Towing attachment points should be so situated that there is no likelihood of the hyperbaric evacuation unit being capsized as a result of the direction of the tow line. Where towing harnesses are provided they should be lightly clipped or secured to the unit and, so far as is possible, be free from snagging when pulled free.

7.3 Hyperbaric evacuation units designed to float should have sufficient reserves of buoyancy to enable the necessary rescue crew and equipment to be carried.

7.4 Where hyperbaric evacuation units are designed to be placed on board a rescue vessel, attachment points should be provided on the unit to enable it to be secured to the deck.

I 2200 Self-propelled hyperbaric evacuation lifeboat

2201 If self propelled hyperbaric evacuation lifeboats are required by statutory regulations or installed to comply with operational criteria, the following requirements in 2202 to 2210 apply.

2202 The hyperbaric evacuation lifeboat's hull, machinery, equipment, manoeuvrability and seagoing properties are to comply with SOLAS 1974 (International Convention for the Safety of Life at Sea) and a relevant recognised national code.

Guidance note:

Lifeboats may be type approved.

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

2203 The hyperbaric evacuation lifeboat is to be fitted with seating arrangement sufficient to carry the maximum number of divers and crew members in a sitting position.

2204 The hyperbaric evacuation lifeboat is to have a sheltered area for at least 2 crew members in addition to the divers in the chamber. The controls for the hyperbaric evacuation unit are to be located in this sheltered area.

2205 The system design is to be such that the time necessary to disconnect and launch the hyperbaric evacuation lifeboat will not exceed 10 minutes, counted after all divers and crew members have entered the hyperbaric evacuation lifeboat and it is free floating with the engine running.

2206 The chamber is to have windows towards the sheltered part in the lifeboat.

2207 The hyperbaric evacuation lifeboat is to have a self-contained support system with capacity for at least 72 hours.

2208 The hyperbaric evacuation lifeboat is to have emergency radio communication and location systems complying with requirements given in IMO Resolution A.809(19) in reference to SOLAS Regulation III/6.2.1 and III/6.2.2.

2209 The propulsion unit is to have sufficient power for 10 minutes running without using air from the atmosphere outside the boat.

2210 Masks for breathing or breathing apparatus are to be available for the crew members or life-support technicians at atmospheric pressure. The masks are to be connected to an air storage sufficient for 30 minutes breathing.

I 2300 Testing, surveys and drills, general

2301 Testing of the hyperbaric evacuation system with hyperbaric evacuation unit and the handling system is to be carried out in compliance with the *Rules for Certification of Diving Systems*, 1988 Sec.1 D and to the maximum possible extent, to SOLAS requirements.

I 2400 Maintenance and testing

2401 The availability of any hyperbaric evacuation system provided is dependent on the regular testing and maintenance of the system. A planned maintenance and testing programme should be devised with the responsibility for carrying out the maintenance tasks being allocated to specific crew members. A maintenance and testing schedule should be available for recording the execution of the tasks and the signatures of the persons allocated the tasks. Such schedules should be maintained on board and be available for inspection.

I 2500 Surveys

2501 DNV scope for surveys of diving systems is given in Pt.7 Ch.2 Sec.4 C.

2502

4.1 Each hyperbaric evacuation system should be subject to:

.1 an initial survey before being put into service. This should comprise a complete and thorough examination of the hyperbaric evacuation system, equipment, fittings, arrangements and materials including functional tests which should be such as to ensure they are suitable for the intended service and in compliance with these guidelines and specifications;

.2 a survey at intervals specified by the Administration but not exceeding 2 years; and

.3 an annual inspection within 3 months of each anniversary date of the survey to ensure that the hyperbaric evac-

uation system, fittings, arrangements, safety equipment and other equipment remain in compliance with the applicable provisions of the Guidelines and Specifications and are in good working order.

4.2 Where a hyperbaric evacuation system complies with the provisions, as applicable, of the Guidelines and Specifications and has been duly surveyed, it may be recorded on the supplement to the Cargo Ship Safety Equipment Certificate as providing the life-saving appliances and arrangements for divers in compression.

I 2600 Training and evacuation drills

2601 Periodic training exercises should be carried out to test the operation of the hyperbaric evacuation system and the efficiency of the personnel responsible for the hyperbaric evacuation of the divers. Such training exercises should not normally be carried out while the chambers are pressurised, but should be carried out at each available opportunity.

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 6 cm per hour.

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.2)
— 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 (offshore supply vessels).

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 are to 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 are to 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 are to be tested to the satisfaction of the Society. A test program is to 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 are to satisfy the applicable stability requirements.

202 The ice weight distribution is to be taken at least:

— generally 150 kg/m^2 of horizontally projected area
— for ships with length L (LOA) above 100 m, 100 kg/m^2 of horizontally projected area aft of L/2.

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.

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 be 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 is not to be less than:

- 300 W/m^2 for open deck areas, helicopter decks, gangways, stairways, etc.
- 200 W/m^2 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 is to 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 is to be appropriate for efficient heating. The fastening of cables or pipes is to 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 is to be installed on the switchboard. Marking on the switchboard is to state the load on each circuit, as well as the total load.

All circuits are to have earth failure monitoring with alarm. Energized circuits are to 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 is to 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.

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

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
- equipment necessary for maintaining propulsion (i.e. cooling water sea chests)
- 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
- air pipe vent heads for tanks
- air horns
- lifeboats with davits
- pick-up boats including launching area
- rafts
- escape exits
- storage facilities for lifesaving outfit, e.g., rescue suits, lines, picks and similar equipment for de-icing purposes.

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

- open deck areas
- gangways and stairways
- helicopter deck if any
- superstructure
- railings
- outdoor piping
- winches, also for anchor handling
- 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.

C 300 Class notation DEICE-C or supply vessels

301 The requirements given in 200 are to be complied with as applicable. In addition, the cargo deck area is to be arranged for proper handling of cargo under icing conditions.

302 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 is also to be provided with deicing facilities.

C 400 Special equipment

401 Protective clothing, safety lines, hand tools and similar equipment for deicing purposes are to be kept onboard. The quantity of the equipment is to be sufficient for the assumed extent of manual deicing.

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

C 500 Electric power generator capacity

501 For calculation of required generator capacity (see Pt.4 Ch.8), the power requirements for the heating arrangements are to be included as specified below:

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

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 about control position for fuel oil bunkering and transfer operations is to be submitted.

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

B. Arrangement of Fuel Oil Tanks

B 100 General

101 Tanks for fuel oil including overflow tanks and tank capacity exceeding 20 m^3 for waste oils, sludge etc. are to be arranged with an inner bottom at least B/15 or 2 m, whichever is less, above the vessels base line. Small suction wells may be arranged in the inner bottom.

102 Tanks for fuel oil including overflow tanks are to be protected by a double side. Double side is however not required for fuel oil tanks or fuel oil overflow tanks in machinery spaces located in the aft part of the ship.

For ships below 20 000 gross tonnage the distance between the oil fuel tank and the shell side plating is nowhere to be less than 760 mm.

For ships of 20 000 gross tonnage and above the distance between the oil fuel tank and the side shell plating is nowhere to be less than 2.0 m.

103 Combined fuel oil and water ballast tanks are not to be arranged.

C. Sundry

C 100 General

101 All fuel oil bunker tanks are to be fitted with a high level alarm which will be activated before the tank is overfilled. The alarm signal is to 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 which are provided with an overflow line to another fuel oil tank which is fitted with a high level alarm.

102 All bunkering lines are to be fitted with a remotely operated closing valve. Closing of the valve is to be possible from where the person in charge of the bunkering operation will normally be located.

103 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 are to be fitted with permanent drip trays or coamings with capacity not less than 80 litres (0.5 US barrels) for vessels between 300 gross tonnage and 1600 gross tonnage and not less than 160 litres (1.0 US barrels) for vessels of 1600 gross tonnage and above.

104 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 is to be installed. The capacity of the bilge water holding tank is to be as given in Table C1.

Table C1 Capacity of bilge water holding tank

Main engine rating (kW)	*Capacity (m^3)*
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 will be specially 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 is to be fitted with heating facilities.

105 On vessels operating with heavy fuel oil the tank(s) for sludge from the fuel oil purifiers is to be built without internal structures.