OFFSHORE STANDARD
DNV-OS-E401

HELICOPTER DECKS

MARCH 2001

DET NORSKE VERITAS

FOREWORD

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

DNV Offshore Codes consist of a three level hierarchy of documents:

— *Offshore Service Specifications.* Provide principles and procedures of DNV classification, certification, verification and consultancy services.
— *Offshore Standards.* Provide technical provisions and acceptance criteria for general use by the offshore industry as well as the technical basis for DNV offshore services.
— *Recommended Practices.* Provide proven technology and sound engineering practice as well as guidance for the higher level Offshore Service Specifications and Offshore Standards.

DNV Offshore Codes are offered within the following areas:

A) Qualification, Quality and Safety Methodology

B) Materials Technology

C) Structures

D) Systems

E) Special Facilities

F) Pipelines and Risers

G) Asset Operation

Comments may be sent by e-mail to *rules@dnv.com*
For subscription orders or information about subscription terms, please use *distribution@dnv.com*
Comprehensive information about DNV services, research and publications can be found at *http*://www.dnv.com, or can be obtained from DNV, Veritasveien 1, N-1322 Høvik, Norway; Tel +47 67 57 99 00, Fax +47 67 57 99 11.

Computer Typesetting (FM+SGML) by Det Norske Veritas.
Printed in Norway by GCS AS.

CONTENTS

OFFSHORE STANDARD
DNV-OS-E401

HELICOPTER DECKS

CHAPTER 1

INTRODUCTION

CONTENTS PAGE

DET NORSKE VERITAS

Veritasveien 1, N-1322 Høvik, Norway Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11

SECTION 1
INTRODUCTION

A. General

A 100 General

101 This standard is intended to provide requirements and guidance to the design of helicopter decks constructed in steel or aluminium for any unit or installation intended for offshore use.

102 The requirements in this standard apply to units or installations with erected landing platform for helicopters or a landing area arranged directly on weather deck or supported by substructure anywhere on the unit or installation.

103 The standard is applicable to the design of complete helicopter deck structures including sub-structure and hull connections and reinforcements.

104 The standard has been written for general worldwide application. Governmental regulations may include requirements in excess of the provisions of this standard depending on the size, type, location and intended service of the offshore unit or installation.

A 200 Objectives

201 The objectives of this standard are to:

— provide an internationally acceptable standard of safety for helicopter decks by defining minimum requirements for the design, materials, construction and commissioning
— serve as a contractual reference document
— serve as a guideline for designers, suppliers, purchasers, contractors and regulators
— specify procedures and requirements for helicopter decks subject to DNV certification and classification.

A 300 Organisation of this standard

301 This standard is divided into three main chapters:

Chapter 1: General information, scope, definitions and references.

Chapter 2: Technical provisions for helicopter decks for general application.

Chapter 3: Specific procedures and requirements applicable for certification and classification in accordance with this standard.

B. Normative References

B 100 General

101 The standards given in Table B1, Table B2 and Table B3 include provisions, which through reference in this text constitute provisions for this standard.

B 200 Offshore service specifications and rules

201 The offshore service specifications and rules given in Table B1 are referred to in this standard.

Table B1 DNV Offshore service specifications and rules	
Reference	*Title*
DNV-OSS-101	Rules for Classification of Offshore Drilling and Support Units
DNV-OSS-102	Rules for Classification of Floating Production and Storage Units
	Rules for Classification of Ships

B 300 Offshore standards

301 The offshore standards given in Table B2 are referred to in this standard.

Table B2 DNV Offshore standards	
Reference	*Title*
DNV-OS-B101	Metallic Materials
DNV-OS-C101	Design of Offshore Steel Structures, General (LRFD method)
DNV-OS-C102	Structural Design of Offshore Ships
DNV-OS-C103	Structural Design of Column Stabilised Units (LRFD method)
DNV-OS-C104	Structural Design of Self Elevating Units (LRFD method)
DNV-OS-C105	Structural Design of TLPs (LRFD method)
DNV-OS-C106	Structural Design of Deep Draught Floating Units
DNV-OS-C201	Structural Design of Offshore Units (WSD method)
DNV-OS-D301	Fire Protection

B 400 Other references

401 The other references given in Table B3 are referred to in this standard.

Table B3 Other references	
Reference	*Title*
IMO Resolution A.855(20)	Standards for on-board Helicopter Facilities
IMO MODU Code, 1989	Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1989

C. Informative References

C 100 General

101 The documents in Table C1 include acceptable methods for fulfilling the requirements in the standards. Other recognised documents may be used provided it is shown that they meet or exceed the level of safety of the actual standards.

Table C1 DNV Recommended Practices and Classification Notes	
Reference	*Title*
DNV-RP-A201	Standard Documentation Types
DNV-RP-A202	Documentation of Offshore Projects
DNV-RP-C203	Fatigue Strength Analysis of Offshore Steel Structures
DNV Classification Note 30.1	Buckling Strength Analysis
DNV Classification Note 30.5	Environmental Conditions and Environmental Loads
DNV Classification Note 30.7	Fatigue Assessment of Ship Structures

D. Definitions

D 100 Verbal forms

101 *Shall:* Indicates requirements strictly to be followed in order to conform to this standard and from which no deviation is permitted.

102 *Should:* Indicates that among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required. Other possibilities may be applied subject to agreement.

103 *May:* Verbal form used to indicate a course of action permissible within the limits of the standard.

104 *Can:* Can-requirements are conditional and indicate a possibility to the user of the standard.

E. Abbreviations and Symbols

E 100 Abbreviations

101 The abbreviations given in Table E1 are used in this standard.

Table E1 Abbreviations

Abbreviation	*In full*
ALS	Accidental limit states
CAA	Civil Aviation Authority
DNV	Det Norske Veritas
FLS	Fatigue limit state
ICAO	International Civil Aviation Organisation
IMO	International Maritime Organization
LRFD	Load and resistance factor design
MODU	Mobile offshore drilling unit
OS	Offshore standard
OSS	Offshore service specification
RP	Recommended practice
SLS	Service limit state
SOLAS	International Convention for the Safety of Life at Sea
ULS	Ultimate Limit State
WSD	Working stress design

E 200 Symbols

201 The following units are used:

g	=	gram
k	=	kilo
m	=	meter
cm	=	centimetre
mm	=	millimetre
t	=	tonne
N	=	Newton
s	=	second.

202 The following Latin characters are used:

g	=	acceleration due to gravity
p	=	pressure
A	=	area
L	=	length between perpendiculars
M	=	mass
P	=	force
V	=	velocity.

203 The following Greek characters are used:

σ	=	stress
η	=	usage factor.

OFFSHORE STANDARD
DNV-OS-E401

HELICOPTER DECKS

CHAPTER 2

TECHNICAL PROVISIONS

CONTENTS PAGE

DET NORSKE VERITAS

Veritasveien 1, N-1322 Høvik, Norway Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11

SECTION 1
STRUCTURAL CATEGORISATION AND SELECTION OF MATERIALS

A. Structural Categorisation

A 100 General

101 Selection of structural categories, material quality, and requirements for inspection of welds are following the principles and requirements given in DNV-OS-C101 Sec.4 or DNV-OS-C201 Sec.4.

A 200 Structural category

201 The main bearing parts of the helicopter deck with substructure shall in general be categorised as primary structure.

B. Material Selection

B 100 General

101 Material specifications shall be established for all structural materials. Such materials shall be suitable for their intended purpose and have adequate properties in all relevant design conditions. Material selection shall be undertaken in accordance with the principles given in DNV-OS-C101 Sec.4 or DNV-OS-C201 Sec.4.

102 When considering criteria appropriate to material grade selection, adequate consideration shall be given to all relevant phases in the life cycle of the unit.

B 200 Design temperatures

201 The helicopter deck including support structure shall be designed for service temperatures equal to the lowest daily mean temperature for the area(s) where the unit shall operate. Definition of mean temperature is given in DNV-OS-C101 Sec.4 or DNV-OS-C201 Sec.4.

SECTION 2
DESIGN LOADS AND LOAD COMBINATIONS

A. General

A 100 General

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

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

Guidance note:

The landing condition will be governing for strength of plates and stiffeners.

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

Both the normal operational conditions and any identifiable accidental conditions shall be considered.

The following loads shall in general be considered:

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

102 For landing platform (erected as separate structure) the following loads shall also be considered:

— gravity and inertia forces of the structure with equipment
— wind forces
— snow and ice loads
— green sea loading on substructure.

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

104 In stowed condition environmental loads with a 100 year return period shall be applied for the operational condition.

105 In accidental conditions environmental loads corresponding to a 100 year return period shall be applied.

106 The loads in 200 to 600, if applicable, shall be combined as follows:

Operational conditions

1) Landing condition:

— landing force
— gravity and inertia forces of the structure with equipment
— wind forces
— hull bending loads.

2) Stowed condition (helicopter lashed onboard):

— gravity and inertia of the helicopter
— gravity and inertia of the structure with equipment
— wind forces
— hull bending loads
— sea pressure
— snow and ice loads.

3) Green sea:

— gravity and inertia of the structure with equipment
— wind forces
— hull bending loads
— sea pressure
— snow and ice loads
— green sea loading on support structure.

Accidental conditions

1) Accidental landing:

— landing force
— gravity and inertia forces of the structure with equipment
— wind forces
— hull bending loads.

2) Stowed condition:

— gravity and inertia of the helicopter
— gravity and inertia of the structure with equipment
— wind forces
— hull bending loads
— sea pressure
— snow and ice loads
— green sea loading on support structure.

Guidance note:

Angle of heel should be considered where applicable.

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

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

A 200 Landing forces

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

$$P_v = CgM \quad (kN)$$

M = maximum take-off mass in tonnes of helicopter
C = 2.0 in operational landing
= 3.0 in accidental condition.

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.

202 The design pressure under wheel loading is normally given by:

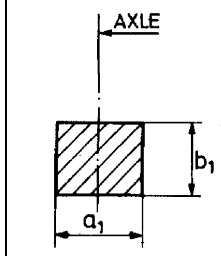
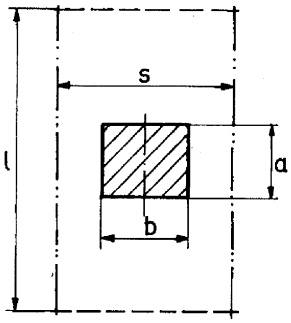
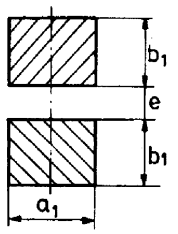
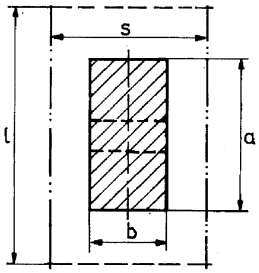
$$p = \frac{f\,P_v}{A} \quad (kN/m^2)$$

P_v = total vertical landing impact force as given in 201
f = fraction of P applicable to the load area in question
A = design load area in m^2 under landing impact condition.

The load area as indicated in Figure 1 is defined as:

— the footprint area of individual wheels or

— the rectangular enveloped area of footprints of a wheel group.

1	2	3
Number of wheels in group	*Footprint dimensions (real contact areas between tyres and deck)*	*Design load area for axle parallel to stiffeners*
Single wheel		
Double wheel		

a = Extent in m of the load area parallel to the stiffeners
= $\sqrt{2A}$ unless otherwise specified
b = Extent in m of the load area perpendicular to the stiffeners
= $\sqrt{0.5A}$ unless otherwise specified
s = Beam spacing in m
l = Beam length in m

Figure 1
Wheel areas

In general the scantlings shall be checked according to both definitions. If however the distance e between individual footprints is less than breadth b_1 of the prints, the load area may normally be calculated for the group of wheels only.

203 A horizontal component of the landing impact force shall be combined with the vertical force when calculating the strength of the supporting structure.

The horizontal component P_h shall normally not be taken less than:

$$P_h = 0.2\ P_v$$

204 For hatch covers and bolted platforms, a horizontal sliding force is set to:

$$P_h = 0.5\ P_v$$

A 300 Gravity and inertia forces due to unit's motions and accelerations

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

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

Guidance note:

For a ship shaped unit in worldwide operation, inertia forces can be determined from Rules for Classification of Ships Pt.3 Ch.1 Sec.4, and combined according to Sec.2 A100 for operational conditions.

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

A 400 Sea pressure

401 Sea pressure shall be included on helicopter decks on ship-shaped units. As a minimum it shall be determined according to the Rules for Classification of Ships Pt.3 Ch.1 Sec.4 C200.

Minimum sea pressure is 2.5 kN/m^2.

A 500 Green sea

501 Green sea loads on support structures shall be included for helicopter deck positioned at the top of deckhouses located in the forward part of ship shaped unit. The horizontal load caused by green sea is given by the following three equations:

$$p = 4.1\ C_D a(1.79\ \ C_W - h_0)\ \ (kN/m^2)$$

where minimum load at deck level is given as:

$$p = 12.5 + 0.05L\ \ (kN/m^2)$$

and minimum load 2 m above deck level is given as:

$$p = 6.25 + 0.025L\ \ (kN/m^2)$$

Deck level is the weather deck at the position considered.

C_D = drag coefficient
= 1.0 for circular cross section and may be taken 2.0 for other sections

a = $2 + \frac{L}{120}$, maximum 4.5

L = length between perpendiculars

h_0 = vertical distance in m from the waterline at draught T to the load point

C_w = wave load coefficient, see Rules for Classification of Ships Pt.3 Ch.1 Sec.4 B200.

This load shall be used for all supporting structures, and shall be combined with acceleration loads calculated for a 100 year storm at the location in question. It is a horizontal load acting in the direction of the ship longitudinal axis.

A 600 Other loads

601 The wind pressure shall be calculated using 'gust' (3 s averaging time interval) wind velocities.

Guidance note:

When evaluating wind pressures the following listed one minute sustained wind velocities at 10 m above base may normally be used as a basis for calculating the gust wind velocities:

$V_{1min.10}$ = 30 m/s for the landing condition
$V_{1min.10}$ = 55 m/s for the stowed conditions.

For additional information regarding wind conditions, please see Classification Note 30.5.

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

602 The wind pressure acting on the surface of helicopter decks shall be calculated using a pressure coefficient $C_p = 2.0$ at the leading edge of the helicopter deck, linearly reducing to $C_p = 0$ at the trailing edge, taken in the direction of the wind. The pressure may act both upward and downward.

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

$$P_W = 1.2\ A_D \quad (kN)$$

A_D = Deck area in m^2

604 For structures where vortex shedding may be of importance, vibration induced loads shall be taken into account.

605 Ice thickness shall be taken into account in the stowed condition load case, by:

— in the North Sea 5 cm on each side
— in Arctic waters 15 cm on each side

or by designers specification of maximum ice thickness before action is taken.

SECTION 3
STRENGTH REQUIREMENTS

A. Deck Plating and Stiffeners

A 100 General

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

A 200 Plating

201 The thickness of deck plating subjected to wheel loading shall not be less than:

$$t = \frac{62.4\ k_a k_{pl}\sqrt{k_w b s p}}{\sqrt{m\sigma_f}} \quad (mm)$$

k_{pl} = 1.0 in separate platform
= 1.08 in weatherdeck general
= 1.17 in longitudinally framed strength deck and in weather deck hatch covers
= 1.5 in transversely framed strength deck

k_a = $1.1 - \frac{0.25s}{l}$, maximum 1.0 for s/*l* = 0.4

minimum 0.85 for s/l = 1.0

kw = $1.3 - \frac{4.2}{\left(\frac{a}{s} + 1.8\right)^2}$, maximum 1.0 for $a \geq 1.94s$

m = $\frac{38}{\left(\frac{b}{s}\right)^2 - 4.7\frac{b}{s} + 6.5}$

The m-value is based on the assumption that b is smaller than s.

σ_f = minimum yield stress of material as defined in DNV-OS-C101 Sec.4 D200 or DNV-OS-C201 Sec.4 D200. When using aluminium, see also B200.

p, *a*, b, s and A as given in Sec.2 A202.

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

Thickness of steel plating

$$t = \frac{k\sqrt{240 f p}}{\sqrt{\sigma_f \sqrt[3]{\varepsilon}}} + 1.5 \quad (mm)$$

k = 1.3 in separate platform
= 1.4 in weatherdeck general
= 1.5 in longitudinally framed strength deck and in weather deck hatch covers
= 2 in transversely framed strength deck

ε = *a*/s

a = length of tubular line load, usually taken as 0.6 m (twice the distance from saddle joint to skid end).

p, f, s and σ_f as given in 201 and Sec.2 A202.

Thickness of aluminium plating

$$t = \frac{k\sqrt{240\ f\ p}}{\sqrt{\sigma_f \sqrt[3]{\varepsilon}}} \quad (mm)$$

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

A 300 Stiffeners

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

$$Z = \frac{1.34 \cdot 10^6 k_z l a b p}{m\sigma_f} \quad (mm^3)$$

k_z = 1.0 for b/s ≤ 0.6

= $\left(1.15 - 0.025\frac{b}{s}\right)$ for 0.6 < b/s ≤ 1.0

m = $\frac{r}{\left(\frac{a}{l}\right)^2 - 4.7\frac{a}{l} + 6.5}$

r = factor depending on the rigidity of girders supporting continuous stiffeners
= 29 unless better support conditions are demonstrated
= 38 when continuous stiffener may be considered as rigidly supported at each girder.

The m-value is based on the assumption that *a* is smaller than *l*.

σ_f as given in 201 in general. When helicopter platform is part of the unit's deck, σ_f shall be reduced by still water longitudinal hull stress in strength deck longitudinals. 0.89 σ_f for weather deck hatch covers.

302 Support of stiffeners to girders shall have a minimum shear area of:

$$A_s = 0.125\ p\ f$$

A 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 tightness, including burning fuel.

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

B. Overall Strength

B 100 Girders and supporting structures

101 The scantlings shall normally be based on direct stress analysis. There are two possible approaches:

— design by partial coefficient method
— design by working stress method.

Partial coefficient method

See DNV-OS-C101 Sec.2 D for details. Note that landing force P is a variable functional load.

Ultimate limit state (ULS), accidental limit state (ALS), service limit state (SLS) and fatigue limit state (FLS), if applicable shall be considered.

Working stress design

See DNV-OS-C201 for details. The basic allowable usage factor, η_0, is as follows:

— Operational conditions:
  Landing condition: η_0 = 0.67
  Stowed condition: η_0 = 0.80
— Accidental conditions: η_0 = 1.0.

102 The procedure for evaluations pertaining to accidental conditions and fatigue life will be the same for both approaches. See the procedure in DNV-OS-C101.

Guidance note:

When dimensioning the support structure part of the hull (e.g. integrated platform beams part of weather deck or deck beams below the supporting structure of separate platforms), the stresses from the loading of the helicopter deck should be combined with relevant global stresses. In operational landing conditions the still water hull bending stress should be applied, while for stowed and accidental conditions both still water and dynamic wave bending stress should be applied.

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

103 Buckling evaluations shall be carried out according to Classification Note 30.1 or equivalent internationally recognised codes and standards.

104 If the helicopter shall be in the stowed condition for a large part of the design lifetime of the structure, fatigue sensitive details shall be documented to have sufficient fatigue strength. This includes details such as connections to main deck, connections helicopter deck to substructure and complex joints in the helicopter deck itself. For guidance on procedures see DNV-OS-C101 Sec.7 or DNV-OS-C201 Sec.7, DNV-RP-C203 or Classification Note 30.7.

Guidance note:

In cases where the helicopter will only be stowed for shorter periods, (hence the main dynamic loading will be inertia forces of the structure itself), fatigue is not considered to be a dimensioning factor.

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

Guidance note:

At deck connections for separate platforms and helicopter decks that is a part of the weather deck, fatigue stresses from loading on the helicopter deck should be combined with relevant dynamic global stresses.

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

B 200 Welded aluminium

201 Upon special consideration the yield stress for unaffected zone may be used in the strength calculations provided the welds are placed at areas with low stresses.

Guidance note:

For rolled plates the yield stress for unaffected zone may be used in the plate thickness formula in A201, provided the distance between the stiffener and the plate butt weld parallel with the stiffener is approximately 0.25 s.

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

SECTION 4
MISCELLANEOUS

A. Connections

A 100 Steel and aluminium connections

101 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. The bolts shall be fitted with sleeves of insulating material.

102 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.

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

104 Aluminium superstructures that are provided with insulating material between aluminium and steel shall be earthed to the hull. See Rules for Classification of Ships Pt.4 Ch.8.

B. Safety Net and Tie-Down Points

B 100 Safety net

101 The helicopter deck shall be protected by a safety net at least 1.5 m wide. The outboard edge shall be slightly above the level of the landing area but not more than 250 mm.

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

103 The test load for safety net and safety net supporting structure surrounding a helicopter deck shall not be taken less than 75 kg dropped from 1 m.

Guidance note:

Approximate calculations may be based on a static load of 0.2 t/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 1.

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

Guidance note:

In rails and brackets etc. supporting safety nets, allowable stresses in approximate static calculations may be taken as given in Sec.3 B101.

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

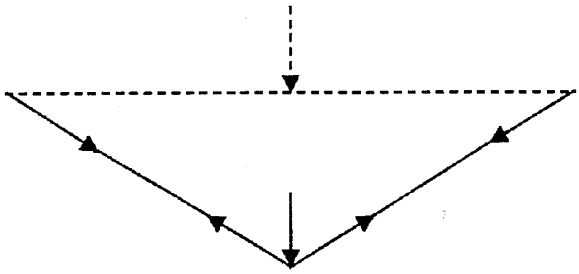


Figure 1

B 200 Tie-down points

201 The breaking load of the tie-down point(s) for helicopters calling at the unit should be confirmed from the helicopter operator or the manufacturer.

Tentative values per point:

— 50 kN
— 0,6 g_0 M.

M as given in Sec.2 A200.

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

SECTION 5
SAFETY REQUIREMENTS

A. Safety Requirements

A 100 Fire safety

101 The deck shall be surrounded by a gutterway for collecting and draining overboard fuel (including burning fuel) leaking out by an accident. IMO requires explicitly that the gutterway shall be made of steel (see IMO Resolution A.855(20) item 3.2).

102 Fire equipment shall be provided according to DNV-OS-D301.

103 Necessary rescue tools to be provided. It is recommended that at least one set of the following equipment is available. Size of equipment should be appropriate for the types of helicopter expected to use the facility.

— adjustable wrench
— rescue axe, large (non wedge or aircraft type)
— cutters, bolt
— crowbar, large
— hook, grab or salving
— hacksaw heavy duty c/w 6 spare blades
— blanket, fire resistant
— ladder *
— pliers, side cutting
— set of assorted screwdrivers
— harness knife c/w sheath **
— gloves, fire resistant **
— self-contained breathing apparatus (complete)
— power cutting toll.

* for access to casualties in an aircraft on its side
** this equipment is required for each helicopter deck crew member.

In proximity of the helicopter deck the following equipment shall be kept:

— 1 portable foam applicator
— 1 45 kg powder apparatus
— 1 set of fireman's equipment.
— Necessary fire and rescue tools, such as fire axes, seat belt cutting knives, intrinsically safe handling etc.

For landing areas in gas-dangerous zones of ships with class notation **Tanker for Oil**, the portable applicator should be replaced by 2 foam monitors covering landing area and helicopter.

A 200 Securing of helicopter onboard

201 Helicopter decks shall have tie-down points for lashing of the helicopter. The tie-down points shall not protrude above the level of the helicopter deck.

Guidance note:

Helicopter operators can advise on the correct configurations. Suggestions for acceptable solutions can be found in British CAA, Norwegian CAA or ICAO regulations.

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

202 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 0.4) in any weather condition. To prevent sliding in cold weather when there is danger of icing, the surface shall either have a grid of ribs (for wheel helicopters) or shall be arranged for fitting a rope net, which shall be kept on board.

203 The rope net mentioned in 202 shall have a size at least as given in Table A1.

Table A1 Net size

Deck diameter according to Sec.6 A101	*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 15m

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.

A 300 Personnel safety

301 Landing platforms and landing areas in exposed positions shall be surrounded 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. See also Sec.4 B101.

302 Landing platforms and landing areas in exposed positions shall be bordered by an about 5 cm high coaming to prevent personnel, helicopter or equipment from sliding off the helicopter deck. The border coaming shall not impede good drainage of water and any fuel, see 101.

303 Escape routes from the helicopter deck shall be arranged on the embarkation side and the rear side. The strength of stairways and walkways shall comply with the standard for walkways to and from the unit.

Guidance note:

Some authorities, such as the British and Norwegian CAA, require a third route for escape.

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

A 400 Unit and helicopter communication equipment

401 Helicopter and ship 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.

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

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

A 500 Guidance related to vessels where the helicopter deck is situated directly above tanks containing hydrocarbons

501 For operation on board oil tankers where the helicopter deck is situated directly above tanks containing hydrocarbons, guidance can be given.

Guidance note:

Only multi-engine, single or twin rotor helicopters should be used. The helicopter load should be limited to a single engine hover capability.

Pressure/vacuum valves should be lifted or closed less than half an hour before helicopter operations; also for vessels with register notation inert.

All openings to cargo tanks should be closed.

The rotor(s) should be kept running at all time during the stay on board the ship. If the rotor(s) should stop or have to be stopped a gas-dangerous zone will re-occur and the helicopter should be shut down, all electrical equipment should be switched off and batteries should be disconnected.

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

SECTION 6
HELICOPTER SAFETY REQUIREMENTS

A. Helicopter Safety Requirements - General

A 100 Size of helicopter deck

101 The diameter D of the helicopter deck or landing area for single main rotor helicopters shall not be less than the overall length of helicopter including main and tail rotors running. Typical values are given in Table A1.

Table A1 D-value for typical helicopters

Type	*D-value (m)*	*Rotor diameter (m)*	*Maximum weight (kg)*
Bolkow Bo 105D	12.00	9.90	2400
Bolkow 117	13.00	11.00	3200
Agusta A109	13.05	11.00	2600
Dauphin SA 365N2	13.68	11.93	4250
Sikorsky S76 B & C	16.00	13.40	5307
Bell 212	17.46	14.63	5080
Super Puma AS332L	18.70	15.00	8599
Bell 214ST	18.95	15.85	7936
Super Puma AS332L2	19.50	16.20	9150
Sikorsky S61N	22.20	18.90	9298
EH101	22.80	18.60	14600
Boeing BV234LR Chinook	30.18	18.29	21315

102 Twin main rotor helicopters are not dealt with in this section.

A 200 Location

201 A helicopter deck shall be located such that the obstacle free approach and take-off sector, 210° normally required, 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.

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

A 300 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 above the deck level e.g. landing lights, floodlights, foam monitors, outer edge of safety net etc.

Guidance note:

Maximum height above deck level should be according to governing regulations. E.g. the Rules for Classification of Ships specify 250 mm, while in the MODU Code it is 150 mm.

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

304 It shall be a clear zone below the landing area level over at least 180° with an origin at the centre of the D circle and with a falling gradient of 5 in 1 from the edges of the landing area to the surface of the sea. Ideally this gradient should clearly cover the whole of the 210° obstacle free sector and extend outwards for 1000 m.

A 400 Daylight marking

401 Obstacles that the helicopter operator should be especially aware of shall be attention painted in diagonal stripes of contrasting colour.

402 The helicopter deck shall be marked with the unit identification.

403 The perimeter of the helicopter deck shall be marked with:

— a 400 mm white line.

The preferred colour of deck within perimeter line is dark grey or dark green.

404 An aiming circle that 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.

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

405 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.

406 A 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».

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

Guidance note:

The advised information will consist of two figures followed by the letter «t» E.g. maximum 8000 and 8500 kg should both 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.

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

407 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 ship side landing area - 90° to each side. Figures shall be 600 mm high and in a contrasting colour to the deck.

A 500 Night operation marking

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

502 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.

Guidance note:

Lighting colour should be according to governing regulations. E.g. the Rules for Classification of Ships require yellow lighting, the MODU Code requires alternating yellow and blue lights.

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

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

504 Floodlight and perimeter lights shall be connected to the emergency power system.

505 All significant obstacles shall be indicated by red obstruction lights visible from all directions, or floodlighting or a combination of both.

A 600 Instrumentation

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

B. Specific Requirements Ship Shaped Units

B 100 Approach and take-off sector

101 For location at the ship's ends a free approach and take-off sector of 210° is required. The whole deck or landing area shall be located within this sector.

Guidance note:

The ship end location is recommended.

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

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

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

B 200 Obstacles

201 In bow or stern located helicopter landing areas, outside the obstacle free sector, obstacle heights shall be limited to 0.05 D to a distance 0.62 D from the centre of the landing area and hence 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.

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

CHAPTER 3

CERTIFICATION AND CLASSIFICATION

CONTENTS PAGE

DET NORSKE VERITAS

Veritasveien 1, N-1322 Høvik, Norway Tel.: +47 67 57 99 00 Fax: +47 67 57 99 11

SECTION 1
GENERAL

A. Introduction

A 100 Application

101 As well as representing DNV's recommendations on safe engineering practice for general use by the offshore industry, the offshore standards also provide the technical basis for DNV classification, certification and verification services.

102 A complete description of principles, procedures, applicable class notations and technical basis for offshore classification is given by the offshore service specifications for classification, see Table A1.

Table A1 DNV Offshore Service Specifications

No.	*Title*
DNV-OSS-101	Rules for Classification of Offshore Drilling and Support Units
DNV OSS-102	Rules for Classification of Floating Production and Storage Units

A 200 Class designation

201 Offshore units and installations fitted with helicopter decks that have been designed, constructed and installed in accordance with the requirements of this standard under supervision of DNV will be entitled to the class notation **HELDK**, **HELDK S**, or **HELDK SH**.

202 Units and installations equipped in compliance with the strength requirements in Ch.2 Sec.1, Ch.2 Sec.2, Ch.2 Sec.3 and Ch.2 Sec.4 may be assigned the class notation **HELDK**.

203 Units and installations also complying with the safety requirements given in Ch.2 Sec.5 may be assigned the extended class notation **HELDK S**.

204 Units and installations complying with 202 and 203, and fulfilling the helicopter safe operations requirements of Ch.2 Sec.6 may be given the extended class notation **HELDK SH**.

A 300 Assumptions

301 Any deviations, exceptions and modifications to the designed codes and standards given as recognised reference codes shall be documented and approved by DNV.

302 Where codes and standards call for the extent of critical inspections and tests to be agreed between contractor or manufacturer and client, the resulting extent is to be agreed with DNV.

A 400 Documentation

401 Documentation requirements for classification are given in DNV-RP-A202.