Base Load Power Hub (BLPH)

Evaluating ISO and DNV approaches

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Table of contents

1 DOCUMENT SCOPE 3

2 REFERENCES 4

2.1 3.1 CODES AND STANDARDS 4

2.2 3.2 COMPANY SPECIFICATIONS 4

2.3 3.3 PROJECT DOCUMENTS 5

2.4 3.4 OTHER DOCUMENTS 5

6 DESIGN DATA 6

6.2 EXPOSURE LEVEL 6

7 MATERIALS 7

7.1 STRUCTURAL STEEL PROPERTIES 7

8 DESIGN CRITERIA AND REQUIREMENTS 12

8.1 GENERAL 12

8.2 PARTIAL RESISTANCE FACTORS 13

8.2.1 Partial Resistance Factors for Tubular Sections: 13

8.2.2 Partial Resistance Factors for Non-tubular Sections 13

8.2.3 Partial Resistance Factors for Accidental Limit State Actions 14

8.3 LOAD CLASSIFICATIONS 15

8.4 PARTIAL ACTION FACTORS 16

8.4.1 Partial Action Factors for In-Service Analysis 16

8.4.2 Partial Action Factors for Pre-Service Analyses 17

8.4.3 Partial Action Factors for Accidental Limit State Actions 17

8.4.4 Partial Action Factors for Fatigue Analysis 17

8.4.5 Partial Action Factors for Serviceability Limit States 17

8.4.2 Variable Actions 18

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1 DOCUMENT SCOPE

Scope of this note is the technical evaluation of the differences in terms of structural design, materials, request of performance and safety level, approaching the design of BLPH topside following ISO norms or DNV-ST-0145 code, Ref. /8/

Document has been requested by DNV during the engineering review phase of BLPH detail design performed by Rosetti Marino.

In the following, for the sake of clarity and cross-checking, the same numbering of chapters/sections in the Structural design basis document is maintained.

3 REFERENCES

3.1 CODES AND STANDARDS

Doc. No.	Description
/1/ BS EN ISO 19900	General requirements for offshore structures - 2019
/2/ BS EN ISO 19901-1	Specific requirements for offshore structures - Part 1: Metocean design and operating considerations - 2015
/3/ BS EN ISO 19901-2	Seismic design procedures and criteria
/4/ BS EN ISO 19901-3	Specific requirements for offshore structures – Part 3: Topsides structure - 2014
/5/ BS EN ISO 19901-5	Specific requirements for offshore structures – Part 5: Weight Management - 2021
/6/ BS EN ISO 19901-6	Specific requirements for offshore structures – Part 6: Marine Operations – 2009
/7/ BS EN ISO 19902	Petroleum and natural gas industries - Fixed steel offshore structures – 2020
/8/ DNV-ST-0145	DNV, Offshore substations
/9/ DNV-RP-C201	DNV, Buckling Strength of Plated Structures, October 2010.
/10/ DNVGL-RP-C203	DNV GL, Fatigue design of offshore steel structures, September 2019 and Amendment January 2020
/11/ DNVGL-RP-C204	DNVGL-RP-C204 Design against accidental loads – 2019
/12/ DNVGL-RP-C205	DNV GL - Environmental conditions and environmental loads - September 2019, amended September 2021.
/13/ DNV-OS-C101	Design of offshore steel structures, general- LRFD method, 2021
/14/ DNV-OS-B101	Metallic materials, 2021
/15/ DNVGL-ST-0126	Support structures for wind turbine, 2018

3.2 COMPANY SPECIFICATIONS

Doc. No.	Description
/16/ DEP 37.19.00.12	Gen - Offshore Topsides Structures
/17/ DEP 37.19.00.30	Gen - Fixed Steel Offshore Structures (Adoption of IOGP S-631-11, Amendments / Supplements to ISO 19902:2020).

3.3 PROJECT DOCUMENTS

Doc. No.	Description
/18/ 123A90-DDL-ST-SP-90017	Structural design basis
/19/ 123A90-DDL-ST-SP-90018	Structural Material Specification

3.4 OTHER DOCUMENTS

Doc. No.	Description
/20/ K559–2254-ST-PHI-001	BLPH Structural Topsides Design & Installation Philosophy, Rev.1, 09 December 2022
/21/ K559–2254-ST-REP-001	BLPH Structural Topsides and Transition Piece Design and Analysis Report, Rev.0, 27 February 2023
/22/ 144671-VOOW-TF-ENG-REP-1011	Design Basis Part C, Re.4, 05-07-2021
/23/ SR.20.01165 (not received)	Meteocean criteria for Hollandse Kust Noord Wind Farm zone (shell), Rev A03, 05-02-2021
/24/ K559–2254-WC-REP-001	BLPH Weight Control Report, Rev.2, 17 March 2023
/25/ 144671-VOOW-TF-ENG-REP-1051	Design Basis Part C for BLPH, Rev. 3, 28 June 2022
/26/ 144671-VOOW-TF-ENG-REP-1052	Wave Loads and Effects for BLPH, Rev. 0, 16 December 2021
/27/ 144671-VOOW-TF-ENG-REP-1016	Wave Run-up Study, Rev.2, 29 November 2021
/28/ 144671-VOOW-TF-ENG-REP-1103	Wave Impact Analysis, Rev.1, 7 May 2021
/29/ 144671-VOOW-TF-ENG-REP-1053	Axial Pile Capacity Assessment for BLPH, Rev.3, 07 July 2022
/30/ 144671-VOOW-TF-ENG-REP-1054	Foundation Load Document for BLPH, Rev.1, 07 April 2022
/31/ 144671-VOOW-TF-ENG-REP-1055	Design Verification Primary Steel for BLPH, Rev.1, 13 April 2022
/32/ 144671-VOOW-TF-ENG-REP-1056	Ship Impact for BLPH, Rev.0, 07 March 2022
/33/ 144671-VOOW-TF-ENG-REP-1502	Main Access Platform – Wave Run-up Braces
/34/ 144671-VOOW-GEN-SUR-REP-0074	Foundation As-built Survey CW70 HNA6
/35/ K559-2254-PM-PLN-003	Basic Design Engineering Package, Rev2, 06 July 2023

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6 DESIGN DATA

6.2 EXPOSURE LEVEL

ISO 19900 Ref./1/ classifies structure according to exposure level (L1, L2 or L3) based on:

- Life safety.
- Damage to environment.

The BLPH topside is classified as exposure level L3, satisfying:

a) The platform is unmanned except for occasional inspection, maintenance and modification visits.

b) Visits are not planned to last more than 24 hours during seasons in which pre-determined hazardous events, for example environmental events, can occur.

c) Visits are not planned to last more than 24 hours on bottom founded platforms in regions with seismic Zone 4 as defined in ISO 19901-2, ref. /3/. (note zone 4 is the highest high seismicity zone, which does not apply to the North Sea).

The DNV code, ref. /8/ sect 4.2.2.1, classifies the structure too, based on the failure consequence, applying the class to topside, foundation and J-tubes. DNV code requests L1, considering the annual probability of failure of 10^{-5}, and asking for ductility of failure mechanism.

Alternatively, ISO approach may be applied with C1 and L1.

Comment: according to ISO 19900 the following are the requirements for L1:

- Section 6.2.2 & 6.2.3 designing for hazard: Group 1, 2 and 3 is applied
- Section 6.5.2 & 9.9.3 design for 100 years return period metocean parameters are applied.
- Table 9.10-1 partial action factors are taken for L1 (see here below section 8.4)
- Section 10.2 vessel collision analysis performed.
- Section 11 seismic events not considered based on operational life of 2 years
- Section 16.1.3 Fatigue is not considered in this project, based on operational life of 2 years.
- Section 19.6.2: the exposure levels do not have direct impact on structural design class assignment. Selection of material has been performed following "Design Class approach" and not following Material selection approach.
- sect. A7.7: the level L3 did not lead to a reduction in extreme weather events. This ensures that all structures have the same reliability in any single year.

Hence, the structure formally respects the L1 despite classified as L3 for the points a), b) and c) above..

7 MATERIALS

7.1 STRUCTURAL STEEL PROPERTIES

For the structural analyses, steel types and grades to be used for the platform structures are summarised in Table 7.1 and specified in /26/ The material selection criteria are based on the requirements of ISO 19906:2019, ISO 19902:2020 and ISO 19901-3:2014. The materials are in accordance with the EN standard 10225:2019 and 10025:2019 and are suitable for plates, rolled sections and welded / seamless tubulars.

			STEEL NAME				
Design Class	**Complexity**	**SQL**	**Plates and Welded tubular**	**Sections**	**SMLS pipes**	**THK**	**CVN inpact test**
DC1 Complex lift-nodes and element connection to topside, main complex joints, TP to monopile flange connection and TP cans	High	I (Z properties)	EN 10225 S420 QLO / MLO EN 10225 S460 QLO / MLO	NA	NA	t <= 12	-
						12 < t <= 25	-
						25 < t <= 50	-40
						t > 50	-40
DC2 simple joints, primary deck girders and beams of Topside and TP, column and diagonal to lift points, main columns, Davit crane support	Low	II	EN 10225 S420 QLO / MLO EN 10225 S460 QLO / MLO	NA	NA	t <= 12	-
						12 < t <= 25	-20
						25 < t <= 50	-40
						t > 50	-40
		I (Z properties)	NA	NA	NA	t <= 12	-
						12 < t <= 25	-
						25 < t <= 50	-
						t > 50	-
DC3 all other columns and diagonals, stiffeners, Secondary deck beams, Grillage and sea fastening	High	II	EN 10225 S355 NLO / MLO	EN 10025 S355 MLO	EN 10225 S355 NLHHO / QLHHO API 5L X52	t <= 12	0
						12 < t <= 25	-20
						25 < t <= 50	-40
						t > 50	-40
DC4 Equipment and vessel supports, modules supports.	Low	III	EN 10025 S355 J2	EN 10025 S355 J2	API 5L X52 EN 10210 S355 J2H	t <= 12	0
						12 < t <= 25	0
						25 < t <= 50	-
						t > 50	-
DC5 floor plating, grating, Walkways, stairs, handrails	Any	IV	EN 10025 S235 JR EN 10025 S275 J0 EN 10025 S355 J0	EN 10025 S235 JR EN 10025 S275 J0 EN 10025 S355 J0	API 5L Gr.B EN 10210 S235 JRH/ S275 J0H/ S355 J0H	t <= 12	10
						12 < t <= 25	10
						25 < t <= 50	-
						t > 50	-

Table 7.1 - Material Selection, Ref /26/

Mechanical properties for structural materials are presented in Table 7.2, Table 7.3 and Table 7.4.

- Young's Modulus = 205,000 N/mm^2
- Density = 7850 kg/m^3
- Poisson's Ratio = 0.3

Thickness (mm)	Min. Tensile Strength (N/mm²)	Min. Yield Strength (N/mm2)	Steel Type (1)
t ≤ 16	500	420	I & II
16 < t ≤ 40	500	400	I & II
40 < t ≤ 63	480	390	I & II
63 < t ≤ 100	480	380	I & II
Note: 1) Type I steel has Z (through the thickness) properties.			

Table 7.2 – Mechanical properties of Plates

Thickness (mm)	Min. Tensile Strength (N/mm²)	Min. Yield Strength (N/mm2)	Steel Type
t ≤ 20	460	355	III
20 < t ≤ 40	460	345	III

Table 7.3 – Mechanical properties of Structural Seamless Tubulars

Thickness (mm)	Min. Tensile Strength (N/mm2)	Min. Yield Strength (N/mm2)	Steel Type
t ≤ 16	460	355	IV
16 < t ≤ 40	460	345	IV

Table 7.4 – Mechanical properties for Structural Sections

According to DNV code the selection of steel material shall follow DNV-OS-C101 Ch.2 sec.3.

In case steel materials according to EN 10225, EN 10025, EN 10210, EN 10219, API Spec 2Y, API Spec 2W or others shall be used, selection shall be according to the flow chart in Figure 4-1. Selection of equivalent steel grades shall consider the following parameters:

- chemical composition especially CEV and sulfur-value–mechanical properties including impact properties
- service temperature
- location and orientation of impact test pieces
- other relevant steel manufacturing parameters.

The DNV code, ref. /8/, section 4.6 defines the steel materials, allowing for EN codes by using equivalent steel grades.

Comment:

The table below has been prepared following the flow chart shown in Figure 4-1.

For clarity the selection according with DNV, ref. /8/, shall be:

			DNV-ST-0145, 2021			
Design Class	**Complexity**	**SQL**	**Classification of Structural members (DNV-OS-C101)**	**Plates and Welded tubular**	**Sections**	**SMLS pipes**
DC1 Complex lift-nodes and element connection to topside, Lift points, main complex joints, TP to monopile flange connection and TP cans	High	**I (Z properties)**	**Special cat. "S"**	NA NV F420 / NV F460 (3)(4)	NA	NA
DC2 simple joints, primary deck girders and beams of Topside and TP, column and diagonal to lift points, main columns, Davit crane support	Low	**II**	**Primary category members "1"**	NV F420 / NV F460 (3)(4)	NA	NA
		I (Z properties)	**Special cat. "S"**	NA	NA	NA
DC3 all other columns and diagonals, stiffeners, Secondary deck beams, Grillage and sea fastening	High	**II**	**Primary category members "1"**	NV F36 (4)	NV F36 (4)	NV F36 (4)
DC4 Equipment and vessel supports, modules supports, bolts	Low	**III**	**Secondary category members "2"**	NV A36 / AW 36	NV A36 / AW 36	NV A36 / AW 36
DC5 floor plating, grating, Walkw ays, stairs, handrails	Any	**IV**	**Non structural members (NS)**	NV A NV A27S	NV A NV A27S	NV A27S

			STEEL NAME					DNV-ST-0145, 2021				
Design Class	Complexity	SQL	Plates and Welded tubular	Sections	SMLS pipes	THK	CVN inpact test	Material designation	Classification of Structural members (DNV-OS-C101)	Plates and Welded tubular	Sections	SMLS pipes
DC1 Complex lift-nodes and element connection to topside, Lift points, main complex joints TP to monopile flange connection and TP cans	High	I (Z properties)	EN 10225 S420 QLO / MLO EN 10225 S460 QLO / MLO	NA	NA	t < = 12	-	-	Special cat. "S"	NA	NA	NA
						12 < t <= 25	-	-				
						25 < t <= 50	-40	DC1-I-420-40_Z DC1-I-460-40_Z		NV F420 / NV F460 (3)(4)		
						t > 50	-40					
DC2 simple joints, primary deck girders and beams of Topside and TP, column and diagonal to lift points, main columns, Davit crane support	Low	II	EN 10225 S420 QLO / MLO EN 10225 S460 QLO / MLO	NA	NA	t < = 12	-	-	Primary category members "1"	NV F420 / NV F460 (3)(4)	NA	NA
						12 < t <= 25	-20	DC2- I-420-20 / DC2- II-460-20				
						25 < t <= 50	-40	DC2- I-420-40 DC2- I-460-40				
						t > 50	-40					
		I (Z properties)	NA	NA	NA	t < = 12	-	-	Special cat. "S"	NA	NA	NA
						12 < t <= 25	-	-				
						25 < t <= 50	-	-				
						t > 50	-	-				
DC3 all other columns and diagonals, stiffeners, Secondary deck beams, Grillage and sea fastening	High	II	EN 10225 S355 NL	EN 10025 S355 MLO	EN 10225 S355 NLHHO / QLHHO API 5L X52	t < = 12	0	DC3- II-355-0 / DC3- II-X52-0	Primary category members "1"	NV F36 (4)	NV F36 (4)	NV F36 (4)
						12 < t <= 25	-20	DC3- I-355-20 / DC3- II-X52-20				
						25 < t <= 50	-40	DC3- I-355-40 / DC3- II-X52-40				
						t > 50	-40					
DC4 Equipment and vessel supports, modules supports, bolts	Low	III	EN 10025 S355 J2	EN 10025 S355 J2	API 5L X52 EN 10210 S355 J2H	t < = 12	0	DC4- III-355-0 / DC4- III-X52-0	Secondary category members "2"	NV A 36 / AW 36	NV A 36 / AW 36	NV A 36 / AW 36
						12 < t <= 25	0					
						25 < t <= 50	-	-				
						t > 50	-					
DC5 floor plating, grating, Walkways, stairs, handrails	Any	IV	EN 10025 S235 JR EN 10025 S275 J0 EN 10025 S355 J0	EN 10025 S235 JR EN 10025 S275 J0 EN 10025 S355 J0	API 5L Gr.B EN 10210 S235 JRH / S275 J0H / S355 J0H	t < = 12	10	DC5-IV-235-10 / DC5-IV-275-10 / DC5-IV- 355-10 / DC5-IV- GRB-10	Non structural members (NS)	NV A NV A27S	NV A NV A27S	NV A27S
						12 < t <= 25	10					
						25 < t <= 50	-	-				
						t > 50	-					

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8 DESIGN CRITERIA AND REQUIREMENTS

8.1 GENERAL

Structures in SOW will be designed in accordance with limit states approach of ISO codes 19901 and 19902, Refs./2/, /4/and /7/. For non-tubular sections, AISC 360-16 code will be adopted. Member forces and moments derived from the global analyses will be used for checking member strength and stability, and joint strength.

Four different design limit states are defined and will be satisfied by the design:

- the Serviceability Limit State (SLS), corresponding to the criteria applicable to normal use or durability;
- the Ultimate Limit State (ULS), corresponding to the ultimate capacity for carrying loads;
- the Accidental Limit State (ALS) corresponding to damage due to an accidental event;
- the Fatigue Limit State (FLS), related to the possibility of failure due to cyclic loadings.

The general requirement of ISO code is that, for the structure as a whole and for each component, the following is satisfied:

$$R_d = \frac{R_k}{\gamma_M} > \gamma_F F_r = F_d$$

Where:

- R_d is the design resistance;
- R_k is the characteristic resistance;
- γ_M is the partial resistance factor reported in section 8.2;
- F_d is the design value of action;
- F_r is the characteristic value of action;
- γ_F is the partial action factor reported in Sec.8.4.

Design according to the provisions for load and resistance factor design (LRFD) of AISC 360-16 shall be performed in accordance with following equation:

$$R_u \leq \phi R_n$$

Where:

- R_u = required strength using LRFD load combinations
- R_n = nominal strength
- ϕ = resistance factor reported in Sec.8.2
- ϕ Rn = design strength.

8.2 PARTIAL RESISTANCE FACTORS

8.2.1 Partial Resistance Factors for Tubular Sections:

The partial resistance factors for tubular sections from ISO 19902, Ref./7/, are listed below:

$\gamma_{R,c}$ = partial resistance factor for compression = 1.10

$\gamma_{R,c}$ = partial resistance factor for compression of dented members = 1.18

$\gamma_{R,t}$ = partial resistance factor for tension = 1.05

$\gamma_{R,b}$ = partial resistance factor for flexure = 1.05

$\gamma_{R,v}$ = partial resistance factor for shear = 1.05

$\gamma_{R,h}$ =partial resistance factor for hoop buckling strength = 1.25

Comment

Fully complies with DNV's request.

8.2.2 Partial Resistance Factors for Non-tubular Sections

Referring to ISO 19901-3, Ref./4/, Section 8, to be consistent with the ISO 19900 inherent level of safety, a "building code correspondence factor" is to be applied to the AISC partial factors. Partial resistance factors have been calculated and are given below.

Φ_c = resistance factors for compression = 0.85

Φ_t = resistance factors for tension yielding = 0.85

Φ_b = resistance factors for flexure = 0.85

Φ_v= resistance factors for shear / torsion = 0.90.

Φ_t = resistance factors for tension rupture = 0.71.

These resistance factors apply to the design of members and are not applicable to local details, such as padeyes. Reference should be made to ISO 19902 for a full listing of partial resistance factors and to ANSI / AISC 360-16, Ref./9/, for weld and bolt design resistance factors.

8.2.3 Partial Resistance Factors for Accidental Limit State Actions

All partial resistance factors for the abnormal / accidental limit state conditions are set equal to 1.00.

Comment

Fully complies with DNV's request.

8.3 LOAD CLASSIFICATIONS

Design loads are classified as either global or local within ISO 19901-3, Ref. /4/ and ISO 19902, Ref./7/ and summarized in Table 8.1.

Load Type	ISO Designation	Description
Permanent (Dead)	G1	Structure self-weight; Equipment & piping dry weight; Any actions due to misalignment of structures such as between the topside and TP
Permanent (Dead)	G2	permanent action imposed on the topsides structure by self-weight of equipment and other objects that remain constant for long periods of time, but which can change from one mode of operation to another, or during a mode of operation
Variable (Live)	Q1	Equipment & piping contents weight; Superimposed area loads (see Section 9.2.2.2); Ice and snow accretions
Variable (Live)	Q2	Crane hook loads; Liquids in pipes and process vessels for pressure testing; Machine operations, cable pulling operation, bulk load
Environmental (extreme)	Ee	Extreme quasi-static action due to wind, waves and current (eg.100-yr storm wind)
Environmental (operational)	Eo	1-yr storm wind
Inertial Response (operational)	Do	Equivalent quasi-static action representing dynamic response caused by the Eo wave condition
Inertial Response (extreme)	Do	Equivalent quasi-static action representing dynamic response caused by the Ee wave condition
Pressure (accidental)	-	Blast
Inertial (accidental)	-	Ship impact on monopile
Impact Energy (accidental)	-	Dropped Object
Transient	T	Transient Loads for Pre-Service Analyses

Table 8.1 - ISO Loads Classification

Comment

Table 8.1 referred to ISO standard fully complies with DNV's request

8.4 PARTIAL ACTION FACTORS

8.4.1 Partial Action Factors for In-Service Analysis

Partial action factors to be applied for the operating and seismic conditions in compliance with ISO codes are reported in Table 8.2.

Load combination		Dead load		Live load		Environmental load	Wave dynamics
		G1	G2	Q1	Q2	Eo / Ee	Do / De
		$\gamma_{f,G1}$	$\gamma_{f,G2}$	$\gamma_{f,Q1}$	$\gamma_{f,Q2}$	$\gamma_{f,Eo}$ / $\gamma_{f,Ee}$	$\gamma_{f,D}$
Operating Gravity / Buoyancy		1.3	1.3	1.5	1.5	-	-
Operating Storm		1.3	1.3	1.5	1.5	1.22	1.25
Extreme Storm (100 years)	Max Compression	1.0	1.0	1.0	-	1.35	1.25
	Max Tension	0.9	0.9	0.8	-	1.35	1.25

Table 8.2 – Partial Action Factors for the In-Service Analysis

The DNV code, ref. /13/ sect 4.5, asks for:

Table 4-2 Load factors γ_f for the ultimate limit states

Load factor set	*Load category*			
	G	*Q*	*E*	*D*
(a)	1.3	1.3	0.7	1.0
(b)	ψ	ψ	1.3	1.0

G and Q for load combination (b) are normally taken =1.0 for ULS combinations.

G and Q for load combination (b) are taken = 0.9 when permanent or variable load is a favourable load..

Comment

Table 8.2 referred to ISO standard fully complies with DNV's request, being even more onerous.

8.4.2 Partial Action Factors for Pre-Service Analyses

Partial Action Factors for Pre-Service analysis (e.g. Lifting, Transportation, Load-out) conditions are shown in Table 8.3 with reference to three design situations, where:

- G_T are the permanent actions during the transient situation.
- Q_T are the variable actions during the transient situation.
- T represents the actions from the transient situation being considered.

SITUATION	ACTION		
	Permanent (GT)	**Variable QT)**	Transient (T)
1	1.3	1.3	1.0
2	1.1	1.1	1.35
3	0.95	0.9	1.35

Table 8.3 – Partial action factors for Pre-service Analyses

Comment

Fully complies with DNV's request.

All the pre-service analyses (e.g. transportation/ lifting / loadout) will be performed in accordance with DNVGL-ST-N001.

8.4.3 Partial Action Factors for Accidental Limit State Actions

All partial action factors for the abnormal / accidental limit state conditions are set equal to 1.00.

Comment

Fully complies with DNV's request.

8.4.4 Partial Action Factors for Fatigue Analysis

In determining stress variations for fatigue analysis, all the partial action factors shall be taken as 1.00.

Comment

Fully complies with DNV's request.

8.4.5 Partial Action Factors for Serviceability Limit States

All partial action factors for Serviceability Limit States conditions are set equal to 1.0.

Comment

Fully complies with DNV's request.

8.4.2 Variable Actions

Live loads

Area loads for local design are to be considered as per Table 9.2.

For global design analyses (e.g. In-Service) only superimposed area loads on laydown platforms will be considered in load combinations.

Area Use	Deck Flooring & Stringers	
	UDL (kN / m2)	CL (kN)
General Laydown and Storage Areas	15	22.5 (+10.0 for pipe support allowance)
Floor Areas in Deck	Actual equip. +5.0 in open areas or 15.0	22.5 (+10.0 for pipe support allowance)
Temporary Refuge	5	5
Walkways, Stairs and Access Platforms	4	4

Notes:

- Concentrated Loads (CL) are applied to an area of 100 mm x 100 mm, and at the most severe position, but not added to wheel loads or distributed loads;
- Uniformly Distributed Loads (UDL) and CL are not considered to act together, except 10 kN pipe support allowance is assumed to act with any load combination.
- Wheel loads to be added to distributed loads, where relevant. Wheel loads can normally be considered acting on an area of 300 mm x 300 mm.
- Trolley route location and loads to be extracted from Mechanical Handling layouts.

Table 8.4 - Superimposed Area Loads for Local Checks

DNV code, section 4.2 states:

Table 3 Variable functional loads on deck areas

	Local design		*Primary design*	*Global design 1)*
	Distributed load, p (kN/m^2)	*Point load, P (kN)*	*Apply factor to distributed load, p*	*Apply factor to distributed load, p*
Storage areas	*q*	1.5 *q*	1.0	1.0
Lay down areas	*q*	1.5 *q*	*f*	*f*
Lifeboat platforms	9.0	9.0	1.0	may be ignored
Area between equipment	5.0	5.0	*f*	may be ignored
Walkways, staircases and platforms, crew spaces	4.5	4.5	*f*	may be ignored
Walkways and staircases for inspection only	3.0	3.0	*f*	may be ignored
Areas not exposed to other functional loads	2.5	2.5	1.0	-

Comment:

The only discrepancy is noted in walkways and staircase distributed and point loads where ISO code states 4.0 kN/m^2 and 4.0 kN respectively, while DNV requests 4.5 kN/m^2 and 4.5 kN.

In the next rev. of the design basis 4.5 kN/m^2 and 4.5 kN values will be presented and used for calculations.