RULES
FOR THE CLASSIFICATION AND CONSTRUCTION OF MOBILE OFFSHORE DRILLING UNITS

PART II
CONSTRUCTION, STRENGTH AND MATERIALS

July
2024

GDAŃSK

RULES FOR CLASSIFICATION AND CONSTRUCTION OF MOBILE OFFSHORE DRILLING UNITS developed and edited by Polski Rejestr Statków S.A., hereinafter referred to as PRS, consist of the following Parts:

Part I – Classification Regulations
Part II – Construction, Strength and Materials
Part III – Subdivision, Stability and Freeboard
Part IV – Machinery Installations
Part V – Fire Safety
Part VI – Electrical Installations
Part VII – Helicopter Facilities

however, "Materials and welding" shall comply with the applicable requirements of *Part IX – Materials and Welding* of the *Rules for the Classification and Construction of Sea-going Ships*.

This *Part II* was approved by the PRS Board on 12 July 2024 and enters into force on 15 July 2024.

This *Part II* are extended and supplemented by the following Publications:

Publication 21/P – Ship Hull Structure Tests.
Publication 51/P – Procedural Requirements for Service Suppliers.
Publication 96/P – Offshore mooring chain.
Publication 120/P – Requirements for Vessels and Units with Dynamic Positioning (DP) Systems
Publication 123/P – Safe Entry to Confined Spaces.

PRS/RP, 07/2024

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1 GENERAL REQUIREMENTS

1.1 Introduction

This *Part II* has been developed in the editorial layout reflecting the layout of technical requirements contained in Chapter 2 of the *Code for the construction and equipment of mobile offshore drilling units (MODU* Code, the *"Code"* in short*)* and IACS Unified Requirements – UR, cited in the original version, treated as a source documents, marked in the text with the appropriate colour of the font. At the end of the paragraph/ section, there is the name and number of the paragraph/section of the source document (if the number is not consistent with the source document).

The text of this *Part II* contains additional and specific PRS requirements/ recommendations/ interpretations, which are marked in black.

The purpose of such an editorial layout is an easy verification of the implementation of all applicable requirements and in the future to simplify procedure for implementing subsequent changes of the source documents into *Rules*.

At the end, there is a summary of currently applicable IMO documents and IACS Resolutions related to this *Part II*.

1.2 Application

1.2.1 This *Part II* applies to the design and construction of mobile offshore drilling units of all types, as defined in sub-chapter 1.2 of *Part I* of the Rules, hereinafter referred to as "units", which are assigned a class mark in accordance with sub-chapter 3.2 of *Part I*.

1.2.2 Where in the text of this *Part II* or in IMO documents referred to therein, reference is made to the *SOLAS Convention*, the *Rules for the Classification and Construction of Sea-going Ships*, *Part III, Hull Equipment*, containing such requirements, may be applied.

1.2.3 Whenever this *Part II* leaves certain technical solutions to the discretion of the Administration, then PRS, acting as Recognized Organisation (RO), will make relevant decisions in cooperation with the Administration, in accordance with the provisions of the relevant Agreement with the Administration.

1.3 Definitions

Definitions of the terminology used in this *Part II* are given in sub-chapter 1.2 of *Part I – Classification Regulations*.

1.4 Documentation for the unit

The scope of documentation required for consideration and approval is given in subchapters 4.2 to 4.5 of *Part I* of the *Rules*.

1.5 Scope of supervision

The general survey regulations for classification, supervision over the construction and operation of units within the scope of structure and materials are given in *Part I - Classification rules*.

1.6 Onboard acceptance and tests

After completing the subsequent stages of the unit construction, structural elements and related equipment are subject to acceptance and tests under the supervision of a PRS Surveyor, in accordance with the agreed acceptance and test program.

2 CONSTRUCTION AND STRENGTH

2.1 General

2.1.1 Administrations should take appropriate action to ensure uniformity in the implementation and application of the provisions of this *MODU Code* chapter.

2.1.2 The review and approval of the design of each unit should be carried out by officers of the Administration. However, the Administration may entrust this function to certifying authorities nominated for this purpose or to organizations recognized by it. In every case the Administration concerned should fully guarantee the completeness and efficiency of the design evaluation.

2.1.3 In addition to the provisions contained elsewhere in this *MODU Code*, units should be designed, constructed and maintained in compliance with the structural, mechanical and electrical requirements of institution which:

.1 has recognized and relevant competence and experience with offshore petroleum activities;

.2 has established rules and procedures for classification of mobile offshore drilling units; and

.3 is recognized by the Administration in accordance with the provisions of *SOLAS* regulation XI-1/1, or with applicable national standards of the Administration which provide an equivalent level of safety.

2.2 Access

2.2.1 Means of access

2.2.1.1 Each space within the unit should be provided with at least one permanent means of access to enable, throughout the life of a unit, overall and close-up inspections and thickness measurements of the unit's structures to be carried out by the Administration, the company, and the unit's personnel and others as necessary. Such means of access should comply with the provisions of paragraph 2.2.4 and with the *Technical provisions for means of access for inspections*, adopted by the Maritime Safety Committee by resolution MSC.133(76), as amended by MSC.158(78)*.

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* See interpretation, contained in MSC.1/Circ.1544 and IACS UI MODU 1.
See *Revised recommendations for entering enclosed spaces aboard ships (Res. A.1050(27)).*

2.2.1.2 Where a permanent means of access may be susceptible to damage during normal operations or where it is impracticable to fit permanent means of access, the Administration may allow, in lieu thereof, the provision of movable or portable means of access, as specified in the *Technical provisions*, provided that the means of attaching, rigging, suspending or supporting the portable means of access forms a permanent part of the unit's structure. All portable equipment should be capable of being readily erected or deployed by the unit's personnel*.

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* Interpretation:
Some possible alternative means of access are listed under paragraph 3.9 of the MODU *Technical Provisions for means of access for inspection* (MODU TP). Always subject to acceptance as equivalent by PRS, alternative means such as an unmanned robot arm, ROV's with necessary equipment of the permanent means of access for overall and close-up inspections and thickness measurements of the deck head structure such as deck transverses and deck longitudinal of ballast tanks and other tanks, holds and other spaces where gas hazardous atmosphere may be present, are to be capable of:

- safe operation in ullage space in gas-free environment;
- introduction into the place directly from a deck access.

When considering use of alternative means of access as addressed by paragraph 3.9 of the MODU TP, refer to IACS Recommendation No.91 "Guidelines for Approval/Acceptance of Alternative Means of Access". (IACS UI MODU 1) and (MSC.1/Circ.1544)

2.2.1.3 The construction and materials of all means of access (MA) and their attachment to the unit's structure should be to the satisfaction of the Administration. The means of access should be subject to inspection prior to, or in conjunction with, its use in carrying out surveys in accordance with chapter 5 of *Part I* (sec. 1.6 of *MODU Code*).

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* **Interpretation:**
Note: This interpretation is to be contained in a section of the MA Manual.

Inspection:
The MA arrangements, including portable equipment and attachments, are to be periodically inspected by the crew or competent inspectors as and when it is going to be used to confirm that the MAs remain in serviceable condition.

Procedures:
1. Any Company authorized person using the MA shall assume the role of inspector and check for obvious damage prior to using the access arrangements. Whilst using the MA the inspector is to verify the condition of the sections used by close up examination of those sections and note any deterioration in the provisions. Should any damage or deterioration be found, the effect of such deterioration is to be assessed as to whether the damage or deterioration affects the safety for continued use of the access. Deterioration found that is considered to affect safe use is to be determined as "substantial damage" and measures are to be put in place to ensure that the affected section(s) are not to be further used prior effective repair.
2. Statutory survey of any space that contains MA shall include verification of the continued effectiveness of the MA in that space. Survey of the MA shall not be expected to exceed the scope and extent of the survey being undertaken. If the MA is found deficient, the scope of survey is to be extended if this is considered appropriate.
3. Records of all inspections are to be established based on the requirements detailed in the MODU's Safety Management System. The records are to be readily available to persons using the MAs and a copy attached to the MA Manual. The latest record for the portion of the MA inspected is to include as a minimum the date of the inspection, the name and title of the inspector, a confirmation signature, the sections of MA inspected, verification of continued serviceable condition or details of any deterioration or substantial damage found. A file of permits issued is to be maintained for verification. (IACS UI MODU 1)

2.2.2 Safe access to holds, tanks*, ballast tanks and other spaces

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* Interpretation:
This regulation is only applicable to integral tanks. Independent tanks can be excluded. Also, spud cans and jack cases of self-elevating units can be excluded. (IACS UI MODU 1) and (MSC.1/Circ.1544)

2.2.2.1 Safe access* to holds, cofferdams, tanks and other spaces should be direct from the open deck and such as to ensure their complete inspection. Safe access may be from a machinery space, pump-room, deep cofferdam, pipe tunnel, hold, double hull space or similar compartment not intended for the carriage of oil or hazardous materials** where it is impracticable to provide such access from an open deck.

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* Refer to *Recommendations for entering enclosed spaces aboard ships*, adopted by IMO by resolution A.864(20), as amended.

** The wording "not intended for the carriage of oil or hazardous materials" applies only to "similar compartments", i.e. safe access can be through a pump-room, deep cofferdam, pipe tunnel, cargo hold or double hull space. (IACS UI MODU 1) and (MSC.1/Circ.1544)

2.2.2.2 Tanks, and subdivisions of tanks, having a length of 35 m or more, should be fitted with at least two access hatchways and ladders, as far apart as practicable. Tanks less than 35 m in length should be served by at least one access hatchway and ladder. When a tank is subdivided by one or more swash bulkheads or similar obstructions which do not allow ready means of access to the other parts of the tank, at least two hatchways and ladders should be fitted*.

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* Interpretation:
A tank of less than 35 m length without a swash bulkhead requires only one access hatch.
Where rafting is indicated in the access manual as the means to gain ready access to the under deck structure, the term "similar obstructions" referred to in the regulation includes internal structures (e.g., webs >1.5m deep) which restrict the ability to raft (at the maximum water level needed for rafting of under deck structure) directly to the nearest access ladder and hatchway to deck. When rafts or boats alone, as an alternative means of access are allowed, permanent means of access are to be provided to allow safe entry and exit. This means:

a) access direct from the deck via a vertical ladder and small platform fitted approximately 2m below the deck in each bay; or
b) access to deck from a longitudinal permanent platform having ladders to deck in each end of the tank. The platform shall, for the full length of the tank, be arranged in level with, or above, the maximum water level needed for rafting of under deck structure. For this purpose, the ullage corresponding to the maximum water level is to be assumed not more than 3m from the deck plate measured at the midspan of deck transverses and in the middle length of the tank. A permanent means of access from the longitudinal permanent platform to the water level indicated above is to be fitted in each bay (e.g. permanent rungs on one of the deck webs inboard of the longitudinal permanent platform). (IACS UI MODU 1) and (MSC.1/Circ.1544)

2.2.2.3 Each hold should be provided with at least two means of access as far apart as practicable. In general, these accesses should be arranged diagonally, e.g., one access near the forward bulkhead on the port side, the other one near the aft bulkhead on the starboard side.

2.2.3 Access Manual*

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* Interpretation:

The access manual** is to address spaces listed in sub-chapter 2.2.2. As a minimum the English version is to be provided.

The access manual is to contain at least the following two parts:

Part 1: Plans, instructions and inventory required by paragraphs .1.1 to .1.7 of section 2.2.3.1. This part is to be approved by the Administration or the organization recognized by the Administration.

Part 2: Form of record of inspections and maintenance, and change of inventory of portable equipment due to additions or replacement after construction. This part is to be approved for its form only at new building.

The following matters are to be addressed in the access manual:

1. The access manual is to clearly cover scope as specified in the regulations for use by crews, surveyors and Port State control officers.
2. Approval/ re-approval procedure for the manual, i.e. any changes of the permanent, portable, movable or alternative means of access within the scope of the regulation and the Technical provisions are subject to review and approval by the Administration or by the organization recognized by the Administration.
3. Verification of MA is to be part of safety construction survey for continued effectiveness of the MA in that space which is subject to the statutory survey.
4. Inspection of MA by the crew and/or a competent inspector of the company as a part of regular inspection and maintenance (see interpretation for section 2.2.1.3).
5. Actions to be taken if MA is found unsafe to use.
6. In case of use of portable equipment plans showing the means of access within each space indicating from where and how each area in the space can be inspected. (IACS UI MODU 1)

** Refer to IACS Recommendation No.90 "Ship Structural Access Manual".

2.2.3.1 A unit's means of access to carry out overall and close-up inspections and thickness measurements should be described in an access manual which may be incorporated in the unit's operating manual. The manual should be updated as necessary, and an updated copy maintained on board. The structure access manual should include the following for each space:

.1.1 plans showing the means of access to the space, with appropriate technical specifications and dimensions;

.1.2 plans showing the means of access within each space to enable an overall inspection to be carried out, with appropriate technical specifications and dimensions. The plans should indicate from where each area in the space can be inspected;
.1.3 plans showing the means of access within the space to enable close-up inspections to be carried out, with appropriate technical specifications and dimensions. The plans should indicate the positions of critical structural areas, whether the means of access is permanent or portable and from where each area can be inspected;
.1.4 instructions for inspecting and maintaining the structural strength of all means of access and means of attachment, taking into account any corrosive atmosphere that may be within the space;
.1.5 instructions for safety guidance when rafting is used for close-up inspections and thickness measurements;
.1.6 instructions for the rigging and use of any portable means of access in a safe manner;
.1.7 an inventory of all portable means of access; and
.1.8 records of periodical inspections and maintenance of the unit's means of access.

2.2.3.2 For the purpose of this paragraph "critical structural areas"* are locations which have been identified from calculations to require monitoring or from the service history of similar or sister units to be sensitive to cracking, buckling, deformation or corrosion which would impair the structural integrity of the unit.

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* Interpretation:
Critical structural areas are to be identified by advanced calculation techniques for structural strength and fatigue performance, if available, and feedback from the service history and design development of similar or sister units. (IACS UI MODU 1) and (MSC.1/Circ.1544)

2.2.4 General technical specifications

2.2.4.1 For access through horizontal openings, hatches or manholes, the dimensions should be sufficient to allow a person wearing a self-contained air-breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also provide a clear opening to facilitate the hoisting of an injured person from the bottom of a confined space. The minimum clear opening should not be less than 600 mm x 600 mm*. When access to a hold is arranged through a flush manhole in the deck or a hatch, the top of the ladder should be placed as close as possible to the deck or hatch coaming. Access hatch coamings having a height greater than 900 mm should also have steps on the outside in conjunction with the ladder.

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* Interpretation:
The minimum clear opening of 600 mm x 600 mm may have corner radii up to 100 mm maximum. The clear opening is specified in MSC/Circ.686 to keep the opening fit for passage of personnel wearing a breathing apparatus. In such a case where as a consequence of structural analysis of a given design the stress is to be reduced around the opening, it is considered appropriate to take measures to reduce the stress such as making the opening larger with increased radii, e.g. 600 x 800 with 300 mm radii, in which a clear opening of 600 x 600 mm with corner radii up to 100mm maximum fits. (IACS UI MODU 1) and (MSC.1/Circ.1544)

2.2.4.2 For access through vertical openings, or manholes, in swash bulkheads, floors, girders and web frames providing passage through the length and breadth of the space, the minimum opening should be not less than 600 mm x 800 mm* at a height of not more than 600 mm from the bottom shell plating unless gratings or other footholds are provided.

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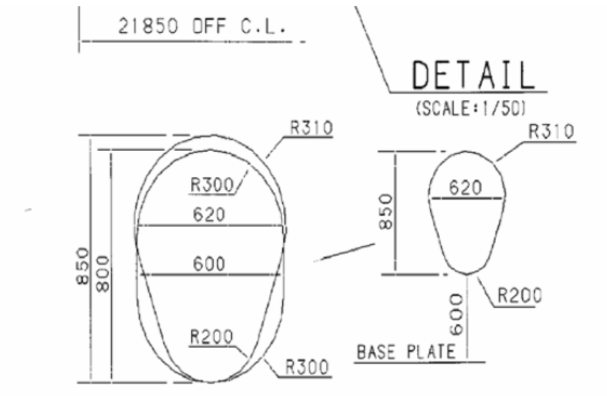
* Interpretation:
1. The minimum clear opening of not less than 600 mm x 800 mm may also include an opening with corner radii of 300 mm. An opening of 600mm in height x 800mm in width may be accepted as access openings in vertical

structures where it is not desirable to make large opening in the structural strength aspects, i.e. girders and floors in double bottom tanks.

2. Subject to verification of easy evacuation of injured person on a stretcher the vertical opening 850 mm x 620 mm with wider upper half than 600 mm, while the lower half may be less than 600 mm with the overall height not less than 850 mm, is considered an acceptable alternative to the traditional opening of 600 mm x 800 mm with corner radii of 300 mm.



3. If a vertical opening is at a height of more than 600 mm, steps and handgrips are to be provided. In such arrangements it is to be demonstrated that an injured person can be easily evacuated. (IACS UI MODU 1) and (MSC.1/Circ.1544)

2.3 Design loads

2.3.1 The modes of operation for each unit are to be investigated using realistic loading conditions including gravity loading with relevant environmental loading for its intended areas of operation. The following environmental considerations should be included where applicable: wind, wave, current, ice, seabed conditions, temperature, fouling and earthquake.

2.3.2 Where possible, the above design environmental conditions should be based upon significant data with a period of recurrence of at least 50 years for the most severe anticipated environment.

2.3.3 Results from relevant model tests may be used to substantiate or amplify calculations.

2.3.4 Limiting design data for each mode of operation should be stated in the operating manual.

Wind loading

2.3.5 Sustained and gust wind velocities, as relevant, should be considered when determining wind loading. Pressures and resultant forces should be calculated by the method referred to in section 3.2 of *Part III* (3.2 of *MODU Code*)or by some other method to the satisfaction of the Administration.

Wave loading

2.3.6 Design wave criteria should be described by design wave energy spectra or deterministic design waves having appropriate shape and size. Consideration should be given to waves of lesser height, where, due to their period, the effects on structural elements may be greater.

2.3.7 The wave forces utilized in the design analysis should include the effects of immersion, heeling and accelerations due to motion. Theories used for the calculation of wave forces and the selection of coefficients should be to the satisfaction of the Administration.

Current loading

2.3.8 Consideration should be given to the interaction of current and waves. Where necessary, the two should be superimposed by adding the current velocity vectorially to the wave particle velocity. The resultant velocity should be used in calculating the structural loading due to current and waves.

Loading due to vortex shedding

2.3.9 Consideration should be given to loading induced in structural members due to vortex shedding.

Deck loading

2.3.10 A loading plan should be prepared to the satisfaction of the Administration showing the maximum design uniform and concentrated deck loading for each area for each mode of operation.

Other loadings

2.3.11 Other relevant loadings should be determined in a manner to the satisfaction of the Administration.

2.4 Structural analysis

2.4.1 Sufficient loading conditions for all modes of operation should be analysed to enable the critical design cases for all principal structural components to be evaluated. This design analysis should be to the satisfaction of the Administration.

2.4.2 The scantlings should be determined on the basis of criteria which combine, in a rational manner, the individual stress components in each structural element. The allowable stresses should be to the satisfaction of the Administration.

2.4.3 Local stresses, including stresses caused by circumferential loading on tubular members, should be added to primary stresses in evaluating combined stress levels.

2.4.4 The buckling strength of structural members should be evaluated where appropriate.

2.4.5 Where deemed necessary by the Administration, a fatigue analysis based on intended operating areas or environments should be provided.

2.4.6 The effect of notches, local stress concentrations and other stress raisers should be allowed for in the design of primary structural elements.

2.4.7 Where possible, structural joints should not be designed to transmit primary tensile stresses through the thickness of plates integral with the joint. Where such joints are unavoidable, the plate material properties and inspection procedures selected to prevent lamellar tearing should be to the satisfaction of the Administration.

2.5 Special considerations for surface units

2.5.1 The required strength of the unit should be maintained in way of the drilling well, and particular attention should be given to the transition between fore-and-aft members. The plating of the well should also be suitably stiffened to prevent damage when the unit is in transit.

2.5.2 Consideration should be given to the scantlings necessary to maintain strength in way of large hatches.

2.5.3 The structure in way of components of the position mooring system such as fairleads and winches should be designed to withstand the stresses imposed when a mooring line is loaded to its breaking strength.

2.6 Special considerations for self-elevating units

2.6.1 The hull strength should be evaluated in the elevated position for the specified environmental conditions with maximum gravity loads aboard and with the unit supported by all legs. The distribution of these loads in the hull structure should be determined by a method of rational analysis. Scantlings should be calculated on the basis of this analysis, but should not be less than those required for other modes of operation.

2.6.2 The unit should be so designed as to enable the hull to clear the highest design wave including the combined effects of astronomical and storm tides. The minimum clearance may be the lesser of either 1.2 m or 10% of the combined storm tide, astronomical tide and height of the design wave above the mean low water level.

2.6.3 Legs should be designed to withstand the dynamic loads which may be encountered by their unsupported length while being lowered to the bottom, and also to withstand the shock of bottom contact due to wave action on the hull. The maximum design motions, sea state and bottom conditions for operations to raise or lower the hull should be clearly stated in the operating manual.

2.6.4 When evaluating leg stresses with the unit in the elevated position, the maximum overturning moment on the unit due to the most adverse combination of applicable environmental and gravity loadings should be considered.

2.6.5 Legs should be designed for the most severe environmental transit conditions anticipated including wind moments, gravity moments and accelerations resulting from unit motions. The Administration should be provided with calculations, an analysis based on model tests, or a combination of both. Acceptable transit conditions should be included in the operating manual. For some transit conditions, it may be necessary to reinforce or support the legs, or to remove sections to ensure their structural integrity.

2.6.6 Structural members which transmit loads between the legs and the hull should be designed for the maximum loads transmitted and so arranged as to diffuse the loads into the hull structure.

2.6.7 When a mat is utilized to transmit the bottom bearing loads, attention should be given to the attachment of the legs so that the loads are diffused into the mat.

2.6.8 Where tanks in the mat are not open to the sea, the scantlings should be based on a design head using the maximum water depth and tidal effects.

2.6.9 Mats should be designed to withstand the loads encountered during lowering including the shock of bottom contact due to wave action on the hull.

2.6.10 The effect of possible scouring action (loss of bottom support) should be considered. The effect of skirt plates, where provided, should be given special consideration.

2.6.11 Except for those units utilizing a bottom mat, the capability should be provided to pre-load each leg to the maximum applicable combined load after initial positioning at a site. The pre-loading procedures should be included in the operating manual.

2.6.12 Deckhouses located near the side shell of a unit may be required to have scantlings similar to those of an unprotected house front. Other deckhouses should have scantlings suitable for their size, function and location.

2.7 Special considerations for column-stabilized units

2.7.1 Unless deck structures are designed for wave impact, a clearance acceptable to the Administration should be maintained between passing wave crests and the deck structure. The Administration should be provided with model test data, reports on past operating experience with similar configurations or by calculations showing that adequate provision is made to maintain this clearance.

2.7.2 For units designed to be supported by the seabed the clearance in paragraph 2.6.2 should be maintained.

2.7.3 The structural arrangement of the upper hull is to be considered with regard to the structural integrity of the unit after the assumed failure of any primary girder. The Administration may require a structural analysis showing satisfactory protection against overall collapse of the unit after such an assumed failure when exposed to environmental loading corresponding to a one-year return period for the intended area of operation.

2.7.4 The scantlings of the upper structure should not be less than those required for the loading shown in the deck loading plan.

2.7.5 When an approved mode of operation or damage condition in accordance with the provisions governing stability allows the upper structure to become waterborne, special consideration should be given to the resulting structural loading.

2.7.6 The scantlings of columns, lower hulls and footings should be based on the evaluation of hydrostatic pressure loading and combined loading including wave and current considerations.

2.7.7 Where a column, lower hull or footing is a part of the overall structural frame of a unit, consideration should also be given to stresses resulting from deflections due to the applicable combined loading.

2.7.8 Particular consideration should be given to structural arrangements and details in areas subject to high local loading resulting from, for example, external damage, wave impact, partially filled tanks or bottom bearing operations.

2.7.9 When a unit is designed for operations while supported by the seabed, the footings should be designed to withstand the shock of bottom contact due to wave action on the hull. Such units should also be evaluated for the effects of possible scouring action (loss of bottom support). The effect of skirt plates, where provided, should be given special consideration.

2.7.10 The structure in way of components of the position mooring system such as fairleads and winches should be designed to withstand the stresses imposed when a mooring line is loaded to its breaking strength.

2.7.11 Bracing members should be designed to make the structure effective against applicable combined loading and, when the unit is supported by the seabed, against the possibility of uneven bottom bearing loading. Bracing members should also be investigated, where applicable, for combined stresses including local bending stresses due to buoyancy, wave forces and current forces.

2.7.12 The unit's structure should be able to withstand the loss of any slender bracing member without causing overall collapse when exposed to environmental loading corresponding to a one-year return period for the intended area of operation.

2.7.13 Where applicable, consideration should be given to local stresses caused by wave impact.

2.7.14 Where bracings are watertight they should be designed to prevent collapse from hydrostatic pressure. Underwater bracing should be made watertight and have a leak detection system.

2.7.15 Consideration should be given to the need for ring frames to maintain stiffness and shape in tubular bracing members.

IACS UR D3/Rev.6 - General design parameters

D3.1 Material

D3.1.1 Unless otherwise specified, the Requirements of this *Part II* are intended for units to be constructed of hull structural steel, manufactured and having the properties as specified in the applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part IX – Materials and Welding.* Where it is proposed to use steel or other material having properties differing from those specified in the *Rules*, the specification and properties of such material shall be submitted to PRS for consideration and special approval. Due consideration is to be given to the ratio of yield to ultimate strength of the materials to be used, and to their suitability with regard to structural location and to design temperatures.

D3.2 Scantlings

D3.2.1 Scantlings of the major structural elements of the unit are to be determined in accordance with the requirements as set forth herein. Scantlings of structural elements which are subject to local load only, and which are not considered to be effective components of the primary structural frame of the unit, shall comply with the applicable requirements of applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part II – Hull*.

D3.2.2 Surface type drilling units are to have scantlings that meet the *Rules*. Also, special consideration is to be given to the items noted in IACS UR D6.

D3.2.3 The following conditions shall be taken into account:

(a) Where the unit is fitted with an acceptable corrosion protection system, the scantlings may be determined from D3.4 in conjunction with allowable stresses given in D3.5, in which case no corrosion allowance is required. If scantlings are determined from the *Rules*, reductions for corrosion protection may be as permitted by the *Rules*.
(b) Where no corrosion protection system is fitted or where the system is considered by PRS to be inadequate, an appropriate corrosion allowance will be required on scantlings determined from D3.4 and D3.5, and no reduction will be permitted on scantlings determined by the use of the *Rules*.

D3.3 Structural design loadings

D3.3.1 General

A unit's modes of operation are to be investigated using realistic loading conditions, including gravity loadings together with relevant environmental loadings due to the effects of wind, waves, currents, ice and, where deemed necessary by the owner (designer), the effects of earthquake, sea bed supporting capabilities, temperature, fouling, etc. Where applicable, the design loadings indicated herein are to be adhered to all types of mobile offshore drilling units. The owner (designer) will specify the environmental conditions for which the unit is to be approved. Where possible, the design environmental criteria determining the loads on the unit and its individual elements shall be based upon significant statistical information and shall have a return period (period of recurrence) of at least 50 years for the most severe anticipated environment. If a unit is restricted to seasonal operations in order to avoid extremes of wind and wave, such seasonal limitations must be specified.

D3.3.2 Wind loading

Sustained and gust velocities, as relevant, are to be considered when determining wind loadings. Sustained wind velocities specified by the owner (designer) are not to be less than 25.8 m/s (50 knots). However, for unrestricted service, the wind criteria for intact stability given in D3.7.2 are also to be applicable for structural design considerations, for all modes of operation, whether afloat or supported by the sea bed. Pressures and resultant forces are to be calculated to the satisfaction of PRS. Where wind tunnel data obtained from tests on a representative model of the unit by a recognized laboratory are submitted, these data will be considered for the determination of pressures and resulting forces.

D3.3.3 Wave loadings

(a) Design wave criteria specified by the owner (designer) may be described either by means of design wave energy spectra or deterministic design waves having appropriate shape, size and period. Consideration is to be given to waves of less than maximum height where, due to their period, the effects on various structural elements may be greater.
(b) The forces produced by the action of waves on the unit are to be taken into account in the structural design, with regard to forces produced directly on the immersed elements of the unit and forces resulting from heeled positions or accelerations due to its motion. Theories used for the calculation of wave forces and selection of relevant coefficients are to be acceptable to PRS.
(c) Consideration is to be given to the possibility of wave induced vibration.

D3.3.4 Current loadings

Consideration shall be given to the possible superposition of current and waves. In those cases where this superposition is deemed necessary, the current velocity shall be added vectorially to the wave particle velocity. The resultant velocity is to be used to compute the total force.

D3.3.5 Loading due to vortex shedding

Consideration shall be given to the possibility of flutter of structural members due to von Karman vortex shedding.

D3.3.6 Deck loadings

As indicated in the list of documentation in *Part I* of the Rules (IACS UR D1.3), a loading plan is to be prepared for each design. This plan is to show the maximum design uniform and concentrated loadings for all areas for each mode of operation. Design loadings are not to be less than:
(i) Crew spaces (walkways, general traffic areas, etc.)
4,5 kN/m²
(ii) Work areas
9 kN/m²

(iii) Storage areas
13 kN/m²

(iv) Helicopter platform
2 kN/m²

D3.4 Structural analysis

D3.4.1 The primary structure of the unit is to be analysed using the loading conditions stipulated below and the resultant stresses are to be determined. Sufficient conditions, representative of all modes of operation, are to be considered, to enable critical design cases to be determined. Calculations for relevant conditions are to be submitted for review. The analysis shall be performed using an appropriate calculation method and shall be fully documented and referenced.

For each loading condition considered, the following stresses are to be determined for comparison with the appropriate allowable stresses given in D3.4.3 or D3.5:

(i) Stresses due to static loadings only, in calm water conditions, where the static loads include service load such as operational gravity loadings and weight of the unit, with the unit afloat or resting on the sea bed, as applicable.

(ii) Stresses due to combined loadings, where the applicable static loads described in (i) are combined with relevant design environmental loadings, including acceleration and heeling forces.

D3.4.2 Stresses analysis

(a) Local stresses, including those due to circumferential loading on tubular members, are to be added to the primary stresses to determine total stress levels.

(b) The scantlings are to be determined on the basis of criteria which combine, in a rational manner, the individual stress components acting on the various structural elements of the unit. This method is to be acceptable to PRS. (See D3.4.3)

(c) The critical buckling stress of structural elements is to be considered, where appropriate, in relation to the computed stresses.

(d) When computing bending stresses, the effective flange areas are to be determined in accordance with 'effective width' concepts acceptable to PRS. Where appropriate, elastic deflections are to be taken into account when determining the effects of eccentricity of axial loading, and the resulting bending moments superimposed on the bending moments computed for other types of loadings.

(e) When computing shear stresses in bulkheads, plate girder webs of hull side plating, only the effective shear area of the web is to be considered. In this regard, the total depth of the girder may be considered as the web depth.

D3.4.3 Design criteria

(a) For plated structures, members may be designed according to the von Mises equivalent stress criterion, where the equivalent stress σ_e is defined as follows:

$$\sigma_e = \sqrt{\sigma_x^2 + \sigma_y^2 - \sigma_x \sigma_y + 3\tau_{xy}^2}$$

where:
σ_x – stress in the x direction,
σ_y – stress in the y direction,
τ_{xy} – shear stress in the x–y plane.

The equivalent stress in plate elements clear of discontinuities shall generally not exceed 0.7 and 0.9 of the yield strength of the material, for the loading conditions given in D3.4.1(i) and (ii), respectively.

(b) Members of lattice type structures shall be designed in accordance with accepted practice for such members; for example, they may comply with the American Institute of Steel Construction's Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.

D3.4.4 Fatigue analysis

D3.4.4.1 The possibility of fatigue damage due to cyclic loading shall be considered in the design of self elevating and column stabilized units.

D3.4.4.2 The fatigue analysis will be dependent on the intended mode and area of operations to be considered in the unit's design.

D3.4.4.3 The fatigue life is to be based on a period of time equal to the specified design life of the structure. The period is normally not to be taken as less than 20 years.

D3.4.5 The effect of notches, stress raisers and local stress concentrations is to be taken into account in the design of load carrying elements.

D3.4.6 Critical joints depending upon transmission of tensile stresses through the thickness of the plating of one of the members (which may result in lamellar tearing) are to be avoided wherever possible. Where unavoidable, plate material with suitable through-thickness properties and inspection procedures may be required.

D3.5 Allowable stresses

D3.5.1 For cases involving individual stress components and, where applicable, direct additions of such stresses, the stress is not to exceed the allowable individual stress σ_i* or τ_i*,

where:

σ_i* – $\eta\sigma_Y$ for axial bending stress,
τ_i* – $\eta\sigma_Y$ for shear stress,
σ_Y – specified minimum tensile yield stress of the material,
η – usage factor,

- for static loadings (see D3.4.1.1)
  η – 0.6 for axial stress,
  0.6 for bending stress,
  0.40 for shear stress,
- for combined loadings (see D3.4.1.2)
  η – 0.8 for axial stress,
  0.8 for bending stress,
  0.53 for shear stress.

D3.5.2 In addition, the stress in structural elements, due to compression, ending, shear or any combination of the three, shall not exceed the allowable buckling stress σ_b* or τ_b ~~b~~*,

where:

σ_b* – $\eta\sigma_{cr}$ for compression or bending,
τ_b* – $\eta\tau_{cr}$ for shear stress,
η – 0.6 for static loadings,

η – 0.8 for combined loadings,
σ_{cr} or τ_{cr} – critical compressive buckling stress or shear buckling stress, respectively, σ_Y is as defined in D3.5.1.

D3.5.3 In addition, when structural members are subjected to axial compression or combined axial compression and bending, the extreme fibre stresses shall comply with the following requirement:

$$\sigma_a/\sigma_a{}^* + \sigma_{ab}/\sigma_{ab}{}^* \leq 1.0$$

where:
σ_a – computed axial compressive stress,
σ_{ab} – computed compressive stress due to bending,
$\sigma_{ab}{}^*$ – $\sigma_i{}^*$ or $\sigma_b{}^*$ for bending stress, as defined in D3.5.1 or D3.5.2,
$\sigma_a{}^*$ – $\eta\ \sigma_{cr,i}\ (1 - 0.13\lambda/\lambda_0)$ if $\lambda < \lambda_0$,
$\sigma_a{}^*$ – $\eta\ \sigma_{cr,e}\ 0.87$ if $\lambda \geq \lambda_0$,
$\sigma_a{}^*$ shall not exceed $\sigma_{ab}{}^*$,
$\lambda = kl/r$,

$$\lambda = \sqrt{2\pi^2 E/\sigma Y}$$

$\sigma_{cr,I}$ – inelastic column critical buckling stress,
$\sigma_{cr,e}$ – elastic column critical buckling stress,
η is as defined in D3.5.2,
kl – effective unsupported length,
r – governing radius of gyration associated with kl,
E – modulus of elasticity of the material,
σ_Y is as defined in D3.5.1.

D3.5.4 Unstiffened or ring-stiffened cylindrical shells subjected to axial compression or compression due to bending, and having proportions which satisfy the following relationship:

$$D/t > E/9\sigma_Y$$

where:
D – mean diameter,
t – wall thickness,
(D and t expressed in the same units),
σ_Y is as defined in D3.5.1,
E is as defined in D3.5.3,
(σ_Y and E expressed in the same units)
are to be checked for local buckling in addition to the overall buckling as specified in D3.5.3.

D3.5.5 Designs based upon novel methods, such as plastic analysis or elastic buckling concepts, will be specially considered.

Note 1:
The allowable stresses as stated in D3.5 are intended to reflect uncertainties in environmental data, determination of loadings from the data and calculation of stresses which may exist at the present time. It is envisioned that the requirements may eventually allow for the adoption of separate load factors or usage factors for the above influences, so that allowance can be given for improvements in forecasting, load estimation or structural analysis, as the technology or expertise in any one of these areas improves.

Note 2:
The specific minimum yield point may be determined, for the use of D3, by the drop of the beam or halt in the gauge in the testing machine or by the use of dividers or by 0.5% total extension under load. When no well defined yield phenomenon exists, the yield strength associated with a 0.2% offset or a 0.5% total extension under load is to be considered the yield strength.

D3.6 Units resting on the sea bed

D3.6.1 Units designed to rest on the sea bed are to have sufficient positive downward gravity loadings on the support footings or mat to withstand the overturning moment of the combined environmental forces from any direction, with a reserve against the loss of positive bearing of any footing or segment of the area thereof, for each design loading condition. Variable loads are to be considered in a realistic manner, to the satisfaction of PRS.
(…)

IACS UR D4/Rev.3 -Self-elevating drilling units

D4.1 General

D4.1.1 This section applies to the unit type as defined in *Part I* of the *Rules* (in IACS UR D2.2.1).

D4.2 Hull scantlings

D4.2.1 Scantlings of the hull structure, except as outlined below, are to meet the applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part II - Hull*.

D4.3 Design considerations

D4.3.1 Legs

(a) Leg types: Legs may be either shell type or truss type. Shell type legs may be designed as either stiffened or unstiffened shells. In addition, individual footings may be fitted or legs may be permanently attached to a bottom mat.

(b) Legs without mats: Where footings or mats are not fitted, proper consideration should be given to the leg penetration of the sea bed and the end fixity of the leg.

(c) Legs in the field transit condition: Legs are to be designed for a bending moment caused by a 6° single amplitude of roll or pitch at the natural period of the unit, plus 120% of the gravity moment caused by the legs' angle of inclination. The legs are to be investigated for any proposed leg arrangement with respect to vertical position during field transit moves, and the approved positions should be specified in the Operating Booklet. Such investigation should include strength and stability aspects.

(d) Legs in the ocean transit condition: Legs should be designed for acceleration and gravity moments resulting from the motions in the most severe anticipated environmental transit conditions, together with corresponding wind moments.

Calculation or model test methods, acceptable to PRS, may be used.

Alternatively, legs may be designed for a bending moment caused by minimum design criteria of a 15° single amplitude of roll or pitch at a 10 second period, plus 120% of the gravity moment caused by the legs' angle of inclination. For ocean transit conditions, it may be necessary to reinforce or support the legs, or to remove sections of them. The approved condition should be included in the Operating Booklet.

(e) Unit in the elevated position: When computing leg stresses, the maximum overturning load on the unit, using the most adverse combination of applicable variable loadings, together with the loadings as outlined in IACS UR D3, is to be considered. Forces and moments due to lateral frame deflections of the legs are to be taken into account. (See D3.3.3.(c) with respect to vibration).

(f) Leg scantlings: Leg scantlings are to be determined in accordance with a method of rational analysis, to the satisfaction of PRS.

D4.3.2 Structure in way of jacking or other elevating arrangements

Load carrying members which transmit loads from the legs to the hull are to be designed for the maximum design loads and are to be so arranged that loads transmitted from the legs are properly diffused into the hull structure.

D4.3.3 Hull structure

The hull is to considered as a complete structure having sufficient strength to resist all induced stresses while in the elevated position and supported by all legs. All fixed and variable loads are to be distributed, by an accepted method of rational analysis, from the various points of application to the supporting legs. The scantlings of the hull are then to be determined consistent with this load distribution, but are not to be less than those required by D4.2. Scantlings of units having other than rectangular hull configurations will be subject to special consideration.

D4.3.4 Wave clearance

The unit is to be designed for a crest clearance of either 1.2 m (4 ft), or 10% of the combined storm tide, astronomical tide and height of the maximum wave crest above the mean low water level, whichever is less, between the underside of the unit in the elevated position and the crest of the design wave. This crest elevation is to be measured above the level of the combined astronomical and storm tides.

D4.3.5 Bottom mat

When the bottoms of the legs are attached to a mat, particular attention is to be given to the attachment and the framing and bracing of the mat, in order that the loads resulting from the legs are properly distributed. The envelope plating of tanks which are not vented freely to the sea is not to be less in thickness than would be required by the Rules for tanks, using a head to the design water level, taking into account the astronomical and storm tides. The effects of scouring on the bottom bearing surface should be considered. The effects of skirt plates, where provided, will be specially considered. Mats are to be designed to withstand the shock of touching bottom while the unit is afloat and subject to wave motions.

D4.3.6 Preload capability

For units without bottom mats, all legs are to have the capability of being preloaded to the maximum applicable combined gravity plus overturning load. The approved preload procedure should be included in the Operating Booklet.

D4.3.7 Sea bed conditions

Classification will be based upon the designer's assumptions regarding the sea bed conditions. These assumptions should be recorded in the Operating Booklet. It is the responsibility of the operator to ensure that actual conditions do not impose more severe loadings on the unit.

D4.3.8 Deckhouses

Deckhouses are to have sufficient strength for their size, function and location, and are to be constructed to approved plans. Their general scantlings are to be as indicated in the Rules. Where they are close to the side shell of the unit, their scantlings may be required to conform to the applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part II – Hull,* for bulkheads of unprotected house fronts.

(…)

Annex to UR D4 as Recommendations on Operation of Legs:

(1) Legs while lowering to bottom: Legs are to be designed to withstand the dynamic loads which may be encountered by their unsupported length just prior to touching bottom, and also to withstand the shock of touching bottom while the unit is afloat and subject to wave motions.

(2) Instructions for lowering legs: The maximum design motions, bottom conditions and sea state while lowering legs should be clearly indicated in the Operating Booklet, and the legs are not to be permitted to touch bottom when the site conditions exceed the allowable.

IACS UR D5/Rev.3 - Column-stabilized drilling units

D5.1 General

D5.1.1 This section applies to the unit type as defined in *Part I* of the Rules (in IACS UR D2.2.2).

D5.1.2 For units of this type, the highest stresses may be associated with less severe environmental conditions than the maxima specified by the owner (designer). Where considered necessary by PRS, account should be taken of the consequent increased possibility of encounter of significant stress levels, by either or both of the following:

(i) suitable reduction of the allowable stress levels for combined loadings given in IACS UR D3.
(ii) detailed investigation of the fatigue properties.

Particular attention should also be given to the details of structural design in critical areas such as bracing members, joint connections, etc.

D5.1.3 Local structures in way of fairleads, winches, etc., forming part of the position mooring system, should be designed to the breaking strength of the mooring line.

D5.2 Upper structure

D5.2.1 The scantlings of the upper structure are not to be less than those required by the *Rules* in association with the loadings indicated on the deck loading plan. (These loadings are not to be less than the minima specified in IACS UR D3.3.6). In addition, when the upper structure is considered to be an effective member of the overall structural frame of the unit, the scantlings are to be sufficient to withstand actual local loadings plus any additional loadings superimposed due to frame action, within the stress limitations of IACS UR D3.

D5.2.2 When the upper structure is designed to be waterborne in any mode of operation or damaged condition, or to meet stability requirements, it will be subject to special consideration.

D5.2.3 Deckhouses fitted to the upper structure are to be designed in accordance with the applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part II – Hull*, with due consideration given to their location and to the environmental conditions in which the unit will operate.

D5.3 Columns, lower hulls and footings

D5.3.1 Main stability columns, lower hulls or footings may be designed as either framed or unframed shells. In either case, framing, ring stiffeners, bulkheads or other suitable diaphragms which are used are to be sufficient to maintain shape and stiffness under all the anticipated loadings.

Portlights or windows including those of the non-opening type, or other similar openings, are not to be fitted in columns.

D5.3.2 Columns shall meet the following requirements:

(a) where columns, lower hulls or footings are designed with stiffened plating, the minimum scantlings of plating, framing, girders, etc., may be determined in accordance with the requirements for tanks as given in IACS UR D7. Where an internal space is a void compartment, the design head used in association with the above is not to be less than corresponding to the maximum allowable waterline of the unit in service. In general, the scantlings are not to less than required for watertight bulkheads in association with a head equivalent to the maximum damaged waterline, and for all areas subject to wave immersion, a minimum head of 6.0 m (20 ft) should be used.

(b) where columns, lower hulls or footings are designed as shells, either unstiffened or ring stiffened, the minimum scantlings of shell plating and ring stiffeners are to be determined on the basis of established shell analysis using the appropriate usage factors and the design heads as given in (a).

(c) scantlings of columns, lower hulls or footings as determined in (a) and (b) are minimum requirements for hydrostatic pressure loads. Where wave and current forces are superimposed, the local structure of the shell is to be increased in scantlings as necessary, to meet the strength requirements of IACS UR D3.4.1(ii).

(d) when the column, lower hull or footing is an effective member of the overall structural frame of the unit, the scantlings are to be sufficient to meet the requirements of D5.3 plus any additional stresses superimposed due to frame action, within the stress limitations of IACS UR D3.

(e) particular consideration is to be given to structural details, reinforcement, etc., in areas subject to high local loadings, or to such loadings that may cause shell distortion, for example:
   .1 bottom bearing loads, where applicable;
   .2 partially filled tanks;
   .3 local strength against external damage;
   .4 continuity through joints;
   .5 wave impacts.

(f) for units designed to rest on the sea bed, the effect of scouring action (loss of bottom support) is to be considered. The effects of skirt plates, where provided, will be specially considered.

D5.3.3 Bracing members

(a) Stresses in bracing members due to all anticipated loadings are to be determined in accordance with the following requirements in conjunction with the relevant requirements of IACS UR D3.

(b) Bracing members are to be designed to transmit loadings and to make the structure effective against environmental forces and, when the unit is supported by the seabed, against the possibility of uneven bearing loads. Although designed primarily as brace members of the overall structure under the designated loadings, the bracing must also be investigated, if applicable, for superimposed local bending stresses due to buoyancy, wave and current forces.

(c) Where relevant, consideration is to be given to local stresses due to wave impact.

(d) When bracing members are of tubular section, ring frames may be required to maintain stiffness and roundness of shape.

(e) When bracings are watertight, they are to be suitably designed to prevent collapse from external hydrostatic pressure.

D5.4 Wave clearance

D5.4.1 Afloat condition

Unless deck structures are designed for wave impact, to the satisfaction of PRS, reasonable clearance between the deck structures and the wave crests is to be ensured for all afloat modes of operation, taking into account the predicted motion of the unit relative to the surface of the sea. Calculations, model test results, or prototype experiences are to be submitted for consideration.

D5.4.2 On-bottom condition

For on-bottom modes of operation, clearances are to be in accordance with those specified in IACS UR D4.3.4 for self-elevating units.

D5.5 Structural redundancy

D5.5.1 When assessing structural redundancy for column stabilized units, the following assumed damage conditions shall apply:

1. The unit's structure shall be able to withstand the loss of any slender bracing member without causing overall collapse of the unit's structure.
2. Structural redundancy will be based on the applicable requirements of IACS UR D3.3, D3.4, D3.5, and D3.6, except:
   a. maximum calculated stresses in the structure remaining after the loss of a slender bracing member are to be in accordance with IACS UR D3.5 in association with usage factors not exceeding 1.0. This criterion may be exceeded for local areas, provided redistribution of forces due to yielding or buckling is taken into consideration;
   b. when considering environmental factors, a one year return period may be assumed for intended areas of operations. (see IACS UR D3.3.1)

D5.5.2 The structural arrangement of the upper hull is to be considered with regard to the structural integrity of the unit after the failure of any primary girder.
(…)

IACS UR D6/Rev.1 - Surface type drilling units

D6.1 General

D6.1.1 This section applies to the unit type, as defined in *Part I* of the Rules (in IACS UR D2.2.3).

D6.2 Ship type drilling units

D6.2.1 Scantlings of the hull structure are to meet the applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part II - Hull*. Special consideration is, however, to be given to items which may require some deviation or additions to the *Rules*, in particular the items indicated in D6.2.2 to D6.2.5.

D6.2.2 The required strength of the unit is to be maintained in way of the drilling well, and particular attention is to be paid to the transition of fore and aft members so as to maintain continuity of the longitudinal material. In addition, the plating of the well is to be suitably stiffened to prevent damage due to foreign objects which may become trapped in the well while the unit is under way.

D6.2.3 The deck area in way of large hatches is to be suitably compensated where necessary to maintain the strength of the unit.

D6.2.4 The structure in way of heavy concentrated loads resulting from the drilling derrick, pipe rack, set back, drilling mud storage, etc., is to be suitably reinforced.

D6.2.5 Local structure in way of fairleads, winches, etc., forming part of the position mooring system, should be designed to the breaking strength of the mooring line.

D6.3 Barge type drilling units

D6.3.1 Scantlings of the hull structure are to meet the applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part II - Hull*. Special consideration, where applicable, is to be given to items listed in D6.2.

(...)

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3 TOWING OF THE UNIT

3.1 Towing arrangements

3.1.1 The design and arrangement of towing fittings should have regard to both normal and emergency conditions. (MODU Code, 2.8.1)

3.1.2 Arrangements, equipment and fittings should meet the appropriate requirements of the Administration or an organization recognized by the Administration, under paragraph 1.6.5.1 of MODU Code.* (MODU Code, 2.8.2)

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* Refer to the *Guidelines for safe ocean towing* (MSC/Circ.884).

Towing arrangements shall meet the applicable requirements given in Chapter 5 of *Part III, Hull Equipment*, of the *Rules for the Classification and Construction of Sea-going Ships*.

3.1.3 Each fitting or item of equipment provided under this regulation should be clearly marked with any restrictions associated with its safe operation, taking into account the strength of its attachment to the unit's structure. (MODU Code, 2.8.3)

4 FATIGUE STRENGTH

4.1 Fatigue analysis

4.1.1 The possibility of fatigue damage due to cyclic loading should be considered in the design of self-elevating and column-stabilized units. (MODU Code, 2.9.1)

4.1.2 The fatigue analysis should be based on the intended mode and area of operations to be considered in the unit's design. (MODU Code, 2.9.2)

4.1.3 The fatigue analysis should take into account the intended design life of the unit and the accessibility of load-carrying members for inspection. (MODU Code, 2.9.3)

5 MATERIALS AND PROTECTIVE COATNINGS

5.1 Materials

5.1.1 Units should be constructed from steel or other suitable material having properties acceptable to the Administration taking into consideration the temperature extremes in the areas in which the unit is intended to operate. (MODU Code, 2.10.1)

5.1.2 Consideration should be given to the minimization of hazardous substances used in the design and construction of the unit, and should facilitate recycling and removal of hazardous materials*.(MODU Code, 2.10.2)

* Refer to the *Guidelines on ship recycling*, adopted by IMO by resolution A.962(23), as amended (refer to A.980(24)).

5.1.3 For all MODUs, new installation of materials which contain asbestos should be prohibited*. (MODU Code, 2.10.3)

* Refer to the *Unified interpretation on implementation of regulation 2.10.3 of the 2009 MODU Code, regulation 2.8.2 of the 1989 MODU Code and regulation 2.7.2 of the 1979 MODU Code* (MSC.1/Circ.1671).

Refer to the *Guidelines for maintenance and monitoring of materials containing asbestos on board MODUs.* (MSC.1/Circ.1672)

5.1.4 Materials and protective coatings used for the construction of the unit shall meet the applicable requirements specified in *Part IX – Materials and Welding,* of the *Rules for the Classification and Construction of Sea-going Ships*.

5.2 Anti-fouling systems

If anti-fouling systems are installed, they should conform to the requirements of the *International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001*. (MODU Code, 2.11)

5.3 Protective coatings of dedicated seawater ballast tanks

5.3.1 All dedicated seawater ballast tanks should be coated during construction in accordance with the recommendations of the Organization*. For the purpose of this section, pre-load tanks on self-elevating units are to be considered dedicated seawater ballast tanks. Mat tanks and spud cans on such units are not to be considered dedicated seawater ballast tanks. (MODU Code, 2.12.1)

* Refer to *Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers*, adopted by the Maritime Safety Committee by resolution MSC.215(82).

5.3.2 Maintenance of the protective coating system should be included in the overall unit's maintenance scheme. The effectiveness of the protective coating system should be verified during the life of a unit by the Administration or an organization recognized by the Administration, based on the guidelines developed by the Organization. *(MODU Code, 2.12.2)

* Refer to the *Guidelines for maintenance and repair of protective coatings* (MSC.1/Circ.1330).

6 TECHNOLOGY OF PRODUCTION

6.1 Construction portfolio

A construction portfolio should be prepared and a copy placed on board the unit. It should include plans showing the location and extent of application of different grades and strengths of materials, together with a description of the materials and welding procedures employed, and any other relevant construction information. Restrictions or prohibitions regarding repairs or modifications should be included. (MODU Code, 2.13)

6.2 Welding

The welding procedures employed during construction should be to a recognized international standard. Welders should be qualified in the welding processes and procedures utilized. The selection of welds for testing and the methods utilized should meet the requirements of a recognized classification society. (MODU Code, 2.14)

Detailed requirements for welding and weld testing are given in *Part IX, Materials and Welding* of the *Rules for the Classification and Construction of Sea-going Ships.*

6.3 Testing

Upon completion, boundaries of tanks should be tested to the satisfaction of the Administration. (MODU Code, 2.15)

Tightness and strength tests shall be carried out in accordance with the applicable requirements specified in *Publication 21/P - Ship Hull Structure Tests*.

6.4 Drainage and sediment control*

* Refer to the *Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens*, adopted by IMO by resolution A.868(20).

All ballast and preload tanks and related piping systems should be designed to facilitate effective drainage and removal of sediments. Coatings which could entrain sediments and harmful aquatic organisms should be avoided. (MODU Code, 2.16)

7 POSITION KEEPING SYSTEMS OF THE UNIT

IACS UR D3/Rev.6 - General design parameters

(…)

D3.11 Position keeping systems and components

D3.11.1 General

D3.11.1.1 Units provided with position keeping systems equipment in accordance with D3.11 will be eligible to have a special optional notation included in the classification designation in accordance with the policy of PRS.

D3.11.2 Anchoring Systems

D3.11.2.1 General

Plans showing the arrangement and complete details of the anchoring system, including anchors, shackles, anchor lines consisting of chain, wire or rope, together with details of fairleads, windlasses, winches, and any other components of the anchoring system and their foundations are to be submitted to PRS.

D3.11.2.2 Design

D3.11.2.2.1 An analysis of the anchoring arrangements expected to be utilized in the unit's operation is to be submitted to PRS. Among the items to be addressed are:

1. Design environmental conditions of waves, winds, currents, tides and ranges of water depth.
2. Air and sea temperature.

3. Ice conditions (if applicable).
4. Description of analysis methodology.

D3.11.2.2.2 The anchoring system should be designed so that a sudden failure of any single anchor line will not cause progressive failure of remaining lines in the anchoring arrangement.

D3.11.2.2.3 Anchoring system components should be designed utilizing adequate factors of safety (FOS) and a design methodology suitable to identify the most severe loading condition for each component. In particular, sufficient numbers of heading angles together with the most severe combination of wind, current and wave are to be considered, to determine the maximum tension in each mooring line. When a particular site is being considered, any applicable cross sea conditions are also to be considered in the event that they might induce higher mooring loads.

D3.11.2.2.3.1 When the Quasi Static Method is applied, the tension in each anchor line is to be calculated at the maximum excursion for each design condition defined in D3.11.2.2.3.2, combining the following steady state and dynamic responses of the Unit:
(a) steady mean offset due to the defined wind, current, and steady wave forces;
(b) most probable maximum wave induced motions of the moored unit due to wave excitation.

For relatively deep water, the effect from damping and inertia forces in the anchor lines is to be considered in the analysis. The effects of slowly varying motions are to be included for MODUs when the magnitudes of such motions are considered to be significant.

D3.11.2.2.3.2 When the Quasi Static Method outlined in D3.11.2.2.3.1 is applied, the following minimum factors of safety at the maximum excursion of the unit for a range of headings should be considered:

DESIGN CONDITION	FOS (factor of safety)
Operating	2.7
Severe storm	1.8
Operating – one line failed	1.8
Severe storm – one line failed	1.25

where:

FOS = PB/T_{max}

T_{max} = characteristic tension in the anchor line, equal to the maximum value obtained according to D3.11.2.2.3.1

PB = minimum rated breaking strength of the anchor line

Operating: the most severe design environmental condition for normal operations as defined by the owner or designer

Severe storm: the most severe design environmental condition for severe storm as defined by the owner or designer

Operating – one line failed: following the failure of any one mooring line in the operating condition

Severe storm – one line failed: following the failure of any one mooring line in the severe storm condition

When a dynamic analysis is employed, other safety factors may be considered to the satisfaction of PRS.

The defined Operating and Severe Storm are to be the same as those identified for the design of the unit, unless PRS is satisfied that lesser conditions may be applicable to specific sites.

D3.11.2.2.3.3 In general, the maximum wave induced motions of the moored unit about the steady mean offset should be obtained by means of model tests. PRS may accept analytical calculations provided that the proposed method is based on a sound methodology which has been validated by model tests.

In the consideration of column stabilized MODUs, the value of C_S and C_H, as indicated in IACS UR D3.8.2 (in stability requirements), may be introduced in the analysis for position keeping mooring systems. The intent of D3.8.3 – Wind tunnel tests, and of D3.8.4 – Other stability requirements, may also be considered by PRS.

D3.11.2.2.3.4 PRS may accept different analysis methodologies provided that it is satisfied that a level of safety equivalent to the one obtained by D3.11.2.2.3.1 and D3.11.2.2.3.2 is ensured.

D3.11.2.2.3.5 PRS may give special consideration to an arrangement where the anchoring systems are used in conjunction with thrusters to maintain the unit on station.

D3.11.3 Equipment

D3.11.3.1 Windlasse

D3.11.3.1.1 The design of the windlass is to provide for adequate dynamic braking capacity to control normal combinations of loads from the anchor, anchor line and anchor handling vessel during the deployment of the anchors at the maximum design payout speed of the windlass. The attachment of the windlass to the hull structure is to be designed to withstand the breaking strength of the anchor line.

D3.11.3.1.2 Each windlass is to be provided with two independent power operated brakes and each brake is to be capable of holding against a static load in the anchor lines of at least 50 percent of its breaking strength. Where PRS so allows, one of the brakes may be replaced by a manually operated brake.

D3.11.3.1.3 On loss of power to the windlasses, the power operated braking system should be automatically applied and be capable of holding against 50 percent of the total static braking capacity of the windlass.

D3.11.3.2 Fairleads and Sheaves

D3.11.3.2.1 Fairleads and sheaves should be designed to prevent excessive bending and wear of the anchor lines. The attachments to the hull or structure are to be such as to withstand the stresses imposed when an anchor line is loaded to its breaking strength.

D3.11.4 Anchor line

D3.11.4.1 PRS is to be ensured that the anchor lines are of a type that will satisfy the design conditions of the anchoring system.

D3.11.4.2 Means are to be provided to enable the anchor lines to be released from the unit after loss of main power.

D3.11.4.3 Means are to be provided for measuring anchor line tensions.

D3.11.4.4 Anchor lines are to be of adequate length to prevent uplift of the anchors under the maximum design condition for the anticipated area(s) of operation.

D3.11.5 Anchors

D3.11.5.1 Type and design of anchors are to be to the satisfaction of PRS.

D3.11.5.2 All anchors are to be stowed to prevent movement during transit.

D3.11.6 Quality Control

D3.11.6.1 Details of the quality control of the manufacturing process of the individual anchoring system components are to be submitted. Components should be designed, manufactured and tested in accordance with recognized standards insofar as possible and practical. Equipment so tested should, insofar as practical, be legibly and permanently marked with PRS stamp and delivered with documentation which records the results of the tests.

D3.11.7 Control Stations

D3.11.7.1 A manned control station is to be provided with means to indicate anchor line tensions at the individual windlass control positions and to indicate wind speed and direction.

D3.11.7.2 Reliable means are to be provided to communicate between locations critical to the anchoring operation.

D3.11.7.3 Means are to be provided at the individual windlass control positions to monitor anchor line tension, windlass power load and to indicate amount of anchor line payed out.

D3.11.8 Dynamic Positioning Systems

D3.11.8.1 Thrusters used as a sole means of position keeping should provide a level of safety equivalent to that provided for anchoring arrangements to the satisfaction of PRS.

Units with a dynamic positioning system shall meet the requirements specified in *Publication 120/P Requirements for Vessels and Units with Dynamic Positioning (DP) Systems.*

Mooring chains should meet the requirements specified in *Publication 96/P - Offshore mooring chain*.

List of reference IMO documents in *Part II*

Resolutions

1. MSC.133(76): Adoption of technical provisions for means of access for inspections.
2. MSC.158(78): Adoption of amendments to the technical provisions for means of access for inspections.
3. MSC.215(82): Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers.
4. A.864(20): Recommendations for entering enclosed spaces aboard ships.
5. A.868(20): Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens.
6. A.962(23): Guidelines on ship recycling.
7. A.980(24): Amendments to the IMO guidelines on ship recycling.
8. A.1050(27): Revised recommendations for entering enclosed spaces aboard ships.

MSC Circulars

1. MSC/Circ.884: Guidelines for safe ocean towing.
2. MSC/Circ.686/Rev.1: Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers (SOLAS Regulation XI-1/2).
3. MSC.1/Circ.1330: Guidelines for maintenance and repair of protective coatings.
4. MSC.1/Circ.1544: Unified interpretations for the application of chapter 2 of the 2009 MODU Code and the revised technical provisions for means of access for inspections (resolution MSC.158(78)).
5. MSC.1/Circ.1671: Unified interpretation on implementation of regulation 2.10.3 of the 2009 MODU Code, regulation 2.8.2 of the 1989 MODU Code and regulation 2.7.2 of the 1979 MODU Code.
6. MSC.1/Circ.1672: Guidelines for maintenance and monitoring of materials containing asbestos on board MODUs.

List of reference IACS documents in *Part II*

Recommendations (Rec.)

Rec No. 90/Rev.1	Ship Structural Access Manual
Rec No. 91/Rev.3	Guidelines for Approval/ Acceptance of Alternative Means of Access

List of IACS resolutions implemented to *Part II*

Unified Requirements (UR)

D3/Rev.6	General design parameters
D4/Rev.3	Self-elevating drilling units
D5/Rev.3	Column stabilized drilling units
D6/Rev.1	Surface type drilling units
D7/Rev.3	Watertight integrity

Unified Interpretations (UI)

MODU 1/Rev.1/Corr.1	IACS Unified Interpretations for the application of MODU Code Chapter 2 paragraphs 2.1, 2.2, 2.3, 2.4 and revised technical provisions for means of access for inspections (resolution MSC.158(78))