Rules For Classification And Construction

Part 5 Offshore Technology

Volume VI

RULES FOR MOBILE OFFSHORE UNITS

Consolidated Edition 2022

Biro Klasifikasi Indonesia

www.bki.co.id

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Foreword

This Rules is a consolidated edition 2022 of Rules for Mobile Offshore Units Part. 5 - Offshore Technology, Volume VI.

In this edition, there are no new amendment added, only consolidate the 2020 edition and RCN No.1. The summary of previous edition and amendments including the implementation date are indicated in Table below:

	Edition / Rule Change Notice (RCN)	Effective Date	Link
1	Edition 2020	1st January 2021	🔗
2	RCN No.1, November 2021	1st January 2022	🔗

Note : Full previous edition and amendments including its amendment notice is available through link above.

This rules is available to be downloaded at www.bki.co.id. Once downloaded, this Rules will be uncontrolled copy. Please check the latest version on the website.

Further queries or comments concerning this Rules are welcomed through communication to BKI Head Office.

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Section 1 General

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A. General

1. Scope and Application

1.1 The requirements in the Rules are to be applied to the design, manufacture, installation and survey of mobile offshore units classed with BKI or intended to be classed under the BKI. Mobile offshore units (hereinafter referred to as "units" in the Rules) are units or vessels that designed for mobile operation, intended for use in offshore operations and related activities including drilling service. It may not be designed remain at a specific location, and which can be relocated without major dismantling or modification. However, for the restricted service units, special consideration may be given by BKI.

1.2 The classification of mobile offshore units covers of following structural design types:

- Self-elevating units
- Column-stabilized units
- Surface type unit:
  - Ship type unit
  - Barge type unit

1.3 The application of 1.2 may be followed by list service below:

- Drilling
- Pipe and Cable laying
- Well stimulation
- Accommodation
- Floating pier
- Offshore Crane
- Power

1.4 The following materials may be used for the main structure/hull:

- steel, normally
- concrete, in exceptional cases

1.5 The requirements in the Rules are to be considered as minima by the BKI. In addition, particular administration may have regulations which might be in excess of these requirements.

1.6 The BKI is prepared to offer assistance, upon the request of an Owner or designer, in evaluating a specific design against published National regulations.

1.7 The items listed below, where applicable, are covered by the Rules and are subject to approval by BKI.

- Material
- Structural strength
- Welding

- Stability, intact and damaged
- Weathertight/watertight integrity
- Corrosion protection
- Constructional fire protection
- Temporary or emergency mooring equipment
- Positioning Mooring System
- Jacking system
- Propulsion machinery, including shafts and propellers
- Steering gear and rudders
- Auxiliary machinery
- Pumping and piping systems, including valves
- Boilers and pressure vessels
- Electrical installations
- Protection against fire and explosion

2. Equivalency and novel features

2.1 Alternative hull construction, equipment, machinery and their arrangement and scantlings will be accepted by BKI, provided that the BKI is satisfied that such construction, equipment, machinery and their arrangement and scantlings are equivalent to those required in this Rules.

2.2 Units which contain novel features of design, with respect to buoyancy, elevating arrangements, structural arrangements, machinery, equipment, etc., to which the requirements are not directly applicable, may be classed, when approved by the BKI on the basis that the Rules, in so far as applicable, have been complied with and that special consideration has been given to the novel features using technology qualification method or based on the best information available at the time.

3. Exemptions

3.1 The Rules are not to be applied to the following items;

1) Machinery, electrical and piping systems used exclusively for industrial purpose, except in so far as their design or arrangement may affect the safety of the unit.
2) Determination of the adequacy of seabed conditions, regarding bearing capacity, resistance to possible sliding and anchor holding capability.

3.2 The assessment of the required holding capacity, arrangement and operation of position mooring equipment and dynamic positioning equipment used for station-keeping activities in connection with the unit's operation is the responsibility of the Owner, and is not included in the Rules.

B. Definition

No	Item	Definition
1	Type of Unit	Units are classified into the following four groups depending upon their types: 1.1 Self-elevating unit Self-elevating unit is a unit having hulls with sufficient buoyancy to safely transport the unit to the desired location, after which the hull is raised to a predetermined elevation above the sea surface on its legs, which are supported by the seabed. Equipment and supplies may be transported on the unit, or may be added to the unit in its elevated position. The legs of such units may penetrate the sea bed may be fitted with enlarged sections or footings to reduce penetration, or may be attached to bottom pads or mats. 1.2 Column stabilized unit Column stabilized unit is a unit which depends upon the buoyancy of widely spaced columns for floatation and stability for all afloat modes of operation or in the raising or lowering of the unit, as may be applicable. The columns are connected at their top to an upper structure supporting the equipment. Lower hulls or footings may be provided at the bottom of the columns for additional buoyancy or to provide sufficient area to support the unit on the sea bed. Bracing members of tubular or structural sections may be used to connect the columns, lower hulls or footings and to support the upper structure. Operations may be carried out in the floating condition, in which condition the unit is described as a semi-submersible, or when supported by the sea bed, in which condition the unit is described as submersible. A semi-submersible unit may be designed to operate either floating or supported by the sea bed, provided each type of operation has been found to be satisfactory. 1.3 Surface type units 1.3.1 Ship type unit Ship type unit is a seagoing ship-shaped unit having a displacement type hull or hulls, of the single, catamaran or trimaran type, which has been designed or converted for operations in the floating condition. The unit of this type normally has propelling machinery. 1.3.2 Barge type unit Barge type unit is a seagoing unit having a displacement type hull or hulls, which has been designed or converted for operations in the floating condition. The unit of this type normally has no propelling machinery. 1.4 Other type units Units other than those specified in 1.1 to 1.3.2, are to be in accordance with the relevant requirements in this Section and are to be at the discretion of the BKI.

No	Item	Definition
		1.5 Drilling Unit A drilling unit is any unit intended for use in offshore drilling service/operations for the exploration or exploitation of the sub-sea resources.
2	Modes of Operation	A mode of operation is a condition or manner in which a unit may operate or function while on location or in transit. In the requirements of these Rules, the approved modes of operation of a unit are defined as follows: 2.1 Operating condition Operating condition is a condition wherein a unit is on location for purposes of operations, and combined environmental and operational loadings are within the appropriate design limits established for such operations. The unit may be either afloat or supported by the seabed, as applicable. 2.2 Severe storm condition Severe storm condition is a condition during which a unit may be subjected to the severest environmental loadings for which the unit is designed. Operations are assumed to have been discontinued due to the severity of the environmental loadings. The unit may be either afloat or supported by the seabed, as applicable. 2.3 Transit condition Transit condition is a condition wherein a unit is moving from one geographical location to another without any operation of its purpose.
3	Length of Unit (L)	3.1 For self-elevating units and barge type units, length is the distance in metres on the summer load line, between the insides of shell platings at the fore and after ends. 3.2 For column stabilized units, length is the maximum distance in metres between the fore and after ends of the primary hull structure which is projected to the centre line of the hull. 3.3 For ship type units, length is the distance in metres on the summer load line, from the foreside of the stem to the centre of the rudderstock. The length is not to be less than 96% and need not be greater than 97% of the extreme of the length on the summer load line. Where a ship does not have a rudder, length is 96% of the length on the summer load line.
4	Breadth of Unit (B)	4.1 For column-stabilized units, breadth is the horizontal distance in metres measured perpendicularly to the longitudinal centre line at die broadest part of the primary hull structure. 4.2 For self-elevating units, ship type units and barge type units, breadth is the horizontal distance in metres between outsides of frames at the broadest Rules of the hull.

No	Item	Definition
5	**Depth of Unit (H)**	5.1 For column-stabilized units, depth is the vertical distance in metres from the top of bottom plating of the lower hull or footing to the top of beam of the uppermost continuous deck at side measured at the middle of **L**. 5.2 For self-elevating units, ship type units and barge type units, depth is the vertical distance in metres from the top of bottom plating to the top of beam of the uppermost continuous deck at side measured at the middle of **L**.
6	**Moulded draught (T)**	The moulded draught is the vertical distance measured from the moulded base line to the assigned load line. Certain components of a unit's structure, machinery or equipment may extend below the moulded base line.
7	**Moulded base line**	The moulded base line is a horizontal line extending through the upper surface of the bottom plating.
8	**Load Line and Designed Maximum Load Line**	8.1 Load line is the water line corresponding to each freeboard assigned in accordance with the provisions in Section 6. 8.2 Designed maximum load line is the water line corresponding to the designed full load condition.
9	**Design Water Depth**	Design water depth is the vertical distance in metres from the seabed to the mean low water level plus the height of astronomical and storm tides.
10	**Light Ship Weight**	Light ship weight is the weight of the complete unit in tons with all its permanently installed machinery, equipment and outfit, including permanent ballast, spare parts normally retained on board, and liquids in machinery and piping to their normal working levels, but does not include cargo, liquids in storage or reserve supply tanks, items of consumable or variable loads, any allowance for stores, or crew and their effects. The weight of mediums on board for the fixed fire-fighting systems (e.g. freshwater, CO_2, dry chemical powder, foam concentrate, etc.) are to be included in the lightweight.
11	**Design Service Temperature of Materials for Unit**	Design service temperature of materials is the lowest of the average daily atmospheric temperatures, based on meteorological data, for any anticipated area of operation. If data giving the lowest daily average temperature are not available, the lowest monthly average temperature may be used.
12	**Weathertight**	Weathertight means that in any sea conditions water will not penetrate into the unit.
13	**Watertight**	Watertight means that the capability of preventing the passage of water through the structure in any direction under a head of water for which the surrounding structure is designed.

No	Item	Definition
14	**Downflooding**	Downflooding means any flooding of the interior of any Rules of the buoyant structure of a unit through openings which cannot be closed watertight or weathertight, or which are required for operational reasons to be left open in all weather conditions, as appropriate for the intact and damage stability criteria.
15	**Control Station**	Control station is a space where radio equipment, main navigational equipment or emergency source of power is located and control panels for posture or position control equipment, leg elevation control equipment, central fire detection or central fire alarm devices are installed.
16	**Non-self-propelled unit**	Non-self-propelled unit is the unit which has no propulsion machinery or designed to be towed or pushed by other ships when the unit voyages through the ocean normally even if the unit has propulsion machinery.
17	**Self-propelled unit**	Self-propelled unit is the unit other than non-self-propelled unit.
18	**Mobile mooring**	A mooring system, generally retrievable, intended for deployment at a specific location for a short-term operation (normally less than 5 years).
19	**Permanent mooring**	A mooring system normally used to secure floating structures deployed for long-term operations (typically more than 5 years or for fixed location), such as floating units for production and/or storage, through their design life.
20	**Restricted service**	Unit whose navigation route or operating area is other than unrestricted service in accordance with Guidance for Class Notation (Pt.0, Vol.B), Sec.1.F
21	**Further definition**	For further definitions see Rules for Classification and Surveys (Pt.5, Vol.I) Sect. 1,B.

Section 2 Classification and Surveys

A. General 2–1
B. Character of Classification and Class Notations 2–1
C. Classification Survey During Construction 2–2
D. Classification Survey of Units not Built under Survey 2–12
E. Surveys After Construction 2–13

A. General

1. Application

1.1 Class Surveys of mobile offshore units, specified in this Rule are to be in accordance with the requirements of this Section.

1.2 In the case of items not specified in this Section, the requirements specified in Rules for Classification and Survey of Offshore Technology (Pt.5, Vol.I) are to be applied.

1.3 For the units which are applied to this Rule and are integrated as one system by multiple number of the units with the same construction, dimensions and arrangements and onshore installations, Class Surveys are to be in accordance with the requirements of this Section as per each unit.

1.4 In class Surveys of the units having a periodically unattended machinery space, attention is to be paid to compliance with the requirements of Rules for Automation (Pt.1, Vol.VII).

1.5 For the units which comply with the requirements of this Section are also to comply with of the country in which the unit is registered.

B. Character of Classification and Class Notations

1. The units complying with this Rules will be assigned with class designations in accordance with Guidance for Class Notation (Pt.0, Vol.B), Sec.1 as applicable.

- construction symbol
- class symbol
- anchoring equipment symbol
- service area symbol
- ship type notation
- special notation and/or additional notation

2. Ship type notation for Mobile Offshore Unit classified into two main group including special notation as follows:

1) Drilling Unit:
   - **Self-Elevating Drilling Unit**
   - **Column Stabilized Drilling Unit**
   - Surface Drilling Unit:
     - **Drilling Vessel**
     - **Drilling Barge**

2) Specific Offshore Unit Type:
   - **Self-Elevating Unit**, with special notation:
     - **Accommodation**
     - **Offshore Crane**
   - **Column Stabilized Unit**, with special notation:
     - **Accommodation**
     - **Offshore Crane**
     - **Cable Layer**
     - **Pipe Layer**
   - Surface Unit
     - **Special Service Ship** or **Barge,** with special notation :
       - **Accommodation** (for Barge only)
       - **Cable Layer**
       - **Pipe Layer**
       - **Well Stimulation**
       - **Offshore Crane**
       - **Power Service**
     - **Pontoon,** with special notation :
       - **Floating Pier**

Detail description of the notations unit above, please see Guidance for Class Notation (Pt.0, Vol.B), Sec.2.T.1 and T.2. For additional notation see Guidance for Class Notation (Pt.0, Vol.B), Sec.3.A.12, and B.7.

C. Classification Survey During Construction

1. General

In the Classification Survey during construction, surveys are to be carried out on hull construction, equipment, machinery, construction of fire protection, means of escape, fire extinguishing arrangements, electrical installations, stability, load line and mooring system and equipment in order to ascertain that they meet the relevant requirements of this Rules.

Examination or verification of the following will be undertaken by BKI:

- design documents, such as load assessment and stress analyses (as far as applicable), reports on model tests, design drawings
- practical qualifications of manufacturing firms and personnel suitability of the materials used, see Rules for Approval of Manufacturers and Service Suppliers (Pt.1, Vol.XI)
- erection procedure of the structure on land and at the port
- transportation procedures and jack-up procedure, if applicable
- critical review of safety management system, see 4.

2. Submission of Plans and Documents for Approval

In the Classification Survey during construction, plans and documents as listed in the following 2.1 to 2.3 are to be submitted in electronic format for review and approval by BKI before the work is commenced.

The general scope of plans and documents is defined in 2.1 to 2.3, the detailed scope will be defined case by case. BKI reserve the right to demand additional documentation if that submitted is insufficient for an

assessment of the unit or essential parts thereof. This may especially be the case for plants and equipment related to new developments and/or which are not tested on board to a sufficient extent.

Once the documents submitted have been approved by BKI they are binding on the execution of the work. Subsequent modifications and extensions require the approval of BKI before becoming effective.

2.1 Plans for the hull and design data

2.1.2 These plans are to include the following, where applicable:

1) For ship type unit and barge type unit;
   a) General arrangement;
   b) Transverse sections, Amidships section, and Typical Section showing scantlings;
   c) Construction profile, Longitudinal section showing scantlings;
   d) Shell expansion;
   e) Bottom and deck construction;
   f) Construction of beams, pillars and longitudinal girders under the deck;
   g) Construction of single bottoms or double bottoms and deck construction including details of helicopter deck, openings such as hatchways, wells, etc.;
   h) Construction of watertight and oiltight bulkheads and deep tanks indicating the heights of the highest parts of tanks and the tops of overflow pipes;
   i) Construction of stem, stern frame, propeller post and rudder;
   j) Construction of superstructures and deckhouses including their end bulkheads;
   k) Seatings of main engines, boilers;
   l) Construction of machinery rooms, pump rooms and motor rooms including their casings and shaft tunnels;
   m) Masts, mast houses and construction of cargo handling machinery and gear and winch platforms; Arrangements and construction of watertight doors, hatchways, side scuttles and closing appliances of openings;
   n) Construction of fire protection with materials used in the construction of superstructures, bulkheads, decks, deckhouses, trunks, stairways, deck coverings, etc., and arrangement of closing appliances of openings and means of escape;
   o) Details of welding procedures ;
   p) Details of painting and corrosion control procedures ;
   q) Stability information booklet;
   r) Loading manual, where the loading manual is to be provided in accordance with the requirement of Section, 5 C.1.2,
   s) Temporary mooring arrangements and towing arrangements
   t) Arrangements and construction of positioning systems
   u) Plan indicating design loadings for all decks;
   v) Details of docking plan and in-water inspection procedures.
   w) Methods and locations for non-destructive testing
2) For self-elevating units ;

   Construction of all legs, leg connections to bottom mats or spud cans, leg tank and leg jacking or other elevating systems, in addition to the relevant plans or documents specified in 1).

3) For column stabilized units ;

Construction of all columns, lower hull, upper hull, bracings, footings, in addition to the relevant plans or documents specified in 1);

4) Other plans and/or documents deemed necessary by BKI.

2.1.2 Plans and documents specified in 1) to 3) above are to indicate in detail the quality of materials used, scantlings and arrangements of structural members, their attachments, clearance between the bottom of boilers and the top of floors, and other particulars necessary for examination of proposed constructions.

2.1.3 In addition an arrangement plan of watertight compartments shall be submitted as early in the design stage as possible, for review of damage stability. This drawing is to indicate the watertight bulkheads, decks and flats and all openings therein. Doors, hatches, ventilators, etc. and their means of closure, are to be indicated. Piping and ventilation systems shall be shown in sufficient detail to evaluate their effects on the watertight integrity after incurring damage.

2.2 Plans for machinery and electrical equipment and design data.

2.2.1 Plans are to be submitted showing the arrangement and details of:

1) Machinery arrangement of machinery spaces, pump arrangements, auxiliary machinery arrangement, and diagrams or internal communication systems including a diagram for an engineers' alarm system;
2) For Machinery installations used for the system or the equipment essential for the safety of the unit or for the propulsion of the unit (only applicable to the unit which has the main propulsion machinery); plans and documents required in the relevant Section in Rules for Machinery Installations (Pt.1, Vol. III and Pt.5, Vol.IV).
3) For machinery installations used solely for the operation which is the purpose of the unit: plans and documents specified in Rules for Machinery Installations (Pt.1, Vol.III) Sec. 2, B, Sec. 7 and Sec. 8, and piping diagram for oil including fuel oil, lubricating oil, hydraulic oil, among the piping diagrams specified in Rules for Machinery Installations (Pt.1, Vol.III) Section 11 and Rules for Machinery Installations (Pt.5, Vol.IV) Sec. 13d and Sec.13.e.
4) Fire extinguishing arrangement fire detection, monitoring systems and alarm systems;
5) For self-elevating units;

Construction and control diagrams of jacking system;

6) For the units provided with the dynamic positioning system;

Construction and control diagrams of dynamic positioning system;

7) Plans and documents for electrical installations specified in Rules for Electrical installations (Pt.1, Vol.IV and Pt.5, Vol.V) Sec. 1, C.
8) Other plans and/or documents deemed necessary by BKI.

2.3 Plans and documents for reference

2.3.1 The following data and calculations are to be submitted in conjunction with the scantling plans, as may be applicable:

1) Specifications;
2) Structural analysis and calculation for relevant loading condition;
3) Data or documents on environmental conditions used for determination to design loads, which indicates in detail the measurement data of the past in service area or navigation area such as winds, waves, etc., the effects of wave breakers, methods of towing and so on, and calculation method of

total external force and moment due to winds, waves, currents and tidal currents, reaction of mooring or positioning systems and other loads;

4) Documents on the effect of loading, stability and projected area due to icing or snowing, if any;

5) Stability calculations, both intact and damaged, over the appropriate range of drafts, including the transit conditions;

6) Relating to the requirements of 3) to 5) above, documents on where the loads and stability are determined using appropriate model tests or computing methods are carried out;

7) Calculation of significant operational loads from derrick, and associated equipment, such as riser tensioners, on supporting structures, and other similar type significant loadings;

8) For self-elevating units, calculations substantiating adequacy of structure to transmit forces between legs and hull through the jacking or other elevating systems;

9) For the units which are embedded on the sea bottom, calculation of the unit`s ability to resist overturning;

10) Cross curves of stability;

11) Curves of righting moment and wind heeling moment;

12) Capacity plans and sounding tables of tanks;

13) Plans indicating arrangement of watertight compartments, openings, their closing, their closing appliances, etc. necessary for calculation of stability;

14) For machinery installations used for safety of the unit or for the propulsion of the unit (only applicable to the unit which has the main propulsion machinery): plans and documents required in the relevant Section in Rules for Machinery Installations (Pt.1, Vol. III and Pt.5, Vol.IV).;

15) For machinery installations used solely for the operation which is for the purpose of the unit: plans and documents indicating safety devices of machinery installations and those specified in Rules for Machinery Installations (Pt.1, Vol.III) Sec. 2, B, Sec. 7 and Sec. 8;

16) Plans and documents for electrical installations specified in Rules for Electrical installations (Pt.1, Vol.IV and Pt.5, Vol.V) Sec. 1, C;

17) Operating instruction (Operating and Construction booklet) defined in 3.

18) Calculation sheets on mooring systems or dynamic positioning systems;

19) Procedures of sea trial and stability experiments, testing procedure of the dynamic positioning systems, in case where the unit is provided with a dynamic positioning system;

20) Hazardous areas plan

21) Arrangement plans of safety devices and equipment, e.g. fire extinguishing plan, escape routes, life-saving appliances, structural fire protection

22) Safety management plans, where applicable

23) Other plans and/or documents deemed necessary by BKI.

2.3.2 Submitted calculations are to be suitably referenced. Results from relevant model tests or dynamic response calculations may be submitted as alternatives or as substantiation for the required calculations.

2.3.3 The choice of computer programs according to the “State of the Art“ is free. If the computer programs to be used are not known to BKI, they may be checked by BKI through comparative calculations with pre-defined test examples. Reference applications, already achieved approvals by other institutions and other relevant information shall be provided in advance. A generally valid approval for a computer program is, however, not given by BKI.

The calculations have to be compiled in a way which allows to identify and check all steps of the calculations with regard to input and output in an easy way.

Comprehensive quantities of output data shall be presented in graphic form. The main conclusions resulting from the calculations has to be provided.

2.4 Further details

The necessary documentation is indicated in further detail in the relevant Rules and Sections.

2.5 Notwithstanding the requirements in 2.1 to 2.3, submission of plans and documents specified in 2.1 to 2.3 may be omitted partially in accordance with the provisions specified by BKI and in case where the unit or machinery is intended to be built at the same manufacturer's work based on the plans and documents which have been approved for other units.

2.6 Plans and documents may be subject to examination by BKI prior to the submission for the classification of the unit in accordance with the provisions specified by BKI.

3. Operating Instruction

3.1 Operating Manual (Booklet)

An Operating Booklet is to be provided for each unit to the satisfaction of the BKI and its copy is to be submitted to the BKI. The Booklet is to include the following information, as applicable to the particular unit, so as to provide suitable guidance to the operating personnel with regard to safe operation of the unit:

1) General description of the unit;
2) Pertinent data for each approved mode of operation, including design and variable loading, environmental conditions, draught, etc.;
3) The lowest temperatures of atmosphere and sea water assumed at the design stage;
4) General arrangement showing watertight compartments, closures, vents, allowable deck loadings, etc.;
5) Hydrostatic curves or equivalent data;
6) Capacity plan showing capacities of tanks, centres of gravity, free surface corrections, etc.;
7) Instructions for operation, including precautions to be taken in adverse weather, changing mode of operation, any inherent limitations of operation, etc.;
8) Plans and description of the ballast system and instructions for ballasting. If permanent ballast is to be used, the weight, location and substance used are to be clearly indicated;
9) Piping diagrams of fuel oil transfer systems;
10) Hazardous areas plan;
11) Fire control plan;
12) Arrangement of life-saving appliances together with escape routes;
13) Light ship data based on the results of an inclining experiment, etc.;
14) Stability information in the form of maximum KG versus draught curve, or other suitable parameters based upon compliance with the required intact and damaged stability criteria;
15) Representative examples of loading conditions for each approved mode of operation together with means for evaluation of other loading conditions;
16) Diagrams of main and auxiliary wiring systems;
17) Details of emergency shut-down procedures for electrical equipment;
18) Identification of the helicopter assumed in the design of the helicopter deck;
19) Instruction for operation of mooring systems

20) Instruction for operation of dynamic positioning system;

21) Other instructions deemed necessary by BKI.

3.2. Construction Portfolio (Booklet)

A set of plans showing the exact location and extent of application of different grades and strengths of structural materials, together with a description of the material and welding procedures employed, is to be placed aboard the unit. Any other relevant construction information is to be included in the booklet, including restrictions or prohibitions regarding repairs or modifications.

3.3 The operating instructions will be subject to examination within the design review procedure only in so far as they are related to the specified loads and load cases to be applied, and to other safety matters covered by these Rules.

4. Safety management system

4.1 Safety management procedures[1], may be subject to review by BKI either

1) based on an agreement with the owner/operator, or
2) due to authorization and request by the competent national Administration.

4.2 Safety management may be related to

1) personal safety of operating personnel, i.e.
   – accident prevention
   – protection against exposure to toxic, radioactive or otherwise harmful substances
   – general preventive and health control measures (alcohol, drugs control, etc.)
2) protection of the environment (sea, sea floor, atmosphere surrounding the installation)
3) operational safety/operability of the technical installations/systems on board

Obviously, an interrelation exists with the operating manual according to 3., see also 4.4 and 4.6.

4.3 Safety Management Plan

4.3.1 Safety management procedures shall be presented in the form of a Safety Management Plan (SMP), to be set up in each individual case, bearing in mind the particular operational and environmental conditions to be expected as well as the applicable legislation and regulations.

4.3.2 Preparation of a SMP will essentially consist in an assessment of all foreseeable risks emerging from the planned activities, and in providing measures and procedures to minimize these risks. The assessment will be based on existing experience and statistical information regarding similar installations and activities. Proven methods of risk and failure analysis including e.g. Fault-Tree or Event-Tree diagrams may be used.

4.3.3 Corrective measures and amendments to the plan may be required following experience gathered during the initial service period, see also 4.4.

4.3.4 The SMP should take into account separately all relevant operational phases and situations and their specific risks, such as

– initial (start-up, test) period(s), also following important changes

[1] See IMO ISM (International Safety Management) procedures.

- normal ("routine") operations
- operations under restricting conditions, e.g.
  - due to extreme environmental impact
  - during repairs, conversions, etc.
  - periods following an accident or failure

4.4 Essential elements of a SMP

4.4.1 The SMP shall clearly show, through adequate procedures and organizational provisions, that

- routine controls, checks, measurements etc. are provided in order to ensure that physical properties and chemical processes remain stable and within prescribed limits, e.g. critical gas concentrations, exposure limits, pressures, ppm values functioning of alarms
- information and training of personnel is ensured, taking into account also possible language problems, like information on danger zones, “hazardous areas“ , alarms; handling of fire fighting and rescue equipment, etc.
- national regulations have been considered
- any (new) hazards becoming known, not taken into account or not sufficiently covered in the original plan, will be evaluated and duly incorporated in a revised SMP
- communication between operating personnel and responsible company management is ensured, including immediate and reliable information on special/ abnormal incidents or events defined in the SMP, see 4.4.2. In relevant cases information to Authorities and BKI is ensured.
- for any abnormal situations, e.g. repairs requiring operational restrictions, the necessary additional precautions are taken and any person possibly involved is aware of the existing danger

4.4.2 The SMP shall indicate follow-up measures and procedures for each case of failure or incident considered. Responsibilities shall be clearly attributed to members of the crew/installation personnel within each contingency procedure, and the paths or chains of information clearly stated for the different cases.

4.4.3 For the unit in service, it shall be guaranteed by regular, and possibly additional, unprecedented, checks, audits etc., that the measures provided by the SMP are actually being observed.

Relevant documentation is to be kept on board and/or in the Operator’s headquarters for a period to be defined by the Administration, but not less than 5 years.

4.5 Types of hazards

Among aspects to be considered in assessing risks are the following:

4.5.1 Hazards to personnel

- explosion, fire
- exposure (through contact, inhalation, ingestion) to toxic, irritant or otherwise harmful gases, liquids, chemicals etc.
- accidents due to operations with lifting gear/appliances and machinery or tools
- accidents due to environmental influences (icing, unit’s motions, bad visibility etc.)
- noise/vibrations exceeding given ("tolerable") limits

4.5.2 Hazards to the environment:

- spills/loss of polluting (toxic or otherwise harmful) substances during "normal" e.g., drilling operations to the sea or sea floor, see 4.6.2
- spills of hydrocarbons, chemicals etc. during transport/conveyance operations, see 4.6.1
- collision and grounding hazard, depending on weather and traffic conditions
- release of polluting (e.g. exhaust) gases to the atmosphere, see 4.6.2
- dropping of objects (e.g. wastes) to the sea/sea floor, see 4.7
- noise exceeding prescribed limits; may be relevant in certain cases, e.g. in sensitive, protected areas

4.6 Pollution prevention during production and transport activities

4.6.1 Transport/conveyance and storing operations

4.6.1.1 Loading and unloading operations, e.g. using transport (supply) vessels and cargo handling equipment, shall be carried out observing weather imposed restrictions, see "operating instructions", and applicable safety and environment protection regulations.

4.6.1.2 For the conveyance of oil/hydrocarbon products from a production unit to a (shuttle) tanker, using articulated piping, swivels, flexible hoses etc., special pre-cautions e.g., emergency shutdown and spill arresting devices may be necessary, depending on environment conditions and regulations applicable to the location.

For import/export flow lines (hydrocarbons production) see also 4.6.2.

4.6.1.3 Any harmful substances subject to controlled handling shall be allocated to defined, properly sheltered and marked spaces. Liquids or substances capable of releasing harmful liquids under certain conditions shall be stored in such a way that spills are prevented.

4.6.1.4 Reception/receiving, use/consumption and return/un-loading of harmful or polluting substances shall be constantly controlled and their volumes or weight noted.

4.6.2 Production and treatment processes

4.6.2.1 Suitable controls using measuring and monitoring techniques shall be provided to ensure safe conveyance of hydrocarbons and other polluting substances to and from the offshore unit, through flow lines, risers, hoses, etc.

4.6.2.2 For safe conveyance/transport of liquid and gaseous substances on board of the production unit, between the different processing stations, the provisions of Rules for Machinery Installations (Pt.5, Vol.IV) and Rules for Electrical Installations (Pt.5, Vol.V) have to be observed (material selection, design requirements, safety, monitoring and alarm devices, etc.).

4.6.2.3 Waste water, in connection with the production process, shall be either collected in storage tanks and discharged via auxiliary vessels or pipeline, or if allowed by the competent Authority pumped to the sea after prescribed treatment/purification and under controlled conditions (monitoring of ppm values).

4.6.2.4 Release of gaseous substances to the atmosphere, including flaring operations, shall occur under controlled conditions and according to the applicable regulations. Un-intentional escape of gases (leakage), particularly in hazardous areas and to accommodation spaces, shall be avoided by pre-cautions such as suitable arrangement of piping, ducts and exhaust openings/intakes, sensors/measuring devices and alarms, pressurizing, according to the Rules, see Rules for Machinery Installations (Pt.5, Vol.IV) and Rules for Electrical Installations (Pt.5, Vol.V).

4.7 Waste management

4.7.1 For sewage waste water the same applies as stated under 4.6.2.3 for waste water originating from the production process. The sewage residues shall be discharged or transported to corresponding installations onshore.

4.7.2 Generally, no solid wastes whatever (sanitary, food processing, production auxiliary materials such as for cleaning, etc.) shall be dumped from an offshore unit. Crew information and strict adherence shall be ensured by suitable measures such as publication (posters), regular instruction and supervision.

5. Supervision of Fabrication and Installation

5.1 General

51.1 Supervision of the fabrication of individual components and of the installation of the hull will generally take the form of inspections by the authorized BKI Surveyor to the extent considered necessary by BKI at any given time.

5.1.2 BKI Branch Offices will receive, for their supervisory work, previously examined, documents from the Head Office. Additionally all technical documents connected with the relevant construction project shall be made available to the Surveyors on request.

5.1.3 BKI will assess the production facilities and procedures of the yard and other fabricators as to whether they meet the requirements of BKI Rules. In general, approvals based on such assessments are conditional for acceptance of products subject to testing.

5.1.4 Materials, components, appliances and installations subject to inspection are to comply with the relevant rule requirements and be presented for inspection and/or construction supervision by BKI Surveyors, unless otherwise provided as a result of special approvals granted by BKI.

5.1.5 It shall be the duty of the fabricator to inform the competent inspection office of the completion of important stages of the construction or of trials and inspections due.

5.1.6 In order to enable the Surveyor to fulfil his duties, he is to be given free access to the unit and the workshop, where parts requiring approval are fabricated, assembled or tested. For performance of the tests required, the yard or fabricators are to give the Surveyor every assistance by providing the staff and equipment necessary for such tests.

5.2. Supervision of fabrication

5.2.1 Aim of supervision

During the phase of fabrication of an unit BKI will ensure by surveys and inspections that:

- parts for hull and machinery and/or special equipment requiring approval have been constructed incompliance with the approved drawings and particulars
- all tests and trials stipulated by BKI Rules are performed satisfactorily
- workmanship is in compliance with current engineering standards and/or BKI Rule requirements
- welded parts are produced by qualified welders having undergone tests
- test Certificates have been presented for components requiring approval (the fabricator will have to ensure that any parts and materials requiring approval will only be delivered and installed, if the appropriate test Certificates have been issued)
- where no individual Certificates are required, type tested appliances and equipment are employed in accordance with rule requirements

5.2.2 Marking and attestation of individual components

.1 In so far as it is necessary to identify materials or components during the fabrication process or possibly also after commissioning, e.g. because of special properties of the material, a permanent mark is to be made by means of a stamp.

.2 The construction supervision, survey and/or final inspection of materials, parts supplied or installation components, corresponding to the relevant specifications and BKI Rules, will be attested by the Surveyor concerned on special forms, or informally, as agreed in the individual case.

5.3 Industrial equipment

Regarding working gear and special equipment, supervision of construction and testing will be agreed upon from case to case.

6. Testing and Commissioning

6.1 Program

An overall test or commissioning program including the complete, combined function of the unit as well as partial tests of the different systems has to be established. The detailed requirements for the overall function and the functioning of the different systems are defined in the following Sections. The test program has to be approved by BKI. For reference see Guidance for Approval and Type Approval of Materials and Equipment for Marine Use (Pt.1, Vol.W).

6.2 Tests at fabricators

As far as practicable, machinery and equipment will be subjected to operational trials on the fabricator's test bed to the scope specified in the Rules for Machinery Installations (Pt.5, Vol.IV), Sec.3.E.3. This applies also to engines produced in large series. Where the machinery, equipment or electrical installations are novel in design or have not yet sufficiently proved their efficiency under actual service conditions on board ships or units, BKI may require performance of a trial under particularly severe conditions.

Upon completion of work, compartments, decks, bulkheads, etc. are to be tested as specified in the following Volumes and Sections.

6.3 Hydrostatic and Watertight Tests

6.3.1 Hydrostatic and watertight tests in the Classification Survey during construction are to be in accordance with the following:

1) Hull and equipment
   - Hydrostatic tests or watertight tests are to be carried out after all work in connection with water tightness are completed but before painting, in accordance with the requirements specified in in Rules for Classification and Survey (Pt.1, Vol.I) Annex A.6. Where a painting is applied to the internal structure, the hydrostatic test may be carried out after the painting, provided that all visual inspection of the welding and construction is completed prior to the application of the painting;
   - A part or all of the hose tests may be dispensed with at the discretion of BKI;
   - Watertight tests may be replaced by airtight tests at the discretion of BKI, provided that certain tanks designated by BKI are to be subjected to hydrostatic tests specified in Rules for Classification and Survey (Pt.1, Vol.I) Annex A.6, afloat;

2) Machinery Installations

Hydrostatic, leakage or airtight tests are to be carried out as specified in each Section of Rules for Machinery Installations (Pt.1, Vol. III and Pt.5, Vol.IV) in relation to the kind of machinery.

6.3.2 Notwithstanding the requirement in 6.3.1.1), where considering the design condition and these are approved by BKI, hydrostatic and watertight tests are to be appropriate to BKI.

6.3.3 Pressure test of rupture hatches is to be carried out over the pressure of 1,2 times of vacuum relief valve setting pressure provided with storage unit.

6.4 Sea Trials

Upon completion of the unit and/or the system/ equipment to be classed, all structure/hull, machinery and electrical installations will be subjected to operational trials in the presence of the BKI Surveyor, prior to and during the sea trial. The following tests corresponding to the type of unit are to be carried out during the sea trial in addition to the relevant test items of sea trials specified in Rules for Classification and Survey (Pt.5, Vol.I) Sec.1.G.1.4.

1) For self-elevating units, elevating and lowering test of legs and decks and function tests of their safety devices, and in case where legs are not provided with bottom mats, pre-loading tests on each leg to the load as near as possible to that considered in the strength calculation specified in Section 5, A.2.1, A.2.2
2) For column stabilized units, function test of ballast system.
3) For the unit with a dynamic positioning system, performance test of the dynamic position system.

6.5 Stability Experiments

6.5.1 The stability experiments of the unit are to be carried out upon completion of the unit. In addition, a stability information booklet prepared on the basis of the particulars of stability determined by the results of stability experiments is to be approved by BKI, and provided on board.

6.5.2 The stability experiments of an individual unit may be dispensed with, provided that available stability data is obtained from the stability experiments of a similar unit and approval is given by BKI. However, the stability experiments for a column stabilized unit are to be carried out even though the stability data is available from a similar unit.

6.6 Report

A test or commissioning report has to be established by the fabricator or owner and to be agreed with the BKI Surveyor.

6.7 Corrective actions

If the tests according to the established test program, see 6.1, are partially or totally not satisfactory to the BKI Surveyor, corrective actions have to be provided by the fabricator or owner and the relevant part of the tests repeated until a satisfactory result has been reached.

D. Classification Survey of Units not Built under Survey

1. General

1.1 In the Classification Survey of units not built under BKI`s survey, the actual scantlings of main parts of the units are to be measured in addition to such examination of the hull, equipment, machinery

installations, construction of fire protection, means of escape, fire extinguishing arrangement, electrical installations, stability, load lines and positioning systems as required for the Class Renewal Survey corresponding to the units' age in order to ascertain that they meet the relevant requirements in this Rules. See also Rules for Classification and Survey (Pt.5, Vol.I), Sec.1.G.2.

1.2 The units intended to be surveyed in accordance with 1.1, necessary plans and documents as required for the Classification Survey during Construction are to be submitted for the approval by BKI.

2. Tests

2.1 Hydrostatic test, watertight tests, leak tests, and hose tests, etc are to be carried out in accordance with the requirements in C.6.3.

2.2 Sea trials are to be carried out in accordance with the requirements in C.6.4. However, the sea trials may be dispensed with provided that sufficient information based on previous tests is available and neither alterations nor repairs affecting the sea trials have been made after the previous trials.

2.3 The stability experiments are to be carried out in accordance with the requirements in C.6.5. Where sufficient information based on previous stability experiments is available and neither alteration nor repair affecting the stability has been made after previous experiments, the stability experiments of the unit may be dispensed with. However, the stability experiments for a column stabilized unit which may be required where deemed necessary by BKI even though the stability data is available from a similar units.

E. Surveys After Construction

1. General

1.1 All units classed with BKI are to be subjected to the following surveys to maintain the classification:

1) Periodical Survey:
   a) Annual Survey;
   b) Intermediate Survey;
   c) Class Renewal Survey;
   d) Docking Survey;
   e) Propeller Shaft and Stern Tube Shaft Survey; and;
   f) Boiler and Thermal Oil Heater Survey.
2) Non-Periodical Survey:
   a) Damage Survey;
   b) Repairs
   c) Lay-up and Reactivation Surveys
   d) Alterations Surveys
   e) Survey for towage or voyage over sea
   f) Welding and Replacement of Materials

1.2 Interval of periodical surveys, all examinations and tests in 1.1 are to be in accordance with the requirements in Rules for Classification and Survey (Pt.5, Vol.I) Sec.3.I and are to be carried out to the satisfaction of the Surveyor.

2. Preparation Surveys

Requirement for safe conduct of survey is to be in accordance with Rules for Classification and Surveys (Pt.5, Vol.I) Sec.3.I.A.6

Section 3 Hull Construction and Equipment

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A. General

1. Hull construction and equipment of units fixed on the seabed or positioned for short-term operation are complied with the requirements in Section 4 to 6 in addition to the requirements in this Section, and further, the requirements in Section 9 to 10 according to the type of unit and those in Section 8 and 12 according to the purpose of unit. Where, however, the service area, operation area or operation season is restricted, the construction and equipment of the unit may be suitably modified, based on its condition under the approval of BKI.

2. Unless otherwise specially specified in this rules, the relevant requirements specified in Rules for for Hull (Pt.1, Vol.II) is correspondingly applied.

B. Material

1. General

1.1 Materials used for hull construction, and equipment (anchor, anchor chain, etc.) such as rolled steels, steel castings, steel forgings, etc. are to comply with the requirement of the Rules for Materials (Pt.1,Vol.V).

1.2 Materials having characteristics differing from those specified in this Rules and above mentioned Rules may be used when the detailed design data and their use are approved by BKI. In this case, detailed data relating to the process of manufacture, the way of using, etc. of those are to be submitted for 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.

1.3 The kinds of rolled steels are given in Table 3.1. Material factor "k" due to kind of steel, corresponding to tensile strength used in calculation of rolled steel hull scantlings are given in Table 3.2.

1.4 Application of steels for structural members for hull are given in Table 3.3 to 3.5, where the design service temperature of material is lower than -50°C and plate thickness is exceeding to 50 mm, however, applied steels are to satisfactory to BKI.

1.5 Consideration is to 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. (Refer to the Guidelines on ship recycling, adopted by IMO Res. A.962(23)).

1.6 Materials which contain asbestos is to be prohibited.

Table 3.1 Category of Rolled Steels for Hull

Kind of Steel	Symbol Specified in the Rules for Materials (Pt.1,Vol.V)	Symbols specified in this Rules	Requirements (Chemical and Mechanical Properties,etc.)
Normal Strength	KI-A KI-B KI-D KI-E	A B D E	Rules for Materials (Pt.1,Vol.V) Sec.4,B
Higher Strength	KI-A 32/36/40	AH	
	KI-D 32/36/40	DH	
	KI-E 32/36/40	EH	
	KI-F 32/36/40	FH	
High Strength quenched and tempered	KI-A 420/460/500 550/620/690	AQ_1 AQ_2	In general to comply with Rules for Materials (Pt.1,Vol.V) Sec.4,D
	KI-D 420/460/500 550/620/690	DQ_1 DQ_2	
	KI-E 420/460/500 550/620/690	EQ_1 EQ_2	
	KI-F 420/460/500 550/620/690	FQ_1 FQ_2	

Table 3.2 Material Factor (k)

Kind of Steels	Symbols of Materials		k
Normal Strength	A B D E		1,0
Higher Strength	AH, DH, EH AH, DH, EH AH, DH, EH	32 36 40	0,78 0,72 0,66
High Strength quenched and tempered	AQ_1, DQ_1, EQ_1, FQ_1 AQ_1, DQ_1, EQ_1, FQ_1 AQ_1, DQ_1, EQ_1, FQ_1 AQ_2, DQ_2, EQ_2, FQ_2 AQ_2, DQ_2, EQ_2, FQ_2 AQ_2, DQ_2, EQ_2, FQ_2	420 460 500 550 620 690	To be specially considered by BKI

2. Categories of structural members

2.1 For self-elevating units and column stabilized units

Structural members of self-elevating units and column stabilized units are to be grouped into the following three material application categories according to the design, as following 2.1.1 to 2.1.3.

2.1.1 Primary structural members

Structural members essential to the overall integrity of the unit, such as columns, legs, bracings, lower hulls, footings, bottom mats, shell plating of leg tanks, decks, main deck girders, and so on.

2.1.2 Secondary structural members

Structural members of minor importance failure of which is unlikely to affect the overall integrity of the unit, such as internal structural members of primary members specified in 2.1.1 and other members.

2.1.3 Special portions of structural members

Special portions of the primary structural members specified in 2.1.1, such as junctions which are specially important in structural view point or in way of stress concentration and so on.

2.2 For structural members of surface type units.

2.2.1 Primary structural members

Sheer strake, deck stringer, bilge strake, hatch corner in way of stress concentration part which are outer 0,4**L** but within 0,6**L** amidships and primary structural members except those specified in 2.2.3 such as bottom plating, side plating, deck plating, longitudinal on deck, etc. within 0,4**L** amidships.

2.2.2 Secondary structural members

Inner members of those specified in 2.2.1 and stern frame, rudder plate, etc., and sheer strake, deck stringer, bilge strake, hatch corner in way of stress concentration part which are outside 0,6**L** amidships and primary structural members such as bottom plating, side plating, deck plating, longitudinal on deck, etc. which are outside 0,4**L** amidships.

2.2.3 Special portions of structural members:

Special members which are specially important in longitudinal strength view point, such as sheer strake, deck stringer, bilge strake, hatch corner in way of stress concentration part which are within 0,4**L** amidships.

3. Application of Steels

3.1 Application of rolled steels for self-elevating units and column-stabilized units is to be in accordance with Table 3.3 to 3.5 depending upon the category of structural members defined in 2.1, thickness and service temperature as defined in Section 1,B.11.

3.2 Application of rolled steels for ship type or barge type units is to be accordance with Rules for Hull (Pt.1,Vol.II) Sec.2.

3.3 Application of the design service temperature specified in 3.1, this need not be lower than 0°C for members which are satisfied with the following requirements.

1) For all units except self-elevating units, their members which are below the light draught.
2) For self-elevating units, bottom mats and footings
3) For column stabilized units, lower hull or footings

3.4 When major loads are applied in the direction across the plate thickness, the steel of which characteristics in the direction across the plate thickness are particularly taken into account is to be used.

Table 3.3 Application of Steels for Primary Structure Members

Thickness t (mm) / Service temperature T (°C)	t ≤ 12,5	12,5 < t ≤ 19	19 < t ≤ 25	25 < t ≤ 35	35 < t ≤ 50
0 ≤ T	A, AH 32, AH 36	A, AH 32, AH 36	B, AH 32, AH 36	B, AH 32, AH 36	D, DH 32, AH 36
-10 ≤ T < 0	A, AH 32, AH 36	B, AH 32, AH 36	D, DH 32, DH 36	D, DH 32, DH 36	E, DH 32, DH 36
-20 ≤ T < -10	B, DH 32, DH 36	D, DH 32, DH 36	E, DH 32, DH 36	E, DH 32, DH 36	E, EH 32, EH 36
-30 ≤ T < -20	D, DH 32, DH 36	E, DH 32, DH 36	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36
-40 ≤ T < -30	E, EH 32, DH 36	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	*
-50 ≤ T < -40	E, EH 32, DH 36	E, EH 32, EH 36	*	*	*
* At the discretion of BKI.					

Table 3.4 Application of Steels for Secondary Structure Members

Thickness t (mm) / Service temperature T (°C)	t ≤ 12,5	12,5 < t ≤ 19	19 < t ≤ 25	25 < t ≤ 35	35 < t ≤ 50
0 ≤ T	A, AH 32, AH 36	A, AH 32, AH 36	A, AH 32, AH 36	A, AH 32, AH 36	B, AH 32, AH 36
-10 ≤ T < 0	A, AH 32, AH 36	A, AH 32, AH 36	B, AH 32, AH 36	B, AH 32, AH 36	D, DH 32, DH 36
-20 ≤ T < -10	B, AH 32, AH 36	B, AH 32, AH 36	D, DH 32, DH 36	D, DH 32, DH 36	E, DH 32, DH 36
-30 ≤ T < -20	D, DH 32, DH 36	D, DH 32, DH 36	E, DH 32, DH 36	E, DH 32, DH 36	E, EH 32, EH 36
-40 ≤ T < -30	E, DH 32, DH 36	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36
-50 ≤ T < -40	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	*	*
* At the discretion of BKI.					

Table 3.5 Application of Steels for Special Portion of Structure Members

Thickness t (mm) / Service temperature T (°C)	t ≤ 12,5	12,5 < t ≤ 19	19 < t ≤ 25	25 < t ≤ 35	35 < t ≤ 50
0 ≤ T	B, AH 32, AH 36	D, DH 32, DH 36	D, DH 32, DH 36	E, DH 32, EH 36	E, DH 32, EH 36
-10 ≤ T < 0	D, DH 32, DH 36	E, DH 32, DH 36	E, DH 32, DH 36	E, EH 32, EH 36	E, EH 32, EH 36
-20 ≤ T < -10	E, DH 32, DH 36	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36
-30 ≤ T < -20	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	*	*
-40 ≤ T < -30	E, EH 32, EH 36	*	*	*	*
-50 ≤ T < -40	*	*	*	*	*
* At the discretion of BKI.					

C. Welding

1. General

1.1 The requirements regarding to welding such as welding methods, welding materials, welding personnel (welder, operator and supervisor staff) and their qualifications are to be in accordance with the requirements of the Rules for Welding (Pt.1,Vol.VI).

1.2 Welding method having characteristics differing from those specified in this Rules and above-mentioned Rules may be used when the detailed design data and their use are approved by BKI. In this

case, detailed data relating to the process of manufacture, the way of using, etc. of those are to be submitted for approval.

2. Welding Structure

2.1 Welded joints of crossing parts at the ends of columns and bracings are, as a rule, to be of full-penetration type.

2.2 Size of fillet welds of Tee-joints applied to respective internal structural members of columns and bracings is to be specified in Rules for Structure (Pt.5, Vol.II) Sec. 4.C.5

2.3 For other welded joints than specified in 2.1 and 2.2, welding is to be in accordance with the requirements in Rules for Welding (Pt.1, Vol.VI) Sec. 7.E.2 for general principle

3. Joints of Special Design

In case of welded joints of special design, BKI may require tests to check the strength of the joints

4. Underwater Welding

Welders to be engaged in underwater welding are to be those who have been accepted through the qualification test approved by BKI.

D. Corrosion Control

1. General

1.1 All steel works are to receive a paint of good quality or to be corrosion-controlled with an effect equivalent to or more than the paint. However, structural members of oil tanks need not to be painted. See also Rules for Structure (Pt.5, Vol.II) Sec. 6

1.2 Where the in-water survey is carried out instead of Docking Survey at the periodical survey, special consideration is to be paid to the prevention of corrosion.

E. Ice Strengthening

1. General

1.1 As for units which are to work or navigate in icy sea areas, special considerations are to be paid to ice strengthening.

1.2 Ship type units and barge type units are to be reinforced in accordance with the requirements of Rules for Hull (Pt.1,Vol.II) Sec. 15.

F. Anti-fouling systems

If anti-fouling systems are installed, they are to conform to the requirements of the International Convention on the Control of Harmful Anti-fouling Systems on Ships.

G. Drainage and Sediment Control

All ballast and preload tanks and related piping systems is to be designed to facilitate effective drainage and removal of sediments. Coatings which could entrain sediments and harmful aquatic organisms should be avoided.

H. Guardrails and Bulwarks

1. General

1.1 Guardrails or bulwarks are to be provided on all exposed decks in order to prevent falling. The height and arrangement of the guardrails or bulwarks are to be in accordance with the requirements specified in Rules for Hull (Pt.1, Vol. II), Sec. 21.Q.

1.2 Regardless of the requirements in 1.1, suitable wire nets may be provided to the helicopter deck in nearly the same plane as the deck surface instead of the guardrails or bulwarks, if the guardrails or bulwarks will become hindrances to take-off and landing of helicopters.

1.3 Regardless of the requirements in 1.1, guardrails or bulwarks which interfere with the operation may be eliminated subject to the approval by BKI at the request of the Owner.

1.4 For contact with other ships, the unit is to be equipped with sufficient fenders.

I. Towing Arrangement

1. General

1.1 The design and arrangement of towing fittings should have regard to both normal and emergency condition.

1.2 Equipment and fittings provided in accordance with 1.1 should meet the appropriate requirements of Rule for Structure (Pt.5,Vol.II) Sec.10.D. or recognized acceptable to BKI and arrangements are to be submitted to BKI for the approval. See also Guidelines for safe ocean towing (MSC/Circ.884).

1.3 Each fitting or item of equipment provided under this Rules 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.

J. Access

1. General

1.1 Each space within the unit is to 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 BKI, the unit's personnel and others as necessary. Such means of access are to comply with the provisions of 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.

1.2 Where permanent means of access may be susceptible to damage during normal operations or where it is impracticable to fit permanent means of access, BKI 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 is to be capable of being readily erected or deployed by the unit's personnel. See Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.1.2

1.3 The construction and materials of all means of access (MA) and their attachment to the unit's structure is to be to the satisfaction of BKI. The MA is to be subject to inspection prior to, or in conjunction with, its use in carrying out surveys in accordance with Rules for Classification and Surveys (Pt.5, Vol.1) Sec. 3.I. See also Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.1.3

2. Safe access to holds, tanks, ballast tanks and other spaces

2.1 Safe access to holds, cofferdams, tanks and other spaces are to 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. See Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.2

2.2 Tanks and subdivisions of tanks, having a length of 35 m or more, are to be fitted with at least two access hatchways and ladders, as far apart as practicable. Tanks less than 35 m in length is to 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 are to be fitted. See Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.2.2

2.3 Each hold is to be provided with at least two means of access as far apart as practicable. In general, these accesses are to 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.

3. Access Manual

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

1) Plans showing the MA to the space, with appropriate technical specifications and dimensions;
2) Plans showing the MA within each space to enable an overall inspection to be carried out, with appropriate technical specifications and dimensions. The plans are to indicate from where each area in the space can be inspected;
3) Plans showing the MA within the space to enable close-up inspections to be carried out, with appropriate technical specifications and dimensions. The plans are to be indicated with the positions of critical structural areas, whether the means of access is permanent or portable and from where each area can be inspected;
4) Instructions for inspecting and maintaining the structural strength of all MA and means of attachment, taking into account any corrosive atmosphere that may be within the space;
5) Instructions for safety guidance when rafting is used for close-up inspections and thickness measurements;
6) Instructions for the rigging and use of any portable MA in a safe manner;
7) An inventory of all portable MA; and
8) Records of periodical inspections and maintenance of the unit's MA.

See Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.3.1

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. See Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.3.2

4. General technical specifications

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. See Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.4.1

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. See Guidance for Code and Convention Interpretations (Pt.1, Vol. Y), Sec.8.2.2.4.2.

K. Protective Coating of Dedicated Sea Water Ballast Tanks

1. General

1.1 All dedicated seawater ballast tanks should be coated during construction in accordance with Guidance for Coating Performance Standards (Pt.7, Vol. G). 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. As reference of coating selection see Rule for Structures (Pt.5, Vol.II) Sec. 6.C.

1.2 Maintenance of the protective coating system should be included in the overall unit's maintenance scheme. The effectiveness of the protective coating system is to be verified during the life of a unit through periodical surveys.

Section 4 Design Condition

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A. Design Loads

1. General

1.1 In regard to loads in determining scantlings of structural members and in calculating mooring forces for the units, unless otherwise specified elsewhere, the following 1) to 7) are to be taken into account, where applicable:

1) Wind Loads
2) Wave Loads
3) Current Loads
4) Loads due to Vortex Shedding
5) Deck Loads
6) Loads due to helicopter
7) Other Loads.

1.2 The criteria in the design of the loads acting upon the units and their structural members are to be based upon statistical data and considerations are to be given to the severest condition anticipated in the period of at least 50 years. However, for units provided with self-propelled system, the period may be 25 years.

1.3 Notwithstanding the requirements of 1.2, in case where considering to the purpose of unit, employment period, etc. and those are approved by BKI, the design loads acting upon the unit or towed barge unit in the most severe condition anticipated in the period which specified by the Owner may be used.

1.4 Except for Self Elevating and Column Stabilize unit, relevant requirements given in Rules for Hull (Pt. 1, Vol. II), Rules for Small Vessels up to 24 m (Pt. 3, Vol. VII) shall be applied. However, in cases where loads produced by designated operations cannot be ignored, such loads are to be considered in addition to the requirements

2. Loads

2.1 General

The requirement of this 2.2 - 2.8 is specified the representative methods for calculation the design loads. In case where the calculation method of the design loads is not specified or even though they are specified, the design load may be determined from the appropriate model tests, wind tunnel tests, tank tests or theoretical methods approved by BKI may be used.

2.2 Wind Load

2.2.1 The design wind velocity used in determining the wind loads may be specified by the Owner, but should not to be less than 25,8 m/s. However, the design wind velocity for the units intended for unrestricted services and operating sea areas is not to be less than 36 m/s for the operating condition, and not to be less than 51,5 m/s for the severe storm condition.

2.2.2 The wind pressure P is to be obtained from the following formula.

$$P = 0{,}611 \cdot C_h \cdot C_s \cdot V^2 \quad [N/m^2]$$

Where:

V = Design wind velocity specified in 2.2.1 (m/s)

C_h = Height coefficient given by Table 4.1 depending on the vertical height in meters at the location under consideration, where the vertical height is a vertical distance from sea surface to the geometric center of the projected area A specified in the following 2.2.3

C_s = Shape coefficient given by Table 4.2 depending on the shape of structural members.

Table 4.1 Height Coefficient C_h

Height [m]		C_h
Over	Not Exceeding	
0,0	15,3	1,00
15,3	30,3	1,10
30,5	46,0	1,20
46,0	61,0	1,30
61,0	76,0	1,37
76,0	91,5	1,43
91,5	106,5	1,48
106,5	122,0	1,52
122,0	137,0	1,56
137,0	152,5	1,60
152,5	167,5	1,63
167,5	183,0	1,67
183,0	198,0	1,70
198,0	213,5	1,72
213,5	228,5	1,75
228,5	244,0	1,77
244,0	259,0	1,79
Above 259,0		1,80

2.2.3 The wind load F is not to be less than obtained from the following formula with regard to each structural member of the unit. In addition, the resultant force and its acting point are to be determined for each wind direction.

$$F = P \cdot A \quad [N]$$

Where:

P = Wind pressure specified in 2.2.2 [N/m^2]

A = Projected area of all exposed structural members on a plane perpendicular to each wind direction in the upright condition or, if necessary, in the heeling condition [m^2], in determining the projected area, the requirements in the 2.2.3.1 to 2.2.3.6 are to be applied.

.1 For self-elevating units, projected areas of all legs are to be included. Where, however, the legs are of open truss work, the above-mentioned projected areas may be determined according to the requirements in 2.2.8.

.2 For column stabilized units, the projected areas of all columns are to be included, i.e. no shielding allowance should be taken.

.3 Notwithstanding the requirements of 2.2.4 or 2.2.5, where legs or columns are closely located, the influence of screening effect, etc. may be considered. The screening effect is to be obtained from an appropriate wind tunnel tests approved by BKI.

.4 Areas exposed due to heel, such as underdecks, etc., should be included using the appropriate shape coefficients.

.5 The projected areas of deckhouses, other structural members, cranes, etc. are to be separately calculated. Where, however, two or more structures such as deckhouses and the like are closely located, they may be considered as one block and their projected areas may be considered as a projected block area perpendicular to each wind direction. In this case, the shape coefficient C_s = 1,1.

.6 Open truss work commonly used for derrick towers, booms and certain types of masts may be approximated by taking 30% of the projected block area of both the front and back sides, e.g. 60% of the projected block area of one side for double-sided truss work. An appropriate shape coefficient is to be taken from the Table 4.2.

Table 4.2 Shape Coefficient C_s

Structural members	C_s
Spherical	0,4
Cylindrical	0,5
Large flat surface (hull, deckhouse, smooth under-deck areas)	1,0
Drilling derrick	1,25
Wires	1,2
Exposed beams and girders under deck	1,3
Small parts	1,4
Isolated shapes (crane, beam, etc.)	1,5
Clustered deckhouses or similar structures	1,1

2.2.4 Where the lifting effect of the wind load is considered not negligible, this effect is determined from an appropriate method approved by the BKI.

2.3 Wave Loads

2.3.1 The design wave height to be used for wave load calculation may be specified by the Owner subject to approval by BKI.

2.3.2 The design wave period to be used for wave load calculation is to be the period which will give the maximum effect to the unit.

2.3.3 For the wave load calculation, the following requirements are to be applied:

1) The wave loads are to be calculated basing on acceptable wave theories appropriate to the design depth of water at the operation area subject to the approval by BKI.
2) Waves from all directions are to be considered acting on the unit.
3) The wave loads produced by shipping water on the deck, the loads acting directly on the immersed elements of the unit and the loads, resulting from heeled positions or accelerations due to its motion are also to be considered.

4) The vibration induced by waves is also to be considered.

5) Where the low frequency motion is considered not negligible, low frequency components of wave such as swell, are to be considered.

6) For detail calculation of wave loads may refer to the Rules for Structure (Pt. 5, Vol. II), Sec. 2, B.4.

2.3.4 Notwithstanding the requirements of 2.3.1 to 2.3.3, the wave loads may be determined from the simulation method in irregular wave using a suitable wave spectrum based upon the wave data at the service area.

2.4 Current and Tidal Current Loads

2.4.1 Where current is acting alone (i.e., no waves), a design value of sea current pressure on structural elements at depth z ($q_D(z)$) below the still-water level is defined as follows:

$$q_D(z) = 513 \cdot u_D^2(z) \qquad \text{for } 0 \geq z \geq -d$$

Where,

$q_D(z)$ = sea current pressure [N/m^2]

$u_D(z)$ = design sea current speed [m/s]

z = coordinate for height above sea level [m]

d = depth from still-water to bottom [m]

The design current speed $u_D(z)$ is either $u_W(z)$, $u_{SS}(z)$ or $u_{nS}(z)$, as defined in Rules for Structure (Pt.5, Vol. II) Sec. 1, C.2., C.3. or C.4., or a superposition of these values, as applicable.

2.4.2 Using $q_D(z)$ as defined above, design sea current loads F(z) may be calculated according to the following formula:

$$F = q_D(z) \cdot A$$

Where,

F = current force [N]

$q_D(z)$ = current pressure [N/m^2]

A = current projected area [m^2]

Values of the current projected area A may be corrected for effects of marine growth, as applicable, compare in Rules for Structure (Pt.5, Vol. II) Sec. 1, F.3.

2.4.3 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 vectorally to the wave particle velocity. The resultant velocity is to be used to compute the total force.

2.5 Loads due to Vortex Shedding

The flutters of immersed structural members due to vortex shedding are also to be considered.

2.6 Deck Loads

For deck loads, uniform and concentrated loads on the respective portions of the deck in each mode of operation and transit condition are to be taken into account. The values of the uniform loads, however, are not to be less than given in Table 4.3.

Table 4.3 Deck Loads

Kind of Deck	Minimum Load [kN/m^2]
Accommodation spaces (including corridors and similar spaces)	4,510
Work areas and machinery spaces	9,020
Storage areas	13,000
Helicopter deck	2,010

2.7 Helicopter Loads

2.7.1 The design load in determining the scantlings of the members of helicopter deck is to be in accordance with the following .1 to .3:

.1 Helicopter landing impact loading

1) As for the deck loads in the range where a helicopter takes off or lands, a load of 75% of the helicopter maximum tak-off weight is to be taken on each of two square areas, 0,3m x 0,3m.
2) For girders, stanchions, etc., the structural weight of the helicopter deck is to be considered in addition to the helicopter impact loading specified in 1).
3) Where the upper deck of a superstructure or deckhouse is used as a helicopter deck and the spaces below are normally manned, the impact loading specified in 1) is to be multiplied by a factor of 1,15.

.2 Stowed helicopter loading

1) The deck loads in the space where a helicopter is stowed are to be taken as wheel loadings at maximum take-off weight. In this case, the dynamical effect due to the motion of the unit is also to be taken into consideration.
2) In addition to 1), a uniformly distributed loading of 500 N/m^2, representing wet snow or ice is to be considered, if necessary.
3) For girders, stanchions, etc., the structural weight of the helicopter deck is to be considered in addition to the loads specified in 1).

.3 Minimum deck load

The minimum deck load for helicopter deck is to be taken as specified in Table 4.3.

2.7.2 In case where a helicopter is provided with any other landing appliances than wheels, the design loads are to be at the discretion of BKI.

2.8 Other Loads

Other relevant loads should be determined in a manner to the satisfaction of BKI. (For example, seabed movement, operational loads due to drilling derrick and riser tensioners, seismic loads, ice loads, mooring loads, etc.).

In case, for requirements of sea level, Climatic condition, temperature and marine growth, sea ice and icebergs and sea bed may be considered, see Rules for Structures (Pt. 1, Vo. II), Sec. 1, E-H.

B. Calculation of Strength

1. Structural Analysis

The primary structure of the unit is to be analyzed using the loading conditions stipulated C.1 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 should be performed using an appropriate calculation method and should be fully documented and referenced.

2. Analysis of Units embedded on the Sea Bottom

Units designed to embed on the sea bottom are to be analyzed assuming the overturning moment due to the combined environmental forces from any direction and the sufficient downward gravity loadings on the support footings or mat to withstand the moment. The overturning safety see Section 5.A.3 and B.3 for Self elevating unit and Column stabilized unit respectively.

3. Plastic Analysis

Scantlings of structural members designed basing upon plastic analysis are to be at the discretion of BKI. Where plastic design is used, the limitations described in Rules for Structures (Pt.5, Vol. II), Sec. 3, B.4, are to be observed.

4. Buckling Strength

Structural members are to have sufficient strength against buckling in consideration of their shapes, scantlings, boundary conditions, etc. For detail calculation of buckling strength see Rules for Hull (Pt.1, Vol. II), Sec. 3, F and Rules for Structures (Pt.5, Vol. II), Sec. 3, G. for Surface Type and Other Type respectively

5. Fatigue Strength

5.1 The possibility of fatigue damage due to cyclic loading should be considered in the design of self-elevating and column stabilized units.

5.2 The area anticipated stress concentration is to be considered to fatigue strength, the fatigue analysis is to be based on the intended mode and area of operations to be considered in the unit's design.

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

5.4 For detail calculation of fatigue strength see Rules for Hull (Pt.1, Vol. II), Sec. 20 and Rules for Structures (Pt.5, Vol. II), Sec. 3, H for Surface Type and Other Type respectively

6. Stress Concentration

6.1 The effect of local stress concentrations is to be considered for notches in members or discontinuous parts of structure and to be taken into account in the design of load carrying elements.

6.2 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 avoid wherever possible. Where unavoidable, plate material with suitable through-thickness properties and inspection procedures may be required.

7. Bending Stress

7.1 The section modulus of members required by the Rules are those including the steel plates with the effective breadth which to be account accordance with Rules for Structures (Pt.5, Vol. II), Sec.3.F.

7.2 Where subjected to eccentric loadings, an increase of bending stresses due to the deflections of the structural members is to be taken into account.

8. Shearing Stress

When calculating shearing stresses in bulkheads, plate girder web of hull side plating, etc. only the effective shear area of web is to be considered as being effective. In this regard, the total depth of the girder may be considered as the web depth.

9. Combination of Stresses

9.1 In obtaining respective local stresses of the structural members, all the stress components concerned are to be summed up. In this case, for tubular members, the effect of circumferential stress due to external pressure is to be considered.

9.2 The scantlings are to be determined on the basis of criteria which combine, in a rational manner deemed appropriate by BKI, the individual stress components acting on the respective structural members (see 10).

10. Equivalent Stress

10.1 For plated structures, members may be designed according to the equivalent stress criterion, where the equivalent stress is obtained from the following formula:

$$\sigma = \sqrt{\sigma_x^2 + \sigma_y^2 - \sigma_x \cdot \sigma_y + 3 \cdot \tau_{xy}^2} \qquad [N/mm^2]$$

Where:

σ_X and σ_y = Stress in the X and Y directions at the center of thickness of the plate, respectively (N/mm^2)

τ_{xy} = Shearing stress in the X-Y plane (N/mm^2)

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

11. Corrosion Allowance

11.1 Where the unit is not fitted with a corrosion protection system deemed appropriate by BKI, the scantlings are to be those determined by the analyzing method specified above in conjunction with the allowable stresses specified by the Rule added by a proper corrosion allowance. In this case, the corrosion allowance is, as a rule, not to be less than 2,5 mm and is to be determined considering the environmental condition, the means and degree of corrosion protection specified in D. and the process of its maintenance. And further, where the requirements in Rules for Hull (Pt.1 Vol. II) are applied, the scantlings are not to be less than those specified in the relevant requirement.

11.2 In case where the unit is fitted with a corrosion protection system deemed appropriate by BKI, with regard to the corrosion allowance specified in 11.1, modification may be made as deemed adequate by BKI.

C. Analysis of Overall Strength

1. Loading Conditions

Analysis of overall strength is to be performed for the static loading and combined loading specified in the following 1.1 and 1.2 in the respective modes of operation:

1.1 The static loading is a condition in which the unit is afloat or embedded on the sea bottom in calm sea and is loaded with static loads only such as loads taken in operating condition, dead load of the unit, etc. which affect the overall strength.

1.2 The combined loading is a condition in which the unit is loaded with combined loads of the static loads specified in 1.1, dynamic loads such as wind loads, wave loads, etc. which affect the overall strength and loads induced by the accelerate motion of the unit due to these loads and heeling.

2. Allowable Stresses

2.1 The equivalent stress specified in B.10 is not to exceed 0,7 and 0,9 times the yield strength (R_{eH}) of the material, for the static loading and combined loading specified in B.1, respectively.

2.2 Allowable stresses for static loading and combined loading specified in 1. are not to exceed the values in Table 4.4 according to the kind of stress.

Table 4.4. Allowable Stresses for Static Loading and Combined Loading.

Kind of Loads	Static Loading	Combined Loading
Tensile	0,6 x R_{eH}	0,8 x R_{eH}
Bending	0,6 x (R_{eH} or σ_{cr})*	0,8 x (R_{eH} or σ_{cr})*
Shearing	0,4 x R_{eH} or 0,6 x σ_{cr} *	0,53 x R_{eH} or 0,6 x τ_{cr} *
Compressive	0,6 x (R_{eH} or σ_{cr})*	0,8 x (R_{eH} or σ_{cr})*

Note: *whichever is smaller

R_{eH} = Specified minimum yield stress of the material [N/mm^2]

σ_{cr} = Critical compressive buckling stress [N/mm^2]

τ_{cr} = Critical shear buckling stress [N/mm^2]

Notes:

- *The allowable stresses as stated in Table 4.4 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.*
- *The specific minimum yield point may be determined with the requirements in Rules for Materials (Pt.1, Vol. V) Sec.2, D.3.2.*

3. Combined Compressive Stress

3.1 In addition to 2.2, where compressive stress is developed in axial compression or combination of axial force and bending, the compressive stress is to satisfy the following relationship:

$$\frac{\sigma_a}{\sigma_{all\_a}} + \frac{\sigma_b}{\sigma_{all\_b}} \leq 1,0$$

Where:

σ_a = Calculated compressive stress due to axial force [N/mm^2]

σ_b = Calculated compressive stress due to bending [N/mm^2]

σ_{all_a} = Allowable axial compressive stress obtained from the following formula, but is not to exceed F_b [N/mm^2].

$$= \eta \cdot \sigma_{cr,i} \cdot \left(1 - \frac{0,13 \cdot \lambda}{\lambda_0}\right) \quad \text{where } \lambda < \lambda_0$$

$$= \eta \cdot \sigma_{cr,e} \cdot 0,87 \quad \text{where } \lambda \geq \lambda_0$$

σ_{all_b} = Allowable compressive stress due to bending prescribed in Table 4.4 [N/mm^2]

λ = Slenderness ratio of the member

$$= \frac{k\ell}{r}$$

$$\lambda_0 = \sqrt{\frac{2\pi^2 E}{R_{eH}}}$$

R_{EH} = as specified in Table 4.4 [N/mm^2]

$\sigma_{cr,i}$ = Inelastic column critical buckling stress [N/mm^2]

$\sigma_{cr,e}$ = Inelastic column critical buckling stress [N/mm^2]

η = 0,6 for static loading

= 0,8 for combined loading

$k\ell$ = Effective unsupported length (m)

r = Governing radius of gyration associated with $k\ell$ (m)

E = Modulus of elasticity of the material

D. Scantlings of Structural Members

1. General

1.1 For the primary structural members which contribute to the overall strength, the scantlings are to be determined in accordance with the requirements in B and C. However, the requirements in 2 and 3 may be applied.

1.2 For the structural members subjected to local loads only, the requirements in Rules for Hull (Pt.1, Vol. II) may be applied subject to the approval by BKI.

2. Thickness of Plating of Hull Structure

The thickness of plating of the primary hull structure such as shell plating which contributes to the overall strength, subjected to distributed loads, is not to be less than obtained from the following formula, whichever is greater:

$$t_1 = 75{,}24 \cdot a \cdot \sqrt{\frac{h_s}{K_e}} + C \qquad [mm]$$

$$t_2 = 60{,}8 \cdot a \cdot \sqrt{\frac{h_s}{K_p}} + C \qquad [mm]$$

Where:

a = spacing of transverse or longitudinal frames [m]

h_s = head of water in static loading specified in C.1.1 [m]

h_c = head of water in combined loading specified in C.1.2 [m]

K_e = as given by the following formula, whichever is smaller:

$$= \frac{235 - k \cdot \sigma_{s1}}{k} \quad \text{or}$$

$$= \frac{1{,}45 \cdot (235 - k \cdot \sigma_{s2})}{k}$$

K_p = as given in i) or ii) below:

i) Where $\sigma_{c1}\, \sigma_{c2} > 0$, the value given by the following formula, whichever is smaller:

$$\frac{55225 - k^2 \cdot \sigma_{c2}^2}{235 \cdot k} \quad \text{or} \quad \frac{2 \cdot (235 - k \cdot |\sigma_{c2}|)}{k}$$

ii) Where $\sigma_{c1}\, \sigma_{c2} < 0$, the value given by the following formula, whichever is smaller:

$$\frac{55225 - k^2 \cdot \sigma_{c2}^2}{235 \cdot k} \quad \text{or} \quad \frac{2 \cdot (235 - k \cdot |\sigma_{c1}| - k \cdot |\sigma_{c2}|)}{k}$$

σ_{s1}, σ_{s2} and σ_{c1}, σ_{c2} = axial stresses acting on the plating in static loading and combined loading, respectively [N/mm^2], see Fig 4.1

k = material factor given in Table 3.2

C = Corrosion allowance specified in B.11 [mm]

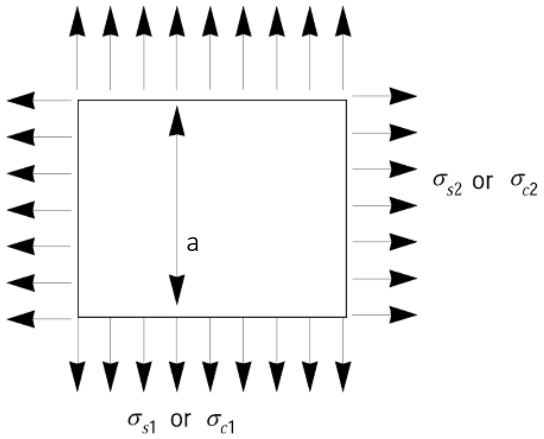

Fig. 4.1 Axial Stresses, σ_{s1}, σ_{s2}, σ_{c1}, and σ_{c2}

3. Section Modulus of Transverse or Longitudinal Frames

The section modulus of transverse or longitudinal frames which support the panels prescribed in 2. is to be obtained from the following formula:

$$W = \frac{1079 \cdot C \cdot k \cdot a \cdot h_c \cdot \ell^2}{(235 - k - \sigma_{c0})} \qquad [cm^3]$$

Where:

C = coefficient given below:
= 1,0 for both ends fixed
= 1,5 for both ends supported

ℓ = span of frames [m]

σ_{c0} = axial stress in combined loading [N/mm^2]

a, h_c, and k = as specified in 2.

4. Local Buckling of Cylindrical Shells

Unstiffened or ring-stiffened cylindrical shells subjected to axial compression, or compression due to bending, and having proportions which do not satisfy the following relationship, are to be checked for local buckling in addition to the overall buckling as specified in C.3.

$$\frac{D}{t} > \frac{E}{9\sigma_y}$$

Where

t = thickness of shell plating

D = diameter of cylindrical shell

(D and t expressed in the same units)

σ_y = as specified in Table 4.4

E = modulus of elasticity of material

(σ_y and E expressed in the same unit system)

E. Helicopter Deck

1. Plans showing the arrangement, scantlings and details of the helicopter deck are to be submitted. The arrangement plan is to show the overall size of the helicopter deck and the designated landing area. If the arrangement provides for the securing of a helicopter or helicopters to the deck, the predetermined position(s) selected to accommodate the secured helicopter, in addition to the locations of deck fittings for securing the helicopter, are to be shown. The helicopter for which the deck is designed is to be specified, and calculations for the relevant loading conditions are to be submitted. The identification of the helicopter which is used for design purposes should be included in the Operating Booklet.

2. The design load in determining the scantlings of the members of helicopter deck is to be in accordance with A.2.7

3. Allowable stresses of the structural members of the helicopter deck are not to exceed the values in Table 4.5 in association with the design loads prescribed in A.2.4.

Table 4.5 Allowable Stresses

Design Loads	Structural Members		
	Deck Plating	Deck Beams	Girder, Stanchions, Truss Supports, etc
Helicopter landing impact load	*	σ_y	0,9 x σ_y'
Stowed helicopter load	σ_y	0,9 x σ_y	0,8 x σ_y'
Overall distributed load	0,6 x σ_y	0,6 x σ_y	0,6 x σ_y'

Note:

*At the discretion of BKI.

where

σ_y = As specified in Table 4.4

σ_y' = For members subjected to axial compression, σ_y or critical buckling stress, whichever is smaller, is to be considered. [N/mm^2]

4. The minimum thickness of helicopter deck plating is not to be less than 6,0 mm.

5. Wind loadings and possible wave impact loadings on helicopter decks are to be considered. Where in this case, those loadings are in accordance with the discretion of BKI.

6. The helideck construction may refer to Guidance for the Class Notation Helicopter Deck and Facilities (Pt.7, Vol.A). Units provided with helicopter deck in accordance with the guidance may have a additional notation, "**HELIL**" or "**HELILSRF**" after the class notation.

Section 5 Type of Units

A. Self-Elevating Units 5–1
B. Column Stabilized Units 5–6
C. Surface Type Units 5–11

A. Self-Elevating Units

1. General

This sub-section covers those specific design criteria and features of self-elevating mobile offshore units. For the requirements which are not covered by this subsection, 1.1 to 1.6 are to be applied.

1.1. Subdivision and watertight integrity

Subdivision and watertight integrity are dealt with in Section 6, B.

1.2. Machinery, auxiliary and electrical installations

1.2.1 Machinery, auxiliary and electrical installations shall be designed according to Section 8. For the jacking system, see Section 8, A.6

1.2.2 Special (auxiliary) installations and equipment are to be designed according to the specific Sections as far as applicable, see Section 1, A.2

1.3 Lifting appliances

For the interaction of lifting appliances with the unit, its foundations, etc. See Rules for Structures (Pt.5, Vol.II) Sec.8.

The requirements for offshore cranes and other lifting appliances themselves are defined in the Guidelines for Loading Gear on Seagoing Ships and Offshore Installations (Pt.4, Vol.3).

1.4 Towing and elevating

Conditions for towing, for the elevating and lowering procedures and for operating phases while standing on the seafloor, shall be clearly indicated in the Operating Manual (Booklet), compare Section 2.C.3.1.

1. 5 Drilling

Drilling derricks shall be designed according to recognized codes/standards and/or applicable national regulations. The rated capacity for each reeving shall be included in the Operating Manual (Booklet).

Permanently installed piping systems for drilling operations are to comply with recognized standard or code.

These Rules do not include requirements for the drilling of subsea wells or procedures for their control. Such drilling operations are subject to control by the coastal state.

2. Structure

2.1 General

2.1.1 The Overall strength of the unit is to be in accordance with the requirements in Section 4.B to E. The unbalanced supported condition by the legs, if necessary, is to be considered.

2.2. Legs

Legs are to be in accordance with the requirements in the following 2.2.1 to 2.2.11, in addition to the requirements in A.2.1.1. However, with regard to the motions of the unit and legs, they may be determined by an analytical method or from a model experiment deemed appropriate by BKI.

2.2.1 Legs may be either shell type or truss type. Shell type legs may be designed as either stiffened or unstiffened shells. According to the sea-bed conditions envisaged, the legs may be designed with fixed or detachable footings, or bottom mats.

2.2.2 Where footings or bottom mats are not fitted, proper consideration is to be given to the leg penetration of the sea bed and the end fixity of the leg. In strength calculation of such a leg, the leg is to be assumed as pin-supported at a position at least 3 meters below the sea bottom.

2.2.3 Legs in the field transit condition are to be in accordance with the following 1) and 2). The field transit condition means the condition which does not exceed a 12-hour voyage between two areas in protected locations or locations where the unit may be safely elevated. However, during any portion of the move, the unit is to be capable of arriving at a protected location or a location where the unit may be safely elevated within 6 hours. In addition, such transit shall not be undertaken when the predicted weather of such that the anticipated motions of the unit will exceed the design condition

1) The legs are to have sufficient strength for the bending moment obtained from the following formula:

$$M_1 + 1{,}2 \cdot M_2 \quad [\text{Nm}]$$

Where

M_1 = Dynamic bending moment caused by a 6- degree single amplitude of roll or pitch at the natural period of the unit [N-m]

M_2 = Static bending moment due to gravity caused by a 6-degree legs' angle of inclination [N-m]

2) The legs are to be investigated for any proposed leg arrangement with respect to vertical position, and the approved positions are to be specified in the Operating Booklet. Such investigation is to include strength and stability aspects.

2.2.4 Legs in the ocean transit condition are to be designed in accordance with the following 1) to 4):

1) The legs are to be designed for acceleration and gravity moments resulting from the motions in the severest anticipated environmental transit condition, together with corresponding wind moments. Calculation or model test methods, acceptable to BKI, may be used.

2) Alternatively, the legs are to have sufficient strength for the bending moment obtained from the following formula:

$$M_3 + 1{,}2 \cdot M_4 \quad [\text{Nm}]$$

Where,

M_3 = Dynamic bending moment caused by a 15- degree single amplitude of roll or pitch at a 10-second period [N-m]

M_4 = Static bending moment due to gravity caused by a 15- degree legs' angle of inclination [N-m]

3) For ocean transit condition, it may be necessary to reinforce or support the legs, or to remove sections of them.

4) The approved condition is to be included in the Operating Manual (Booklet).

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

2.2.6 The maximum design motions, water depth, bottom conditions and sea state while lowering legs and the sea state while raising the legs are to be clearly indicated in the Operating Booklet (Booklet), and the legs are not to be permitted to touch bottom when the site conditions exceed the allowable.

2.2.7 The legs are to be designed to withstand the loads acting on both, the unit's hull and the legs themselves, during the elevating procedure. The environmental conditions are the same as foreseen for lowering of the legs. The analysis may have to be done for several intermediate positions of the hull.

2.2.8 When computing leg stresses, while in the elevated position, the maximum overturning load on the unit, using the most adverse combination of applicable variable loadings together with the loadings as specified in Section 4.A, is to be considered. Forces and moments due to lateral frame deflections of the legs are to be taken into account.

2.2.9 Eccentricity of support or partial restraint of the lower leg ends may have to be considered (e.g. for spud can design), depending on the soil conditions. The analysis will usually have to be carried through for several water depths and corresponding site and environmental conditions.

2.2.10 Leg scantlings are to be determined in accordance with a method of rational analysis, to the satisfaction of BKI.

2.2.11 Fatigue may have to be specially considered, particularly for legs of truss type. For fatigue criteria, see Rules for Structure (Pt.5 Vol.II) Sec. 3.H.

2.3. Hull Structure

2.3.1 The hull is to be 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.

2.3.2 The scantlings of the respective hull structural members are to be in accordance with the requirements in Section 4.B. to E. with reference to the loads prescribed in Section 4.A in addition to the requirements in A.2.1.1.

2.3.3 The hull structure, including the parts of the well, etc., is to be good in the continuity of longitudinal strength and transverse strength.

2.3.4 Scantlings of units having other than rectangular hull configurations are to be subject to special consideration.

2.3.5 Special attention is to be paid to the foundation and fastening of drilling derrick(s) and cranes, also with regard to transit condition, see also Rules for Structures (Pt.5, Vol.II) Sec.8.

2.4. Deckhouses

2.4.1 Deckhouses are to have sufficient strength for their size, function and locations and are to be constructed to approval plans.

2.4.2 Where deckhouses are close to the side shell of the unit, their scantlings may be required to conform to the requirements for bulkheads of unprotected deckhouse fronts and shall be designed to resist the possible impact of sea wash during conveyance. See Rules for Hull (Pt.1, Vol.II) Sec.16.

2.5. Bottom Mats

2.5.1 The design regarding sea-bed conditions are to be according to 2.9.

2.5.2 If the sea-bed conditions are characterized by very soft mud and silt, the lower ends of the legs are to be attached to a mat. The construction of bottom mats is to be designed so that loads transmitted from the legs may be evenly distributed to the respective parts of the mats.

2.5.3 The thickness of shell plating of the bottom mats without opening to the sea and the scantlings of shell stiffeners are not to be less than determined by the requirements in Section 4.D.2. and Section 4.D.3. In this case, the top of h_s is at the water level at flood tide, and the top of h_c is 0,6 times the design wave height in the severe storm condition above the water level at the design water depth.

2.5.4 The scantlings of the watertight bulkheads and their stiffeners provided in the bottom mats are not to be less than determined by the requirements in Rules for Hull (Pt.1,Vol.II) Sec.11. In this case, the top of h_s to be substituted to the top of h_c specified in 2.5.3.

2.5.5 Where the unit is resting on the sea bed, the effects of scouring are also to be considered.

2.5.6 The effects of skirt plates, where provided, are to be specially considered.

2.5.7 Mats are to be designed to withstand the shock of touching sea bottom while the unit is afloat and subject to wave motions.

2.5.8 Provisions for ballasting and de-ballasting the mat have to be installed. These may be pipelines running down each leg into the mat to vent off trapped air during ballasting or to induce air for displacing the water and thus de-ballasting the mat. These pipelines may also be used to blow air under the bottom of the mat with the aim of facilitating the lifting of the mat from the bottom of the sea.

2.6. Deck Elevating Apparatus and Load Carrying Members

2.6.1 Operating device, mechanism, strength and safety equipment of the deck elevating apparatus are to be in accordance with the requirements in Section 8.A.6.

2.6.2 Load carrying members which transmit loads from the legs to the hull are to have sufficient strength for the loads prescribed in 2.2 and Section 4.A.

2.6.3 Load carrying members are to be so arranged that loads transmitted from the legs are properly diffused into the hull structure.

2.6.4 For the elevated position, special attention is to be paid to the distribution of the loads from the supporting points (legs) into the hull structure, taking account also of possible load redistributions resulting from lack of support at one leg.

The structure surrounding the legs (points of support) shall be designed with particular regard to the introduction of local concentrated forces; main load bearing elements should be continuous in the vertical direction.

Regarding the maximal force to be transmitted, pre-loading of the legs shall be considered, see 2.7 below.

2.6.5 For loose elements, e.g. bars, rods, bolts, pins, serving for transmission of forces to support the unit, special requirements may be imposed regarding dimensioning (safety factors) and testing

2.7. 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 Manual (Booklet). Regarding the preloading capability of the elevating machinery, Section 8.A.6 are to be observed.

2.8. Wave Clearance (Air Gap)

The unit is to be designed for a crest clearance of either 1,2 m, 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. See also Rules for Structure (Pt.5, Vol.II) Sec.2.B.4.11

2.9. Seabed Condition

Sea bed conditions are to be based upon the designer's assumptions, and these assumptions are to be recorded in the Operating Manual (Booklet). The operator is to be watchful against that actual conditions do not impose more severe loadings on the unit. In addition, Rules for Structure (Pt.5, Vol.II) Sec.1.H may be considered.

3. Stability on Seabed

3.1. General

The general requirements for stability are defined in Section 6. Additional aspects are given in the following.

3.2. Overturning Stability

3.2.1 The unit, when resting on the sea-bed, is to have sufficient downward gravity loading on the support footings or mats to withstand the overturning moment of the combined environmental forces from any direction, for each design loading condition. The overturning safety, defined as the sum of the restoring moments divided by the sum of the overturning moments, should not be less than:

- 1,5 for loading condition of operating load
- 1,3 for loading condition of extreme environmental load

according to Rules for Structures, (Pt.5, Vol.II) Sec. 3.C.

3.2.2 It is assumed that noticeable inclinations of the unit will not occur or will be corrected immediately, and that the effects of any dangerous changes of the sea-bed will be kept under control. Corresponding instructions shall be contained in the Operating Manual (Booklet).

B. Column Stabilized Units

1. General

This sub-section covers those specific design criteria and features of column stabilized mobile offshore units. For the requirements which are not covered by this subsection, 1.1 to 1.8 are to be applied.

1.1 Subdivision and watertight integrity

Subdivision and watertight integrity are dealt with in Section 6

1.2 Machinery, auxiliary and electrical installations

1.2.1 Machinery, auxiliary and electrical installations shall be designed according to Section 8. For ballast and bilge pumping arrangements see Section 8.A.5.5 to A.5.8.

1.2.2 Propulsion installations, designed for conveyances under own power or for towage assistance, and/or for positioning, shall also be designed according to Section 8.

1.2.3 Special (auxiliary) installations and equipment are to be designed according to the specific Sections as far as applicable. See also, see Section 1.A.2.

1.3 Mooring system

Mooring system for temporary and position keeping including dynamic position keeping are defined in Section 7.

1.4 Lifting appliances

For the interaction of lifting appliances with the unit, its foundations, etc. See Rules for Structures (Pt.5, Vol.II) Sec.8.

Each elevator cabin in a column shall provide for an emergency exit with an escape ladder in the hoistway.

The requirements for offshore cranes and other lifting appliances themselves are defined in the Guidelines for Loading Gear on Seagoing Ships and Offshore Installations (Pt.4, Vol.3).

1.5 Towing and ballasting

Conditions for towing, for ballasting and de-ballasting procedures and for mooring operations shall be clearly indicated in the Operating Manual (Booklet), compare Section 2.C.3.1.

1.6 Drilling

Drilling derricks shall be designed according to recognized codes / standards and / or applicable nationalregulations. The rated capacity for each reeving shallbe included in the Operating Manual.

Permanently installed piping systems for drilling operations are to comply with an recognized standard or code.

These Rules do not include requirements for the drilling of subsea wells or procedures for their control. Such drilling operations are subject to control by the coastal state.

2. Structure

2.1 General

2.1.1 The overall strength of the unit is to be in accordance with the requirements in Section 4.B to E.

2.1.2 For the dimensioning of ship-like structural members such as decks, bulkheads, deck houses, girders and pillars, Rules for Hull (Pt.1, Vol.II) may be used as a design basis.

2.2 Stress and Motion Analysis

2.2.1 As the design of column stabilized units is governed by both, structural and motion behaviour, calculations will have to be presented for approval covering both aspects. The investigation shall be carried out for a sufficient number of draughts and environmental conditions in order to determine the most severe cases of stressing and the associated motions, and vice versa.

Model tests may serve as additional basis for design.

2.2.2 For units of this type, the highest stresses, considering the arrangements of lower hull, distance between the lower hulls, etc., may be associated with less severe environmental conditions than the maximum specified by the Owner (designer). Where considered necessary, account is to be taken of the consequent increased possibility of encounter of significant stress levels, by either or both of the following:

1) Suitable reduction of the allowable stress levels for combined loadings given in Rules for Structures (Pt.5, Vol.II) Sec.3.D.
2) Detailed investigation of the fatigue properties, in order to evaluate the possibility of high stresses in association with probability of occurrence.

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

2.3. Upper Structure

2.3.1 The scantlings of the upper structure are not to be less than those required by Rules for Hull (Pt.1, Vol.II) in association with the loadings indicated on the deck loading plan. These loadings are not to be less than the requirements specified in Section 4. A.2.6

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 Section 4.C.2 and Section 4.C.3.

2.3.2 Where the upper structure is to be waterborne in any mode of operation specified in Section 1.B.2 or damaged condition, it is to be designed taking account of the loads induced under the condition.

2.3.3 Deckhouses fitted to the upper structure are to be designed in accordance with the requirements in Rules for Hull (Pt.1, Vol.II) Sec.16. The construction and scantlings of deckhouses provided on the hull of the unit are to be determined taking account of their location and the environmental conditions in which the unit will operate.

2.3.4 The upper structure, including the opening parts of the well, etc., is to be good in the continuity of longitudinal strength and transverse strength.

2.3.5 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. BKI 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.

2.3.6 Where a bridge is provided for access from the shore, the jointed part of the hull with the bridge is to be sufficiently strengthened.

2.3.7 For contact with other ships, the unit is to be equipped with sufficient fenders and particular attention is to be given to the reinforcement of shell plating, frames, girders, etc.

2.3.8 Tanks

1) Tanks for fresh water or fuel oil, or other tanks which are not intended to be kept entirely filled in service, are to have divisions or deep swashes as may be required to minimize the dynamic stress on the structure. Tight divisions and boundary bulkheads of all tanks are to be constructed in accordance with the Rules according to 2.1.2. The arrangement of all tanks, together with their intended service, and the height of the over-flow pipes are to be clearly indicated on the plans submitted for approval. Consideration is to be given to the specific gravity of the liquid in the tank.
2) Tanks are to be tested in accordance with the Rules and/or specifications.

2.3.9 Local structures in way of fairleads, winches, etc., forming part of the positional mooring system, shall be designed to the breaking strength of the mooring line or chain.

2.3.10 Special attention is to be paid to the foundations (supporting structure) and fastening of drilling derrick(s), cranes (see also Rules for Structures (Pt.5, Vol.II) Sec.8 and similar installations.

2.4 Columns, Lower Hulls and Footings

2.4.1 Where columns, lower hulls or footings are of stiffened shell construction, the scantlings of plating, stiffeners, girders, etc. are not to be less than determined by the requirements in Section 4.D.2 and Section 4.D.3. In this case, h_s and h_c are to be in accordance with the requirements in the following 1) to 3):

1) Where an internal space is loaded with liquid, h_s is the vertical distance in meters from the load line to the tank top and h_c is the vertical distance in meters from the tank top to the top of overflow pipes. Where, however, the specific gravity of the liquid is greater than that of sea water, h_s and h_c are to be modified taking account of specific gravity.
2) Where an internal space is a void compartment, the top of h_s is at the load line and the top of h_c is 0,6 times the design wave height in the severe storm condition above the water level at the design water depth.
3) The minimum values of h_s and h_c are not to be less than 6,0 m for areas subject to wave immersion and 3,4 m for other areas.

2.4.2 Where columns, lower hulls or footings are designed as shells either unstiffened or ring stiffened, the scantlings of shell plating and ring stiffeners are to be determined to satisfy the strength requirements in Section 4.C and Section 4.D in response to the design heads, h_s and h_c specified in 2.4.1.

2.4.3 The scantlings of deep tank bulkheads and their stiffeners provided in columns, lower hulls or footings are not to be less than determined by the requirements in Rules for Hull (Pt.1, Vol.II) Sec.12.

2.4.4 Where the column, lower hull or footing is an effective member for the overall strength of the unit, the stress resulting from the overall strength added by the stress determined by the requirements in 2.4.1 is not to exceed the allowable stress specified in Section 4.C .

2.4.5 Particular consideration is to be given to structural details, reinforcement, etc., in areas subject to high local loadings indicated in the following 1) to 7):

1) Areas subject to sea bottom bearing loads, where applicable,
2) Bulkheads of partially filled tanks,

3) Areas liable to sustain external damages,
4) Jointed parts between columns and footings or lower hulls,
5) Bracing connection force
6) Areas subject to wave impact.
7) Load due to mooring operations

2.4.6 Where a unit is designed for operations while supported by the sea bottom, the footings shall be designed to withstand the shock of bottom contact due to wave action on the hull. Such units shall also be evaluated for the effects of possible scouring action (loss of bottom support).The effects of skirt plates, where provided, are to be specially considered.

2.4.7 Openings in columns, like portlights or windows, including those of the non-opening type, or other similar openings are not to be fitted in columns. Regarding openings in external and internal walls, bulkheads, etc. see also Section 6.B.

2.4.8 Consideration shall be given to objects falling down from the platform onto the lower hull or footing. The size of objects and the potential area where objects may fall down has to be determined under special consideration of crane operations. From there the following angles of fall direction may be assumed:

– in air, unit floating : 10°
– in air, unit supported on sea-bed : 5°
– in water : 15 °

The endangered main structural elements of the lower hull determined in this way have to be reinforced to withstand the impact energy of fallen objects.

2.5. Bracing Members

2.5.1 Bracing member should be so arranged that they are protected as far as possible against boat impact (collisions) and other forces resulting from normal operations.

2.5.2 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 Section 4.C .

2.5.3 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 sea bottom, against the possibility of uneven bearing loads.

2.5.4 Bracing members are to have sufficient strength for buoyancy, wave forces, current forces and wave impact.

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

2.5.6 Underwater bracing members are normally to be made watertight. They shall be accessible for internal inspection and to be provided with a leak detection system make it possible to detect fatigue cracks at an early stage.

2.5.7 When bracing members are watertight, they are to be suitably designed to prevent collapse from external hydrostatic pressure.

2.5.8 The unit's structure are to be able to withstand the loss of any slender bracing member without causing overall collapse.

2.5.9 When any one slander bracing member are lost, overall strength of unit is complied with the following requirements where overall structure analysis are carried out based upon the design loads specified in Section 4.

1) For determining the design loads, environmental loads such as wind force, wave force, etc., are to be obtained from not less than 1-year return period.
2) Notwithstanding the kind of stress, the allowable stress at the combined loads condition is to be following formula.

$$\sigma_{all} = R_{eH} \qquad \text{[Nm]}$$

Where

σ_{all} = allowable stress [N/mm^2]

R_{eH} = specified yield stress of materials [N/mm^2]

3) In case of taking into consideration of combined compression stress, η specified in Section 4.C.3 maybe 1,0.
4) When taking into consideration of redistribution of forces due to yielding or buckling and overall strength is to be satisfied with the 2.5.9, the criteria of allowable stress may be exceeding for local stress.

2.6 Wave clearance (Air Gap)

2.6.1 Afloat condition

Unless deck structures are designed for wave impact, to the satisfaction of BKI, reasonable clearance between the deck structures and the wave crests is to be ensured for 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 reports on past operating experience with similar configurations showing that adequate provision is made to maintain this clearance are to be submitted.

2.6.2 On-bottom condition

For on-bottom modes of operation, clearances are to be in accordance with those specified in A.2.8.

3. Stability on Seabed

3.1. General

The general requirements for stability are defined in Section 6. Additional aspects are given in the following.

3.2. Stability of units resting on the sea-bed

Units designed to rest on the sea-bed are to have sufficient downward gravity loading on the support footings or lower hull to withstand the overturning moment of the combined environmental forces from any direction, for each applicable design loading condition.

The overturning safety factor, defined as the sum of the restoring moments divided by the sum of the overturning moments, should not be less than:

– 1,5 for loading condition of operating load
– 1,3 for loading condition of extreme environmental load

according to Rules for Structures (Pt.5, Vol.II Sec.3.C).

C. Surface Type Units

1. General

This sub-section covers those specific design criteria and features of surface type units (ship and barge type). For the requirements which are not covered by this subsection, 1.1 to 1.5 are to be applied.

1.1 Subdivision and watertight integrity

Subdivision and watertight integrity of surface units are dealt with in Section 6. Regarding stability see A.2 of the section.

For drilling unit, stability according to the requirements defined above has to be investigated for the three occurring modes of operation:

1) Drilling operation under defined environmental conditions
2) Severe storm conditions
3) Transit conditions between different drilling

1.2 Machinery and electrical installations

Machinery and electrical installations shall be designed according to Section 8.

1.3 Mooring system

Mooring system for temporary and position keeping including dynamic position keeping are defined in Section 7.

1.4 Lifting appliances

Drawings showing the location and support of foundations for cranes and davits have to be submitted. The forces to the hull structure have to be defined. For the interaction of lifting appliances with the unit, their foundations, etc. See Rules for Structures (Pt.5, Vol.II Sec.8).

The requirements for offshore cranes and other lifting appliances themselves are defined in the Guidelines for Loading Gear on Seagoing Ships and Offshore Installations (Pt.4, Vol.3).

1.5 Towing

If the unit is towed by tugs, a general arrangement drawing of the towing system has to be submitted. Towing forces and permissible towing directions are to be defined, see also Section 3, I.

In the drawings of the hull structure the measures to transfer the towing forces into the hull have to be shown. As maximum towing forces the breaking strength of the towing ropes or cables defined in the towing arrangement has to be assumed.

Conditions for towing shall be clearly indicated in the Operating Manual (Booklet), compare Section 2.C.3.1.

1.6 Drilling Facilities

1.6.1 General

These Rules do not include requirements for the drilling of subsea wells or procedures for their control. Such drilling operations are subject to control by the coastal state.

1.6.2 Drawings to be submitted

The planned interaction of the drilling systems with hull has to be clearly documented, e.g. by:

1) Drawings showing the arrangement of the drilling derrick including weights and moments
2) Drawings showing the pipe storage and handling
3) Drawings showing mud tanks, cement silos, etc.

1.6.3 Operating manual (Booklet)

The rated capacity for each reeving shall be included in the Operating Manual (Booklet).

1.6.4 Drilling equipment

1) Drilling derricks shall be designed according to recognized codes/standards and/or applicable National Regulations. Permanently installed piping systems for drilling operations are to comply with a recognized standard or code.
2) Requirements for drilling systems are contained in Section 8.D.

2 Structure

2.1 General

2.1.1 Scantlings of the hull structure for ship type and barge type are to meet the Rules for Hull (Pt.1, Vol.II) as applicable, notwithstanding the requirements in Section 4.B to D. Special consideration however is to be given to items which may require some deviation or additions to these Rules, in particular the items indicated in 2.2 and 2.3.

2.1.2 In order to avoid occurrences of unacceptable stress in the hull structure with length $L \geq 65$ m for ship type and barge type, the unit is to be provided with the loading manual indicated following items which is approved by BKI. However, the loading manual may not be provided with where deemed unnecessary by BKI.

1) Loading conditions on the basis of which the barge is designed, and the allowable limits of longitudinal still water bending moment and still water shearing force.
2) Results of calculation of longitudinal still water bending moment and still water shearing force.

2.1.3 Where a bridge is provided for access from the shore, the jointed part of the hull with the bridge is to be sufficiently strengthened.

2.1.4 For contact with other ships, the unit is to be equipped with sufficient fenders and consideration is to be given to the reinforcement of shell plating, frames, girders, etc.

2.2 Drilling Well

2.2.1 The required strength of the unit shall be maintained in way of the drilling well and particular attention shall be given to the transition between fore and aft members so as to maintain continuity of the longitudinal material. Stress concentrations have to avoided by a favourable structural detailed design.

2.2.2 The plating of the well is to be suitably stiffened to prevent damage due to foreign objects which may become trapped in the well.

2.2.3 The drilling well is to be surrounded by cofferdams. Such cofferdams may temporarily be used also as tanks for liquids related to drilling operations, if they can be easily emptied for inspection.

2.3 Deck Area

2.3.1 Where large deck openings such as wells, etc. are provided, the hull structure is to be suitably reinforced and to be good in the continuity of longitudinal strength and transverse strength.

2.3.2 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.

2.3.3 The local structure in way of elements of the position mooring system and of the towing system, if applicable, has to be reinforced accordingly, compare C.1.3 and C.1.5

3 Safety Aspect

3.1 Hazardous areas

The general classification in hazardous and non-hazardous areas is contained in Section 9.A.2.1, whereas the area classification requirements to be observed for drilling are defined in Section 9.A.3.2.

The requirements for explosion protection of electrical equipment in hazardous areas are defined in Section 9.D.1.3.

3.2 Fire protection

The requirements for structural fire protection and means of escape are defined in Section 10.B.

3.3 Fire detection and extinguishing

The requirements for fire detection and alarm systems are defined in Section 10.C.11. The requirements for fire extinguishing systems and equipment are summarized in Rules for Machinery Installations (Pt.5, Vol.IV), Sec. 10, C.

3.4 Life-saving appliances

The number, size and arrangement of life-saving appliances for the complete crew shall follow the requirements defined in Section 11.

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Section 6 Stability, Watertight Integrity and Load Line

A. Stability 6–1
B. Watertight Integrity 6–8
C. Load Lines 6–11

A. Stability

1. General

1.1. Application

1.1.1 All mobile offshore unit are to meet the stability requirements in this Section.

1.1.2 Any additional National Regulations should be observed, where applicable.

1.1.3 Regarding the effects of (maximum) angles of inclination on machinery installations see Section 8, A.3

1.2. General Requirements

1.2.1 The stability for units embedded on the sea bottom, are according to Section 5, A.3 and B.3.

1.2.2 For the purpose of stability calculation, it is to be assumed that the unit is floating free of mooring restraints. However, where there are the possible detrimental effects of mooring for stability of the unit, these effects are to be considered.

1.2.3 For the purpose of stability calculation, the free surface effect of liquids in tanks are to be taken into account.

1.2.5 For the purpose of stability calculation, if available, the snowing and icing data based upon the service area of the unit are to be included.

1.3. Intact Stability

1.3.1 All units are to have positive stability in calm water equilibrium position.

1.3.2 All units are to have sufficient stability to withstand the overturning effect of heeling moment induced by the wind and motions induced by the wave.

1.3.3 For units provided to change the units condition in the severe storm condition, the way of changing the units, condition such as rearrangement of variable load and equipment, by changing the draught or both are to be indicated in the Operating Manual (Booklet).

1.3.4 Each unit should be capable of attaining a severe storm condition in a period of time consistent with the meteorological conditions. The procedures recommended and the approximate length of time required, considering both operating conditions and transit conditions, should be contained in the Operating Manual. It should be possible to achieve the severe storm condition without the removal or relocation of solid consumables or other variable load. However, BKI may permit loading a unit past the point at which solid consumables would have to be removed or relocated to go to severe storm condition under the following conditions, provided the allowable KG is not exceeded:

1) in a geographic location where weather conditions annually or seasonally do not become sufficiently severe to require a unit to go to severe storm condition; or

2) where a unit is required to support extra deck load for a short period of time that falls well within a period for which the weather forecast is favourable.

The geographic locations, weather conditions and loading conditions in which this is permitted should be identified in the Operating Manual (Booklet).

1.3.5 For surface type unit, Loading conditions covering departure and arrival in full load as well as ballast conditions, along with anticipated operating conditions at site are to be included in the Operating Manual (Booklet). For detail, see Rules for Hull (Pt.1, Vol.II) Sec.5.A.

1.4. Damage Stability

1.4.1 All units are to have sufficient freeboard and be subdivided by means of watertight decks and bulkheads to provide sufficient buoyancy and stability to withstand the flooding of any one compartment in any operating or transit condition consistent with the damage assumptions set out in 3.

1.4.2 All units are to have sufficient stability to withstand the flooding any one compartment or any combination of compartments, and the heeling moment induced by horizontal wind velocity superimposed from any direction and units, motions due to waves.

1.4.3 The final waterline after flooding is to be below the lower edge of any down flooding opening.

1.4.4 Damage stability calculation is to take into consideration the proportions and design characteristics of the unit and the arrangements and configuration of the damaged compartments. In making these calculations, it shall be assumed that the unit is in the worst anticipated service condition as regards stability and is floating free of mooring restraints.

1.4.5 For the purpose of damage stability calculation, the abilities to compensate for heeling angle due to damage such as pumping out from the damaged compartment, ballasting or filling other compartments, or mooring force, etc. are not to be considered.

1.5. Wind Heeling Moment

1.5.1 Wind velocity and wind loads are to be obtained from in accordance with the requirements in Section 4,A.2 by considering at least two loading conditions of operating and severe storm condition, respectively. For damage stability calculation, however, wind loads are to be obtained from wind velocity which may be 25,8 m/s imposed from any direction.

1.5.2 The lever for the heeling force is to be taken vertically from the center of lateral resistance or, if available, the center of hydrodynamic pressure, of the underwater body to the center of pressure of the areas subject to wind loading.

1.5.3 The wind heeling moment is to be calculated at several angles of inclination for each mode of operation.

1.5.4 In calculating wind heeling moments for ship-shaped and barge-shaped hulls, the curve may be assumed to vary as the cosine function of the unit's heel.

1.

1.5.5 Wind heeling moments derived from authoritative wind tunnel tests on a representative model of the unit may be considered as alternatives to the method given in 5.2 to 5.4. Such overturning moment determination is to include lift effects at various applicable heel angles, as well as drag effects.

1.6. Inclining Test

6.1. An inclining test is to be carried out with the first unit of a design, when as near to completion as possible, to determine accurately the light ship data (weight and position of centre of gravity).

1.6.2. For successive units which are identical by design, the light ship data of the first unit of the series may be accepted in lieu of an inclining test, provided the difference in light ship displacement or position of centre of gravity due to weight changes and minor differences in machinery, outfitting or equipment, confirmed by the results of a lightweight survey, are less than 1 % of the values of the light ship displacement and principal horizontal dimensions as determined for the first of the series.

Particular care is to be given to the detailed weight calculation and comparison with the original unit of a series of column stabilized semi-submersibles as these, even though identical by design, are recognized as being unlikely to attain an acceptable similarity of weight or centre of gravity to warrant a waiver of the inclining test.

1.6.3. The results of the inclining test, or dead weight survey and inclining experiment adjusted for weight differences, shall be indicated in the Operating Manual (Booklet).

1.6.4. A record of all changes to machinery, structure, outfit and equipment that affect the light ship data, shall be maintained in the Operating Manual, or a light ship data alterations log, and be taken into account in daily operations.

1.6.5. For column stabilized units :

1) A lightweight survey shall be conducted at intervals not exceeding five years. If a lightweight survey is conducted and it indicates a change from the calculated light ship displacement in excess of 1% of the operating displacement, an inclining test should be conducted, or the difference in weight should be placed in an indisputably conservative vertical centre of gravity and approved by the BKI.
2) If the survey or test at the first renewal survey demonstrated that the unit was maintaining an effective weight control programme, and at succeeding renewal surveys this is confirmed by the records under paragraph 1.6.4, light ship displacement may be verified in operation by comparison of the calculated and observed draught. Where the difference between the expected displacement and the actual displacement based upon draught readings exceed 1% of the operating displacement, a lightweight survey should be completed in accordance with paragraph 2)

1.6.6. The inclining test or lightweight survey shall be carried out in the presence of the BKI Surveyor.

2. Intact Stability Criteria

2.1. General

2.1.1 For all units, curves of righting moments and of wind heeling moments similar to Fig. 6.1 with supporting calculation are to be prepared covering the full range of operating draughts including those in transit conditions, taking into account the maximum deck cargo and equipment in the most unfavourable position applicable.

2.1.2 The righting moment curves and wind heeling moment curves are to be calculated in relation to the most critical axis. Account should be taken of the free surface of liquids in tanks.

2.2.3. Where equipment is of such a nature that it can be lowered and stowed, additional wind heeling moment curves may be required; such data shall clearly indicate the position of such equipment. Provisions regarding the lowering and effective stowage of such equipment should be included in the operating manual

2.2.4 The righting moment curve are to be positive over the entire range of angle from upright to the second intercept angle θ_3 shown in Fig. 6.1.

2.2. Self-elevating Unit

In Fig. 6.1, units of this type are to meet the following stability criteria.

Area (A + B) $\geq$ 1,4 · Area (B + C)

However, angle of heel is to be taken up to the down flooding angle, θ_2 or the second intercept, θ_3, whichever is less.

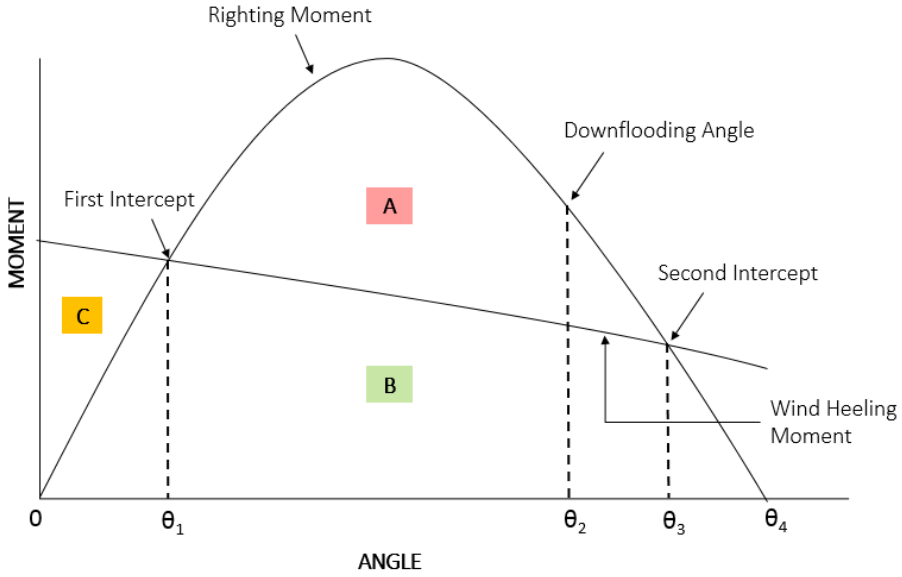

Fig. 6.1 Righting Moments and Wind Heeling Moment Curves

2.3. Column Stabilized type Unit

In Fig. 6.1, units of this type are to meet the following stability criteria.

Area (A + B) $\geq$ 1,3 · Area (B + C)

However, angle of heel is to be taken up to the down flooding angle, θ_2.

2.4. Ship type and Barge type Unit

In Fig. 6.1, units of this type are to meet the following stability criteria.

Area (A + B) $\geq$ 1,4 · Area (B + C)

However, angle of heel is to be taken up to the down flooding angle, θ_2 or the second intercept, θ_3, whichever is less.

3. Extent of Damage depending on the Type of Units

3.1. General

3.1.1 For the damage stability calculation, extent of damage is to be assumed in accordance with requirements of 3.2 to 3.4 corresponding to unit's type, however, unless otherwise provided in case of considering the purpose of the units, service area, service period, etc. and which are approved by BKI.

3.1.2 Where damage of a lesser extent than the requirements of 3.2 to 3.4 in a more severe condition for units, such lesser extent of damage are to be assumed.

3.1.3 All piping, ventilation systems, trunks, etc., within the extent of damage are to be assumed to be damaged. Positive means of closure are to be provided at watertight boundaries to preclude the

progressive flooding of other spaces which are intended to be intact. Where effective means of closure are not to be provided thereto, the compartments bounded by the bottom shell are to be considered flooded individually.

3.2. Self-Elevating Unit

In assessing the damage stability of self-elevating units, the following extent of damage is to be assumed to occur between effective watertight bulkheads:

1) Horizontal penetration is 1,5 m. However, the recessed ends and sides of the drilling slot need not be subject to horizontal penetration if warning signs be posted on each side of the vessel stating that no boats be allowed inside the drilling slot. Instructions to this effect should be included in the Operating Manual (Booklet).
2) Vertical extent is bottom shell upwards without limit.
3) The compartments bounded by the bottom shell are to be assumed to be damaged. Where a bottom mat is fitted, assumed damage penetration simultaneous to both the mat and the upper hull need only be considered when the lightest draught allows any part of the mat to fail within 1,5 m vertically of the waterline, and the difference in length or breadth of the upper hull and mat is less than 1,5 m in any area under consideration. In case where other than above, only the compartments bounded by the bottom shell of the bottom mat are to be considered.
4) The distance between effective watertight bulkheads or their nearest stepped portions which are positioned within the extent of horizontal penetration assumed by 1) is to be not less than 3,0 m. Where there is a lesser distance, one or more of the adjacent bulkheads are to be disregarded.

3.3. Column Stabilized Unit

In assessing the damage stability of column stabilized units, the following extent of damage is to be assumed to occur between effective watertight bulkheads:

1) Only those columns, underwater hulls and braces on the periphery of the unit are to be assumed to be damaged and the damage will occur in the exposed outer portions of the columns, underwater hulls and braces.
2) Columns and braces are to be assumed to be flooded by damage having vertical extent of 3,0 m occurring at any level between 5,0 m above and 3,0 m below the draughts. Where a watertight flat is located within this region, the damage is to be assumed to have occurred in both compartments above and below the watertight flat in question.
3) Lesser distances above or below the draughts may be applied to the satisfaction of BKI, taking into account the actual operating conditions. However, the extent of required damage region is to be at least 1.5 m above 2) and below the draughts specified in the Operating Manual (Booklet) and where a watertight flat is located within this region, the damage is to be assumed to have occurred in both compartments above and below the watertight flat in question.
4) No vertical bulkhead is assumed to be damaged except where bulkheads are spaced closer than a distance one-eighth the column perimeter at the draught under consideration, measured at the periphery, in which case one or more of the bulkheads will be disregarded.
5) Horizontal penetration of damage is to be assumed not to exceed 1,5 m.
6) Underwater hull or footings are to be treated as damaged when operating at a light or transit condition in the same manner as indicated in 1) through 5).

3.4. Ship type and Barge type Unit

In assessing the damage stability of ship type and barge type units, the following extent of damage is to be assumed to occur between effective watertight bulkheads:

1) Horizontal penetration is 1,5 m.

2) Vertical extent is bottom shell upwards without limit.

3) The compartments bounded by the bottom shell are to be considered flooded individually.

4) The distance between effective watertight bulkheads or their nearest stepped portions which are positioned within the extent of horizontal damage assumed by 1) are to be not less than 3,0 m. Where the distance of this is less than 3,0 m, one or more of the adjacent bulkheads are to be disregarded.

4. Damage Stability Criteria

4.1. Self-Elevating Unit

All units of this type, considering the extent of damage required in 3.1 and 3.2, are to meet the requirements in A.4 at all floating conditions.

For self-elevating units particularly, the flooding of any single compartment with the assumption of no wind while meeting the following criterion:

where:

$$R_{oS} = \theta_m - \theta_s \geq \text{Max} \left\{ \left(7^o + 1{,}5\,\theta_s\right); 10^o \right\}$$

where

R_{oS} = range of stability [deg]

θ_m = maximum angle of positive stability [deg]

θ_s = static angle of inclination after damage[deg]

The range of stability is determined without reference to the angle of downflooding. Refer to Fig.6.2.

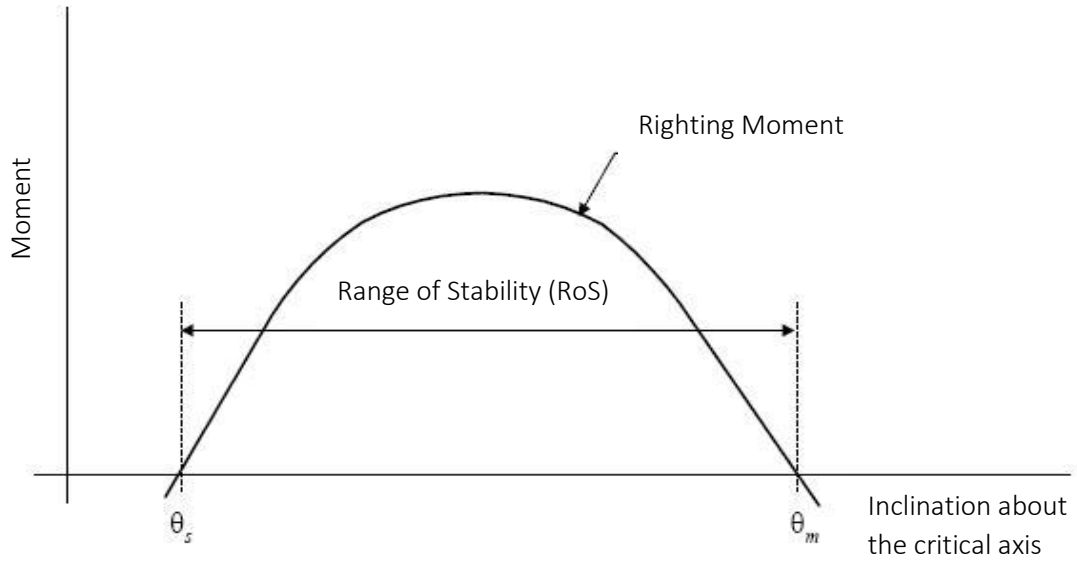

Fig. 6.2 Range of Stability

4.2. Column Stabilized Unit

4.2.1 For all units of this type, curves of righting moments and of wind heeling moments in damage condition similar to Fig. 6.3 are to be prepared.

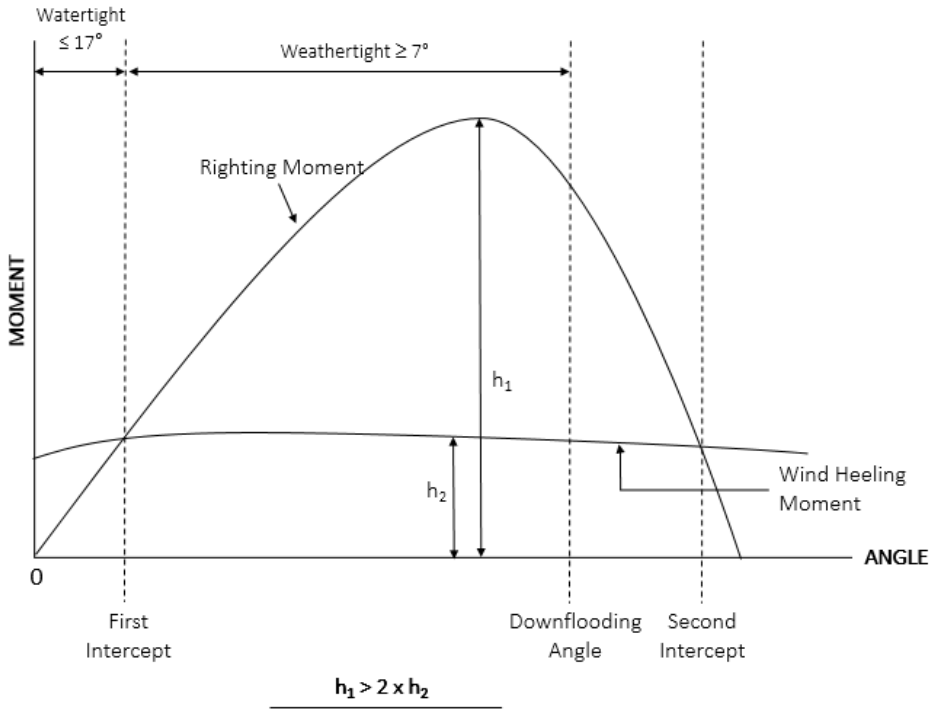

Fig. 6.3 Righting Moments and Wind Heeling Moment Curves

4.2.2 The righting moment curves and wind heeling moment curves are to be calculated in relation to the most critical axis and sufficient numbers of floating condition.

4.2.3 The unit are to have sufficient buoyancy and stability to withstand a wind heeling moment in any operating or transit condition, and are to be in accordance with following condition.

1) The angle of inclination after the damage set out in 3.1 and 3.3 are not to be greater than 17 degrees.
2) Any openings below the final waterline are to be made watertight, and openings within 4,0 m above the final waterline are to be made weathertight.
3) The righting moment curve, after the damage set out above, are to have, from the first intercept to a lesser of extent of watertight integrity and the second intercept angle or downflooding angle, a range of at least 7 degree. Within this range, the righting moment are to reach a value of at least twice the wind heeling moment curve, both being measure at the same angle, See Fig. 6.3.

4.2.4 The unit are to provide sufficient buoyancy and stability in any operating or transit condition with the assumption of no wind to withstand the flooding of any watertight compartment wholly or partially below tie waterline in question, which is a pump room, a room containing machinery with a salt water cooling system or a compartment adjacent to the sea, and are to be in accordance with the following requirements.

1) The angle of inclination after flooding are not to be greater than 25 degrees.
2) Any opening below the final waterline shall be made watertight.
3) A range of positive ability are to be provided, beyond the calculated angle of inclination from the first intercept to a lesser of the extent of watertight integrity and the second intercept angle or downflooding angle , of at least 7 degrees.

4.3. Ship type or Barge Type Unit

All units of these type, considering the extent of damage required in 3.1 and 3.4., are to be meet the requirements in 1.4 at all floating conditions.

5. Alternative Stability Criteria

5.1. Alternative stability criteria may be considered acceptable provided the criteria afford adequate righting moment to resist the heeling effects of operating and environmental forces and sufficient margins to preclude downflooding and capsizing in intact and damaged conditions.

5.2. The following will be considered in determining the adequacy of alternative criteria submitted for review:

- Environmental conditions representing realistic winds (including gusts) and waves appropriate for various modes of operations;
- Dynamic response of a unit. Where appropriate, the analysis should include the results of wind tunnel tests, wave tank model tests and nonlinear simulation. Any wind and wave spectra used should cover sufficient frequency ranges to ensure that critical motion responses are obtained;
- Potential for downflooding, taking into account dynamic responses and wave profile;
- Susceptibility to capsizing considering the unit's restoration energy, static inclination due to mean wind speed and maximum dynamic responses;
- A safety margin consistent with the methodology to account for uncertainties;
- Damage assumptions at least equivalent to the requirements contained in 3;

  For column stabilized units one compartment flooding assumptions at least equivalent to the requirement contained in 4.2.3.

B. Watertight Integrity

1. Watertight Bulkhead

1.1. General

1.1.1 Watertight bulkheads of Ship type and Barge type are to be in accordance with the requirements Rules for Hull (Pt.1, Vol.II) Sec.11 or Sec.31.C.

1.1.2 The arrangement of watertight bulkheads in self-elevating units and column stabilized units is to be at the discretion of BKI.

1.1.3 The ararrangements and scantlings of watertight decks and bulkheads in column stabilized unit are to be made effective to that point necessary to meet the requirements of damage stability.

1.1.4 Ship type and Barge type units are to be fitted with a collision bulkhead in accordance with the requirements Rules for Hull (Pt.1, Vol.II) Sec.11, A.2.1 or Sec.31.C.

1.1.5 Where openings, etc. are provided on watertight bulkheads, the requirements in Rules for Hull (Pt.1, Vol.II) Sec.11, A.3 and Rules for Machinery (Pt.1, Vol.III) Sec.11 are to be applied. Elsewhere, watertight bulkhead is to be fitted as necessary to provide transverse strength and subdivision.

1.2. Tank Boundary

1.2.1 Tanks for fresh water or fuel oil, or any other tanks which are not intended to be kept entirely filled in service, are to have divisions or deep swashes as may be required to minimize the dynamic stress on the structure.

1.2.2 Tight division and boundary bulkheads of all tanks are to be constructed in accordance with Rules for Hull (Pt.1, Vol.II) Sec.12.

1.2.3 The arrangement of all tanks, together with their intended service and the height of the overflow pipes, is to be clearly indicated on the plans submitted for approval. Consideration is to be given to the specific gravity of the liquid in the tank.

1.2.4 Each tank is to be tasted in accordance with Rules for Hull (Pt.1 Vol. II) Sec. 12 A.4.5

1.3. Boundary Penetrations

1.3.1 Where watertight boundaries are required for damage stability, they are to be made watertight, including piping, ventilation, shafting, electrical penetrations, and so on. Piping systems and ventilation ducts within the extent of damage are to be provided with valves which are capable of being remotely operated from the weather deck, pump room, or other normally manned space, and are to be satisfactorily arranged to preclude the possibility of progressive flooding through the system to other spaces, in the event of damage. Valve position indicators are to be provided at the remotely operating positions.

1.3.2 Notwithstanding the requirements in 1.3.1, non-watertight ventilation ducts are to be provided with watertight valves at the sub division boundaries and the valves are to be capable of being operated from a remote location, with position indicators on the weather deck, or in a normally manned space.

1.3.3 In the case of self-elevating units, ventilating systems which are not used during the transit condition may be secured by alternative methods approved by BKI. In this case, necessary ventilation for closed spaces and closing methods are to be arranged at the discretion of BKI.

1.3.4 In the case of column stabilized units, valve operating devices are to be in the central ballast control station. And valve position indicators are to be provided at the remote-control station.

1.3.5 The number of opening in watertight subdivisions is to be kept to a minimum compatible with the design and safe operation of the unit. Where penetration of watertight decks and bulkheads are necessary for access, piping, ventilation, electrical cables, etc., arrangements are to be made to maintain the watertight integrity of the enclosed compartments

2. Closing Appliances

2.1. General

2.1.1 The construction and closing appliances of openings through which the sea water is likely to flow in are to be in accordance with the requirements in Rules for Hull (Pt.1, Vol.II) Sec.11, A.3.

2.1.2 Closing appliances provided in column stabilized units, which are not located within areas of calculated immersion and for which special considerations are given, are to be at the discretion of BKI.

2.2. Internal Openings used during Operation

2.2.1. Internal openings fitted with appliances to ensure watertight integrity, which are used during operation of the unit while afloat, are to comply with the following .1 to .3:

.1 Doors and hatch cover are to be capable of being remotely operated from a control position (ballast control room) which is above the final waterline after flooding as well as being operable locally from both sides of the bulkhead. Indicators are to be provided at the control position to indicate whether the doors are open or closed. In addition, remotely operated doors provided to ensure the watertight integrity of internal openings which are used while at sea are to be sliding watertight doors with audible alarm. The power, control and indicator are to be operable in the event of main power failure. Particular attention is to be paid to minimizing the effect of control system failure. Each power-operated sliding watertight doors shall be provided with an individual hand operated mechanism. It shall be possible to open and close the door by hand at the door itself from both side

.2 Doors or hatch covers in self-elevating units, or doors placed above the deepest load line draft in column-stabilized and surface units, which are normally closed while the unit is afloat may be of the quick acting type and should be provided with an alarm system (e.g., light signals) showing personnel both locally and at the central ballast control station whether the doors or hatch covers in question are open or closed. A notice should be affixed to each such door or hatch cover stating that it is not to be left open while the unit is afloat

.3 The closing appliances are to have strength, packing and means for securing which are sufficient to maintain water tightness under the design water pressure of the watertight boundary under consideration.

2.3. External Openings used during Operation

External openings fitted with appliances to ensure watertight integrity, which are used during operation of the units while afloat, are to comply with the following 2.3.1 to 2.3.6:

2.3.1 The waterline in the final condition of equilibrium after flooding, taking into account the effect of wind, is to be below the lower edge of any opening through which progressive flooding may take place.

2.3.2 Openings under 2.3.1 include air pipes (regardless of closing appliances), ventilators, ventilation intakes and outlets, non-watertight hatches and weathertight doors are not to submerge when the unit is inclined to the first intercept of the righting moment and wind heeling moment curves in any intact or damaged condition

2.3.3 External openings for column stabilized unit are to be weathertight within the range necessary to comply with the requirement of damage stability criteria and within a zone measured 4,0 m or 7,0 degrees perpendicularly above the final waterline shown in Fig. 6.4.

2.3.4 Openings fitted with appliances to ensure watertight integrity, such as non-opening side scuttles, manholes and small hatches, may be submerged and are to comply with requirement of 2.4.

2.3.5 Small hatches above 2.3.4 are those which are normally used for access by personnel. Such openings, which may be submerged in case of damage, are to comply with the following:

1) Openings are to be closed by approved quick acting watertight covers of steel or equivalent material.
2) An alarm system (e.g. light signals) is to be arranged showing personnel, both locally and at a control position, whether the hatch covers in question are open or closed.
3) A signboard to the effect that the closing appliances to be closed while the unit is afloat, and is only to be used temporarily, is to be fitted locally.
4) Such hatches are not to be regarded as emergency exits.

2.3.6 Where flooding of chain lockers or other buoyant volume may occur, the openings to these spaces are to be considered as down flooding points.

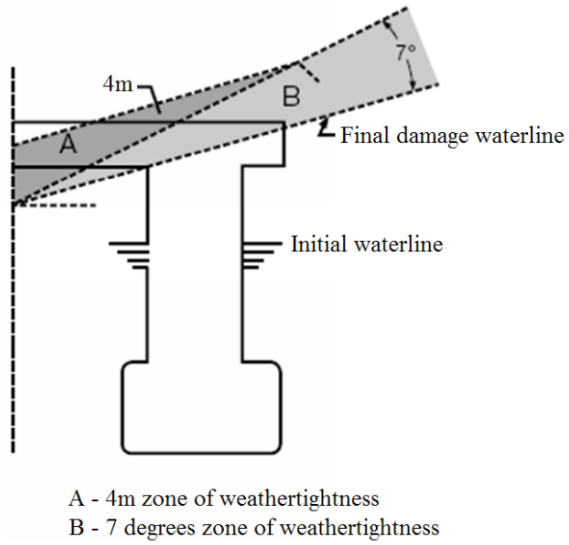

Fig. 6.4 Minimum Weathertight Integrity Requirements for Column Stabilized Unit

2.4. Internal and External Openings kept permanently closed while afloat

Internal and external openings fitted with appliances to ensure watertight integrity, which are to be kept permanently closed while afloat, are to comply with the following:

2.4.1 A signboard to the effect that the opening is always to be kept closed while afloat is to be fitted on the closing appliances in question.

2.4.2 Manholes fitted with bolted covers need not be dealt with as under 2.4.1.

2.4.3 The closing appliances are to have strength, packing and means for securing which are sufficient to maintain water tightness under the design water pressure of the watertight boundary under consideration.

2.4.4 Opening and closing of such closure devices should be noted in the unit's logbook, or equivalent.

C. Load Lines

1. General

1.1. Application

1.1.1 The requirements in this Sub-section apply to all units intended for international voyages or unrestricted services except units with **L** of which is less than 24 meters.

1.1.2 For units which is not complied with requirement in 1.1.1, marking of the load line is not necessary, however, designed maximum load line of these units are to be determined by the requirements in A, B, C.2 and Section 4.

1.1.3 BKI may request special requirements as instructed by the flag government of units or the government of sovereign nation in which units navigate or operate in addition to the requirements in this Sub-section. For Indonesian flag units, Indonesian Domestic Load Line Regulation may be applied.

2. Load Lines

2.1. General

2.1.1 The requirements of the 1988 LL Protocol, including those relating to certification, should apply to all units and certificates should be issued as appropriate. The minimum freeboard of units which cannot be computed by the normal methods laid down by that Protocol is to be determined on the basis of meeting the applicable intact stability, damage stability and structural requirements for transit conditions and drilling operations while afloat. The freeboard should not be less than that computed from the Protocol where applicable.

2.1.2 With respect to weathertightness and water tightness of decks, superstructures, deck houses, doors, hatchway covers, other openings, ventilators, air pipes, scuppers, inlets and discharges, etc., these are to comply with the requirements in B and shall be taken as a basis for all units in the afloat condition.

2.1.3 Heights of hatch and ventilator coamings, air pipes, doors sills, etc., in exposed positions and their means of closing are to comply with the relevant requirements of Rules for Hull (Pt.1, Vol.II) and Rules for Machinery Installations (Pt.1, Vol.III), in addition these are to be determined by consideration of the requirements in A and B in both intact and damage stability condition.

2.1.4 All downflooding openings which may become submerged, before the angle of inclination at which the required area under the intact righting moment curve specified in A is achieved, are to be fitted with weathertight closing appliances.

2.1.5 BKI may give special considerations to the position of openings which cannot be closed in emergencies, such as air intakes for emergency generators, having regard to the intact righting arm curves and the final waterline after assumed damage.

2.1.6 Load line markings including such seasonal allowances as may be determined, are to be placed at suitable visible locations on the structure, to the satisfaction of BKI. These marks, where practicable, are to be visible to the person in charge of mooring, lowering or otherwise operating the unit.

2.1.7 A load line, where assigned, is not applicable to bottom-supported units when resting on the sea bed, or when lowering to or raising from such position.

2.1.8 Special consideration shall be given to small hatches with an opening area of 2,5 m^2 or less at the exposed deck over the forward 0,25**L** on seagoing units of length 80 m or more, that are contracted on or after 1st January 2004, where the height of the exposed deck in way of the hatch is less than 0,1**L** or 22 m above the summer load waterline, whichever is the lesser. For design details see Rules for Hull (Pt.1, Vol.II Sec.17 D.2)

2.1.9 Special consideration shall be given to air pipes, ventilator pipes and their closing devices at the exposed deck over the forward 0,25**L** on seagoing units of length 80 m or more, that are contracted on or after 1st January 2004, where the height of the exposed deck in way of the pipes is less than 0,1**L** or 22 m above the summer load waterline, whichever is the lesser. For design details see Rules for Hull (Pt.1, Vol.II Sec.21 F.5)

2.2. Self-Elevating Units

2.2.1 Load lines shall be assigned to self-elevating units as calculated under the terms of the 1988 ILLC Protocol. When floating or when in transit from one operational area to another, units shall be subject to all the conditions of assignment of that Protocol unless specifically excepted. However, these units shall not be subject to the term of that Protocol while they are supported by the sea-bed or are in the process of lowering or raising their legs.

2.2.2 Self-elevating units may be manned when under tow. In such cases a unit would be subject to the bow height and reserve buoyancy requirements which may not always be possible to achieve. In such circumstances, the Administration should consider the extent of application of regulations 39(1), 39(2) and 39(5) of the 1988 ILLC Protocol, as amended, and give special consideration to such units, having regard to the occasional nature of such voyages on predetermined routes and to prevailing weather conditions.

2.2.3 The minimum freeboard of self-elevating units which due to their configuration cannot be computed by the normal methods laid down by the Load Line Convention is to be determined on the basis of meeting applicable intact stability, damage stability and structural requirements in the afloat condition.

2.2.4 For some unit utilized a large mat or similar supporting structure which contributes to the buoyancy when the unit is floating, the mat or similar supporting structure is to be ignored in calculation of freeboard. However, the mat or similar supporting structure is to always be taken into account in the evaluation of the stability of the unit when floating since its vertical positionrelative to the upper hull may be critical

2.3. Column Stabilized Units

2.3.1 The hull form of this type of unit makes the calculation of geometric freeboard in accordance with the provisions of Chapter III of 1988 ILLC Protocol impracticable. The minimum freeboard of this unit is to be determined by meeting applicable requirements for:

- Strength of unit's structure, Section 4.B
- The minimum clearence beetwen passing wave crest and deck structure, Section 5.B.2.6
- Intact and damage stability requirements, A.2

2.3.2 The minimum freeboard is to be marked in appropriate location on the structure which is satisfactory to BKI.

2.3.3 The enclosed deck structure of this unit is to be made weathertight.

2.3.4 Windows, side scuttles and port lights, including those of the non-opening type, or other similar openings are not to be located below the deck structure of this unit.

2.3.5 The position of openings which cannot be closed in emergencies, such as air intakes for emergency generators will be specially considered having regard to the intact righting arm curves and the final waterline after assumed damage.

2.4. Ship Type Units and Barge Type Units.

2.4.1 Freeboard of this unit is to be assigned in accordance with 1988 ILLC Protocol (see 1.1.3) after confirming that the hull structure has a sufficient strength for the draught corresponding to the freeboard assigned. Freeboard of units which cannot be assigned in accordance with load line regulations due to special forms of units, however, is to be assigned in accordance with the requirements in A, B and Section 4 at floating condition.

2.4.2 Load lines corresponding to assigned freeboards are to be marked with in accordance with applied load line regulations.

2.4.3 Where it is necessary to assign a greater than minimum freeboard to meet intact or damage stability requirements, or due to any other restriction, seasonal marks above the centre of the ring shall not be marked, and any seasonal marks below the centre of the ring shall be marked.

2.4.4 Where moonpools are arranged within the hull in open communication with the sea, the volume of the moonpool are not to be included in the calculation of any hydrostatic properties.

2.4.5 Where the moonpool has a larger cross-sectional area above the waterline at 0,85**H** than below, an addition is to be made to the geometric freeboard corresponding to the lost buoyancy. This addition for the excess portion above the waterline at 0,85**H** are to be dealt with the following 1) to 3) as below for wells and recesses.

1) Where an enclosed superstructure contains part of the moonpool, deductions are to be made for the effective length of the superstructure.
2) Where open wells or recesses are arranged in the freeboard deck, a correction equal to the volume of the well or recess to the freeboard deck divided by the waterplane area at 0,85**H** are to be made to the freeboard obtained after all other corrections, except bow height correction have been made.
3) In stability calculation, free surface effects of the flooded well or recess are to be taken in to consideration.

2.4.6 Where small notches or relatively narrow cut-outs at the stern of the unit, the same procedure for correction described in 2.4.5 is to be carried out.

2.4.7 Narrow wing extensions at the stern of the unit are to be considered as appendages and excluded for the determination of length (**L**) and for the calculation of freeboards. BKI should determine the effect of such wing extensions with regard to the requirements for the strength of the unit based upon length(**L**).

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Section 7 Mooring System and Equipment

A. General 7-1
B. Temporary Mooring Equipment 7-3
C. Position Mooring System 7-4

A. General

1. Definition

1.1 Temporary mooring equipment

Temporary mooring equipment (with symbol ⓘ) in the context of this section is a mooring equipment consisting of anchors, cables, winches etc. intended to be used while the mobile offshore unit is not in a working condition but during voyages and location moves, and for anchoring within harbours or in sheltered areas (transit condition). The system is to be designed to hold a unit in position when exposed to moderate environmental loads.

1.2 Position mooring system

Position mooring system (with additional notation **POSMOSYS**) in the context of this section is a mobile mooring and equipment for position keeping on the working location . The system is intended to keep the unit in position with single or multiple mooring line (also called spread mooring), i.e. maintaining the prescribed limits of movement during the work envisaged and preventing the unit or other floating bodies from drifting under all anticipated sea and weather conditions.

2. Scope

2.1 All self-propelled units are to have temporary mooring equipment for anchoring while the unit is in the transit condition. The symbol ⓘ is a condition of classification for self-propelled units except as stated in 3.

For non-self-propelled units, when requested by the Owner, the symbol ⓘ may be placed after the symbols of classification in the Register.

2.2 All units, except self-elevating units and submersible units, should be provided with position mooring system designed to maintain the floating unit on station in all design conditions valid for its intended area(s) of operation. The positioning system referred to here includes a mooring system or a dynamic positioning system for position keeping on the working location.

2.3 When temporary mooring equipment is not fitted, consideration will be given to accepting the position mooring system as equivalent to the rule requirements for temporary mooring equipment, if the provisions of B. are complied with.

2.4 Where positioning of the unit on the working location is achieved by a dynamic positioning system, the additional notation **"DP"** will be assigned to class notation for Machinery, see Guidance for Notation (Pt.0, Vol. B) Sec.3.B.2. In that case separate temporary mooring equipment according to B. will be required except as stated in 3.

3. Alternative Requirements

For self-propelled Column Stabilized Units classed with the notation **DP 2** or **DP 3** and self-propelled Self-elevating Units fitted with thrusters to maintain afloat position while lowering legs, an alternative to the requirement for symbol ① to be a condition of classification maybe specially considered subject to the following.

1) At least a single set of anchoring and mooring equipment is to be provided.
2) The set of anchoring and mooring equipment is to be based on specifications provided by the Owner. These specifications are to be submitted to BKI.
3) Justification to demonstrate adequacy of the proposed anchoring and mooring equipment for environmental condition to be considered based on wind speed of 25 m/s, current speed of 2,5m/s and a scope of 6 through 10 (the scope being the ratio between length of chain paid out and water depth).
4) Procedure for deploying the temporary anchor and activation of DP system after a propulsion failure during transit is to be included in the unit's Operation Manual (Booklet).
5) When a unit is equipped with wire rope, an inspection, maintenance and replacement procedure to demonstrate the wire rope availability and capability to be deployed when required is to be submitted to BKI for approval.
6) The mooring equipment, anchors, chain cable or wire rope which have been specified by the Owner are to be tested in accordance with the specifications of the Owner and in the presence of a Surveyor.
7) Applicable requirements of Rules for Material (Pt.1, Vol.V) Sec.12 for anchor testing and Rules for Hull (Pt.1, Vol.II), Sec.18.C for anchor types are to be complied with.
8) When a unit with single bower anchor arrangement is anchored for periods longer than 21 days, additional means of anchoring or external assistance such as a stand-by towing vessel will need to be provided and instructions in this regard are to be included in the Operating Manual (Booklet).
9) For units with "Restricted Service" as define in Section 1.B.20 the environmental conditions may be established in accordance with the following in lieu of 3):
   - Wind: The highest monthly average value annually for the operating area considered.
   - Current: 1,5 m/sec
   - Water Depth: Maximum still-water anchorage depth within the area of operation but not less than 18,3 m.

For such units in Domestic Service, the criteria of the flag state may be applied.

In addition, for self-propelled Column Stabilized Units classed with the notation **DP 2** or **DP 3**, anchoring equipment will not be required if the following are satisfied:

1) Unit is assisted by tugs when in transit near / within harbor, coast or busy waters.
2) Special arrangement is made when the unit is anchored in shallow waters.

The above items are to be addressed by use of a risk-based study and any recommended contingencies or operational restrictions (arising for the study) included in the Operating Manual (Booklet).

When requested by the owner and with the requirements in this section satisfied, the symbol **H** will not be required as a condition of classification.

4. Documents to be submitted

Plans showing the arrangement and complete details of the anchoring system, including anchors, shackles, mooring 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 BKI.

B. Temporary Mooring Equipment

1. General

1.1 Temporary mooring equipment fitted in accordance with the provisions of this Sub-section is to be designed for quick and safe operation in all foreseeable service conditions and for holding the unit at anchor.

Note:

1) *Temporary mooring equipment is, therefore, not intended to hold a unit off fully exposed coasts in rough weather or to stop a unit which is moving or drifting. In this condition, the loads on the mooring equipment increase to such a degree that its components may be damaged or lost owing to the high energy forces generated, particularly for large units.*

2) *In good holding ground the temporary mooring equipment required by this sub-section is intended to hold a unit in conditions such as to avoid dragging of the anchor. In poor holding ground, the holding power of the anchors will be significantly reduced.*

1.2 The temporary mooring equipment shall consist of anchors, chain cables, windlass or winches, chain stoppers, chain lockers (if chains are fitted) and wire ropes in accordance with the requirements in Rules for Hull (Pt.1, Vol. II), Sec.18.

1.3 The anchors are to be effectively stowed and secured to prevent any movement at sea. If the anchors are stowed at the shell, the shell plating is to be increased in thickness and the framing may have to be strengthened.

1.4 The arrangements are to be such as to provide an easy lead of chain cable/wire rope from the anchor to the windlass/winch and to ensure that the anchor can be dropped by its own weight without assistance.

1.5 The supporting structure under windlasses, chain stoppers, fairleads, sheaves and any other items of equipment subjected to loads from the anchor cables as determined in accordance with the provisions of Rules for Hull (Pt.1, Vol.II) Sec. 10, B.5.

Where hawse pipes are not installed and the chain cables are guided by fairleads and sheaves, the acting forces are to be taken as 100 % or 50 % of the rated braking load of the chain cable, i.e.

- for chain stoppers 100%
- for windlasses 100%, where chain stoppers are not fitted
- for windlasses 50%, where chain stoppers are fitted

1.6 Where wire ropes are fitted in lieu of chain cables on unit with less than 40 m in length, the following applies:

- The length of ropes is to be equal to 1,5 times the corresponding tabular chain cable length.
- The ropes breaking strength is not to be less than the breaking strength of the tabular Grade KI-K1 chain cable. Strength according to Grade KI-K2 chains is recommended.

– A short length of chain cable is to be fitted between the wire rope and anchor having a length of 12,5m or the distance between anchor in stowed position and winch, whichever is less
– All surfaces being in contact with the wire need to be rounded with a radius of not less than 10 times the wire rope diameter (including stem).

2. Equipment Number

2.1 The equipment number of Ship type and Barge type units is to comply with the requirements in Rules for Hull (Pt.1, Vol. II), Sec. 18.

2.2 The equipment number of Self-elevating units and Column-stabilized units is to be obtained from the following formula.

$$Z = \Delta^{\frac{2}{3}} + 2 \cdot A_1 + 0{,}1 \cdot A_2$$

Δ : Displacement of the unit in temporary mooring condition [ton].

A_1, A_2 : projected areas except that of legs of self-elevating units, above the water line on planes perpendicular and parallel to the centre line of the unit, respectively [m^2].

3. Anchors

Type/design, materials, manufacture and testing of anchors used for mooring equipment are to be in accordance with Rules for Hull (Pt.1, Vol.II) Sec.18. C.

For anchors used as positional anchors in accordance with C.2, which shall be specially laid the right way up or which require flukes and profile to be adjusted to meet sea-bed conditions, will not normally be approved for temporary mooring purposes.

4. Mooring Chain Cable and Accessories

Grade, design, material, manufacture, testing and provision of mooring chain cable and accessories used for temporary mooring equipment are to be in accordance with Rules for Hull (Pt.1, Vol.II), Sec.18.D and Rules for Material (Pt.1, Vol.V) Sec.13.A

5. Chain Locker

Type/design of chain looker is to be in accordance with Rules for Hull (Pt.1, Vol.II), Sec.18.E

C. Position Mooring System

1. General

1.1 Units provided with positional mooring system complying with 2. will be eligible to the additional notation **"POSMOSYS"**, see A.2.2.

The **POSMOSYS** notation shall prove that the unit has a mooring system which is documented to be able to operate safely within a range of water depths and environmental conditions according to the requirements in Section 4.A and 2.3. BKI shall not require new mooring analyses carried out as long as the unit is operating within the limits which form the basis for the approval.

1.2 Units provided with thrusters serving (also) for position keeping will be eligible for the additional notation **DP0** to **DP3**, see 3.

2. Anchor mooring systems

2.1 General

2.1.1 Anchor mooring systems are defined as those comprising anchors and sinkers laid to the sea bottom, fairleaders, windlasses, winches and other mooring equipment provided at several parts of the hull, and mooring lines connecting them, and obtaining a mooring force mainly from the net weight of the catenary mooring lines (for those provided with intermediate buoys or intermediate sinkers, their net weight or buoyancy). Here, the term "mooring line" means an integration of chains, wire ropes, fibre ropes or their combination, connecting means such as shackles, or intermediate buoys or intermediate sinkers.

2.1.2 The individual system components consisting on anchor mooring systems are to be designed using a design procedure capable of verifying the most severe loading conditions, having a minimum safety factor coefficient as defined in 2.3.

2.1.3 It is desirable that the maximum value of motions of the unit in waves is determined by model experiments. However, its value may be calculated by an analytical method verified through model experiments which are deemed appropriate by BKI.

2.1.4 For assessing motions of the unit in waves at shallow waters, the shallow water effects are to be taken into account. Where changes in tidal levels in shallow waters are relatively large, the tidal deference affecting unit motions is to be considered.

2.1.5 When multiple mooring system (spread mooring) is adopted as mooring systems, all mooring lines, in principle, are to be of the same elastic coefficient.

2.1.6 The design of anchor mooring systems, where anchor mooring systems are used in combination with propulsion system, such as thrusters, for positioning, is to be as deemed appropriate by BKI.

2.2 Approval Documents

2.2.1 Plans showing the arrangement and complete details of the anchoring system, including anchors, shackles, mooring line components, wires, together with details of fairleads, windlasses, winches, controls and instrumentation, as well as any other components of the anchoring system and its foundations, are to be submitted to BKI for approval.

2.2.2 An analysis of the anchoring arrangements expected to be utilised during the unit's operation is to be submitted to BKI. The analysis shall cover both operating and storm (survival) conditions. Among items to be addressed are:

- design environmental conditions: waves, wind, currents, tides, and ranges of water depth (typically three water depths).
- detailed description of the mooring system with mooring line type, quality, diameter, total length and minimum breaking capacity.
- anchor holding capacities for various sea-bed soil conditions
- air and sea temperature
- ice conditions, if applicable
- description of analysis method
- mooring pattern and line length from fairlead to anchor for each water depth

- pretension and/or /horizontal distance between fairlead and anchor for each water depth, both for survival and operation condition
- the analysis shall include mooring system condition (intact, one line damage, transient)
- for units provided with thrusters, the thruster capacity, and how this capacity is utilized in the analyses, shall be documented.

2.2.3 Plans showing the towing arrangement(s) and equipment are to be submitted for information.

2.3 Mooring System Design and Analysis

2.3.1 Redundancy

The anchoring system should be designed such that a sudden failure of any single mooring line will not cause progressive failure of the remaining lines.

2.3.2 Loads

Anchoring system components should be designed utilizing adequate safety factors 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 waves are to be considered, usually from the same direction, 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 taken into account in the event that they might induce higher mooring loads.

2.3.3 Design Analysis

The maximum tension acting on the mooring lines can be evaluated by engineering analysis with methodologies below:

1) Quasi static methods

   When the Quasi static method is applied, the tension in each mooring line is to be calculated at the maximum excursion for each design condition defined in 2.3.5. The excursion is to include the steady state and dynamic responses of the unit of following:

   a) Steady mean excursion due to the defined wind, current, and mean wave drift forces.
   b) Maximum surge/sway excursions of the unit due to first-order wave excitations.
   c) The effects of second order wave-induced motions are to be included for units when the magnitudes of such motions are considered important

   For relatively deep water, the effect from damping and inertia forces in the mooring lines is to be considered in the analysis

2) Dynamic analysis method

   When a dynamic analysis is employed, the effects due to added mass, damping, fluid acceleration and relative velocity between the mooring system and the fluid are to be considered.

Both frequency domain and time domain analyses methods can be used for mooring analysis. In the time domain method, nonlinear effects, such as line stretch, line stiffness, and nonlinear wave frequency load can be included in the analysis.

In the frequency domain method, on the other hand, the loads, mooring line stiffness and responses are assumed linear as the linear principle of superposition is used. Methods of approximating nonlinear effects in

the frequency domain and their limitations are to be investigated so that the analysis results are not compromised.

2.3.5 Design environmental condition

Design environmental conditions are to be recorded in the Operations Manual (Booklet). The following environment conditions are to be specified:

1) Operating condition

   For the most severe design environmental condition for normal operations as defined by the owner or Designer.

2) Severe Storm condition

   For the most severe design environmental condition for severe storm as defined by the owner or designer.

2.3.6 Mooring system condition

The following mooring system conditions, are to be included in the mooring analysis as minimum.

1) Intact Condition

   A condition with all components of the mooring system as designed.

2) One line damage

   A condition with any one mooring line not in service that would cause maximum mooring line tension for the system. The mooring line subjected to the maximum tension at intact condition, when broken, might not lead to the worst broken mooring line case. The designer should determine the worst case by analyzing several cases of broken mooring line, including lead line broken and adjacent line broken cases.

3) One Line Damage Transient.

   A condition with one mooring line broken (usually the lead line) in which the moored installation exhibits transient motions (overshooting) before it settles at a new equilibrium position.

2.3.6 Mooring line design Factor of safety

The mooring line are to be designed with the minimum factors of safety specified in Table 7.1. The factor of safety is defined as the ratio of the minimum breaking strength (MBS) to the maximum tension of mooring line.

Table 7.1 Minimum Strength Factors of Safety for Mooring Line

Mooring Analysis Condition		Mooring line FOS Quasi Static	Mooring line FOS Dynamic Analysis
Operating	Intact	2,70	2,25
	One line damage	1,80	1,57
	Transient	1,40	1,22
Severe Storm	Intact	2,00	1,67
	One line failed	1,43	1,25
	Transient	1,18	1,05

2.3.7 BKI may accept different analysis methodologies provided that it is satisfied that a level of safety equivalent to the one obtained by 2.3.3 to 2.3.6 is ensured.

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

2.4 Mooring Equipment

2.4.1 Anchors

.1 Type/design, materials, manufacture and testing of anchors used for position mooring shall comply with the BKI Rules mentioned under B.3., if Certification by BKI is requested.

Anchors specially designed for position mooring are normally not to be used for temporary mooring, see B.3.

.2 Anchors are to be securely stowed on board to prevent movement during transit/towage.

2.4.2 Mooring line

.1 BKI are to be ensured that the mooring lines are of a type/composition that will satisfy the design conditions of the anchoring system. In general anchor cables may be of wire, rope, chain or any combination thereof. For wire ropes see B.1.6.

In the case where chains are used as the mooring line, these chains (the grade, design, material, manufacture, testing and provision of mooring chain cable) are to comply with the requirements of the Rules for Material (Pt.1, Vol. V), Sec. 13.C.

.2 Means are to be provided to enable the mooring lines to be released from the unit after loss of main power.

.3 Means are to be provided for measuring mooring line tensions.

.4 Mooring lines are to be of adequate length to prevent up-lift of the anchors under the maximum design load condition for the anticipated area(s) of operation.

2.4.3 Windlass and Winches

The requirements for mooring windlass and winches including their controls are defined in Rules for Machinery Installations (Pt.5, Vol.IV) Sec 8.A and C.

2.4.4 Fairleads and sheaves

Fairleads and sheaves shall 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 comply with the requirements of B.1.5.

2.4.5 Control Station

The means specified in 1) through 3) below are to be provided for controlling anchor mooring systems:

1) Mooring line tension indicator, wind velocity and wind direction indicators at the control station of each windlass are to be provided at the manned control position.

   An alarm for maximum limit of anchor line tension is to be provided at the control station with facility for remote release of anchor line tension.

2) Means of communication are to be provided between essential place for mooring operations (for example: operating position, wheel house, control room, etc.)

3) Means are to be provided at the windlass control position to monitor the mooring line tension and windlass power load and to indicate the amount of mooring line paid out.

2.5 Quality Control

Details of the quality control of the manufacturing process of individual anchoring system components are to be submitted. Components shall be designed, manufactured, and tested in accordance with recognized standards and, if included in the Classification procedure according to 1.1, also in accordance with Rules. Equipment so tested shall, insofar as practical, be legibly and permanently marked with KI Hard Stamp and delivered with documentation which records the results of the tests. Concerning details on chain cables see 2.4.2.

3. Dynamic Positioning System

3.1 Dynamic positioning system means the positioning system in which the unit is kept at specific position by automatically control of thruster systems such as thruster or propeller provided with the unit and its system consists of the following systems:

- Power system
- Thruster systems such as thruster or propeller
- Dynamic positioning control system

3.2 Dynamic positioning systems used as a sole means of position keeping are to provide a level of safety equivalent to that provided for anchoring arrangements, refer to Rules for Dynamic Positioning System (Pt. 4, Vol. II).

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Section 8 Machinery Installations and Electrical Equipment

A. Machinery Installations and Electrical Equipment for Units 8-1
B. Machinery Installations and Electrical Equipment for Self-propelled Units 8-15
C. Drilling Units 8-16

A. Machinery Installations and Electrical Equipment for Units

1. Scope

1.1 The requirement in this Section apply to engines, shafting and power transmission systems, prime movers other than main propulsion machinery, auxiliaries, boiler and pressure vessels and their control systems (hereinafter referred to as "machinery installations" in this Rules) and electrical equipment installed in units for the safe operation of the mobile offshore unit.

1.2 In addition to the requirements in this section, the requirements relevant to the machinery and electrical listed in the following are also to be complied with depending upon the service of the unit.

- Rules for Machinery Installations (Pt.1, Vol.III and Pt.5, Vol.IV)
- Rules for Automation (Pt.1, Vol.VII)
- Rules for Refrigerating Installations(Pt.1, Vol.VIII)
- Rules for Electrical Installations (Pt.5, Vol.V)

1.3 When alternative design or arrangements deviate from the prescriptive provisions of this section, see Section 1.A.2.

2. General Requirements

2.1 All machinery, electrical equipment, boilers and other pressure vessels, associated piping systems, fittings and wiring is to be of a design and construction adequate for the intended service.

2.2 Machinery installations are to be of a design and construction adequate for the service for which they are intended and are to be so installed and protected as to reduce to a minimum any danger to persons on-board, due regard being paid to moving parts, hot surfaces and other hazards. The design is to have regard to materials used in construction, and to the marine and industrial purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on-board.

2.3 Means are to be provided to ensure that machinery installations can be brought into operation from the dead unit condition without external aids. However, machinery installations of the unit for restricted areas (except for a unit which has a large embarking capacity), this requirement may be dispensed with.

2.4 Means are to be provided whereby normal operation of vital systems, such as ballast systems in semi-submersible units, jacking systems in self-elevating units and blow-out preventers, can be sustained or restored even though one of the essential auxiliaries becomes inoperable

2.5 Machinery installations are to be designed to operate smoothly under the temperature conditions given in Table 8.1.

Table 8.1 Temperature

	Installed Location	Temperature
Air	In enclosed spaces	0 to 45[1]
	In spaces subject to temperature exceeding 45°C and below 0°C	Accordance to specific local condition
	On the open deck	-25 to 45[1]
Sea water		32[1]
[1] Other temperatures deemed appropriate by BKI may accepted in units for rstricted areas		

2.6 As for machinery installations of the unit which is to work or navigate in icy sea areas, special considerations are to be paid to ice strengthening.

2.7 Provision is to be made to the design, construction and installation of machinery installations facilitate cleaning, inspection, maintenance and operation.

2.8 Where fuel oils with a flash point (to be determined by a closed cup method) of less than 60°C are used, the flashpoint of the fuel oils is to be clearly indicated on the drawings submitted to BKI for approval. The use of fuels of a flash point lower than 43 °C, closed cup test, will require special consideration of storage and handling facilities and controls as well as the electrical installations and ventilation provisions.

2.9 The unit provided with fuel oil arrangements for helicopters is to be in accordance with the following 2.9.1 to 2.9.5.

2.9.1 Areas where fuel oil tanks are situated and fuelling operations conducted are to be suitably isolated from enclosed spaces or other areas which contain a source of vapour ignition. These areas are to be properly marked.

2.9.2 Vent heads with suitable flame arresters are to be fitted to vent pipes of tanks.

2.9.3 Fuel oil tanks are to be of metallic construction which is acceptable to BKI.

2.9.4 Special attention is to be given to the design, mounting and securing arrangements and electrical bonding of the tanks and fuel oil transfer systems.

2.9.5 Coamings or other arrangements are to be provided to contain fuel oil spills.

3. Conditions of Inclinations

3.1 All machinery, components and systems essential to the safe operation of a unit are to be designed to operate under the following static conditions of inclination:

1) when column stabilized units are upright and inclined to an angle up to 15° in any direction;
2) when self-elevating units are upright and inclined to an angle up to 10°in any direction;
3) when surface units are upright and level trim and when inclined to an angle of list up to 15° in either way and simultaneously trimmed to angle up to 5° by the bow or stern.

3.2 Prime movers for emergency generators of all units are to be designed to function at full rated power when inclined up to the maximum angle of heel in the intact and damaged conditions as determined in accordance with Section 6. In no case need the equipment be designed to operate when inclined more than an angle listed below.

1) 25° in any direction on a column stabilized units;
2) 15° in any direction on a self-elevating units; and
3) 22,5° about the longitudinal axis and/or when inclined 10° about the transverse axis on surface type units.

4. Engines, shafting and power transmission gears

4.1 Internal combustion engines

1) General construction, safety devices, installation, exhaust arrangements and fuel oil arrangements of internal combustion engines are to be in accordance with the requirements in Rules for Machinery Installations (Pt.5, Vol.IV). However, the requirement in Rules for Machinery Installations (Pt.5, Vol.IV).Sec 3.G.6 for alarming devices of lubricating oil supply is only applied for engines for the main source of electrical power and for engines for the power plant of jacking systems.
2) Internal combustion engines used for the systems essential for the safety of the units are to be in accordance with the requirements in Rules for Machinery Installations (Pt.5, Vol.IV).
3) Internal combustion engines are not to be installed in the hazardous areas as delineated in Section 9 in this Rules. Where they are unavoidably installed, special consideration is to be given to the arrangement to eliminate the risk of ignition of inflammable or explosive gases existing around these engines.
4) Exhaust outlets of internal combustion engines are to be fitted with suitable spark arresting devices and to discharge outside the hazardous areas. Exhaust pipe insulation, if fitted, is to be protected against possible oil absorption.
5) Air intakes for internal combustion engines are to be not less than 3 m from the hazardous areas

4.2 Steam turbines

4.2.1 Steam turbines are to be provided with overspeed protective devices to prevent the design speed from being exceeded by more than 15 %.

4.2.2 Steam turbines used for the systems essential for the safety of the units are to be in accordance with the requirements in Rules for Machinery Installations (Pt.1, Vol.III) Sec.3,I.

4.3 Gas turbines

Gas turbines are to be in accordance with the requirements in Rules for Machinery Installations (Pt.1, Vol.III) Sec.3,II.

4.4 Stern bearings and sealing's of propeller shafts

Where the units with propulsion machinery are impractical to dock, the units are to be designed to enable the measurement of weardown of the stern bearings and the inspection and repair of bearings and sealings in a floating condition.

4.5 Power transmission gears

All gearing, shafts and couplings used for transmission of power to machinery are to be designed and constructed so that they will withstand the maximum working stresses to which they may be subjected in all service conditions, taking into account the type of engines by which they are driven or of which they form part.

5. Auxiliary and Piping Arrangements

5.1 General

5.1.1 Auxiliaries and piping arrangements are to be in accordance with the requirements in this subsection as well as those in Rules for Machinery Installations (Pt.1, Vol.III).

5.1.2 Pipes are to be arranged inboard of the zone of assumed damage penetration unless special consideration has been taken in the damage stability review.

5.1.3 Piping systems carrying non-hazardous fluids are generally to be separate from piping systems which may contain hazardous fluids. Cross connection of the piping systems may be permitted where means for avoiding possible contamination of the non-hazardous fluid system by the hazardous medium are provided.

5.1.4 For prevention of ignition possibility, exhaust pipe insulation, if fitted, is to be encased in steel sheathing or equivalent material against possible flammable oil absorption.

5.1.5 Where air or steam is used to atomize well bore fluids prior to flaring, a non-return valve is to be fitted in the air or steam line. This valve should be part of the permanently installed piping, readily accessible and as close as possible to the burner boom. Alternative arrangements shown to provide an equivalent level of safety may be accepted by BKI.

5.2 Feed water systems and fuel oil burning systems for boilers

5.2.1 Burning Systems for Boilers

Where the removal of residual fuel oil in burners is conducted by means of steam or air, a means is to be provided to prevent the mixing of oil into steam or air.

5.2.2 Feed Water Systems for Boilers

Every boiler which could be rendered dangerous by the failure of its feed water supply is to be provided with two separate feed water systems from and including the feed pumps so that these systems are capable of supplying feed water to the boiler with any one system being out of use. However, a single penetration of the steam drum is acceptable.

5.3 Arrangements for oil fuel, lubricating oil and other flammable oils

5.3.1 Arrangements for the storage, distribution and utilization of oil fuel and pressure lubrication systems are to be such as to ensure the safety of the unit and persons on board.

5.3.2 Arrangements for the storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heat transfer systems are to be such as to ensure the safety of the unit and persons on board.

5.3.3 In machinery spaces pipes, fittings and valves carrying flammable oils are to be of a material approved by BKI.

5.3.4 Location and arrangement of vent pipes for fuel oil service, settling and lubrication oil tanks are to be such that, in the event of a broken vent pipe, the risk of ingress of rainwater or seawater is minimized.

5.3.5 Two fuel oil service tanks for each type of fuel used on board necessary for propulsion and vital systems or equivalent arrangements are to be provided, each with a capacity of at least eight hours at the maximum continuous rating of the propulsion plant, if any, and normal operating load of the generator plant.

5.3.6 High pressure fuel delivery lines

1) All external high pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors are to be protected with a jacketed piping system capable of containing fuel from a high pressure line failure. A jacketed pipe incorporates an outer pipe into which the high pressure fuel pipe is placed forming a permanent assembly. The jacketed piping system is to include a means for collection of leakages and arrangements are to be provided for an alarm to be given of a fuel line failure.

2) All surfaces with temperatures above 220°C, which may be impinged as a result of a fuel system failure, are to be properly insulated.

3) Oil fuel lines are to be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages onto hot surfaces, into machinery air intakes, or other sources of ignition. The number of joints in such piping systems is to be kept to a minimum.

5.4 Compressed air system

5.4.1 Pressure-relief valves are to be provided to prevent excess pressure in any part of compressed air systems and where water jackets or casings of air compressors and coolers might be subjected to dangerous excess pressure due to leakage into them from air pressure parts.

5.4.2 The starting air arrangements for internal combustion engines are to be adequately protected against the effects of backfiring and internal explosions in the starting air pipes.

5.4.3 Starting air pipes from the air receivers to internal combustion engines are to be entirely separate from the compressor discharge pipe system.

5.4.4 Provision is to be made to reduce to a minimum the entry of oil into the starting air pressure systems and to drain these systems.

5.5 Bilge System

5.5.1 An efficient bilge pumping system is to be provided, capable of pumping from and draining any watertight compartment other than a space permanently appropriate for the carriage of liquid and for which other efficient means of pumping are provided, under all practical conditions. A means is to be provided to detect the presence of water in such compartments which are adjacent to the sea or adjacent to tanks containing liquids. If BKI is satisfied that the safety of the unit is not impaired, the bilge pumping arrangements and the means to detect the presence of water may be dispensed with in particular compartments.

5.5.2 Suitable measures are to be taken to the bilge pumping system to prevent the possibility of water passing from the sea to the watertight compartment and of bilge inadvertently passing from one compartment to another. To achieve this requirement, all bilge distribution boxes and manually operated valves in connection with the bilge pumping system are to be in positions which are accessible under ordinary circumstances. All valves in the bilge distribution boxes are to be of non-return type. Where such valves are located in normally unattended spaces below the assigned load line or the designed maximum load line, a high bilge water level alarm of toe space is to be provided or such valves are to be operable from outside the space.

5.5.3 A means to indicate whether a valve is open or closed is to be provided at each location from which the valve can be controlled. The indicator is to rely on movement of the valve spindle.

5.5.4 Hazardous and non-hazardous areas are to be provided with separate bilge suction arrangements.

5.5.5 At least two independent power bilge pumps of self-priming type or equivalent thereto are to be provided and are to be connected respectively to the main bilge suction pipes. Ballast pumps, sanitary pumps, general service pumps, etc. driven by independent power may be accepted as independent power bilge pumps provided that they are connected properly to the main bilge line. As for the unit for restricted areas (except for a unit which has a large embarking capacity), however, one bilge pump maybe accepted.

5.5.6 The internal sectional area of the main bilge suction pipes is not to be less than the combined internal sectional areas of the two largest branch bilge suction pipes.

5.5.7 Branch bilge suction pipes from each compartment are to be of the internal diameter obtained from the following formula or the standard pipes of internal diameter nearest to the calculated diameter. In case where the internal diameter of such standard pipes is short of the calculated value by 5,0 mm or more, standard pipes of one grade higher diameter are to be used.

$$d' = 2{,}15\sqrt{A} + 25 \quad [mm]$$

$$= \text{minimum } 50 \quad [mm]$$

d' = internal diameter of branch bilge suction pipes [mm]

A = wetted surface area of the compartment, excluding stiffening members when the compartment is half filled with water [m^2]

5.5.8 The capacity, Q, of each bilge pumping unit or bilge pump is not to be less than that required by the following formula.

$$Q = 5{,}66\, d_m^2\, 10^{-3} \quad [m^3/hr]$$

Where:

d_m = required internal diameter of main bilge line (mm)

5.5.9 Bilge pipes passing through deep tanks are to be led through an oil-tight or watertight pipe tunnel or, alternatively, are to be of sufficient thicknesses complying with the requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.11, Tables 11.5 to 11.8 and all joints of them are to be welded.

5.5.10 Bilge pipes passing through double bottom tanks are to be led through oil tight or watertight pipe tunnel or, alternatively, are to be of sufficient thicknesses complying with the requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.11, Tables 11.5 to 11.8.

5.5.11 Bilge pipes passing through double bottoms, side tanks, bilge hopper tanks or void spaces, where there is a possibility of damage of these pipes due to grounding or collision, are to be provided with non-return valves near the bilge suctions or stop valves capable of being closed from readily accessible positions.

5.5.12 Bilge of chain lockers may be drained by eductors, hand pumps or portable means. A means is to be provided for removal of mud and debris from the bilge system.

5.5.13 Void Compartments adjacent to the sea or to tanks containing liquids, and void compartments through which piping conveying liquids passes, are to be drained by permanently installed bilge or drainage systems or by portable means. If portable pumps are used, two are to be provided and both pumps and arrangements for pumping are to be readily accessible. Void compartments as defined above which are not provided with bilge or drainage systems in compliance with the above are to be accounted for in the unit's stability analysis.

5.6 Bilge Piping's of Column stabilized Units

Bilge piping's of the column stabilized unit are to comply with the requirements in the following 5.6.1 to 5.6.3 as well as the requirements in 5.5.

5.6.1 Chain lockers which, if flooded, could substantially affect the unit's stability are to be provided with a remote means to detect flooding and to provide an audible and visual alarm at the central ballast control station.

5.6.2 At least one of the pumps specified in 5.5.5 and pump room bilge suction valves are to be capable of both remote and local operation.

5.6.3 Machinery spaces and pump rooms in lower hulls are to be provided with two independent high bilge water level alarms providing an audible and visual alarm at the central ballast control station.

5.7 Ballast Pipings

5.7.1 An efficient ballast piping system is to be provided, capable of pumping ballast water into and from any tanks for carriage of ballast water under all practical conditions.

5.7.2 Ballast piping system is to be provided with a suitable provision such as a non-return valve or a stop valve which can be kept closed any time excluding the time of ballasting and de ballasting, and which is provided with an indicator to show whether it is open or closed, in order to prevent the possibility of water inadvertently passing from the sea to the ballast tanks or of ballast passing from one ballast tank to another.

5.7.3 Ballast pipes passing through deep tanks other than ballast tanks are to be led through an oil tight or watertight pipe tunnel or, alternatively, are to be of sufficient thickness complying with the requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.11, Tables 11.5 to 11.8 and Rules for Machinery Installations (Pt.5, Vol.IV), Tables 13d.4 to 13d.7 and all joints of them are to be welded.

5.8 Ballast Piping of Column stabilized Units

5.8.1 Ballast piping's of the column stabilized unit are to comply with the following requirements as well as the requirements in 5.7.

5.8.2 The ballast system is to provide the capability to bring the unit, while in an intact condition, from the maximum normal operating draught to a severe storm draught, or to a greater distance, as may be specified by BKI, within 3 hours.

5.8.3 The ballast system is to be arranged to provide at least two independent power pumps of self-priming type or equivalent thereto so that the system remains operational in the event of failure of any one such pump. The pumps provided need not be dedicated ballast pumps, but are to be readily available for such use at all times.

5.8.4 The ballast system is to be capable of operating after the damage specified in Section 6.A.3 and have the capability of restoring the unit to a level trim and safe draught condition without taking on additional ballast, with any one pump inoperable. BKI may permit counter-flooding as an operational procedure.

5.8.5 The ballast system is to be arranged and operated so as to prevent inadvertent transfer of ballast water from one tank or hull to another, which could result in moment shifts leading to excessive angles of heel or trim. The system is also to be arranged so that the transfer of ballast water from one tank to any other tank through a single valve is not possible except where such a transfer could not adversely affect the stability of the unit.

5.8.6 It is to be possible to supply each ballast pump required by 5.8.3 from the emergency source of electrical power. The arrangements are to be such that the system is capable of restoring the unit from an inclination specified in 3.1 to a level trim and safe draught condition after loss of any single component in the power supply system.

5.8.7 All valves and operating controls are to be clearly marked to identify the function they serve. A means is to be provided locally to indicate whether a valve is open or closed.

5.8.8 A central ballast control station providing control systems, indicating systems, indicators and a communication system specified in 1) to 7) below is to be provided. It is to be located above the worst damage waterline and in a space not within the assumed extent of damage referred to in Section 6.A.3 and adequately protected from weather.

1) A ballast pump control system (including a ballast pump status-indicating system)
2) A ballast valve control system for ballasting and deballasting (including a ballast valve position indicating system)
3) A ballast tank level indicating system
4) A draught indicating system
5) A heel and trim indicator
6) A power availability indicating system (main and emergency)
7) A ballast system hydraulic or pneumatic pressure indicating system

5.8.9 The control and indicating systems listed in 5.8.8 are to function independently of one another, or have sufficient redundancy, such that a failure in one system does not dangered the operation of any of the other systems.

5.8.10 The ballast tank level indicating system required by 5.8.10 is to provide means specified in 1) and 2) below.

1) A means to indicate liquid levels in all ballast tanks. A secondary means of determining levels in ballast tanks, which may be a sounding pipe is to be provided. Tank level sensors are not to be situated in the tank suction lines.
2) A means to indicate liquid levels in other tanks, such as fuel oil, fresh water, drilling water or liquid storage tanks, the filling or emptying of which, in the view of BKI, could affect the stability of the unit. Tank level sensors are not to be situated in the tank suction lines.

5.8.11 The draught indicating system is to indicate the draught at each corner of the unit or at representative positions as deemed appropriate by BKI.

5.8.12 In addition to remote control of the ballast pumps and valves from the central ballast control station, all ballast pumps and valves are to be fitted with independent local control operable in the event of remote control failure. The independent local control of each ballast pump and of its associated ballast tank valves are to be in the same location.

5.8.13 Each power-actuated ballast valve is to foil to the closed position upon loss of control power. Upon reactivation of control power, each such valve is to remain closed until the reactivation of the system is assumed. BKI may accept ballast valve arrangements that do not fail to the closed position upon loss of power provided BKI is satisfied that the safety of the unit is not impaired.

5.8.14 A means to indicate whether a valve is open or closed is to be provided at each location from which the valve can be controlled. The indicators are to rely on movement of the valve spindle.

5.8.15 A means is to be provided at the central ballast control station to isolate or disconnect the ballast pump control and ballast valve control systems from their sources of electrical, pneumatic or hydraulic power.

5.9 Valve Arrangements

5.9.1 General

Where valves of piping systems are arranged for remote control and are power operated, a secondary means of operating the valves which may be manual or other control is to be provided.

5.9.2 Sea Suction Valves and Overboard Discharge Valves

Remote operation of sea-water inlet and discharge valves Inlet and discharge valves in compartments situated below the assigned load line (normally unattended compartments) are to be provided with remote controlled valves. Where remote operation is provided by power actuated valves for sea-water inlets and discharges for operation of propulsion and power generating machinery, power supply failure of the control system is not to result in:

- closing of open valves
- opening of closed valves.

Consideration will be given to accepting bilge alarms in lieu of remote operation for surface type and self-elevating units only.

5.10 Tank Vents and Overflow Pipes

5.10.1 Tank vents and overflows are to be located giving due regard to damage stability and the location of the final calculated immersion line in the assumed damage condition as specified in Section 6.A. Tank vents and overflows which could cause progressive flooding are to be avoided unless special consideration has been taken in the damage stability review.

In cases where tank vents, air pipes and overflow pipes terminate externally or in spaces assumed flooded, the vented tanks are to be also considered flooded. In cases where tanks are considered damaged, the spaces in which their vents or overflows terminate are also to be considered flooded. Vents and overflows from tanks not considered flooded as a result of damage and located above the final calculated immersion line may require to be fitted with automatic means of closing.

5.10.2 The size of the vents is to be in accordance with the Rules with due consideration being given to the design pressure of the tank.

5.10.3 Location and arrangement of vent pipes serving fuel oil tanks and lubrication tanks are to be done in a way providing protection against ingress of seawater or rain water in case of accidental vent pipes damage.

(IACS UR D9 7.3)

5.11 Sounding Pipes

5.11.1 All tanks are to be provided with separate sounding pipes, or approved remote level indicating system. Where a sounding pipe exceeds 20 m in length, the minimum internal diameter 38 mm as required by the Rules is to be increased to at least 50 mm.

5.11.2 Where a remote level indicator is used for tanks which are not always accessible, an additional sounding system is to be provided.

5.11.3 Void compartments adjacent to the sea or tanks containing liquids, and void compartments through which piping carrying liquids passes are to be fitted with separate sounding pipes, approved tank liquid level indicating apparatus or be fitted with means to determine if the void tanks contain liquids. Voids as defined above which do not comply with this requirement are to be accounted for in the unit's stability analysis.

5.12 Ship-side valves

For the units for which the exemption of docking survey is especially approved by BKI, special considerations are to be given to a prevention of corrosion and marine growth prevention to the valves, cocks and distance pieces fitted to the shell plating under the load water line.

5.11 Protection against flooding

5.11.1 The control systems and indicators provided in Section 6.B.2 should be operable in both normal conditions and in the event of main power failure. Where stored energy is provided for this purpose, its capacity should be to the satisfaction of BKI.

5.11.2 Non-metallic expansion joints in piping systems, if located in a system which penetrates the unit's side and both the penetration and the non-metallic expansion joint are located below the deepest load waterline, should be inspected as part of the Docking survey in Rules for Classification and Survey (Pt.5, Vol.I) Section 3.I. E.2 And replaced as necessary, or at an interval recommended by the manufacturer.

5.14 Tests

Tests for the auxiliary machinery and piping are to be in accordance with the requirements in 10.

6. Jacking Systems

6.1 The driving gear, mechanism, strength and safety device of the jacking system are to be accordance with Rules for Machinery Installations (Pt.5, Vol.IV), Sec.9.

6.2 The jacking system is to be designed and constructed to maintain the safety of the unit in the event of failure of a critical component during operation of the jacking system. Suitable monitoring is to be provided at a manned control station to indicate such failure.

7. Electrical System

7.1 General

7.1.1 Electrical equipment is generally to be in accordance with the requirements in Rules for Electrical Installations (Pt.5, Vol.V) with the exclusion of those in Section 17. However, electrical equipment complying with any relevant regulation of the National Authority of the country in which the unit is to be registered or international standards may be accepted, provided that they are used solely for operating purpose. The design and installation of other equipment including that used for drilling operations are to be such that there is minimal risk of fire due to its failure.

7.1.2 Where the requirements in Rules for Electrical Installations (Pt.5, Vol.V) are applied in accordance with requirements in 7.1.1, the electrical equipment may be in accordance with the requirements in. 7.1.2 to 7.1.6 instead of the requirements in Rules for Electrical Installations (Pt.5, Vol.V) Sec.3. For the tests of the electrical equipment the requirements in 2. are to be applied.

7.1.3 All electrical services necessary for maintaining the unit in normal operational and habitable conditions are to be assured without recourse to the emergency source of power.

7.1.4 Electrical services essential for safety are to be assured in case of failure of the main source of electrical power.

7.1.5 Electrical and electronic equipment on the bridge are to be so installed that electromagnetic interference does not affect the proper function of navigational systems and equipment.

7.1.6 The safety of personnel and unit from electrical hazards is to be assured.

7.2 Main source of electrical power

7.2.1 The units are to be provided with at least two sets of main sources of electric power of sufficient capacity so that electric power supply to the systems essential for the safety of the units and to the equipment listed in 1) to 8) below can be maintained even when one set of these sources is out of service due to any failure of generators, driving engines and their associated auxiliaries.

1) Ventilation of hazardous areas and those areas maintained at an overpressure to exclude the ingress of dangerous gases.
2) Navigation, signal and special purpose lights.
3) Lights for all machinery spaces, control stations, alleyways, stairway and exits.
4) Fire pumps.
5) Propulsion equipment.
6) Bilge pumps.
7) Ballast pumps for column-stabilized units.
8) Radio equipment.

7.2.2 For restricted service units, one set of the main sources of electrical power may be acceptable. Where, however, the lighting systems of these units listed in 7.2.1. 2) are solely operated by electric power, the units are to be provided with an independent electric power source capable of operating these lightings in the event of failure of the main source of electrical power.

7.2.3 Where A.C. generators are used as a main source of electrical power, they are to have sufficient capacity to permit the starting of the largest motor in the units without causing any other motors to stall or any other devices to fail due to excessive voltage drop on the system.

7.2.4 The requirements in 7.2.1 to 7.2.3 do not apply to the units which are so designed that electric power is supplied from other units or from the shore. However, the units having the lighting systems listed in 7.2.1. 2) are to be so designed as to be capable of operating these lighting systems without supplying electric power from other units or from the shore except that two or more sets of electric power sources are provided at these suppliers.

7.2.5 For restricted service units, where generators used mainly for operating purpose are provided in addition to the main source of electric power except the independent electrical power source required in 7.2.2, these generators and their driving engine are to be regarded as machinery used solely for operating purpose.

7.3 Number and ratings of transformers for power and lighting

7.3.1 The number and ratings of transformers for feeder circuits are to be sufficient to ensure the operation of the systems essential for the safety of the units as well as the systems or equipment listed in 7.2.1. 1) to 8) even when one of these transformers is out of service. Where, however, any other suitable means are provided to ensure the operation of these services, one transformer will be acceptable.

7.3.2 The requirement in 7.3.1 will not be applied to the restricted service units where approved by the BKI.

7.4 Emergency electrical equipment

7.4.1 The units are to be provided with emergency electrical equipment according to the requirements in Rules for Electrical Installations (Pt.5, Vol.V) Sec 3,D. However, the capacity of the emergency source of power and the kind of emergency loads will be varied depending upon the type of the unit.

7.4.2 The emergency source of power is to be located, at a sufficient distance from any hazardous area prescribed in each Section, in such a place that fire, flooding or other casualties in the space containing the main source of electrical power will not affect the operation of the emergency source of power.

7.4.3 A self-contained emergency source of power is to be located on or above the uppermost continuous deck and above the worst damage waterline and inboard of the damage conditions specified in Section 6.A.1.4

7.4.4 The requirements in above 7.4.1 to 7.4.3 will not be applied to the restricted service units.

7.5 Final sub-circuits

7.5.1 In general, each motor for the systems or equipment essential for the safety of the units is to be connected to a separate final sub-circuit.

7.5.2 Lighting circuits are to be supplied by final sub-circuit separate from those for heating and motor. This requirement does not apply to cabin fans and electrical appliances for domestic use.

7.5.3 Each heater is to be connected to a separate final sub-circuit except that small heaters may be connected to a single final sub-circuit of aggregate current rating not exceeding 15 Ampere.

7.5.4 Each insulated pole of final sub-circuit is to be protected by a fuse or a circuit-breaker

7.6 High voltage electrical installations

7.6.1 Where the high voltage electrical systems or equipment exceeding the voltage of A.C. 1 kV is used for the systems or equipment essential for the safety of the units, the constructions and installations of these systems or equipment are to be in accordance Rules for Electrical Installations (Pt.5, Vol.V) Sec 6.

7.6.2 Other high voltage electrical equipment and cables used solely for operating purpose may comply with National or International Standards recognized by BKI.

8 Automatic and remote control for machinery

8.1 In cases where the automatic or remote control systems are adopted to the machinery installed in the units, the control devices and measuring instruments are to be such that the safe operation of the units can be made by the planned number of personnel.

8.2 The control system is to be designed to act, as far as possible, in fail-safe so as not to be in danger of operators or not to damage the system concerned in the event of failure of the equipment or loss of the power source. The safety devices are, if necessary, to be provided independently from control systems.

8.3 The apparatus belonging to the systems or equipment essential for the safety of the units is to be provided with suitable means to ensure the safe operation of the units even when their automatic or remote control systems are out of service.

8.4 Machinery installations of the unit which has the periodically unattended machinery spaces are to comply with the relevant requirements in Rules for Automation (Pt.1, Vol. VII).

9 Spare parts, tools and instruments

9.1 General

Spare parts, tools and instruments prescribed in this Rules are generally to be provided on the units. For the units specially approved by BKI, those may be dispensed with.

9.2 Spare parts, tools and instrument's

9.2.1 Spare parts for internal combustion engines, steam turbines and boilers used for the main source of electric power are to be in accordance with the requirements Rules for Machinery Installations (Pt.1, Vol.III), Sec.17.

9.2.2 Spare parts for bilge pumps are to be in accordance with the requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.17, Table 17.5.

9.2.3 Spare parts for ballast pumps prescribed 5.8.5 are to be provided in accordance with the requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.17, Table 17.5.

9.2.4 Spare parts for starting air compressors of internal combustion engines used for the main source of electrical power are to be provided in accordance with the requirements Rules for Machinery Installations (Pt.1, Vol.III), Sec.17.

9.2.5 BKI may require to provide spare part for jacking system.

9.2.5 Tools and instruments for boilers used for the main source of electrical power and for all boilers are to be as given in Table 8.1

Table 8.1 Spare Parts for Boilers

Item	Remarks	Number required
Safety valve spring of each size	Including super heater safety valve springs	1
Oil burner nozzles, complete, for one boiler		1 set
Round type water gauge glasses	Including packings	12
Flat type water gauge glasses		2
Flat type water gauge frame		1
Notes: The number of water gauge glasses of round type and flat type are required to be the number in this Table for each boiler. The number of flat type water gauge frames is required to be one for two boilers.		

9.3 Spare Parts, tools and instruments for restricted service units

Spare parts, tools and instruments for restricted services are to be agreed between the ship owner and BKI.

10. Tests

10.1 General

10.1.1 The tests for the machinery are to be in accordance with the requirements in this Section.

10.1.2 BKI may require, where considered necessary, other tests than those prescribed in this Section.

10.1.3 Where machinery has test certificates considered satisfactory by BKI, a part or all of tests for the machinery may be dispensed with.

10.1.4 As regards machinery manufactured by mass production system or specially controlled system, BKI may adopt test procedures suited to the production method, in place of tests stipulated in this rule, for the factory which considered suitable, upon the request of the manufacturer.

10.1.5 BKI may adopt test procedures suited to the production method, in place of tests stipulated in this rule, for the factory which considered suitable, upon the request of the manufacturer.

10.1.6 BKI may adopt, where considered satisfactory, other test procedures than those stipulated in this Rules.

10.2 Tests

10.2.1 Boilers, pressure vessels belonging to PV -1 and PV -2, piping's and electrical equipment are to be tested in accordance with the relevant requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.7.I. However, for piping's used solely for the operating purpose with the exclusion of those for inflammable or toxic media, tests may be dispensed with. For the apparatuses listed in the following 1) to 5), the testing at the manufacturer's works is to be carried out, where these apparatuses are used for the systems essential for the safety of the units. However, the high voltage tests considered suitable by BKI are to be carried out for electrical equipment with rated voltage above 3000 V even where the equipment is not used for the systems or equipment essential for the safety of the units.

1) Generators and motors
2) Control gears for motors
3) Switchboards
4) Transformers for power and lighting
5) Semi-conductor rectifiers for power

10.2.2 Engines, shafting's and power transmission gears, pressure vessels belonging to PV-3 and auxiliary machinery used for the systems or equipment essential for the safety of the units are to be tested in accordance with the relevant requirements in Rules for Machinery Installations (Pt.1, Vol.III). However, the tests may be waived depending upon the usage of these installations where approved by BKI.

10.2.3 The systems or equipment essential for the safety of the units are, after installation on board, to be subjected to performance tests.

10.2.4 Remote control systems and automatic control systems for boilers and the systems or equipment essential for the safety of the units are, after installation on board, to be subjected to performance tests.

10.2.5 Safety devices required by this rule are, after installation on board, to be tested.

10.2.6 Running tests are, after installation on board, to be carried out for the generators stated in 7.2.5 and other electrical equipment not used for the systems essential for the safety of the units coming under the following 1) or 2)

1) Where rated voltage exceeds DC. 1000 V or AC. 3000 V.
2) Where parallel running's (including changing over operation) are carried out with the main source of electrical power.

B. Machinery Installations and Electrical Equipment for Self-propelled Units

1. General

1.1 Application

For the Machinery installations and electrical equipment for self-propelled units, in addition to the requirements in A, the requirements in this sub-section are applied.

1.2 Special consideration

Means are to be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative. Special consideration is to be given to the malfunction of:

1) a generator set which serves as a main source of electrical power;
2) the sources of steam supply;
3) the arrangements for boiler feed water;
4) the arrangements which supply fuel oil for boilers or engines;
5) the sources of lubricating oil pressure;
6) the sources of water pressure;
7) a condensate pump and the arrangements to maintain vacuum in condensers;
8) the mechanical air supply for boilers;
9) an air compressor and receiver for starting or control purposes; and
10) the hydraulic, pneumatic or electrical means for control in main propulsion machinery including controllable-pitch propellers. However, BKI, having regard to overall safety considerations, may accept a partial reduction in capability from full normal operation.

1.3 Conditions of inclinations

In addition to the requirements in A.3, main propulsion machinery and all auxiliary machinery essential to the propulsion and for the safety of the unit are, as fitted in the unit, to be capable of operating under the static conditions required by A.3.1 and the following dynamic conditions :

1) column-stabilized units : 22.5° in any direction.
2) self-elevating units : 15° in any direction.
3) surface units : 22.5° rolling and simultaneously pitching 7.5° by bow or stern.

BKI may permit deviation from these angles, in consideration of the type, size and service conditions of the unit.

2. Boiler

2.1 Water tube boilers serving turbine propulsion machinery are to be fitted with a high water level alarm.

2.2 Every steam generating system which provides services essential for the propulsion of the unit is to be provided with not less than two separate feed water systems from and including the feed pumps, noting that a single penetration of the steam drum is acceptable. Means are to be provided which will prevent overpressure in any part of the systems.

3. Control and monitoring for propulsion machinery

Where propulsion machinery spaces are normally unattended during transit, the control and monitoring systems are to be constructed and installed in accordance with the applicable requirements in Guidelines for Machinery Condition Monitoring (Pt.1, Vol.3).

4. Astern tests

In addition to the requirements in A.10. for machinery installations, the following tests are to be carried out.

4.1 In the astern trial, an order for full astern is issued while the unit is running ahead at the speed specified in Rules for Machinery Installations (Pt.1, Vol.III), Sec.2.A.3, whereby reversing operation from ahead run to full astern run is to be carried out as fast as possible. In this case, astern operation is to be continued until the astern speed (rotational speed in rpm) is stabilized for diesel units, or for the period of 15 minutes after the order of astern for steam turbine units, gas turbine units and electric propulsion units respectively, whereby the astern performance and stopping performance are to be verified and the test results recorded are to be available on board for the use as a guidance for unit manoeuvres.

4.2 In units having multiple propellers, the unit navigating and manoeuvring performance with one or more propellers inoperative is to be verified, as well as the test results recorded are to be made available on board for the use as a guidance for unit manoeuvres.

4.3 When the units provided with supplementary means for manoeuvring or stopping, performance test for such means is to be carried out, and the test results are to be available on board for the use as a guidance for unit manoeuvres.

C. Drilling Units

1. Machinery Installations

1.1 Scope

Machinery installations of the mobile offshore drilling unit are to comply with the requirements in this Sub-section as well as the requirements in A and B.

1.2 Piping and Auxiliary Systems

1.2.1 General

.1 Piping Systems used for the safe operation of the unit are, as a rule, to be separated from systems used for drilling operations. Where necessarily interconnected, such piping systems are to be acceptable to BKI.

.2 Where air or steam is used to atomize well bore fluids to flaring, non-return valve is to be fitted in the air or steam line. This valve is to be part of the permanently installed piping, readily accessible and close as possible to the burner boom. Alternative arrangements show to provide an equivalent level of safety may be accepted by BKI.

1.3 Alarm systems

A suitable audible and visual alarm to indicate significant increase or decrease in the level of the contents of the mud pit is to be provided at the control station for drilling operations and at the mud pit. Where deemed appropriate by BKI, any other means may be substituted.

Ventilation system alarms are to be in accordance with the requirements in Section 9.A.4.

1.4 High pressure piping for drilling operations

Permanently installed piping systems for drilling operations are to comply with an acceptable standard or code.

2. Electrical Installations

2.1 Scope

Electrical installations of the mobile offshore drilling unit are to comply with the requirements in this Sub-section as well as the requirements in A and B.

2.2 Main Source of Electrical Power and Lighting System

2.2.1 In case where main sources of electrical power are necessary for the propulsion and steering ships, systems are to be arranged so that electrical supplies to equipment necessary for propulsion and steering and to ensure ship safety will be maintained or immediately restored in cases where there is the loss of any one of the generators in service.

2.2.2 In case where electrical sources are necessary to restore propulsion, capacities of emergency sources of power is to be sufficient to restore propulsion to ships from dead ship conditions within a period of 30 minutes after a blackout.

2.3 Emergency Shutdown Facility

2.3.1 Emergency conditions due to drilling operations

.1 In view of exceptional conditions in which the explosion hazard may extend outside the areas defined in Section 9, special arrangements should be provided to facilitate the selective disconnection of shutdown of :

- Ventilating system
- All electrical equipment outside Zone 1 areas, except where of a certified safe type for Zone 1 applications.
- Main electrical generators and prime movers.
- Emergency equipment except those items listed in 2.5
- Emergency generators.

Initiation of the foregoing shutdown of facilities will be the operator's responsibility. The initiated action may vary according to the nature of the emergency. A recommended sequence of shutdowns should be included in the Operating Manual (Booklet) stipulated in Section. 2.C.3.1.

.2 In the case of unit using dynamic positioning systems as sole means of position keeping, special consideration maybe given to the selective disconnection or shutdown of machinery and equipment

associated with maintaining the operability of the dynamic positioning systems in order to preserve the integrity of the well.

.3 Emergency shutdown facilities stipulated in 2.3.1.1 and the systems specified in the following 1) and 2) are to be provided near the drilling console and at a suitable attended location outside the hazardous areas.

1) Manually operated switches for actuating the general alarm system
2) An efficient means of communication between these places and all locations vital to the safety of the unit

.4 Shutdown systems provided to comply with 2.3.1.1 are to be so designed that the risk of unintentional stoppages caused by malfunction in a shutdown system and the risk of inadvertent operation of a shutdown are minimized.

2.4 Emergency Source of Electrical Power

The emergency source of electrical power is to be capable of supplying simultaneously the services listed in the following 2.4.1 to 2.4.9 for the period specified hereinafter if they depend upon an electrical source for the operation.

2.4.1 For a period of 18 hours, emergency lighting specified in 2.2

2.4.2 For a period of 18 hours, navigation lights or sound signals which may be required by national regulations or international regulations.

2.4.3 For a period of 4 days, any signalling lights or sound signals which may be required for marking of offshore structures.

2.4.4 For period of 18 hours, the services listed in the following unless such services have an independent supply for the period of 18 hours from an accumulator battery suitably located for use in an emergency.

1) All internal communication equipment as required in an emergency
2) VHF radio installations, MF radio installations, INMARSAT ship earth stations and MF / HF radio installations as required by Chapter IV, the Annex to SOLAS Convention and installed in the unit. Where, however, those radio installations are installed in duplicate, it is not necessary to consider duplicated installations are operated simultaneously in determining capacity of the emergency source of electrical power
3) Fire and gas detection and their alarm systems
4) Manual fire alarms and all internal signals that are required in an emergency
5) Devices of closing the blow-out preventer and of disconnecting the unit from the well head arrangement, if electrically controlled

2.4.5 For a period of 30 minutes, safety devices required by 2.2

2.4.6 For a period of 18 hours, one of the fire pumps if dependent upon the emergency generator for its source of power

2.4.7 For a period of 18 hours, permanently installed diving equipment

2.4.8 On column-stabilized units, for a period of 18 hours, the services listed below

1) Any of the ballast pump required by A.5.8.3. Only one of the connected pumps need be considered to be in operation at any time
2) Ballast control and indicating systems required by A.5.8.8

2.4.9 For a period of 30 minutes, the service listed below

1) Devices to operate the watertight doors required by Section 6.B.2, but not necessarily all of the simultaneously, unless an independent temporary source of stored energy is provided.
2) Control devices and indicators required by Section 6.B.2

2.4.10 In every ship of 10000 gross tonnage or above for at least 30 minutes and in any other ship for at least 10 minutes, steering gear designed to receive emergency generators according to the requirements in Rules for Electrical Installations (Pt.1. Vol.IV) Sec.7.A.2.3.

2.5 Equipment to remain operational after emergency shutdown

At least the following facilities are to be operable after an emergency shutdown. Equipment which is located in spaces other than enclosed spaces and arranged to be operated after complete shutdown as given 2.3.1.1 is to be suitable for installation in Zone 2 locations. Such equipment, when located in enclosed spaces, is to be suitable for its intended application to the satisfaction of BKI:

- Emergency lighting required by 2.6 1) to 5) for half an hour;
- Blow-out preventer control system;
- General alarm system;
- Public address system; and
- Battery supplied radio communication installations.

2.5 Emergency lighting providing sufficient illumination necessary for the safety is to be provided:

1) at every muster and embarkation station, and over sides;
2) in all service and accommodation alleyways, stairways and exits, personnel lift cars, and personnel lift trunks;
3) in the machinery spaces and main generating stations including their control positions;
4) in all control stations, machinery control rooms, and at each main and emergency switchboard;
5) at all stowage positions for firemen's outfit;
6) at the fire pumps, at the sprinkler pumps and at the emergency bilge pumps, and at the starting positions of their motors;
7) in all spaces from which control of the drilling process is performed and where control of machinery essential for the performance of this process, or devices for emergency switching-off of the power plant are located; and
8) on helicopter landing decks.

2.7 Internal Means of Communication

2.7.1 An internal means of communication available for transfer of information between all spaces where action may be necessary in case of an emergency is to be provided.

2.7.2 For column stabilized units, a permanently installed internal means of communication, independent of the unit's main source of electrical power, is to be provided between the central ballast control station and spaces that contain ballast pumps or valves, or other spaces deemed necessary by BKI for the operation of the ballast system.

2.8 Earthing (grounding) arrangements

2.8.1 Where not obtained through normal construction, arrangements are to be provided to effectively earth (ground) all machinery, metal structures of derricks, masts and helicopter platforms.

2.8.2 Cathodic protection

Details of impressed-current cathodic protection systems, including installation and locations, are to be submitted when such systems are installed.

Section 9 Machinery Installations, Electrical Installations, and So on in Hazardous Areas

A. General 9–1
B. Ventilation Systems 9–5
C. Machinery Installations in Hazardous Areas 9–6
D. Electrical Installations in Hazardous Areas 9–6

A. General

1. Scope

1.1 For machinery installations, electrical installations, and so on installed in hazardous areas, requirements in this Section are to be applied. Especially for offshore drilling unit, equipment for well testing is to be specially considered, if present.

1.2 In addition to the requirements in this section, the requirements relevant to the machinery and electrical in hazardous area listed in the following are also to be complied with depending upon the service of the unit.

- Rules for Machinery Installations (Pt.5, Vol.IV) Sec.2
- Rules for Electrical Installations (Pt.5, Vol.V) Sec.13

1.3 Hazardous areas as specified in A.3 may be extended or reduced depending on the actual arrangements in each case, by use of windshields, special ventilation arrangements, structural arrangements, (e.g., low deck head), etc.

2. Definition

2.1 Hazardous area

2.1.1 Hazardous areas are all those areas where a flammable atmosphere may be expected to exist continuously or intermittently. See IEC Publication 60079-10-1. Such flammable atmospheres may arise from drilling or well test operations, other operations such as use and storage of flammable liquids, paint and acetylene, or any such operation pertinent to the particular service of the unit, the use without proper consideration of machinery or electrical equipment may lead to fire hazard or explosion.

2.1.2 Hazardous areas are divided into zones as follows;

- Zone 0 : an area in which ignitable concentrations of flammable gases or vapours are continuously present or present for long periods.
- Zone 1 : an area in which ignitable concentrations of flammable gases or vapours are likely to occur in normal operation.
- Zone 2 : an area in which ignitable concentrations of flammable gases or vapours are not likely to occur, or in which such a mixture and if it occurs, it will only exist for a short time.

(IACS UR D9 1.3)

2.2 Non-hazardous areas

Non-hazardous areas are understood to be locations where the existence of ignitable gas/air mixtures or escape gas can be excluded in normal operation.

The terms "hazardous area" and "non-hazardous area" apply to outdoor locations and enclosed or partially enclosed spaces.

2.3 Enclosed Space

An enclosed space is considered to be a space bounded by bulkheads and decks which may have doors, windows, of other similar openings.

2.4 A semi-enclosed location

A semi-enclosed location is considered to be a location where natural conditions of ventilation are notably different from those on open decks due to the presence of structure such as roofs, windbreaks and bulkheads and which are so arranged that the dispersion of gas may not occur.

2.5 Outdoor Location

An outdoor location is considered to be a location substantially free of structures (or other obstructions) where natural ventilation is not impeded and causes the rapid dispersion (dilution) of gases and vapors, and stagnant areas are not present.

3. Classification Detail of Hazardous Area

For the purpose of machinery and electrical installations, hazardous areas are classified as in paragraphs 3.1 to 3.2. Hazardous areas not covered (such as, but not limited to, well test equipment areas, helicopter fuel storage areas, acetylene cylinder storage areas, battery rooms, paint lockers, flammable gas or vapour vents and diverter line outlets) in this section should be classified in accordance with 2.1.2.

3.1 Classification of Areas for None Hydrocarbon Related

3.1.1 Hazardous areas zone 0

1) The internal spaces of closed tanks and pipes for oil (closed-cup flash point below 60°C) and gas products including escape gas outlet pipes.
2) Outdoor location within 0,5 m from an opening to the hazardous areas defined in 1).

3.1.2 Hazardous areas zone 1

1) Enclosed spaces containing tanks and pipes described in 3.1.1 1)
2) Enclosed spaces containing liquid or solid substances that are likely to emit flammable gases or vapors.
3) An enclosed space or semi-enclosed location:
    a) Having a direct access or opening into the hazardous areas defined in 1) or 2) or other Zone 1 areas, through a door, a ventilation opening, etc.;
    b) Immediately adjacent to the closed tanks defined in 3.1.1 1) or
    c) Containing pumps or piping used for conveying liquid described in 3.1.1 1), except for all welded or continuous closed piping systems without valves, flanges or similar devices;
4) Outdoor location within 1,0 m beyond the Zone 0 area defined in 3.1.1 2).
5) Outdoor location within 1,5 m from an opening to the hazardous areas defined in 1) to 3), such as a door, a ventilation opening, a tank vent, etc;
6) Outdoor or semi-enclosed locations within 1,5 m from any equipment, container, etc., stowed in a designated open deck area, that are likely to emit flammable gases or vapors.

7) Pits, ducts or similar structures in locations which would otherwise be hazardous areas zone 2 but which are so arranged that the dispersion of gas may not occur.

3.1.3 Hazardous areas zone 2

1) Outdoor location within 3,0 m from the boundaries of the closed tanks defined in 3.1.1 1)
2) Outdoor location within 1,5 m from pumps or piping used for conveying liquid described in 3.1.1 1), except for all-welded or continuous closed piping systems without valves, flanges or similar devices;
3) Outdoor location within 1,5 m beyond the Zone 1 areas defined in 3.1.2 4) and 5)
4) Outdoor or semi-enclosed location within 1,5 m beyond the Zone 1 areas defined in 3.1.2 6).
5) Air locks between a Zone 1 and a non-hazardous area.

3.2 Classification of Areas Associated with Drilling Activities

3.2.1 Hazardous areas zone 0

1) The internal spaces of closed tanks and piping for containing active non-degassed drilling mud, oil that has a closed-cup flash-point below 60°C or flammable gas and vapour.
2) Other spaces in which a flammable oil vapor-air mixture or a flammable gas-air mixture is present, continuously or for long periods.

(IACS UR D8 2.1)

3.2.2 Hazardous areas zone 1

1) Enclosed spaces containing any part of the mud circulating system that has an opening into the spaces and is between the well and the final degassing discharge.
2) In outdoor or semi-enclosed locations, except as provided for in 4), the area within 1,5 m from the boundaries of any openings to equipment which is part of the mud system as specified in 1), any ventilation outlets of hazardous areas zone 1, or any access to hazardous areas zone 1, except where 4.2.1 or 4.2.2 applies.
3) Pits, ducts or similar structures in locations which would otherwise be hazardous areas zone 2 but which are so arranged that the dispersion of gas may not occur.
4) Enclosed spaces or semi-enclosed locations that are below the drill floor and contain a possible source of release such as the top of a drilling nipple.
5) Enclosed spaces that are on the drill floor and which are not separated by a solid floor from the spaces in 4).
6) Outdoor locations below the drill floor and within a radius of 1,5 m from a possible source of release such as the top of a drilling nipple.

(IACS UR D8 2.2)

3.2.3 Hazardous area zone 2

1) Enclosed spaces which contain open sections of the mud circulating system from the final degassing discharge to the mud pump suction connection at the mud pit
2) Outdoor locations within the boundaries of the drilling derrick up to a height of 3,0 m above the drill floor.
3) To the extent of their enclosure, semi-enclosed locations that are on the drill floor and which are not separated by a solid floor from the spaces in 3.2.2 4)

4) Semi-enclosed towers/derrick to the extent of their enclosures above the drill floor or to a height of 3,0 m above the drill floor, whichever is greater.

5) Semi-enclosed locations below and contiguous to the drill floor and to the boundaries of the tower or to the extent of any enclosure which is liable to trap gases.

6) Outdoor locations below the drill floor and within a radius of 1,5 m area beyond the zone 1 area as specified in 3.2.2.6).

7) The areas 1,5 m beyond the hazardous areas zone 1 specified in 3.2.2 2) and beyond the semi-enclosed locations specified in 3.2.2 4).

8) Outdoor areas within 1,5 m of the boundaries of any ventilation outlet from or access to hazardous areas zone 2, except where 4.2.3 applies.

9) Air locks between a Zone 1 and a non-hazardous area.

(IACS UR D8 2.3)

4. Openings, Access and Ventilation Conditions affecting the Extent of Hazardous Areas

4.1 Except where necessary for the safety and operation of the unit, access doors or other openings are not to be provided in the locations specified in the following 1) and 2).

1) Between a hazardous area zone 2 and a hazardous area zone 1

2) Between a non-hazardous area and a hazardous area.

4.2 Where such access doors or other openings are provided, any enclosed space not referred to 3.1.2, 3.1.3, 3.2.2 or 3.2.3 and having a direct access to any zone 1 location or zone 2 location becomes the same zone as the location except that:

4.2.1 An enclosed space with a direct access to any hazardous area zone 1 can be considered as a hazardous area zone 2, if:

1) The access is fitted with a self-closing gas tight door opening into the hazardous area zone 2;

2) Ventilation is such that the air flow with the door open is from the hazardous area zone 2 into the hazardous area zone 1; and

3) Loss of ventilation is alarmed at an attended station.

4.2.2 An enclosed space with a direct access to any hazardous area zone 1 is not considered hazardous if:

1) The access doors of self-closing gas tight type are provided in duplicate to form an air lock;

2) The space has ventilation overpressure in relation to the hazardous area; and

3) Loss of ventilation overpressure is alarmed at an attended station.

4.2.3 An enclosed space with a direct access to any hazardous area zone 2 is not considered hazardous if:

1) The access is fitted with a self-closing gas tight door that opens into the non-hazardous area;

2) Ventilation is such that the air flow with the door open is from the non-hazardous area into the hazardous areas zone 2; and

3) Loss of ventilation is alarmed at an attended station.

4.3 Where ventilation arrangements of the intended safe space are considered sufficient by BKI to prevent any ingress of gas from the Zone 1 location, the two self-closing doors forming an air lock may be replaced by a single self-closing gas-tight door which opens into the non-hazardous location and has no hold-back device.

4.4 Piping systems should be designed to preclude direct communication between hazardous areas of different classifications and between hazardous and non-hazardous areas.

4.5 Hold-back devices should not be used on self-closing gastight doors forming hazardous area boundaries.

B. Ventilation Systems

1 General

1.1 Attention is to be given to ventilation inlet and outlet locations and airflow in order to minimize the possibility of cross contamination.

1.2 Inlets are to be located in non-hazardous areas as high and far away from any hazardous area as practicable.

1.3 Each air outlet is to be located in an outdoor area which, in the absence of the considered outlet, is of the same or lesser hazard than the ventilated space.

2. Ventilation of Hazardous Area

2.1 Ventilation for hazardous areas is to be completely separate from that used for non-hazardous areas.

2.2 Where the ventilation duct passes through a hazardous area of a higher level, the ventilation duct should have overpressure in relation to this area; where the ventilation duct passes through a hazardous area of a lower level, the ventilation duct should have under pressure in relation to this area.

2.3 The arrangement of ventilation inlet and outlet openings in the space is to be such that the entire space is efficiently ventilated, giving special consideration to location of equipment which may release gases, and to spaces where gases may accumulate.

2.4 The outlet air from hazardous areas zone 0, zone 1 and zone 2 is to be led in separate ducts to the outdoor locations. The internal spaces of such ducts belong to the same Zone as the inlet space

2.5 Air inlet ducts designed for constant relative under pressure are to be rigidly constructed to avoid air leaks.

2.6 Fans are to be designed so as to reduce the risk that sparks may occur.

2.7 Hazardous enclosed spaces should be adequately ventilated. For Drilling Unit, Hazardous enclosed mud processing spaces should be ventilated at a minimum rate of 12 air changes per hour.

2.8 Where mechanical ventilation is applied, it should be such that the hazardous enclosed spaces are maintained with under-pressure in relation to the less hazardous spaces or areas and non-hazardous enclosed spaces are maintained in overpressure in relation to adjacent hazardous locations.

3. Ventilation of Non-Hazardous Area

3.1 Enclosed non-hazardous spaces adjacent to hazardous spaces or areas are to be provided with adequate ventilation so as to maintain them at a higher pressure than adjacent hazardous spaces or areas. Refer to A.4 for adjacent spaces not separated by gastight boundaries.

3.2 Ventilation inlets and outlets for non-hazardous spaces are to be located in non-hazardous areas, see 1.

3.3 Where passing through hazardous areas, ducts are to have overpressure in relation to the hazardous area.

C. Machinery Installations in Hazardous Areas

1. General Requirement for All Units

1.1 Machinery installations in hazardous areas are to be limited to those essential for operational purposes.

1.2 Mechanical equipment and machinery installations in hazardous areas are to be so constructed and installed as to reduce the risk of ignition from sparking due to the formation of static electricity or friction between moving parts and from high temperatures of exposed parts due to exhausts or other emissions.

2. Drilling Unit

2.1 Combustion engines, as a rule, are not to be installed in hazardous areas. Where this cannot be avoided, internal combustion engines may be installed in hazardous areas zone 1 and 2, provided that BKI approves and sufficient precautions listed in the following 2.1.1 to 2.1.3 have been taken against the risk of dangerous ignitions.

2.1.1 Exhaust outlets are to be fitted with suitable spark arresting devices and to be located outside hazardous areas.

2.1.2 Where exhaust pipes are insulated, the insulation is to be protected against possible oil absorption.

2.1.3 Air intakes are not to be less than 3 m apart from any hazardous area.

2.2 Fired boilers, as a rule, are not to be installed in hazardous areas. Where this cannot be avoided, fired boilers may be installed in hazardous areas zone 2 provided that BKI approves and sufficient precautions listed in the following 2.2.1 and 2.2.2 have been taken against the risk of dangerous ignitions.

2.2.1 Exhaust outlets are to be located outside hazardous areas.

2.2.2 Where exhaust pipes are insulated, the insulation is to be protected against possible oil absorption.

D. Electrical Installations in Hazardous Areas

1. General Requirement for All Units

1.1 Electrical installations are not to be installed in hazardous areas unless essential for operational purposes. Where installation of electrical installations is unavoidable, it is to comply with requirements in this sub-section

1.2 Distribution system

1.2.1 Notwithstanding the requirement in Rules for Electrical Installations (Pt.1 Vol. IV), Sec. 17, the system of power supply is to be one of the following.

1) Two-wire insulated for DC system

2) Single-phase two-wire insulated for AC system

3) Three-phase three-wire insulated for AC system

1.2.2 Notwithstanding the requirement in 2.1, a hull return distribution system may be used for

– Impressed current cathodic protection system for external hull.

– Limited and locally earthed system

1.2.3 Notwithstanding the requirement in 2.1. an earthed distribution system may be used for the following systems.

1) Intrinsically safe circuits

2) Power supplies, control circuits and instrumentation circuits where technical or safety reasons preclude the use of a system, with no connection to earth, provided the current in the hull is limited to not more than 5A in both normal and fault conditions .

3) Limited and locally earthed systems, provided that any possible resulting current does not flow directly through any dangerous spaces

4) A.C. power networks of 1000 V root mean square (line to line) and over, provided that any possible resulting current does not flow directly through any dangerous spaces

1.3. Explosion-protected electrical equipment is to comply with the requirements in Rules for Electrical Installations (Pt.1 Vol. IV), Sec. 13.K & 13.M, and to be certified that it is safety usable in the explosive gas atmosphere concerned.

1.4. Electrical measuring, monitoring, control and communication apparatuses are to be of intrinsically safe type. Where it is, however, technically impracticable to meet this requirement, electrical equipment of other explosion-protected construction as deemed appropriate by BKI may be used as an alternative to intrinsically safe type electrical equipment.

1.5. Portable lamps are to be of intrinsically safe type, flameproof type or increased safety type with self-contained battery or of air-driven type with pressurized enclosure.

1.6. Switch gears installed in feeder circuits for explosion protected electrical equipment in hazardous areas are to be provided with effective means for preventing dangers arising from miss-operation, except for the intrinsically safe circuits, in addition to the compliance with the requirements in Rules for Electrical Installations (Pt.1 Vol. IV).

1.7. Aerials and associated riggings are to be sited well clear of gas or vapour outlets.

1.8. As a rule, no portable electrical equipment is to be located in hazardous areas. Where it is unavoidable to locate, it is subjected to the special approval of BKI.

1.9. Wiring in Hazardous Area

1.9.1 Cables permitted in hazardous areas are to be as follows.

1) Zone 0 areas : Cables associated with intrinsically safe circuits.

2) Zone 1 areas - all cables are to be sheathed as follows:
   – Non-metallic impervious sheath plus metal screening or braiding for earth detection.
   – Copper sheath plus non-metallic outer sheath for earth detection (for mineral insulated cable only).

3) Zone 2 areas - all cables are to be sheathed as follows:
   – As for Zone 1 areas.

– Non-metallic sheath without metal screening or braiding, provided the cable is adequately protected against mechanical damage.

1.9.2 installation of cable is to be comply with the following.

1) Cables are to be installed as close to the hull centre line as practicable.
2) Cables are to be installed, sufficiently distant from decks, bulkheads, tanks and various kinds of pipes.
3) Cables are, as a rule, to be protected against mechanical damage. Further, the cables and their supports are to be fitted on such a manner as to withstand expansion and construction and other effects of the hull structure.
4) The penetration part of the cables or cable pipes through decks and bulkhead of the dangerous spaces is to be constructed so as to maintain gas-tightness and liquid-tightness as the case may require.
5) When mineral insulated cables are used, special precautions are to be taken to ensure termination

1.9.3 Power and lighting cables are to be in accordance with the requirements specified in Section 8.A.7

1.10 Selection and Installation of Electrical Equipment

1.10.1 Electrical equipment and wiring installed in hazardous areas are to be limited to that necessary for operational purposes. Only the cables and types of equipment described in this chapter may be installed. Selection and installation of equipment and cables in hazardous areas should be in accordance with following standards.

1) IEC 61892-1: Mobile and fixed offshore units–Electrical installations–Part 1: General requirements and conditions.
2) IEC 61892-2: Mobile and fixed offshore units–Electrical installations–Part 2: System design.
3) IEC 61892-3: Mobile and fixed offshore units–Electrical installations–Part 3: Equipment.
4) IEC 61892-4: 2007 Mobile and fixed offshore units–Electrical installations–Part 4: Cables.
5) IEC 61892-5: Mobile and fixed offshore units–Electrical Installations–Part 5: Mobile units.
6) IEC 61892-6: Mobile and fixed offshore units–Electrical installations–Part 6: Installation.
7) IEC 61892-7: Mobile and fixed offshore units–Electrical installations–Part 7: Hazardous areas.

1.10.2 In selection of electrical apparatus for use in hazardous areas, consideration is to be given to:

1) the zone in which the apparatus will be used;
2) the sensitivity to ignition of the gases or vapours likely to be present, expressed as a gas group; and
3) the sensitivity of the gases or vapours likely to be present to ignition by hot surfaces, expressed as a temperature classification.

1.11 Protection of electrical installations

1.11.1 Electrical apparatus used in hazardous areas is to be manufactured, tested, marked and installed in accordance with following standards and certified by an independent testing laboratory recognized by BKI.

1) IEC 60079-10-1, Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres.
2) IEC 60079-10-1, Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i".
3) IEC 60079-13, Explosive atmospheres - Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v".

4) IEC 60079-14, Explosive atmospheres–Part 14: Electrical installations design, selection and erection.
5) EC/TR 60079-16, Electrical apparatus for explosive gas atmospheres–Part 16: Artificial ventilation for the protection of analyser(s) houses.
6) IEC 60079-17, Explosive atmospheres–Part 17: Electrical installations inspection and maintenance
7) IEC 60079-19, Explosive atmospheres–Part 19: Equipment repair, overhaul and reclamation.
8) IEC 60079-25, Explosive atmospheres–Part 25: Intrinsically safe electrical systems.
9) IEC 60079-28, Explosive atmospheres–Part 28: Protection of equipment and transmission systems using optical radiation.
10) IEC 60079-29-1, Explosive atmospheres–Part 29-1: Gas detectors–Performance requirements of detectors for flammable gases.
11) IEC 60079-29-2, Explosive atmospheres–Part 29-2: Gas detectors–Selection, installation, use and maintenance of detectors for flammable gases and oxygen.
12) IEC/IEEE 60079-30-1, Explosive atmospheres–Part 30-1: Electrical resistance trace heating–General and testing requirements.
13) IEC/IEEE 60079-30-2, Explosive atmospheres–Part 30-2: Electrical resistance trace heating–Application guide for design, installation and maintenance.
14) ISO/IEC 80079-20-1, Explosive atmospheres - Part 20-1: Material characteristics for gas and vapour classification - Test methods and data

1.11.2 Equipment classified in accordance with the following protection classes may be used:

Table 9.1 Electrical protection type

Type	Protection method
i	Intrinsic safety
ia	Intrinsic safety very high level
ib	Intrinsic safety high level
d	Flameproof enclosures
e	Increased safety
m	Encapsulation
n	Non incendive
o	Oil immersion
p	Pressurized enclosures
q	Powder filling
s	Equipment specially approved for use in this

1.11.3 Types of electrical equipment permitted should be determined according to the electrical hazardous area classification of the location in which the equipment is to be installed. Permissible equipment is shown by an "x" in Table 9.2. The use of type "o" is to be limited. For transportable apparatus, protection type "o" is not to be used.

Table 9.2 Type of electrical apparatus used in hazardous zones

Protection Type	ia	ib	d	e	m	n	o	p	q	s
Zone 0	x									
Zone 1	x	x	x	x	x		x	x	x	
Zone 2	x	x	x	x	x	x	x	x	x	x

1.11.4 Group selection for electrical equipment is to be as follows:

1) Group II should be selected for types "e", "m", "n", "o", "p", "q" and "s" apparatus.

2) Group IIA, IIB or IIC should be selected for types "i", "d", and certain types of "n" apparatus according to table Table 9.3.

Table 9.3 Relationship between gas/vapour group and permitted equipment group

Gas/vapour group	Electrical equipment group
IIC	IIC
IIB	IIB or IIC
IIA	IIA, IIB or IIC

1.11.5 Electrical apparatus is to be so selected that its maximum surface temperature will not reach ignition temperature of any gas/vapour possibly presenting in the hazardous areas in which the electrical apparatus is located. The relationship among equipment temperature class, equipment maximum surface temperature, gas/vapour ignition temperature is shown in Table 9.4.

Table 9.4 Relationship among temperature class, maximum surface temperature and ignition temperature

Electrical Apparatus Temperature Class	Electrical Apparatus Maximum Surface Temperature (°C)	Gas/Vapour Ignition Temperature (°C)
T1	450	>450
T2	300	>300
T3	200	>200
T4	135	>135
T5	100	>100
T6	85	>85

1.11.6 Explosion proof type or equivalent essential lighting is to be supplied from at least two final sub-circuits in such a way that failure of any one of the circuits does not leave the space in darkness. For lighting (explosion proof or equivalent type) in hazardous areas or spaces, switches are to be of the two-pole type and wherever practicable located in a non-hazardous area.

2. Drilling Unit

2.1 Unless otherwise specified, requirements in 1 shall additionally apply.

2.2 Electrical apparatus located in hazardous drilling well and mud processing areas is to meet at least Group IIA and temperature class T3.

2.3 Electrical cables are to meet the following:

1) Only cables associated with type "ia" equipment are to be permitted in Zone 0 areas.
2) Thermoplastic sheathed cables, thermosetting sheathed cables or elastomeric sheathed cables are to be used for fixed wiring in Zone 2 areas.
3) Flexible and portable cables, where necessary, used in Zone 1 and Zone 2 areas are to be to the satisfaction of the Administration.

   Permanently installed, fixed cable passing through Zone 1 hazardous areas is to be fitted with conductive covering, braiding or sheathed for earth detection.

Section 10 Fire Protection, Means of Escape and Fire Extinction

A. General 10–1
B. Fire Protection and Means of Escape 10–1
C. Fire Extinguishing System 10–11

A. General

1. General Requirements of Fire Protection and Means of Escape

1.1 The hull, superstructures, structural bulkheads, decks, deckhouse and walls of control station are to be constructed of steel. Units constructed of other materials may be accepted, provided that, in the opinion of BKI, they provide an equivalent standard of safety

1.2 Structural fire protection details, materials and methods of construction should be in accordance with the FTP Code, as applicable, and SOLAS regulations II-2/5.3 and II-2/6, as applied to cargo ships.

1.3 The insulation of alluminium alloy components of "A" or "B" class divisions is to be such that the temperature at the structural core does not rise more than 200°C above the ambient temperature at any time during the applicable exposure to the standard fire test, except where these insulations are as deemed appropriate by BKI.

1.4 In working areas, paints, varnishes and similar preparations having nitro-cellulose or other highly inflammable bases are not to be used.

1.5 Helicopter decks, if they are provided, are to be of a steel or other equivalent tire resistant materials. If the spaces below the helicopter deck are fire risk spaces, the insulation standard is to be satisfaction of BKI.

2. General Requirements of Fire Extinction

2.1 Unless otherwise specially required in this Section, fire extinguishing systems, fire extinguishers, fire detection systems, etc., and associated piping's are to comply with the requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.12 and (Pt.5, Vol.IV) Sec.10. D to L.

2.2 All fire extinguishing systems and fire extinguishers are to be being available for immediate use at all time.

2.3 Where helicopter facilities are provided in the units except mobile offshore drilling units, fire extinguishing systems on helicopter decks are to be in accordance with the requirements in Rules for Machinery Installations (Pt.1, Vol.III), Sec.12.O. and Rules for Structure (Pt.5, Vol.II) Sec.9.D.

B. Fire Protection and Means of Escape

1. Application

1.1 In addition to the requirements in Rules for Machinery Installations (Pt.5, Vol.IV) Sec.10.B, Structural fire protection and means of escape provided in the units are to be in accordance with the requirements in this Section. However, where approved specially by BKI, the requirements may be modified.

1.2 When fire safety design or arrangements deviate from the prescriptive provisions of this rule, engineering analysis, evaluation and approval of the alternative design and arrangements should be carried out in accordance with SOLAS regulation II-2/17.

1.3 Attention is directed to the appropriate governmental authority in each case, as there may be additional requirements, depending on the size, type and intended service of the units as well as other particulars and details. Consideration will be given to fire protection arrangements and fire extinguishing systems which comply with the published requirements of the governmental authority of the country in which the unit is to be registered. Also, attention is directed to IMO MODU Code Chapter 9, which contains minimum requirements for structural fire protection.

2. Construction of Fire Protection

2.1 Bulkheads and decks are to be the divisions respectively specified in Table 10.1 and Table 10.2 according to the spaces adjoining to the relevant bulkheads or decks. Exterior boundaries of superstructures and deckhouses enclosing accommodation are to be constructed to “A-60" standard for the whole of the portion which faces and is whithin 30 m of the centre of the rotary table. For units that have a movable substructure the distant 30 m is to be measured with the substructure at its closest drilling position to the accommodation.

2.2 For determining the appropriate fire integrity standards to be applied to the Tables 10.1 and Table 10.2 required divisions between adjacent spaces, such spaces are classified according to their tire risk, as shown in following categories 1) to 11)

1) Control stations

Control stations are spaces as defined in Sec.1.B.15, excluding the spaces where emergency sources of power are located.

2) Corridors

Corridors mean corridors and lobbies.

3) Accommodation spaces

Accommodation spaces are spaces, excluding corridors, lavatories and pantries containing no cocking appliances, which are used for public spaces, cabins, offices, hospitals, cinemas, games and similar spaces. Public spaces are those portions of the accommodation spaces which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

4) Stairways

Stairways are enclosed interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) and enclosures there to. In this connection, a stairway which is enclosed only at one level is to be regarded as part of the space from which it is not separated by a fire door.

5) Service spaces with low risk of fire

Service spaces with low risk of fire are locker rooms and store rooms not having the storage of flammable liquids and having areas less than 4,0 m^2, drying rooms and laundries.

6) Machinery spaces of Category A

Machinery spaces of Category A are the spaces which fall under anyone of the following a) to c), including trunks to such spaces:

1) Spaces where internal combustion engines for main propulsion are installed.

2) Spaces where internal combustion engines used for other purposes than main propulsion, having aggregate power of not less than 375 kW are installed,

3) Spaces which contain oil-fired boilers or oil fuel units.

7) Other machinery spaces

Other machinery spaces are all other machinery spaces than machinery spaces of Category A, containing propelling machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilating and air-conditioning machinery and similar spaces, including trunks to such spaces.

8) Hazardous areas

Hazardous areas are as defined in Sec.1.B.16.

9) Service spaces with high risk of fire

Service spaces with high risk of fire are galleys, pantries containing cooking appliances, paint and lamp rooms, locker rooms and store rooms having areas of 4 m^2 or more, spaces for the storage of flammable liquids, and workshops which are not included in the machinery spaces.

10) Open decks

Open decks are open deck spaces, excluding hazardous areas.

11) Sanitary and similar spaces

Sanitary and similar spaces are communal sanitary facilities such as showers, baths, lavatories, etc., and isolated pantries containing no cooking appliances. Sanitary facilities which serve a space and with access only from that space are to be considered a portion of space in which they are located.

Table 10.1 Fire integrity of bulkheads separating Adjacent Spaces

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control Stations (1)	A-0 [d]	A-0	A-60	A-0	A-15	A-60	A-15	A-60	A-60	*	A-0 [d]
Corridors (2)		C	B-0	B-0 A-0 [b]	B-0	A-60	A-0	A-0	A-0	*	B-0
Accommodation Spaces (3)			C	B-0 A-0 [b]	B-0	A-60	A-0	A-0	A-0	*	C
Stairway (4)				B-0 A-0 [b]	B-0 A-0 [b]	A-60	A-0	A-0	A-0	*[b]	B-0 A-0 [b]
Service spaces with low risk of fire (5)					C	A-60	A-0	A-0	A-0	*	B-0
Machinery Spaces of category A (6)						*a	A-0 [a]	A-60	A-60	*	A-0
Other machinery spaces (7)							A-0[ac]	A-0	A-0	*	A-0
Hazardous Area (8)								-	A-0	*	A-0
Service spaces with high risk of fire (9)									A-0 A-0 [c]	*	A-0
Open deck (10)										-	*
Sanitary and similar spaces (11)											C

1 C in the Table means that divisions are made non-combustible materials.

2 a to d, * and - in the Table means as follows:

a : Where the space contains an emergency power source or components of an emergency power source that adjoins a space containing a unit's service generator or the components of unit's generator, the boundary bulkhead or deck between those spaces is to be an "A-60" Class division.

b : Either of the divisions indicated above or below is to be provided in consideration of 2.8 3) and 6)

c : Where spaces are of the same numerical category and superscript c appears, a bulkhead or deck of the rating shown in the Table is only required when the adjacent spaces are for a different purpose, e.g. in category (9). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.

d : Bulkhead separating the navigating bridge chartroom and radio room from each other may be "B-0" rating.

* : Where an asterisk appears in the Table, the division is required to be of steel or equivalent material but is not required to be of "A" Class standard. However, where a deck is penetrated for the passage of electric cables, pipes and vent ducts, such penetrations are to be made tight to prevent the passage of flame and smoke.

- : Where a dash appears in the Table. the division need not be of "A", "B" nor "C" Class standard

Table 10.2 Fire Integrity of Decks Separating Adjacent Spaces

space above / space below	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control Stations (1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0	*	A-0
Corridors (2)	A-0	*	*	A-0	*	A-60	A-0	A-0	A-0	*	*
Accommodation Spaces (3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0	A-0	*	*
Stairway (4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0	A-0	*	A-0
Service spaces with low risk of fire (5)	A-15	A-0	A-0	A-0	*	A-60	A-0	A-0	A-0	*	A-0
Machinery Spaces of category A (6)	A-60	A-60	A-60	A-60	A-60	*[a]	A-0	A-0	A-0	*	A-0
Other machinery spaces (7)	A-15	A-0	A-0	A-0	A-0	A-0	*[a]	A-0	A-0	*	A-0
Hazardous Area (8)	A-60	A-0	A-0	A-0	A-0	A-60	A-0	-	A-0	-	A-0
Service spaces with high risk of fire (9)	A-60	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0	*	A-0
Open deck (10)	*	*	*	*	*	*	*	-	*	-	*
Sanitary and similar spaces (11)											*

Note:
See Notes under Table 10.1.

2.3 Continuous "B" Class ceilings or linings in association with the relevant decks or bulkheads may be accepted as contributing wholly or in part to the required insulation and integrity of a division.

2.4 Windows and side scuttles, with the exception of navigating bridge windows, are to be of the non-opening type. Navigating bridge windows may be of the opening type provided the design of such windows would permit rapid closure. BKI may permit windows and side scuttles outside hazardous areas to be of the opening type.

2.5 In approving structural fire protection details, BKI is to have regard to the risk of heat transmission at intersections and terminal points of required thermal barriers. The insulation of a deck or bulkhead is to be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of "A" class standard having insulation of different values, the insulation with the higher value shall continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

2.6 The fire resistance of doors are, as far as practicable, to be equivalent to that the division in which they are fitted. External doors in superstructures and deckhouses are to be constructed to “A-0” Class divisions and, where applicable, be self-closing.

2.7 Self-closing doors in fire rated bulkheads should not be fitted with hold-back hooks. However, hold-back arrangements incorporating remote release fittings of the fail-safe type may be utilized.

2.8 Protection of accommodation spaces, service spaces and control stations specified in Sec.1, B.15. (except the space where the emergency source of electric power is installed), is to be in accordance with the requirements in the following.

1) In general, accommodation spaces, service spaces and control stations should not be located adjacent to hazardous areas. However, where this is not practicable, an engineering evaluation should be performed to ensure that the level of fire protection and blast resistance of the bulkheads and decks separating these spaces from the hazardous areas are adequate for the likely hazard.

2) All bulkheads that are to be "A" class divisions are to extend from deck to deck and to the deckhouse side or other boundaries.

3) All bulkheads required to be "B" Class divisions are to be extend from deck to deck and to the deckhouse side or other boundaries, unless continuous "B" Class ceilings or linings are fitted on both sides of the bulkhead, in which case the bulkhead may terminate at the continuous ceiling or linings.

4) In corridor bulkheads, ventilation openings may be permitted only in and under the doors of cabins, public spaces, offices and sanitary spaces. The openings are to be provided only in the lower half of the door. Where such an opening is in or under a door, the total net area of any such opening or openings are not to exceed 0,05 m^2. When such an opening is cut in a door it is to be fitted with a grille made of non-combustible material. Such openings are not to be provided in a door in a division forming a stairway enclosure.

5) Stairs are to be constructed of steel or other other equivalent material.

6) Stairways which penetrate only a single deck are to be protected at least at one level by “A” or “B” class divisions and self-closing doors so as to limit the rapid spread of tire from one deck to another. Personnel lift trucks are to be protected by "A" class divisions. Stairways and lift trunks which penetrate more than a single deck are to be surrounded by “A" Class divisions and protected by self-closing doors at all levels.

7) Air spaces enclosed behind ceilings, panelling’s or linings are to be divided by close fitting draught stops spaced not more than 14 m apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., is to be closed at each deck.

8) Except for insulation in refrigerated compartments, insulation material, pipe and vent duct lagging, ceiling, lining and bulkheads are to be of non-combustible material. Insulation of pipe fittings for cold service systems and vapour briers and adhesives used in conjunction with insulation need not be non-combustible but they are to be kept to a minimum and their exposed surfaces are to have low-flame spread characteristic. In spaces where penetration of oil products is possible, the surface of the insulation are to be impervious to oil or oil vapours.

9) The framing, including grounds and the joint pieces of bulkheads, linings, ceilings and draught stops are to be of non-combustible material.

10) All exposed surfaces in corridors and stairway enclosures and surfaces in concealed or inaccessible spaces in accommodation and service spaces and control stations are to have low flame-spread characteristics. Exposed surfaces of ceilings in accommodation and service spaces and control stations are to have low-flame-spread characteristics.

11) Bulkheads, linings and ceilings may have combustible veneers provided that the thickness of such veneers are not to exceed 2,5 mm within any space other than corridors, stairway enclosures and control stations where the thickness is not to exceed 1,5 mm. Alternately, thicker veneers of low calorific value not exceeding 45 MJ/m^2 will be considered.

12) Primary deck coverings, if applied, are to be of materials approved by BKI, which will not readily ignite, or give rise to toxic or explosive hazards at elevated temperatures.

13) Paints, varnishes and other finishes used on exposed interior surfaces are not to be of a nature to offer an undue fire hazard in discretion of BKI and are not to be capable of producing excessive quantities of smoke or toxic fumes.

2.9 Ventilation provided with units except those provided in hazardous area are to be in accordance with following 1) to 9).

1) The ventilation of the accommodation spaces and control stations are to be arranged in such a way as to prevent the ingress of flammable, toxic or noxious gasses, or smoke from the surrounding area.

2) Ventilation ducts are to be of non-combustible material. Short ducts, however, not generally exceeding 2,0 m in length and with a cross-sectional area not exceeding 0,02 m^2 need not be non-combustible, subject to the following conditions:

   1) subject to b),These ducts are to be of a material which, in the opinion of BKI, has a low fire risk;

   2) the ducts are to be made of heat resisting non-combustible material, which may be faced internally and externally with membranes having low flame-spread characteristics and, in each case, a calorific value not exceeding 45 MJ/m^2 of their surface area for the thickness used;

   3) the ducts are be used at the end of the ventilation devices; and

   4) the ducts are not to be situated less than 600 mm, measured along the duct, from where it penetrates any "A" or "B" Class division including continuous "B" Class division.

3) Where a thin plated duct with a free cross-sectional area equal to, or less than, 0,02 m^2 passes through "A" class bulkhead or decks, the opening should be lined with a steel sheet sleeve having a thickness of at least 3,0 mm and a length of at least 200 mm, divided preferably into 100 mm on each side of the bulkhead or, in the case of the deck, wholly laid on the lower side of the deck pierced.

   Where ventilation ducts with a cross-sectional area exceeding 0,02 m^2 pass through class "A" bulkheads or decks, the opening is to be lined with a steel sheet sleeve unless the ducts passing through the bulkheads or decks are of steel in the vicinity of penetrations through the deck or bulkhead. The ducts and sleeves at such places are to comply with the followings.

   1) The ducts or sleeves are to have a thickness of at least 3,0 mm and a length of at least 900 mm. When passing through bulkheads, this length are to be divided preferably into 450 mm on each side of the bulkhead. These ducts, or sleeves lining such ducts, are to be provided with fire insulation. The insulation are to have at least the same fire integrity as the bulkhead or deck through which the duct passes. Equivalent penetration protection may be provided to the satisfaction of BKI.

   2) Ducts with a cross-sectional area exceeding 0,075 m^2, except those serving hazardous areas, are to be fitted with fire dampers in addition to meeting the requirement of a). The fire damper are to operate automatically but are also to be capable of being closed manually from both sides of the bulkhead or deck. The damper are to be provided with an indicator which shows whether the damper is open or closed. Fire dampers are not required, however, where ducts pass through spaces surrounded by "A" Class divisions, without serving these spaces, provided those ducts have the same fire integrity as the divisions which they pierce. Fire dampers are to be easily accessible. Where they are placed behind ceilings or linings, these ceilings or linings are to be provided with an inspection door on which a plate reporting the identification number of the fire damper is provided. The fire damper identification number is also to be placed on any remote controls required.

4) In general, ventilation systems for machinery spaces of category A, galleys and hazardous areas should be separated from each other and from the ventilation systems serving other spaces. Ducts serving hazardous areas should not pass through accommodation spaces, service spaces, or control spaces. Ducts provided for ventilation of machinery spaces of Category A, galleys and hazardous areas are not to pass through accommodation and service spaces or control stations, except where the following requirements of a) or b) are complied with:

   1) :

      i) The ducts are constructed of steel having a thickness of at least 3,0 mm for ducts of 300 mm in width or less and at least 5,0 mm for ducts of 760 mm in width and over. In case of ducts the width or diameter of which is between 300 mm and 760 mm, the thickness are to be obtained by interpolation;

      ii) the ducts are suitably supported and stiffened;

      iii) The ducts are to be fitted with automatic fire dampers close to the boundaries penetrated;

iv) The ducts are to be insulated to “A-60" standard from the machinery or galleys to a point at least 5,0 m beyond each fire damper.

2) :

i) The ducts are constructed of steel in accordance with a) i) and a) ii);

ii) The ducts are to be insulated to "A-60" standard throughout the accommodation spaces, service spaces or control stations.

5) Ducts provided for ventilation of accommodation and service spaces or control stations are not to pass through machinery spaces of Category A, galleys or hazardous areas, except where the following requirements of a) or b) are complied with:

1) :

i) The ducts where they pass through a machinery space of category A or galley are constructed of steel in accordance with the requirement in paragraph 4) a) i) and 4) a) ii);

ii) Automatic fire dampers are fitted close to the boundaries penetrated; and

iii) The integrity of the machinery space or galley boundaries is maintained at the penetrations.

2) :

iv) The ducts where they pass through a machinery space of category A or a galley are constructed of steel in accordance with the requirement of 4) a) i) and 4) a) ii);

v) The ducts are insulated to II A-60" standard within the machinery space or galley.

6) Ventilation ducts with a cross-sectional area exceeding 0,02 m^2 passing through "B" Class bulkheads are to be lined with steel sleeves of 900 mm in length divided preferably into 450 mm on each side of the bulkhead unless the duct is of steel for this length.

7) Where they pass through accommodation spaces or space containing combustible materials, the exhaust ducts from galley ranges are to be of equivalent fire integrity to “A” Class divisions. Each such exhaust duct are to be fitted with following a) to d).

1) a grease trap readily removable for cleaning

2) a fire damper located in the lower end of the duct which is automatically and remotely operated and, in addition a remotely operated fire damper located in the exhaust end of the duct;

3) Arrangements, operable from within the galley, for shutting off the exhaust fans

4) fixed means for extinguishing a fire within the duct

8) The main inlets and outlets of all ventilation systems are to be capable of being closed from outside the spaces being ventilated.

9) Power ventilation of accommodation spaces, service spaces, control stations, machinery spaces and hazardous areas are to be capable of being stopped from an easily accessible position outside the space being served. The means provided for stopping the power ventilation serving machinery spaces or hazardous areas are to be entirely separate from the means provided for stopping ventilation of other spaces.

2.10 Windows and side scuttles in boundaries which are required to meet an “A-60” standard which face the drill floor areas are to be in accordance with one of the following requirements.

- They are to be constructed to an "A-60" standard, or
- They are protected by a water curtain, or
- They are fitted with shutters of steel or equivalent material.

2.11 Where helicopter facilities are provided with the units, helicopter decks are to be in accordance with following requirements 2.11.1 to 2.11.3.

2.11.1 Helicopter deck shall be of a steel or steel equivalent fire-resistant construction. If the space below the helicopter deck forms the deck head of deckhouse or superstructure, it shall be insulated to "A-60" class standard. If an alumunium or other low melting metal construction will be allowed, the following provisions shall be satisfied:

.1 If the platform is cantilevered over the side of the ship, after each fire on the ship or on the platform, the platform shall undergo a structural analysis to determine its suitability for further use.

.2 If the platform is located above the ship's deckhouse or similar structure, the following condition shall be satisfied:

- The deckhouse top and bulkheads under the platform shall have no openings
- All windows under the platform shall be provided with steel shutters
- After each fire on the platform or in close proximity, the platform shall undergo a structural analysis to determine its suitability for further use.

2.11.2 Means are to be provided to prevent the collection of liquids on the helicopter deck and to prevent liquids from spreading to or falling on other part of unit.

2.11.3 Deckhouse top directly below helicopter decks are to have no openings.

2.12 Where more than 1 cylinder of oxygen and acetylene are carried simultaneously on the unit, such cylinders are to be arranged in accordance with the requirements of following 2.12.1 to 2.12.7

2.12.1 Permanent piping systems for oxyacetylene systems are acceptable to BKI.

2.12.2 Where two or more cylinders of each gas are intended to be carried in enclosed spaces, separate dedicated storage rooms are to be provided for each gas.

2.12.3 Storage rooms are to be constructed of steel, and be well ventilated and accessible from the open deck.

2.12.4 Provisions are to be made for the expeditious removal of cylinders in the event of fire.

2.12.5 "NO SMOKING" signs are to be displayed at the gas cylinder storage rooms.

2.12.6 Where cylinders are stowed in open locations means are to be provided to :

- protect cylinders and associated piping from physical damage;
- minimize exposure to hydrocarbons; and
- ensure suitable drainage.

2.12.7 Fire-extinguisher arrangement for protection of areas or spaces where such cylinder are stored are to be to the satisfaction of BKI

3. Means of Escape

3.1 Within the accommodation spaces, service spaces and control stations, the means of escape specified in the following 3.1.1 to 3.1.4 are to be provided:

3.1.1 In every general area which is likely to be regularly manned or in which personnel are accommodated, at least two separate escape routes are to be provided, situated as far apart as practicable, to allow ready means of escape to the open decks and embarkation stations. Where, however, deemed appropriate by BKI inconsideration of the nature, location of spaces and the number of persons who might normally be accommodated or employed there, one of these means of escape may be dispensed with.

3.1.2 Stairways are normally to be used for means of vertical escape. Where, however, the installation of a stairway is shown to be impracticable, a vertical ladder may be used for one of the means of escape.

3.1.3 Every escape route is to be readily accessible and unobstructed. All exit doors along the route are to be readily operable. Dead-end corridors exceeding 7,0 m in length are not to be provided.

3.1.4 In addition to the emergency lighting, the means of escape in accommodation areas, including stairways and exits, should be marked by lighting or photo-luminescent strip indicators placed not more than 300 mm above the deck at all points of the escape route, including angles and intersections. The marking should enable personnel to identify the routes of escape and readily identify the escape exits. If electric illumination is used, it should be supplied by the emergency source of power and it should be so arranged that the failure of any single light or cut in a lighting strip will not result in the marking being ineffective. Additionally, escape route signs and fire equipment location markings should be of photo-luminescent material or marked by lighting. The Administration should ensure that such lighting or photo-luminescent equipment has been evaluated, tested and applied in accordance with the FSS Code.

3.2 Two means of escape should be provided from each machinery space of category A. Ladders should be of steel or other equivalent material. In particular, one of the following provisions should be complied with:

3.2.1 Two sets of ladders, as widely separated as possible, leading to doors in the upper part of the space, similarly separated and from which access is provided to the open deck. One of these ladders should be located within a protected enclosure that satisfies Tables 10.1 and 10.2, category (4), from the lower part of the space it serves to a safe position outside the space. Self-closing fire doors of the same fire integrity standards should be fitted in the enclosure. The ladder should be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The enclosure should have minimum internal dimensions of at least 800 mm by 800 mm, and should have emergency lighting provisions; or

3.2.2 One ladder leading to a door in the upper part of the space from which access is provided to the open deck. Additionally, in the lower part of the space, in a position well separated from the ladder referred to, a steel door capable of being operated from each side should be provided with access to a safe escape route from the lower part of the space to the open deck.

3.3 From machinery spaces other than those of Category A, escape routes are to be provided to the satisfaction of BKI, having regard to the nature and location of the space and whether persons are normally employed in that space.

3.4 Lifts are not to be considered as forming one of the required means of escape.

3.5 Consideration is to be given to the siting of superstructures and deckhouses such that in the event of fire at the drill floor at least one escape route to the embarkation position and survival craft is protected against radiation effects of that fire as far as practicable.

C. Fire Extinguishing System

1. Application

Fire detection and extinguishing systems provided in the units are to comply with the requirements in this Section.

2. Fire Pumps and Water Supply

2.1 At least two independently driven power pumps are to be provided, each arranged to draw directly from the sea and discharge into a fixed fire main. However, in units with high suction lifts, booster pumps and storage tanks may be installed.

2.2 At least one of the pumps required in 2.1 is to be dedicated from fire-fighting duties and be available for such duties at all times.

2.3 The arrangements of the pumps, sea suctions and sources of power are to be such as to ensure that a fire in any one space would not put both the pumps required in 2.1 out of action.

2.4 The capacity of the pumps required in 2.1 is to be appropriate to the fire-fighting services supplied from the main. However, the total capacity of the pumps are to be appropriate to BKI. (Need not exceed 180 m^3/hr).

2.5 Each pump is to be capable of delivering at least one jet simultaneously from each of any two fire hydrants, hoses and 19 mm nozzles while maintaining a minimum pressure of 0,35 MPa at any hydrant. In addition, where a foam system is provided for protection of the helicopter deck, the pump are to be capable of maintaining a pressure of 0,7 MPa at the foam installation. If the water consumption for any other fire protection or fire-fighting purpose are to exceed the rate of the helicopter deck foam installation, this consumption is to be the determining factor in calculating the required capacity of the fire pump.

2.6 Where either of the pumps required in 2.1 is located in a space not normally manned and is relatively far removed from working areas, suitable provision is to be made for remote start-up of that pump and remote operation of associated suction and discharge valves.

2.7 Except as provided in 2.2, sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil.

2.8 Every centrifugal pump which is connected to the fire main is to be fitted with a non-return valve.

2.9 Relief valves are to be provided in conjunction with all pumps connected to the fire main if the pumps are capable of developing a pressure exceeding the design pressure of the fire main, hydrants and hoses. Such valves are to be so placed and adjusted as to prevent excessive pressure in the fire main system.

2.10 At least two water supply sources (sea chests, valves, strainers and pipes) are to be provided and so arranged that one supply source failure will not put all supply sources out of action.

2.11 For the self-elevating units, the following additional fire water supply measures are to be provided:

1) Water is to be supplied from sea water main filled by at least two submersible pumping systems. One system failure will not put the other system(s) out of function, and
2) Water is to be supplied from drill water system while unit lifting or lowering. Water stored in the drill water tank(s) is not less than 40 m^3 plus engine cooling water consumptions before unit lifting or lowering. Alternatively, water may be supplied from buffer tank(s) in which sea water stored is not less the quantity as the above mentioned.

3. Fire Main, Hydrants and Hoses

3.1 A fixed fire main is to be provided and be so equipped and arranged as to meet the requirements in 2. and 3.

3.2 The diameter of the fire main and water service pipes are to sufficient for the effective distribution of the maximum required discharge from the required fire pumps operating simultaneously.

3.3 With the required fire pumps operating simultaneously, the pressure maintained in the fire mains is to be adequate for the safe and efficient operation of all equipment supplied therefrom.

3.4 The fire main is, where practicable, to be routed clear of hazardous areas and be arranged in such a manner as to make maximum use of any thermal shielding or physical protection afforded by the structure of the unit.

3.5 The fire main is to be provided with isolating valves located so as to permit optimum utilization in the event of physical damage to any part of the main.

3.6 The fire main is not to have connections other than those necessary for fire-fighting purposes.

3.7 All practical precautions consistent with having water readily available are to be taken to protect the fire main against freezing.

3.8 Materials readily rendered ineffective by heat are not to be used for fire mains and hydrants unless adequately protected. The pipes and hydrants are to be so placed that the fire hoses may be easily coupled to them.

3.9 A cock or valve is to be fitted to serve each fire hose so that any fire hose may be removed while the fire pumps are operating.

3.10 The number and position of the hydrants are to be such that at least two jets of water, not emanating from the same hydrant, one of which is to be from a single length of fire hose, may reach any part of the unit normally accessible to those on board while the unit is being navigated or is engaged in drilling operations. A hose is to be provided for every hydrant.

3.11 Fire hoses are to be of non-perishable material approved by BKI and be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Their maximum length is to be to the satisfaction of BKI. Every fire hose is to be provided with a dual purpose nozzle and the necessary couplings. Fire hoses, together with any necessary fittings and tools, are to be kept ready for use in conspicuous positions near the water service hydrants or connections. Fire hoses should have a length of at least 10 m, but not more than:

- 15 m in machinery spaces;
- 20 m in other spaces and open decks; and
- 25 m for open decks with a maximum breadth in excess of 30 m.

4. Nozzles

Nozzles are to comply with the following requirements:

4.1 Standard nozzle sizes are to be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of BKI.

4.2 For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.

4.3 For machinery spaces and exterior locations, the nozzle size is to be such as to obtain the maximum discharge possible from two jets at the pressure specified in 2.5 from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.

5. Fire Extinguishing Systems in Machinery Spaces and in Spaces containing Fired Processes

5.1 In spaces where main or auxiliary oil-fired boilers and other fired processes of equivalent thermal rating are situated, or in spaces containing oil fuel units or settling tanks, the unit is to be provided with the following:

5.1.1 One of the following fixed fire extinguish systems:

1) A pressure water-spraying system complying with Rules for Machinery Installations (Pt.1, Vol. III), Sec. 12.L.1.2.
2) A gas fire-extinguishing installation complying with Rules for Machinery Installations (Pt.1, Vol. III), Sec. 12.G and 12.H and (Pt.5, Vol.IV) Sec.10.F.
3) A high expansion foam installation complying with Rules for Machinery Installations (Pt.1, Vol. III), Sec.12.K.3 and (Pt.5, Vol.IV) Sec.10.E.2. Where the machinery space containing fired processes are not entirely separated, or if fuel oil can drain from the latter spaces into the machinery space, the combined machinery space and fired process space are to be considered as one compartment.

5.1.2 At least two approved portable foam extinguishers or equivalent in each space containing a fired process and each space in which a part of the oil fuel installation is situated. In addition, at least one extinguisher of the same description with a capacity of 9,0 litre for each burner, provided that the total capacity of the additional extinguisher or extinguishers need not exceed 45 litre for any one space.

5.13 A receptacle containing sand, sawdust impregnated with soda, or other approved dry material in such quantity as may be required by BKI. Alternatively, an approved portable extinguisher may be substituted.

5.2 The following arrangements are to be provided in the spaces containing internal combustion machinery used either for main propulsion or for other purposes when such machinery has a total power output of not less than 750 kW.

5.2.1 One of the fixed arrangements required in 5.1.1.

5.2.2 One approved froth extinguisher of not less than 45 litre capacity or equivalent in every engine space and one approved portable froth extinguisher for each 750 kW of engine power output or part thereof. The total number of portable extinguishers so supplied are to be not less than two and need not exceed six.

5.3 Where a fire hazard exists in any machinery space for which no specific provisions for fire extinguishing appliances are prescribed in 5.1 to 5.2, there are to be provided in, or adjacent to, that space a number of approved portable fire extinguishers of other means of fire extinction to the satisfaction of BKI.

6. Portable Fire Extinguishers in Accommodation, Service and Working Spaces

6.1 Except for the supplemental arrangements provided in 5.2, portable fire extinguishers in accommodation spaces, service spaces, control stations, machinery spaces of category A, other machinery spaces, cargo spaces, weather deck and other spaces should be provided in number and arrangement in accordance with Rules for Machinery Installations (Pt.1, Vol. III) Table 12.5

6.2 Table 10.3 contains supplemental recommendations for number and distribution of additional portable fire extinguishers on units. Where the Recommendations in Table 10.3 differ from Rules for

Machinery Installations (Pt.1, Vol. III) Table 12.5, the provisions of Table 10.3 is to be followed. Classes of extinguishers are to be in accordance with Res. A 951(23).

Table 10.3 Recommended number and distribution of additional portable extinguishers

Type of Space	Minimum number of extinguishers[1]	Class(es) of extinguisher(s)
Space containing the controls for the main source of electrical power	1; and 1 additional extinguisher suitable for electrical fires when main switchboards are arranged in the space	A and/or C
Cranes: With electric motors/hydraulics	0	
Cranes: With internal combustion engine	2 (1 in cab and 1 at exterior of engine compartment)	B
Drill floor	2 (1 at each exit)	C
Helidecks	In accordance with 14.	B
Machinery spaces of category A	In accordance with 5.	B
Machinery spaces of category A which are periodically unattended	At each entrance in accordance with 5. [2]	B
Main switchboards	2 in the vicinity	C
Mud pits, Mud processing areas	1 for each enclosed space (Travel distance to an extinguisher not to exceed 10 m for open space)	B

Note:

[1] Minimum size should be in accordance with paragraph 3.1.1 of chapter 4 of the FSS Code.

[2] A portable extinguisher provided for that space may be located outside near the entrance to that space.
A portable fire extinguisher placed outside near the entrance to that space may also be considered as satisfying the provisions for the space in which it is located.

7. International Shore Connection

7.1 Ship type, barge type and column stabilized units are to be provided with at least one international shore connection complying with Rules for Machinery Installations (Pt.1, Vol. III), Sec.12.E.2. and (Pt.5, Vol.IV) Sec.10.L.4

7.2 Facilities are to be available enabling such a connection to be used on either side of the unit.

8. Firemen's Outfits

8.1 At least two firemen's outfits complying with Rules for Machinery Installations (Pt.5, Vol.IV), Sec. 10.H.2, are to be provided.

8.2 Two spare charges should be provided for each required breathing apparatus. Units that are equipped with suitably located means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus. The apparatus for recharging air cylinder are to comply with following requirements

1) The apparatus for recharging air cylinders, if provided, should have its power supplied from the emergency supply or be independently diesel-powered, or be so constructed or equipped that the air cylinders may be used immediately after recharging.
2) The apparatus should be suitably located in a sheltered space above main deck level on the unit.
3) Intakes for air compressors should draw from a source of clean air.
4) The air should be filtered after compression to eliminate compressor oil contamination.

5) The recharging capacity should meet the requirements of SOLAS regulation II-2/10.10.2.6.

6) The equipment and its installation should be to the satisfaction of BKI

8.3 The firemen's outfits are to be stored so as to be easily accessible and ready for use, and where applicable one of the outfits is to be located within easy access of any helicopter deck.

9. Arrangements in Machinery and Working Spaces

9.1 Means are to be provided for stopping ventilating fans serving machinery and working spaces and for closing all doorways, ventilators, annual spaces around funnels and other openings to such spaces. These means are to be capable of being operated from outside such spaces in case of fire.

9.2 Machinery driving forced and induced draught fans, electric motor pressurization fans, oil fuel transfer pumps, oil fuel unit pumps and other similar fuel pumps are to be fitted with remote controls situated outside the space concerned so that they may be stopped in the event of a fire arising in the space in which they are located.

9.3 Every oil fuel suction pipe from a storage, settling or daily service tank situated above the double bottom are to be fitted with a cock or valve capable of bang closed from outside the space concerned in the event of a fire arising in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel, valves on the tanks are to be fitted but control in event of fire may be effected by means of an additional valve on the pipeline or lines outside the tunnel or tunnels.

10. Fire Detection and Alarm System

10.1 All accommodation, service spaces, spaces having a fire risk, in principle, is to be provided with an automatic fire detection and alarm system. An automatic fire detection and alarm system is to be designed according to Rules for Machinery Installations (Pt.5, Vol. IV) Sec.10.J.2.5.

10.2 In selecting the type of detectors, their following features should be taken into account:

1) Capability to detect fire at the incipient stage;

2) Ability to avoid spurious alarm and trips; and

3) Suitability to the located environment.

10.3 The fire main indicator board is to be at a manned control station and is to be clearly to indicate where fire has been detected.

10.4 Accommodation space is to be fitted with smoke detectors.

10.5 Thermal detectors are to be fitted in galleys.

10.6 Smoke detectors are to be provided in all electrical rooms and control stations.

10.7 Flame or thermal detectors are to be installed in open drilling and/or mud processing areas. Smoke detectors may be used in enclosed mud processing areas.

10.8 A fixed fire detection and fire alarm system should be installed in:

1) periodically unattended machinery spaces; and

2) machinery spaces where:

– the installation of automatic and remote control system and equipment's has been approved in lieu of continuous manning of the spaces, and

– the main propulsion and associated machinery, including the main sources of electrical power, are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room.

10.9 Sufficient number of manual fire alarm are to be installed at suitable locations throughout the unit, i.e the accommodation spaces, service spaces and control stations. One manually operated call point is to be located at each exit. Manually operated call points are to be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m from a manually operated call point. Measures are to be taken to prevent inadvertent operation of the manual call alarm system.

11. Gas Detection and Alarm System

11.1 Combustible Gas Detection and Alarm System

11.1.1 A fixed automatic gas detection and alarm system are to be provided to the satisfaction of BKI so arranged as to monitor continuously all enclosed areas of the units in which an accumulation of flammable gas may be expected to occur and capable of indicating at the main control point by aural and visual means the presence and locations of an accumulation. The gas detection system is to be designed according to Rules for Electrical Installations (Pt.5, Vol. V) Sec.9.C.10.

11.1.2 Fixed automatic combustible gas detection and alarm systems are to be provided for the following areas:

1) Cellar deck
2) Drill floor
3) Mud pit area
4) Shale shaker area
5) Enclosed spaces containing the open components of mud circulation system from the bell nipple to the mud pits.
6) Ventilation intakes of enclosed machinery spaces contiguous to hazardous areas and containing internal combustion engines and boilers; and
7) Ventilation intakes and near other openings of accommodation spaces.

11.1.3 The gas detectors are to be connected to an audible and visual alarm system with indicators on the drill floor and in the main control station. The alarm system is to clearly indicate the location and concentration of the gas hazard. The combustible gas detectors are to alarm at not more than 20% and at 60% of the lower explosive limit (LEL).

11.1.4 At least two portable gas monitoring devices are to provided, each capable of accurately measuring a concentration of flammable gas.

11.2 Hydrogen Sulphide Detection and Alarm System

11.2.1 A fixed automatic hydrogen sulphide gas detection and alarm system are to be provided for the following areas:

1) Drill area;
2) Mud processing area; and
3) Well test area.

11.2.2 The detectors are to be connected to an audible and visual alarm system with indicators in main control room. The system is clearly to indicate where gas has been detected. Low level alarm set at 10 ppm and high level alarm set not higher than 70 ppm are to be designed. The high level alarm is to activate an

evacuation alarm. If the alarm at the main control point is unanswered within 2 min, the toxic gas (hydrogen sulphide) alarm and the helideck status light is to be automatically activated.

11.2.3 At least two portable hydrogen sulphide gas monitoring devices should be provided on the unit.

12. Respiratory protection equipment for hydrogen sulphide

12.1 Self-contained breathing apparatus (SCBA) positive-pressure/pressure-demand breathing equipment with full-face piece and rated for a minimum of 30 minutes is to be provided for each person in working areas where hydrogen sulphide may be encountered, and each person in other areas is to be provided with a SCBA rated for a minimum of 15 minutes, or

12.2 positive-pressure/pressure-demand air line breathing equipment coupled with a SCBA equipped low pressure warning alarm and rated for a minimum of 15 minutes is to be provided for each person on board the unit. Breathing air supply line stations are to be provided at least in the following areas:

1) Living quarter;
2) Muster/evacuation area;
3) Drilling areas;
4) Mud processing areas; and
5) Other working areas.

12.3 Respiratory protection equipment shall be in line with valid national rules and regulations.

13. Intermediate Tanks

Where the intermediate tanks are provided in the units for an adequate and readily available water supply for fire-fighting purposes, following requirements of 13.1 to 13.6 are to be complied with:

13.1 The intermediate tanks are to be of such size and so operated that the lowest water level permitted will ensure that the supply of water is adequate for two hoses at a minimum of 0,35 MPa nozzle pressure at the uppermost hydrant for at least 15 minutes . Minimum tank capacity is to be 10 m^3.

13.2 The inlet is to be designed as to allow for sufficient time bringing a replenishment pump into service.

13.3 Valves and pumps saving the intermediate tank which are not readily accessible are to be provided with means for remote operation.

13.4 A low water level alarm is to be provided.

13.5 Two reliable and adequate means to replenish water in the intermediate tank are to be provided. These pumps are to be arranged in accordance with C.2. At least one of the replenishment pump is to be arranged for automatic operation.

13.6 If the unit is intended to operate in cold weather, the entire fire-fighting system is to be protected from freezing. This is to include tanks used as water reservoirs.

14. Fire Extinguishing System for Helicopter Facilities

14.1 This section provides additional measures in order to address the fire safety objectives for units fitted with facilities for helicopters and meets the following functional provisions:

1) Helideck structure should be adequate to protect the unit from the fire hazards associated with helicopter operations;

2) Fire-fighting appliances should be provided to adequately protect the unit from the fire hazards associated with helicopter operations;
3) Refuelling facilities and operations should provide the necessary measures to protect the unit from the fire hazards associated with helicopter operations; and
4) Helicopter facility operation manuals and training are to be provided

14.2 On helicopter decks, following fire extinguishing systems are to be provided at the space which can be readily accessible.

14.2.1 At least two dry powder extinguishers withn aggregate capacity not less than 45 kg but not less than 9,0 kg each.

14.2.2 A suitable foam application system (fixed or portable) capable of delivering a foam solution at a rate of not less than 6,0 ℓ per minute for each square metre of a zone with a circle of diameter (D), and sufficient foam compound to enable the rate to be maintained for at least 5,0 minutes, where D is an overall length of helicopter when a helicopter's rotor rotates.

14.2.3 Carbon dioxide (CO_2) extinguishers with an aggregate capacity of not less than 18 kg or efficient extinguishers equivalent of these. One of these extinguishers is to be enable to reach machinery part of helicopter.

14.2.4 A deck water system capable of delivering at least two jets of water to any part of the helicopter operating area and at least two fire hoses and nozzles which are to be of the dual purpose type.

14.2.5 At least the following equipment is to be stored in a manner that provides for immediate use and protection from the elements:

1) Adjustable wrench;
2) Blanket, fire-resistant;
3) Cutters, bolt, 600 mm;
4) Hook, grab or salving;
5) Hacksaw, heavy duty complete with six spare blades;
6) Ladder;
7) Lift line 5 mm diameter and 30 m in length;
8) Pliers, side-cutting;
9) Set of assorted screwdrivers;
10) Harness knife complete with sheath; and
11) Crowbar.

14.2.6 Drainage facilities in way of helidecks are to be:

1) Constructed of steel or other arrangements providing equivalent fire safety;
2) Lead directly overboard independent of any other system; and
3) Designed so that drainage does not fall onto any part of the unit.

14.2.7 Where the unit has helicopter refuelling, the following provisions are to be complied with:

1) Designated area should be provided for the storage of fuel tanks which should be:
   – As remote as is practicable from accommodation spaces, escape routes and embarkation stations; and
   – Isolated from areas containing a source of vapour ignition;

2) The fuel storage area should be provided with arrangements whereby fuel spillage may be collected and drained to a safe location;
3) Tanks and associated equipment should be protected against physical damage and from a fire in an adjacent space or area;
4) Where portable fuel storage tanks are used, special attention should be given to:
   – Design of the tank for its intended purpose;
   – Mounting and securing arrangements;
   – Electric bonding; and
   – Inspection procedures;
5) Storage tank fuel pumps should be provided with means which permit shutdown from a safe remote location in the event of a fire. Where a gravity-fuelling system is installed, equivalent closing arrangements should be provided to isolate the fuel source;
6) The fuel pumping unit should be connected to one tank at a time. The piping between the tank and the pumping unit should be of steel or equivalent material, as short as possible, and protected against damage;
7) Electrical fuel pumping units and associated control equipment should be of a type suitable for the location and potential hazards;
8) Fuel pumping units should incorporate a device which will prevent over-pressurization of the delivery or filling hose;
9) Equipment used in refuelling operations should be electrically bonded; and
10) "NO SMOKING" signs should be displayed at appropriate locations.

14.1.5 At least two sufficient fire proximately suits (including fire resistant blankets and gloves).

14.3 Operational manual (booklet of safety operation, manual including an instruction and check lists, etc.) showing the necessary items to ensure that a helicopter takes off and/or lands on the unit or operates winching is to be provided. And this operation manual is to be submitted for reference to BKI.

15. Additional Requirements for Units with Periodically Unattended Machinery Space

15.1 Notwithstanding the requirements in 5, units with periodically unattended machinery space are to be provided with the fixed fire extinguishing systems complying with 15.

15.2 Service pipes are to comply with the following requirements 15.2.1 and 15.2.2 in order to serve immediate water delivery from the fire main system at a suitable pressure.

1) One main fire pump is to be operable with remotely starting from the navigation bridge or the control station. And other fire pump, if possible, is to be provided with remote starting device in fire control station in order to be operable with remotely.
2) The fire main is to be permanently kept for pressurizing, and the entire fire-fighting system is to be protected from freezing.

15.3 A fire detection and alarm system complying with the requirement in FSS Code, Chapter 9 and Rules for Electrical Installations, (Pt.5, Vol. V) Sec. 9, C.2 are to be provided in the following areas, in addition to the area required in 10.

15.3.1 Periodically unattended machinery spaces. Detection systems using only thermal detectors, in general, are not to be permitted in this area.

15.3.2 Spaces in which exhaust pipes of main propulsion and associated machinery are contained. In case where this system need not to be provided in these areas by the discretion of BKI, this requirement may be reduced.

15.3.3 Spaces in which air supply casings of boiler and discharging part are contained. In case where this system need not to be provided in these areas by the discretion of BKI, this requirement may be reduced.

16. Fire Control Plan

Fire control plans are to be submitted for review on which the following, as a minimum, should be clearly shown:

1) Locations of fire control stations;
2) Various fire sections enclosed by various classes of fire divisions;
3) Arrangement of fire detectors and manual fire alarm stations;
4) Arrangement of combustible gas detectors;
5) Arrangement of hydrogen sulphide gas detectors;
6) Locations of respiratory protection equipment for hydrogen sulphide;
7) General alarm actuating positions;
8) Arrangement of various fire-extinguishing appliances;
9) Locations of Fighter's Outfits;
10) Location of Helicopter Crash Kit;
11) Arrangement of water spray nozzles and sprinklers (if fitted);
12) Locations of emergency shutdown (such as oil fuel source shutdown, engine shutdown, etc.) stations;
13) The Ventilating system including Fire dampers positions, Ventilating Fans control positions with indication of identification numbers of Ventilating Fans serving each section;
14) Arrangement of fire/watertight doors and their remote control positions;
15) Blowout preventer control positions;
16) Escape route and means of access to different compartments, decks, etc.;
17) Locations of Emergency Escape Breathing Devices (EEBD); and
18) Arrangement of emergency muster stations and life-saving appliances.

Section 11 Life-Saving Appliances

A. General 11–1
B. Life-Saving Appliances 11–2
C. Arrangement of Lifeboats and Liferafts 11–3
D. Rescue Boats 11–5

A. General

1. Scope

1.1 Life-saving appliances shall comply with the relevant applicable International Regulations according to 2.1 and/or National Regulations and shall be suitable for the type and service of the unit.

1.2 The design and testing of lifeboats, liferafts and rescue boats with their launching appliances is in general not within the scope of Classification of units by BKI. However, their arrangement in the overall design of the unit and the structure in way of launching appliances taking into account the forces from above appliances are always part of Classification.

1.3 On special request lifeboats and rescue boats and their launching appliances may be approved by BKI on the basis of the reference defined in 2.

1.4 For the requirements for life-jackets, immersion suits, lifebuoys, radio life-saving appliances, distress flares and line-throwing appliances, etc. see B.1.5. These requirements have to follow the regulations defined in 2.1.

2. Reference

- International Maritime Organisation (IMO): International Convention for the Safety of Life at Sea (SOLAS), Chapter III - Life-Saving Appliances and Arrangements
- IMO : International Life-Saving Appliance Code (LSA Code), Resolution MSC.48(66)
- IMO : Testing and Evaluation of Life-Saving Appliances, Resolution MSC.81(70), as amended by MSC.200(80)
- IMO : Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code), Chapter 10
- IMO : Code of Safety for Special Purpose Ships, Resolution A.534(13), Chapter 8
- IMO: 1974 SOLAS Convention, Resolution 6(48), Chapter III

3. Emergency warnings and instructions

3.1 Alarm signals

For alarm and public address system see Rules for Electrical Installations (Pt.5, Vol.V) Sec.9.B.

3.2 Operating instructions

Illustrations and instructions shall be provided on or in the vicinity of lifeboats and life-rafts and their launching controls and shall:

- illustrate the purpose of controls and the procedures for operating the appliance and give relevant instructions or warnings

- be easily readable under emergency lighting conditions
- use symbols in accordance with the recommendations of SOLAS, MODU Code, National Regulations, etc.

B. Life-Saving Appliances

1. Type and equipment

1.1 Life-saving appliances shall be suitable for the type and use of the unit.

1.2 The lifeboats shall meet the requirements of the LSA Code, Chapter IV and the Testing Regulations defined in A.2.1 and shall be of the following type:

- totally enclosed lifeboats launched by falls with fire protection and self-contained air support system considering LSA Code 4.6, 4.8 and 4.9, or
- free-fall lifeboats with fire protection and self-contained air support system considering LSA Code 4.7 to 4.9
- if the unit is considered as "special purpose ship", the reduced requirements according to IMO Resolution A.534 (13), Chapter 8 may be applied, compare A.2.1.

1.3 The liferafts shall meet the requirements for davit-launched liferafts of the LSA Code, Chapter IV and the Testing Regulations defined in A.2.1.

1.4 Lifeboats and liferafts shall be fully equipped as required by the LSA Code, Chapter IV defined in A.2.1. However, for operation in restricted areas items may be dispensed by the Administration of the state of flag or location.

1.5 Personal life-saving appliances shall meet the requirements of the LSA Code, Chapter II, of the relevant Administration and of BKI considering climatic conditions.

2. Number and size

The number and size of life- saving appliances has to be defined according to the regulations mentioned in A.2.

If not stated otherwise by the responsible Administration, each manned unit should be provided with at least the lifeboats and liferafts listed in the following:

2.1 Surface type units

2.1.1 Each unit shall carry on each side, one or more lifeboats of such aggregate capacity as will accommodate the total number of persons on board. Alternatively, the Administration may accept one or more free-fall lifeboats, complying with the requirements of section 4.7 of the LSA Code, capable of being free-fall launched over the end of the unit of such aggregate capacity as will accommodate the total number of persons on board.

2.1.2 In addition, a liferaft or liferafts shall be carried, capable of being launched on either side of a unit and of such aggregate capacity as will accommodate the total number of persons on board. If the liferaft or liferafts cannot be readily transferred for launching on either side of a unit, the total capacity available on each side should be sufficient to accommodate the total number of persons on board.

2.1.3 If lifeboats and liferafts are stowed in a position which is more than 100 m from the stem or stern, in addition to the liferafts as provided in 2.1.2, a liferaft shall be stowed as far forward or aft, or one as far

forward and another as far as aft, as is reasonable and practicable. Notwithstanding C.2.4 such liferaft or liferafts may be securely fastened so as to permit manual release.

2.2 Self-elevating and column-stabilized units

2.2.1 Each unit shall carry lifeboats, installed in at least two widely separated locations on different sides or ends of the unit. The arrangement of lifeboats should provide sufficient capacity to accommodate the total number of persons on board if:

- all the lifeboats in any one location are lost or rendered unusable, or
- all the lifeboats on any one side, any end or any one corner of the unit are lost or rendered unusable

2.2.2 In addition liferafts shall be carried of such aggregate capacity as will accommodate the total number of persons on board.

2.2.3 In the case of a self-elevating unit where, due to its size or configuration, lifeboats cannot be located in widely separated locations to satisfy 2.2.1 the Administration of the state of location or flag may permit the aggregate capacity of the lifeboats to accommodate only the total number of persons on board. However, the liferafts should be served by launching appliances or marine evacuation systems.

C. Arrangement of Lifeboats and Liferafts

1. Muster and embarkation arrangements

1.1 If separate, muster stations shall be provided close to the embarkation stations. Each muster station shall have sufficient space to accommodate all persons assigned to muster at that station, but at least 0,35 m^2 per person.

1.2 Muster and embarkation stations shall be readily accessible from accommodation and work areas.

1.3 Muster and embarkation stations shall be adequately illuminated by emergency lighting.

1.4 Alleyways, stairways and exits giving access to the muster and embarkation stations shall be adequately illuminated by emergency lighting.

1.5 Davit-launched survival craft muster and embarkation stations shall be so arranged as to enable stretcher cases to be placed in survival craft.

1.6 Survival craft embarkation arrangements shall be so designed that:

- lifeboats can be boarded and launched directly from the stowed position
- davit-launched liferafts can be boarded and launched from a position immediately adjacent to the stowed position or from a position to which the liferaft is transferred prior to launching in compliance with C.2.4
- where necessary, means shall be provided for bringing the davit-launched liferaft to structure/hull side and holding it alongside so that persons can be safely embarked

1.7 At least two widely separated fixed metal ladders or stairways should be provided extending from the deck to the surface of the water. The fixed metal ladders or stairways and sea areas in their vicinity should be adequately illuminated by emergency lighting.

1.8 If fixed ladders cannot be installed, alternative means of escape with sufficient capacity to permit all persons on board to descend safely to the waterline should be provided.

2. Stowage

2.1 Each lifeboat and liferaft shall be stowed:

- so that neither they nor their stowage arrangements will interfere with the operation of any other lifeboat or liferaft or rescue boat at any other launching station
- as near the water surface as is safe and practicable
- in a state of continuous readiness so that two crew members can carry out preparations for embarkation and launching in less than 5 minutes
- fully equipped as required by the LSA Code; however, in the case of units operating in areas such that, in the opinion of the Administration, certain items of equipment are unnecessary, the Administration may allow these items to be dispensed with
- as far as practicable, in a secure and sheltered position and protected from damage by fire and explosion

2.2 A survival craft or davit-launched liferaft should be so positioned that the survival craft or raft is upon embarkation at least 2 m above the waterline when the unit is in the limiting damaged condition determined in accordance with Section 6.

2.3 Lifeboats shall be stowed

- that they are protected from damage by heavy seas
- attached to launching appliances

2.4 Liferafts shall be stowed:

- as to permit manual release from their securing arrangements
- within reach of the lifting hooks, if liferafts are davit-launched; unless some means of transfer is provided which is not rendered inoperable within the limits of trim and list prescribed in Section 6 for any damaged condition or by motion or power failure
- every liferaft, other than those in B.2.1.3, shall be stowed with the weak link of its painter permanently attached and with a float free arrangement complying with the requirements of the regulations defined in A.2. so that the liferaft floats free and, if inflatable, inflates automatically when the unit sinks.

3. Launching and recovery arrangements

3.1 Launching appliances shall be provided for all lifeboats and davit-launched liferafts. They shall meet the requirements defined in Rules and Regulation defined in A.2.

3.2 Launching stations shall be in such positions as to ensure safe launching having particular regard to clearance from any exposed propeller, if applicable. Launching stations shall not be located near or even above working stations which would hinder the launching at certain working conditions.

3.3 Preparation and handling of survival craft at any one launching station shall not interfere with the prompt preparation and handling of any other survival craft or rescue boat at any other station.

3.4 As far as possible, launching stations shall be located so that lifeboats and liferafts can be launched down a straight side of the structure/shell, except for:

- lifeboats and liferafts specially designed for free-fall launching
- lifeboats and liferafts mounted on structures intended to provide clearance from lower structures

3.5 Means shall be available to prevent any discharge of fluids on to lifeboats or liferafts during abandonment.

3.6 During preparation and launching, lifeboats and liferafts, its launching appliance and the area in the water into which they are to be launched shall be adequately illuminated by emergency lighting.

3.7 Launching and recovery arrangements shall be such that the appliance operator on the unit is able to observe the survival craft at all times during launching and lifeboats during recovery.

3.8 Falls, where used, shall be long enough for the survival craft to reach the water with the unit under unfavourable conditions, such as maximum air gap, lightest transit or operational condition or any damaged condition as described in Section 6. Only one type of release mechanism shall be used for similar survival craft on board and the opening of the mechanism shall be possible under load from inside the boat.

3.9 In any case of damage defined in the Section 6, lifeboats with an aggregate capacity of not less than 100 % of persons on board shall, in addition to meeting all other requirements of launching and stowage defined in this Section, be capable of being launched clear of any obstruction.

3.10 Each survival craft should be so arranged as to clear each leg, column, footing, brace, mat and each similar structure below the hull of a self-elevating unit and below the upper hull of a column-stabilized unit, with the unit in an intact condition.

D. Rescue Boats

1. Number and requirements

Each unit shall carry at least one fast rescue boat complying to the requirements defined in A.2.

2. Stowage

Rescue boats shall be stowed:

- in a state of continuous readiness for launching in not more than 5 minutes, and if the inflated type, in a fully inflated condition at all times
- in a position suitable for launching and recovery
- so that neither the rescue boats nor their stowage arrangements will interfere with the operation of any lifeboat or raft of another launching station
- in compliance with C.2, if they are lifeboats

3. Embarkation and launching

The rescue boat embarkation and launching arrangements shall be such that the rescue boat can be boarded and launched in the shortest possible time.

Launching arrangements shall include a single point hoist and release mechanism and in other aspects comply with C.3.

4. Recovery

Rapid recovery of the rescue boat should be possible when loaded with its full complement of persons and equipment. If the rescue boat is also a lifeboat, rapid recovery should be possible when loaded with its lifeboat equipment and the approved rescue boat complement of at least six persons.

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Section 12 Specific Unit Type

A. Pipe and Cable Laying Unit 12–1
B. Well Stimulation Units 12–8
C. Accommodation Unit 12–9
D. Floating Piers 12–11
E. Crane Unit 12–12
F. Power Unit 12–14

A. Pipe and Cable Laying Unit

1. General

1.1 Application

1.1.1 The requirements in this Sub-Section and other relevant Section of this Rules apply to pipe and cable laying units as define in 1.2. The units will be assigned the special notation of **Pipe Layer** or **Cable Layer** after unit type notation as described in Section 2, B.

1.1.2 Machinery and electrical installations shall be designed according to Section 8, as applicable.

1.1.3 Drawings showing the location and support of foundations for cranes and davits have to be submitted. The forces to the hull structure have to be defined. Rules for the interaction of lifting appliances with the unit, their foundations, etc. are defined in Rules for Structures (Pt.5, Vol.II) Sec. 8.

1.2 Definition

As pipe and cable laying unit are to be understood:

1.2.1 Pipe Laying Unit

Pipe-laying unit is mobile offshore unit primarily intended for subsea pipe line installation. The unit may be ship-shaped type, barge type or column stabilised type. Such types have propulsion machinery and a dynamic positioning system or positional mooring system.

1.2.2 Cable Laying Barge

Cable-laying unit is mobile offshore unit primarily intended for subsea cable installation. The unit may be ship-shaped type, barge type or column stabilised type. Such types have propulsion machinery and a dynamic positioning system or positional mooring system.

1.3 Safety aspects

1.3.1 Hazardous areas

The general classification in hazardous and non-hazardous areas is contained in Section 9.

The requirements for explosion protection of electrical equipment in hazardous areas are defined in Section 9.D

1.3.2 Fire protection

The requirements for structural fire protection and means of escape are defined in Section 10.B.

1.3.3 Fire detection and extinguishing

The requirements for fire detection, fire extinguishing systems and alarm systems are defined in Section 10.C.

1.3.4 Life-saving appliances

The number, size and arrangement of life-saving appliances for the complete crew shall follow the requirements defined in Section 11.

2. Movement and Position Keeping

2.1 Possibilities

For the movement and position keeping of the unit during operation (pipe/cable laying) the following possibilities may be established:

- positional mooring with cables and anchors
- dynamic positioning by a greater number of thrusters on the unit
- combination of mooring and dynamic positioning

2.2 Dynamic analysis of the pipe/cable-laying system

A dynamic analysis has to be submitted to BKI, which has to consider:

- Arrangement of positional mooring system considering elasticity of cables, if applicable
- function of dynamic positioning system, if applicable
- influence of the laid pipe/cable and forces at the tensioners
- influence of sea state, wind and current conditions, see Section 4, A.

2.3 Positional mooring system

2.3.1 If the Additional Class Notation "POSMOSYS" will be assigned, such a system consisting of:

- heavy anchors belonging to the unit and regularly changed in position by anchor handling tugs
- safe stowage of the anchors on the unit and appliances to hand them over to the tugs
- anchor cables as wire ropes or chain cables from the anchors to fairleads and winches on the unit including accessories like shackles, quick release devices, wire rope terminations, etc.
- a winch or windlass for each anchor cable including tension control and measuring of cable length paid out
- central control of all winches to keep position and allow forward movement of the unit on the planned track

has to be provided, see also Guidance for Class Notation (Pt.0, Vol.B), Sec.3.A.12

2.3.2 An arrangement drawing for the mooring system has to be submitted. Mooring forces and permissible mooring directions are to be defined. An example for a mooring system with 10 anchors is shown in Fig. 12.1 and Fig. 12.2 for the two phases of starting of the operation and after a travel of abt. 600 m.

2.3.3 In the drawings for the hull structure the foundations for the mooring winches and the fairleads have to be shown. The acting forces on the foundations are to be calculated for 100 % of the nominal

breaking load of the mooring cables. For the supporting structure under this equipment 100 % of the minimum yield stress R_{eH} is to be observed as acceptance criteria in the calculation.

2.3.4 The mooring equipment for position keeping on the pipeline track is defined in Section 7, C.

2.4 Dynamic position keeping

2.4.1 Dynamic position keeping at the pipe/cable laying route means maintaining a desired position within the normal allowance of the control system and under defined environmental conditions. The required position tolerances during pipe/cable laying operations have to be defined by the owner/operator.

Thrusters used as sole means of position keeping shall provide a level of safety equivalent to that provided for mooring arrangements to the satisfaction of BKI.

2.4.2 The complete dynamic positioning system requires the following sub-systems:

- power system
- thruster system
- control system

2.4.3 The Class Notations **DP 1** to **DP 3** will be assigned if the systems complies with the requirements of the Rules for Dynamic Positioning Systems (Pt.4, Vol.II), see also Guidance for Class Notation (Pt.0, Vol.B), Sec.3.B.2.

2.5 Combination of positional mooring systems with dynamic positioning

2.5.1 Also a combination of the positional mooring system according to 2.3 with a dynamic positioning system according to 2.4 may be established, if it is of advantage for a special task.

2.5.2 It shall be secured that all elements of the combined system are operated from one control station overlooking the unit and the mooring area.

2.5.3 The detailed requirements for such a combination will be defined case by case.

2.6 Towing

2.6.1 If the unit is towed by tugs, a general arrangement drawing of the towing system has to be submitted. Towing forces and permissible towing directions are to be defined.

2.6.2 Towing arrangements and procedures shall be such as to reduce to a minimum any danger to personnel during towing operations. The design and arrangement of towing fittings shall have regard to both normal and emergency conditions. See Section 3.I

2.6.3 In the drawings of the hull structure the measures to transfer the towing forces into the hull have to be shown. As towing forces 100 % of the nominal breaking load of the towing lines have to be considered. For the supporting structure under this equipment 100 % of the minimum yield stress R_{eH} is to observed as acceptance criterion in the calculation.

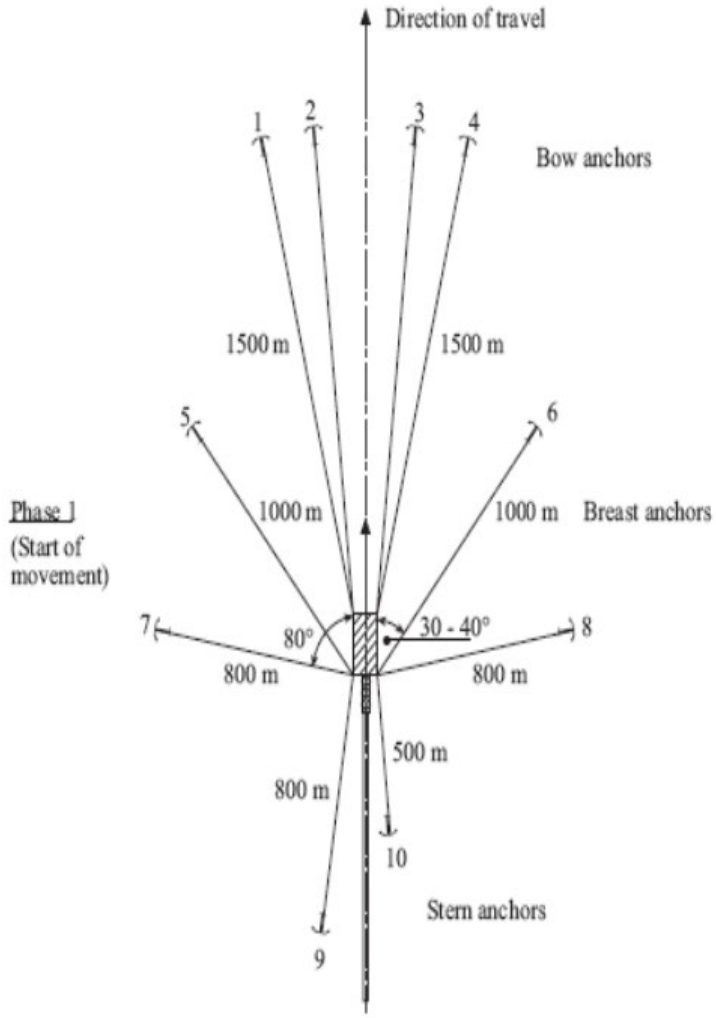

Fig. 12.1 Example for a typical position mooring system in abt. 100 m water depth (starting phase)

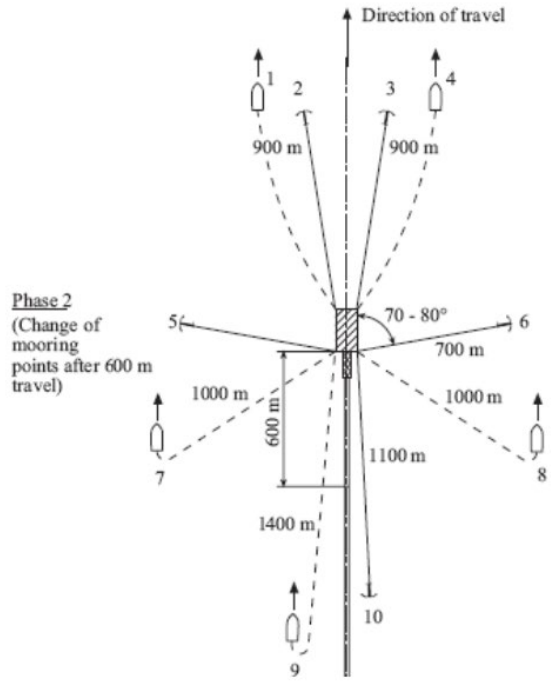

Fig. 12.2 Example for a typical position mooring system in abt. 100 m water depth (after 600 m travel)

2.7. Operating manual (Booklet)

For the positioning and towing systems the following aspects have to be included in the Operating Manual, compare Section 2, C.3.1:

- principal functioning and co-operation of the different elements of the system
- procedure for the start of pipe/cable laying
- procedure for normal pipe/cable laying operation with advancing unit
- stopping or finishing the pipe/cable laying operation with disconnecting and abandoning of the pipeline
- towing conditions
- procedures in the event of failure of the systems
- emergency measures

2.8 Sea trials

2.8.1 A schedule for the proposed tests of the positioning and towing systems has to be submitted for approval to BKI Head Office in due time before the sea trials.

2.8.2 All procedures defined in the Operating Manual have to be tested as far as practicable in this stadium.

2.8.3 The trials have to be executed in presence of the BKI Surveyor who will sign a detailed trials protocol to be prepared by the builder, if the tests are successful. The duplicate of this protocol has to be sent to BKI Head Office for final approval.

3. Structure

3.1 General design

Scantlings of the hull structure based on type of unit are to be in accordance with Section 3, 4 and 5 of this Rules.

Special consideration however is to be given to items which may require some deviation or additions to these Section, in particular the items defined in the following.

3.2 Loads

The loads established in the dynamic analysis of the pipe/cable laying system according to 2.2 have to be considered.

3.3 Special aspects for the hull structure

The following requirements, which are characteristic for pipe/cable laying, have to be considered for the design of the hull structure, e.g.:

- slot in the rear part of the main deck to lead the pipe/cable with the necessary bending radius to the stinger
- transmission of the forces from the stinger to the stern of the unit and of the forces from the a frame for holding the stinger back and adjusting the inclination of it to the main deck
- transmission of the pipeline/cable forces pulling the (two) tensioners horizontally to the stern into the midship section of the hull
- considerable mooring forces from different directions at stern and bow

– various loads from the pipe/cable laying facility as described in 5.

4. Watertight Integrity and Stability

4.1 Watertight integrity

For subdivision into watertight compartments see Section 6, B.

4.2 Stability

In addition to the requirements of Section 6, A, the following requirements apply to pipe/cable laying units.

4.2.1 Load cases

The following load cases have to be considered:

.1 Standard load cases

– normal pipe/cable laying operation up to defined environmental limit conditions
– severe storm and seaway conditions with pipe disconnected and abandoned at the sea-bed.

.2 Special load cases

– ocean towage for long distances without or with stinger, if applicable
– field towage for short distances with stinger
– inspection or repair of existing pipelines by lifting up a part of the pipeline from the sea-bed to the units side
– influences from crane operation and positional mooring have to be considered

.3 Other load cases

Depending on the type of pipe/cable laying unit and the method of operation other load cases may be considered case by case.

4.2.2 Stability criteria

.1 Intact stability

Concerning stability criteria the Code of Intact Stability for All Types of Ships Covered by IMO Instruments Resolution A.749(18) as amended by resolution MSC 75(69) shall be applied[1].

Special considerations shall be given to an unusual arrangement of units, which also may lead to additional stability criteria.

.2 Damage stability

The criteria of the Code of Safety for Special Purpose Ships acc. to IMO Res.A.543(13) and of the Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code) shall be used as far as applicable.

[1] In addition the criteria of the Code of Safety for Special Purpose Ships acc. to IMO Res.A.543(13) and of the Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code) shall be used as far as applicable.

5. Pipe/Cable-laying Facility

5.1 Scope

In general the facility directly used for pipe/cable storage, fabrication of the pipe/cable connections, pipe/cable fixing and delivering/recovering to/from the sea-bed are not subject to Classification or Certification by BKI. But the characteristics of the facilities, which influence:

- overall design of the unit
- overall safety of the unit
- weights and forces on all foundations
- floating and stability behaviour, etc.

will be considered by BKI. Therefore BKI has to be fully informed by the documents defined in 5.2.

5.2 Documents to be submitted

A complete set of documentation to define the influences on the unit has to be submitted by the builder/operator of the facility, consisting of e.g.:

- general arrangement of the pipe/cable-laying facility and description of the main functions, definition of the environmental conditions up to which the facility is able to operate
- facilities for lifting the pipes/cable from the supply vessels to the storage area and pipe/cable transport on the unit defining all created moments and forces
- plans showing the arrangement of the pipe/cable storage/rack/reel, the maximum weights and the intended foundations on the upper deck
- plans defining the foundation forces of the facility for pipe/cable connections
- plans showing the arrangement of the pipe/cable tensioners and the maximum tension forces
- plans showing the support arrangement on the pipe/cable ramp and the maximum forces to be experienced
- plans showing the integration of the stinger at the stern of the hull and definition of the forces to be transferred into the hull, if applicable
- plans showing the stinger including length variation, if applicable and its floating support, if applicable
- plans showing the A-frame for variation of the stinger inclination, if applicable
- BKI reserve the right to ask for any other documentation necessary to define the interaction of the facility with the unit

5.3 Operating Manual (Booklet)

The Operating Manual of the unit, compare Section 2, C.3.1, shall include all safety aspects created by the facility and has also to be submitted to BKI. This manual shall include e.g.:

- functions of the pipe/cable-laying facility including repair of existing pipelines or cable, if applicable
- influence of pipe/cable-laying on unit operation
- special hazards to the unit
- emergency measures if a failure happens in the pipe/cable-laying facility, etc.

B. Well Stimulation Units

1. General

1.1 Application

The requirements in this Sub-Section and other relevant Section of this Rules apply to well stimulation units as define in 1.2. The units will be assigned the special notation of **Well stimulation** after ship type notation as describe in Section 2, B, and Guidance for Class Notation (Pt.0, Vol. B), Sec. 2, K.2 and M.2.

1.2 Definition

Well stimulation vessels or units are self-propelled ship type vessels equipped for intervention at subsea wells with the aim to improve the operational well performance.

1.3 Stimulation service

The service of well stimulation vessels/units may be distinguished in:

- stimulation of subsea wells using various operating procedures
- stimulation of subsea wells including handling and storage of well fluids

2. Special Safety Aspects

2.1 Area classification

For all types of vessels/units hazardous and non-hazardous areas have to be investigated and a complete area classification has to be performed, as far as needed. For the relevant criteria of such a classification see Section 9.

2.2 Fire protection

Special attention shall be given to fire protection and measures for firefighting. Relevant methods are summarized in Section 10.

2.3 Emergency shutdown

For all vessels/units an emergency shut down and quick well disengagement concept has to be developed distinguishing different shutdown levels according to the used procedures of well stimulation. The requirements for relevant safety systems are defined in Section 8, C.2.3.

2.4 Evacuation

If the stimulation procedures fail and the crew will be in extreme danger the equipment for a quick and smooth evacuation shall be available. The requirements for such equipment are defined in Section 11.

2.5 Documentation

All safety aspects have to be clearly defined in written form, such as a Safety Management Plan, and shall be included in the Operating Manual of the vessel/unit, compare Section 2, C.3.1.

3. Position Keeping

3.1 As the well stimulation vessel/unit has to stay near or above the well within a very restricted location allowance, the position keeping will be a major pre-requisite.

3.2 Position keeping may be established by the following methods:

- positional mooring with anchors, cables and mooring winches according to Section 7, C and Rules for Machinery Installations (Pt.5, Vol. IV), Sec. 8, C.
- dynamic positioning with propulsion systems according to Rules for Machinery Installations (Pt.5, Vol. IV) Sec. 6, E. For this type of vessel/unit the requirements for Class Notation **DP 2** are recommended.

4. Well Stimulation Equipment

4.1 The foundations for such equipment have to be integrated into the structure of the vessel/unit considering extreme loads likely to occur during the stimulation process.

4.2 Well stimulation equipment is in general not subject to Classification by BKI. Nevertheless this equipment shall be designed and built according to recognized regulations and safety standards.

4.3 Especially equipment to be installed in hazardous areas shall meet the necessary safety standards. For electrical installations reference may be given in Section 9, D.

C. Accommodation Unit

1. General

1.1 Application

The requirements in this Sub-Section and other relevant Sections of this Rules apply to offshore accommodation units as define in 1.2.1. The units will be assigned the special notation of **Accommodation** after ship type notation as describe in Section 2, B and Guidance for Class Notation (Pt.0, Vol. B), Sec. 2, M.2 and T.2.

1.2 Definition

1.2.1 Accommodation Unit

Accommodation unit is a unit primarily intended for the accommodation of persons who are industrial personnel, engaged in some aspect of offshore or related employment, excluding members of the crew. It is intended to accommodate these persons only when the unit is moored or otherwise fixed on location. During jacking or transit of unit, only members of the crew (operator) necessary for the jacking or transit operation are to be onboard.

1.2.2 Industrial Personnel

Industrial Personnel are individuals from the offshore or similar industry who are temporarily housed on the unit. These persons do not include members of the crew of the accommodation unit, but may include crew members or industrial personnel from other vessels, drilling units, offshore fixed platforms, etc.

1.2.3 Crew

Crew means all persons carried on board the accommodation unit to provide maintenance and operation of the unit, its machinery, systems and arrangements or to provide services for other persons onboard the unit.

2. Hull construction and equipment

2.1 Hull construction

2.1.1 Hull construction is to be in accordance with the requirements in Section 3 to 6 depending on the type of the unit. In this case, where approved by BKI, suitable modification may be done in accordance with the environmental condition of the areas where the unit is stationed.

2.1.2 Decks, provided with mooring equipment such as bollards, etc., are to be sufficiently reinforced.

2.2 Mooring system

Mooring system, sufficiently effective for stationing the unit, is to be provided. In this case, temporary mooring equipment specified in Section 7, B need not be provided.

3. Fire protection

For the unit intended for the accommodation of more than 36 persons, fire protection are to complied with the following requirements in addition to those in Section 10, B.

3.1 Main vertical zones are to be complied with the following requirements.

1) The hull, superstructure and deckhouses in way of accommodation and service spaces shall be subdivided into main vertical zones by "A" class divisions. These divisions are to have insulation values in accordance with Table 10.1 and 10.2 in Section 9, B.
2) As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the bulkhead deck shall be in line with watertight subdivision bulkheads situated immediately below the bulkhead deck. The length and width of main vertical zones may be extended to a maximum of 48 m in order to bring the ends of main vertical zones to coincide with watertight subdivision bulkheads or in order to accommodate a large public space extending for the whole length of the main vertical zone provided that the total area of the main vertical zone is not greater than 1600 m^2 on any deck. The length or width of a main vertical zone is the maximum distance between the furthermost points of the bulkheads bounding it.
3) Such bulkheads shall extend from deck to deck and to the shell or other boundaries.

3.2 Corridor bulkheads, where not required to be "A" class, shall be "B" class divisions which shall extend from deck to deck except.

1) when continuous "B" class ceilings or linings are fitted on both sides of the bulkhead, the portion of the bulkhead behind the continuous ceiling or lining shall be of material which, in thickness and composition, is acceptable in the construction of "B" class divisions, but which shall be required to meet "B" class integrity standards only in so far as is reasonable and practicable in the opinion of BKI; and
2) in the case of a ship protected by an automatic sprinkler system complying with the provisions of the Fire Safety Systems Code, the corridor bulkheads of "B" class material may terminate at a ceiling in the corridor provided such ceilings are acceptable in the construction of "B" class divisions. All doors and frames in such bulkheads shall be of non-combustible materials and shall have the same fire integrity as the bulkhead in which they are fitted.

3.3 Exterior boundaries of superstructures and deckhouses enclosing accommodation and including any overhanging decks which support such accommodation, are to be an “A-60” Class boundary for the whole of the portion which faces and is within 30 m of any area in the adjacent drilling or production platform served by the accommodation unit where a hydrocarbon fire may arise. If the distance is more than 30 m, but less than 100 m, an “A-0” Class boundary is required.

4. Fire fighting

For the unit intended for the accommodation of more than 36 persons, fire fighting are to complied with the following requirements in addition to those in Section 10, C.

4.1 The arrangements for the ready availability of water supply shall be:

1) such that at least one effective jet of water is to immediately available from any hydrant in an interior location and so as to ensure the continuation of the output of water by the automatic starting of one required fire pump; and
2) if fitted with periodically unattended machinery spaces, BKI shall determine provisions for fixed water fire-extinguishing arrangement for such spaces equivalent to those required for normally attended machinery spaces.

4.2 There shall be installed throughout each separate zone in all accommodation and service spaces and, where it is considered necessary, in control stations, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc., either:

1) a fixed fire detection and fire alarm system so installed and arranged as to detect the presence of fire in such spaces and providing smoke detection in corridors, stairways and escape routes within accommodation spaces. Detectors fitted in cabins, when activated, shall also be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located.; or
2) an automatic sprinkler, fire detection and fire alarm system of an approved type complying with the relevant requirements of the Fire Safety Systems Code and so installed and arranged as to protect such spaces and, in addition, a fixed fire detection and fire alarm system and so installed and arranged as to provide smoke detection in corridors, stairways and escape routes within accommodation spaces.

D. Floating Piers

1. General

1.1 Application

The requirements in this Sub-Section apply to floating piers as define in 1.2. The units will be assigned the special notation of **Floating Pier** after ship type notation as describe in Section 2, B, and Guidance for Class Notation (Pt.0, Vol. B), Sec. 2, M.1.

1.2 Definition

Floating pier is a unit which has mooring equipment, loading apparatus, etc. for loading or unloading and has bridges for access from the shore. This unit is to be stationed at smooth water areas or sea areas equivalent to smooth water areas.

1.3 Alternation of the stationed areas

When the unit, of which construction and equipment are modified by considering the environmental condition of the areas where the unit is stationed, is moved to a new location, approval is to be obtained in advance.

2. Hull Construction and Equipment

2.1 Hull Construction

2.1.1 Hull construction is to be in accordance with the requirements in Rules for Hull (Pt. 1, Vol. II), Sec. 31. In this case, where approved by the BKI, suitable modification may be done in accordance with the environmental condition of the areas where the unit is stationed.

2.2.2 Deck structure is to be in accordance with the requirements in Section 4, B., using loads indicated by the Owner. Moreover, the load due to cars is to be determined by considering the relative motion of the cars against hull.

2.2.3 Deck, subject to the load due to the bridge for access from the shore, is to be sufficiently strengthened.

2.2 Longitudinal strength

Longitudinal strength of the unit with cranes is to be in accordance with the requirements in E.3.1.2.

2.3 Reinforcement for connect with the ship, etc.

For contact with the ship, etc., the unit is to be equipped with sufficient fenders, and shell plates, frames, girders, etc. are to be suitably reinforced.

3. Machinery

3.1 General

3.3.1 For the machinery of floating piers having their own electric power sources or being supplied with electric power of 10 kW or more from the shore, the requirements in Section 8 except for those in Section 8, A.9 are generally applied, as a restricted service unit. These requirements may be modified for floating piers designed to be moored directly to the shore.

3.3.2 Bilge systems are to be provided for compartments below load water line continuing power sources or auxiliary machinery. In this case, one bilge pump may be acceptable.

E. Crane Unit

1. General

1.1 Application

The requirements in this Sub-Section apply to crane units. The units will be assigned the special notation of **Offshore Crane** after ship type notation as describe in Section 2, B. and Guidance for Class Notation (Pt.0, Vol.B), Sec. 2

1.2 Definition

Offshore Crane unit is a unit engaged in the operation for the lifting of heavy loads in oil drilling and/or production operations or offshore construction.

2. Certification of Cranes

Any crane permanently installed on board the crane unit and intended for operations other than supply of provisions and maintenance of the unit may be certified by BKI in accordance with Guidelines for Loading Gear on Seagoing Ships and Offshore Installations (Pt.4, Vol.3) or equivalent (e.g. API Spec. 2C).

3. Hull Construction and Equipment

3.1 Hull construction and equipment of the crane units are to be in accordance with the requirements in Section 3 to 6, depending on the type of the unit.

3.2 Details and strength calculations of crane pedestal and supporting structure are to be submitted for review. Allowable stresses are defined in Section 4, C.2.

3. Machinery

3.1 The machinery of crane units is, in general, to be in accordance with the requirements in Section 8.

3.2 As for the machinery of barge-type crane units, the relevant requirements in Section 8 may be applied, as a restricted service unit.

4. Stability

For surface type unit Guidelines for Intact Stability (Pt. 6, Vol. 3). Sec. 3, M. are to be considered.

In addition to complying with the requirements of Section 6, the following requirements apply to other than column stabilized units.

4.1 Overturning Moment

In calculating overturning moments for crane units, the effect of the crane loads acting simultaneously with the maximum design wind force associated to the operation of the crane is to be determined. The full range of crane positions, elevations and weights is to be considered in order to investigate the most critical scenarios. The wind area of the deck cargo is to be considered in the calculation of the overturning moment.

When the crane unit is equipped to counter-ballast while lifting, the unit is to be able to withstand the sudden loss of the hook load in each condition of loading and operation. The free surface effects are to be considered for those tanks which are ballasted. Specific reference may be made to Annex 1.

4.2 Deck Cargo

Loading conditions in the operations manual are to include the effect of the deck cargo for each operating condition, using the estimated weight and the height of the center of gravity of the cargo based on the most severe loading assumptions. The loading conditions are to cover the full range of operating configurations, from no deck cargo on board to the maximum design deck load.

If the unit is intended to carry deck cargoes that may accumulate water, such as open cargo bins or open pipes, a free surface correction is to be applied to afloat conditions.

F. Power Unit

1. General

1.1 Application

The requirements in this Sub-Section and other relevant Section apply to unit that installed with power plant whose generated power is transferred or distributed externally. The units will be assigned the special notation of **Power Service** and/or additional notation **Power Plant** are affixed to after unit type notation as follows,

- For Surface type unit
  - Ship type: 1) **Special Service Ship, Power Service**
    2) **Special Service Ship, Power Service Power Plant**
  - Barge type: 1) **Barge, Power Service**
    2) **Barge, Power Service Power Plant**
- For Other Unit
  1) **Self Elevating Unit, Power Service**
  2) **Column Stabilized Unit, Power Service**
  3) **Self Elevating Unit, Power Service Power Plant**

This special and additional notation is also relevant to be affixed after others ship type notations, such as Floating Production Installations (FPI) and Floating Offshore Liquefied Gas Terminals (FOLGT). The rules set for base Class notation shall be complied as applicable. For detail explanation about class notation, see Guidance for Class Notations (Pt. 0, Vol. B).

1.2 Definition

As power service and power plant are to be understood:

1.2.1 Power Service

Power service is vessels (including units, installations and converted vessels) intended to mount the power plant whose generated power is transferred or distributed externally that comply with full requirements of 1.- 4. and 6.

1.2.2 Power Plant

Power plant is power generation and distribution equipment, systems, subsystems, and components that have been built, installed, and commissioned to the satisfaction of the Surveyors that comply with requirements in 5. and 6.

1.3 Conversion of Existing Vessels

When an existing vessel is converted to a power service vessel and it complies with the full requirements of 1.- 4. and 6, it may be distinguished in the Register by adding the classification notation **Power Service**. The primary class notation should reflect the base rule set notation for the conversion.

For example, if an existing **Drilling Barge** is converted into a power service barge, the base rule set, the mobile offshore unit rules, is to be applied for this conversion and it would be assigned with the notation **Barge, Power Service**.

1.4 Documents plan for approval

For the **Power Service** class notation, plans and documents specified in 1 to 4, together with supporting calculations, as appropriate, are to be submitted before proceeding with the work.

For the optional additional class notation **Power Plant**, the submission of design plans and data is specified in 5.

1.4.1 Materials

The use of steel or other materials that have properties different from those specified in the Rules for Materials (Pt. 1, Vol. V) and Rules for Welding (Pt. 1, Vol. VI) and the corresponding scantlings are subject to special consideration.

Where the power plant is fuelled by natural gas the materials used in the construction of the liquefied natural gas (LNG) tanks, gas piping, process pressure vessels, and other components in contact with cryogenic liquids or gases are to be suitable for the intended purpose and in compliance with Guidelines for The Use of Gas as Fuel for Ships (Pt. 1, Vol. 1), Section 7.

1.4.2 Stability, Loading and Operating Information

Details are to be submitted of the ballast, fuel, supplies and hold arrangement and capacities; summary and distribution of fixed and variable weights for each reviewed condition; and information on all loaded and ballasted conditions in which the power service barge, ship, floating offshore installation, or mobile offshore unit may be operated.

In accordance with the requirements contained in 3.2, stability calculations demonstrating that the power service barge, ship, floating offshore installation, or mobile offshore unit meets the stability criteria in all loading and ballast conditions are to be submitted for review.

Information is to be submitted for intended operating location and any specific requirements based on applicable local/national codes and standards for review.

1.5 Operating Manual (Booklet)

Instead of an operating manual addressed in Section 2.C.3.1, an operating manual consistent with the information and criteria upon which classification is based, is to be placed on board the power service vessel for the guidance of the operating personnel. Insofar as classification is concerned, the operating manual is to include, as appropriate, the following information:

1) A general description of the vessel, including major dimensions and lightship characteristics
2) Summaries of approved operation conditions for offshore power service vessels including:
   - Limiting environmental conditions (e.g., wave height and period, wind velocity, current velocity, service temperature of the vessel)
   - Design deck loadings, mooring loads, icing loads, variable load, cranes, and types of
   - helicopters for which the helideck is designed
   - Disposition (open or closed) of watertight and weathertight closures
   - Identification of “Restricted Service” conditions
3) Vessel Information:

- General arrangement drawings
- Watertight and weathertight boundaries, location of unprotected openings, and watertight and weathertight closures
- Type, location, and quantities of permanent ballast
- Allowable deck loadings
- Capacity, centers of gravity, and free surface correction for each tank
- Hydrostatic curves or equivalent

4) Guidance for the maintenance of adequate stability and the use of the stability data
5) Guidance for the routine recording of lightweight alterations
6) Guidance for the recommended sequence of emergency shut-downs, where applicable
7) Examples of loading conditions for each mode of operation and instructions for developing other acceptable loading conditions, including the vertical components of the forces in the anchor cables
8) Power Plant:
   - Details on power plant electrical connections to shore and to marine systems, as applicable
   - Guidance on power plant monitoring and associated safety systems
   - Guidance on startup, normal, and emergency operating procedures
   - Guidance on maintenance requirements
   - Guidance on periodic testing and maintenance requirements

The Operating Manual (Booklet) is to be in the language or languages required by the Flag State. If the language is not English, a translation into English is to be included and submitted to BKI.

The Operating Manual (Booklet) is to be submitted for review by BKI solely to verify the presence of the above information, which is to be consistent with the design information and limitations considered in the classification of the power vessel. BKI is not responsible for the operation of the vessel.

The Operating Manual (Booklet) required by this Subsection does not need to be in addition to that required by flag and coastal Administrations. The administration may require that additional information be included in the Operating Manual.

1.6 Alternative arrangements, Novel feature

Alternative arrangements and Novel feature for the unit to be comply with Section 1, A.2 and for others to be comply with applicable be based on Class notation Rules sets.

1.7 Administration Requirements and National Standards

Requirements additional to those given in this Sub-Section may be imposed by the flag Administration with whom the vessel is registered or by the Administration within whose territorial jurisdiction the vessels is intended to operate.

Additionally, for power generation and distribution systems and equipment:

1) BKI will consider special arrangements or designs of equipment, components, systems, or subsystems that can be shown to comply with codes/standards recognized in the country, provided the proposed codes/standards are no less effective.
2) When alternate standards are proposed, comparative analyses are to be provided to demonstrate an equivalent level of safety to this Rules.

1.8 References

Additional requirements from the following Rules, Guidelines and Guidance are referenced in this Sub-Section:

- Rules for Classification and Surveys (Pt. 1, Vol. I)
- Rules for Classification and Surveys (Pt. 5, Vol. I)
- Rules for Hull (Pt. 1, Vol. II)
- Rules for Inland Waterways (Pt. 2, Vol. I – Vol. V)
- Rules for Facilities on Offshore Installations (Pt. 5, Vol. XII)
- Guidelines for Floating Production Installations (Pt. 5, Vol. 3)
- Guidelines for Floating Offshore Liquefied Gas Terminal (Pt. 5, Vol. 2)

The additional requirements of the following codes and standards are referenced in this Sub-Section:

- MODU Code: IMO Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code)
- FSS Code: International Code for Fire Safety Systems (FSS Code)
- SOLAS: International Convention for the Safety of Life at Sea, 1974, as amended
- NFPA Codes/Standards: National Fire Protection Association Codes/Standards
- IEC 80005-1: Utility connections in port, Part 1: High Voltage Shore Connection (HVSC) Systems

2. Safety aspects

2.1 Hazardous areas

Power service vessels may have hazardous areas due to permanent or temporary equipment onboard required for marine operations which utilizing gas or other low flash point fuels. The area where such equipment will be installed is to be considered as a hazardous area, and electrical equipment, ventilation, and access to adjacent spaces in this area are to comply with the applicable requirements in Guidelines for The Use of Gas as Fuel for Ships (Pt. 1, Vol. 1).

Where power vessels are using gas or other low flash point fuels for power generation, the hazardous areas due to permanent or temporary equipment onboard for such operation are to be determined based on acceptable recognized codes / standards or as per applicable requirements in Guidelines for The Use of Gas as Fuel for Ships (Pt. 1, Vol. 1).

For power service offshore installations, Section 9, D and Rules for Electrical Installations (Pt.1, Vol. IV), Sec. 1, K.3 is to be complied with

2.2 Fire protection

The requirements for structural fire protection and means of escape are defined in Section 10. B.

2.3 Fire detection and extinguishing

The requirements for fire detection, fire extinguishing systems and alarm systems for units are defined in Section 10, C.

In addition to above requirements, for Barges permanently moored alongside Jetty/Pier firefighting systems to be meet following requirements:

1) Power generation machinery spaces housing the generators, turbines or boilers are to be appropriately protected by fixed firefighting systems per international standards (e.g. FSS Code, applicable NFPA Codes/Standards etc.). This is to be to the satisfaction of the flag Administration. The designer or builder is to submit evidence that the flag Administration has reviewed the arrangements and that the details are acceptable to that flag Administration. Alternatively, BKI certification of the system to the standard is required.
2) In addition to the above fixed firefighting systems, power service barges are to be provided with hand portable fire extinguishers and semi portable fire extinguishing systems in accordance with the requirements of the Section 10, C.6.1.

2.4 Life-saving appliances

The number, size and arrangement of life-saving appliances for the complete crew for units shall follow the requirements defined in Section 11.

In addition to Barges permanently moored alongside Jetty/Pier. For power service operations, the requirements of flag Administration are to be complied with. These power service barges are to maintain at least two access/exit gangways during operations to facilitate personnel escape in the event of an emergency situation on the barge.

2.5 Emergency Shutdowns

For power generation machinery/equipment, means are to be provided with an emergency shutdown system. Means of control system to be situated outside the space in which the machinery/equipment are located so that they may be stopped in the event of fire or emergency.

3. Hull Construction and Equipment

3.1 General

The BKI Rule set, as applicable for the vessel's rule set based on Class notation, applies in full for hull construction and equipment except as modified herein.

For power service of mobile offshore units, hull design requirements are subject to special review and approval. The requirements in Section 3, 4 and 5 are to be complied with, as applicable. For special design requirements to take account of the site specific environmental conditions, detailed structural analyses are to be submitted for BKI review and approval.

For power service offshore installations, hull design requirements are subjected to special review and approval. The applicable requirements in Rules for Structures (Pt. 5, Vol. II) are to be complied with for fixed service power offshore installations. The applicable requirements in Guidelines for Floating Production Installations (Pt. 5, Vol. 3), Sec. 4 and 5 are to be complied with for floating power service offshore installations.

Hull interface structures are to comply with the applicable requirements of the appropriate base rule set. Where heavy power plant equipment is installed on the deck, details of hull interface scantlings are to be submitted for review and calculations are to be submitted to demonstrate the adequacy of the interface structure. Reference may be made to Guidelines for Floating Production Installations (Pt. 5, Vol. 3), Sec. 4, A.4 as applicable.

3.2 Stability

For all applications, stability is to meet the rule set based on Class notation and be acceptable by the flag Administration of the vessel/coastal state or local regulatory body. In the case of a pier/jetty or bottom founded unit, the stability should be considered in accordance with 1.4.

3.3 Mooring Systems

The purpose of the position mooring system in this Sub-Section is to keep the power service vessel on station at a specific site.

The system includes mooring lines, anchors, mooring accessories, mooring equipment, and thrusters, where applicable.

For floating power service vessels, the mooring system design is to comply with the applicable requirements associated with the power service vessel's based on ship type notation (e.g., Barge, Floating Offshore Installation and Column Stabilized Unit). The mooring system not addressed in rules set based on Class notation is outside the scope of class. However, the documents related to informations and statements which shows that the mooring system is adequate for the intended installation site are to be submitted. For those that are moored to a jetty, or similar bottom supported structure, the jetty structure is the responsibility of the Owner, including compliance with coastal state requirements.

For floating power service under short-term operations at one site, the requirements of the mooring system in Section 7 are to be complied with, as applicable.

3.4 Bottom Founded Power Service Vessels

For a power service vessel intended to rest on the seabed, the effect of the foundation is to be considered in the structural analysis including uneven loading, sliding, etc. The effect of scouring and possible loss of bottom support is also to be considered as follows: for a broad mat type support, 20% of the bottom bearing area is to be considered unsupported.

4. Machinery, Piping and Electrical Systems

4.1 General

This requirements are applicable to machinery, piping, and electrical systems utilized to support power service vessel operations, excluding the power plant systems which is covered in 5. The BKI Rule set, as applicable for the vessel's rule set based on Class notation, applies in full for machinery, piping, and electrical systems, except as modified herein.

For ship type power service installations, the applicable requirements in Part 1. Seagoing Ship rules are to be complied with. For power service offshore installations other than ship type, the applicable requirements in this Rules are to be complied with.

Plans showing the general arrangement of all machinery spaces are to be submitted for review and approval.

4.2 LNG or LPG as Fuel

Where natural gas or petroleum gas is used as a fuel source for power vessels and the optional additional notation **Power Plant** is requested, the classification of the arrangements, machinery, equipment, and containment systems, etc. are to meet the requirements and safety principles in Guidelines for The Use of Gas as Fuel for Ships (Pt. 1, Vol. 1).

If the optional **Power Plant** notation is not requested, the entire power generation system need not comply with the requirements of Guidelines for The Use of Gas as Fuel for Ships (Pt. 1, Vol. 1). However, the arrangements, systems and equipment are to meet the safety requirements of recognized codes or standards.

For non-propelled vessels such as barges, redundancy requirements need not be considered. In addition, for vessels that do not store or handle LNG or LPG onboard, Guidelines for The Use of Gas as Fuel for Ships (Pt. 1, Vol. 1), Sec. 4.2 and 6 need not be considered.

4.3 Marine Systems Powered by the Power Plant

When marine systems are powered via a power plant, the following additional conditions are to be met:

1) The electrical distribution arrangements for the marine systems are to be clearly indicated.
2) Where the main source of electrical power is necessary for the support systems of power generation plant, the system is to be so arranged that, in the event of the loss of any one of the generators or transformers in service, the electrical supply to equipment necessary for support systems are maintained or restored.
3) A self-contained emergency source of electrical power is to be provided, as required by vessel's rule set based on Class notation (e.g., Rules for Electrical Installations (Part. 1, Vol. IV), Rules for Electrical Installations (Pt. 5, Vol. V)), so that in the event of a failure of the main source of electrical power, the emergency source of power will become available to supply power to services that are essential for safety in an emergency. Shore power supply may be considered as an emergency source of power if the loss of the power plant will not disrupt the shore power supply and supply is automatically connected within 45 seconds upon failure of power plant.
4) Instrumentation is to be provided at the marine system switchboard showing energized status of the connected power plant switchboard. Means are to be provided for checking the polarity (for DC) or the phase sequence (for three-phase AC) of the power plant supply in relation to the marine system.

4.4 Marine System Powered by Shore Power Supply

When the marine systems of a power service vessel are powered via shore power supply and the vessel is not fitted with an auxiliary power generation machinery, the following additional conditions are to be met:

1) The vessel is to be provided a standby source of power in case of loss of shore power.
2) The standby source is to be capable to take the load automatically within 45 seconds upon loss of shore power.
3) The standby source is to be capable to run services that are essential for safety and provide necessary lighting, ventilation and other services to allow movement of service personnel from and to the barge for a period of at least 6 hours.

5. Power Generation and Distribution Systems and Equipment

5.1 General

This requirements applies to installations seeking the optional classification for the design, construction, installation, and survey of power generation and distribution equipment for exporting power to external loads. Vessels whose systems and components meet the full following requirements may receive the optional additional class notation **Power Plant**.

The scope of 5. includes power generation and distribution systems and equipment installed on board power service vessels. Power plant systems may be used to provide power to vessel marine services and the arrangement is to be in accordance with 4.3.

5.2 Design Plans and Data for Approval

The following requirements describe the minimum design plans and data submission requirements for associated power generation and distribution systems, subsystems, equipment and/or components. Additional details may be required for submittal.

1) The submitted design plans and data are to be in accordance with the requirements of this Sub-Section.
2) The design plans and data as specified in this Sub-Section are to be generally submitted electronically to BKI.
3) All plan submissions originating from designers or manufacturers are understood to be made with the knowledge of the primary contracting party.
4) All plan submissions originating from manufacturers are understood to be made with the cognizance of the primary contracting party. A fee may be charged for the review of plans that are not covered by the contract for Classification.

5.2.1 Electrical Systems and Components

The following plans and data are to be submitted for review:

1) *One Line Diagram* – One line diagram of main and emergency power distribution systems to show:
   - *Generators*: kW rating, voltage, rated current, frequency, number of phases and power factor
   - *Motors*: kW or hp rating, voltage and current rating
   - *Motor controllers*: type (direct-on-line, star-delta, etc.), disconnect devices, overload and under voltage protections and remote stops, as applicable
   - *Transformers*: kVA rating, rated voltage and current, winding connection
   - *Circuits*: designations, type and size of cables, trip setting and rating of circuit protective devices, rated load of each branch circuit, emergency tripping and preferential tripping features
   - *Batteries*: type, voltage, rated capacity, conductor protection and charging and discharging boards
2) *Schematic Diagrams* – Schematic diagrams for the following systems are to be submitted. Each circuit in the diagrams is to indicate type and size of cable, trip setting and rating of circuit protective device, and rated capacity of the connected load.
   - Interior communications
   - General emergency alarm
   - Intrinsically safe systems
   - Fire detection and alarm system (if independent from vessel marine systems)
3) Other documents required in Rules for Electrical Installations (Pt. 1, Vol. IV), Sec. 1, C as applicable (such as short circuit data, protective device coordination study, high voltage systems, installation plans and electrical equipment)

5.2.2 Piping Systems

The following plans are to be submitted for review as referenced in Rules for Machinery Installations (Pt. 1, Vol. III), Sec. 11, A.2, as applicable:

- Power plant machinery space arrangement, including locations of fuel oil tanks
- Compressed air system
- Cooling water systems
- Exhaust piping (for boilers, incinerators, and engines)

- Fuel oil systems, including storage tanks, drip trays, and drains
- Hydraulic and pneumatic systems
- Lubricating oil systems
- Sea water systems
- Vent, overflow, and sounding arrangements
- Steam systems
- Steam piping analyses, as applicable
- Tank venting and overflow systems

In addition Booklet of standard details should be submitted, if desired. This document contains standard practices to be used in the construction of the vessel, typical details of such items as bulkhead, deck and shell penetrations, welding details, pipe joint details, etc.

5.2.3 Internal-Combustion Engines and Turbines

Technical submissions for internal-combustion engines are to include, but are not limited to, the requirements of Rules for Machinery Installations (Pt. 1, Vol. III), Sec. 2, B

Technical submissions for steam turbines and gas turbines are to include, but are not limited to, the requirements of Rules for Machinery Installations (Pt. 1, Vol. III), Sec. 3.I.A.2 and II.A.2.

Alternatively, technical submissions based on the requirements of applicable industry standards may be acceptable after BKI review and approval.

5.2.4 General Equipment Details

Plans and data for equipment and components are to provide the following, as applicable:

1) Model and size
2) Design specifications, including design codes, standards, and references
3) Design parameters: loads, temperature, environmental conditions, etc.
4) Design analysis and/or calculations, as applicable
5) Dimensional details and drawings
6) Fabrication details and welding configurations
7) Material specifications and material properties

5.3 Design Requirements

5.3.1 General Arrangement and Equipment Layout Drawings

General arrangement and layout drawings are to denote:

1) The layout of the power generation machinery with essential auxiliaries, specifications of main equipment with information on manufacturer's name, type, rating, and number of the equipment
2) General arrangement of the switchboards and distribution boards

5.3.2 Certification and Classification Requirements

In general, power generation and distribution machinery and electrical systems are to be in built and constructed in accordance with BKI Rules or recognized industry standards. BKI design review verifies that the design of systems, subsystems, equipment, and/or components meets the requirements of this Sub-Section.

5.3.3 Loss of Export Load

Power generating installations are to be arranged and provided with necessary equipment so that in the event of a disconnection of all transmission lines and total loss of external load the system can be removed from service without damage. Additionally, the entire plant is to be arranged to be able to be returned to service without external assistance to the power service vessel.

5.3.4 High Voltage Shore Power Connection

Vessels equipped with a high voltage shore connection designed to power the vessel with the shore power alone, enabling the shipboard generators to be shut down while in port, are to comply with the requirements given in the IEC 80005-1.

5.3.5 Protection from Shore Distribution Faults

If the power service vessel provides power to shore, which may also augment other shore power generation sources as a parallel power source, the connection from the power service vessel to the shore distribution system is to be protected from shore power faults, frequency, and voltage variations in accordance with the applicable recognized codes/standards in the country where it is providing power.

5.3.6 Environmental Suitability

Design of system and components for power plant applications are to be suitable for the inclination and vibration requirements of the host vessel or unit.

6. Survey

6.1 General

The requirements of 6.2 and 6.3 are provided for surveys during and after construction for power service vessel classification of **Power Service**. The requirements of 6.4 are provided for surveys during and after construction for the optional **Power Plant** notation.

6.2 Testing, Trials and Surveys during Construction

The BKI Rules set, as applicable based on Class notation, applies in full for testing, trials, and surveys during construction, except as modified herein.

For mobile offshore unit, the requirements of testing, trials and survey during construction are complied with Section 2, C.5 - 6.

6.3 Surveys after Construction

The BKI Rules set, as applicable based on Class notation, applies in full for surveys after construction, except as modified herein.

For mobile offshore unit, the requirements of survey after construction is complied with Section 2, E.

6.4 Surveys for Optional Power Plant Notation

Where a power service vessel is assigned the optional notation **Power Plant**, the survey requirements in 6.4.1 and 6.4.2 are to be complied with. Annual Surveys and Class Renewal Survey for Machinery are to be carried out in accordance with vessel's rule set based on Class notation as applicable.

6.4.1 Surveys during Construction and Commissioning

This Sub-Section provides requirements for initial surveys during manufacturing, installation, and start-up (commissioning) of power generation and distribution systems installed on offshore installations, or mobile offshore units.

During construction, BKI Surveyors are to be provided access to manufacturers' or fabricators' facilities to witness construction and/or testing as required by Rules for Machinery Installations (Pt. 1, Vol. III) and Rules for Electrical Installations (Pt. 1, Vol. IV), and the applicable design codes and/or standards.

The manufacturer/fabricator is to contact the BKI Surveyor to make necessary arrangements to examine systems, subsystem, equipment, and/or components.

The purpose of the initial onboard survey of equipment is to verify that the installation is in compliance with the BKI approved plans, with particular emphasis on examination of the following, as applicable:

1) Location of equipment in relation to any hazardous areas
2) Equipment orientation on the vessel or unit, equipment structural arrangements, supporting foundations, securing details, and protective coating
3) Visual and/or NDT examination of assembled and installed equipment, attachment on board, including underdeck support
4) Hook-up and integrity of equipment piping, electrical, machinery, and ventilation system, including watertight penetrations and integration with associated ship systems
5) Piping system visual examination, NDT, and pressure test per applicable Rules or codes
6) Testing of pressure relief and safety valves for hydraulic/pneumatic systems on board
7) Visual examination of electrical equipment, wiring connections, cable routing, earthing, cable penetrations, and distribution panels to include testing of electrical systems and insulation tests
8) Lighting systems examination and test
9) Ventilation systems examination, ducting arrangements, and penetrations, damper arrangements, operational tests
10) Control systems, safety devices, and shutdowns to be tested to the satisfaction of the attending Surveyor
11) Fire/Safety measures such as fire control plan, EEBDs, lifesaving appliances, as applicable, crew protection, general alarm/pa, fire detection, portable extinguishers, escape arrangements, main and emergency lighting, and any required emergency shutdowns
12) Compliance with any special requirements from the flag Administration, local codes, or regulations
13) Commissioning of communication equipment related to power plant operation
14) All power plant systems and equipment to be checked for proper operation

6.4.2 Surveys after Construction

Surveys after construction of power generation and distribution systems installed on power service vessels are mandatory for maintenance of the **Power Plant** notation.

Surveys after construction are to be in accordance with the applicable requirements based on vessel's rule set based on Class notation and Rules for Classification and Surveys (Pt. 1, Vol. I), Sec. 3, B.1.1, B.1.3 – B.1.5 for Annual and Class Renewal Survey of machinery as applicable.

.1 Annual Surveys

In addition to the surveys referenced in the Rules for Classification and Surveys (Pt. 1 and Pt. 5, Vol. I) as applicable, the following requirements are to be carried out in the presence of BKI Surveyor on an annual basis, as applicable:

1) Examination of structure and hull connection weld points
2) Satisfactory operational test of all emergency stops, controls, and remote controls
3) Review of calibration record, operations manual and logbooks, and insulation resistance log
4) Examination and testing of fire/safety alarms, detectors, and ventilator dampers
5) Testing of all means of communication
6) Examination of all piping systems
7) Functional tests of equipment integrated or associated with vessel's systems
8) Examination and testing of electrical systems and related equipment
9) Satisfactory operational test of all vessel equipment alarms
10) Compliance with any special requirements from the flag Administration, local codes, or regulations

If the BKI Surveyor recommends repairs or additional surveys based on his/her observations/findings, notice will be given to the Owner or their representative so that appropriate action may be taken.

.2 Class Renewal Survey

In addition to the applicable requirements noted in 6.4.2.1 for Annual Surveys of Machinery, the following is to be carried out in the presence of an BKI Surveyor:

1) Examination of structure and hull connection weld points, supplemented by NDT of the connection welds
2) Examination of power plant equipment wiring, wireways, junction boxes, and electrical panels for damage, corrosion, or loose connections
3) Examination and testing of insulation resistance of motors and cables related to power systems and equipment
4) Calibration of essential safety alarms, detectors, and equipment
5) Satisfactory operational test of all emergency stops, controls, and remote controls
6) Satisfactory operational test of all equipment alarms

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Annex 1 Stability Criteria for Counter-Ballasted Crane

A. Intact Stability after Loss of Crane Load A1–1
B. Damage Stability A1–1

A. Intact Stability after Loss of Crane Load

The following recommended criteria are based on crane operations taking place in favorable weather conditions on counter-ballasted column-stabilized crane units. The analysis should be carried out for the counter-ballast case when the unit is floating on even keel.

The maximum heeling moment developed by multiplying the weight of the hook load and boom by the horizontal distance from center of floatation at the selected draft to the hook load and boom center of gravity, considering the full range of crane elevations and weights, is to be determined. The resulting heeling moment is to be converted to a heeling arm at zero degrees by dividing it by the rig displacement. The heeling arm thus achieved is to be assumed constant with the inclination.

The righting arm curve is to be corrected for the increase in the vertical center of gravity due to the load. (The increase in the VCG is due to the boom being in the elevated position, and the hook load acting at the elevated end of the boom.).

1) For any condition of loading, the first intercept of the heeling arm curve with the righting arm curve (equilibrium point) is to occur prior to submergence of the deck edge.

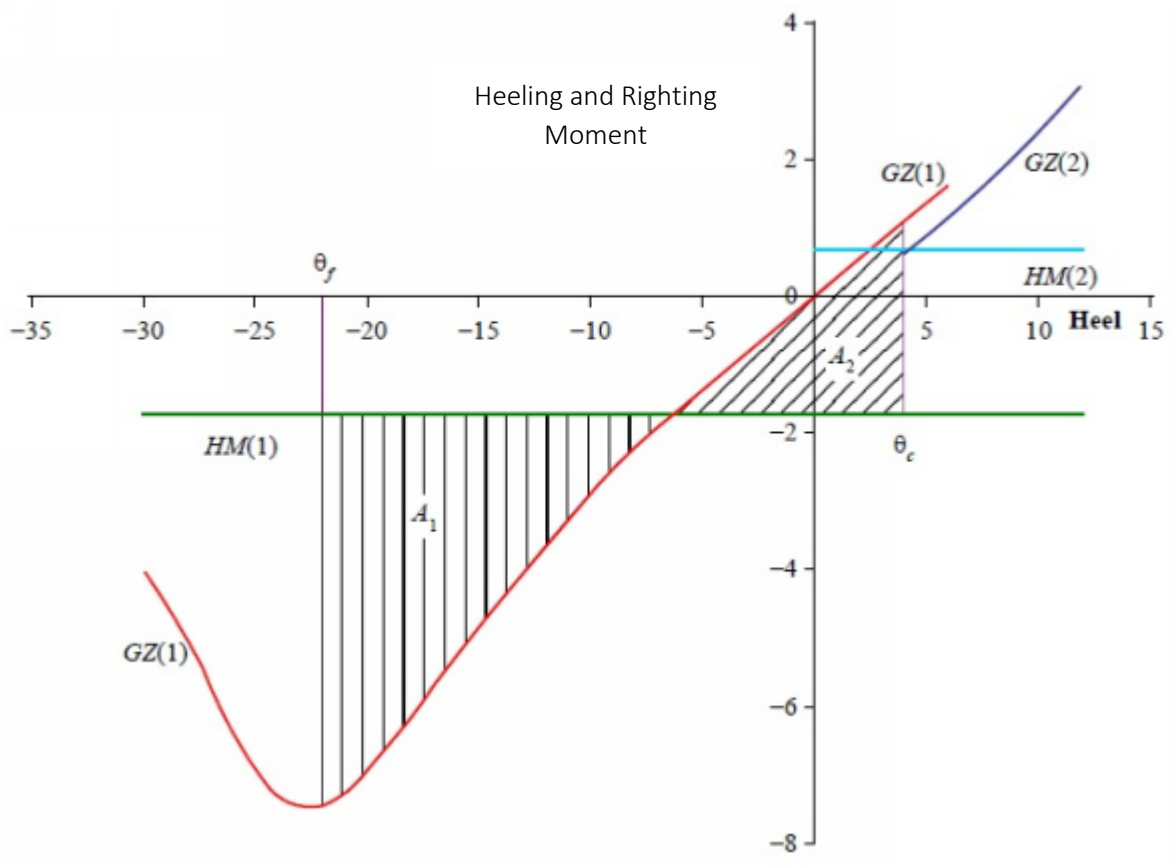
   The following requirements are also to be met, with the unit at the maximum allowable vertical center of gravity in operation mode, to provide adequate stability in case of sudden loss of crane load:

2) The residual area between the first intercept and the angle of downfloading, the second intercept, or 30°, whichever occurs first, (area A_1 in Fig. A1.1) is not to be less than 30% in excess of area A_2 in Fig. A1.1.

3) The angle of the first intercept between the righting lever curve after loss of crane load and the maximum permissible counter ballast lever curve is not to exceed 15° (angle of equilibrium after loss of crane load).

B. Damage Stability

The unit must also meet the damage stability criteria in the Section 6, A.4.2. The crane overturning moment is to be used concurrent with the wind overturning moment for the limiting environmental criteria established in the operations manual.



GZ(1) = The righting moment curve at the displacement corresponding to the vessel without hook load

GZ(2) = The righting moment curve at the displacement corresponding to the unit with hook load

HM(1) = The heeling moment curve due to the heeling moment of the counter-ballast at the displacement without hook load

HM(2) = The heeling moment curve due to the combined heeling moment of the hook load and the counter-ballast at the displacement with hook load

θ_f = Limit of area integration to downflooding angle or second intercept (or 30°) on the counter-ballasted side of the unit.

θ_c = Limit of area integration to the angle of static equilibrium due to the combined hook load and counter-ballast heeling moment.

Fig. A1.1. Criteria for Column Stabilized after Accidental Loss of Crane Load : $A_1 \geq 1.3 * A_2$