



**2017**

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**Rules and Guidance for the Classification of  
Mobile Offshore Drilling Units**

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**2017**

Rules for the Classification of  
Mobile Offshore Drilling Units

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**Rules**

**2017**

Guidance Relating to the Rules for the Classification of  
Mobile Offshore Drilling Units

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**Guidance**



**2017**

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**Rule for the Classification of  
Mobile Offshore Drilling Units**

**APPLICATION OF  
"RULES FOR THE CLASSIFICATION OF  
MOBILE OFFSHORE DRILLING UNITS"**

1. Unless expressly specified otherwise, the requirements in the Rules apply to Mobile Offshore Drilling Units for which contracts for construction are signed on or after 1 July 2017.
2. The amendments to the Rules for 2016 edition and their effective date are as follows;

**Effective Date 1 July 2017**

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< No revision >

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# CHAPTER 1 GENERAL

## Section 1 General

### 101. Application

1. The requirements in the Rules are to be applied to the surveys, hull construction, equipment and machinery of mobile offshore drilling units. Mobile offshore drilling units (hereinafter referred to as "units" in the Rules) as used herein are units or vessels capable of engaging in drilling operations for the exploration for or exploitation of resources beneath the seabed such as liquid or gaseous hydrocarbons, sulphur or salt.
2. The requirements in the Rules are to be considered as minima by the Society. In addition, particular National Governments may have regulations which might be in excess of these requirements.
3. The Society is prepared to offer assistance, upon the request of an Owner or designer, in evaluating a specific design against published National regulations.
4. Other similar units/other special purpose units, which do not engaged in drilling operations but which have configurations and modes of operation similar to drilling units, may be considered for classification by the Society, on the basis of the requirements as found to be applicable, and the relevant rules. In addition, evaluation must be made of other possible loading condition peculiar to the type of unit under consideration. Calculations substantiating the adequacy of the design are to be submitted to the Society. Machinery and electrical installations, etc. for other special purpose units will be subject to approval by the Society, as found to be applicable.
5. The items listed below, where applicable, are covered by the Rules and are subject to approval by the Society.
  - Material
  - Structural strength
  - Welding
  - Stability, intact and damaged
  - Weathertight/watertight integrity
  - Temporary or emergency mooring equipment
  - 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
6. When drilling systems are classed by the Society upon request of the Owner, drilling systems are to be comply with the Guidance. **[See Guidance]**

### 102. Types of units

Units are classified into the following four groups depending upon their types.

- (1) Self-elevating Units : 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 sea bed. 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 mat.

- (2) Column-stabilized Units : Column-stabilized unit is a unit which depends upon the buoyancy of widely spaced columns for flotation 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 semisubmersible, or when supported by the sea bed, in which condition the unit is described as submersible. A semisubmersible 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.
- (3) Surface Type Units
  - (A) Ship Type Units : Ship type unit is a seagoing ship-shaped unit having a displacement type hull or hulls, of the single, catamaran or trimaran type, which have been designed or converted for operations in the floating condition. The unit of this type has propelling machinery.
  - (B) Barge Type Units : Barge type unit is a seagoing unit having a displacement type hull or hulls, which have been designed or converted for operations in the floating condition. The unit of this type has no propelling machinery.
- (4) Other Type of Units : Units other than those specified in (1) to (3), are to be in accordance with the relevant requirements in this Chapter and are to be at the discretion of the Society.

### 103. Exemptions

1. The Rules are not to be applied to the following items ;
  - (1) Structural details of industrial items used exclusively in drilling or related operations.
  - (2) 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.
  - (3) Determination of the adequacy of sea bed conditions, regarding bearing capacity, resistance to possible sliding and anchor holding capability.However, when drilling systems are classed by the Society, drilling systems are to be comply with the Guidance.
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.

### 104. Equivalency and novel features

1. Alternative hull construction, equipment, machinery and their arrangement and scantlings will be accepted by the Society, provided that the Society is satisfied that such construction, equipment, machinery and their arrangement and scantlings are equivalent to those required in the Rules.
2. Units which contain novel features of design, with respect to buoyancy, elevating arrangements, structural arrangements, machinery, etc., to which the Rules are not directly applicable, may be classed, when approved by the Society 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 based on the best information available at the time.

### 105. Operating Booklet

An Operating Booklet is to be provided for each unit to the satisfaction of the Society, and its copy is to be submitted to the Society. 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 and light ship data based on the results of inclining experiment of the unit, etc.

- (2) Pertinent data for each approved mode of operation, including design and variable loading, environmental conditions, assumed sea bed 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 capacity of tanks, centre 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 descriptions 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) 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.
- (14) Representative examples of loading conditions for each approved mode of operation specified in **207.**, together with means for evaluation of other loading conditions.
- (15) Diagrams of main and auxiliary wiring systems.
- (16) Details of emergency shutdown procedures for electrical equipment.
- (17) Identification of the helicopter assumed in the design of the helicopter deck.

### 106. Construction 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.

## Section 2 Definitions

### 201. Application

The definitions of terms and symbols which appear in the Rules are to be as specified in this Section, unless otherwise specified, and definitions of terms and symbols not specified in the Rules are to be as specified in **Rules for the Classification of Steel Ships** and **Rules for the Classification of Steel Barges**.

### 202. Length( $L$ )

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 end.
2. For column-stabilized units, length is the maximum distance in metres between the fore and after end of the primary hull structure which is projected to the centre line of the unit.
3. For ship type units, length is the distance in metres on the summer load line, from the fore side of the stem to the centre of the rudder stock, or 96 % of the length on the summer load line, whichever is the greater.

### 203. Breadth( $B$ )

1. For column-stabilized units, breadth is the horizontal distance in metres measured perpendicularly to the longitudinal centre line at the broadest part of the primary hull structure.
2. For self-elevating units, ship type units and barge type units, breadth is the horizontal distance in metres between outside of frames at the broadest part of hull.

## 204. Depth( $D$ )

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  $L$ .
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  $L$ .

## 205. Design water depth

Design water depth is the vertical distance in metres from the sea bed to the mean low water level plus the height of astronomical and storm tides.

## 206. 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, liquid in storage or reserve supply tanks, items of consumable or variable loads, any allowance for stores, or crew and their effects.

## 207. 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 application of the Rules, the approved modes of operation of a unit are defined as follows.

- (1) Operating condition : Operating condition is a condition wherein a unit is on location for the 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 on the sea bed, as applicable.
- (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 on the sea bed, as applicable.
- (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.
- (4) Temporary mooring condition : Temporary mooring condition is a condition wherein a unit is temporarily moored in the afloat condition.

## 208. 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.

## 209. Self-propelled unit

Self-propelled unit is the unit other than non-self-propelled unit.

## 210. Working area

Working spaces are those open or enclosed spaces containing equipment and processes, associated with drilling operations, which are not included in hazardous areas and machinery spaces.

## 211. Control station

Control stations are those spaces in which the ships radio equipment, main navigation equipment or emergency source of power is located and control panels for posture or position control equipment, leg elevation control equipment, central ballast control devices, central fire detection central fire alarm devices are installed.

**212. Down flooding**

Down flooding means any flooding of the interior or any part of the buoyant structure of a unit through openings which cannot be closed weathertight, watertight or which are required for operational reasons to be left open in all weather conditions, as appropriate for the intact and damage stability criteria.

**213. Weathertight**

Weathertight means that in any sea conditions water will not penetrate into the unit.

**214. Watertight**

Watertight means that capability of preventing the passage of water through structure in any direction under the head of water for which the surrounding structure is designed.

**215. Moulded draught**

The moulded draught is the vertical distance in metres 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.

**216. Moulded base line**

The moulded base line is a horizontal line extending through the upper surface of the bottom plating.

**217. Drilling system**

Drilling systems are entire machinery and systems used in drilling well and producing petroleum. ⚡

## CHAPTER 2 CLASSIFICATION AND SURVEYS

### Section 1 General

#### 101. General

1. The classification and surveys of units intended to be classed with the Society or classed with the Society are to be in accordance with the requirements specified in this Chapter.
2. In the case of items not specified in this Chapter, the requirements specified in **Pt 1 of Rules for the Classification of Steel Ships** are to be applied.
3. For Surface Type Units the survey requirements detailed in this Chapter replace those requirements laid out in **Pt 1 of Rules for the Classification of Steel Ships** except when noted in the text. The thickness measurement requirements of **Pt 1 of Rules for the Classification of Steel Ships** are adapted and incorporated into **Table 2.1** of this Chapter.

#### 102. Definition

##### 1. Ballast tank

A ballast tank is a tank which is used primarily for salt water ballast.

##### 2. Preload tank

A preload tank is a tank within the hull of a self-elevating unit. These tanks are periodically filled with salt water ballast and used to preload the footings of the unit prior to commencing drilling operations. Preload tanks are considered equivalent to ballast tank.

##### 3. Spaces

Spaces are separated compartments

##### 4. Coating condition

Coating condition is defined as follows:

- (1) **GOOD** condition with only minor spot rusting
- (2) **FAIR** condition with local breakdown at edges of stiffeners and weld connections and/or light rusting over 20 % or more of areas under consideration, but less than as defined for **POOR** condition
- (3) **POOR** condition with general breakdown of coating over 20 % or more, or hard scale at 10 % or more, of areas under consideration

##### 5. Close-up Survey

A Close-up Survey is a survey where the details of structural components are within the close visual inspection range of the Surveyor, i.e. normally within reach of hand.

##### 6. Transverse section(girth belt)

A transverse section(girth belt) includes all continuous longitudinal members such as plating, longitudinals and girders at a given section of the unit.

##### 7. Representative spaces

Representative spaces are those which are expected to reflect the conditions of other spaces of similar type and service and with similar corrosion prevention systems. When selecting representative spaces, account is to be taken of the service and repair history on board and identifiable critical structural areas and/or suspect areas.

##### 8. Critical structural area

Critical structural areas are locations which have been identified from calculations to require monitoring or from the service history of the subject unit or from similar units or sister units, if applicable, to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the unit.

### 9. Suspect area

Suspect areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

### 10. Substantial corrosion

Substantial corrosion is an extent of corrosion such that assessment of corrosion pattern indicates a wastage in excess of 75 % of allowable margins, but within acceptable limits.

### 11. Excessive diminution

Excessive diminution is an extent of corrosion beyond allowable limits.

### 12. Corrosion prevention system

A corrosion prevention system is normally considered a full hard protective coating. Hard protective coating is usually to be epoxy coating or equivalent. Other coating systems, which are neither soft nor semi-hard coatings, may be considered acceptable as alternatives provided that they are applied and maintained in compliance with the manufacturer's specifications.

### 13. Prompt and thorough repair

A prompt and thorough repair is a permanent repair completed at the time of survey to the satisfaction of the Surveyor, therein removing the need for the imposition of any associated condition of classification, or recommendation.

### 14. Special consideration

Special consideration or specially considered (in connection with Close-up Surveys and thickness measurements) means sufficient close-up inspection and thickness measurements are to be taken to confirm the actual average condition of the structure under the coating.

### 15. Propulsion assist

Propulsion assist are non-self-propelled units fitted with thrusters intended to assist in manoeuvring or propelling while under tow.

## 103. Repairs

1. Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Surveyor, will affect the unit's structural, watertight or weathertight integrity, is to be promptly and thoroughly (see **102. 13**) repaired. For location where adequate repair facilities are not available, consideration may be given to allow the unit to proceed directly to a repair facility. This may require temporary repairs for the intended voyage.
2. Additionally, when a survey results in the identification of structural defects or corrosion, either of which, in the opinion of the Surveyor, will impair the unit's fitness for continued service, remedial measures are to be implemented before the unit continues in service.
3. Where the damage found on structure mentioned in **Par 1** is isolated and of a localised nature which does not affect the unit's structural integrity, consideration may be given by the Surveyor to allow an appropriate temporary repair to restore watertight or weather tight integrity and impose a Recommendation/Condition of Class in accordance with IACS PR No.35 (Procedure for Imposing and Clearing Recommendation/Condition of Class), with a specific time limit.

## Section 2 Classification

### 201. Classification

Units built and surveyed for the classification in accordance with the Rules or in accordance with requirements deemed to be equivalent to the Rules by the Society will be assigned a class and registered in the Register of Ships.

### 202. Class notations

The class will be distinguished by the class notations and the class notations assigned to the units classed with the Society are to be in accordance with the requirements specified in **Pt 1, Ch 1, 201. of Rules for the Classification of Steel Ships**. However, "Mobile Offshore Drilling Unit" shall be assigned as a ship type notation and the following special feature notations shall be assigned according to the type of unit.

- (1) Self-elevating
- (2) Column-stabilized
- (3) Ship Type
- (4) Barge Type

### 203. Maintenance of classification

1. Units classed with the Society are to be subjected to the surveys to maintain the classification and are to be maintained in good condition in accordance with the requirements specified in this Chapter.
2. Plans and particulars of any proposed alterations to the approved scantlings or arrangements of hull, machinery or equipment are to be submitted for approval by the Society before the work is commenced and such alterations are to be surveyed by the Surveyor of the Society.

### 204. Classification Survey during Construction

#### 1. General

At the Classification Survey during Construction, the hull, machinery and equipment are to be examined in detail in order to ascertain that they meet the relevant requirements of the Rules.

#### 2. Submission of plan and documents

- (1) At the Classification Survey during Construction, the following plans and documents are to be submitted to the Society for approval before the work is commenced.
  - (A) Hull and hull equipments
    - (a) Transverse section showing scantlings
    - (b) Longitudinal section showing scantlings
    - (c) Deck construction plan(including details of well and helicopter deck)
    - (d) Framing
    - (e) Shell expansion
    - (f) Final stability data
    - (g) Methods and locations for non-destructive testing
    - (h) Construction plan of watertight bulkheads and deep tanks indicating the highest position of tank and positions of tops of overflow pipes
    - (i) Construction of leg, bottom mats, leg tanks and load transmitting parts of jacking system, etc.
    - (j) Construction of columns, lower hull, footings
    - (k) Construction of superstructures and deckhouses
    - (l) Details of arrangement and closing devices of watertight doors and hatchways, etc.
    - (m) Seatings of boilers, main engines, thrust blocks, plummer blocks, dynamos and other important auxiliary machinery
    - (n) Construction of machinery casings
    - (o) Construction of cargo handling appliances and its foundation
    - (p) Pumping arrangements
    - (q) Steering gear

- (r) Construction of fire protection
  - (s) Means of escape
  - (t) Temporary mooring arrangements and towing arrangements
  - (u) Welding details and procedures
  - (v) Details of corrosion control arrangements
  - (w) Documents in respect of maintenance, corrosion control and inspection
  - (x) Other plans and/or documents considered necessary by the Society
- (B) Machinery
- (a) For self-elevating unit, construction plan and operating diagram of jacking systems
  - (b) General arrangement of machinery spaces, boilers and pressure vessels, main and auxiliary engines, shaftings, and auxiliary machinery and pipings, etc. specified in **Pt 5, Ch 1 of Rules for the Classification of Steel Ships.**
  - (c) Electrical installations specified in **Pt 6, Ch 1 of Rules for the Classification of Steel Ships,** and automatic and remote control system specified in **Pt 6, Ch 2 of Rules for the Classification of Steel Ships.**
  - (d) Fire extinguishing arrangements and inert gas system
  - (e) Other plans and/or documents considered necessary by the Society
- (2) At the Classification Survey during Construction, the following plans and documents are to be submitted to the Society for reference.
- (A) Specifications
  - (B) General arrangement
  - (C) Summary of distributions of fixed and variable weights
  - (D) Plan indicating design loadings for all decks
  - (E) Preliminary stability data
  - (F) Structural analysis and calculation for relevant loading conditions
  - (G) Resultant forces and moments from wind, waves, current, mooring and other environmental loadings taken into account in the structural analysis
  - (H) Calculations for significant operational loads from derrick and other equipment
  - (I) For self-elevating unit, calculations substantiating adequacy of structure to transmit forces between legs and hull through the jacking systems
  - (J) Evaluation of the unit's stability to resist overturning while bearing on the sea bed
  - (K) Lines or offsets
  - (L) Capacity plans and sounding tables of tanks
  - (M) Plans showing arrangement of watertight compartments, openings, their closing appliances, etc., necessary for calculation of stability
  - (N) Other plans and/or documents considered necessary by the Society
- 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.

### 3. Presence of Surveyor

- (1) At the Classification Survey during Construction, the presence of the Surveyor is required at the following stages of the work in relation to hull and equipment.
- (A) When the tests of the materials specified in **Pt 2, Ch 1 of Rules for the Classification of Steel Ships** and the equipment specified in **Pt 4 of Rules for the Classification of Steel Ships** are carried out.
  - (B) When the tests of welding specified in **Pt 2, Ch 2 of Rules for the Classification of Steel Ships** are carried out.
  - (C) When designated by the Society during shop work or sub-assembly.
  - (D) When each block is assembled and erected.
  - (E) When each part of the hull is completed.
  - (F) When structural tests, leak test, hose tests and non-destructive tests are carried out.
  - (G) When performance tests are carried out on closing appliances of openings, anchoring and mooring equipment, cargo handling appliances, fire detection systems, etc.
  - (H) When each part of the fire protection construction is completed.
  - (I) When measurement of principal dimensions, hull deflection, etc. are carried out.
  - (J) When a loading instrument is installed on board.
  - (K) When the load line mark is marked.



- (L) When each part of drilling derricks and sub-structures including supporting structures of drilling derricks is completed and drilling derricks and sub-structures are installed on board.
  - (M) When the onboard tests and stability experiments are carried out.
  - (N) When the sea trials are carried out.
  - (O) When deemed necessary by the Society.
- (2) At the Classification Survey during Construction, the presence of the Surveyor is required at the following stages of the work in relation to machinery.
- (A) For units not provided with propelling machinery
    - (a) When the tests specified in **Ch 5, 209.** are carried out. However, the presence of the surveyors at respective tests of apparatuses used for the systems specified in **Ch 5, 104.** may be modified in accordance with the usage of the apparatuses.
    - (b) When generators, prime movers for generators and essential auxiliaries are installed on board.
    - (c) When sea trials are carried out.
  - (B) For units provided with propelling machinery
    - (a) When the tests specified in **Ch 5, 209.** are carried out.
    - (b) When the tests of materials of main parts of machinery prescribed in **Pt 2 of Rules for the Classification of Steel Ships** are carried out.
    - (c) Main parts of machinery
      - (i) When the tests prescribed in **Pt 5 and 6 of Rules for the Classification of Steel Ships** according to the respective kind of machinery are carried out.
      - (ii) When machining of the main parts is finished and, if necessary, at the proper stage during machining.
      - (iii) In the case of welded construction, before welding is commenced and when it is completed.
      - (iv) When shop trials are carried out on main engines and generators.
    - (d) When main engines, generators and essential auxiliaries are installed on board.
    - (e) When performance tests/onboard tests are carried out on measurement instruments, remote control devices of closing appliances, remote control devices for machinery and gears, automatic control devices, steering gear, jacking system, fire extinguishing equipments, piping, etc.
    - (f) When sea trials are carried out.
  - (3) For column-stabilized units, when the draught scales are fitted.
  - (4) For units requiring the mooring system specified in **Ch 4, Sec 2, 205.** when that system is installed on the unit.
  - (5) For units with a dynamic positioning system, when components of the dynamic positioning system are installed on the units and tests are carried out in accordance with the testing procedure.

#### 4. Tests

At the Classification Survey during Construction, hydrostatic tests, leak tests, hose tests and performance tests, etc are to be carried out in accordance with the relevant requirements of the Rules.

#### 5. Sea trials and stability experiments

- (1) At the Classification Survey during Construction, 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 **Pt 1, Ch 1, 308.** of the **Rules for the Classification of Steel Ships.**
  - (A) For self-elevating units, elevating and lowering tests of legs and decks and function tests of their safety devices; and where legs are not provided with bottom mats, pre-loading tests on each leg to a load as near as possible to that of the strength calculation specified in **Ch 6, 103.**
  - (B) For column-stabilized units, a function test of the ballast system
  - (C) For units with the dynamic positioning system, performance tests of the dynamic positioning system.
- (2) Stability experiments
  - (A) At the Classification Survey during Construction, stability experiments 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 the Society and provided on board.

- (B) The stability experiments of an individual unit may be dispensed with, provided that reliable stability data can be obtained from the stability experiments of a similar unit and approval is given by the Society. 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.

## 205. Classification Survey after Construction

### 1. General

At the Classification Survey after Construction, the examination of the hull, machinery and equipment are carried out as required for the Special Survey corresponding to the age, kind and purpose of the unit and the actual scantlings, etc. of the main parts of the unit are to be measured as necessary.

### 2. Submission of plans and documents

At the Classification Survey after Construction, plans and documents as may be required for the Classification Survey during Construction are to be submitted. If plans and documents cannot be obtained, facilities are to be given for the Surveyor to take the necessary information from the unit.

### 3. Sea trials and stability experiments

At the Classification Survey after Construction, sea trials and stability experiments are to be carried out in accordance with the requirements specified in **204. 5**. However, sea trials and stability experiments may be dispensed with provided that sufficient information based on previous tests is available and neither alteration nor repair affecting sea trials and stability experiments has been made after such previous tests. The stability experiments for a column-stabilized unit may be required where deemed necessary by the Society even though the stability data is available from a similar unit.

## Section 3 Surveys

### 301. General

1. Units classed with the Society are to be subjected to the following surveys to maintain the classification.
  - (1) Special Surveys
  - (2) Annual Surveys
  - (3) Docking Surveys
  - (4) Surveys of Propeller Shaft and Stern Tube Shaft, Etc.
  - (5) Boiler Surveys
  - (6) Continuous Surveys
  - (7) Alteration Surveys
  - (8) Occasional Surveys
2. In the Annual Surveys and Special Surveys to hull and equipment of units, the requirements among those in **Pt 1, Ch 2 of Rules for the Classification of Steel Ships** which are deemed especially difficult to apply in relation to the type and purpose of units may be modified in their application under the approval of the Society on the occasion of plan approval for Classification Survey, submitting information in relation to the maintenance, corrosion control and inspection.
3. It is the responsibility of the owner/operator of the unit to report to the Society without delay any damage, defect or breakdown, which could invalidate the conditions for which a classification has been assigned so that it may be examined at the earliest opportunity by the Surveyor. All repairs found necessary by the Surveyor are to be carried out to his satisfaction.
4. Plan and procedures for Special Surveys, Continuous Surveys, and Drydocking Surveys(or In-water Survey in lieu of Docking Survey) are to be submitted for review in advance of the survey and made available on board. These should include drawings or forms for identifying the areas to be surveyed, the extent of hull cleaning, non-destructive testing locations(including NDT methods), nomenclature, and for the recording of any damage or deterioration found. Submitted data, after review by the Society, will be subject to revision if found to be necessary in light of experience.

### 5. Preparation for survey

- (1) Conditions for survey
  - (A) The Owner is to provide the necessary facilities for a safe execution of the survey. For confined space entry, the requirements of IACS PR No.37(Procedural Requirement for Confined Space Safe Entry) should be followed.
  - (B) Tanks and spaces are to be safe for access, i.e. gas freed, ventilated, and illuminated.
  - (C) In preparation for survey and thickness measurements and to allow for a thorough examination, all spaces are to be cleaned including removal from surfaces of all loose accumulated corrosion scale. Spaces are to be sufficiently clean and free from water, scale, dirt, oil residues etc. to reveal corrosion, deformation, fractures, damages, or other structural deterioration. However, those areas of structure whose renewal has already been decided by the Owner need only be cleaned and descaled to the extent necessary to determine the limits of the areas to be renewed.
  - (D) Sufficient illumination is to be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration.
  - (E) Where soft or semi-hard coatings have been applied, safe access is to be provided for the Surveyor to verify the effectiveness of the coating and to carry out an assessment of the conditions of internal structures which may include spot removal of the coating. When safe access cannot be provided, the soft or semi-hard coating is to be removed.

- (2) Access to structures
  - (A) For survey, means are to be provided to enable the Surveyor to examine the hull structure in a safe and practical way.
  - (B) For survey in void compartments and water ballast tanks, one or more of the following means for access, acceptable to the Surveyor, is to be provided:
    - (a) permanent staging and passages through structures
    - (b) temporary staging and passages through structures
    - (c) hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
    - (d) boats or rafts
    - (e) other equivalent means
- (3) Equipment for survey
  - (A) Thickness measurement is normally to be carried out by means of ultrasonic test equipment. The accuracy of the equipment is to be proven to the Surveyor as required. Thickness measurements are to be carried out by a firm approved by the Society in accordance with **Pt 1, Annex 1-11 of Guidance Relating to the Rules for the Classification of Steel Ships**.
  - (B) One or more of the following fracture detection procedures may be required if deemed necessary by the Surveyor:
    - (a) radiographic equipment
    - (b) ultrasonic equipment
    - (c) magnetic particle equipment
    - (d) dye penetrant
    - (e) other acceptable NDT Techniques
- (4) Surveys offshore or at anchorage
  - (A) Survey offshore or at anchorage may be accepted provided the Surveyor is given the necessary assistance from the personnel onboard.
  - (B) A communication system is to be arranged between the survey party in the tank or space and the responsible officer on deck. This system must also include the personnel in charge of ballast pump handling if boats or rafts are used.
  - (C) When boats or rafts are used, appropriate life jackets are to be available for all participants. Boats or rafts are to have satisfactory residual buoyancy and stability even if one chamber is ruptured. A safety check-list is to be provided.
  - (D) Surveys of tanks by means of boats or rafts may only be undertaken at the sole discretion of the Surveyor, who is to take into account the safety arrangements provided, including weather forecasting and unit response in reasonable sea conditions.

## 302. Annual Survey

### 1. Due range

The due date of Annual Surveys is to be in accordance with **Pt 1, Ch 2, 201.** of **Rules for the Classification of Steel Ships.**

### 2. Scope

The survey consists of an examination for the purpose of verifying, as far as practicable, that the hull, structure, equipment, and machinery are maintained in accordance with the applicable Rule requirements.

### 3. Hull, structure and equipment

At each Annual Survey the exposed parts of the hull, deck, deck house, structures attached to the deck, derrick substructure, including supporting structure, accessible internal spaces, and the applicable parts listed below are to be generally examined and placed in satisfactory condition as found necessary.

And the Surveyors are to be satisfied at each Annual Survey that no material alterations have been made to the unit, its structural arrangements, subdivision, superstructure, fittings, and closing appliances upon which the stability calculations or the load line assignment is based.

Suspect areas identified at previous surveys are to be examined. Thickness measurements are to be taken of the areas of substantial corrosion and the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. **Table 2.2** may be used as guidance for these additional thickness measurements. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed.

#### (1) All units

- (A) Accessible hatchways, manholes and other openings
- (B) Machinery casings and covers, companionways, and deck houses protecting openings
- (C) Portlights together with deadcovers, cargo ports and similar openings in hull sides, ends, or in enclosed superstructures
- (D) Ventilators, tank vent pipes together with flame screens, and overboard discharges from enclosed spaces
- (E) Watertight bulkheads and end bulkheads of enclosed superstructures
- (F) Closing appliances for all the above (A) to (E), including hatch covers, doors, together with their respective securing devices, dogs, sill, coamings and supports
- (G) Freeing ports together with bars, shutters and hinges
- (H) Protection of the crew, guard rails, lifelines, gangways, and deck houses accommodating crew
- (I) Windlass and attachment of anchor racks and anchor cables
- (J) The type, location and extent of corrosion control as well as effectiveness, and repairs or renewals should be reported and submitted to the Society at each survey.
- (K) Documentations on board including the stability data, etc. approved by the Society are to be confirmed to be kept on board.
- (L) Where the loading instrument having a stability computation capability is provided on board, the system is to be tested.

#### (2) Surface type units

In addition to the requirements of above (1) the following items are to be examined:

- (A) The hull and deck structure around the drilling well(moon-pool) and in vicinity of any other structural changes in section, slots, steps
- (B) Openings in the deck or hull
- (C) The back-up structure in way of structural members or sponsons connecting to the hull

#### (3) Self-elevating units

In addition to the requirements of above (1) the following items are to be examined:

- (A) Legs as accessible above the waterline
- (B) Jack house structures and attachment to upper hull or platform
- (C) Jacking or other elevating systems and leg guides, externally
- (D) Plating and supporting structure in way of leg wells

## (4) Column-stabilized unit

In addition to the requirements of above (1) the following items are to be examined:

(A) Columns, diagonal and horizontal braces together with any other parts of the upper hull supporting structure as accessible above the waterline

- (5) At the 1st Annual Survey after construction, column-stabilized and self-elevating units may be subject to examination of major structural components including non-destructive testing, as deemed necessary by the Society. If the Society deems such survey to be necessary, the extent should be agreed to by the Society and the Owner or operator prior to commencement of the Survey.

#### 4. Machinery

- (1) Propelling machinery of self-propelled units is to be surveyed in accordance with the requirements specified in **Pt 1, Ch 2, 203. and 502. 2** (4), (5), (8), (9) (a), (10) and (12) of **Rules for the Classification of Steel Ships**.

- (2) Machinery of units not provided with propelling machinery is to be complied with the following requirements.

(A) A general examination of machinery is to be carried out.

(B) The inspections and performance tests specified in **Pt 1, Ch 2, 203. 14, 20, 24 and 502. 2** (5), (8), (9) (a), (10) and (12) of **Rules for the Classification of Steel Ships** are carried out.

- (3) For units with propulsion-assist or dynamic positioning, propulsion-assist and dynamic positioning equipment should be surveyed on the basis of Annual Survey-Machinery in accordance with **Pt 1, Ch 2, Sec 5** of **Rules for the Classification of Steel Ships**.

- (4) Other tests and inspections considered necessary by the Surveyor are to be carried out.

#### 5. Electrical Equipment

A general examination of electrical machinery, the emergency sources of electrical power, the switchgear, and other electrical equipment, including operation of same is to be carried out. The operation of the emergency sources of power, including their automatic operation, is to be confirmed as far as practicable.

#### 6. Shipboard Automatic and Remote-Control Systems

A general examination of the automatic and remote-control system is to be made to the Surveyor's satisfaction. The machinery-space fire-detection and bilge water-level alarms are to be tested to confirm satisfactory operation.

#### 7. Special Features

A general examination of hazardous areas, remote shutdown arrangements, fire fighting systems where included in the Society's Rules, self-elevating systems, piping systems, and bilge systems is to be made.

### 303. Special Survey

#### 1. Due range

Special Surveys of hull, structure, equipment, and machinery are to be carried out at 5 year intervals to renew the Certificate of Classification.

- (1) The first Special Survey is to be completed within 5 years from the date of the initial Classification Survey and thereafter within 5 years from the credited date of the previous Special Survey. Extensions of class beyond the 5th year may be granted in exceptional circumstances (for a definition of exceptional circumstances, see **Pt 1, Ch 2, 401. 1** of **Rules for the Classification of Steel Ships**). In this case the next period of class will start from the expiry date of the Special Survey before the extension was granted.
- (2) For survey completed within 3 months before the expiry date of the Special Survey, the next period of class will start from the expiry date of the Special Survey. For survey completed more than three months before the expiry date of the Special Survey, the period of class will start from the survey completion date.
- (3) The Special Survey may be commenced at the 4th Annual Survey and be progressed with a view to completion by the 5th anniversary date. When the Special Survey is commenced prior to the 4th Annual Survey, the entire survey is to be completed within 15 months if such work is to be credited to the Special Survey.
- (4) A survey planning meeting is to be held prior to the commencement of the survey.
- (5) When considered necessary by the Society the interval between Special Surveys may be reduced.
- (6) Special Survey requirements of units of unusual design, in lay-up or in unusual circumstances will be determined on individual basis.
- (7) At the request of the Owner, and upon the Society's approval of the proposed arrangements, a system of Continuous Survey may be undertaken whereby the Special Survey requirements are carried out in regular rotation in accordance with the requirements of the Society to complete all the requirements of the particular Special Survey within a five year period. Any defects that may affect classification found during the survey, are to be reported to the Society and dealt with to the satisfaction of the Surveyor.

#### 2. Kind of Special Survey

The kinds of Special Surveys are to be in accordance with **Pt 1, Ch 2, 402.** of **Rules for the Classification of Steel Ships**.

#### 3. Scope

- (1) The Special Surveys shall include, in addition to Annual Survey requirements per **302.**, the following examinations, tests, and checks of sufficient extent to verify that the hull, structure, equipment, and machinery are in satisfactory condition and that the unit is in compliance with the applicable Rule requirements for the new period of class of 5 years to be assigned subject to proper maintenance and operation and the periodical surveys carried out at the due dates.
- (2) The examinations of the hull are to be supplemented by thickness measurements and testing as required, to verify that the structural integrity. The aim of the examination is to discover excessive diminution, substantial corrosion, significant deformation, fractures, damages, or other structural deterioration, that may be present.
- (3) The Special Survey is to include examination of underwater parts per **304.**

#### 4. Special Survey No. 1

(1) Hull, structure and equipments

(A) All units

The following parts are to be examined:

- (a) The hull or platform structure including tanks, watertight bulkheads and deck, cofferdams, void spaces, sponsons, chain lockers, duck keels, helicopter deck and its supporting structure, machinery spaces, peak spaces, steering gear spaces, and all other internal spaces are to be examined externally and internally for damage, fractures or excessive diminution. Thickness gauging of plating and framing, non-destructive testing and tightness testing may be required where wastage is evident or suspected.
- (b) All tanks, compartments and free-flooding spaces throughout the unit are to be examined externally and internally for excess diminution or damage.
- (c) Internal examinations of spud cans and mats may be specially considered.
- (d) Watertight integrity of tanks, bulkheads, hull, decks and other compartments is to be verified by visual inspection.
- (e) Suspect areas and critical structural areas should be examined and may be required to be tested for tightness, non-destructive tested or thickness gauged.
- (f) All special and primary application structures (as defined in **Ch 3, Sec 10**) and identified critical structural areas are to be subjected to Close-up Survey.
- (g) Tanks and other normally closed compartments are to be ventilated, gas freed and cleaned as necessary to expose damages and allow meaningful examination and thickness gauged in case of excessive diminution.
- (h) Internal examination and testing of void spaces, compartments filled with foam or corrosion inhibitors, and tanks used only for lube oil, light fuel oil, diesel oil, fresh water, drinking water or other non-corrosive products may be waived provided that upon a general examination the Surveyor considers their condition to be satisfactory. External thickness gauging may be required to confirm corrosion control.
- (i) Structures such as derrick substructure and supporting structure, jack house, deck houses, superstructures, helicopter landing areas, raw water (sea water intake) towers and their respective attachments to the deck or hull.
- (j) Windlass and attachments of anchor racks and anchor cable fairleads.
- (k) Foundations and supporting headers, brackets, and stiffeners for drilling related apparatus, where attached to hull, deck, superstructure or deck house.
- (l) Thickness gaugings are to be carried out where wastage is evident or suspect.
- (m) Where provided, the condition of corrosion prevention system of ballast tanks is to be examined. Where a hard protective coating is found in POOR condition and it is not renewed, where soft or semi-hard coating has been applied, or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined at annual intervals. Thickness measurements are to be carried out as deemed necessary by the Surveyor.
- (n) Thickness measurements are to be carried out in accordance with **1, 2 or 3** of **Table 2.1** as applicable. The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to determine areas of substantial corrosion. **Table 2.2** may be used as guidance for these additional thickness measurements. These extended thickness measurements are to be carried out before the survey is credited as completed.
- (o) Where the loading instrument having a stability computation capability is provided on board, all approved test loading conditions are to be examined.



**Table 2.1 Minimum requirements for Thickness Measurements at Special Survey**

**1. Surface type units**

Special Survey No. 1	Special Survey No. 2	Special Survey No. 3	Special Survey No. 4 and Subsequent
1. Suspect areas throughout the unit	<p>1. Suspect areas throughout the unit</p> <p>2. One transverse section of deck plating in way of the moon pool opening within the amidships <math>0.6 L</math>, together with internals in way as deemed necessary by the Surveyor. Where unit is configured with side ballast tanks, the plating and internals of the side ballast tanks are also to be gauged in way of the transverse section chosen.</p> <p>3. Moon pool boundary bulkhead plating</p>	<p>1. Suspect areas throughout the unit</p> <p>2. Two transverse sections(girth belts) of deck, bottom and side plating in way of moon pool and one hatch opening within the amidships <math>0.6 L</math>, together with internals in way as deemed necessary by the Surveyor. Where unit is configured with side ballast tanks, the plating and internals of the side ballast tanks are also to be gauged in way of the transverse sections chosen, Remaining internals in the side ballast tanks are to be gauged as deemed necessary by the Surveyor.</p> <p>3. Moon pool boundary bulkhead plating</p> <p>4. Internals in forepeak tank and afterpeak tank as deemed necessary by the Surveyor</p>	<p>1. Suspect areas throughout the unit</p> <p>2. A minimum of three transverse sections(girth belts) of deck, bottom, side and longitudinal bulkhead plating in way of the moon pool and other areas within amidships <math>0.5 L</math>, together with internals in way( including in perimeter ballast tanks, where fitted in way of the transverse sections chosen)</p> <p>3. Moon pool boundary bulkhead plating</p> <p>4. Internals in forepeak and afterpeak tanks as deemed necessary by the Surveyor</p> <p>5. Lowest strake of all transverse bulkheads in hold spaces. Remaining bulkhead plating are to be gauged as deemed necessary by the Surveyor.</p> <p>6. All plates in two wind and water stakes, port and starboard, full length</p> <p>7. All exposed main deck plating full length and all exposed first-tier superstructure deck plating(poop, bridge and fore-castle decks)</p> <p>8. All keel plates full length plus additional bottom plating as deemed necessary by the Surveyor, particularly in way of cofferdams and machinery spaces</p> <p>9. Duck keel or pipe tunnel plating or pipe tunnel plating and internals as deemed necessary by the Surveyor</p> <p>10. Plating of sea chests. Shell plating in way of overboard discharges as deemed necessary by the Surveyor.</p>

(NOTES)

- 1) Thickness measurement locations are to be selected to provide the best representative sampling of areas likely to be most exposed to corrosion, considering ballast history and arrangement and condition of protective coatings.
- 2) Thickness measurements of internals may be specially considered by the Surveyor if the hard protective coating is in GOOD condition.
- 3) For units less than 100 meters in length, the number of transverse sections required at Special Survey No. 3 may be reduced to one(1), and the number of transverse sections required at Special Survey No. 4 and subsequent Special Surveys may be reduced to two(2).
- 4) For units more than 100 meters in length, at Special Survey No. 3, thickness measurements of exposed deck plating within amidship  $0.5 L$  may be required.

**Table 2.1 Minimum requirements for Thickness Measurements at Special Survey (continued)**  
**2. Self-elevating units**

Special Survey No. 1	Special Survey No. 2	Special Survey No. 3	Special Survey No. 4 and Subsequent
1. Suspect areas throughout the unit(particular attention is to be paid to the legs in way of the splash zone <sup>2)</sup> )	1. Suspect areas throughout the unit  2. Legs in way of splash zone <sup>2)</sup>  3. Primary structural members <sup>1)</sup> where wastage is evident        4. Representative thickness measurements of upper hull deck and bottom plating and internal of one pre-load (ballast) tank	1. Suspect areas throughout the unit  2. Legs in way of splash zone <sup>2)</sup>  3. Representative thickness measurements, throughout, of special portions of structural members and primary structural members <sup>1)</sup>  4. Leg well structure  5. Representative thickness measurements of deck, bottom and side shell plating of hull and mat    6. Representative thickness measurements of upper hull deck and bottom plating and internals of at least two pre-load (ballast) tanks	1. Suspect areas throughout the unit  2. Legs in way of splash zone <sup>2)</sup>  3. All special portions of structural members and primary structural members <sup>1)</sup>  4. Leg well structure  5. Representative thickness measurements of deck, bottom and side shell plating of hull and mat  6. Substructure of derrick as deemed necessary by the Surveyor  7. Representative thickness measurements of upper hull deck and bottom plating and internals of all pre-load (ballast) tanks
(NOTES) 1) Categories of structural members(primary structural members, secondary structural members and special portions of structural members) are defined in <b>Ch 3, 1002</b> . 2) Splash zone is to be considered as the structural area that has been periodically in and out of the water when the unit was at its operating depth, most of the time during the past five-year period. Based on operational record of the unit, additional zones may also be gauged.			

Table 2.1 Minimum requirements for Thickness Measurements at Special Survey (continued)

## 3. Column-stabilized units

Special Survey No. 1	Special Survey No. 2	Special Survey No. 3	Special Survey No. 4 and Subsequent
1. Suspect areas throughout the unit  2. Columns and bracings where wastage is evident in splash zone <sup>2)</sup>	1. Suspect areas throughout the unit  2. Representative thickness measurements of columns and bracings in splash zone <sup>2)</sup> together with internals in way as deemed necessary by the Surveyor  3. Special portions of structural members and primary structural members <sup>1)</sup> where wastage is evident	1. Suspect areas throughout the unit  2. One transverse section (girth belt) of each two columns and two bracings in splash zone <sup>2)</sup> together with internals in way as deemed necessary by the Surveyor  3. Representative thickness measurements, throughout, of special portions of structural members and primary structural members <sup>1)</sup>  4. Lower hulls in way of mooring lines where wastage is evident  5. One transverse section (girth belt) of each lower hull between one set of columns	1. Suspect areas throughout the unit  2. One transverse section (girth belt) of each one-half of the columns and bracings in splash zone <sup>2)</sup> and internals in way as deemed necessary by the Surveyor (i.e., gauge half of the unit's columns and bracings in splash zone <sup>2)</sup> )  3. All special portions of structural members and primary structural members <sup>1)</sup>  4. Lower hulls in way of mooring lines where wastage is evident  5. One transverse section (girth belt) of each lower hull between one set of columns  6. Representative thickness measurements of sub-structure of drilling derrick
(NOTES) 1) Categories of structural members(primary structural members, secondary structural members and special portions of structural members) are defined in <b>Ch 3, 1002</b> . 2) Splash zone is to be considered as the structural area that has been periodically in and out of the water when the unit was at its operating depth, most of the time during the past five-year period. Based on operational record of the unit, additional zones may also be gauged.			

Table 2.2 Requirements for extent of additional thickness measurement at those areas of substantial corrosion

Structural Member	Extent of Measurement	Pattern of Measurement
Plating	Suspect area and adjacent plates	5 point pattern over 1 m <sup>2</sup>
Stiffeners	Suspect area	3 measurements each in line across web and flange

## (B) Surface type units

In addition to the requirements of (A) the following items are to be examined:

- (a) Structural appendages and ducts for positioning units.

## (C) Self-elevating units

In addition to the requirements of (A) the following items are to be examined:

- (a) All legs including chords, diagonal and horizontal braces, gussets, racks, joints, together with leg guides. Tubular or similar type legs are to be examined externally and internally, together with internal stiffeners and pinholes as applicable.
- (b) Structure in, around and under jack house and leg wells. Non-destructive testing of these areas may be required.
- (c) Leg jacking or other elevating systems externally. Non-destructive testing of these areas may be required.
- (d) Leg connections to bottom mats or spud cans, including non-destructive testing of leg connections to mats or spud cans
- (e) Jetting piping systems or other external piping, particularly where penetrating mats or spud cans
- (f) Spud cans or mats. Where the spud cans or mat are partly or entirely obscured below the mud line where the Special Survey is otherwise being completed, consideration may be given to postponement of these examinations until the next rig move.

## (D) Column-stabilized units

In addition to the requirements of (A) the following items are to be examined:

- (a) Connections of columns and diagonals to upper hull, structure or platform and lower hull, structure or pontoons. Joints of supporting structure including diagonals, braces and horizontals, together with gussets and brackets. Internal continuation or back-up structure for the above. Non-destructive examination may be required of these areas.

## (2) Machinery

## (A) Non-self-propelled units

In addition to the requirements for Annual Surveys, at each Special Survey, special attention is to be given to the following items as applicable:

- (a) All openings to the sea, including sanitary and other overboard discharges, together with cocks and valves connected therewith are to be examined internally and externally while the Unit is in drydock, or at the time of underwater examination in lieu of drydocking, and the fastenings to the shell plating are to be renewed when considered necessary by the Surveyor.
- (b) Pumps and pumping arrangements, including valves, cocks, pipes and strainers are to be examined. Non-metallic flexible expansion pieces in the main salt water circulating system are to be examined internally and externally. The Surveyor is to be satisfied with the operation of the bilge and ballast systems. Other systems are to be tested as considered necessary.
- (c) The foundations of machinery are to be examined.
- (d) Heat exchangers and other unfired pressure vessels within the scope of classification are to be examined, opened up or thickness gauged and pressure tested as considered necessary, and associated relief valves proved operable. Evaporators that operate with a vacuum on the shell need not be opened, but may be accepted on basis of satisfactory external examination and operational test or review of operating records.

## (B) Self-propelled Units

In addition to the requirements for non-propelled units, the main and auxiliary propulsion machinery, including associated pressure vessels should be surveyed. In addition, examination of the steering machinery is to be carried out, including an operational test and checking or relief-valve settings. The machinery may be required to be opened for further examination as considered necessary by the Surveyor.

## (C) Units with Propulsion - Assist or Dynamic Position

Propulsion-assist and dynamic positioning equipment should be surveyed on the basis of Special Survey-Machinery in accordance with **Pt 1, Ch 2, Sec 5** of **Rules for the Classification of Steel Ships**.

## (3) Other equipments

## (A) Electrical Equipment

In addition to the requirements for Annual Surveys, at each Special Survey, special attention is to be given to the following items as applicable:

- (a) Fittings and connections on main switchboards and distribution panels are to be examined, and care is to be taken to see that no circuits are overfused.
- (b) Cables are to be examined as far as practicable without undue disturbance of fixtures.
- (c) All generators are to be run under load, either separately or in parallel. Switches and circuit breakers are to be tested.
- (d) All equipment and circuits are to be inspected for possible development of physical changes or deterioration. The insulation resistance of the circuits is to be measured between conductors and between conductors and ground and these values compared with those previously measured.
- (e) Electrical auxiliaries installed for vital purposes, generators and motors are to be examined and their prime movers opened for inspection. The insulation resistance of each generator and motor is to be measured.
- (f) The windings of main propulsion generators and motors are to be thoroughly examined and found or made dry and clean. Particular attention is to be paid to the ends of all windings of stators and rotors.
- (g) Emergency power systems are to be examined and tested.

## (B) Shipboard Automatic and Remote-Control Systems

In addition to the requirements of Annual Surveys the following parts are to be examined:

- (a) Control Actuators: All mechanical, hydraulic, and pneumatic control actuators and their power systems are to be examined and tested as considered necessary.
- (b) Electrical equipments: The insulation resistance of the windings of electrical control motors or actuators is to be measured, with all circuits of different voltages above ground being tested separately to the Surveyor's satisfaction.
- (c) Unattended Plants: Control systems for unattended machinery spaces are to be subjected to dock trials at reduced power on the propulsion engine to verify the proper performance of all automatic functions, alarms, and safety systems.

## (C) Special Features (All Types)

Units may have many items of machinery and electrical equipment not found on conventional vessels. Certain of these items are required for classification even if the unit is without propulsion machinery. Items to be especially examined and reported upon at all Special Surveys are as follows:

## (a) Hazardous Areas

- (i) Enclosed hazardous areas such as those containing open active mud tanks, shale shakers, degassers and desanders are to be examined and doors and closures in boundary bulkheads verified as effective.
- (ii) Electric lighting, electrical fixtures, and instrumentation are to be examined, proven satisfactory and verified as explosion-proof or intrinsically safe.
- (iii) Ventilating systems including ductwork, fans, intake and exhaust locations for enclosed restricted areas are to be examined, tested and proven satisfactory.
- (iv) Ventilating-air alarm systems to be proven satisfactory.
- (v) Electrical motors are to be examined including closed-loop ventilating systems for large d-c motors.
- (vi) Automatic power disconnect to motors in case of loss of ventilating air is to be proved satisfactory.

## (b) Remote shutdown arrangements

- (i) Remote shutdown for fuel-oil transfer service pumps and ventilating equipment are to be proved satisfactory.
- (ii) Oil tank outlet valves where required to be capable of being remotely closed are to be proved satisfactory.
- (iii) Emergency switches for all electrical equipment including main and emergency generators, except alarm and communication systems and lighting in vital areas such as escape routes and landing platforms, are to be proved satisfactory.

- (c) Fire fighting systems

A general examination of the fire detection and extinguishing systems is to be made in order that the Surveyor may be satisfied with its efficient state. The following items are to be especially examined.

  - (i) Fire hoses, nozzles, and spanners at each fire station.
  - (ii) Servicing of all portable extinguishers.
  - (iii) Weighing and re-charging as necessary of all dry chemical and CO<sub>2</sub> extinguishers.
  - (iv) Fire pumps and piping including operation and capacity.
  - (v) Alarm system including fire and gas detection.
- (d) Self-elevating Systems

On self-elevating units, the elevating systems are to be examined and reported on. Pinions and gears of the climbing pinion gear train of rack and pinion systems are to be examined, as far as practicable, to the Surveyor's satisfaction by an effective crack detection method.
- (e) Piping Systems - Piping systems used solely for drilling operations and complying either with the Society's requirements or a recognized standard are to be examined, as far as practical, operationally or hydrostatically tested to working pressure, to the satisfaction of the Surveyor.
- (f) Miscellaneous - Bilge alarm systems, if fitted, to be tested.

#### 5. Special Survey No. 2 and Subsequent Special Surveys

In addition to the requirements for Special Survey No.1, following items should be surveyed.

- (1) These Surveys are to be at least as comprehensive as Special Survey No. 1, with special attention being given to the condition and thickness of material in high corrosion areas.
- (2) Representative gaugings will be required as per **Table 2.1**.
- (3) Special attention should be paid to splash zones on structure, legs or related structure, and in ballast tanks, pre-load tanks, free-flooding spaces, spud cans and mats.

## 304. Docking Surveys

### 1. Due range

- (1) There is to be a minimum of two examination of the outside of the unit's bottom and related items during each five-year special survey period. One such examination is to be carried out in conjunction with the Special Survey. In all cases the interval between any two such examinations is not to exceed 36 months. For units operating in salt water for less than six months each year, the survey interval may be increased by the Society.
- (2) Consideration may be given at the discretion of the Society, to any special circumstances justifying an extension of the interval.
- (3) Proposals for alternative means of examining the unit's bottom and related items while afloat may be considered, provided they are in general agreement with **309**.

### 2. Parts to be Examined

- (1) Surface type units(ship or barge type units)
  - (A) External surfaces of the hull, keel, stem, stern frame, rudder, nozzles, and sea strainers are to be selectively cleaned to the satisfaction of the attending Surveyor and examined together with appendages, the propeller, exposed parts of stern bearing assembly, rudder pintle and gudgeon securing arrangements, sea chest and strainers, and their fastenings.
  - (B) Propeller shaft bearing, rudder bearing, and steering nozzle clearances are to be ascertained and recorded.
  - (C) Nonmetallic expansion joints in piping systems, if located in a system which penetrates the unit's side and both the penetration and the nonmetallic expansion joint are located below the deepest load waterline, as applicable, should be inspected in accordance with **Ch 5, 203. 10 (2)**.
- (2) Self-elevating units
  - (A) External surfaces of the upper hull or platform, spud cans, mat, underwater areas of legs, together with their connections as applicable, are to be selectively cleaned to the satisfaction of the attending Surveyor and examined.
  - (B) At each Docking Survey or equivalent, after Special Survey No. 2, the Surveyor is to be satisfied with the condition of the internal structure of the mat or spud cans. Leg connections to mat and spud cans are to be examined at each Docking Survey or equivalent. Non-destructive testing may be required of areas considered to be critical by the Society or found to be suspect by the Surveyor.
  - (C) Nonmetallic expansion joints in piping systems, if located in a system which penetrates the unit's side and both the penetration and the nonmetallic expansion joint are located below the deepest load waterline, as applicable, should be inspected in accordance with **Ch 5, 203. 10 (2)**.
- (3) Column-stabilized units
  - (A) External surfaces of the upper hull or platform, footings, pontoons or lower hulls, underwater areas of columns, bracing and their connections, sea chests, and propulsion units as applicable, are to be selectively cleaned and examined to the satisfaction of the attending Surveyor.
  - (B) Non-destructive testing may be required of areas considered to be critical by the Society or found to be suspect by the Surveyor.
  - (C) Nonmetallic expansion joints in piping systems, if located in a system which penetrates the unit's side and both the penetration and the nonmetallic expansion joint are located below the deepest load waterline, as applicable, should be inspected in accordance with **Ch 5, 203. 10 (2)**.

### 3. Ballast Spaces

In conjunction with Docking Surveys(or equivalent) after Special Survey No. 1 and between subsequent Special Surveys, the following ballast spaces are to be internally examined, thickness gauged, placed in satisfactory condition as found necessary, and reported upon. If such examination reveals no visible structural defects, the examination may be limited to a verification that the corrosion prevention arrangements remain effective.

#### (1) All units

Particular attention is to be given to corrosion prevention systems in ballast spaces, free-flooding areas and other locations subjected to sea water from both sides.

- (2) Surface type units(identical)  
For surface type units, one peak tank and at least two other representative ballast tanks between the peak bulkheads used primarily for water ballast.
- (3) Self-elevating units  
Representative ballast tanks or free-flooding compartments in mat or spud cans, if accessible, and at least two representative hull pre-load tanks.
- (4) Column-stabilized units  
Representative ballast tanks in footings, lower hulls, or free-flooding compartments as accessible, and at least two ballast tanks in columns or upper hull, if applicable.

### 305. Surveys of Propeller Shaft and Stern Tube Shaft, Etc.

#### 1. Due range

Refer to the schedule in **Pt 1, Ch 2, Sec 7** of **Rules for the Classification of Steel Ships** for tailshaft surveys.

#### 2. Extension of Intervals of Tailshaft Surveys

Surveys are to be carried out in accordance with the Rules of the Society, except that in the case of the unit, due to low running hours on tailshafts, extended intervals between tailshaft surveys may be considered based on:

- (1) Satisfactory diver's external examination of stern bearing and outboard seal area including wear-down check as far as is possible.
- (2) Internal examination of the shaft area (inboard seals) in propulsion room(s).
- (3) Confirmation of satisfactory lubricating oil records (oil loss rate, contamination).
- (4) Shaft seal elements are examined/replaced in accordance with seal manufacturer's recommendations.

#### 3. Other propulsion systems

Other propulsion systems shall be surveyed according to **Pt 1, Ch 2, 701. 3** of **Rules for the Classification of Steel Ships**.

### 306. Boiler Surveys

#### 1. Survey Interval

- (1) Water-Tube boiler for propulsion
  - (A) For units fitted with more than one boiler the interval between surveys is, in general, to be 2-1/2 years.
  - (B) For units fitted with one boiler, the interval between survey is, in general, to be 2.5 years for the first 7.5 years; thereafter the boiler is to be surveyed within 3 months before or after every year.
- (2) Waste-heat or fired auxiliary boilers used for the operation of the vessel, within the scope of classification, are to be surveyed at intervals, in general, of 2.5 years.

#### 2. Extension of survey

The Boiler Surveys may be extended upon the request of an Owner within 6 months except for the boilers which are to be surveyed annually.

#### 3. Survey items

The survey items in accordance with **Pt 1, Ch 2, Sec 8, 802.** of **Rules for the Classification of Steel Ships**.



### 307. Survey Preplanning and Record Keeping

1. A specific Survey Program for Special Surveys and Continuous Surveys must be worked out in advance of the Special Survey by the Owner in cooperation with the Society. The Survey Program shall be in written format.
2. Plans and procedures for Docking Surveys (or In-water Survey in lieu of Docking Survey) are to be submitted for review in advance of the survey and made available on board. These should include drawings or forms for identifying the areas to be surveyed, the extent of hull cleaning, non-destructive testing locations (including NDT methods), nomenclature, and for the recording of any damage or deterioration found. Submitted data, after review by the Society, will be subject to revision if found to be necessary in light of experience.

### 308. Occasional Surveys

#### 1. Damage Survey

- (1) It is the responsibility of the Owner/operator of the unit to report to the Society without delay any damage, defect or breakdown, which could invalidate the conditions for which a classification has been assigned so that it may be examined at the earliest opportunity by the Society's Surveyor(s). All repairs found necessary by the Surveyor are to be carried out to his satisfaction.

#### 2. Repairs

- (1) Where repairs to hull, legs, columns or other structures, machinery or equipment, which affect or may affect classification, are planned in advance to be carried out, a complete repair procedure including the extent of proposed repair and the need for Surveyors attendance is to be submitted to and agreed upon by the Society reasonably in advance. Failure to notify the Society, in advance of the repairs, may result in suspension of the unit's classification until such time as the repair is redone or evidence submitted to satisfy the Surveyor that the repair was properly carried out. This applies also to repairs during voyage or on site.
- (2) The above is not intended to include maintenance and overhaul to hull, other structures, machinery and equipment in accordance with recommended manufacturers procedures and established marine practice and which does not require Society approval; however, any repair as a result of such maintenance and overhauls which affects or may affect classification is to be noted in the ships log and submitted to the Surveyor.

#### 3. Lay-up and Reactivation Surveys

- (1) When the Society is notified by the Owner that a unit has been laid-up, this status will be noted in the unit's survey status and surveys falling due during lay-up may then be held in abeyance until the unit reactivates, at which time they are to be brought up-to-date.
- (2) Units which have been laid up and are returning to active service, regardless of whether the Society has been previously informed that the unit has been in lay-up, a Reactivation Survey is required. The requirements for the Reactivation Survey are to be specially considered in each case, having due regard being given to the status of surveys at the time of the commencement of lay-up, the length of the lay-up period and the conditions under which the unit has been maintained during that period.

#### 4. Alterations

No alterations which may affect classification are to be made to the hull or machinery of a classed unit unless plans of proposed alterations are submitted and approved by the Society before the work of alterations is commenced. Such work is to be carried out in accordance with approved plans and tested on completion as required by the Society and to the satisfaction of the Surveyor.

#### 5. Welding and Replacement of Materials

- (1) Welding of steels, including high strength structural steel, is to be to the satisfaction of the Society.
- (2) Welding or other fabrication performed on steels of special characteristics or repairs or renewals of such steel or in areas adjacent to such steel is to be accomplished with procedures approved by the Society considering the special materials involved. Substitution of steels differing from those originally installed is not to be made without approval by the Society.

### 309. In-water Survey in lieu of Docking Survey

#### 1. General

Following are the procedures and conditions under which a properly conducted In-water Survey may be credited as equivalent to a Docking Survey.

Where in this case, an examination of the entire unit below the waterline is to be carried out by a suitably qualified diver using closed-circuit television with two-way communication capable of being monitored by the Surveyor.

#### 2. Conditions

##### (1) Limitations

In-water Survey in lieu of Docking Survey may not be acceptable where there is record of abnormal deterioration or damage to the underwater structure; or where damage affecting the fitness of the unit is found during the course of the survey.

##### (2) Thickness Gauging and Non-Destructive Testing

Underwater or internal thickness gaugings of suspect areas may be required in conjunction with the In-water Survey. Means for underwater non-destructive testing may also be required for fracture detection.

##### (3) Plans and Data

Plans and procedures for the Docking Survey(In-water Survey) are to be submitted for review in advance of the survey and made available on board. These should include drawings or forms for identifying the areas to be surveyed, the extent of underwater cleaning, non-destructive testing locations(including NDT methods), nomenclature, and for the recording of any damage or deterioration found.

##### (4) Underwater Conditions

The in-water visibility and the cleanliness of the hull below the waterline is to be clear enough to permit a meaningful examination which allows the Surveyor and diver and/or ROV pilot to determine the condition of the plating, appendages and the welding. The Society is to be satisfied with the methods of orientation of the divers/ROVs on the plating, which should make use where necessary of permanent markings on the plating at selected points. Overall or spot cleaning may be required.

#### 3. Physical Features

The following physical features are to be incorporated into the unit's design in order to facilitate the In-water Survey. When verified they will be noted in the unit's classification for reference at subsequent surveys.

##### (1) Stern Bearing

For self-propelled units, means are to be provided for ascertaining that the seal assembly on oil-lubricated bearings is intact and for verifying that the clearance or wear-down of the stern bearing is not excessive. For use of the wear-down gauges, up-to-date records of the base depths are to be maintained on board. Whenever the stainless-steel seal sleeve is renewed or machined, the base readings for the wear-down gauge are to be re-established and noted in the vessel's records and in the survey report.

##### (2) Rudder Bearings

For self-propelled units with rudders, means and access are to be provided for determining the condition and clearance of the rudder bearings, and for verifying that all parts of the pintle and gudgeon assemblies are intact secure. This may require bolted access plates and a measuring arrangement.

##### (3) Sea Suctions

Means are to be provided to enable the diver to confirm that the sea suction openings are clear. Hinged sea suction grids would facilitate this operation.

##### (4) Sea Valves

For the Docking Survey(In-water Survey) associated with the Special Survey, means must be provided to examine any sea valve.

#### 4. Procedures

(1) Exposed Areas

An examination of the outside of the structure above the waterline is to be carried out by the Surveyor. Means and access are to be provided to enable the Surveyor to accomplish visual inspection and non-destructive testing as necessary.

(2) Underwater Areas

An examination of the entire unit below the waterline is to be carried out by an approved service supplier in accordance with **Guidance Relating to the Rules for Classification of Steel Ships Pt 1, Annex 1-11.**

(3) Damage Areas

Damage areas are to be photographed. Internal examination, measurements, marking and thickness gauging of such locations may be necessary as determined by the attending Surveyor. Means are to be provided for location, orienting and identifying underwater surfaces in photographs or on video tapes.

#### 5. Alternatives

The Society is prepared to consider alternatives to the above guidelines including remotely operated vehicles, provided means and details for accomplishing results are not less effective.

- (1) **309.** would be applicable to all unit types due to contents of **Par 2 (3)** - Plans and Data. ↴

## CHAPTER 3 CONSTRUCTION, STRENGTH AND MATERIALS

### Section 1 General

#### 101. Application

1. Where 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 the Society.
2. Unless otherwise specially specified in this rule, the relevant requirements specified in **Rules for the Classification of Steel Ships** and **Rules for the Classification of Steel Barges** are correspondingly applied.

### Section 2 Access

#### 201. General

1. Each space within the unit should be provided with at least one permanent means of access to enable, throughout the life of a unit, overall and close-up inspections and thickness measurements of the unit's structures to be carried out by the Administration, the company, and the unit's personnel and others as necessary. Such means of access should comply with the provisions of paragraph 204. and with the Technical provisions for means of access for inspections, adopted by the Maritime Safety Committee by resolution MSC.133(76), as may be amended by the Organization.
2. Where a permanent means of access may be susceptible to damage during normal operations or where it is impracticable to fit permanent means of access, the Administration may allow, in lieu thereof, the provision of movable or portable means of access, as specified in the Technical provisions, provided that the means of attaching, rigging, suspending or supporting the portable means of access forms a permanent part of the unit's structure. All portable equipment should be capable of being readily erected or deployed by the unit's personnel.
3. The construction and materials of all means of access and their attachment to the unit's structure should be to the satisfaction of the Administration. The means of access should be subject to inspection prior to, or in conjunction with, its use in carrying out surveys in accordance with **Ch 2**.

#### 202. Safe access to holds, tanks, ballast tanks and other spaces

1. Safe access to holds, cofferdams, tanks and other spaces should be direct from the open deck and such as to ensure their complete inspection. Safe access may be from a machinery space, pump-room, deep cofferdam, pipe tunnel, hold, double hull space or similar compartment not intended for the carriage of oil or hazardous materials where it is impracticable to provide such access from an open deck.
2. Tanks, and subdivisions of tanks, having a length of 35 m or more, should be fitted with at least two access hatchways and ladders, as far apart as practicable. Tanks less than 35 m in length should be served by at least one access hatchway and ladder. When a tank is subdivided by one or more swash bulkheads or similar obstructions which do not allow ready means of access to the other parts of the tank, at least two hatchways and ladders should be fitted.
3. Each hold should be provided with at least two means of access as far apart as practicable. In general, these accesses should be arranged diagonally, e.g., one access near the forward bulkhead on the port side, the other one near the aft bulkhead on the starboard side.

### 203. Access manual

1. A unit's means of access to carry out overall and close-up inspections and thickness measurements should be described in an access manual which may be incorporated in the unit's operating manual. The manual should be updated as necessary, and an updated copy maintained on board. The structure access manual should include the following for each space:
  - (1) plans showing the means of access to the space, with appropriate technical specifications and dimensions;
  - (2) plans showing the means of access within each space to enable an overall inspection to be carried out, with appropriate technical specifications and dimensions. The plans should indicate from where each area in the space can be inspected;
  - (3) plans showing the means of access within the space to enable close-up inspections to be carried out, with appropriate technical specifications and dimensions. The plans should indicate the positions of critical structural areas, whether the means of access is permanent or portable and from where each area can be inspected;
  - (4) instructions for inspecting and maintaining the structural strength of all means of access and means of attachment, taking into account any corrosive atmosphere that may be within the space;
  - (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 means of access in a safe manner;
  - (7) an inventory of all portable means of access; and
  - (8) records of periodical inspections and maintenance of the unit's means of access.
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.

### 204. General technical specifications

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 × 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.
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 × 800 mm at a height of not more than 600 mm from the bottom shell plating unless gratings or other footholds are provided.

## Section 3 Design Loads

### 301. Loads

1. The modes of operation for each unit are to be investigated using realistic loading conditions including gravity loading with relevant environmental loading for its intended areas of operation. The following environmental considerations should be included where applicable: wind, wave, current, ice, seabed conditions, temperature, fouling and earthquake.
2. Drawings of a unit are to be approved for the environmental conditions. Where possible, the above design environmental conditions apply to units and structural members should be based upon significant data with a period of recurrence of at least 50 years for the most severe anticipated environment.
3. Results from relevant model tests may be used to substantiate or amplify calculations.
4. Limiting design data for each mode of operation should be stated in the operating manual.

### 302. Wind loads

Sustained and gust wind velocities, as relevant, should be considered when determining wind loading. Pressures and resultant forces should be calculated by the method referred to in section 4.2 or by some other method to the satisfaction of the Society.

### 303. Wave loads

1. Design wave criteria should be described by design wave energy spectra or deterministic design waves having appropriate shape and size. The design wave height to be used for wave load calculation may be specified by the Owner under the approval of the Society. The design wave period to be used for wave load calculation is to be the period which gives the maximum effect to the unit.
2. The wave forces utilized in the design analysis should include the effects of immersion, heeling and accelerations due to motion.
3. In calculating wind loads, the following requirements are to be applied.
  - (1) The wave loads are to be calculated, based on acceptable wave theories appropriate to the design depth of water at the operation area subject to the approval by the Society. The wave loads, however, may be determined from the tank test approved by the Society on a model of the unit.
  - (2) Waves from all directions are to be considered 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.

### 304. Current loads

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

### 305. Loads due to vortex shedding

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

### 306. 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 3.1**.

**Table 3.1 Deck Loads**

Kind of deck	Minimum load (kN/m <sup>2</sup> )
Helicopter deck	2
Accommodation spaces (including corridors and similar spaces)	4.5
Work areas and machinery spaces	9
Storage areas	13

### 307. Other loads

Other relevant loads should be determined in a manner to the satisfaction of the Society.

## Section 4 Calculation of Strength

### 401. Structural analysis

The unit is to be analysed by the method deemed appropriate by the Society for a sufficient number of conditions including all conditions specified in **Ch 1, 107**.

### 402. Analysis of units resting on the sea bed

Units designed to rest on the sea bed are to be analysed 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.

### 403. Plastic analysis

Scantlings of structural members designed on the basis of plastic analysis are to be at the discretion of the Society.

### 404. Buckling strength

Structural members subject to in-plane loads are to have the sufficient strength against buckling in consideration of their shapes, scantlings, boundary conditions, etc.

### 405. Fatigue strength

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

### 406. Stress concentration

1. The effect of local stress concentrations is to be considered for notches in members or discontinuous parts of structure.
2. Where the tensile stresses acting on the thickness direction of plating, plate material with suitable through-thickness properties is required in accordance with **Pt 2, Ch 1 of Rules for the Classification of Steel Ships**.

### 407. Bending stress

1. When calculating bending stresses of structural members, the effective width of the plate is to be determined in accordance with the requirements in **Pt 3, Ch 1, 602. of Rules for the Classification of Steel Ships**.
2. Where subjected to eccentric loadings, an increase of bending stress due to the deflections of the structural members is to be taken into account.

### 408. Shearing stress

When calculating shearing stresses in bulkheads, plate girder webs, 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.

### 409. Combination of stresses

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.

- The scantlings are to be determined on the basis of criteria which combine, in a rational manner deemed appropriate by the Society, the individual stress components acting on the respective structural members. (See **410**.)

#### 410. Equivalent stress

- For plate structures, members may be designed according to the equivalent stress criterion, where the equivalent stress is obtained from the following formula.

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

$\sigma_x, \sigma_y$  : Stress in the  $x$ - and  $y$ -directions at the centre of thickness of the plate, respectively (N/mm<sup>2</sup>).

$\tau_{xy}$  : Shearing stress in the  $x-y$  plane (N/mm<sup>2</sup>).

- The equivalent stress specified in **Par 1** is not to exceed 0.7 and 0.9 times the yield strength of the material, for the static loading and combined loading condition specified in 412., respectively.

#### 411. Corrosion allowance

- In case where the unit is fitted with a corrosion protection system deemed appropriate by the Society, with regard to the corrosion allowance specified in **Par 2** reduction may be made as deemed adequate by the Society.
- Where the unit is not fitted with a corrosion protection system deemed appropriate by the Society, the scantlings determined by the analysing method and the allowable stresses specified in this chapter are to be 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 **Sec 17** and the process of its maintenance. And further, where the requirements in **Rules for the Classification of Steel Ships** or **Rules for the Classification of Steel Barges** are applied, the scantlings are not to be less than those specified in the relevant requirements.

#### 412. 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) and (2) in the respective modes of operation specified in **Ch 1, 107**.

- The static loading is a condition in which the unit is afloat or resting on the sea bed 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.
- The combined loading is a condition in which the unit is loaded with combined loads of the static loads specified in (1), and dynamic loads such as wind loads, wave loads, etc. which affect the overall strength and loads induced by the accelerative motion of the unit due to these loads and heeling.

##### 2. Allowable stresses

Allowable stresses for static loading and combined loading specified in **Par 1** are not to exceed the values in **Table 3.2** according to the kind of stress.

##### 3. Combined compressive stress

In addition to **Par 2**, when structural members are subjected to axial compression or combined axial compression and bending, the extreme fibre stresses shall comply with the following requirement:

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1.0$$



- $f_a$  : Calculated compressive stress due to axial force(N/mm<sup>2</sup>).
- $f_b$  : Calculated compressive stress due to bending (N/mm<sup>2</sup>).
- $F_b$  : Allowable compressive stress due to bending prescribed in **Table 3.2** (N/mm<sup>2</sup>).
- $F_a$  : Allowable axial compressive stress obtained from the following formula, but is not to exceed  $F_b$  (N/mm<sup>2</sup>)

$$F_a = \eta \times \sigma_{cr,i} \times (1 - 0.13 \times \lambda / \lambda_0) \dots\dots\dots \lambda < \lambda_0$$

$$= \eta \times \sigma_{cr,e} \times 0.87 \dots\dots\dots \lambda \geq \lambda_0$$

$$\lambda = kl/r$$

$$\lambda_0 = \sqrt{2\pi^2 E / \sigma_y}$$

- $\sigma_y$  : As specified in **Par 2** (N/mm<sup>2</sup>).
- $\sigma_{cr,i}$  : Inelastic column critical buckling stress (N/mm<sup>2</sup>).
- $\sigma_{cr,e}$  : Elastic column critical buckling stress (N/mm<sup>2</sup>).
- $\eta = 0.6$  for static loading
- $= 0.8$  for combined loading
- $kl$  = Effective unsupported length (m)
- $r$  = Governing radius of gyration associated with  $kl$  (m)
- $E$  = Modulus of elasticity of the material

**Table 3.2 Allowable Stresses for Static Loading and Combined Loading**

Kind of stress	Static loading	Combined loading
Tensile	$0.6 \times \sigma_y$	$0.8 \times \sigma_y$
Bending	$0.6 \times (\sigma_y \text{ or } \sigma_{cr}^*)$	$0.8 \times (\sigma_y \text{ or } \sigma_{cr}^*)$
Shearing	$0.4 \times \sigma_y \text{ or } 0.6 \times \tau_{cr}^*$	$0.53 \times \sigma_y \text{ or } 0.8 \times \tau_{cr}^*$
Compressive	$0.6 \times (\sigma_y \text{ or } \sigma_{cr}^*)$	$0.8 \times (\sigma_y \text{ or } \sigma_{cr}^*)$
* : Whichever is the smaller		
$\sigma_y$ : Specified minimum yield stress of the material (N/mm <sup>2</sup> ).		
$\sigma_{cr}$ : Critical compressive buckling stress (N/mm <sup>2</sup> ).		
$\tau_{cr}$ : Critical shear buckling stress(N/mm <sup>2</sup> ).		

**413. Scantlings of Structural Members**

**1. General**

- (1) For the primary structural members which contribute to the overall strength, the scantlings are to be determined in accordance with the requirements in **Sec 2** and **3**. However, the requirements in **401.** and **412.** may be applied.
- (2) For the structural members subjected to local loads only, the requirements in **Rules for the Classification of Steel Ships** may be applied under the approval of the Society.

**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 formulae, whichever is the greater.

$$75.2S\sqrt{\frac{h_s}{K_c}} + C \quad (\text{mm}), \quad 60.8S\sqrt{\frac{h_c}{K_p}} + C \quad (\text{mm})$$

- $S$  : Spacing of transverse or longitudinal frames(m).
- $h_s$  : Head of water in static loading specified in **412. 1.**(m).
- $h_c$  : Head of water in combined loading specified in **412. 1.**(m).
- $K_c$  : As given by the following formulae, whichever is the smaller.

$$\frac{235 - k\sigma_{s1}}{k}, \quad 1.45\left(\frac{235 - k\sigma_{s2}}{k}\right)$$

$K_p$  : As given in (a) or (b) below.

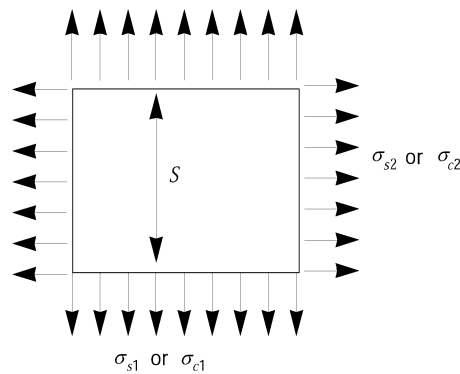
- (a) Where  $\sigma_{c1} \times \sigma_{c2} > 0$ , the value given by the following formulae, whichever is the smaller.

$$\frac{5750 - k^2\sigma_{c1}^2}{235k}, \quad 2\left(\frac{235 - k|\sigma_{c2}|}{k}\right)$$

- (b) Where  $\sigma_{c1} \times \sigma_{c2} < 0$ , the value given by the following formulae, whichever is the smaller.

$$\frac{5750 - k^2\sigma_{c1}^2}{235k}, \quad 2\left(\frac{235 - k|\sigma_{c1}| - k|\sigma_{c2}|}{k}\right)$$

$\sigma_{s1}$ ,  $\sigma_{s2}$  and  $\sigma_{c1}$ ,  $\sigma_{c2}$  : Axial stresses acting on the plating in static loading and combined loading, respectively (N/mm<sup>2</sup>). (See **Fig 3.1**)



**Fig 3.1 Axial stress**  $\sigma_{s1}$ ,  $\sigma_{s2}$ ,  $\sigma_{c1}$ ,  $\sigma_{c2}$

$k$  : Material factor, as given in the following.

Mild steels ----- 1.00

High tensile steels

A 32, DH 32, EH 32 ----- 0.78

AH 36, DH 36, EH 36 ----- 0.72

For other high tensile steels, the value of  $k$  is to be dedicated at the discretion of the Society.

$C$  : Corrosion allowance specified in **411**.

### 3. Section modulus of transverse or longitudinal frames

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

$$1079C \left( \frac{kSh_c l^2}{235 - k\sigma_{c0}} \right) \quad (\text{cm}^3)$$

$C$  : Coefficient given below.

1.0 for both ends fixed

1.5 for both ends simply supported

$l$  : Span of frames (m).

$\sigma_{c0}$  : Axial stress in combined loading (N/mm<sup>2</sup>).

$S, h_c, k$  : As specified in **Par 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 satisfy the following relationship are to be checked for local buckling in addition to the overall buckling as specified in **412. Par 3**.

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

$D$  : Diameter of cylindrical shell

$t$  : Thickness of shell plating

( $D$  and  $t$  expressed in the same units.)

$\sigma_y$  : Specified minimum yield stress of the material

$E$  : Modulus of elasticity of the material

( $\sigma_y$  and  $E$  expressed in the same unit system.)

## 414. Helicopter Deck

### 1. Design loads

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

#### (1) Helicopter landing impact loading

(A) As for the deck loads in the range where a helicopter takes off or lands, a load of 75 % of the helicopter maximum take-off weight is to be taken on each of two square areas, 0.3 m × 0.3 m.

(B) For girders, stanchions, etc., the structural weight of the helicopter deck is to be considered in addition to the helicopter impact loading specified in (A).

(C) Where the upper deck of a structure or deck house is used as a helicopter deck and the spaces below are normally manned, the impact loading specified in (A) is to be multiplied by a factor of 1.15.

#### (2) Stowed helicopter loading

(A) The deck loads in the space where a helicopter is stowed are to be taken as wheel load-

ings at maximum take-off weight. In this case, the dynamical effect due to the motion of the unit is also to be taken into account.

- (B) In addition to (A), a uniformly distributed loading of  $0.5 \text{ kN/m}^2$ , representing wet snow or ice is to be considered, if necessary.
  - (C) For girders, stanchions, etc., the structural weight of the helicopter deck is to be considered in addition to the loads specified in (A).
- (3) Minimum deck load

The minimum deck load for helicopter deck is to be taken as  $2 \text{ kN/m}^2$ .

## 2. Allowable stresses

Allowable stresses of the structural members of the helicopter deck are not to exceed the values in **Table 3.3** in association with the design loads prescribed in **Par 1**.

**Table 3.3 Allowable Stresses**

Design loads \ Structural members	Deck plating	Deck beams	Girders, stanchions, truss supports, etc.
Helicopter landing impact load	*	$\sigma_y$	$0.9 \times \sigma'_y$
Stowed helicopter load	$\sigma_y$	$0.9 \times \sigma_y$	$0.8 \times \sigma'_y$
Overall distributed load	$0.6 \times \sigma_y$	$0.6 \times \sigma_y$	$0.6 \times \sigma'_y$
* : At the discretion of the Society. $\sigma_y$ : As specified in <b>412. 1.</b> ( $\text{N/mm}^2$ ). $\sigma'_y$ : For members subjected to axial compression, $\sigma_y$ or critical buckling stress, whichever is the smaller ( $\text{N/mm}^2$ ).			

## 3. Minimum thickness

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

## 4. Landing appliances other than wheels

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

## 5. Loadings on helicopter deck

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 the Society.

# 415. Position Keeping Systems and Components

## 1. General

Units provided with position keeping systems equipment in accordance with this Section may have a Additional Installation Notation, "PKS" after the class notation.

## 2. Anchoring systems

### (1) General

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

### (2) Design

(A) An analysis of the anchoring arrangements expected to be utilized in the unit's operation is to be submitted to the Society. Among the items to be addressed are:

- (a) Design environmental conditions of waves, winds, currents, tides and ranges of water depth
- (b) Air and sea temperature
- (c) Ice condition (if applicable)
- (d) Description of analysis methodology

- (B) The anchoring system should be designed so that a sudden failure of any single anchor line will not cause progressive failure of remaining lines in the anchoring arrangement.
- (C) Anchoring system components should be designed utilizing adequate factors of safety and a design methodology suitable to identify the most severe loading condition for each component. In particular, sufficient numbers of heading angles together with the most severe combination of wind, current and wave are to be considered, 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 considered in the event that they might induce higher mooring loads.
- (a) When the Quasi Static Method is applied, the tension in each anchor line is to be calculated at the maximum excursion for each design condition defined in (b) below, combining the following steady state and dynamic responses of the Unit:
- (i) steady mean offset due to the defined wind, current, and steady wave forces
  - (ii) most probable maximum wave induced motions of the moored unit due to wave excitation
- For relatively deep water, the effect from damping and inertia forces in the anchor lines is to be considered in the analysis. The effects of slowly varying motions are to be included when the magnitudes of such motions are considered to be significant.
- (b) Factors of safety (FOS) are dependent on the design conditions of the system (intact, damaged, or transient), as well as the level of analyses (Quasi static or dynamic analysis). The minimum Quasi Static FOS, specified in the table below, at the maximum excursion of the unit for a range of headings should be satisfied if the quasi static method outlined in (a) is applied. Otherwise, the minimum Dynamic Analysis FOS in the **Table 3.4** should be satisfied, including the effects of line dynamics when these effects are considered significant.
- The defined 'Operating' and 'Severe Storm' are to be the same as those identified for the design of the unit, unless the Society is satisfied that lesser conditions may be applicable to specific sites.
- (c) In general, the maximum wave induced motions of the moored unit about the steady mean offset should be obtained by means of model tests. The Society may accept analytical calculations provided that the proposed method is based on a sound methodology which has been validated by model tests.
- In the consideration of column-stabilized units, the value of  $C_s$  and  $C_h$ , as indicated in **Ch 4, 201**, may be introduced in the analysis for position keeping mooring systems. The intent of **Ch 4, 302. 3**(Wind tunnel test) and of **Ch 4, 302. 4**(Other stability requirements) may also be considered by the Society.
- (d) The Society may accept different analysis methodologies provided that it is satisfied that a level of safety equivalent to the one obtained by (a) and (b) above.
- (e) The Society may give special consideration to an arrangement where the anchoring systems are used in conjunction with thrusters to maintain the unit on station.

Table 3.4 Anchor Line FOS

Design Condition		Anchor Line FOS	
		Quasi Static	Dynamic Analysis
Operating	Intact	2.70	2.25
	Damaged	1.80	1.57
	Transient	1.40	1.22
Severe Storm	Intact	2.00	1.67
	Damaged	1.43	1.25
	Transient	1.18	1.05

where,

$$FOS = PB / T_{max}$$

$PB$  = maximum rated breaking load of the weakest component of the anchor line.

$T_{max}$  = maximum anchor line tension calculated in accordance with (C) or Section 5.1.3.2 of API RP 2SK for each of the following design conditions.

- (a) Operating Intact:  $T_{max}$  determined under the most severe design environmental conditions for normal operations specified by the Owner or designer with all anchor lines intact.
- (b) Operating Damaged:  $T_{max}$ , under the operating environmental conditions specified above, but assuming the sudden failure of any one anchor line, after reaching a steady-state condition.
- (c) Operating Transient:  $T_{max}$ , under the operating environmental conditions specified above, due to transient motions resulting from the sudden failure of any one anchor line.
- (d) Severe Storm Intact:  $T_{max}$  determined under the most severe design environmental conditions for severe storm specified by the Owner or designer with all anchor lines intact.
- (e) Severe Storm Damaged:  $T_{max}$ , under the severe storm environmental conditions specified above, but assuming the sudden failure of any one anchor line, after reaching a steady-state condition.
- (f) Severe Storm Transient:  $T_{max}$ , under the severe storm environmental conditions specified above, due to transient motions resulting from the sudden failure of any one anchor line.

### 3. Equipment

#### (1) Windlass

- (A) The design of the windlass is to provide for adequate dynamic braking capacity to control normal combinations of loads from the anchor, anchor line and anchor handling vessel during the deployment of the anchors at the maximum design payout speed of the windlass. The attachment of the windlass to the hull structure is to be designed to withstand the breaking strength of the anchor line.
- (B) Each windlass is to be provided with two independent power operated brakes and each brake is to be capable of holding against a static load in the anchor lines of at least 50 percent of its breaking strength. Where the Society so allows, one of the brakes may be replaced by a manually operated brake.
- (C) On loss of power to the windlasses, the power operated braking system should be automatically applied and be capable of holding against 50 percent of the total static braking capacity of the windlass.

#### (2) Fairleads and sheaves

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

### 4. Anchor line

- (1) The Society is to be ensured that the anchor lines are of a type that will satisfy the design conditions of the anchoring system.
- (2) Means are to be provided to enable the anchor lines to be released from the unit after loss of main power.
- (3) Means are to be provided for measuring anchor line tensions.

- (4) Anchor lines are to be of adequate length to prevent uplift of the anchors under the maximum design condition for the anticipated area(s) of operation. However, only steady wind, wave and current forces need to be applied in evaluating anchor uplift forces in transient conditions.

#### 5. Anchors

- (1) Type and design of anchors are to be to the satisfaction of the Society.
- (2) All anchors are to be stowed to prevent movement during transit.

#### 6. Quality control

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

#### 7. Control stations

- (1) A manned control station is to be provided with means to indicate anchor line tensions at the individual windlass control positions and to indicate wind speed and direction.
- (2) Reliable means are to be provided to communicate between locations critical to the anchoring operation.
- (3) Means are to be provided at the individual windlass control positions to monitor anchor line tension, windlass power load and to indicate amount of anchor line payed out.

#### 8. Dynamic positioning systems

Thrusters used as a slow means of position keeping should provide a level of safety equivalent to that provided for anchoring arrangements to the satisfaction of the Society.

## Section 5 Surface Type Units

### 501. Application

The requirements in this Section apply to surface type units.

### 502. Ship type units

The hull structure is to be in accordance with the requirements in the Rules, taking account of the followings. Where, however, approved by the Society, the requirements in **Rules for the Classification of Steel Ships** may apply, except the requirements in **Sec 3** and **4**.

- (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) The plating of the well is to be suitably stiffened to prevent damage due to other objects which may become trapped in the well.
- (3) The unit's structure in way of heavy concentrated loads is to be suitably reinforced.
- (4) Local structures in way of fairleads, winches, etc., forming part of the position mooring system, are to be designed to the breaking strength of the mooring line or chain.

### 503. Barge type units

The hull structure is to be in accordance with the requirements in this rule, taking account of the requirements in **502**. Where, however, approved by the Society, the requirements in **Rules for the Classification of Steel Barges** may apply.

## Section 6 Self-elevating Units

### 601. Application

The requirements in this Section apply to self-elevating units.

### 602. Overall strength

The overall strength of the unit is to be in accordance with the requirements in **401.** and **412.** The unbalanced supported condition by the legs, if necessary, is to be considered.

### 603. Legs

Legs are to be in accordance with the requirements in the following, in addition to the requirements in **602.** 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 the Society.

- (1) Legs are to be either shell type or truss type and, as a rule, footings or bottom mats are to be fitted. 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 metres below the sea bed.
- (2) Legs in the field transit condition are to be in accordance with the followings. The field transit condition means the condition which does not exceed a twelve-hours 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 six hours.
  - (A) The legs are to have sufficient strength for the bending moment obtained from the following formulae :

$$m_1 + 1.2m_2 \quad (\text{kN} \cdot \text{m})$$

$m_1$  : Dynamic bending moment caused by a  $6^\circ$  single amplitude of roll or pitch at the natural period of the unit (kN · m).

$m_2$  : Static bending moment due to gravity caused by a  $6^\circ$  legs' angle of inclination (kN · m).

- (B) The legs are to be investigated for any proposed leg arrangement with respect to vertical position. Such investigations are to include strength and stability aspects.
- (3) Legs in the ocean transit condition are to be designed in accordance with the followings :
  - (A) 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.
  - (B) The legs are to have sufficient strength for the bending moment obtained from the following formulae :

$$m_3 + 1.2m_4 \quad (\text{kN} \cdot \text{m})$$

$m_3$  : Dynamic bending moment caused by a  $15^\circ$  single amplitude of roll or pitch at a 10-second period (kN · m).

$m_4$  : Static bending moment due to gravity caused by a  $15^\circ$  legs' angle of inclination (kN · m).

- (C) For ocean transit condition, it may be necessary to reinforce or support the legs, or to remove sections of them.
- (D) The approved condition is to be included in Operating Booklet.
- (4) 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 **Sec 4**, is to be considered. Forces and moments due to lateral frame



deflections of the legs are to be taken into account .

- (5) Leg scantlings are to be determined in accordance with a method of rational analysis, to the satisfaction of the Society.

#### 604. Hull structure

1. The hull is to be considered as a complete structure having sufficient strength to resist all induced stress while in the elevated position and supported by all legs.
2. The scantlings of the respective hull structural members are to be in accordance with the requirements in **Sec 4** with reference to the loads prescribed in **Sec 3** in addition to **602**.
3. The hull structure, including the parts of the well, etc., is to be good in the continuity of longitudinal strength and transverse strength.
4. Scantlings of units having other than rectangular hull configurations are to be subject to special consideration.

#### 605. Bottom mats

1. 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. The thickness of shell plating of the bottom mats without opening to the sea and scantlings of shell stiffeners are not to be less than determined by the requirements in **413. 2** and **Par 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.
3. The scantlings of watertight bulkheads and their stiffeners provided in the bottom mats are not to be less than determined by the requirements in **Pt 3, Ch 14** of **Rules for the Classification of Steel Ships**. In this case, the top of  $h$  is to be substituted to the top of  $h_c$  specified in **Par 2**.
4. Where the unit is resting on the sea bed, the effects of scouring are also to be considered. The effects of skirt plates, where provided, are to be specially considered.
5. Mats are to be designed to withstand the shock of touching bottom while the unit is afloat and subject to wave motions.

#### 606. Deck elevating apparatus and load carrying members

1. Operating device, mechanism, strength and safety equipment of the deck elevating apparatus are to be in accordance with the requirements in **Ch 5, 204**.
2. Load carrying members which transmit loads from the legs to the hull are to have sufficient strength for the loads prescribed in **603**. and **Par 3**.
3. Load carrying members are to be arranged so that loads transmitted from the legs are properly diffused into the hull structure.

#### 607. Deckhouses

1. Deckhouses are to have sufficient strength for their size, function and locations and are to be constructed to approval plans.
2. General scantlings are to comply with the requirements in **Pt 3, Ch 17** of **Rules for the Classification of Steel Ships** and the scantlings of enclosed spaces are to comply with the requirements for bulkheads of unprotected house fronts in **Pt 3, Ch 17** of **Rules for the Classification of Steel Ships**.

#### 608. Sea bed condition

Sea bed conditions are to be based upon the designer's assumptions, and these assumptions are to be recorded in the Operating Booklet. The operator is to be watchful against that actual conditions do not impose more severe loadings on the unit.

### 609. Wave clearance

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 the smaller, 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.

### 610. Preload capability

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

## Section 7 Column-stabilized Units

### 701. Application

The requirements in this Section apply to the column-stabilized units.

### 702. Overall strength

1. The overall strength of the unit is to be in accordance with the requirements in **412**.
2. For units of this type, the highest stresses may be associated with less severe environmental conditions than the maxima specified by the owner or designer. Particular attention is to be given to such a case.

### 703. Strength of structure in way of position mooring system

Local structure in way of fairleads, winches, etc., forming a part of the position mooring system, is to be designed to the breaking strength of the mooring line or chain.

### 704. Upper structure

1. The scantlings of the upper structure are not to be less than those required by **Rules for the Classification of Steel Ships** in association with the loadings indicated on the deck loading plan. These loadings are not to be less than the requirements specified in **306**.
2. 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 **Sec 4**.
3. When upper structure is designed to be floating in any mode of operation or damaged condition, or to meet stability requirements, it is to be subject to special consideration.
4. Deckhouses fitted to the upper structure are to be designed in accordance with the requirements in **Pt 3, Ch 17 of Rules for the Classification of Steel Ships**. 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.
5. The upper structure, including the parts of the well, etc., is to be good in the continuity of longitudinal strength and transverse strength.
6. Unless deck structures are designed for wave impact, a clearance acceptable to the Society should be maintained between passing wave crests and the deck structure. The Administration should be provided with model test data, reports on past operating experience with similar configurations or by calculations showing that adequate provision is made to maintain this clearance.
7. The structural arrangement of the upper hull is to be considered with regard to the structural integrity of the unit after the assumed failure of any primary girder. The Society may require a structural analysis showing satisfactory protection against overall collapse of the unit after such an

assumed failure when exposed to environmental loading corresponding to a one-year return period for the intended area of operation.

### 705. Column, lower hulls and footings

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 **413. 2** and **Par 3**. In this case,  $h_s$  and  $h_c$  are to be in accordance with the requirements in the followings.
  - (1) Where an internal space is loaded with liquid,  $h_s$  is the vertical distance in metres from the load line to the tank top and  $h_c$  is the vertical distance in metres 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 metres for areas subject to wave immersion and 3.4 metres for other areas.
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 **Sec 4** in response to the design heads,  $h_s$  and  $h_c$ , specified in **Par 1**.
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 **Pt 3, Ch 15** of **Rules for the Classification of Steel Ships**.
4. When column, lower hull or footing is an effective member for the overall strength of the unit, the stress resulting from the overall strength is to be added by the stress determined by the requirements in **Par 1**.
5. Where a column, lower hull or footing is a part of the overall structural frame of a unit, consideration should also be given to stresses resulting from deflections due to the applicable combined loading.
6. Particular consideration is to be given to structural details, reinforcement, etc., in areas subject to high local loadings indicated in the followings ;
  - (1) Areas subject to bottom bearing loads, where applicable,
  - (2) Bulkheads of partially filled tanks, etc.,
  - (3) Areas liable to sustain external damages,
  - (4) Jointed parts between columns and footings or lower hulls,
  - (5) Areas subject to wave impact.
7. Where a unit is designed for operations while supported by the sea bed, the effects of scouring are to be considered. The effects of skirt plates, where provided, are to be specially considered.

### 706. Bracing members

1. Bracing members are to be designed to transmit loadings and to make the hull structure effective against environmental forces, and when the unit is supported by the sea bed, against the possibility of uneven bearing loads.
2. Bracing members are to have sufficient strength for buoyancy, wave and current forces and wave impact.
3. When bracing members are of tubular section, ring frames may be required to maintain stiffness and roundness of shape.
4. When bracings are watertight, they are to be suitably designed to prevent collapse from external hydrostatic pressure.
5. When any one slender bracing member are lost, overall strength of unit is compiled with the following requirements where overall structure analysis are carried out based upon the design loads specified in **Sec 3**.

- (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 formulae.

$$\sigma_a = \sigma_Y$$

$\sigma_a$  : allowable stress (N/mm<sup>2</sup>)

$\sigma_Y$  : specified yield stress of materials (N/mm<sup>2</sup>)

- (3) In case of taking into consideration of combined compression stress,  $\eta$  specified **412. 3** may be 1.0
6. Underwater bracing members are to be provided with a leak detection system make it possible to detect fatigue cracks at an early stage.
7. The unit's structure should be able to withstand the loss of any slender bracing member without causing overall collapse when exposed to environmental loading corresponding to a one-year return period for the intended area of operation.
8. Consideration should be given to the need for ring frames to maintain stiffness and shape in tubular bracing members.

#### 707. Wave clearance

1. Unless deck structures are designed either in accordance with the requirements in **704. 3** or by considering wave impact, to the satisfaction of the Society, reasonable clearance between the lower surface of deck structure and the wave crest is to be ensured for all afloat modes of operation, taking into account the predicted motion of the unit relative to the surface of the sea.
2. For on-bottom modes of operation, clearances are to be in accordance with those specified in **609**.

## Section 8 Towing Arrangements

### 801. General

1. The design and arrangement of towing fittings should have regard to both normal and emergency conditions.
2. Equipments and fittings provided in accordance with **Par 1** should meet the appropriate requirements of recognized standards acceptable to the Society(KS, JIS etc.) and arrangements are to be submitted to the Society for the approval.(Refer to the **Guidelines for safe ocean towing (MSC/Circ.884)**).
3. Each fitting or item of equipment provided under this regulation should be clearly marked with any restrictions associated with its safe operation, taking into account the strength of its attachment to the unit's structure.

## Section 9 Fatigue Analysis

### 901. General

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

3. The fatigue analysis should take into account the intended design life of the unit and the accessibility of load-carrying members for inspection. The fatigue life is normally not to be taken as less than 20 years.

## Section 10 Materials

### 1001. General

1. Rolled steels, steel castings and steel forgings used for hull construction and equipment are to be in accordance with the requirements in **Pt 2, Ch 1 of Rules for the Classification of Steel Ships**. Where it is proposed to use steel or other material having properties differing from those specified in the Rules, the specification and properties of such material shall be submitted to the Society for consideration and special approval. Due consideration is to be given to the ratio of yield to ultimate strength of the materials to be used, and to their suitability with regard to structural location and to design temperatures.
2. Consideration should be given to the minimization of hazardous substances used in the design and construction of the unit, and should facilitate recycling and removal of hazardous materials. (Refer to the Guidelines on ship recycling, adopted by the Organization by resolution A.962(23)).
3. Materials which contain asbestos should be prohibited.

### 1002. Categories of structural members of self-elevating units and column-stabilized units

Structural members are to be grouped into the following three material application categories according to the design.

#### (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 platings of leg tanks, decks, main deck girders, and so on.

#### (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 (1) and other members.

#### (3) Special portions of structural members

Special portions of the primary structural members specified in (1), such as junctions which are specially important in structural viewpoint or in way of stress concentration and so on.

### 1003. Categories of structural members of surface type units

#### 1. Primary structural members

Sheer strake, deck stringer, bilge strake, hatch corner in way of stress concentration part which are outer  $0.4L$  but within  $0.6L$  amidship and primary structural members except those specified in **Par 3** such as bottom plating, side plating, deck plating, longitudinals on deck, etc. within  $0.4$  amidship.

#### 2. Secondary structural members

Inner members of those specified in **Par 1** and stern frame, rudder plate, etc., and sheer strake, deck stringer, bilge strake, hatch corner in way of stress concentration part which are outer  $0.6L$  amidship and primary structural members such as bottom plating, side plating, deck plating, longitudinals on deck etc. which are outer  $0.4L$  amidship.

#### 3. Special portions of structural members

Special members which are specially important in longitudinal strength viewpoint, such as sheer strake, deck stringer, bilge strake, hatch corner in way of stress concentration part which are within  $0.4L$  amidship.

**1004. Definition of design service temperature of materials**

Design service temperature of materials is the lowest of the daily average atmospheric temperatures, based on meteorological data, for any anticipated area of operation. If the data of the lowest daily average temperature are not available, the lowest monthly average temperature may be used. The design service temperature, however, need not be lower than 0°C for members which are below the light draught.

**1005. Application of steels**

1. Application of rolled steels for surface type units is to be in accordance with the requirements in Pt 3, Ch 1, Sec 4 of Rules for the Classification of Steel Ships.

**Table 3.5 Application of Steels for Primary Structure Members**

Thickness $t$ (mm) Service temperature $T(^{\circ}\text{C})$	$t \leq 12.5$	$12.5 < t \leq 19$	$19 < t \leq 25$	$25 < t \leq 35$	$35 < t \leq 50$
$0 \leq T$	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
$-10 \leq T < 0$	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
$-20 \leq T < -10$	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
$-30 \leq T < -20$	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
$-40 \leq T < -30$	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	*
$-50 \leq T < -40$	E, EH 32, EH 36	E, EH 32, EH 36	*	*	*

\* At the discretion of the Society.

**Table 3.6 Application of Steels for Secondary Structure Members**

Thickness $t$ (mm) Service temperature $T(^{\circ}\text{C})$	$t \leq 12.5$	$12.5 < t \leq 19$	$19 < t \leq 25$	$25 < t \leq 35$	$35 < t \leq 50$
$0 \leq T$	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
$-10 \leq T < 0$	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
$-20 \leq T < -10$	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
$-30 \leq T < -20$	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
$-40 \leq T < -30$	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
$-50 \leq T < -40$	E, EH 32, EH 36	E, EH 32, EH 36	E, EH 32, EH 36	*	*

\* At the discretion of the Society.

Table 3.7 Application of Steels for Special Portion of Structure Members

Thickness $t$ (mm) Service temperature $T(^{\circ}\text{C})$	$t \leq 12.5$	$12.5 < t \leq 19$	$19 < t \leq 25$	$25 < t \leq 35$	$35 < t \leq 50$
$0 \leq T$	<i>B, AH 32, AH 36</i>	<i>D, DH 32, DH 36</i>	<i>D, DH 32, DH 36</i>	<i>E, DH 32, EH 36</i>	<i>E, DH 32, EH 36</i>
$-10 \leq T < 0$	<i>D, DH 32, DH 36</i>	<i>E, DH 32, DH 36</i>	<i>E, DH 32, DH 36</i>	<i>E, EH 32, EH 36</i>	<i>E, EH 32, EH 36</i>
$-20 \leq T < -10$	<i>E, DH 32, DH 36</i>	<i>E, EH 32, EH 36</i>	<i>E, EH 32, EH 36</i>	<i>E, EH 32, EH 36</i>	<i>E, EH 32, EH 36</i>
$-30 \leq T < -20$	<i>E, EH 32, EH 36</i>	<i>E, EH 32, EH 36</i>	<i>E, EH 32, EH 36</i>	*	*
$-40 \leq T < -30$	<i>E, EH 32, EH 36</i>	*	*	*	*
$-50 \leq T < -40$	*	*	*	*	*

\* At the discretion of the Society.

2. Application of rolled steels for self-elevating units and column-stabilized units is to be in accordance with **Table 3.5** to **3.7** depending on the categories of structural members, thickness and design service temperature.

## Section 11 Anti-fouling Systems

### 1101. General

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

## Section 12 Protective Coatings of Dedicated Seawater Ballast Tanks

### 1201. General

- All dedicated seawater ballast tanks should be coated during construction in accordance with the **IMO Res. MSC. 215(82)**. 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.
- Maintenance of the protective coating system should be included in the overall unit's maintenance scheme. The effectiveness of the protective coating system should be verified during the life of a unit by the Society, based on the guidelines developed by the Organization (**MSC.1/Circ. 1330**).

## Section 13 Construction Portfolio

### 1301. General

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

## Section 14 Welding

### 1401. General

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

### 1402. Welding structure

1. Welded joints of crossing parts at the ends of columns and bracings are, as a rule, to be of full-penetration type.
2. Size of fillet welds applied to respective internal structural members of columns and bracings is to be F1 specified in **Pt 3, Ch 1, Table 3.1.4 of Rules for the Classification of Steel Ships.**
3. For welded joints other than specified in **Par 1 and 2**, welding is to be in accordance with the requirements in **Pt 3, Ch 1, Sec 5 of Rules for the Classification of Steel Ships.**
4. Welding is to be carried out by the personnel qualified by the Society in accordance with the approved welding specification.

### 1403. Joints of special design

In case of welded joints of special design, the Society may require tests to check the strength of the joints and any defects.

### 1404. Underwater welding

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

## Section 15 Drainage and Sediment Control

### 1501. General

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

## Section 16 Ice Strengthening

### 1601. Reinforcement

1. Units designed to be located in areas where ice strengthening may be necessary will be specially considered and, provided that the unit is reinforced as necessary for operation in the specified ice conditions to the satisfaction of the Society, and an appropriate Additional Special Feature Notations may be added to the Class Notation by the Society.
2. Ice strengthening for surface type units is to be in accordance with **Pt 3, Ch 20 of Rules for the Classification of Steel Ships.**



## Section 17 Corrosion Control

### 1701. General

All steelworks are to be coated with a paint of good quality or to be corrosion controlled with an effect equivalent to or more than paint. Where, however, the requirements in **Ch 2, 304.** are applied, special considerations are to be paid to the prevention of corrosion.

## Section 18 Guardrails and Bulwarks

### 1801. General

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 **Pt 4, Ch 4** of **Rules for the Classification of Steel Ships**.
2. Regardless of the requirements in **Par 1**, suitable wirenets may be provided to the helicopter deck in a plane nearly same as the deck surface instead of the guardrails or bulwarks, if guardrails or bulwarks will become hindrances to take-off and landing of helicopters.
3. Regardless of the requirements in **Par 1**, guardrails or bulwarks which interfere with the operation may be eliminated under the approval of the Society upon the request of the Owner.

## Section 19 Temporary or Emergency Mooring Equipment

### 1901. General

Anchors, anchor chains and ropes necessary for temporary or emergency mooring are to be provided on units in accordance with the requirements in **Pt 4, Ch 8** of **Rules for the Classification of Steel Ships** according to their equipment number specified in **1902**. Where, however, deemed appropriate by the Society, the requirements in **Ch 19** of **Rules for the Classification of Steel Barges** may be applied to the mooring equipment of units having no propelling machinery. And further, the mooring equipment of units moored for long period of time or semi-permanently is to be at the discretion of the Society.

### 1902. Equipment number

1. The equipment number of surface type units is to comply with the requirements in **Pt 4, Ch 8** of **Rules for the Classification of Steel Ships** for ship type units and **Ch 19** of **Rules for the Classification of Steel Barges** for barge type units.
2. The equipment number of self-elevating units and column-stabilized units is to be obtained from the following formula.

$$\Delta^{\frac{2}{3}} + 2A_1 + 0.1A_2$$

$\Delta$  : Displacement of the unit in temporary mooring condition(t).

$A_1$  and  $A_2$  : 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<sup>2</sup>).

### 1903. Equivalent mooring equipment

1. A part or whole parts of the temporary mooring arrangement and the mooring equipment for operating condition may be used in each other.

2. If the Society recognizes that the effect of mooring equipment for operating condition is equivalent to that of the temporary mooring equipment specified in **1901.**, such mooring equipment for operating condition is regarded as the temporary mooring equipment specified in this Chapter.
3. Where approved by the Society, wire ropes, which is possessed breaking load not to be less than the breaking test load of anchor chain, may be used in lieu of anchor chain. In this case, however, the wire ropes are to satisfy the requirements in **Pt 4, Ch 8, Sec 5** of **Rules for the Classification of Steel Ships**.

#### **1904. Windlass**

Units, except for those moored for a long period of time or semi-permanently, are to be provided with windlasses having a sufficient hoisting capacity. ⚓

## CHAPTER 4 SUBDIVISION, STABILITY AND FREEBOARD

### Section 1 Inclining Test

#### 101. General

1. An inclining test should be required for the first unit of a design, when the unit is as near to completion as possible, to determine accurately the light ship data (weight and position of centre of gravity).
2. For successive units which are identical by design, the light ship data of the first unit of the series may be accepted by the Society in lieu of an inclining test, provided the difference in light ship displacement or position of centre of gravity due to weight changes for minor differences in machinery, outfitting or equipment, confirmed by the results of a lightweight survey, is less than 1% of the values of the light ship displacement and principal horizontal dimensions as determined for the first of the series. Extra care should be given to the detailed weight calculation and comparison with the original unit of a series of column-stabilized, semisubmersible types 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.
3. The results of the inclining test, or those of the lightweight survey together with the inclining test results for the first unit should be indicated in the operating manual.
4. A record of all changes to machinery, structure, outfitting and equipment that affect the light ship data should be maintained in a light ship data alterations log and be taken into account in daily operations.
5. For column-stabilized units:
  - (1) A lightweight survey or inclining test should be conducted at the first renewal survey. 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 Society.
  - (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 **Par 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 (1).
6. The inclining test or lightweight survey should be carried out in the presence of the Surveyor.

### Section 2 Righting Moment and Heeling Moment Curves

#### 201. General

1. Curves of righting moments and of wind heeling moments similar to **Fig 4.1** with supporting calculations should be prepared covering the full range of operating draughts, including those in transit conditions, taking into account the maximum loading of materials in the most unfavourable position applicable. The righting moment curves and wind heeling moment curves should be related to the most critical axes. Account should be taken of the free surface of liquids in tanks.
2. Where equipment is of such a nature that it can be lowered and stowed, additional wind heeling moment curves may be necessary and such data should clearly indicate the position of such equipment. Provisions regarding the lowering and effective stowage of such equipment should be included in the operating manual.
3. The curves of wind heeling moments should be drawn for wind forces calculated by the following formula:

$$F = 0.5 C_s C_h \rho V^2 A$$

$F$  : the wind force (N).

$C_s$  : the shape coefficient depending on the shape of the structural member exposed to the wind (see table 4.1)

$C_h$  : the height coefficient depending on the height above sea level of the structural member exposed to wind (see table 4.2)

$\rho$  : the air mass density (1.222 kg/m<sup>3</sup>)

$V$  : Design wind velocity specified in **Par 4** (m/sec).

$A$  : the projected area of all exposed surfaces in either the upright or the heeled condition (m<sup>2</sup>).

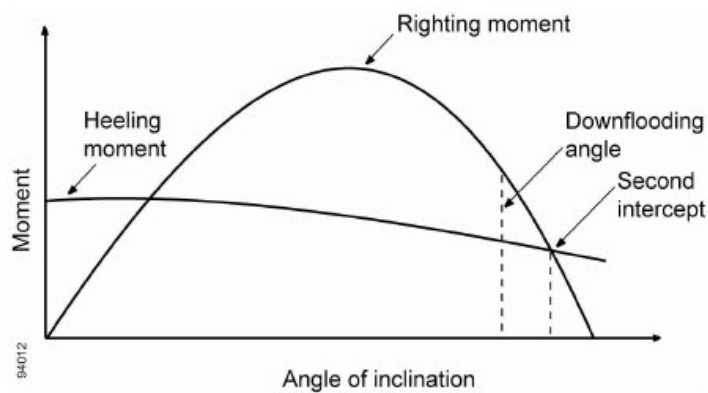


Fig 4.1 Righting moment and heeling moment curves

Table 4.1 Shape Coefficient  $C_s$

Shape	$C_s$
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

Table 4.2 Height Coefficient  $C_h$ 

Height (m)		$C_h$
Over	Not Exceeding	
	15.3	1.00
15.3	30.5	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
259.0		1.80

4. Wind forces should be considered from any direction relative to the unit and the value of the wind velocity should be as follows:
  - (1) In general a minimum wind velocity of 36 m/s (70 knots) for offshore service should be used for normal operating conditions and a minimum wind velocity of 51.5 m/s (100 knots) should be used for the severe storm conditions.
  - (2) Where a unit is to be limited in operation to sheltered locations (protected inland waters such as lakes, bays, swamps, rivers, etc.) consideration should be given to a reduced wind velocity of not less than 25.8 m/s (50 knots) for normal operating conditions.
5. In calculating the projected areas to the vertical plane, the area of surfaces exposed to wind due to heel or trim, such as under-deck surfaces, etc., should be included using the appropriate shape factor. Open truss work may be approximated by taking 30% of the projected block area of both the front and back section, i.e. 60% of the projected area of one side.
6. In calculating the wind heeling moments, the lever of the wind overturning force should be taken vertically from the centre of pressure of all surfaces exposed to the wind to the centre of lateral resistance of the underwater body of the unit. The unit is to be assumed floating free of mooring restraint.
7. The wind heeling moment curve should be calculated for a sufficient number of heel angles to define the curve. For ship-shaped hulls the curve may be assumed to vary as the cosine function of vessel heel.
8. Wind heeling moments derived from wind tunnel tests on a representative model of the unit may be considered as alternatives to the method given in **Par 3** to **7**. Such heeling moment determination should include lift and drag effects at various applicable heel angles.

### Section 3 Intact Stability Criteria

#### 301. General

1. All units are to have sufficient stability (righting ability) to withstand the overturning effect of the force produced by a sustained wind from any horizontal direction, in accordance with the stability criteria given in **302**. for all afloat modes of operation.

2. Realistic operating conditions are to be evaluated, and the unit is to be capable of maintaining in operating mode with a sustained wind velocity designated by the Owner, but not less than 36 m/sec (70 knots).
3. The capability is to be provided to change the mode of operation of the unit to that corresponding to a severe storm condition, with a sustained with velocity of not less than 51.5 m/sec (100 knots), in reasonable period of time for the particular unit. In all cases, the limiting wind velocities are to be specified and instructions should be included in the Operating Booklet for changing the mode of operation by redistribution of the variable load and equipment, by changing draughts, or both.
4. For restricted operations consideration may be given to a reduced sustained wind velocity specified in **Par 2** and **3**, of not less than 25.8 m/sec (50 knots).
5. For the purpose of calculation, it is to be assumed that the unit is floating free of mooring restraints. However, the possible detrimental effects of mooring restraints are to be considered.
6. 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, the Society 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  $K_G$  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.
7. Alternative stability criteria may be considered by the Society, provided an equivalent level of safety is maintained and if they are demonstrated to afford adequate positive initial stability. In determining the acceptability of such criteria, the Society should consider at least the following and take into account as appropriate:
  - (1) environmental conditions representing realistic winds (including gusts) and waves appropriate for world-wide service in various modes of operation;
  - (2) dynamic response of a unit. Analysis should include the results of wind tunnel tests, wave tank model tests, and non-linear simulation, where appropriate. Any wind and wave spectra used should cover sufficient frequency ranges to ensure that critical motion responses are obtained;
  - (3) potential for flooding taking into account dynamic responses in a seaway;
  - (4) susceptibility to capsizing considering the unit's restoration energy and the static inclination due to the mean wind speed and the maximum dynamic response;
  - (5) an adequate safety margin to account for uncertainties.

## 302. Stability Criterion under Wind Force

### 1. Intact condition

- (1) Righting moment curves and wind heeling moment curves related to the most critical axis, with supporting calculations, are to be prepared for a sufficient number of conditions covering the full range of drafts corresponding to afloat modes of operation.
- (2) Where drilling equipment is of the nature that it can be lowered and stowed, additional wind heeling moment and stability curves may be required, and such data is to clearly indicate the position of such equipment.
- (3) The stability of a unit in each mode of operation should meet the following criteria (see also **Fig 4.1**):
  - (A) For surface and self-elevating units the area under the righting moment curve to the second intercept or downflooding angle, whichever is less, should be not less than 40% in excess of the area under the wind heeling moment curve to the same limiting angle.
  - (B) For column-stabilized units the area under the righting moment curve to the angle of down-

flooding should be not less than 30% in excess of the area under the wind heeling moment curve to the same limiting angle. (Refer to An example of alternative intact stability criteria for twin-pontoon column-stabilized semisubmersible units, adopted by the Organization by resolution A.650(16)).

- (C) The righting moment curve should be positive over the entire range of angles from upright to the second intercept.

## 2. Wind heeling moment

- (1) The wind heeling moment is to be calculated at several angles of inclination for each mode of operation, based on the wind force obtained from **201**.
- (2) The calculations are to be performed in a manner to reflect the range of stability about the most critical axis.
- (3) The lever for the heeling force is to be taken vertically from the centre of lateral resistance or, if available, the centre of hydrodynamic pressure, of the underwater body to the centre of pressure of the areas subject to wind loading.
- (4) In calculating wind heeling moments for ship-shaped hulls, the curve may be assumed to vary as the cosine function of the vessel's heel.

## 3. Wind tunnel test

- (1) 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 **Par 2**. Such heeling moment determination is to include lift effects at various applicable heel angles, as well as drag effects.

## 4. Other stability criteria

- (1) The stability may be reviewed and evaluated in accordance with the alternative criteria deemed appropriate by the Society, taking into account the operation modes and environment conditions.

# Section 4 Subdivision and Damage Stability

## 401. Surface and self-elevating units

1. In general, the flooding of any one compartment in any operating or transit condition consistent with the damage assumptions set out in **Sec 5**; and
2. For a self-elevating unit, the flooding of any single compartment while meeting the following criterion (see **Fig 4.2**):

$$RoS \geq 7^\circ + (1.5\theta_s)$$

where,

$$RoS \geq 10^\circ$$

$$RoS : \text{range of stability, in degrees} = \theta_m - \theta_s$$

where,

$\theta_m$  : maximum angle of positive stability, in degrees

$\theta_s$  : static angle of inclination after damage, in degrees

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

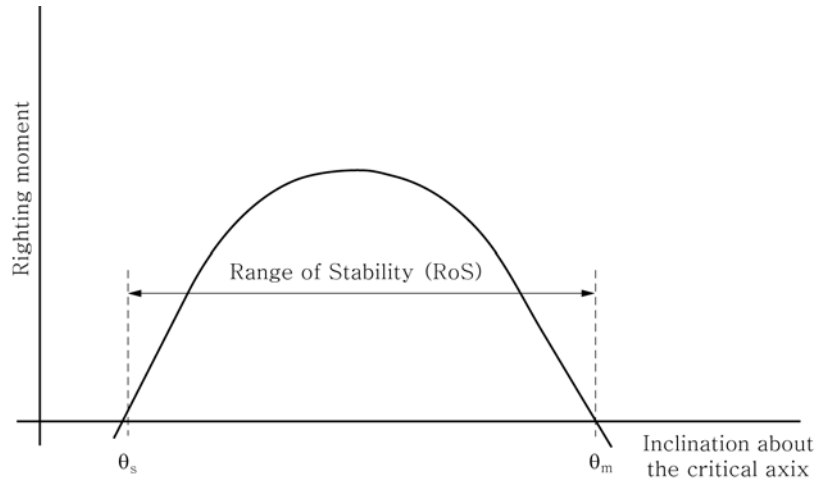


Fig 4.2 Residual Stability for Self-elevating Units

402. Column-stabilized units

1. The unit should have sufficient freeboard and be subdivided by means of watertight decks and bulkheads to provide sufficient buoyancy and stability to withstand a wind heeling moment induced by a wind velocity of 25.8 m/s (50 knots) superimposed from any direction in any operating or transit condition, taking the following considerations into account:
  - (1) the angle of inclination after the damage set out in **503. 1 (2)** should not be greater than 17°;
  - (2) any opening below the final waterline should be made watertight, and openings within 4 m above the final waterline should be made weathertight;
  - (3) the righting moment curve, after the damage set out above, should have, from the first intercept with the wind heeling moment to the lesser of the extent of weathertight integrity under paragraph (2) and the second intercept, a range of at least 7°. Within this range, the righting moment curve should reach a value of at least twice the wind heeling moment curve, both being measured at the same angle. (See **Fig 4.3**) (Refer to An example of alternative stability criteria for a range of positive stability after damage or flooding for column-stabilized semisubmersible units, adopted by the Organization by resolution A.651(16)).

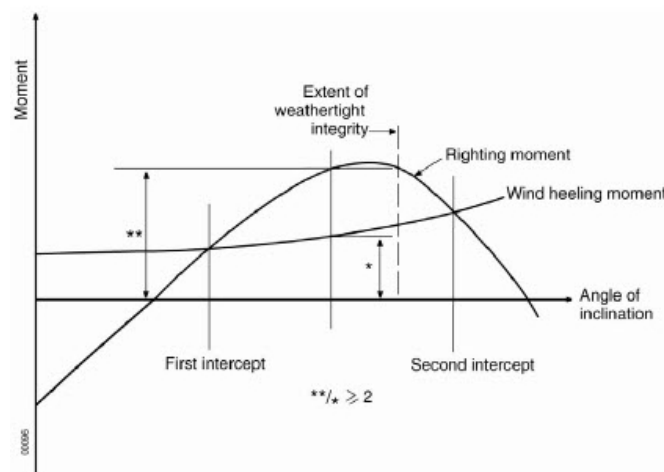


Fig 4.3 Righting moment and heeling moment curves



2. The unit should 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 the 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, taking the following considerations into account:
  - (1) the angle of inclination after flooding should not be greater than 25°;
  - (2) The final waterline is to be located below the lower edge of any opening that does not meet the requirements in **602. 2** and **3**. However, no openings are provided in column.;
  - (3) Sufficient margin of stability is provided which requires a range of positive stability of at least 7° beyond the first intercept of the righting moment curve and the horizontal coordinate axis of the static stability curve to the second intercept of them or the downflooding angle, whichever is less.

#### 403. All types of units

1. Compliance with the provisions of **401. 1** to **402. 2** should be determined by calculations which 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 should be assumed that the unit is in the worst anticipated service condition as regards stability and is floating free of mooring restraints.
2. The ability to reduce angles of inclination by pumping out or ballasting compartments or application of mooring forces, etc., should not be considered as justifying any relaxation of these provisions.
3. Alternative subdivision and damage stability criteria may be considered for approval by the Society provided an equivalent level of safety is maintained. In determining the acceptability of such criteria, the Society should consider at least the following and take into account:
  - (1) extent of damage as set out in **Sec 5**;
  - (2) on column-stabilized units, the flooding of any one compartment as set out in **402. 2**;
  - (3) the provision of an adequate margin against capsizing.

### Section 5 Extent of Damage

#### 501. Surface units

1. In assessing the damage stability of surface units, the following extent of damage should be assumed to occur between effective watertight bulkheads:
  - (1) horizontal penetration: 1.5 m; and
  - (2) vertical extent: from the base line upwards without limit.
2. The distance between effective watertight bulkheads or their nearest stepped portions which are positioned within the assumed extent of horizontal penetration should be not less than 3 m; where there is a lesser distance, one or more of the adjacent bulkheads should be disregarded.
3. Where damage of a lesser extent than in **Par 1** results in a more severe condition, such lesser extent should be assumed.
4. All piping, ventilation systems, trunks, etc., within the extent of damage referred to in **Par 1** should be assumed to be damaged. Positive means of closure should be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.
5. The compartments bounded by the bottom shell are to be considered flooded individually.

#### 502. Self-elevating units

1. In assessing the damage stability of self-elevating units, the following extent of damage should be assumed to occur between effective watertight bulkheads:
  - (1) horizontal penetration: 1.5 m; and
  - (2) vertical extent: from the base line upwards without limit.

2. The distance between effective watertight bulkheads or their nearest stepped portions which are positioned within the assumed extent of horizontal penetration should be not less than 3 m; where there is a lesser distance, one or more of the adjacent bulkheads should be disregarded.
3. Where damage of a lesser extent than in **Par 1** results in a more severe condition, such lesser extent should be assumed.
4. 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 fall within 1.5 m vertically of the waterline, and the difference in horizontal dimension of the upper hull and mat is less than 1.5 m in any area under consideration.
5. All piping, ventilation systems, trunks, etc., within the extent of damage referred to in **Par 1** should be assumed to be damaged. Positive means of closure should be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.
6. Positive means of closure are to be provided to preclude progressive flooding of other intact spaces.
7. The compartments adjacent to the bottom shell are also to be considered flooded individually.
8. The recessed ends and sides of 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 are to be included in the Operating Booklet.

### 503. Column-stabilized units

1. In assessing the damage stability of column-stabilized units, the following extent of damage should be assumed:
  - (1) Only those columns, underwater hulls and braces on the periphery of the unit should be assumed to be damaged and the damage should be assumed in the exposed portions of the columns, underwater hulls and braces.
  - (2) Columns and braces should be assumed to be flooded by damage having a vertical extent of 3 m occurring at any level between 5 m above and 3 m below the draughts specified in the operating manual. Where a watertight flat is located within this region, the damage should be assumed to have occurred in both compartments above and below the watertight flat in question. Lesser distances above or below the draughts may be applied to the satisfaction of the Society, taking into account the actual operating conditions. However, the required damage region should extend at least 1.5 m above and below the draught specified in the operating manual.
  - (3) No vertical bulkhead should be assumed to be damaged, except where bulkheads are spaced closer than a distance of one eighth of the column perimeter at the draught under consideration, measured at the periphery, in which case one or more of the bulkheads should be disregarded.
  - (4) Horizontal penetration of damage should be assumed to be 1.5 m.
  - (5) Underwater hull or footings should be assumed to be damaged when operating in a transit condition in the same manner as indicated in (1), (2), (4) and either (3) or (7), having regard to their shape.
  - (6) If damage of a lesser extent than specified in (1) to (5) results in a more severe damage equilibrium condition, such a lesser extent is to be assumed.
  - (7) All piping, ventilation systems, trunks, etc., within the extent of damage should be assumed to be damaged. Positive means of closure should be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.

## Section 6 Watertight Integrity

### 601. Watertight Bulkheads

#### 1. General

- (1) All units are to be provided with watertight bulkheads in accordance with the requirements in **Pt 3, Ch 14 of Rules for the Classification of Steel Ships** and **Ch 14 of Rules for the Classification of Steel Barges**. In the case of column-stabilized units, the scantlings of water-

tight flats and bulkheads are to be made of effective to that point necessary to meet the requirements of damage stability.

- (2) All surface type units are to be provided with a collision bulkhead in accordance with the requirements in **Pt 3, Ch 14, 201.** of **Rules for the Classification of Steel Ships**. However, where openings, etc. are provided on collision bulkhead, the requirements for watertight doors in **Pt 3, Ch 14, Sec 4** and **Pt 5, Ch 6, 107.** of **Rules for the Classification of Steel Ships** are to be satisfied.

## 2. Tank boundaries

- (1) Tight divisions and boundary bulkheads of all tanks are to be constructed in accordance with the requirements in **Pt 3, Ch 15** of **Rules for the Classification of Steel Ships**.
- (2) 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.
- (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.
- (4) Each tank is to be tested in accordance with **Table 3.1.1** in **Pt 3, Ch 1** of **Rules for the Classification of Steel Ships**.

## 3. Boundary penetrations

- (1) The number of openings in watertight subdivisions should be kept to a minimum compatible with the design and safe operation of the unit. 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.
- (2) Notwithstanding the requirements in **Par 1**, non-watertight ventilation ducts are to be provided with watertight valves at the 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. However, for self-elevating units, ventilating systems which are not used during the transit condition may be secured by alternative methods approved by the Society. In this case, necessary ventilation for closed spaces is to be arranged at the discretion of the Society.
- (3) Watertight doors should be designed to withstand water pressure to a head up to the bulkhead deck or freeboard deck respectively. A prototype pressure test should be conducted for each type and size of door to be installed on the unit at a test pressure corresponding to at least the head required for the intended location. The prototype test should be carried out before the door is fitted. The installation method and procedure for fitting the door on board should correspond to that of the prototype test. When fitted on board, each door should be checked for proper seating between the bulkhead, the frame and the door. Large doors or hatches of a design and size that would make pressure testing impracticable may be exempted from the prototype pressure test, provided that it is demonstrated by calculations that the doors or hatches maintain watertightness at the design pressure, with a proper margin of resistance. After installation, every such door, hatch or ramp should be tested by means of a hose test or equivalent.

## 602. Closing Appliances

### 1. General

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 **Pt 4, Ch 3, Sec 3** of **Rules for the Classification of Steel Ships** and International Convention on Load Lines, except that those which are 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 the Society.

### 2. General requirements related to watertight integrity.

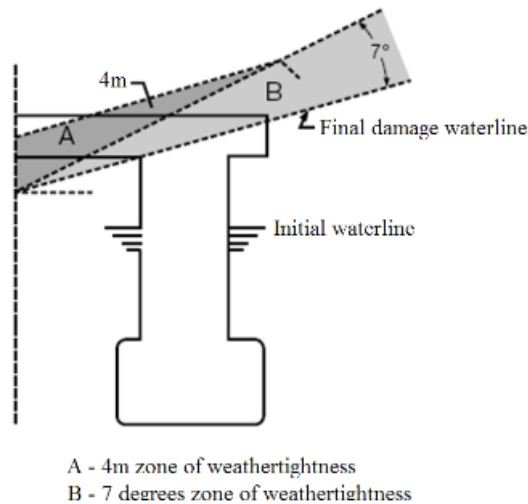
- (1) External openings, such as air pipes (regardless of closing appliances), ventilators, ventilation intakes and outlets, non-watertight hatches and weathertight doors, which are used during operation of the unit while afloat, are not to submerge when the unit is inclined to the first intercept of the righting moment and wind heeling moment curves in any intact or damaged condition.

Openings, such as side scuttles of the non-opening type, manholes and small hatches, which are fitted with appliances to ensure watertight integrity, may be submerged. (Such openings are not allowed to be fitted in the column of stabilized units.) Such openings are not to be regarded as emergency exits. Where flooding of chain lockers or other buoyant volumes may occur, the openings to these spaces should be considered as downflooding points.

- (2) External openings fitted with appliances to ensure watertight integrity, which are kept permanently closed while afloat, are to comply with the requirements of (5).
- (3) Internal openings fitted with appliances to ensure watertight integrity are to comply with the following:
  - (A) Doors and hatch covers which are used during the operation of the unit while afloat should be remotely controlled from the central ballast control station and should also be operable locally from each side. Open/shut indicators should be provided at the control station. 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 indicators 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 door 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 sides.
  - (B) 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.
  - (C) The closing appliances are to have strength, packing and means for securing which are sufficient to maintain watertightness under the design water pressure of the watertight boundary under consideration.
- (4) Remotely operated doors should meet **SOLAS regulation II-1/13-1**.
- (5) Internal openings fitted with appliances to ensure watertight integrity, which are to be kept permanently closed while afloat, are to comply with the following:
  - (A) A signboard to the effect that the opening is always to be kept closed while afloat is to be fitted on the closing appliance in question.
  - (B) Opening and closing of such closure devices should be noted in the unit's logbook, or equivalent.
  - (C) Manholes fitted with bolted covers need not be dealt with as under (A).
  - (D) The closing appliances are to have strength, packing and means for securing which are sufficient to maintain watertightness under the design water pressure of the watertight boundary under consideration.

### 3. General requirements related to weathertight integrity.

- (1) Any opening, such as an air pipe, ventilator, ventilation intake or outlet, non-watertight side-scuttle, small hatch, door, etc., having its lower edge submerged below a waterline associated with the zones indicate in (A) or (B) below, is to be fitted with a weathertight closing appliance to ensure the weathertight integrity, when:
  - (A) a unit is inclined to the range between the first intercept of the right moment curve and the wind heeling moment curve and the angle necessary to comply with the requirements of **302**. during the intact condition of the unit while afloat; and
  - (B) a column-stabilized unit is inclined to the range:
    - (a) necessary to comply with the requirements of **402. 1 (3)** and with a zone measured 4.0 m perpendicularly above the final damaged waterline per **402. 1 (1)** referred to **Fig 4.4**, and
    - (b) necessary to comply with the requirements of **402. 2 (3)**.
- (2) External openings fitted with appliances to ensure weathertight integrity, which are kept permanently closed while afloat, are to comply with the requirements of **602. 2 (5)** (A) and (B).
- (3) External openings fitted with appliances to ensure weathertight integrity, which are secured while afloat are to comply with the requirements of **602. 2 (3)** (A) and (B).



**Fig 4.4 Minimum weathertight integrity requirements for column-stabilized units**

## Section 7 Freeboard

### 701. General

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 should 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. The requirements of the 1988 LL Protocol with respect to weathertightness and watertightness of decks, superstructures, deckhouses, doors, hatchway covers, other openings, ventilators, air pipes, scuppers, inlets and discharges, etc., should be taken as a basis for all units in the afloat condition.
3. In general, heights of hatch and ventilator coamings, air pipes, door sills, etc., in exposed positions and their means of closing should be determined by consideration of the provisions regarding both intact and damage stability.
4. All downflooding openings which may become submerged before the angle of inclination at which the required area under the intact righting arm curve is achieved should be fitted with weathertight closing appliances.
5. With regard to damage stability, the provisions of **402. 1 (2)**, **402. 2** and **602. 2** should apply.
6. The Society should give special consideration 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.

### 702. Surface units

1. Load lines should be assigned to surface units as calculated under the terms of the 1988 LL Protocol and should be subject to all the conditions of assignment of that Protocol.
2. Where it is necessary to assign a greater than minimum freeboard to meet the provisions regarding intact or damage stability or on account of any other restriction imposed by the Society, regulation 6(6) of the 1988 LL Protocol should apply. When such a freeboard is assigned, seasonal marks above the centre of the ring should not be marked and any seasonal marks below the centre of the

ring should be marked. If a unit is assigned a greater than minimum freeboard at the request of the owner, regulation 6(6) need not apply.

3. Where moonpools are arranged within the hull in open communication with the sea, the volume of the moonpool should not be included in the calculation of any hydrostatic properties. If the moonpool has a larger cross-sectional area above the waterline at 85% of the depth for freeboard than below, an addition should be made to the geometric freeboard corresponding to the lost buoyancy. This addition for the excess portion above the waterline at 85% of the depth for freeboard should be made as prescribed below for wells or recesses. If an enclosed superstructure contains part of the moonpool, deduction should be made for the effective length of the superstructure. 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 85% of the depth for freeboard should be made to the freeboard obtained after all other corrections, except bow height correction, have been made. Free surface effects of the flooded well or recess should be taken into account in stability calculations.
4. The procedure described in **Par 3** should also apply in cases of small notches or relatively narrow cut-outs at the stern of the unit.
5. Narrow wing extensions at the stern of the unit should be considered as appendages and excluded for the determination of length (L) and for the calculation of freeboards. The Society should determine the effect of such wing extensions with regard to the provisions relating to the strength of unit based upon length (L).

### 703. Self-elevating units

1. Load lines should be assigned to self-elevating units as calculated under the terms of the 1988 LL Protocol. When floating, or when in transit from one operational area to another, units should be subject to all the conditions of assignment of that Protocol unless specifically excepted. However, these units should not be subject to the terms of that Protocol while they are supported by the seabed or are in the process of lowering or raising their legs.
2. The minimum freeboard of units which due to their configuration cannot be computed by the normal methods laid down by the 1988 LL Protocol should be determined on the basis of meeting applicable provisions regarding intact stability, damage stability and structure in the afloat condition.
3. Where it is necessary to assign a greater than minimum freeboard to meet intact or damage stability provisions or on account of any other restriction imposed by the Society, regulation 6(6) of the 1988 LL Protocol should apply. When such a freeboard is assigned, seasonal marks above the centre of the ring should not be marked and any seasonal marks below the centre of the ring should be marked. If a unit is assigned a greater than minimum freeboard at the request of the owner, regulation 6(6) need not apply.
4. Where moonpools are arranged within the hull in open communication with the sea, the volume of the moonpool should not be included in the calculation of any hydrostatic properties. If the moonpool has a larger cross-sectional area above the waterline at 85% of the depth for freeboard than below, an addition should be made to the geometric freeboard corresponding to the lost buoyancy. This addition for the excess portion above the waterline at 85% of the depth for freeboard should be made as prescribed below for wells or recesses. If an enclosed superstructure contains part of the moonpool, deduction should be made for the effective length of the superstructure. 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 85% of the depth for freeboard should be made to the freeboard obtained after all other corrections, except bow height correction, have been made. Free surface effects of the flooded well or recess should be taken into account in stability calculations.
5. The procedure described in **Par 4** should apply in cases of small notches or relatively narrow cut-outs at the stern of the unit.
6. Narrow wing extensions at the stern of the unit should be considered as appendages and excluded for the determination of length (L) and for the calculation of freeboards. The Society should determine the effect of such wing extensions with regard to the requirements of the 1988 LL Protocol for the strength of unit based upon length (L).

7. 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 Society should consider the extent of application of regulations 39(1), 39(2) and 39(5) of the 1988 LL 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.
8. Some self-elevating units utilize a large mat or similar supporting structure which contributes to the buoyancy when the unit is floating. In such cases the mat or similar supporting structure should be ignored in the calculation of freeboard. The mat or similar supporting structure should, however, always be taken into account in the evaluation of the stability of the unit when floating since its vertical position relative to the upper hull may be critical.

#### 704. Column-stabilized units

1. The hull form of this type of unit makes the calculation of geometric freeboard in accordance with the provisions of chapter III of the 1988 LL Protocol impracticable. Therefore the minimum freeboard of each column-stabilized unit should be determined by meeting the applicable provisions for:
  - (1) the strength of the unit's structure;
  - (2) the minimum clearance between passing wave crests and deck structure (see **Ch 3, 707.**); and
  - (3) intact and damage stability.
2. The minimum freeboard should be marked in appropriate locations on the structure.
3. The enclosed deck structure of each column-stabilized unit should be made weathertight.
4. Windows, sidescuttles and portlights, including those of the non-opening type, or other similar openings should not be located below the deck structure of column-stabilized units.
5. The Society should give special consideration 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. ↓

# CHAPTER 5 MACHINERY INSTALLATIONS OF ALL TYPES OF UNITS

## Section 1 General

### 101. Application

1. The requirements in this Section apply to engines, shaftings and power transmission gears, boilers, pressure vessels, auxiliaries, piping arrangements installed in all types of units.
2. Codes and standards of practice which have been proven to be effective by actual application by the offshore drilling industry which are not in conflict with the Rule, and which are acceptable to the Society, may be applied in addition to these requirements.
3. For ship type units, in addition to the requirements in this Chapter, the requirements relevant to the machinery in **Pt 5 of Rules for the Classification of Steel Ships** are also to be complied with.
4. Systems and equipment that are used solely for drilling and that may affect the safety of the unit on which they are installed may be designed to the alternative requirements of recognized standards acceptable to the Society.

### 102. General

1. All machinery, electrical equipment, boilers and other pressure vessels, associated piping systems, fittings and wiring should be of a design and construction adequate for the intended service
2. The machinery is to be so designed, manufactured and installed as to reduce to a minimum any danger to the units and persons on board under the normal service condition.
3. The design should have regard to materials used in construction, and to the marine and industrial purposes for which the equipment is intended, the working conditions and the environmental conditions to which it will be subjected. Consideration should be given to the consequences of the failure of systems and equipment essential to the safety of the unit.
4. The moving parts, hot surfaces and the live parts of the machinery are to be arranged with suitable protections, so that persons will be kept from getting injured.
5. The machinery is to be so constructed that any combustible or unhealthy gases will not leak out under the normal service condition.
6. The machinery is to be located in well ventilated spaces capable of discharging the gases mentioned in **Par 5**.
7. Where it is intended to burn fuels of a flash point below 60 °C, closed cup test, this fact is to be indicated clearly on the arrangement submitted. 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 installation and ventilation provisions.
8. All boilers, all parts of machinery, all steam, hydraulic, pneumatic and other systems and their associated fittings which are under internal pressure should be subjected to appropriate tests including a pressure test before being put into service for the first time.
9. Adequate provisions and arrangements should be made to facilitate safe access, cleaning, inspection and maintenance of machinery including boilers and pressure vessels.
10. Where risk from overspeeding of machinery exists, means should be provided to ensure that the safe speed is not exceeded.
11. Where machinery including pressure vessels or any parts of such machinery are subject to internal pressure and may be subject to dangerous overpressure, means should, where applicable, be provided which will protect against such excessive pressure.
12. Machinery, where applicable, should be provided with automatic shutoff arrangements or alarms in



the case of failures, such as lubricating oil supply failure, which could lead rapidly to complete breakdown, damage or explosion. The Society may permit provisions for overriding automatic shut-off devices.

13. Means should be provided whereby normal operation of vital systems, such as ballast systems in semisubmersible units, jacking systems in selfelevating units and blowout preventers, can be sustained or restored even though one of the essential auxiliaries becomes inoperable.
14. Means should be provided to ensure that machinery can be brought into operation from the "dead ship" condition without external aid.

### 103. Conditions of inclinations

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° either way and simultaneously trimmed to an angle up to 5° by the bow or stern.

The Society may permit or require deviations from these angles, in consideration of the type, size and service conditions of the unit.

### 104. Terminology

1. The systems essential for the safety of the units are those listed below :
  - (1) Anchor handling systems
  - (2) Mooring systems
  - (3) Fire extinguishing systems
  - (4) Bilge systems
  - (5) Ballast systems
  - (6) Jacking systems
  - (7) Lighting systems
  - (8) Interior communication systems
  - (9) Ventilation systems in the compartments in which internal combustion engines or boilers are installed or other compartments required to be ventilated
  - (10) Feed water systems and burning systems for boilers which supply steam to any one of the systems prescribed in (1) to (9) and (11).
  - (11) Electric power plant and their starting arrangements (hereinafter referred to as "main source of electrical power") for the systems prescribed in (A) to (J), lighting systems required by the National or International Regulations to be installed in the units such as navigation lights, signal lights and for the radio equipment
  - (12) Other systems considered necessary by the Society
2. Restricted service unit is a unit whose navigation route or service area is limited to the coastal waters, smooth waters or equivalent.

### 105. Alternative design and arrangements

When alternative design or arrangements deviate from the prescriptive provisions of the Code, an engineering analysis, evaluation and approval of the design and arrangements should be carried out in accordance with **SOLAS regulation II-1/55**.

## Section 2 Machinery Installations

### 201. Engines, shaftings and power transmission gears

#### 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 **Pt 5, Ch 2, Sec 2** and **Ch 6, Sec 6** and **9** of **Rules for the Classification of Steel Ships** respectively. However, the requirement in **Pt 5, Ch 2, 203. 10** of **Rules for the Classification of Steel Ships** 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 **Pt 5, Ch 2, Sec 2** of **Rules for the Classification of Steel Ships**.

#### 2. Steam turbines

- (1) Steam turbines are to be provided with overspeed protective devices to prevent the design speed from being exceeded by more than 115 %.
- (2) Steam turbines used for the systems essential for the safety of the units are to be in accordance with the requirements in **Pt 5, Ch 2, Sec 3** of **Rules for the Classification of Steel Ships**.

#### 3. Gas turbines

Gas turbines are to be in accordance with the requirements in **Pt 5, Ch 2, Sec 4** of **Rules for the Classification of Steel Ships**.

#### 4. Stern bearings and sealings of propeller shafts

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

#### 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.

### 202. Boilers and pressure vessels

Boilers and pressure vessels are to be in accordance with the requirements in **Pt 5, Ch 5** of **Rules for the Classification of Steel Ships**.

### 203. Auxiliaries and piping arrangements

#### 1. General

- (1) Auxiliaries and piping arrangements are to be in accordance with the requirements in this Article as well as those in **Pt 5, Ch 6** of **Rules for the Classification of Steel Ships**.
- (2) Pipes are to be arranged inboard of the zone of assumed damage penetration in **Ch 7, 104**, unless special consideration has been taken in the damage stability review.
- (3) Where valves of piping systems are arranged for remote control and are power-operated, a secondary means of operating the valves which may be manually controlled, is to be provided.
- (4) Piping systems carrying non-hazardous fluids are generally to be separated 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) Piping systems used for the safe operation of the unit are generally to be separate from those used solely for drilling operations. However, consideration will be taken in the connection of the two piping systems, if necessarily accepted by the Society.
- (6) To prevent ignition, exhaust pipe insulation is to be encased in steel sheathing or equivalent

material to be protected against possible oil absorption.

## 2. Feed water systems and fuel oil burning systems for boilers

For boilers intended to supply steam for other than the systems or the equipment for the safety of the unit and for the propulsion of the unit (only applicable to the unit which has the main propulsion machinery), only one feed water piping and pump and fuel oil burning system for boilers may be acceptable notwithstanding the requirements in Pt 5, Ch 6, Sec 5 and 6 of Rules for the Classification of Steel Ships.

## 3. Arrangements for oil fuel, lubricating oil and other flammable oils

- (1) Arrangements for the storage, distribution and utilization of oil fuel and pressurized lubricating oil should be such as to ensure the safety of the unit and persons on board.
- (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 should be such as to ensure the safety of the unit and persons on board.
- (3) In machinery spaces pipes, fittings and valves carrying flammable oils should be of a material approved by the Society, having regard to the risk of fire.
- (4) Location and arrangement of vent pipes for fuel oil service, settling and lubrication oil tanks should be such that, in the event of a broken vent pipe, the risk of ingress of rainwater or seawater is minimized.
- (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 with a capacity of at least 8 hours at maximum continuous rating of the propulsion plant and normal operating load at sea of the generating plant and the boiler.
- (6) High pressure fuel delivery lines
  - (A) All external high pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors should 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 should include a means for collection of leakages and arrangements should be provided for an alarm to be given of a fuel line failure.
  - (B) All surfaces with temperatures above 220°C, which may be impinged as a result of a fuel system failure, should be properly insulated.
  - (C) Oil fuel lines should 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 should be kept to a minimum.

## 4. Compressed air systems

- (1) In every unit means should 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. Suitable pressure relief arrangements should be provided for all systems.
- (2) The starting air arrangements for internal combustion engines should be adequately protected against the effects of backfiring and internal explosions in the starting air pipes.
- (3) Starting air pipes from the air receivers to internal combustion engines should be entirely separate from the compressor discharge pipe system.
- (4) Provision should be made to reduce to a minimum the entry of oil into the starting air pressure systems and to drain these systems.

## 5. Bilge systems

- (1) An efficient bilge pumping system should be provided, capable of pumping from and draining watertight compartments other than spaces permanently appropriated for the carriage of liquid and for which other efficient means of pumping are provided, under all practical conditions whether the unit is upright or inclined, as specified in 103. Additional suction should be provided in large compartments or compartments of unusual form, as deemed necessary by the Society. In addition to bilge piping arrangements required by (12) below, means are to be provided to detect the presence of water in such compartments which are adjacent to the sea or adjacent to tanks containing liquids and in void compartments through which pipes conveying liquids pass. If the Society is satisfied that the safety of the unit is not impaired, the means to detect the presence of water may be dispensed with

- (2) Emergency bilge suction may be dispensed with notwithstanding the requirements in **Pt 5, Ch 6, 403. 6** of **Rules for the Classification of Steel Ships**.
- (3) For units subject to the requirements in this Section, the requirements for the direct bilge suction prescribed in **Pt 5, Ch 6, Sec 4** of **Rules for the Classification of Steel Ships** are only applied for compartments under the load line containing the main source of electric power. Where, however, these compartments are pumped up by exclusive bilge pumps, the direct bilge suction may be dispensed with.
- (4) Notwithstanding the requirements in **Pt 5, Ch 6, Sec 4** of **Rules for the Classification of Steel Ships**, in determination of the internal diameters of the main bilge line and the branch bilge suction, the following requirements are to be complied:

- (A) 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 mm or more, standard pipes of one grade higher diameter are to be used. The internal diameter of any bilge line is not to be less than 50 mm.

$$d = 2.15 \sqrt{A} + 25 \quad (\text{mm})$$

where :

$d$  : Internal diameters of the branch bilge suction (mm).

$A$  : Wetted surface of the compartment, excluding stiffening members when the compartment is half filled with water ( $\text{m}^2$ ).

- (B) The cross sectional area of the main bilge line is not to be less than the combined areas of the two largest branch suction.
- (5) The capacity,  $Q$ , of each bilge pumping unit or bilge pump is not to be less than that required by the following formula.

$$Q = 5.66 d_m^2 10^{-3} \quad (\text{m}^3/\text{hr})$$

where:

$d_m$  = Required internal diameter of main bilge line (mm)

- (6) Taking account of purposes and operating mode of the units, the Society may accept one bilge pump notwithstanding the requirements in **Pt 5, Ch 6, Sec 4** of **Rules for the Classification of Steel Ships**.
- (7) The following additional provisions are applicable to column-stabilized units:
- (A) Chain lockers which, if flooded, could substantially affect the unit's stability should be provided with a remote means to detect flooding and a permanently installed means of dewatering. Remote indication of flooding should be provided at the central ballast control station.
- (B) At least one of the pumps referred to in Subparagraph (8) and pump-room bilge suction valves should be capable of both remote and local operation.
- (C) Propulsion rooms and pumprooms in lower hulls should be provided with two independent systems for high bilge water level detection providing an audible and visual alarm at the central ballast control station.
- (8) At least two self-priming power pumps connected to each bilge main should be provided. Sanitary, ballast and general service pumps may be accepted as independent power bilge pumps if fitted with the necessary connections to the bilge pumping system. Ejectors and their associated pumps which are so arranged as to be capable of discharging bilge effectively will be considered as power bilge pumps according to the requirement in **Pt 5, Ch 6, Sec 4, 405. 1 (3)** of **Rules for the Classification of Steel Ships**.
- (9) Compartments below deck containing essential equipment for operation and safety of the unit are to have a permanently installed bilge or drainage system. These compartments are to be drained with at least two bilge pumps, or equal.
- (10) All distribution boxes and manually operated valves in connection with the bilge pumping arrangements are to be in positions which are accessible under normal circumstances. Where such

valves are located in normally unmanned spaces below the assigned load line and not provided with high bilge water level alarms, they are to be operable from outside the spaces.

- (11) Chain lockers are to be capable of being drained by a permanently installed bilge or drainage system or by portable means. Means are to be provided for removal of mud and debris from the bilge or drainage system.
- (12) 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 the stability analysis in the unit.
- (13) Drainage of hazardous areas should be given special consideration having regard to the risk of explosion. Hazardous and non-hazardous areas are to be provided with separate drainage or pumping arrangements.
- (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 indicator is to rely on movement of the valve spindle.
- (15) All bilge pipes should be of steel or other suitable material having properties acceptable to the Administration. Special consideration should be given to the design of bilge lines passing through ballast tanks taking into account effects of corrosion or other deterioration.
- (16) The arrangement of the bilge pumping system should be such as to prevent the possibility of water passing from the sea into dry spaces, or inadvertently from one compartment to another.

## 6. Ballast systems for column-stabilized units

- (1) Units are to be provided with an efficient pumping system capable of ballasting and deballasting any ballast tank under normal operating and transit conditions.
- (2) The system is to be capable of raising the unit, starting from a level trim condition at the deepest normal operating draft, to the severe storm draft, or a greater distance as may be specified by the Society, within three hours.
- (3) For column-stabilized units, the ballast systems are to consist of two or more adequate means by way of pumps or other suitable apparatuses, and they are to be capable of ballasting and de-ballasting all compartments even when one of them is out of service. The ballast pumps are to be of the self-priming type or be provided with a separate priming system.
- (4) The ballast system should be capable of operating after the damage specified in **Ch 4, Sec 5** 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. The Society may permit counter-flooding as an operational procedure. Counter-flooding is not to be considered as a means to improve the suction head available to the ballast pumps when considering the operability of the ballast system after the damage specified in **Ch 4, Sec 5**.
- (5) The ballast system is to be arranged to prevent the inadvertent transfer of ballast water from one quadrant to any other quadrant of the unit. 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.
- (6) It is to be possible to supply each ballast pump required by Subparagraph (3) above 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 **103**. to a level trim and safe draught condition after loss of any single component in the power supply system.
- (7) All ballast pipes should be of steel or other suitable material having properties acceptable to the Society. Special consideration should be given to the design of ballast lines passing through ballast tanks, taking into account effects of corrosion or other deterioration.
- (8) All valves and valve control systems for their function are to be clearly marked. 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.
- (9) Air pipes should be provided on each ballast tank sufficient in number and cross-sectional area to permit the efficient operation of the ballast pumping system under the conditions referred to in Subparagraphs (1) to (8).
- (10) Sounding devices of approved type are to be provided in the ballast tanks in the lower hulls of the column-stabilized units. However, for the units to be used at both the high and low pre-determined ballast water levels, the sounding devices may be substituted by alarming devices

- which will alarm at either of these levels.
- (11) A central ballast control station should be provided. It should be located above the worst damage waterline and in a space not within the assumed extent of damage referred to in **Ch 4** and adequately protected from weather. It should be provided with the following control and indicating systems, having appropriate audible and visual alarms, where applicable:
    - (A) ballast pump control system
    - (B) ballast pump status-indicating system
    - (C) ballast valve control system
    - (D) ballast valve position-indicating system
    - (E) tank level indicating system
    - (F) draught indicating system
    - (G) heel and trim indicators
    - (H) power availability indicating system (main and emergency)
    - (I) ballast system hydraulic/pneumatic pressure-indicating system.
  - (12) In addition to remote control of the ballast pumps and valves from the central ballast control station, all ballast pumps and valves should 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 should be in the same location.
  - (13) The control and indicating systems listed in Subparagraph (11) above should function independently of one another, or have sufficient redundancy, such that a failure in one system does not jeopardize the operation of any of the other systems.
  - (14) Each power-actuated valve is to fail 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. The Society may accept ballast valve arrangements that do not fail to the closed position upon loss of power provided that the Society is satisfied that the safety of the unit is not impaired.
  - (15) The ballast tank level indicating system required by Subparagraph (11) above is to provide means specified in the following (A) and (B).
    - (A) 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, should be provided. Tank level sensors should not be situated in the tank suction lines;
    - (B) A means to indicate liquid levels in tanks which, in view of the Society, could affect the stability of the unit. Tank level sensors are not to be situated in the tank suction lines.
  - (16) The draught indicating system required by Subparagraph (11) above is to indicate the draught at each corner of the unit or at representative positions as deemed appropriate by the Society.
  - (17) Enclosures housing ballast system electrical components, the failure of which would cause unsafe operation of the ballast system upon liquid entry into the enclosure, should comply with **Ch 6, 203. 21**.
  - (18) 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.
  - (19) A permanently installed means of communication, independent of the unit's main source of electrical power, should be provided between the central ballast control station and spaces that contain ballast pumps or valves, or other spaces that may contain equipment necessary for the operation of the ballast system.

## 7. Air pipes and sounding pipes

- (1) Air pipe openings and discharge openings of overflow pipes are to be located above the final calculated immersion line in the assumed damage condition specified in **Ch 7**, and are to be positioned outside the extent of damage, as defined in **Ch 7**.
- (2) Air pipes and overflow pipes which could cause progressive flooding are to be considered in the damage stability review.
- (3) Where the air pipes or sounding pipes for the ballast tanks in the lower hulls of the column-stabilized units are exposed to sea water under the load water line, these pipes are to have sufficient thickness against corrosion and to be protected from mechanical damage or to have sufficient strength.
- (4) One air pipe may be acceptable for certain tanks notwithstanding the requirements in **Pt 5, Ch 6, Sec 2 of Rules for the Classification of Steel Ships** provided that the Society considered satisfactory taking account of the types and service conditions of the units.

- (5) 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 is to be at least 50 mm notwithstanding the requirements in **Pt 5, Ch 6, 203. 3 (3)** of **Rules for the Classification of Steel Ships**.

Sounding pipes are to be of the minimum internal diameter 38 mm. Where a sounding pipe exceeds 20 m in length, the minimum internal diameter is to be increased to at least 50 mm.

- (6) Where a remote level indicating system is used, an additional sounding system is to be provided for tanks which are not always accessible.
- (7) 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.

#### 8. Ship-side valves

For the units for which the exemption of Docking survey is especially approved by the Society, 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.

#### 9. Remote operation of sea-water inlet and discharge valves

- (1) Each seawater inlet and discharge in spaces below the assigned load line should be provided with a valve operable from an accessible position outside the space on:
- (A) all column-stabilized units or
  - (B) all other units where the space containing the valve is normally unattended and is not provided with high bilge water level detection
- (2) 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 or in opening of closed valves.
- (3) Consideration will be given to accepting bilge alarms in lieu of remote operation for surface type and self-elevating units specified in (1) (B).

#### 10. Protection against flooding

- (1) The control systems and indicators provided in **Ch 4, 602. 1 (1)** 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 the Society.
- (2) Nonmetallic expansion joints in piping systems, if located in a system which penetrates the unit's side and both the penetration and the nonmetallic expansion joint are located below the deepest load waterline, should be inspected as part of the Docking survey in **Ch 2, 304.** and replaced as necessary, or at an interval recommended by the manufacturer.

#### 11. Tests

Tests for the auxiliary machinery and piping are to be in accordance with the requirements in **109.**, notwithstanding the requirements in **Pt 5, Ch 6, Sec 13** of **Rules for the Classification of Steel Ships**.

#### 204. Jacking systems

The jacking systems are to be complied with **Ch 10, 105.** of **Rules for the Classification of Mobile Offshore Unit**.

#### 205. Anchoring arrangements for surface and column-stabilized units

1. Anchoring arrangements, where fitted as the sole means for position keeping, should be provided with adequate factors of safety and be designed to maintain the unit on station in all design conditions. The arrangements should be such that a failure of any single component should not cause progressive failure of the remaining anchoring arrangements.

2. The anchors, cables, shackles and other associated connecting equipment should be designed, manufactured and tested in accordance with an internationally recognized standard for offshore mooring equipment. Documentation of testing, where applicable, should be maintained on board the unit. Provisions should be made on board for the recording of changes to and inspection of the equipment.
3. Anchor cables may be of wire, rope, chain or any combination thereof.
4. Means should be provided to enable the anchor cable to be released from the unit after loss of main power.
5. Fairleads and sheaves should be designed to prevent excessive bending and wear of the anchor cable. The attachments to the hull or structure should be such as to adequately withstand the stresses imposed when an anchor cable is loaded to its breaking strength.
6. Suitable anchor stowage arrangements should be provided to prevent movement of the anchors in a seaway.
7. Each windlass should be provided with two independent power-operated brakes. Each brake should be capable of holding against a static load in the anchor cable of at least 50% of its breaking strength. Where the Society so allows, one of the brakes may be replaced by a manually operated brake.
8. The design of the windlass should provide for adequate dynamic braking capacity to control normal combinations of loads from the anchor, anchor cable and anchor handling vessel during the deployment of the anchors at the maximum design payout speed of the windlass.
9. On loss of power to the windlasses, the power-operated braking system should be automatically applied and be capable of holding against 50% of the total static braking capacity of the windlass.
10. Each windlass should be capable of being controlled from a position which provides a good view of the operation.
11. Means should be provided at the windlass control position to monitor cable tension and windlass power load and to indicate the amount of cable paid out.
12. A manned control station should be provided with means to indicate and automatically record cable tensions and the wind speed and direction.
13. Reliable means should be provided to communicate between locations critical to the anchoring operation.
14. Special consideration should be given to arrangements where the anchoring systems provided are used in conjunction with thrusters to maintain the unit on station.

## 206. Dynamic positioning systems

Dynamic positioning systems used as a means of position keeping are to comply to the requirements in **Pt 9, Ch 4** of **Rules for the Classification of Steel Ships**.

## 207. Automatic and remote control for machinery

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.
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.
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.
4. Machinery installations of the unit which has the periodically unattended machinery spaces are to



comply with the relevant requirements in **Pt 9, Ch 3, 206.** of **Rules for the Classification of Steel Ships** as well as the requirements in **Ch 9.**

## 208. Spare parts, tools and instruments

### 1. General

Spare parts, tools and instruments prescribed in this Article are generally to be provided on the units. For the units specially approved by the Society, those may be dispensed with.

### 2. Spare parts

- (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 in **Pt 5, Ch 1, Sec 4** of **Rules for the Classification of Steel Ships.**
- (2) Spare parts for bilge pumps are to be in accordance with the requirements in **Pt 5, Ch 1, Sec 4** of **Rules for the Classification of Steel Ships.**
- (3) Spare parts for ballast pumps prescribed in **104. 7** are to be provided in accordance with the requirements in **Pt 5, Ch 1, Sec 4** of **Rules for the Classification of Steel Ships.**
- (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 in **Pt 5, Ch 1, Sec 4** of **Rules for the Classification of Steel Ships.**
- (5) The Society may require to provide spare parts for jacking systems.

### 3. Tools and instruments

Tools and instruments for boilers used for the main source of electrical power and for all boilers are to be provided in accordance with the requirements in **Pt 5, Ch 1, Sec 4** of **Rules for the Classification of Steel Ships.**

### 4. Spare Parts, tools and instruments for restricted service units

The restricted service units are to be in accordance with the requirements in **Pt 5, Ch 1, Sec 4** of **Rules for the Classification of Steel Ships** regarding as ships of restricted service.

## 209. Tests

### 1. General

- (1) The tests for the machinery are to be in accordance with the requirements in this Article.
- (2) The Society may require, where considered necessary, other tests than those prescribed in this Article.
- (3) Where machinery has test certificates considered satisfactory by the Society, a part or all of tests for the machinery may be dispensed with.
- (4) As regards machinery manufactured by mass production system or specially controlled system, the Society 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.
- (5) The Society may adopt, where considered satisfactory, other test procedures than those stipulated in this Article.

### 2. Tests

- (1) Boilers, pressure vessels belonging to PV -1 and PV -2, pipings and electrical equipment are to be tested in accordance with the relevant requirements in **Pt 5** and **Pt 6** of **Rules for the Classification of Steel Ships.** However, for pipings 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 (A) to (E), 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 the Society are to be carried out for electrical equipment with rated voltage above 3,000 V even where the equipment is not used for the systems or equipment essential for the safety of the units.
  - (A) Generators and motors

- (B) Control gears for motors
  - (C) Switchboards
  - (D) Transformers for power and lighting
  - (E) Semi-conductor rectifiers for power
- (2) Engines, shaftings 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 **Pt 5 of Rules for the Classification of Steel Ships**. However, the tests may be waived depending upon the usage of these installations where approved by the Society.
- (3) The systems or equipment essential for the safety of the units are, after installation on board, to be subjected to performance tests.
- (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.
- (5) Safety devices required by this rule are, after installation on board, to be tested.
- (6) Running tests are, after installation on board, to be carried out for the generators stated in **Ch 6 201. 6** and other electrical equipment not used for the systems essential for the safety of the units coming under the following (A) or (B).
- (A) Where rated voltage exceeds d.c. 1,000 V or a.c. 3,000 V.
  - (B) Where parallel runnings (including changing over operation) are carried out with the main source of electrical power. ↓

## CHAPTER 6 ELECTRICAL INSTALLATIONS FOR ALL TYPES OF UNITS

### Section 1 General

#### 101. Application

1. Electrical equipment is generally to be in accordance with the requirements in **Pt 6, Ch 1** of **Rules for the Classification of Steel Ships** with the exclusion of those in **Ch 16** and **18** and of those for test in each Chapter in the said Part. 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.
2. Where the requirements in **Pt 6, Ch 1** of **Rules for the Classification of Steel Ships** are applied in accordance with requirements in (1), the electrical equipment may be in accordance with the requirements in the following **Sec 2** instead of the requirements in **Pt 6, Ch 1, 202., 203., 204. 9** (1) to (3), **601. 2** and **Ch 15** in the said Part. For the tests of the electrical equipment the requirements in **Ch 5, 209.** are to be applied.

#### 102. General

1. All electrical services necessary for maintaining the unit in normal operational and habitable conditions will be assured without recourse to the emergency source of power.
2. Electrical services essential for safety will be assured in case of failure of the main source of electrical power.
3. 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.
4. The safety of personnel and unit from electrical hazards will be assured.

#### 103. Condition of inclinations

The emergency generator and its prime mover and any emergency accumulator battery are to be designed to function at full rated power when upright and when inclined up to the maximum angle of heel in the intact and damaged condition, as determined in accordance with **Ch 4**. However, in no case need the equipment be designed to operate when inclined more than:

- (1) 25° in any direction on a column-stabilized;
- (2) 15° in any direction on a self-elevating unit; and
- (3) 22.5° about the longitudinal axis and/or when inclined 10° about the transverse axis on a surface unit.

#### 104. Alternative design and arrangements

When alternative design or arrangements deviate from the prescriptive provisions of the Code, an engineering analysis, evaluation and approval of the design and arrangements should be carried out in accordance with **SOLAS regulation II-1/55**.

## Section 2 Electrical Installations

### 201. Main source of electrical power

1. Every unit should be provided with a main source of electrical power which is to include at least two generating sets.
2. The power of these sets is to be such that it is still possible to ensure the functioning of the services referred to in **102.1** and listed in (1) to (8) below, except for power servicing drilling operations, in the event of any one of these generating sets being stopped.
  - (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.
3. 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 above **2** (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.
4. 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.
5. The requirements in above **Par 1** to **Par 4** 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 above **2** (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.
6. 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 by above **Par 3**, these generators and their driving engine are to be regarded as machinery used solely for operating purpose.
7. Where transformers or converters constitute an essential part of the supply system, the system is to be so arranged as to ensure the same continuity of the supply as stated in **Par 2**.
8. A main electrical lighting system which is to provide illumination throughout those parts of the unit normally accessible to and used by personnel is to be supplied from the main source of power.
9. The arrangement of the main lighting system should be such that a fire or other casualty in the space or spaces containing the main source of power, including transformers or converters, if any, will not render the emergency lighting system under **202**. inoperative.
10. The arrangement of the emergency lighting system is to be such that a fire or other casualty in the space or spaces containing the emergency source of power, including transformers or converters, if any, will not render the main lighting system required by this Article inoperative.
11. The main source of electrical power is to comply with the following:
  - (1) Where the electrical power can normally be supplied by one generator, suitable load shedding arrangements are to be provided to ensure the integrity of supplies to services required for propulsion and steering as well as the safety of the unit. In the case of loss of the generator in operation, adequate provision is to be made for automatic starting and connecting to the main switchboard of a standby generator of sufficient capacity to ensure safe navigation when underway and to ensure the safety of the unit with automatic restarting of the essential auxiliaries including, where necessary, sequential operations. The Society may dispense with these provisions where the power necessary to ensure the functioning of the service referred to in **102. 1**, ex-

- cept for power servicing drilling operations, is 250 kW or less.
- (2) If the electrical power is normally supplied by more than one generator simultaneously in parallel operation, provision should be made, for instance, by load shedding to ensure that, in case of loss of one of these generating sets, the remaining ones are kept in operation without overload to ensure safe navigation when underway and to ensure the safety of the unit.
  - (3) Where the main source of electrical power is necessary for propulsion of the unit, the main busbar should be subdivided into at least two parts which should normally be connected by circuit breakers or other approved means. The connection of generating sets and other duplicated equipment are, so far as is practicable, to be equally divided between the parts.

## 202. Emergency source of electrical power

1. Every unit is to be provided with a self-contained emergency source of electrical power.
2. The emergency source of power, the transitional source of emergency power and the emergency switchboard are to be located above the worst damage waterline and in a space not within the assumed extent of damage referred to in **Ch 4**, and be readily accessible. They should not be forward of the collision bulkhead, if any.
3. The location of the emergency source of power, the transitional source of emergency power and emergency switchboard in relation to the main source of electrical power are to be such as to ensure that a fire or other casualty in the space containing the main source of electrical power or in any machinery space of category A will not interfere with the supply or distribution of emergency power. As far as practical, the space containing the emergency source of power, the transitional source of emergency power and the emergency switchboard are not to be contiguous to boundaries of machinery spaces of category A or of those spaces containing the main source of electrical power. Where the emergency source of power, the transitional source of emergency power, and the emergency switchboard are contiguous to the boundaries of machinery spaces of category A or to those spaces containing the main source of electrical power, or to spaces of Zone 1 or Zone 2, the contiguous boundaries should be in compliance with **Ch 10, 201**.
4. Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency switchboard may be used to supply non-emergency circuits, and the emergency generator may be used exceptionally and for short periods to supply non-emergency circuits.
5. For units where the main source of electrical power is located in two or more spaces which have their own systems, including power distribution and control systems, completely independent of the systems in the other spaces and such that a fire or other casualty in any one of the spaces will not affect the power distribution from the others, or to the services under **Par 6**, the provisions of above **Par 1** may be considered satisfied without an additional emergency source of electrical power, provided that the Society is satisfied that:
  - (1) there are at least two generating sets, meeting the provisions of **103**. and each of sufficient capacity to meet the provisions of **Par 6**, in each of at least two spaces;
  - (2) the arrangements under above Subparagraph (1) in each such space are equivalent to those under **Par 8**, and **Par 11** to **Par 14**, and **204**. so that a source of electrical power is available at all times to the services under **Par 6**;
  - (3) the location of each of the spaces referred to in above Subparagraph (1) is in compliance with **Par 2** and the boundaries meet the provisions of **Par 3** except that contiguous boundaries should consist of an "A-60" bulkhead and a cofferdam, or a steel bulkhead insulated to class "A-60" on both sides.
6. The power available is to be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously. The emergency source of power should be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source for their operation:
  - (1) For a period of 18 h, emergency lighting:
    - (A) at every embarkation station on deck and over sides;
    - (B) in all service and accommodation alleyways, stairways and exits, personnel lift cars, and personnel lift trunks;
    - (C) in the machinery spaces and main generating stations including their control positions;

- (D) in all control stations and in all machinery control rooms;
  - (E) in all spaces from which control of the drilling process is performed and where controls of machinery essential for the performance of this process, or devices for emergency switching-off of the power plant are located;
  - (F) at the stowage position or positions for fire-fighters' outfits;
  - (G) at the sprinkler pump, if any, at the fire pump referred to in Subparagraph (5) at the emergency bilge pump, if any, and at their starting positions;
  - (H) on helidecks, to include perimeter and helideck status lights, wind direction indicator illumination, and related obstruction lights, if any;
- (2) For a period of 18 h, the navigation lights, other lights and sound signals, required by the International Regulations for the Prevention of Collisions at Sea, in force;
  - (3) For a period of four days signalling lights and sound signals required for marking of offshore structures;
  - (4) For a period of 18 h:
    - (A) all internal communication equipment that is required in an emergency;
    - (B) fire and gas detection and their alarm systems;
    - (C) intermittent operation of the manual fire alarms and all internal signals that are required in an emergency; and
    - (D) the capability of closing the blowout preventer and of disconnecting the unit from the well-head arrangement, if electrically controlled;
 

unless they have an independent supply from an accumulator battery suitably located for use in an emergency and sufficient for the period of 18 h;
  - (5) For a period of 18 h, one of the fire pumps, if dependent upon the emergency generator for its source of power;
  - (6) For a period of at least 18 h, permanently installed diving equipment, if dependent upon the unit's electrical power;
  - (7) On column-stabilized units, for a period of 18 h:
    - (A) ballast control and indicating systems under **Ch 5, 203. 6** (11) and
    - (B) any of the ballast pumps under **Ch 5, 203. 6** (3); only one of the connected pumps need be considered to be in operation at any time;
  - (8) For a period of half an hour:
    - (A) power to operate the watertight doors as provided under **Ch 4, 602. 2** (3) (A), but not necessarily all of them simultaneously, unless an independent temporary source of stored energy is provided; and
    - (B) power to operate the controls and indicators provided under **Ch 4, 602. 2** (3) (A).
7. The emergency source of power may be either a generator or an accumulator battery.
8. Where the emergency source of power is a generator it is to be:
- (1) driven by a suitable prime mover with an independent supply of fuel, having a flashpoint (closed cup test) of not less than 43°C ;
  - (2) started automatically upon failure of the main source of electrical power supply unless a transitional source of emergency electrical power in accordance with Subparagraph (3) is provided; where the emergency generator is automatically started, it is to be automatically connected to the emergency switchboard; those services referred to the requirements in **Par 10** are then to be connected automatically to the emergency generator ;
  - (3) provided with a transitional source of emergency power, as specified in **Par 10**, unless the emergency generator is capable of supplying the services mentioned in **Par 10** and of being automatically started and supplying the required load as quickly as is safe and practicable but in not more than 45 seconds.
9. Where the emergency source of power is an accumulator battery it is to be capable of:
- (1) carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12 % above or below its nominal voltage ;
  - (2) automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power ; and
  - (3) immediately supplying at least those services specified in **Par 10**.
10. The transitional source of emergency electrical power where required by **8** (3) is to consist of an accumulator battery suitably located for use in an emergency which is to :
- (1) operate without recharging whilst maintaining the voltage of the battery throughout the discharge

- period within plus or minus 12% of its nominal voltage,
- (2) be of sufficient capacity and be so arranged as to supply automatically in the event of failure of either the main or the emergency source of electrical power for half an hour at least the following services if they depend upon an electrical source for their operation :
    - (A) The lighting required by 6 (1) and (2). For this transitional phase, the required emergency electric lighting, in respect of the machinery space and accommodation and service spaces may be provided by permanently fixed, individual, automatically charged, relay operated accumulator lamps ; and
    - (B) All essential internal communication equipment required by 6 (4) (A) and (B) ;and
    - (C) Intermittent operation of the services referred to in 6 (4) (C) and (D), unless, in the case of (B) and (C), they have an independent supply from an accumulator battery suitably located for use in an emergency and sufficient for the period specified.
  11. The emergency switchboard is to be installed as near as is practicable to the emergency source of power and, where the emergency source of power is a generator, the emergency switchboard is to be located in the same space unless the operation of the emergency switchboard would thereby be impaired.
  12. No accumulator battery fitted to meet the provisions for emergency or transitional power supply should be installed in the same space as the emergency switchboard, unless appropriate measures to the satisfaction of the Society are taken to extract the gases discharged from the said batteries. An indicator is to be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of electrical power are being discharged.
  13. The emergency switchboard is to be supplied during normal operation from the main switchboard by an interconnector feeder which is to be adequately protected at the main switchboard against overload and short circuit and which is to be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power. Where the system is arranged for feed-back operation the interconnector feeder is also to be protected at the emergency switch board at least against short circuit.
  14. In order to ensure ready availability of the emergency source of electrical power, arrangements are to be made where necessary to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that electrical power is to be available automatically to the emergency circuits.
  15. Condition of inclinations for emergency generator operation are to be in accordance with 103.
  16. Provision is to be made for the periodic testing of the complete emergency system. This is to include the testing of transitional sources and automatic starting arrangements.

### 203. Starting arrangements for emergency generators

1. Emergency generating sets are to be capable of being readily started in their cold condition at a temperature of 0°C. If this is impracticable, or if lower temperatures are likely to be encountered, provision acceptable to the Society is to be made for maintenance of heating arrangements, to ensure ready starting of the generating sets.
2. Each emergency generating set arranged to be automatically started is to be equipped with approved starting devices approved by the Society with a storage energy capability of at least three consecutive starts. The source of stored energy is to be protected to preclude critical depletion by the automatic starting system, unless a second independent means of starting is provided. In addition, a second source of energy is to be provided for an additional three starts within 30 minutes unless manual starting can be demonstrated to be effective.
3. The stored energy is to be maintained at all times, as follows :
  - (1) Electrical and hydraulic starting systems are to be maintained from the emergency switchboard.
  - (2) Compressed air starting systems may be maintained by the main or auxiliary compressed air receivers through a suitable non-return valve or by an emergency air compressor which, if electrically driven, is supplied from the emergency switchboard.
  - (3) All of these starting, charging and energy storing devices are to be located in the emergency generator space. These devices are not to be used for any purpose other than the operation of

the emergency generator set. This does not preclude the supply to the air receiver of the emergency generator set from the main or auxiliary compressed air system through a non-return valve fitted in the emergency generator room.

4. Where automatic starting is not required, manual starting is permissible, such as manual cranking inertia starters, manually charged hydraulic accumulators, or power charge cartridges, where they can be demonstrated as being effective.
5. When manual starting is not practicable, the requirements of **Par 2** and **Par 3** are to be complied with except that starting may be manually initiated.

#### 204. Precautions against shock, fire and other hazards of electrical origin

1. Exposed metal parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live are to be earthed unless the machines or equipment are:
  - (1) supplied at a voltage not exceeding 50 V *d.c.* or 50 V *a.c.*, root mean square between conductors; auto-transformers are not to be used for the purpose of achieving this voltage; or
  - (2) supplied at a voltage not exceeding 250 V by safety isolating transformers supplying only one consuming device; or
  - (3) constructed in accordance with the principle of double insulation.
2. Additional safety means are to be provided for portable electrical apparatus for use in confined or exceptionally damp spaces where particular risks due to conductivity exist.
3. All electrical apparatus should be so constructed and so installed that it does not cause injury when handled or touched in the normal manner.
4. Where not obtained through normal construction, arrangements should be provided to effectively earth all permanently installed machinery, metal structures of derricks, masts and helicopter decks. Details of impressed-current cathodic protection systems, including installation and locations, are to be submitted when such systems are installed.
5. Switchboards are to be so arranged as to give easy access, where needed, to apparatus and equipment, in order to minimize danger to personnel. The sides and backs and, where necessary, the fronts of switchboards should be suitably guarded. Exposed live parts having voltages to earth exceeding a voltage to be specified by the Society are not to be installed on the front of such switchboards. There are to be nonconducting mats or gratings at the front and rear, where necessary.
6. Distribution systems with hull return are not to be installed, but this does not preclude, under conditions approved by the Society, the installation of:
  - (1) impressed current cathodic protective systems;
  - (2) limited and locally earthed systems (e.g., engine starting systems);
  - (3) limited and locally earthed welding systems; where the Society is satisfied that the equipotential of the structure is assured in a satisfactory manner, welding systems with hull return may be installed without this restriction; and
  - (4) insulation level monitoring devices provided the circulation current does not exceed 30 mA under the most unfavourable conditions.
7. When a distribution system, whether primary or secondary, for power, heating or lighting, with no connection to earth is used, a device capable of continuously monitoring the insulation level to earth and of giving an audible or visual indication of abnormally low insulation values is to be provided.
8. All metal sheaths and armour of cables are to be electrically continuous and are to be earthed.
9. All electric cables and wiring external to equipment should be at least of a flame-retardant type and should be so installed as not to impair their original flame-retarding properties. Where necessary for particular applications, the Society may permit the use of special types of cables such as radio frequency cables, which do not comply with the foregoing.
10. Cables and wiring serving essential or emergency power, lighting, internal communications or signals are to be so far as practicable routed clear of galleys, laundries, machinery spaces of category A and their casings and other high fire risk areas. Cables connecting fire pumps to the emergency



switchboard are to be of a fire resistant type where they pass through high fire risk areas. Where practicable all such cables are to be run in such a manner as to preclude their being rendered un-serviceable by heating of the bulkheads that may be caused by a fire in an adjacent space.

11. Cables and wiring are to be installed and supported in such a manner as to avoid chafing or other damage.
12. Terminations and joints in all conductors are to be so made that they retain the original electrical, mechanical, flame-retarding and, where necessary, fire-resisting properties of the cable.
13. Each separate circuit should be protected against short circuit and against overload, except as permitted in **Ch 8, 506.**, or where the Society may exceptionally otherwise permit.
14. The rating or appropriate setting of the overload protection device for each circuit are to be permanently indicated at the location of the protection device.
15. Lighting fittings are to be so arranged as to prevent temperature rises which could damage the cables and wiring, and to prevent surrounding material from becoming excessively hot.
16. Accumulator batteries are to be suitably housed, and compartments used primarily for their accommodation are to be properly constructed and efficiently ventilated.
17. Electrical or other equipment which may constitute a source of ignition of flammable vapours are to not be permitted in these compartments except as permitted in **Par 19**.
18. Accumulator batteries, except for batteries of self-contained battery-operated lights, are not to be located in sleeping quarters. The Society may grant exemptions from or equivalencies to this provision where hermetically sealed batteries are installed.
19. In paint lockers, acetylene stores, and similar spaces where flammable mixtures are liable to collect as well as any compartment assigned principally to accumulator batteries, no electrical equipment is to be installed unless the society is satisfied that such equipment is:
  - (1) essential for operational purposes;
  - (2) of a type which will not ignite the mixture concerned;
  - (3) appropriate to the space concerned;and
  - (4) appropriately certified for safe usage in the vapours or gases likely to be encountered.
20. Electrical apparatus and cables are to, where practicable, be excluded from any compartment in which explosives are stored. Where lighting is required, the light is to come from outside, through the boundaries of the compartment. If electrical equipment cannot be excluded from such a compartment, it is to be so designed and used as to minimize the risk of fire or explosion.
21. Where spilling or impingement of liquids could occur upon any electrical control or alarm console, or similar electrical enclosure essential to the safety of the unit, such equipment is to have suitable protection against the ingress of liquids referring to KS C IEC 60529.

#### 205. Final sub-circuits

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.
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.
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 15A.
4. Each insulated pole of final sub-circuit is to be protected by a fuse or a circuit -breaker.

#### 206. High voltage electrical installations

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 with **Pt 6, Ch 1, Sec 15 of Rules for the Classification of Steel Ships**.

2. Other high voltage electrical equipment used solely for operating purpose may comply with National or International Standards recognized by the Society.

### 207. Earthing and cathodic protection

1. Where not obtained through normal construction, arrangements are to be provided to effectively earth all machinery, metal structures of drilling towers, masts and helicopter platforms.
2. Details of impressed-current cathodic protection systems, including installation and locations, are to be submitted when such systems are installed.

## Section 3 Alarms and Internal Communication

### 301. General

1. Alarms and indicators are to be installed in accordance with the **Code on Alerts and Indicators, 2009**, adopted by the **IMO Res. A.1021(26)**.
2. Internal means of communication are to be available for transfer of information between all spaces where action may be necessary in case of an emergency.
3. Audible signals in high noise areas are to be supplemented with visual signals.

### 302. General alarm

1. Each unit should be provided with a general alarm system so installed as to be clearly perceptible in all normally accessible parts of the unit, including open decks. Alarm signal devices are to be provided which will produce a distinctive and strong note.
2. The signals used should be limited to: general emergency, toxic gas (hydrogen sulphide), combustible gas, fire alarm, and abandon unit signals. These signals are to be described in the muster list and operations manual.
3. The signals given over the general alarm system should be supplemented by instructions over the public address system.
4. At least in the following spaces general alarm is to be capable of being operated:
  - (1) Main control station;
  - (2) Drilling console;
  - (3) Navigating bridge (if any); and
  - (4) Fire control station (if any).

### 303. Mud system level alarms

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. Equivalent means to indicate possible abnormal conditions in the drilling system may be considered by the Society.

### 304. Ventilation system alarms

Ventilation system alarm is to be in accordance with the requirements in **Ch 7, 205**.

### 305. Public address

1. The public address system is to be a loudspeaker installation enabling the broadcast of messages into all spaces where personnel are normally present and muster stations.
2. It is to allow for the broadcast of messages from navigation bridge, central control room, emergency response centre, engine control room, ballast control station, jacking control station and drill-

ing console.

3. It is to be installed with regard to acoustically marginal conditions and not require any action from the addressee.
4. It is to be protected against unauthorized use.
5. The minimum sound pressure levels for broadcasting emergency announcements are to be:
  - (1) In interior spaces 75 dB(A) and at least 20 dB(A) above the speech interference level; and
  - (1) In exterior spaces 80 dB(A) and at least 15 dB(A) above the speech interference level. ↓

# CHAPTER 7 MACHINERY AND ELECTRICAL INSTALLATIONS IN HAZARDOUS AREAS

## Section 1 General

### 101. Application

1. The hazardous areas defined in this Chapter are those which normally apply to offshore drilling units for oil and gas exploration. The hazardous areas as specified may be extended or reduced depending on the actual arrangements in each case, by use of windshields, special ventilation arrangements, structural arrangements, etc.
2. For the purpose of this Chapter :
  - (1) An enclosed space is considered to be a space bounded by bulkheads and decks which may have doors, windows, of other similar openings.
  - (2) 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.

### 102. Definition of hazardous area

1. Hazardous areas are all those areas where, due to the possible presence of a flammable atmosphere arising from the drilling operations, the use without proper consideration of machinery or electrical equipment may lead to fire hazard or explosion.
2. Hazardous areas are divided into zones as follows;
  - Zone 0 : an area in which an explosive gas-air mixture is continuously present or present for long periods.
  - Zone 1 : an area in which an explosive gas-air mixture is likely to occur in normal operating conditions.
  - Zone 2 : an area in which an explosive gas-air mixture is not likely to occur, and if it occurs, it will only exist for a short time.

## Section 2 Extent of Hazardous Area

### 201. Application

For the purpose of machinery and electrical installations, hazardous areas are classified as in **202.** to **204.** 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 **102.**

### 202. Hazardous areas Zone 0

Hazardous areas Zone 0 include ;

- (1) The internal spaces of closed tanks and pipes of the mud-circulating system between the well and the final degassing discharge.
- (2) The internal spaces of closed tanks and piping for containing oil that has a closed-cup flash-point below 60°C.
- (3) The internal spaces of closed tanks and pipes for oil and gas products including escape gas outlet pipes.
- (4) The spaces in which an oil-gas-air mixture is continuously present or present for long periods.

### 203. Hazardous areas Zone 1

Hazardous areas Zone 1 include ;

- (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 provide for in Subparagraph (4), the area within 1.5 m of the boundaries of any openings to equipment which is part of the mud system as specified in Subparagraph (1), any ventilation outlets of Zone 1 spaces, or any access to Zone 1 spaces.
- (3) Pits, ducts or similar structures in locations which otherwise would be Zone 2 but which are arranged so 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 Subparagraph (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.

### 204. Hazardous areas Zone 2

Hazardous areas Zone 2 include;

- (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 m above the drill floor.
- (3) Semi-enclosed derricks to the extent of their enclosures above the drill floor or to a height of 3 m above the drill floor, whichever is the greater.
- (4) Semi-enclosed locations below and contiguous with the drill floor and to the boundaries of the derrick or to the extent of any enclosure which is liable to trap gases.
- (5) Outdoor locations below the drill floor and within a radius of 1.5 m from the area specified in **203.** (6).
- (6) The areas 1.5 m beyond the Zone 1 areas specified in **203.** (2) and beyond the semi-enclosed locations specified in **203.** (4).
- (7) Outdoor spaces within 1.5 m of the boundaries of any ventilation outlet from or access to a Zone 2 space.
- (8) Air locks between a Zone 1 and a non-hazardous area.

### 205. Openings, access and ventilation conditions affecting the extent of hazardous zones

1. Except for operational reasons access doors or other openings are not to be provided between the following spaces.
  - (1) A non-hazardous space and a hazardous zone
  - (2) A Zone 2 space and a Zone 1 space
2. Where such access doors or other openings referred to under **Par 1** are provided, any enclosed space not referred to under **203.** or **204.** and having a direct access to any Zone 1 location or Zone 2 location becomes the same zone as the location except that ;
  - (1) An enclosed space with direct access to any Zone 1 location can be considered as Zone 2 :
    - (A) The access is fitted with a gas-tight door opening into the Zone 2 space, and
    - (B) Ventilation is such that the air flow with the door open is from the Zone 2 space into the Zone 1 location, and
    - (C) Loss of ventilation is alarmed at a manned station.
  - (2) An enclosed space with direct access to any Zone 1 location is not considered hazardous if ;
    - (A) The access is fitted with a self-closing gas-tight door forming an air lock, and
    - (B) The space has ventilation overpressure in relation to the hazardous space, and
    - (C) Loss of ventilation overpressure is alarmed at a manned station.
  - (3) An enclosed space with direct access to any Zone 2 location is not considered hazardous if ;
    - (A) The access is fitted with a self-closing gas-tight door that opens into the non-hazardous location, and

- (B) Ventilation is such that the air flow with the door open is from the non-hazardous space into the Zone 2 locations, and
  - (C) Loss of ventilation is alarmed at a manned station.
3. Where ventilation arrangements of the intended safe space are considered sufficient by the Society 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. Piping systems should be designed to preclude direct communication between hazardous areas of different classifications and between hazardous and nonhazardous areas.
  5. Hold-back devices should not be used on self-closing gastight doors forming hazardous area boundaries.

## Section 3 Ventilation

### 301. General

1. Attention is to be given to ventilation inlet and outlet location and airflow in order to minimize the possibility of cross contamination.
2. Inlets are to be located in non-hazardous areas as high and as far away from any hazardous area as practicable.
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.
4. Ventilation for hazardous areas is to be completely separate from that used for non-hazardous areas.

### 302. Ventilation of hazardous areas

1. Where the ventilation duct passes through a hazardous area of a higher level, the ventilation duct should have overpressure in relation to this area and 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. 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 gas, and to spaces where gas may accumulate.
3. The outlet air from Zone 1 and Zone 2 spaces is to be led in separate ducts to outdoor locations. The internal spaces of such ducts belong to the same Zone as the inlet space.
4. Air inlet ducts designed for constant relative underpressures are to be rigidly constructed to avoid air leaks.
5. Fans are to be designed so as to reduce the risk that sparks may occur.
6. Hazardous enclosed spaces should be adequately ventilated. Hazardous enclosed mud processing spaces should be ventilated at a minimum rate of 12 air changes per hour.
7. 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 nonhazardous enclosed spaces are maintained in overpressure in relation to adjacent hazardous locations.

## Section 4 Emergency Shutdown for Electrical Equipment

### 401. Emergency conditions due to drilling operations

1. In view of exceptional conditions in which the explosion hazard or fire may extend outside the hazardous areas, special arrangements are to be provided to facilitate the selective disconnection of shutdown of :
  - (1) ventilation systems, except fans necessary for supplying combustion air to prime movers for the production of electrical power;
  - (2) main electrical generators and prime movers, including the ventilation systems for these;
  - (3) emergency generators;
  - (4) emergency equipment except those items listed in **402.**; and
  - (5) all electrical equipment outside Zone 1 areas, except where of a certified safe type for Zone 1 applications.
2. In the case of units using dynamic positioning systems as a sole means of position keeping, special consideration may be given to the selective disconnection or shutdown of machinery and equipment associated with maintaining the operability of the dynamic positioning system in order to preserve the integrity of the well.
3. Disconnection or shutdown should be possible from at least two strategic locations, one of which is to be outside hazardous areas.
4. Shutdown systems that are provided to comply with **Par 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.
5. A recommended sequence of shutdowns specified in above Subparagraph (1) is to be included in the Operating Booklet stipulated in **Ch 1, 105.**

### 402. Equipment to remain operational after emergency shutdown.

1. Equipment which is located in spaces other than enclosed spaces and arranged to be operated after complete shutdown as given in above **401. 1** is to be suitable for installation in Zone 2 locations. Such equipment which is located in enclosed spaces is to be suitable for its intended application to the satisfaction of the Society.
2. At least the following facilities are to be operable after an emergency shutdown.
  - (1) Emergency lighting required by **Ch 6, 202. 6 (1) to (7)** for half an hour ;
  - (2) Blow-out preventer control system ;
  - (3) General alarm system ;
  - (4) Public address system ; and
  - (5) Battery supplied radio communication installations.

## Section 5 Electrical Installations in Hazardous Areas

### 501. Selection and installation of electrical equipment

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) KS C IEC 61892-1: Mobile and fixed offshore units—Electrical installations—Part 1: General requirements and conditions.
  - (2) KS C IEC 61892-2: Mobile and fixed offshore units—Electrical installations—Part 2: System design.
  - (3) KS C 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) KS C IEC 61892-5: Mobile and fixed offshore units—Electrical Installations—Part 5: Mobile units.

- (6) KS C IEC 61892-6: Mobile and fixed offshore units—Electrical installations—Part 6: Installation.
- (7) KS C IEC 61892-7: Mobile and fixed offshore units—Electrical installations—Part 7: Hazardous areas.

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.

## 502. Protection of electrical installations

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 the Society.

- (1) KS C IEC 60079-4: Electrical apparatus for explosive gas atmospheres—Part 4: Method of test for ignition temperature.
- (2) IEC 60079-4A: 1970 Electrical apparatus for explosive gas atmospheres—Part 4: Method of test for ignition temperature—First supplement.
- (3) KS C IEC 60079-10: Electrical apparatus for explosive gas atmospheres—Part 10: Classification of hazardous areas.
- (4) IEC/TR 60079-12: 1978 Electrical apparatus for explosive gas atmospheres—Part 12: Classification of mixtures of gases of vapours with air according to their maximum experimental safe gaps and minimum igniting currents.
- (5) IEC/TR 60079-13: 1982-01 Electrical apparatus for explosive gas atmosphere—Part 13: Construction and use of rooms or buildings protected by pressurization.
- (6) KS C IEC 60079-14: Explosive atmospheres—Part 14: Electrical installations design, selection and erection.
- (7) IEC/TR 60079-16: 1990 Electrical apparatus for explosive gas atmospheres—Part 16: Artificial ventilation for the protection of analyser(s) houses.
- (8) IEC 60079-17: 2007 Explosive atmospheres—Part 17: Electrical installations inspection and maintenance
- (9) IEC 60079-19: 2006-10 Explosive atmospheres—Part 19: Equipment repair, overhaul and reclamation.
- (10) IEC/TR 60079-20: 1996 Electrical apparatus for explosive gas atmospheres—Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus.
- (11) IEC 60079-25: 2003 Electrical apparatus for explosive gas atmospheres—Part 25: Intrinsically safe systems.
- (12) IEC 60079-27: 2008 Explosive atmospheres—Part 27: Fieldbus intrinsically safe concept (FISCO).
- (13) KS C IEC 60079-28: Explosive atmospheres—Part 28: Protection of equipment and transmission systems using optical radiation.
- (14) IEC 60079-29-1: 2007 Explosive atmospheres—Part 291: Gas detectors—Performance requirements of detectors for flammable gases.
- (15) IEC 60079-29-2: 2007 Explosive atmospheres—Part 292: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen.
- (16) KS C IEC 60079-30-1: Explosive atmospheres—Part 301: Electrical resistance trace heating—General and testing requirements.
- (17) KS C IEC 60079-30-2: Explosive atmospheres—Part 302: Electrical resistance trace heating—Application guide for design, installation and maintenance.



2. Equipment classified in accordance with the following protection classes may be used:

**Table 7.1 Electrical protection type**

Type	Protection method
ia and ib	Intrinsic safety
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 zone by the Society.

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 7.2**. The use of type "o" is to be limited. For transportable apparatus, protection type "o" is not to be used.

**Table 7.2 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

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 7.3**.

**Table 7.3 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

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 7.4**.

**Table 7.4 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

6. Electrical apparatus located in hazardous drilling well and mud processing areas is to meet at least Group IIA and temperature class T3.
7. 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.
  - (4) Permanently installed, fixed cable passing through Zone 1 hazardous areas is to be fitted with conductive covering, braiding or sheathed for earth detection.
8. 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.

## Section 6 Machinery Installations in Hazardous Areas

### 601. General

1. Mechanical equipment is to be limited to that necessary for operational purposes.
2. Mechanical equipment and machinery 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.
3. Internal combustion engines are not to be installed in the hazardous areas. The installation of internal combustion machinery may be permitted in Zone 1 and Zone 2 hazardous areas, provided that the Society is satisfied that sufficient precautions have been taken against the risk of dangerous ignition.
4. The installation of fired equipment may be permitted in Zone 2 hazardous areas, provided that the Society is satisfied that sufficient precaution has been taken against the risk of dangerous ignition.
5. Exhaust outlets of internal combustion engines are to be fitted with suitable spark arresting devices and to discharge outside the hazardous areas.
6. Air intakes for internal combustion engines are to be not less than 3 m from the hazardous areas.
7. Exhaust outlets of boilers are to be located outside the hazardous areas. ↓

## CHAPTER 8 MACHINERY AND ELECTRICAL INSTALLATIONS FOR SELF-PROPELLED UNITS

### Section 1 General

#### 101. Application

1. The provisions of this chapter apply to units which are designed to undertake self-propelled passages without external assistance and are not applicable to units which are fitted only with means for the purpose of positioning or of assistance in towing operations.
2. Requirements in **Ch 5**, **Ch 6** and **Ch 7**. are to be applied in addition to those in this chapter.

#### 102. Construction of propulsion machinery and auxiliaries

1. 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 should 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 feedwater;
  - (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, the Society, having regard to overall safety considerations, may accept a partial reduction in capability from full normal operation.

2. Main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the unit are to, as fitted in the unit, be capable of operating under the static conditions under **Ch 5**, **103**. 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.

The Society may permit deviation from these angles, taking into consideration the type, size and service conditions of the unit.

3. Special consideration is to be given to the design, construction and installation of propulsion machinery systems so that any mode of their vibrations should not cause undue stresses in this machinery in the normal operating ranges.

### Section 2 Means of Going Astern

#### 201. General

1. Units are to have sufficient power for going astern to secure proper control of the unit in all normal circumstances.
2. The ability of the machinery to reverse the direction of thrust of the propeller in sufficient time and so to bring the unit to rest within a reasonable distance from maximum ahead service speed is to be demonstrated.

## 202. Tests

1. In the astern trial, an order for full astern is issued while the unit is running ahead at the speed specified in **Pt 3, Ch 1, 120. of Rules for the Classification of Steel Ships**, 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.
2. In units having multiple propellers, the unit navigating and maneuvering 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.
3. When the units provided with supplementary means for maneuvering 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.

## Section 3 Steam Boilers and Boiler Feed Systems

### 301. General

1. Water tube boilers serving turbine propulsion machinery are to be fitted with a high-water-level alarm.
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 feedwater 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.

## Section 4 Machinery Controls

### 401. General

Main and auxiliary machinery essential for the propulsion of the unit are to be provided with effective means for its operation and control. All control systems essential for the propulsion, control and safety of the unit are to be independent or designed such that failure of one system does not degrade the performance of another system. A pitch indicator is to be provided on the navigating bridge for controllable-pitch propellers.

### 402. Control of propulsion machinery

1. Where remote control of propulsion machinery from the navigating bridge is provided and the machinery spaces are intended to be manned, the following is to be apply:
  - (1) the speed, direction of thrust and, if applicable, the pitch of the propeller is to be fully controllable from the navigating bridge under all sailing conditions, including manoeuvring;
  - (2) the remote control is to be performed, for each independent propeller, by a control device so designed and constructed that its operation does not require particular attention to the operational details of the machinery. Where more than one propeller is designed to operate simultaneously, these propellers may be controlled by one control device;
  - (3) the main propulsion machinery is to be provided with an emergency stopping device on the navigating bridge and independent from the bridge control system;
  - (4) propulsion machinery orders from the navigating bridge is to be indicated in the main machinery control station or at the manoeuvring platform as appropriate;
  - (5) remote control of the propulsion machinery is to be possible from only one station at a time; at one control station interconnected control units are permitted. There is to be at each station an indicator showing which station is in control of the propulsion machinery. The transfer of control between navigating bridge and machinery spaces is to be possible only in the machinery

- space or machinery control room;
- (6) it is to be possible to control the propulsion machinery locally, even in the case of failure in any part of the remote control system;
  - (7) the design of the remote control system is to be such that in case of its failure an alarm will be given and the preset speed and direction of thrust be maintained until local control is in operation, unless the Society considers it impracticable;
  - (8) indicators are to be fitted on the navigating bridge for:
    - (A) propeller speed and direction in case of fixed-pitch propellers
    - (B) propeller speed and pitch position in case of controllable-pitch propellers;
  - (9) an alarm should be provided at the navigating bridge and in the machinery space to indicate low starting air pressure set at a level which still permits main engine starting operations. If the remote control system of the propulsion machinery is designed for automatic starting, the number of automatic consecutive attempts which fail to produce a start should be limited to safeguard sufficient starting air pressure for starting locally; and
  - (10) automation systems should be designed in a manner which ensures a threshold warning of impending or imminent slowdown or shutdown of the propulsion system is given to the officer in charge of the navigational watch in time to assess navigational circumstances in an emergency. In particular, the systems should control, monitor, report, alert and take safety action to slow down or stop propulsion while providing the officer in charge of the navigational watch an opportunity to manually intervene, except for those cases where manual intervention will result in total failure of the engine and/or propulsion equipment within a short time, for example in the case of overspeed.
2. Where the main propulsion and associated machinery including sources of main electrical supply are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room, this control room should be designed, equipped and installed so that the machinery operation will be as safe and effective as if it were under direct supervision; for this purpose sections **Ch 9, Sec 2 to Sec 4 and Sec 5, 501.** are to apply as appropriate. Particular consideration is to be given to protection against fire and flooding.

## Section 5 Steering

### 501. General

1. Except as provided in **Par 2**, units are to be provided with a main steering gear and an auxiliary steering gear to the satisfaction of the Society. The main steering gear and the auxiliary steering gear are to be so arranged that a single failure in one of them so far as is reasonable and practicable will not render the other one inoperative.
2. Where a non-conventional rudder is installed, or where a unit is steered by means other than a rudder, the Society is to give special consideration to the steering system so as to ensure that an acceptable degree of reliability and effectiveness, which is based on **Par 1**, is provided.

### 502. Performance of main steering gear

1. The main steering gear is to be of adequate strength and sufficient to steer the unit at maximum service speed and this should be demonstrated. The main steering gear and rudder stock are to be so designed that they will not be damaged at maximum astern speed but this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.
2. The main steering gear is to, with the unit at its deepest seagoing draught, be capable of putting the rudder over from 35° on one side to 35° on the other side with the unit running ahead at maximum service speed. The rudder is to be capable of being put over from 35° on either side to 30° on the other side in not more than 28 s, under the same conditions.
3. The main steering gear is to be operated by power where necessary to fulfil the provisions of **Par 2** and in any case in which the Society would require a rudder stock of over 120 mm diameter in way of the tiller.
4. The main steering gear power unit or units are to be arranged to start automatically when power is

restored after a power failure.

### 503. Performance of auxiliary steering gear

1. The auxiliary steering gear is to be of adequate strength and sufficient to steer the unit at navigable speed and capable of being brought speedily into action in an emergency.
2. The auxiliary steering gear is to be capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 seconds with the unit at its deepest seagoing draught while running at one half of its maximum speed ahead or seven knots, whichever is the greater.
3. The auxiliary steering gear is to be operated by power where necessary to fulfil the provisions of **Par 1** and in any case in which the Society would require a rudder stock of over 230 mm diameter in way of the tiller.

### 504. Number of steering gears

Where the main steering gear comprises two or more identical power units, the auxiliary steering gear need not be fitted provided that:

- (1) The main steering gear is capable of operating the rudder in accordance with the provisions of **502. 2** while operating with all power units.
- (2) As far as is reasonable and practicable the main steering gear is to be so arranged that a single failure in its piping or in one of the power units will not impair the integrity of the remaining part of the steering gear.

### 505. Controls

1. Control of the main steering gear is to be provided both on the navigating bridge and in the steering gear compartment. If the steering gear control system which provides for control from the navigating bridge is electric, it is to be supplied from the steering gear power circuit from a point within the steering gear compartment.
2. When the main steering gear is arranged according to **504.**, two independent control systems are to be provided, each of which can be operated from the navigating bridge. Where the control system comprises a hydraulic telemeter, the Society may waive the provisions for a second independent control system.
3. Where the auxiliary steering gear is power operated, it is to be provided with a control system operated from the navigating bridge and this is to be independent of the control system for the main steering gear.
4. Means are to be provided in the steering gear compartment to disconnect the steering gear control system from the power circuit.
5. A means of communication is to be provided between the navigating bridge and:
  - (1) the steering gear compartment; and
  - (2) the emergency steering position, if provided.
6. The exact angular position of the rudder, if power operated, is to be indicated on the navigating bridge. The rudder angle indication is to be independent of the steering gear control system.
7. The angular position of the rudder is to be recognizable in the steering gear compartment.
8. An alternative power supply, sufficient at least to supply a steering gear power unit which complies with the provisions of **503. 2** and also its associated control system and the rudder angle indicator, is to be provided, automatically, within 45 s, either from the emergency source of electrical power or from another independent source of power located in the steering gear compartment. This independent source of power is to be used only for this purpose and is to have a capacity sufficient for 10 min of continuous operation.

### 506. Electric and electro-hydraulic steering gear

1. Indicators for running indication of the motors of electric and electro-hydraulic steering gear are to be installed on the navigating bridge and at a suitable machinery control position.
2. Each electric or electro-hydraulic steering gear comprising one or more power units is to be served by at least two circuits fed from the main switchboard. One of the circuits may pass through the emergency switchboard. An auxiliary electric or electrohydraulic steering gear associated with a main electric or electrohydraulic steering gear may be connected to one of the circuits supplying this main steering gear. The circuits supplying an electric or electrohydraulic steering gear are to have adequate rating for supplying all motors which can be simultaneously connected to it and have to operate simultaneously.
3. Short-circuit protection and an overload alarm should be provided for these circuits and motors. Protection against excess current, if provided, is to be for not less than twice the full load current of the motor or circuit so protected, and is to be arranged to permit the passage of the appropriate starting currents. Where a three-phase supply is used, an alarm is to be provided that will indicate failure of any one of the supply phases. The alarms required herein is to be both audible and visual and be situated in a position on the navigating bridge where they can be readily observed.

## Section 6 Communication between the Navigating Bridge and the Engine Room

### 601. General

Units are to be provided with at least two independent means for communicating orders from the navigating bridge to the position in the machinery space or control room from which the engines are normally controlled, one of which should provide visual indication of the orders and responses both in the engine room and on the navigating bridge. Consideration is to be given to providing a means of communication to any other positions from which the engines may be controlled.

## Section 7 Engineers' Alarm

### 701. General

An engineers' alarm is to be provided to be operated from the engine control room or at the manoeuvring platform, as appropriate, and clearly audible in the engineers' accommodation.

## Section 8 Main Source of Electrical Power

### 801. Main source of electrical power

1. In addition to complying with **Ch 6, 201.**, the main source of electrical power is to comply with the following:
  - (1) The arrangement of the unit's main source of power is to be such that the services referred to in **Ch 6, 102. 1** can be maintained regardless of the speed and direction of the main propelling engines or shafting.
  - (2) The generating plant is to be such as to ensure that with any one generator or its primary source of power out of operation, the remaining generator or generators will be capable of providing the electrical services necessary to start the main propulsion plant from a dead ship condition. The emergency generator may be used for the purpose of starting from a dead ship condition if its capability either alone or combined with that of any generator is sufficient to provide at the same time those services required by **Ch 6, 206. 6** (1) to (4).
  - (3) For electrically self-propelled units, the application of **Ch 6, 201. 2** need only include for propulsion sufficient power to ensure safe navigation when underway.
  - (4) Where electrical power is necessary to restore propulsion, the capacity is to be sufficient to restore propulsion to the unit in conjunction with other machinery, as appropriate, from a dead ship condition within 30 min after blackout.

2. The main switchboard is to be so placed relative to one main generating station that, as far as is practicable, the integrity of the normal supply may be affected only by a fire or other casualty in one space. An environmental enclosure for the main switchboard, such as may be provided by a machinery control room situated within the main boundaries of the space, is not to be considered as separating the switchboards from the generators.
3. In every unit where the total installed electrical power of the main generators is in excess of 3 MW, the main busbars are to be subdivided into at least two parts which are to normally be connected by removable links or other approved means; so far as is practicable, the connection of generators and any other duplicated equipment are to be equally divided between the parts. Equivalent alternative arrangements should be permitted.

### 802. Emergency source of electrical power

In addition to complying with **Ch 6, 202.**, the emergency source of power is to provide:

- (1) For a period of 18 hours, emergency lighting at the steering gear;
- (2) For a period of 18 hours:
  - (A) navigational aids as required by **SOLAS chapter V**;
  - (B) intermittent operation of the daylight signalling lamp and the unit's whistle; unless they have an independent supply from an accumulator battery suitably located for use in an emergency and sufficient for the period of 18 hours;
- (3) For the period of 30 minutes or a lesser period as permitted by **SOLAS regulation II-1/29.14**, the steering gear. ↓



## CHAPTER 9 PERIODICALLY UNATTENDED MACHINERY SPACES FOR ALL TYPES OF UNITS

### Section 1 General

#### 101. General

1. The provisions of this chapter are additional to those of **Ch 5** to **Ch 8** and **Ch 10** and apply to periodically unattended machinery spaces specified herein.
2. The arrangements are to ensure that the safety of the unit in the marine mode, including manoeuvring, and in machinery spaces of category A during drilling operations, where applicable, is equivalent to that of a unit having manned machinery spaces.

#### 102. Application

1. The provisions of **Sec 2** to **Sec 7** apply to units which are designed to undertake self-propelled passages without external assistance.
2. Units other than those designed for unassisted passages, having periodically unattended spaces in which machinery associated with the marine mode is located, are to comply with the applicable parts of **Sec 2**, **Sec 3**, **Sec 5 502.**, **Sec 6** and **Sec 7**.
3. Where in any unit machinery spaces of category A for drilling purposes are intended to be periodically unattended, the application of **Sec 2** and **Sec 7** to machinery spaces of category A is to be considered by the Society, due consideration being given to the characteristics of the machinery concerned and to the supervision envisaged to ensure safety.
4. Measures are to be taken to the satisfaction of the Society to ensure that the equipment of every unit is functioning in a reliable manner and that satisfactory arrangements are made for regular inspections and routine tests to ensure continuous reliable operation.
5. Every unit is to be provided with documentary evidence, to the satisfaction of the Society, of its fitness to operate with periodically unattended machinery spaces.

### Section 2 Fire Protection and Fire Fighting

#### 201. Fire protection

1. Where necessary, oil fuel and lubricating oil pipes should be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages on to hot surfaces or into machinery air intakes and the number of joints in such piping systems should be kept to a minimum. Where practicable, leakages from high-pressure oil fuel pipes are to be collected and arrangements provided for an alarm to be given.
2. Where daily service oil fuel tanks are filled automatically, or by remote control, means are to be provided to prevent overflow spillages. Other equipment which treats flammable liquids automatically, e.g., oil fuel purifiers, which, whenever practicable, is to be installed in a special space reserved for purifiers and their heaters, should have arrangements to prevent overflow spillages.
3. Where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high-temperature alarm is to be provided if the flashpoint of the oil fuel can be exceeded.

#### 202. Fire detection

1. An approved fire detection system designed with self-monitoring properties and including facilities for periodical testing is to be installed in periodically unattended machinery spaces.

2. The fire detection system is to comply with the following.
  - (1) This fire detection system is to be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is specially appropriate, detection systems using only thermal detectors are not to be permitted. The detection system should initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed at the locations determined in accordance with **Sec 5, 502. 1**.
  - (2) After installation the system is to be tested under varying conditions of engine operation and ventilation.
  - (3) The fire detection system is to be fed automatically from an emergency source of power by a separate feeder if the main source of power fails.
3. Means are to be provided in case of fire:
  - (1) in boiler air supply casings and exhausts (uptakes); and
  - (2) in scavenging air belts of propulsion machinery,to detect fires and give alarms at an early stage, unless the Society considers this to be unnecessary in a particular case.
4. Internal combustion engines of 2,250 kW and above or having cylinders of more than 300 mm bore are to be provided with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices.

### 203. Fire fighting

1. An approved fixed fire extinguishing system is to be provided in units that are not required to have this provision by **Ch 10, 303**.
2. Provision is to be made for immediate water delivery from the fire main system at a suitable pressure, due regard being paid to the possibility of freezing, either:
  - (1) by remote starting arrangements for one of the main fire pumps. The starting positions are to be provided at strategic locations including the navigating bridge, if any, and a normally manned control station;. or
  - (2) by permanent pressurization of the fire main system, either
    - (A) by one of the main fire pumps;. or
    - (A) by a dedicated pump for the purpose with automatic starting of one of the main fire pumps on reduction of the pressure.
3. The Society are to give special consideration to maintaining the fire integrity of the machinery spaces, to the location and centralization of the fire extinguishing system controls and to the required shutdown arrangements (e.g., ventilation, fuel pumps, etc.); it may require additional fire extinguishing appliances and other fire fighting equipment and breathing apparatus.

## Section 3 Protection against Flooding

### 301. Bilge water level detection

1. High bilge water level in periodically unattended machinery spaces below the assigned load line is to activate an audible and visual alarm at the locations determined in accordance with **502. 1**.
2. Bilge wells are to be provided in periodically unattended machinery spaces and are to be large enough to accommodate easily the normal drainage during unattended periods. They are to be located and monitored in such a way that the accumulation of liquids is detected at preset levels, at normal angles of inclination.
3. Where the bilge pumps are capable of being started automatically, alarm devices are to be provided to indicate at the locations determined in accordance with **502. 1** either one of the following conditions:

- (1) When the influx of liquid is greater than the pump capacity.
- (2) When the pump is operating more frequently than would be normally expected.

In these cases, smaller bilge wells to cover a reasonable period of time may be permitted. Where automatically controlled bilge pumps are provided, special attention should be given to oil pollution prevention requirements.

## Section 4 Bridge Control of Propulsion Machinery

### 401. General

1. In the marine mode, including manoeuvring, the speed, direction of thrust and, if applicable, the pitch of the propeller are to be fully controllable from the navigating bridge.
2. Such remote control is to be performed by a single control device for each independent propeller, with automatic performance of all associated services, including means of preventing overload of the propulsion machinery. However, where more than one propeller is designed to operate simultaneously, these propellers may be controlled by a single control device.
3. The main propulsion machinery is to be provided with an emergency stopping device on the navigating bridge which should be independent of the navigating bridge control system referred to in **Par 2**.
4. Propulsion machinery orders from the navigating bridge are to be indicated in the main machinery control station or at the propulsion machinery control position, as appropriate.
5. Remote control of the propulsion machinery is to be possible only from one location at a time; at such locations interconnected control positions are permitted. At each location there is to be an indicator showing which location is in control of the propulsion machinery. The transfer of control between the navigating bridge and machinery spaces is to be possible only in the main machinery space or in the main machinery control station. The system is to include means to prevent the propelling thrust from altering significantly when transferring control from one location to another.
6. It is to be possible for all machinery essential for propulsion and manoeuvring to be controlled from a local position, even in the case of failure in any part of the automatic or remote control systems.
7. The design of the remote automatic control system is to be such that in case of its failure an alarm will be given on the navigating bridge and at the main machinery control station. Unless the Society considers it impracticable, the preset speed and direction of thrust of the propeller is to be maintained until local control is in operation.
8. Indicators are to be fitted on the navigating bridge for:
  - (1) propeller speed and direction of rotation in the case of fixed-pitch propellers; or
  - (2) propeller speed and pitch position in the case of controllable-pitch propellers.
9. The number of consecutive automatic attempts which fail to produce a start is to be limited to safeguard sufficient starting air pressure. An alarm is to be provided to indicate low starting air pressure, set at a level which still permits starting operations of the propulsion machinery.

## Section 5 Communication and Alarm System

### 501. Communication

A reliable means of vocal communication is to be provided between the main machinery control station or the propulsion machinery control position as appropriate, the navigating bridge, the engineer officers' accommodation and, on column-stabilized units, the central ballast control station.

### 502. Alarm system

1. An alarm system is to be provided in the main machinery control station giving audible and visual

indication of any fault requiring attention. It is also to:

- (1) activate an audible and visual alarm at another normally manned control station;
  - (2) activate the engineers' alarm provided in accordance with **Ch 8, Sec 7** if an alarm function has not received attention locally within a limited time;
  - (3) as far as is practicable be designed on the fail-to-safety principle; and
  - (4) when in the marine mode, activate an audible and visual alarm on the navigating bridge for any situation which requires action by the officer on watch or which should be brought to the attention of the officer on watch.
2. The alarm system is to be continuously powered and is to have an automatic changeover to a stand-by power supply in case of loss of normal power supply.
  3. Failure of the normal power supply of the alarm system is to be alarmed.
  4. The alarm system is to be able to indicate at the same time more than one fault and the acceptance of any alarm is not to inhibit another alarm.
  5. Acceptance at the position mentioned in **Par 1** of any alarm condition is to be indicated at the positions where it has been shown. Alarms are to be maintained until they are accepted and the visual indications are to remain until the fault has been corrected, when the alarm system is to automatically reset to the normal operating condition.

## Section 6 Special Provisions for Machinery, Boiler and Electrical Installations

### 601. General

The special provisions for the machinery, boiler and electrical installations are to be to the satisfaction of the Society and are to include at least the requirements of this section.

### 602. Change-over function

Where standby machines are required for other auxiliary machinery essential to propulsion, automatic changeover devices are to be provided. An alarm is to be given on automatic change-over.

### 603. Automatic control and alarm systems

1. The control systems are to be such that the services needed for the operation of the main propulsion machinery and its auxiliaries are ensured through the necessary automatic arrangements.
2. Means are to be provided to keep the starting air pressure at the required level where internal combustion engines are used for main propulsion.
3. An alarm system complying with **502.** is to be provided for all important pressures, temperatures and fluid levels and other essential parameters.

## Section 7 Safety Systems

### 701. General

A safety system is to be provided to ensure that serious malfunction in machinery or boiler operations, which presents an immediate danger, should initiate the automatic shutdown of that part of the plant and that an alarm should be given at the locations determined in accordance with **502. 1**. Shutdown of the propulsion system is not to be automatically activated except in cases which could lead to serious damage, complete breakdown, or explosion. Where arrangements for overriding the shutdown of the main propelling machinery are fitted, these are to be such as to preclude inadvertent operation. Visual means should be provided to indicate when the override has been activated. ↓

# CHAPTER 10 FIRE PROTECTION, MEANS OF ESCAPE AND FIRE EXTINCTION

## Section 1 General

### 101. Application

1. The units are to comply with the requirements in this Chapter, in addition to the requirements in **Pt 8 of Rules for the Classification of Steel Ships**. However, where approved specially by the Society, the requirements may be modified.
2. Despite of **Sec 3** and **Sec 4**, for the units not applied to the MODU Code but applied to the national regulations, those fire detection system and fire extinction system are to be in accordance with the relevant requirements specified by these regulations.
3. For fire protection, means of escape and fire detection and extinction of the units, attention is to be paid to the requirements of the national regulations of the country in which the unit is registered.
4. 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.

### 102. Alternative design and arrangements

When fire safety design or arrangements deviate from the prescriptive provisions of the Code, engineering analysis, evaluation and approval of the alternative design and arrangements should be carried out in accordance with **SOLAS regulation II-2/17**.

## Section 2 Fire Protection and Means of Escape

### 201. Fire protection

1. Hulls, superstructures, structural bulkheads, decks and deckhouses are to be constructed of steel or other material equivalent thereto.
2. In addition to complying with the specific provisions for fire integrity of bulkheads and decks, the minimum fire integrity of all bulkheads and decks shall be as prescribed in **Table 10.1** and **10.2**

according to the spaces adjoining to the relevant bulkheads or decks.

3. Exterior boundaries of superstructures and deckhouses enclosing accommodation should be constructed to "A-60" standard for the whole of the portion which faces and is within 30 m of the centre of the rotary table. For units that have a movable substructure the 30 m should be measured with the substructure at its closest drilling position to the accommodation.
4. Windows and sidescuttles, 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. The Society may permit windows and sidescuttles outside hazardous areas to be of the opening type.
5. 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.
6. In approving structural fire protection details, the Society 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.
7. The fire resistance of doors should, as far as practicable, be equivalent to that of the division in which they are fitted. External doors in superstructures and deckhouses should be constructed to at least "A-0" class standard and be self-closing, where practicable.
8. 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
9. Protection of accommodation spaces, service spaces and control stations specified in **Ch 1, 211**. excluding the space where the emergency source of electrical power is installed) is to be in accordance with the requirements in the followings.
  - (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 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 lining. 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 is not to exceed 0.05 m<sup>2</sup>. 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.
  - (4) Stairs are to be constructed of steel or equivalent material.
  - (5) 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 fire from one deck to another. Personnel lift trunks 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.
  - (6) Air spaces enclosed behind ceilings, panellings or linings are to be divided by close fitting draught stops spaced not more than 14 m apart.

Table 9.1 Fire Integrity of Bulkheads Separating Adjacent Spaces

Spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations	(1) A-0 <sup>(d)</sup>	A-0	A-60	A-0	A-15	A-60	A-15	A-60	A-60	*	A-0
Corridors	(2)	C	B-0	B-0 A-0 <sup>(b)</sup>	B-0	A-60	A-0	A-0	A-0	*	B-0
Accommodation spaces	(3)		C	B-0 A-0 <sup>(b)</sup>	B-0	A-60	A-0	A-0	A-0	*	C
Stairways	(4)			B-0 A-0 <sup>(b)</sup>	B-0 A-0 <sup>(b)</sup>	A-60	A-0	A-0	A-0	*	B-0 A-0 <sup>(b)</sup>
Service spaces(low risk)	(5)				C	A-60	A-0	A-0	A-0	*	B-0
Machinery spaces of Category A	(6)					* <sup>(a)</sup>	A-0 <sup>(a)</sup>	A-60	A-60	*	A-0
Other machinery spaces	(7)						A-0 <sup>(a)(C)</sup>	A-0	A-0	*	A-0
Hazardous areas	(8)							-	A-0	*	A-0
Service spaces(high risk)	(9)								A-0 <sup>(c)</sup>	-	A-0
Open deck	(10)									*	*
Sanitary and similar spaces	(11)									-	C

## Notes :

## 1. The following requirements are to govern application of the table :

- (1) Control stations are spaces as defined in **Ch 1, 211**. (A station where the emergency power source is located is not considered.)
- (2) Corridors mean corridors and lobbies.
- (3) Accommodation spaces are those used for public spaces, cabins, offices, hospitals, cinemas, games and hobby rooms and similar spaces, excluding corridors, lavatories and pantries containing no cooking appliances.
- (4) Stairways are interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto. 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 (low risk) are lockers, store-rooms and working spaces in which flammable materials are not stored, drying rooms and laundries.
- (6) Machinery spaces of Category A are those spaces and trunks to such spaces which contain :
  - (a) internal combustion machinery used for main propulsion ; or
  - (b) internal combustion machinery used for purpose other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW ; or
  - (c) any oil-fired boiler or oil fuel unit.
- (7) 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 are areas as defined in **Ch 7, 102. 1**.
- (9) Service spaces (high risk) are lockers, store-rooms and working spaces in which flammable materials are stored, galleys, pantries containing cooking appliances, paint rooms and workshops other than those forming part of the machinery space.
- (10) Open decks are open deck spaces, excluding hazardous areas.
- (11) Sanitary and similar spaces are communal sanitary facilities such as showers, bath, 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 the space in which they are located.

## 2. Explanation for the subscripts and the marks on the table

- (a) Where the space contains an emergency power source or components of an emergency power source adjoining a space containing a ship's service generator or the components of a ship's service 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 **201. 9** (3) and (5).
- (c) Where spaces are of the same numerical category and superscript (c) appears, a bulkhead or deck of 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) Bulkheads separating the navigating bridge, chartroom and radio room from each other may be an "B-0" rating. Where an asterisk " \* " appears in the table, the division is required to be of steel or equivalent material but not required to be of "A" class standard.
- (e) An engineering evaluation should be conducted in accordance with **201. 9** (1). In no case should the bulkhead or deck rating be less than the value indicated in the tables. Where an asterisk " \* " appears in the table, the division is required to be of steel or equivalent material but not required to be of "A" class standard. Where " - " appears in the table, the division need not be of "A", "B" nor "C" class divisions.

Table 9.2 Fire Integrity of Decks Separating Adjacent Spaces

Spaces above deck Spaces below deck	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
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	*	*
Stairways (4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0	A-0	*	A-0
Service spaces(low risk) (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	* <sup>(a)</sup>	A-60	A-60	A-60	*	A-0
Other machinery spaces (7)	A-15	A-0	A-0	A-0	A-0	A-0 <sup>(a)</sup>	* <sup>(a)</sup>	A-0	A-0	*	A-0
Hazardous areas (8)	A-60	A-0	A-0	A-0	A-0	A-60	A-0	-	A-0	-	A-0
Service spaces(high risk) (9)	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0 <sup>(c)</sup>	*	A-0
Open deck (10)	*	*	*	*	*	*	*	-	*	-	*
Sanitary and similar spaces (11)	A-0	A-0	*	A-0	*	A-0	A-0	A-0	A-0	*	*

Note : The explanation for spaces, subscripts and marks on the table are as indicated in the Notes of **Table 9.1**

- (7) Except for insulation in refrigerated compartments, insulation material, pipe and vent duct lagging, ceilings, linings and bulkheads are to be of non-combustible material. Insulation of pipe fittings for cold service systems and vapour barriers 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 characteristics. In spaces where penetration of oil products is possible, the surfaces of the insulation are to be impervious to oil or oil vapours.
- (8) The framing, including grounds and the joint pieces of bulkheads, linings, ceilings and draught stops are to be of non-combustible material.
- (9) 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.
- (10) Bulkheads, linings and ceilings may have combustible veneers provided that the thickness of such veneers is not to exceed 2 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<sup>2</sup> will be considered.
- (11) Primary deck coverings, if applied, are to be of approved materials by the Society which will not readily ignite, or give rise to toxic or explosive hazards at elevated temperatures.
- (12) Paints, varnishes and other finishes used on exposed interior surfaces are not to offer an undue fire hazard in the judgement of the Society and are not to be capable of producing excessive quantities of smoke or toxic fumes.
- (13) Ventilation ducts are to be of steel or equivalent material. However, short ducts, not generally exceeding 2 m in length and with a free cross-sectional area not exceeding 0.02 m<sup>2</sup>, need not be steel or equivalent subject to the following conditions :
- (A) subject to (B), the ducts are made of a material which has low flame spread characteristics;
- (B) 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<sup>2</sup> of their surface area for the thickness used;
- (C) the ducts are only used at the end of the ventilation device; and
- (D) the ducts are not situated less than 600 mm, measured along the duct, from an opening in an "A" or "B" class division including continuous "B" class ceiling.
- (14) Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 m<sup>2</sup> passes through "A" class bulkheads or decks, the opening shall be lined with a steel sheet sleeve having a thickness of at least 3 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 decks pierced. Where ventilation ducts with a free cross-sectional area exceeding  $0.02 \text{ m}^2$  pass through "A" class bulkheads or decks, the opening is to be lined with a steel sheet sleeve. However, where such ducts are of steel construction and pass through a deck or bulkhead, the ducts and sleeves are to comply with the following:

- (A) The sleeves are to have a thickness of at least 3 mm and a length of at least 900 mm. When passing through bulkheads, this length is 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 is to have at least the same fire integrity as the bulkhead or deck through which the duct passes; and
  - (B) Ducts with a free cross-sectional area exceeding  $0.075 \text{ m}^2$  shall be fitted with fire dampers in addition to the requirements of paragraph (A). The fire damper is to operate automatically, but is also to be capable of being closed manually from both sides of the bulkhead or deck. The damper shall 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 those 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.
- (15) Ducts provided for ventilation of machinery spaces of Category A, galleys and hazardous areas are not to pass through accommodation or service spaces or control stations. However, ducts provided for ventilation of machinery spaces of Category A and galleys, excluding hazardous areas, may pass through accommodation or service spaces or control stations where they comply with the conditions specified in paragraphs (A) to (D) or (E) and (F) below:
- (A) the ducts are constructed of steel having a thickness of at least 3 mm and 5 mm for ducts the widths or diameters of which are up to and including 300 mm and 760 mm and over respectively and, in the case of such ducts, the widths or diameters of which are between 300 mm and 760 mm having a thickness obtained by interpolation;
  - (B) the ducts are suitably supported and stiffened;
  - (C) the ducts are fitted with automatic fire dampers close to the boundaries penetrated; and
  - (D) the ducts are insulated to "A-60" class standard from the machinery spaces, galleys, vehicle spaces, ro-ro spaces or special category spaces to a point at least 5 m beyond each fire damper; or
  - (E) the ducts are constructed of steel in accordance with paragraphs (A) and (B); and
  - (F) the ducts are insulated to "A-60" class standard throughout the accommodation spaces, service spaces or control stations.
- (16) Ducts provided for ventilation of accommodation, service spaces or control stations are not to pass through machinery spaces of Category A, galleys and hazardous areas. However, ducts provided for ventilation to accommodation spaces, service spaces or control stations may pass through machinery spaces of category A and galleys excluding hazardous areas where they comply with the conditions specified in paragraphs (A) to (C) or (D) and (E) below:
- (A) the ducts where they pass through a machinery space of category A and galley are constructed of steel in accordance with paragraphs (11) (A) and (11) (B);
  - (B) automatic fire dampers are fitted close to the boundaries penetrated; and
  - (C) the integrity of the machinery space and galley boundaries is maintained at the penetrations; or
  - (D) the ducts where they pass through a machinery space of category A and galley are constructed of steel in accordance with paragraphs (11) (A) and (11) (B); and
  - (E) the ducts are insulated to "A-60" standard within the machinery space and galley.
- (17) Ventilation ducts with a free cross-sectional area exceeding  $0.02 \text{ m}^2$  passing through "B" class bulkheads are to be lined with steel sheet sleeves of 900 mm in length divided preferably into 450 mm on each side of the bulkheads unless the duct is of steel for this length.
- (18) Where they pass through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges should be of equivalent fire integrity to "A" class divisions and each galley exhaust duct should be fitted with:
- (A) a grease trap readily removable for cleaning;
  - (B) a fire damper located in the galley end of the duct which is automatically and remotely op-

erated and, in addition a remotely operated fire damper located in the exhaust end of the duct;

(C) arrangements, operable from within the galley, for shutting off the exhaust fans; and

(D) fixed means for extinguishing a fire within the duct.

- (19) The main inlets and outlets of all ventilation systems shall be capable of being closed from outside the spaces being ventilated.
- (20) Power ventilation of accommodation spaces, service spaces, cargo spaces, control stations and machinery spaces shall be capable of being stopped from an easily accessible position outside the space being served. The accessibility of this position in the event of a fire in the spaces served is to be specially considered. 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.
- (21) Windows and sidescuttles in the boundaries which are required to meet an "A-60" standard which face the drill floor area are to be constructed to an "A-60" standard or fitted with inside covers of steel or other material equivalent thereto. Such shutters may be replaced by a water-curtain, which provide a discharge rate of  $6.0 \ell/m^2\text{-min}$ , protecting those windows and sidescuttles on the exposed wall.
- (22) The ventilation of the accommodation spaces and control stations is to be arranged in such a way as to prevent the ingress of flammable, toxic or noxious gases, or smokes from surrounding areas.

## 202. Means of escape

1. Within the accommodation spaces, service spaces and control stations, the means of escape specified in the following (1) to (4) are to be provided.
  - (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 the Society in consideration of the nature and 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.
  - (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) 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 m in length are not to be provided.
  - (4) In addition to the emergency lighting, the means of escape in accommodation areas, including stairways and exits, is to be marked by lighting or photoluminescent strip indicators placed not more than 300 mm above the deck at all points of the escape route, including angles and intersections. The marking is to 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 is to 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 photoluminescent material or marked by lighting. The Society is to ensure that such lighting or photoluminescent equipment has been evaluated, tested and applied in accordance with the FSS Code.
2. Two means of escape are to be provided from every machinery space of Category A by either one of the following (1) or (2). Where, however, deemed appropriate by the Society in consideration of the nature and location of spaces and the number of persons who might normally be employed there, one of these means of escape may be dispensed with.
  - (1) Two sets of steel 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. In general, one of these ladders is to provide continuous fire shelter from the lower part of the space to a safe position outside the space. This shelter is to be of steel insulated to the satisfaction of the Society and be provided with a self-closing steel door at the lower end. However, in cases where a safe escape route from the lower part of this space is provided due to special arrangements or dimension of machinery space, the shelter may be dispensed with at the discretion of the Society.

- (2) One steel ladder leading to a door in the upper part of the space from which access is provided to the open deck and additionally, in the lower part of the space and in a position well separated from the ladder referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the open deck.
3. From machinery spaces other than those of Category A, escape routes are to be provided to the satisfaction of the Society, having regard to the nature and location of the space and whether persons are normally employed in that space.
4. Lifts are not to be considered as forming one of the required means of escape.
5. Consideration is to be given to the site 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.
6. Stairways and corridors used as a means of escape are to meet the provisions of paragraph 13.3 of the FSS Code.
7. Emergency escape breathing devices are to comply with the following requirements.
  - (1) Emergency escape breathing devices are to comply with the Fire Safety Systems Code. Spare emergency escape breathing devices shall be kept onboard.
  - (2) In machinery spaces of category A containing internal combustion machinery used for main propulsion, EEBDs are to be positioned as follows:
    - (A) one (1) EEBD in the engine control room, if located within the machinery space;
    - (B) one (1) EEBD in workshop areas. If there is, however, a direct access to an escape way from the workshop, an EEBD is not required; and
    - (C) one (1) EEBD on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).
    - (D) Alternatively, a different number or location may be determined by the Society taking into consideration the layout and dimensions or the normal manning of the space.
  - (3) For machinery spaces of category A other than those containing internal combustion machinery used for main propulsion, one (1) EEBD is to, as a minimum, be provided on each deck or platform level near the escape ladder constituting the second means of escape from the space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).
  - (4) For other machinery spaces, the number and location of EEBDs are to be determined by the Society.

## Section 3 Fire Extinction

### 301. Water supply systems

1. 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. 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 systems 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 tanks is not less than 40 m<sup>3</sup> plus engine cooling water consumptions before unit lifting or lowering. Alternatively, water may be supplied from buffer tanks in which sea water stored is not less the quantity as the above mentioned.

### 302. Fire pumps, fire mains, hydrants and hoses

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. The arrangements of the pumps, sea suctions and sources of power are to be such as to ensure that a fire in any space would not put both the required pumps out of action.
3. At least one of the required pumps specified in **Par 1** is to be dedicated for fire fighting duties and be available for such duties at all times.
4. Every centrifugal pump which is connected to the fire main is to be fitted with a non-return valve.
5. Where either of the required pumps is located in a space not normally manned and is relatively far removed from working areas, suitable means are to be made for remote start-up of that pump and remote operation of associated suction and discharge valves.
6. Except as provided in **Par 3**, sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil.
7. 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 is 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 should 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 pumps.
8. Each of the fire pumps is to have a capacity appropriate to the fire fighting services supplied from the fire main at the pressure specified in **Par 7**. Where more pumps than required are installed, their capacity should be to the satisfaction of the Society. In no case is the single pump capacity to be less than 25 m<sup>3</sup>/h.
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.
10. 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.
11. 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.
12. 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.
13. The fire main is not to have connections other than those necessary for fire fighting purposes.
14. The diameter of the fire main and water service pipes are to be sufficient for the effective distribution of the maximum required discharge from the required fire pumps operating simultaneously.
15. All practical precautions consistent with having water readily available are to be taken to protect the fire main against freezing.
16. Materials readily rendered ineffective by heat are not to be used for fire mains and hydrants unless adequately protected. The pipes and hydrants should be so placed that the fire hoses may be easily coupled to them.
17. 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.
18. 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.

19. Fire hoses are to be of non-perishable material approved and to be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Each hose is to be provided with a nozzle and the necessary couplings. Hoses specified in this chapter as "fire hoses" are, together with any necessary fittings and tools, to be kept ready for use in conspicuous positions near the water service hydrants or connections. Fire hoses shall have a length of at least 10 m, but not more than:
- (1) 15 m in machinery spaces;
  - (2) 20 m in other spaces and open decks; and
  - (3) 25 m for open decks with a maximum breadth in excess of 30 m.
20. Size and types of nozzles are to comply with the following requirements.
- (1) For the purposes of this chapter, standard nozzle sizes shall be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Society.
  - (2) For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.
  - (3) For machinery spaces and exterior locations, the nozzle size shall be such as to obtain the maximum discharge possible from two jets at the pressure mentioned in **Par 7** from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.
  - (4) Nozzles shall be of an approved dual-purpose type (i.e., spray/jet type) incorporating a shutoff.
21. The surface unit is to be provided with at least one international shore connection complying with **SOLAS regulation II-2/10-2.1.7**. Facilities are to be available enabling such a connection to be used on any side of the unit.

### 303. Fire extinguishing systems in machinery spaces and in spaces containing fired processes

1. 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:
  - (1) One of the following fixed fire-extinguishing systems is to be provided.
    - (A) a fixed pressure water-spraying system
    - (B) a fixed gas fire-extinguishing system
    - (C) a fixed high expansion foam installationWhere the machinery space and spaces containing fired processes are not entirely separate, 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.
  - (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 ℓ for each burner, provided that the total capacity of the additional extinguisher or extinguishers need not exceed 45 litres for any one space.
  - (3) A receptacle containing sand, sawdust impregnated with soda, or other approved dry material in such quantity as may be required by the Society. An approved portable extinguisher may be provided as an alternative.
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.
  - (1) One of the fixed arrangements required by **Par 1**.
  - (2) One approved foam-type extinguisher of not less than 45 ℓ capacity or equivalent in every engine space and one approved portable foam 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.
3. The Society is to give special consideration to the fire extinguishing arrangements to be provided in spaces not fitted with fixed fire extinguishing installations containing steam turbines which are separated from boiler rooms by watertight bulkheads.
4. Where a fire hazard exists in any machinery space for which no specific provisions for fire extinguishing appliances are prescribed in **Par 1** to **3**, there is to be provided in, or adjacent to, that

space a number of approved portable fire extinguishers or other means of fire extinction to the satisfaction of the Society.

#### 304. Fire extinguishing system on drilling floor

1. The system is to involve two portable fire extinguishers approved by the Society in accordance with **Table 10.3**. These fire extinguishers are to be of dry chemical type with a capacity of 5 kg or more, or of any other equivalent type.
2. Sufficient manual fire alarms are to be installed at suitable locations throughout the unit.
3. A fixed water spray system is to be provided to protect drilling area. The minimum water application rate is not less than  $20.4 \ell/m^2$ -min, or
4. At least two dual-purpose (jet/spray) fire monitors are to be installed to cover drilling and well test areas. The minimum capacity of each monitor is not less than  $100 m^3/h$ . The monitors may be operated either remotely or locally. Monitor arranged for local operation should be sited on an accessible protected position.

#### 305. Fire extinguishing system in mud processing area installed with degassers, shale-shakers, mud-ditches and mud tanks

1. The system is to involve two portable fire extinguishers approved by the Society in accordance with **Table 10.3**. These fire extinguishers are to be of dry chemical type with a capacity of 5 kg or more, or of any other equivalent type.
2. A hydrant with a hose, and its applicator approved by the Society are to be equipped.
3. A suitable fixed foam system is to be provided. The system is to be capable of delivering foam solution at a rate of not less than  $6.5 \ell/m^2$ -min ( $4.1 \ell/m^2$ -min for Aqueous Film Forming Foam or Film-Forming Fluoroprotein Foam) for 15 minutes. Alternatively, a gas fixed fire extinguishing system may be used for enclosed mud processing spaces.

#### 306. Portable fire extinguishers in accommodation, service, machinery and working spaces

1. Except for the supplemental arrangements provided in **Par 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 **Pt 8, Ch 8, 202. of Guidance Relating to the Rules for the Classification of Steel Ships**.
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 **Pt 8, Ch 8, 202. of Guidance Relating to the Rules for the Classification of Steel Ships**, the provisions of **Table 10.3** is to be followed. Classes of extinguishers are to be in accordance with **Res.A 951(23)**.

#### 307. Fire detection and alarm system

1. Spaces having a fire risk, in principle, are to be provided with an automatic fire detection and alarm system.
2. In selecting the type of detectors, their following features are to 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.
3. The fire detection main indicator board is to be at a manned control station and is to be clearly to indicate where fire has been detected.

Table 10.3 Numbers and distribution of additional portable extinguishers on units

Type of spaces	Minimum number of extinguishers(1)	Class(es) of extinguisher(s)
Space containing the controls for the main source of electrical power	1 (1 additional extinguisher suitable for electrical fires when main switchboards are arranged in the space)	A and/or C
Cranes with electric motors or 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 <b>402.</b>	B
Machinery spaces of category A	In accordance with <b>303.</b>	B
Machinery spaces of category A which are periodically unattended	At each entrance in accordance with <b>303.</b>	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 10m for open space)	B

Notes :

(1) Minimum size is to 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.

4. An automatic fire detection and alarm system are to be provided in all accommodation and service spaces. Accommodation space is to be fitted with smoke detectors. Thermal detectors are to be fitted in galleys.
5. A fixed fire detection and fire alarm system shall be installed in:
  - (1) periodically unattended machinery spaces;
  - (2) machinery spaces where:
    - (A) machinery spaces where the installation of automatic and remote control systems and equipment has been approved in lieu of continuous manning of the space; and
    - (B) machinery spaces where the main propulsion and associated machinery including sources of main source of electrical power are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room. and
  - (3) enclosed separate spaces containing incinerators

Detection systems using only thermal detectors, in general, are not to be permitted.
6. Smoke detectors are to be provided in all electrical rooms and control stations.
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.
8. Sufficient manual fire alarm stations are to be installed at suitable locations throughout the unit. Sufficient manual fire alarm stations are to be installed throughout 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.

**308. Fixed automatic gas detection and alarm systems**

1. Fixed automatic 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.
2. At least two portable gas monitoring devices should be provided, each capable of accurately measuring a concentration of flammable gas.
3. The gas detectors are to be connected to an audible and visible alarm system with indicators on the drill floor and at the required emergency control stations. 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 25 % and at 60 % of the lower explosive limit.

**309. Hydrogen sulphide detection and alarm system**

1. A fixed automatic hydrogen sulphide gas detection and alarm system is to be provided to the satisfaction of the Society so arranged as to monitor continuously the drilling area, mud processing area and well fluid test area of the unit and capable of giving audible and visual alarm at the main control points. The system is clearly to indicate where gas has been detected.
2. Low level alarm set at 10 ppm and high level alarm set not higher than 300 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 minutes, the toxic gas (hydrogen sulphide) alarm and the helideck status light is to be automatically activated.
3. At least two portable hydrogen sulphide gas monitoring devices are to be provided on the unit.

**310. Respiratory protection equipment for hydrogen sulphide**

1. A 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;
2. A 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.
3. 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.

**311. Fire-fighters' outfits**

1. At least two fire-fighters' outfits complying with the relevant requirements of the FSS Code are to be provided, each with portable instruments for measuring oxygen and flammable vapour concentrations acceptable to the Society.
2. Two spare charges are to 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.



3. The fire-fighters' outfits are to be kept ready for use in an easily accessible location that is permanently and clearly marked and, where more than one fire-fighter's outfit or more than one set of personal equipment is carried, they are to be stored in widely separated positions.

### 312. Recharging of air cylinders

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**.

### 313. Arrangements in machinery and working spaces

1. Means are to be provided for stopping ventilating fans serving machinery and working spaces and for closing all doorways, ventilators, annular 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.
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.
3. Every oil fuel suction pipe from a storage, settling or daily service tank situated above the double bottom is to be fitted with a cock or valve capable of being 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 the event of fire may be effected by means of an additional valve on the pipeline or lines outside the tunnel or tunnels.

## Section 4 Fire Extinguishing Systems for Helicopter Facilities

### 401. General

Units fitted with facilities for helicopters are to meet 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 are to be provided to adequately protect the unit from the fire hazards associated with helicopter operations;
- (3) Refuelling facilities and operations are to provide the necessary measures to protect the unit from the fire hazards associated with helicopter operations; and
- (4) Each helicopter facility is to have an operations manual and training is to be provided.
- (5) The fire fighting equipment as given in **402**. are to be provided.

### 402. Helicopter decks and refueling facilities

1. Hoses and nozzles : at least two approved combination nozzle and applicators and hoses sufficient in length to reach any part of the helicopter deck are to be provided.
2. Portable extinguishers : at least two dry powder extinguishers of a total capacity of not less than 45 kg, but not less than 9 kg each, are to be provided.
3. Back-up fire fighting system : A back-up fire fighting system is to be provided, consisting of CO<sub>2</sub> extinguishers of a total capacity of not less than 18 kg or equivalent, one of these extinguishers being so equipped as to enable it to reach the engine area of any helicopter using the deck. The

back-up system is to be located so that the equipment would not be vulnerable to the same damages as the primary extinguishing system.

4. Fixed foam system :

- (1) A suitable foam application system, consisting of monitors or foam making branch pipes capable of delivering foam solution at a rate of not less than  $6.0 \ell/m^2\text{-min}$  ( $4.1 \ell/m^2\text{-min}$  for Aqueous Film Forming Foam or Film-Forming Fluoroprotein Foam) of the areas protected (the area of a circle of diameter "D" where "D" is the distance across the main rotor and tail rotor in the fore and aft line of a helicopter) for at least 5 minutes, is to be provided.
- (2) Foam delivery at the minimum application rate is to start within 30 s of system activation. The operation of the foam system is not to interfere with simultaneous operation of the fire main.
- (3) The principal agent shall be suitable for use with salt water and conform to performance standards not inferior to those acceptable to the IMO Organization (Refer to the International Civil Aviation Organization Airport Services Manual, part 1, Rescue and Fire Fighting, chapter 8, Extinguishing Agent Characteristics, paragraph 8.1.5, Foam Specifications table 8-1, level 'B').

5. In addition to the requirement of 311., two fire-fighter's outfits; and

6. At least the following equipment is to be stored in a manner that provides for immediate use and protection from the elements:

- adjustable wrench;
- blanket, fire resistant;
- cutters, bolt 60 cm;
- hook, grab or salving;
- hacksaw, heavy duty complete with 6 spare blades;
- ladder;
- lift line 5 mm diameter  $\times$  15 m in length;
- pliers, side cutting;
- set of assorted screwdrivers; and
- harness knife complete with sheath.
- crowbar.

7. Drainage facilities in way of helidecks shall be constructed of steel and shall lead directly overboard independent of any other system and shall be designed so that drainage does not fall onto any part of the ship.

8. Where the unit has helicopter refuelling, the following provisions should be complied with:

- (1) A designated area shall be provided for the storage of fuel tanks which are to be:
  - (A) as remote as is practicable from accommodation spaces, escape routes and embarkation stations; and
  - (B) isolated from areas containing a source of vapour ignition;
- (2) The fuel storage area is to be provided with arrangements whereby fuel spillage may be collected and drained to a safe location;
- (3) Tanks and associated equipment are to be protected against physical damage and from a fire in an adjacent space or area;
- (4) Vent heads of an approved type with flame arrestors are to be fitted to vent pipes.
- (5) Where portable fuel storage tanks are used, special attention shall be given to:
  - (A) design of the tank for its intended purpose;
  - (B) mounting and securing arrangements;
  - (C) electric bonding; and
  - (D) inspection procedures;
- (6) Storage tank fuel pumps are to 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 are to be provided to isolate the fuel source;
- (7) The fuel pumping unit is to be connected to one tank at a time. The piping between the tank and the pumping unit is to be of steel or equivalent material, as short as possible, and protected against damage;
- (8) Electrical fuel pumping units and associated control equipment are to be of a type suitable for the location and potential hazards;
- (9) Fuel pumping units are to incorporate a device which will prevent over-pressurization of the delivery or filling hose;

- (10) Equipment used in refuelling operations is to be electrically bonded;
- (11) "NO SMOKING" signs are to be displayed at appropriate locations.

#### 403. Alarm systems

In areas of helicopter facilities, a manual fire alarm is to be provided at each of two spots properly separated each other.

## Section 5 Gas Cylinders

### 501. Storage of gas cylinders

1. Where more than one cylinder of oxygen and more than one cylinder of acetylene are carried simultaneously, such cylinders are to be arranged in accordance with the following:
  - (1) Permanent piping systems for oxyacetylene systems are acceptable provided that they are designed having due regard to standards and codes of practice to the satisfaction of the Administration.
  - (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.
  - (3) Storage rooms are to be constructed of steel, and be well ventilated and accessible from the open deck.
  - (4) Provision is to be made for the expeditious removal of cylinders in the event of fire.
  - (5) "NO SMOKING" signs are to be displayed at the gas cylinder storage rooms.
  - (6) Where cylinders are stowed in open locations, means are to be provided to:
    - (A) protect cylinders and associated piping from physical damage;
    - (B) minimize exposure to hydrocarbons;and
    - (C) ensure suitable drainage.
2. Fire-extinguishing arrangements for the protection of areas or spaces where such cylinders are stored are to be to the satisfaction of the Society.

## Section 6 Other Operational Requirements

### 601. Fire control plan

A fire control plan complying with **SOLAS regulation II-2/15.2.4** is to be permanently exhibited.

### 602. Operational readiness and maintenance

1. The following functional provisions are to be met:
  - (1) gas detection systems, fire protection systems and fire fighting systems and appliances are to be maintained ready for use;and
  - (2) gas detection systems, fire protection systems and fire fighting systems and appliances are to be properly tested and inspected.
2. At all times while the unit is in service, the provisions of **Par 1** are to be complied with. A unit is not in service when:
  - (1) it is in for repairs or lay up (either at anchor or in port) or in drydock;a
  - (2) it is declared not in service by the owner or the owner's representative.
3. Operational readiness
  - (1) The following gas detection and fire protection systems are to be kept in good order so as to ensure their intended performance if a fire occurs:
    - (A) structural fire protection including fire-resisting divisions and protection of openings and penetrations in these divisions;
    - (B) fire detection and fire alarm systems;

- (C) gas detection and alarm systems;and
  - (D) means of escape systems and appliances.
- (2) Fire-fighting systems and appliances and portable gas detection systems are to be kept in good working order and readily available for immediate use. Portable extinguishers which have been discharged are to be immediately recharged or replaced with an equivalent unit.
4. Maintenance, testing and inspections
- (1) Maintenance, testing and inspections are to be carried out based on the **Guidelines on maintenance and inspection of fire protection systems and appliances (MSC/Circ.850)** developed by the IMO and in a manner having due regard to ensuring the reliability of fire fighting systems and appliances.
- (2) The maintenance plan is to be kept on board the unit and be available for inspection whenever required by the Society.
- (3) The maintenance plan is to include at least the following fire protection systems and fire fighting systems and appliances, where installed:
- (A) fire mains, fire pumps and hydrants including hoses, nozzles and international shore connections;
  - (B) fixed fire detection and fire alarm systems;
  - (C) fixed fire-extinguishing systems and other fire-extinguishing appliances;
  - (D) automatic sprinkler, fire detection and fire alarm systems;
  - (E) ventilation systems including fire and smoke dampers, fans and their controls;
  - (F) emergency shut down of fuel supply;
  - (G) fire doors including their controls;
  - (H) general emergency alarm systems;
  - (I) emergency escape breathing devices;
  - (J) portable fire extinguishers including spare charges or spare extinguishers;
  - (K) portable hydrogen sulphide gas detection monitoring devices;
  - (L) portable flammable gas and oxygen monitoring devices;
  - (M) gas detection and alarm systems;and
  - (N) fire-fighter's outfits.
- (4) The maintenance programme may be computer-based. ↓

# CHAPTER 11 LIFTING DEVICES, PERSONNEL AND PILOT TRANSFER

## Section 1 Cranes

### 101. General

1. Each crane, including its supporting structure, which is used for the transfer of material, equipment or personnel between the unit and attending vessels should be of a design and construction to the satisfaction of the requirements of **Pt 9, Ch 2 of Rules for the Classification of Steel Ships** or with national or international standards or codes.
2. Cranes should be so located and protected as to reduce to a minimum any danger to personnel, due regard being paid to moving parts or other hazards. Their design should have regard to the materials used in construction, the working conditions to which they will be subjected and the environmental conditions. Adequate provisions should be made to facilitate cleaning, inspection and maintenance.
3. Consideration should be given to the failure mode for each crane in the event of extreme overload so that the crane operator is exposed to minimum danger.
4. The Society should survey the installation of each crane, with particular regard to its supporting structure.
5. After each crane has been erected on board, and before it is placed in service, operational and load tests should be conducted. These tests should be witnessed and verified by the Surveyor. A record of these tests and other information concerning initial certification should be readily available.
6. Each crane should be examined at intervals not exceeding 12 months. It should be further tested and recertified, at intervals not exceeding five years, or after substantial alteration or repairs. These tests should be witnessed and verified by the Surveyor. A record of these examinations, tests and certifications should be readily available.
7. Cranes used for loading and discharging of offshore supply vessels should be furnished with rating tables or curves which take into account the dynamics associated with the unit's and vessel's motions.
8. Except when loads are determined and marked prior to lifting, each crane should be fitted, to the satisfaction of the Society, with a safety device to give the crane operator a continuous indication of hook load and rated load for each radius. The indicator should give a clear and continuous warning when approaching the rated capacity of the crane.
9. The Society should give consideration to the installation of limit switches to provide for the safe operation of the crane.
10. A crane manual should be provided for each crane and should be readily available. This manual should contain full information concerning:
  - (1) design standard, operation, erection, dismantling and transportation;
  - (2) all limitations during normal and emergency operations with respect to safe working load, safe working moment, maximum wind, maximum heel and trim, design temperatures and braking systems;
  - (3) all safety devices;
  - (4) testing of the emergency lowering system for personnel transfer, if fitted;
  - (5) diagrams for electrical, hydraulic and pneumatic systems and equipment;
  - (6) materials used in construction, welding procedures and extent of non-destructive testing; and
  - (7) guidance on maintenance and periodic inspection.

## Section 2 Lifting and Hoisting Equipment

### 201. General

1. All lifting and hoisting equipment, including its supporting structure, should be of a design and construction to the satisfaction of the requirements of **Pt 9, Ch 2 of Rules for the Classification of Steel Ships** or with national or international standards or codes.
2. Information on the rated capacity of all lifting and hoisting equipment, developed in accordance with national or international standards or codes, should be available on the unit.

## Section 3 Personnel Lifts

### 301. General

1. Personnel lifts should be of a design acceptable to the Society and adequate for the service intended.
2. The construction and installation should be surveyed by the Surveyor. The inspections should be carried out on installation and at intervals not exceeding 12 months and certificates or reports should be readily available.
3. Each lift car in a column of a column-stabilized unit should provide for an emergency exit with an escape ladder in the hoistway.

## Section 4 Personnel and Pilot Transfer

### 401. General

1. All personnel transfer nets or platforms should be designed and constructed to the satisfaction of the Society.
2. A personnel transfer net or platform may be used to satisfy the pilot transfer arrangement required by **SOLAS regulation V/23**.

## Section 5 Drilling Derricks

### 501. General

The design of each drilling derrick and its supporting structure should be to the satisfaction of the Society. The rated capacity for each reeving should be included in the operating manual. ↓

## CHAPTER 12 HELICOPTER FACILITIES

### Section 1 General

#### 101. General

Each helideck should be of sufficient size and located so as to provide a clear take-off and approach to enable the largest helicopter using the helideck to operate under the most severe conditions anticipated for helicopter operations.

### Section 2 Definitions

#### 201. General

1. Final approach and take-off area (FATO) is a defined area over which the final phase of the approach manoeuvre to hover or landing of the helicopter is intended to be completed and from which the take-off manoeuvre is intended to be commenced.
2. Limited obstacle sector (LOS) is a sector extending outward which is formed by that portion of the 360° arc, excluding the obstacle-free sector, the centre of which is the reference point from which the obstacle-free sector is determined. Obstacles within the limited obstacle sector are limited to specified heights.
3. Obstacle is any object, or part thereof, that is located on an area intended for the movement of a helicopter on a helideck or that extends above a defined surface intended to protect a helicopter in flight.
4. Obstacle-free sector is a complex surface originating at, and extending from, a reference point on the edge of the FATO of a helideck, comprised of two components, one above and one below the helideck for the purpose of flight safety within which only specified obstacles are permitted.
5. Touchdown and lift-off area (TLOF) is a dynamic load-bearing area on which a helicopter may touch down or lift off. For a helideck it is presumed that the FATO and the TLOF will be coincidental.

### Section 3 Construction

#### 301. General

1. The helideck should be of a design and construction, adequate for the intended service and for the appropriate prevailing climatic conditions, approved to the satisfaction of the Society.
2. Except as provided for in **Par 3**, the helideck should meet the following provisions, with reference to the ICAO Convention, Annex 14, Volume II (Heliports), taking into account the type of helicopter used, the conditions of wind, turbulence, sea state, water temperature and icing conditions:
  - (1) the helideck should be of sufficient size to contain an area within which can be drawn a circle of diameter not less than D for single main rotor helicopters;
  - (2) a helideck obstacle-free sector should comprise of two components, one above and one below helideck level (see **Fig 12.1**):
    - (A) above helideck level: The surface should be a horizontal plane level with the elevation of the helideck surface that subtends an arc of at least 210° with the apex located on the periphery of the D reference circle extending outwards to a distance that will allow for an unobstructed departure path appropriate to the helicopter(s) the helideck is intended to serve; and

(B) below helideck level: Within the (minimum) 210° arc, the surface should additionally extend downward at a 5:1 falling gradient from the edge of the safety net below the elevation of the helideck to water level for an arc of not less than 180° that passes through the centre of the FATO and outwards to a distance that will allow for safe clearance from the obstacles below the helideck in the event of an engine failure for the type of helicopter(s) the helideck is intended to serve (see Fig 12.1);

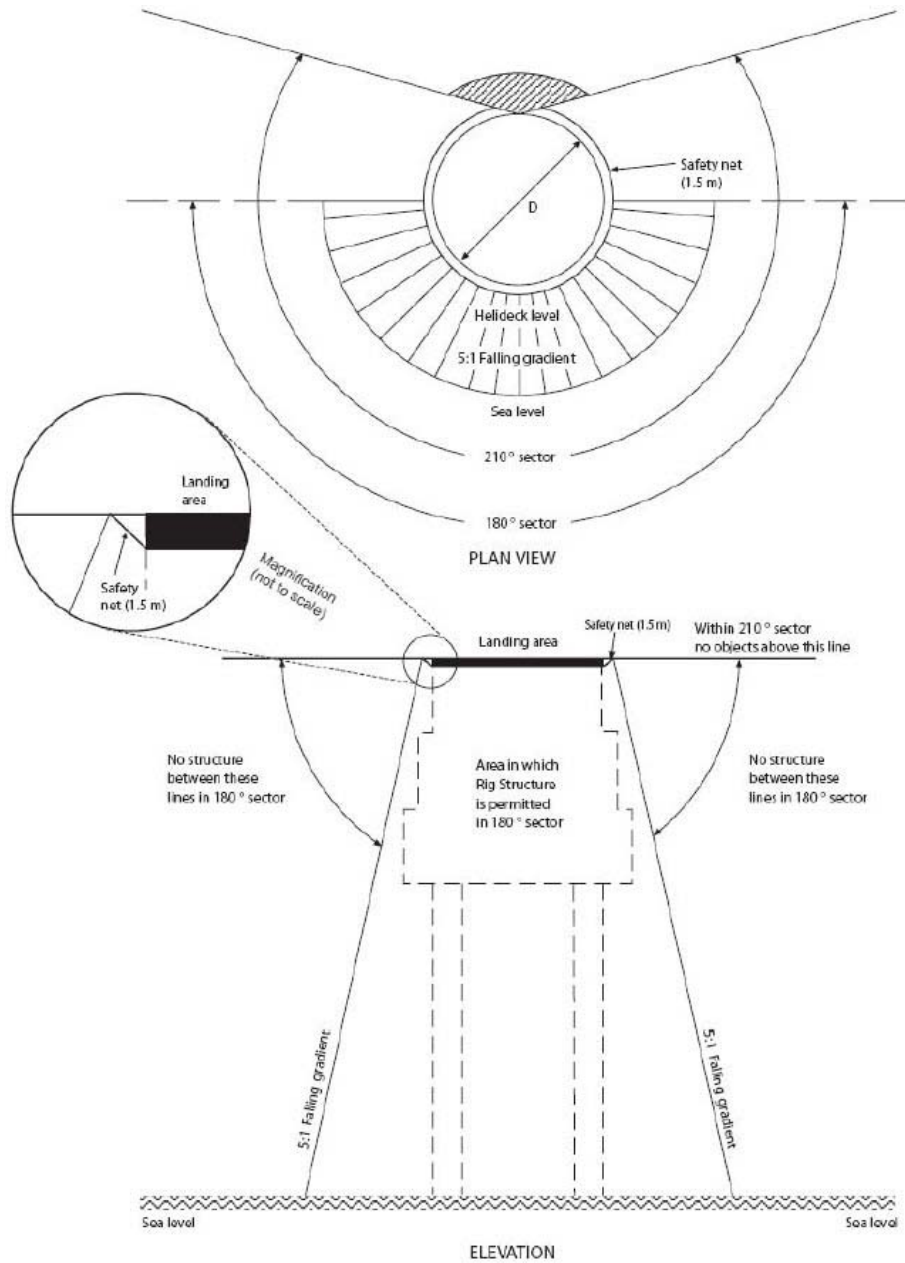


Figure 12.1 - Obstacle free areas - below landing area level



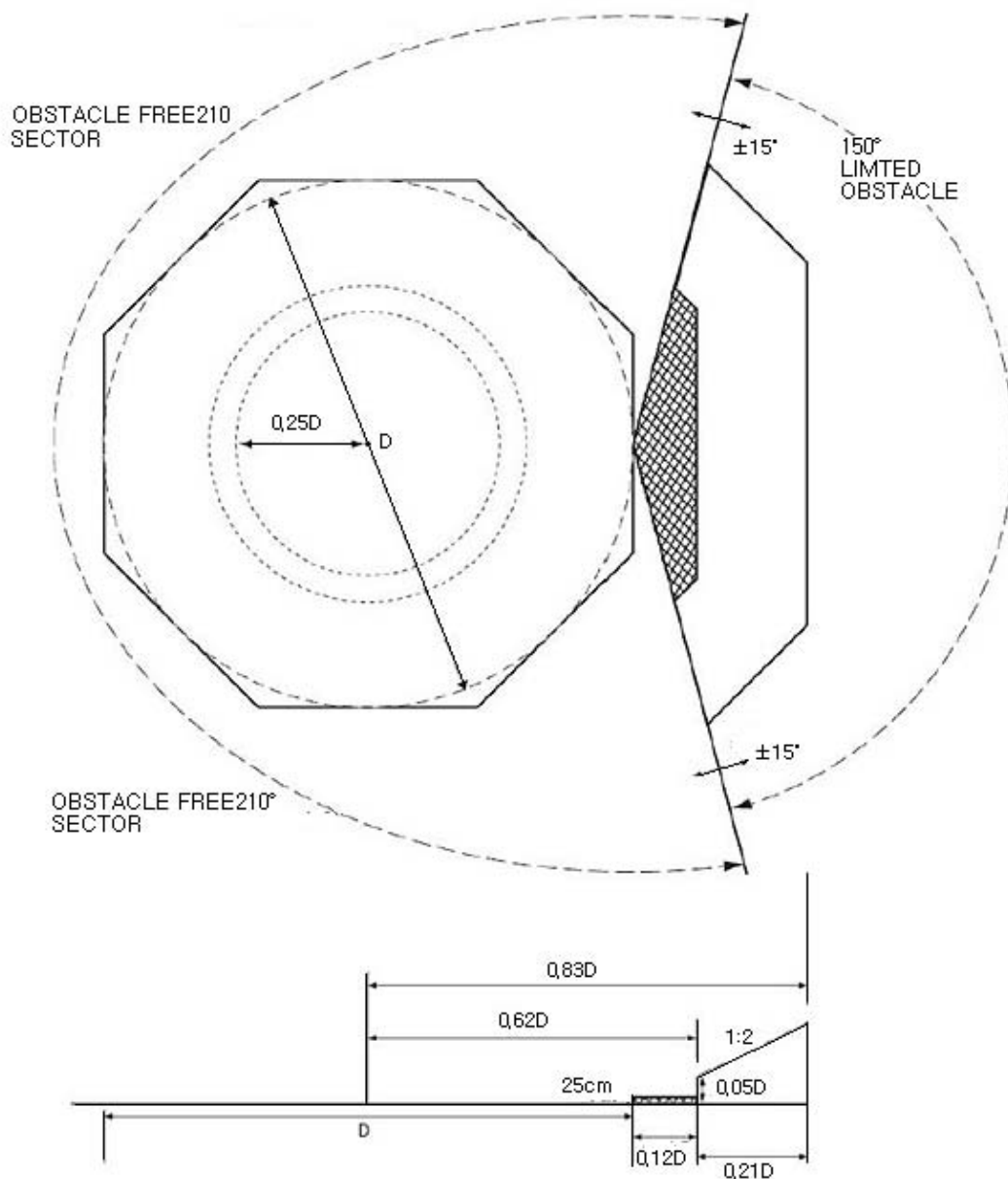
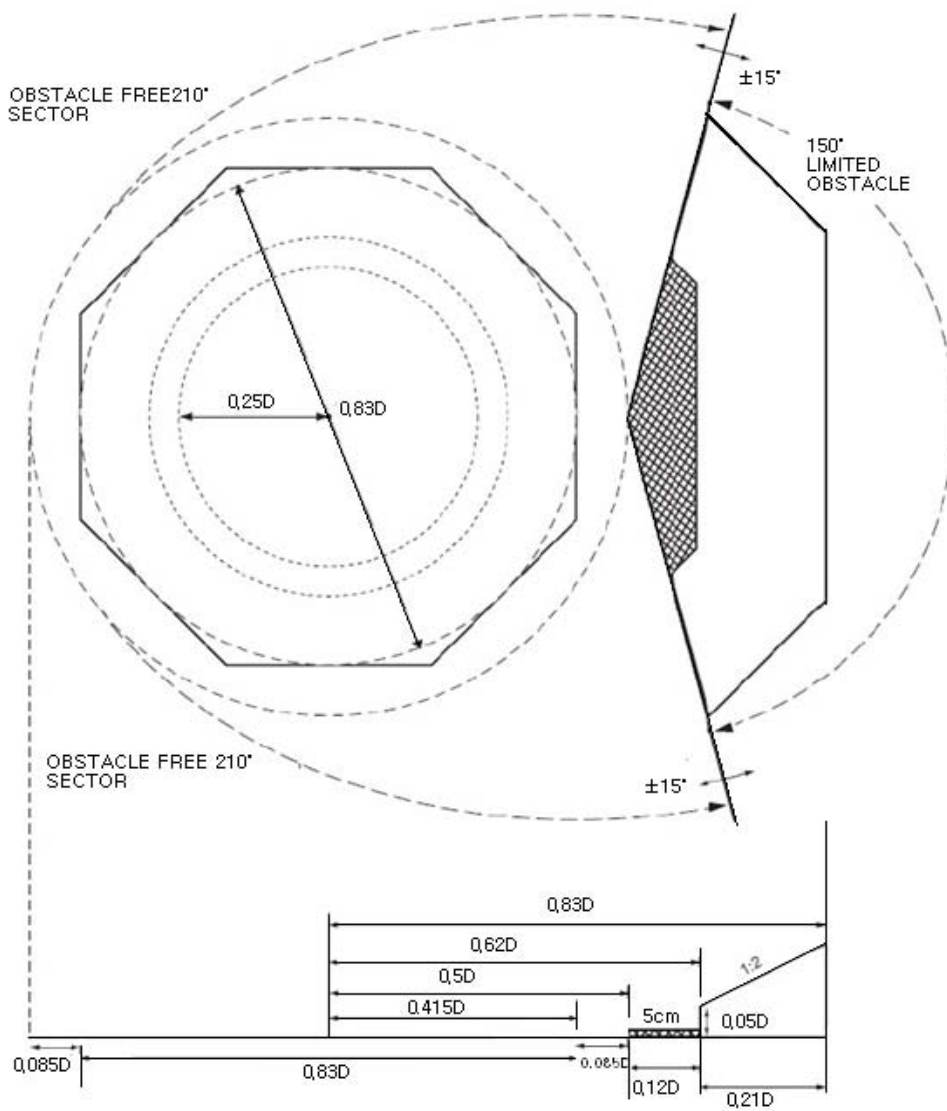


Figure 12.2 Helideck obstacle limitation sector: single main rotor helicopters

- (3) for single main rotor helicopters, within the 150° LOS out to a distance of 0.12 D, measured from the point of origin of the LOS, objects should not exceed a height of 0.25 m above the helideck. Beyond that arc, out to a distance of an additional 0.21 D, the maximum obstacle height is limited to a gradient of one unit vertically for each two units horizontally originating at a height of 0.05 D above the level of the helideck (see **Fig 12.2**);
  - (4) objects the function of which requires that they be located on the helideck within the FATO should be limited to landing nets (where required) and certain lighting systems and should not exceed the surface of the landing area by more than 0.025 m. Such objects should only be present provided they do not cause a hazard to helicopter operations; and
  - (5) operations by tandem main rotor helicopters should be specially considered by the Society.
3. For benign climates as determined by the coastal State, taking into account the type of helicopter used, the conditions of wind, turbulence, sea state, water temperature and icing conditions, the helideck should meet the following:

- (1) the helideck should be of sufficient size to contain a circle of diameter no less than  $0.83 D$ ;
- (2) a helideck obstacle-free sector shall comprise of two components, one above and one below helideck level (see **Fig 12.1**):
  - (A) above helideck level: The surface should be a horizontal plane level with the elevation of the helideck surface that subtends an arc of at least  $210^\circ$  with the apex located on the periphery of the  $D$  reference circle extending outwards to a distance that will allow for an unobstructed departure path appropriate to the helicopter(s) the helideck is intended to serve, and
  - (B) below helideck level: Within the (minimum)  $210^\circ$  arc, the surface should additionally extend downward at a 5:1 falling gradient from the edge of the safety net below the elevation of the helideck to water level for an arc of not less than  $180^\circ$  that passes through the centre of the FATO and outwards to a distance that will allow for safe clearance from the obstacles below the helideck in the event of an engine failure for the type of helicopter(s) the helideck is intended to serve (see **Fig 12.1**);



Note: Heights of 2.5cm and 5cm high shaded areas are not to scale

Figure 12.3 Helideck obstacle limitation sector: single main rotor helicopters for benign climate conditions as accepted by the coastal State

- (3) for single main rotor helicopters, within 0.415 D to 0.5 D objects should not exceed a height of 0.025 m. Within the 150° LOS out to a distance of 0.12 D, measured from the point of origin of the LOS, objects should not exceed a height of 0.05 m above the helideck. Beyond that arc, out to a distance of an additional 0.21 D, the LOS rises at a rate of one unit vertically for each two units horizontally originating at a height of 0.05 D above the level of the helideck (refer to figure **Fig 12.3**);
  - (4) objects the function of which requires that they be located on the helideck within the FATO should be limited to landing nets (where required) and certain lighting systems and should not exceed the surface of the landing area by more than 0.025 m. Such objects should only be present provided they do not cause a hazard to helicopter operations; and
  - (5) operations by tandem main rotor helicopters should be specially considered by the Society.
4. The helideck should have a skid-resistant surface.
  5. Where the helideck is constructed in the form of a grating, the underdeck should be such that the ground effect is maintained.

## Section 4 Arrangements

### 401. General

1. The helideck should have recessed tie-down points for securing a helicopter.
2. The periphery of the helideck should be fitted with a safety net except where structural protection exists. The net should be inclined upwards at an angle of 10° and outwards from below the edge of the helideck to a horizontal distance of 1.5 m and should not rise above the edge of the deck.
3. The helideck should have both a main and an emergency personnel access route located as far apart from each other as practicable.
4. Reference should be made to **Ch 10, 402. 7** concerning helideck drainage.

## Section 5 Visual Aids

### 501. Wind direction indicator

1. A wind direction indicator should be located on the unit which, in so far as is practicable, indicates the wind conditions over the TLOF in such a way as to be free from the effects of airflow disturbances caused by nearby objects or rotor downwash. It should be visible from a helicopter in flight or in a hover over the helideck. Where the TLOF may be subject to a disturbed air flow then additional wind direction indicators located close to the area should be provided to indicate the surface wind on those areas. Placement of the wind direction indicators should not compromise obstacle-protected surfaces.
2. Units on which night helicopter operations take place should have provisions to illuminate the wind direction indicators.
3. A wind direction indicator should be a truncated cone made of lightweight fabric and should have the following minimum dimensions:
  - Length : 1.2 m
  - Diameter (larger end) : 0.3 m
  - Diameter (smaller end) : 0.15 m
4. The colour of the wind direction indicator should be so selected as to make it clearly visible and understandable from a height of at least 200 m above the heliport, having regard to background. Where practicable, a single colour, preferably white or orange, should be used. Where a combination of two colours is required to give adequate conspicuity against changing backgrounds, they should preferably be orange and white, or red and white, and should be arranged in five alternate bands the first and last band being the darker colour.

### 502. Heliport identification marking

A heliport identification marking should be located at the centre of the touchdown/positioning marking described in **506. 1** to **3**. It should consist of a white "H" that is 4 m high, 3 m wide, with a stroke width of 0.75 m.

### 503. D-value marking

1. The actual D-value of the helideck should be painted on the helideck inboard of the chevron provided in accordance with **507**. in alphanumeric symbols of 0.1 m in height.
2. The helideck D-value should also be marked around the perimeter of the helideck in the manner shown in **Fig 12.4** in a colour contrasting (preferably white: avoid black or grey for night use) with the helideck surface. The D-value should be to the nearest whole number with 0.5 rounded down, e.g., 18.5 marked as 18. Markings for some helicopters may require special consideration. (Helidecks designed specifically for AS332L2 and EC 225 helicopters, each having a D-value of 19.5 m, should be rounded up to 20 in order to differentiate between helidecks designed specifically for L1 models.)

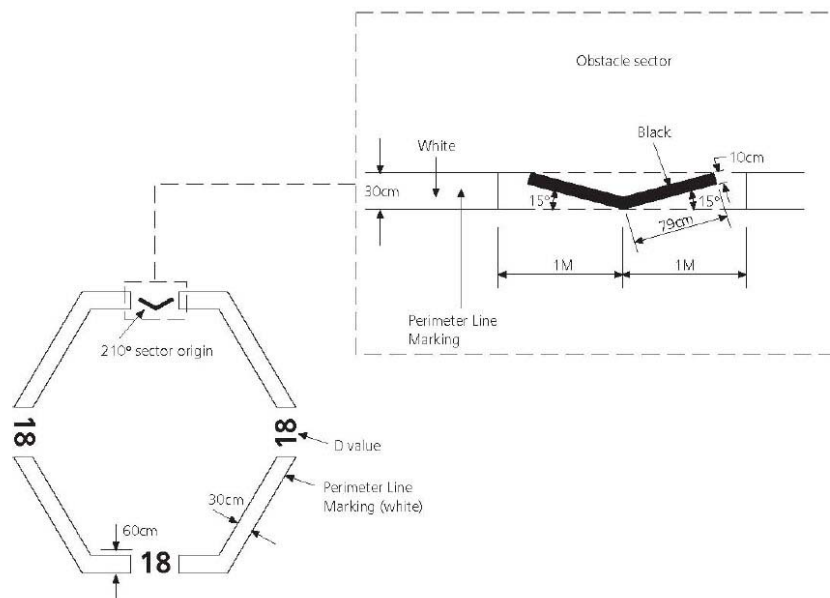


Figure 12.4 Obstacle-free sector marking

### 504. Maximum allowable mass marking

1. A maximum allowable mass marking should be located within the TLOF and so arranged as to be readable from the preferred final approach direction, i.e. towards the obstacle-free sector origin.
2. The maximum allowable mass marking should consist of a two- or three-digit number followed by a letter "t" to indicate the allowable helicopter mass in tonnes (1,000 kg). The marking should be expressed to one decimal place, rounded to the nearest 100 kg. Where States require that a maximum allowable weight is indicated in pounds, the marking should consist of a two- or three-digit number to indicate the allowable helicopter weight in thousands of pounds, rounded to the nearest 1,000 pounds.
3. The height of the figures should be 0.9 m with a line width of approximately 0.12 m and be in a colour (preferably white) which contrasts with the helideck surface. Where possible the mass marking should be well separated from the installation identification marking in order to avoid possible confusion on recognition.

### 505. TLOF perimeter marking

The TLOF perimeter marking should be located along the perimeter of the TLOF and should consist of a continuous white line with a width of at least 0.3 m. TLOF perimeter markings are typically for a 1 D or 0.83 D value (see **Fig 12.2** and **Fig 12.3**).

### 506. Touchdown/positioning marking

1. A touchdown/positioning marking should be located so that when the pilot's seat is over the marking the whole of the undercarriage will be within the TLOF and all parts of the helicopter will be clear of any obstacle by a safe margin.
2. The centre of the touchdown/positioning marking should be concentric to the centre of the TLOF. (The marking may be offset away from the origin of the obstacle-free sector by no more than 0.1 D where an aeronautical study indicates such offsetting to be beneficial, provided that the offset marking does not adversely affect the safety of operations.)
3. A touchdown/positioning marking should be a yellow circle and have a line width of 1 m. The inner diameter of the circle should be half the D-value of the largest helicopter for which the TLOF is designed.

### 507. Helideck obstacle-free sector marking

1. Except as provided in **Par 2**, a helideck obstacle-free sector marking should be located on the TLOF perimeter marking and indicated by the use of a black chevron, each leg being 0.8 m long and 0.1 m wide forming the angle in the manner shown in **Fig 12.4** (replaced by **Res.A.1023(26)/Corr.1**). The obstacle-free sector marking should indicate the origin of the obstacle-free sector, the directions of the limits of the sector and the verified D-value of the helideck. Should there not be room to place the chevron where indicated, the chevron marking, but not the point of origin, may be displaced towards the circle centre.
2. For a helideck less than 1 D (i.e. a helideck meeting **301. 3**), a helideck obstacle free sector marking should be located at a distance from the centre of the TLOF equal to the radius of the largest circle which can be drawn in the TLOF or 0.5 D whichever is greater.
3. The height of the chevron should equal the width of the TLOF perimeter marking, but should be not less than 0.3 m. The chevron should be black in colour and may be painted on top of the TLOF perimeter marking in **505**.

### 508. Unit identification markings

1. The name of the unit should be clearly displayed on unit identification panels located in such positions that the unit can be readily identified from the air and sea from all normal angles and directions of approach. The height of the figures should be at least 0.9 m with a line width of approximately 0.12 m. The unit identification panels should be highly visible in all light conditions and located high up on the unit (e.g., on the derrick). Suitable illumination should be provided for use at night and in conditions of poor visibility.
2. The unit's name should be provided on the helideck and be positioned on the obstacle side of the touchdown/positioning marking with characters not less than 1.2 m in height and in a colour contrasting with the background.

### 509. Perimeter lights

1. The perimeter of the TLOF should be delineated by green lights visible omnidirectionally from on or above the landing area. These lights should be above the level of the deck but should not exceed 0.25 m in height for helidecks sized in accordance with **301. 2** and 0.05 m in height for helidecks sized in accordance with **301. 3**. The lights should be equally spaced at intervals of not more than 3 m around the perimeter of the TLOF, coincident with the white line delineating the perimeter in **505. 1**. In the case of square or rectangular decks there should be a minimum of four lights along each side including a light at each corner of the TLOF. Flush fitting lights may be

used at the inboard (150° limited obstacle sector origin) edge of the TLOF where there is a need to move a helicopter or large equipment off the TLOF.

2. Perimeter lights should meet the chromaticity characteristics given in **Table 12.1**, and the vertical beam spread and intensity characteristics given in **Table 12.2**. (If higher intensity lighting is provided to assist in conditions of poor visibility during daylight, it should incorporate a control to reduce the intensity to not more than 60 cd for night use.)

Table 12.1 Perimeter lighting chromaticity

Yellow boundary	$x = 0.36 - 0.08y$
White boundary	$x = 0.65y$
Blue boundary	$y = 0.9 - 0.171x$

Table 12.2 Green perimeter lighting intensity

Elevation	Intensity(cd)
0° - 90°	60 max
> 20° - 90°	3 min
> 10° - 20°	15 min
0° - 10°	30 min
Azimuth +180° - 180	

### 510. Helideck floodlights

Helideck floodlights should be located so as to avoid glare to pilots, and provision should be made for periodically checking their alignment. The arrangements and aiming of floodlights should be such that helideck markings are illuminated and that shadows are kept to a minimum. Floodlights should conform to the same height limitations specified in **505.1** for perimeter lights.

### 511. Obstacle marking and lighting

1. Fixed obstacles and permanent equipment, such as crane booms or the legs of self-elevating units, which may present a hazard to helicopters, should be readily visible from the air during daylight. If a paint scheme is necessary to enhance identification by day, alternate black and white, black and yellow, or red and white bands are recommended, not less than 0.5 m nor more than 6 m wide.
2. Omnidirectional red lights of at least 10 cd intensity should be fitted at suitable locations to provide the helicopter pilot with visual information on objects which may present a hazard to helicopters and on the proximity and height of objects which are higher than the landing area and which are close to it or to the limited obstacle sector boundary. Such lighting should comply with the following:
  - (1) Objects which are more than 15 m higher than the landing area should be fitted with intermediate red lights of the same intensity spaced at 10 m intervals down to the level of the landing area (except where such lights would be obscured by other objects).
  - (2) Structures such as flare booms and towers may be illuminated by floodlights as an alternative to fitting the intermediate red lights, provided that such lights should be arranged such that they will illuminate the whole of the structure and not interfere with the helicopter pilot's night vision.
  - (3) On self-elevating units the leg(s) nearest the helideck may be illuminated by floodlights as an alternative to fitting the intermediate red lights, provided that such lights should be arranged such that they will not interfere with the helicopter pilot's night vision.
  - (4) Alternative equivalent technologies to highlight dominant obstacles in the vicinity of the helideck may be utilized in accordance with the recommendations of the ICAO.

3. An omnidirectional red light of intensity 25 to 200 cd should be fitted to the highest point of the unit and, in the case of self-elevating units, as near as practicable to the highest point of each leg. Where this is not practicable (e.g., flare towers) the light should be fitted as near to the extremity as possible.

## 512. Status lights

1. Status lights should be installed to provide warning that a condition exists on the unit which may be hazardous for the helicopter or its occupants. The status lights should be a flashing red light (or lights), visible to the pilot from any direction of approach and on any landing heading. The system should be automatically initiated when the toxic gas alarm under **Ch 6, 302.** is initiated as well as being capable of manual activation at the helideck. It should be visible at a range in excess of the distance at which the helicopter may be endangered or may be commencing a visual approach. The status light system should:
  - (1) be installed either on or adjacent to the helideck. Additional lights may be installed in other locations on the unit where this is necessary to meet the requirement that the signal be visible from all approach directions, i.e. 360° in azimuth;
  - (2) have an effective intensity of at least 700 cd between 2° and 10° above the horizontal and at least 176 cd at all other angles of elevation;
  - (3) be provided with a facility to enable the output of the lights (if and when activated) to be dimmed to an intensity not exceeding 60 cd while the helicopter is landed on the helideck;
  - (4) be visible from all possible approach directions and while the helicopter is landed on the helideck, regardless of heading with a vertical beam spread as describe above;
  - (5) use lights that are 'red' as defined by ICAO (Reference is made to the ICAO Convention, Annex 14, Volume 1, Appendix 1, Colours for aeronautical ground lights);
  - (6) flash at a rate of 120 flashes per minute and, if two or more lights are needed to meet this requirement, they should be synchronised to ensure an equal time gap (to within 10%) between flashes. Provision should be made to reduce the flash rate to 60 flashes per minute should a helicopter be on the helideck. The maximum duty cycle should be no greater than 50%;
  - (7) have facilities at the helideck to manually override the automatic activation of the system;
  - (8) reach full intensity in not more than three seconds at all times; (replaced by **Res.A.1023(26)/Corr.1**)
  - (9) be designed so that no single failure will prevent the system operating effectively. In the event that more than one light unit is used to meet the flash rate requirement, a reduced flash frequency of at least 60 flashes per minute is acceptable in the failed condition for a limited period; and
  - (10) where supplementary 'repeater' lights are employed for the purposes of achieving the 'on deck' 360° coverage in azimuth, these should have a minimum intensity of 16 cd and a maximum intensity of 60 cd for all angles of azimuth and elevation.

## Section 6 Motion Sensing System

### 601. General

Vessel motions represent a potential hazard to helicopter operations. Surface units should be equipped with an electronic motion-sensing system capable of measuring or calculating the magnitude and rate of pitch roll and heave at the helideck about the true vertical datum. A motion-sensing system display should be located at the aeromobile VHF radiotelephone station provided in accordance with MODU Code Ch 11, 11.6, so that this information may be relayed to the helicopter pilot. The form of the report should be agreed with the aeronautical service provider.

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## Section 7 Exemptions

### 701. General

Administrations should consider exemptions from or equivalencies to the provisions of this chapter regarding markings and landing aids when:

- (1) the Administration is provided with evidence that the coastal State in whose waters the unit is operating has notified the ICAO of differences to its requirements for visual aids; or
- (2) the Administration is provided with evidence that the coastal State in whose waters the unit is operating has established requirements for visual aids that differ from the provisions of this chapter. ↓





**2017**

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**Guidance Relating to  
the Rules for the Classification of  
Mobile Offshore Drilling Units**

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#### APPLICATION OF THE GUIDANCE

This "Guidance Relating to the Rules for the Classification of Mobile Offshore Drilling Units" (hereafter called as the Guidance) is prepared with the intent of giving guidelines as to the treatment of the various provisions for items required the unified interpretations and items not specified in details in the Rules, and the requirements specified in the Guidance are to be applied, in principle, in addition to the various provisions in the Rules.

As to any technical modifications which can be regarded as equivalent to any requirements in the Guidance, their flexible application will be properly considered.

# **APPLICATION OF "GUIDANCE RELATING TO THE RULES FOR THE CLASSIFICATION OF MOBILE OFFSHORE DRILLING UNITS"**

1. Unless expressly specified otherwise, the requirements in the Guidance apply to Mobile Offshore Drilling Units for which contracts for construction are signed on or after 1 July 2017.
2. The amendments to the Rules for 2016 edition and their effective date are as follows;

**Effective Date 1 July 2017**

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## **ANNEX 2 TECHNICAL PROVISIONS OF MEANS OF ACCESS**

- 103. Fig. 1 and Fig. 2 have been amended.

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# CHAPTER 1 GENERAL

## Section 1 General

### 101. Application

1. In application to **101. 6** of the Rules, drilling systems are to comply with **Annex 1**. ↓

## CHAPTER 3 CONSTRUCTION, STRENGTH AND MATERIALS

### Section 2 Access

#### 201. General

1. In application of **201. 2** of the Rules, the details are as follows.

Some possible alternative means of access are listed under **Annex 2 103. 9**. Always subject to acceptance as equivalent by the Society, alternative means such as an unmanned robot arm, ROV's with necessary equipment of the permanent means of access for overall and close-up inspections and thickness measurements of the deck head structure such as deck transverses and deck longitudinals of ballast tanks and other tanks, holds and other spaces where gas hazardous atmosphere may be present, are to be capable of:

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

2. In application of **201. 3** of the Rules, the details are as follows.

- (1) Inspection

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

- (2) Procedures

- (A) Any Company authorised person using the MA shall assume the role of inspector and check for obvious damage prior to using the access arrangements. Whilst using the MA the inspector is to verify the condition of the sections used by close up examination of those sections and note any deterioration in the provisions. Should any damage or deterioration be found, the effect of such deterioration is to be assessed as to whether the damage or deterioration affects the safety for continued use of the access. Deterioration found that is considered to affect safe use is to be determined as "substantial damage" and measures are to be put in place to ensure that the affected section(s) are not to be further used prior effective repair.

- (B) Statutory survey of any space that contains MA shall include verification of the continued effectiveness of the MA in that space. Survey of the MA shall not be expected to exceed the scope and extent of the survey being undertaken. If the MA is found deficient the scope of survey is to be extended if this is considered appropriate.

- (C) Records of all inspections are to be established based on the requirements detailed in the MODU's Safety Management System. The records are to be readily available to persons using the MAs and a copy attached to the MA Manual. The latest record for the portion of the MA inspected is to include as a minimum the date of the inspection, the name and title of the inspector, a confirmation signature, the sections of MA inspected, verification of continued serviceable condition or details of any deterioration or substantial damage found. A file of permits issued is to be maintained for verification.

#### 202. Safe access to holds, tanks, ballast tanks and other spaces

1. In application of **202.** of the Rules, this regulation is only applicable to integral tanks. Independent tanks can be excluded. Also, spud cans and jack cases of self-elevating units can be excluded. In application of **202. 1** of the Rules, the wording "not intended for the carriage of oil or hazardous materials" applies only to "similar compartments", i.e. safe access can be through a pump-room, deep cofferdam, pipe tunnel, cargo hold or double hull space.

2. In application of **202. 2** of the Rules, the details are as follows. A tank of less than 35 m length without a swash bulkhead requires only one access hatch. Where rafting is indicated in the access manual as the means to gain ready access to the under deck structure, the term "similar obstructions" referred to in the regulation includes internal structures (e.g., webs >1.5m deep) which restrict the ability to raft (at the maximum water level needed for rafting of under deck structure) directly to the nearest access ladder and hatchway to deck. When rafts or boats alone, as an alter-

native means of access are allowed, permanent means of access are to be provided to allow safe entry and exit. This means:

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

### 203. Access manual

1. In application of **203. 1** of the Rules, the access manual is to address spaces listed **202.** of the Rules. As a minimum the English version is to be provided.

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

Part 1: Plans, instructions and inventory required by **203. 1** (1) to (7) of the Rules. This part is to be approved by the Society.

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

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

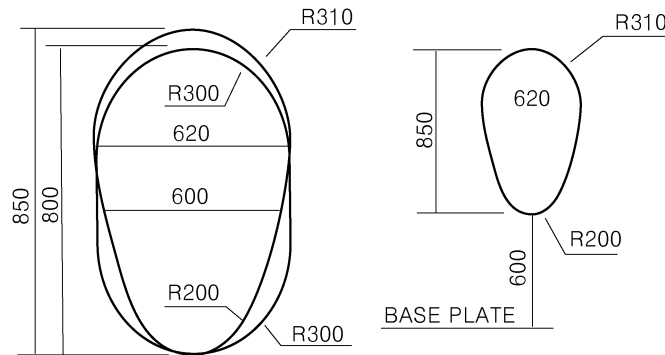
- (1) The access manual is to clearly cover scope as specified in the regulations for use by crews, surveyors and port State control officers.
  - (2) Approval/re-approval procedure for the manual, i.e. any changes of the permanent, portable, movable or alternative means of access within the scope of the regulation and the Technical provisions are subject to review and approval by the Society.
  - (3) Verification of MA is to be part of safety construction survey for continued effectiveness of the MA in that space which is subject to the statutory survey.
  - (4) Inspection of MA by the crew and/or a competent inspector of the company as a part of regular inspection and maintenance
  - (5) Actions to be taken if MA is found unsafe to use.
  - (6) In case of use of portable equipment plans showing the means of access within each space indicating from where and how each area in the space can be inspected.
2. In application of **203. 2** of the Rules, the details are as follows.

Critical structural areas are to be identified by advanced calculation techniques for structural strength and fatigue performance, if available, and feed back from the service history and design development of similar or sister units.

### 204. General technical specifications

1. In application of **204. 1** of the Rules, the details are as follows. The minimum clear opening of 600 mm x 600 mm may have corner radii up to 100 mm maximum. The clear opening is specified in MSC/Circ.686 to keep the opening fit for passage of personnel wearing a breathing apparatus. In such a case where as a consequence of structural analysis of a given design the stress is to be reduced around the opening, it is considered appropriate to take measures to reduce the stress such as making the opening larger with increased radii, e.g. 600 x 800 with 300 mm radii, in which a clear opening of 600 x 600 mm with corner radii up to 100 mm maximum fits.
2. In application of **204. 2** of the Rules, the details are as follows.
  - (1) The minimum clear opening of not less than 600 mm x 800 mm may also include an opening with corner radii of 300 mm. An opening of 600mm in height x 800mm in width may be accepted as access openings in vertical structures where it is not desirable to make large opening in the structural strength aspects, i.e. girders and floors in double bottom tanks.

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



- (3) If a vertical opening is at a height of more than 600 mm steps and handgrips are to be provided. In such arrangements it is to be demonstrated that an injured person can be easily evacuated. ↓



# **ANNEX 1**

# **DRILLING SYSTEMS**

# CHAPTER 1 GENERAL

## SECTION 1 General

### 101. Application

1. This Annex apply to the drilling systems which are installed on the unit classed with the Society or intended to be registered under the Society.
2. The requirements not specified in this Annex are to be in accordance with recognized national or international standards.
3. The following standards may be adequately referred as recognized national or international standards.

Systems	Standard No.	Standard Title
Blowout Preventer (BOP) System	API Spec 6A	Specification for Wellhead and Christmas Tree Equipment
	API Spec 16A	Specification for Drill-through Equipment
	API Spec 16D	Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
	API RP 53	Blowout Prevention Equipment Systems for Drilling Operations
	API RP 59	Recommended Practice for Well Control Operations
Lower Marine Riser Package (LMRP)	API Spec 16A	Specification for Drill-through Equipment
	API Spec 16D	Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
	API Spec 16F	Specification for Marine Drilling Riser Equipment
	API Spec 16R	Marine Drilling Riser Couplings
	API PR 16Q	Design, Selection, Operation and Maintenance of Marine Drilling Riser Systems
Choke and Kill System	API Spec 6A	Specification for Wellhead and Christmas Tree Equipment
	API Spec 16C	Choke and Kill Systems
	API Spec 16F	Specification for Marine Drilling Riser Equipment
	API RP 53	Blowout Prevention Equipment Systems for Drilling Operations
	API RP 59	Recommended Practice for Well Control Operations
Diverter System	API Spec 16D	Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
	API Spec 6A	Specification for Wellhead and Christmas Tree Equipment
	API RP 53	Blowout Prevention Equipment Systems for Drilling Operations
	API RP 64	Recommended Practice for Well Control Operations
Auxiliary Well Control System	API Spec 7-1	Specification for Rotary Drill Stem Elements
	API Spec 16A	Specification for Drill-through Equipment
	API RP 53	Blowout Prevention Equipment Systems for Drilling Operations

Systems	Standard No.	Standard Title
Marine Drilling Riser System	API Spec 16A	Specification for Drill-through Equipment
	API Spec 16Q	Design, Selection, Operation and Maintenance of Marine Drilling Riser Systems
	API Spec 16R	Marine Drilling Riser Couplings
	API Spec 16J	Comparison of Marine Drilling Riser Analyses
	API Spec 16F	Specification for Marine Drilling Riser Equipment
Hoisting, Lifting, Rotating and Pipe Handling System	API Spec 7F	Oil Field Chain and Sprockets
	API Spec 7K	Specification for Drilling and Well Servicing Equipment
	API Spec 8A	Drilling and Production Hoisting Equipment
	API Spec 8C	Specification for Drilling and Production Hoisting Equipment (PSL 1 and PSL 2)
	API Spec 2C	Offshore Cranes
	API Spec 9A	Specification for Wire Rope
Derrick	API Spec 4G	Recommended Practice for Use and Procedures for Inspection, Maintenance, and Repair of Drilling and Well Servicing Structures
	API Spec 4F	Drilling and Well Servicing Structures
Well Test System	API Spec 6A	Specification for Wellhead and Christmas Tree Equipment
	API Spec 16C	Choke and Kill Systems
	API Spec 6D	Specification for Pipeline Valves
	API Spec 6AV1	Specification for Verification Test of Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Service
Materials	API RP 2A-WSD	Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design
	API Spec 4F	Drilling and Well Servicing Structures
Piping	ASME B 31.3	Process Piping
	API Spec 16C	Choke and Kill Systems
	API Spec 16D	Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
	API RP 14E	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems

## 102. Scope

This Annex covers the drilling system which includes the following. However items may differ according to type of units and is not limited to the following.

1. Well control system
  - (1) Blowout preventer (BOP) system
  - (2) Lower marine riser package (LMRP)
  - (3) Choke and kill system
  - (4) Diverter system
  - (5) Auxiliary well control system
2. Marine drilling riser system
3. Drill string compensation system
4. Mud and cementing system
  - (1) Bulk storage and transferring systems
  - (2) Mud circulating and mixing system
  - (3) Cementing system

5. Hoisting, lifting, rotating and pipe handling system
6. Derrick
7. Well test system
8. Burner booms

### 103. Equivalence and novel feature

1. Drilling systems which are not in compliance with this Annex may be acceptable provided that satisfactory service experience or a systematic analysis based on sound engineering principles demonstrate their overall safety and function.
2. Drilling systems which are not in compliance with this Annex may be acceptable provided that Systems are designed and constructed in accordance with recognized national standards or international standards.
3. The Society may consider the classification of systems based on or applying novel design principles or features, to which the Annex is not directly applicable, on the basis of experiments, calculations or other supporting information provided to the Society.
4. Risk evaluations may be applicable for the justification of alternative arrangements or novel features.

### 104. Design conditions

The drilling systems are to be designed to account for all applicable following environmental, operational, and test loads, or combination thereof.

1. Environmental conditions
  - (1) Earthquake
  - (2) Wind
  - (3) Ice
  - (4) Temperature
  - (5) Current, waves
  - (6) 1, 10, 50, 100 year storm event
2. Operational conditions
  - (1) Static pressure
  - (2) Vibration
  - (3) Transient pressure excursion
  - (4) Acceleration loads due to movement of the unit
  - (5) Temperature excursion
  - (6) Retrieval
  - (7) Tension
  - (8) Bending
  - (9) Drifting
3. Transportation
4. Installation
5. Commissioning
6. Storage and maintenance
7. Test loads

## SECTION 2 Definitions

### 201. Application

The definitions of terms which appear in this Annex are to be as specified in this Section, unless otherwise specified, and definitions of terms and symbols not specified in the Annex are to be as specified in **Rules for the Classification of Steel Ships** and **Ch 1, Sec 2** of the Rules.

### 202. Definitions

1. **Well** is general term for any boring through the Earth's surface that is designed to find and acquire petroleum oil hydrocarbons.
2. **Blowout preventer(BOP)** is a device that allows the well to be sealed to confine the well fluids in the wellbore.
3. **Blowout preventer stack** is the assembly of well control equipment including BOP's, valves, and nipples connected to the top of the casing head.
4. **Ram BOP** is a blowout preventer that use rams to seal off pressure in the wellbore.
5. **Annular BOP** is a device with a generally toroidal shaped steel-reinforced elastomer packing element that is hydraulically operated to close and seal around any drill pipe size or to provide full closure of the wellbore.
6. **Drilling spool** is a short pipe placed in the blowout preventer stack to provide connections of choke and kill lines.
7. **Lower Marine Riser Package (LMRP)** is the upper section of a two-section subsea BOP stack consisting of the hydraulic connector, annular BOP, flex/ball joint, riser adapter, flexible chock and kill lines, and subsea control pods.
8. **Riser** is a vertical pipe that allows the well fluids to be circulated. A riser is installed from a BOP to a unit.
9. **Riser tensioner** is a device that allow the riser to be in tension to prevent compression load on riser.
10. **Riser spider** is a device used to support the riser string on the uppermost coupling support shoulder during deployment and retrieval of the riser.
11. **Choke system** is a system used to reduce wellbore pressure by control of the rate of the flow of drilling mud out of the hole when the well is closed in with the blowout preventer and a kick is being circulated out of the hole.
12. **Kill system** is a system that allows high density drilling fluid to be pumps into the well with the BOP closed to prevent a threatened blowout.
13. **Accumulator** is a pressure vessel charged with inert gas used to store hydraulic fluid under pressure for operation of blowout preventers.
14. **Control pod** is the assemblage of valves and pressure regulators which respond to control signals to direct hydraulic power fluid through assigned porting to operate function.
15. **Agitators** is a device that stir the fluid to keep solids from settling and maintain homogeneous mixture in the mud tank
16. **Hopper** is a con-shaped fitting that is installed to mix dry mud or chemicals.
17. **Degasser** is a device used to remove unwanted gases from the returned mud.
18. **Shale shaker** is a device used to remove cuttings from the returned mud.
19. **Desander** is a device used to remove sand from the returned mud.
20. **Desilter** is a device used to remove silt from the returned mud.
21. **Centrifuge** is a device used to remove very fine particles from the returned mud.
22. **Mud tank** is a tank which retain mud .

23. **Trip tank** is a tank which compensate the volume of drill string when pull drill string from the hole.
24. **Diverter** is a device attached to the wellhead or marine drilling riser to close the vertical access in order to prevent upward flow of well fluids and direct flow into a line away from the unit.
25. **Kelly** is the steel bar, four-, six-sided, suspended from the swivel through the rotary table and connected to the topmost joint of drill pipe to turn the drill pipe as the rotary table turns
26. **Kelly cock** is a valve close to protect the rotary hose from high pressure that may exist in the drill string
27. **Mixing pump** is a pump to circulate mud of mud mixing system to mix dry mud in mud.
28. **Mud-gas separator** is a vessel to separate gas from kick fluid and mud depressurized by chock manifold.
29. **Mud pump** is a pump to pick up mud from the mud tank and circulate mud.
30. **Pulsation damper** is a device used to smooth out the surge created by pistons as they discharge mud.
31. **Standpipe** is a rigid metal pipe that provides the high-pressure path way for drilling mud to travel approximately one-third of the way up the derrick, where it connects to a rotary hose.
32. **Standpipe manifold** is a manifold to connect mud pump discharge to standpipe and divide flow into several part.
33. **Rotary hose** is a flexible hose attached to standpipe to allow up-and-down movement of swivel
34. **Swivel** is a mechanical device that prevents the motion of the kelly being transferred to the drilling line and permit high-volume flow of high-pressure drilling mud from the fixed portion to the rotating portion without leaking.
35. **Umbilical** is a control hose bundle or electric cable used to control subsea function.
36. **Derrick** is a main load-bearing structure in drilling unit used as support structure for the drill string, and top drive assembly.
37. **Crown Block** is a assembly of sheaves mounted at the derrick top (crown) through which the drilling line is reaved.
38. **Traveling lock** is a set of sheaves which move up and down in the derrick as drilling line is paid out or taken in.
39. **Drawwork** is a large winch located on the drill floor used to raise and lower the drill string, top drive assembly by taking in or paying out the drilling line through the crown block and traveling block.
40. **Stabbing board** is a folding platform located in the derrick which positions the stabbing hand (pipe stabber) while running casing. Similar to monkey board, but at a lower height.
41. **Monkey board** is a derrick man's working place which is installed in the derrick.
42. **Cathead** is a spool-shaped component on which hoisting rope is wounded. A cathead is fitted in the winch.
43. **Catwalk** is a ramp used to move riser sections, drill pipes, casing or tool joints from deck storage to the drill floor.
44. **Riser running tool** is a A device that joins to the upper end of a riser joint to permit the lifting and lowering of the joint and the assembled riser string in the derrick by the elevators.
45. **Water table** is a step that is installed at top of derrick to allows to access to crown block
46. **Acoustic control system** is a subsea control system that uses coded acoustic signals for communications and is normally used as an emergency backup having control of a few selected critical functions.
47. **Autoshear system** is a safety system that is designed to automatically shut-in the wellbore in

the event of a disconnect of the LMRP. When the autoshear is armed, disconnect of the LMRP closes the shear rams on BOP stack.

48. **Deadman system** is a safety system that is designed to automatically close the wellbore in the event of a simultaneous absence of hydraulic supply and signal (control and communication) transmission capacity in both subsea control pods.
49. **Multiplex control system(MUX)** is a system utilizing electrical or optical conductors in an armored subsea umbilical cable such that, on each conductor, multiple distinct functions are independently operated by dedicated serialized coded commands.
50. **Test stump** is a stump with wellhead profile used to support the BOP during surface pressure test operations.
51. **Gimbal** is a shock absorbing support for the riser spider which allows some angular movement of the spider and riser relative to the rig support structure.
52. **Setback** is a substructure which supports vertically standing tubular goods at bottom.
53. **Tool joint** is a connection part of each drill pipe.
54. **Riser Recoil System** is a means of limiting the upward acceleration of the riser when a disconnect is made at the riser connector. ⚡

## CHAPTER 2 CLASSIFICATION AND SURVEYS

### SECTION 1 General

#### 101. General

The classification and surveys of drilling systems intended to be classed with the Society or classed with the Society are to be in accordance with the requirements specified in this Chapter. In the case of items not specified in this Chapter, the requirements specified in **Pt 1 of Rules for the Classification of Steel Ships** are to be applied.

### SECTION 2 Classification

#### 201. Character of classification

The class notations assigned to the drilling system classed with the Society are to be in accordance with **Pt 1, Ch 1, 201.** of **Rules for the Classification of Steel Ships** except that a notation "Drilling System" may be given as an additional installation notation.

#### 202. Maintenance of classification

1. All ships classed with the Society are, for continuation of the classification, to be subjected to the periodical and other surveys, and are to be maintained in good condition in accordance with the requirements of this Chapter.
2. When a ship classed with the Society makes an alteration or modification of such an extent as to influence to the ship's original performances, the plans have to be submitted for the Society's approval before the work is commenced and the alteration work has to be supervised by the Surveyor.

#### 203. Classification survey during construction

##### 1. General

Drilling systems are to be examined in detail in Classification Survey during Construction in order to ascertain that they meet the appropriate requirements of the Annex.

##### 2. Submission of plans and documents

- (1) For drilling systems, the following plans and documents are to be submitted for the approval of the Society at classification survey during construction before the work is commenced.
  - (A) Entire drilling system
    - (a) General arrangement showing locations of all machinery, equipment, structures for drilling operations and locations of all control panels and stations for drilling systems.
    - (b) Piping & instruments diagrams associated with the drilling systems
    - (c) An arrangement plan clearly indicating locations of the fire and gas monitoring and fire fighting control locations
    - (d) Detailed arrangements of the well test areas or location of well test equipment
    - (e) Escape and egress routes, including their protections, and muster stations
    - (f) The locations of openings (air intake, exhaust, windows, doors, etc.) for all closed spaces
    - (g) Ventilation arrangements
    - (h) HAZOP or HAZID study reports for the essential drilling systems
    - (i) Drawings identifying hazardous areas in accordance with **Ch 7** of the Rules.
  - (B) Well Control Systems
    - (a) Blowout preventer systems
      - (i) Design data (description of the well control systems, design pressure and temperature, shutdown logic, details on hierarchy of control(primary, secondary, emergency,



- etc.), applicable codes and standards)
- (ii) Piping & instruments diagrams
- (iii) Equipment technical specifications
- (iv) Failure Modes and Effects Analysis, FMEA for the complete integrated drilling systems
- (v) All control panel arrangements for well control of BOP systems
- (vi) Design of BOP stack including the followings.
  - Design parameters such as design pressure and temperature, loads, maximum water depth, service conditions, etc.
  - Dimensional detailed drawings and fabrication details
  - Material specifications
  - Individual BOP (annular and ram) details to attest appropriate BOP capability with regard to drill pipe size, tool joints, casing, wire line and combination of them
  - Documentation to confirm the shear rams capability of shearing the various tubulars (sizes, grades, strengths, etc.) under the specified design conditions
  - BOP stack assembly drawings for BOP systems showing stack configuration showing all equipment, structural frame details, lift points/attachments, arrangements showing accumulators, pods, valves, piping, connectors, jumper lines, etc.
  - Design details and structural analysis for BOP structural frame and lifting attachments
- (vii) Subsea control pods drawings and associated calculations
- (b) Lower marine riser package
  - (i) Design data (load cases and limit states for all design and operating conditions, design analysis methodology, applicable codes and standards)
  - (ii) Equipment technical specifications
  - (iii) Design analysis of mechanical-load bearing components and pressure-retaining equipment
  - (iv) Annular BOP
  - (v) Connector details
  - (vi) LMRP structural frame
  - (vii) Material specifications
- (c) Choke and kill systems
  - (i) Design data (design pressure and temperature, applicable codes and standards)
  - (ii) Piping & instruments diagrams
  - (iii) Equipment arrangement
  - (iv) Equipment technical specifications
- (d) Diverter systems
  - (i) Design data (design pressure and temperature, applicable codes and standards)
  - (ii) Piping & instruments diagrams
  - (iii) Equipment arrangement
- (e) Design details for auxiliary well control equipment include kelly valves, drill pipe safety valves, drill string float valves, etc.
- (C) Marine drilling riser systems
  - (a) Design data (load cases and limit states for all design and operating conditions, design analysis methodology, assumptions used in the global design analysis of the marine drilling riser system and design analysis of its components, applicable codes and standards)
  - (b) Design analysis
  - (c) Installation analysis
  - (d) Riser and its components fabrication drawings
  - (e) Material specifications
- (D) Drill string compensation systems
  - (a) Design data (Load capacity, design pressure and temperature, applicable codes and standards)
  - (b) Piping & instruments diagrams
  - (c) Equipment technical specifications
- (E) Bulk storage, transferring and mud circulating system
  - (a) Design data (design pressure and temperature, design medium, applicable codes and standards)
  - (b) Piping & instruments diagrams
  - (c) Equipment technical specifications

- (d) Drawings of prime movers such as engines and motors
- (f) Drawings of pumps
- (F) Hoisting, lifting, pipe handling system
  - (a) Derrick drawings including the followings
    - (i) Applicable codes and standards
    - (ii) Derrick structure drawing
    - (iii) Design condition
    - (iv) Combined load cases and limit states for all design and operating conditions
    - (v) Assumptions used in the design analysis of the derrick structure and associated components
    - (vi) Corrosion control plans
    - (vii) Manufacturing specifications
    - (viii) Design analysis methodology for the derrick structure and associated components, and component analyses including computer modeling and computer program used
    - (ix) Structural analysis report
    - (x) General arrangement drawings
    - (xi) Derrick assembly drawings
    - (xii) Crown block assembly drawings
    - (xiii) Water table assembly drawings
  - (b) Crane drawings including the followings
    - (i) Applicable codes and standards
    - (ii) Equipment technical specifications
    - (iii) Load cases and limit states for all design and operating conditions
    - (iv) Wire rope specifications
    - (v) Material specifications
    - (vi) General arrangement
    - (vii) Crane capacity rating chart
    - (viii) Welding details and procedures
    - (ix) Procedures of non-destructive testing
    - (x) Procedures of load tests
    - (xi) Stress analysis and other supporting calculations
  - (c) Riser and pipe handling
    - (i) Applicable codes and standards
    - (ii) Equipment technical specifications
    - (iii) Design load and temperature
    - (iv) Prime mover power rating
    - (v) Assembly drawings
    - (vi) Equipment drawings
    - (vii) Dimensional detailed drawings
- (G) Well testing system
  - (a) Well testing system drawings including the followings
    - (i) Descriptions of the well testing system, and well test equipment
    - (ii) General arrangement
    - (iii) Piping & instruments diagrams
    - (iv) Design pressure and temperature
    - (v) Shutdown logic
    - (vi) Gas dispersion and flare/heat radiation analyses
    - (vii) Equipment technical specifications
    - (viii) Applicable codes and standards
  - (b) Well testing equipments drawings including the followings
    - (i) Design parameter such as design pressure, design temperature, maximum water depth, etc.
    - (ii) Design analysis to justify safety factor
    - (iii) Dimensional detailed drawings and fabrication details
    - (iv) Material specifications
    - (v) Structural design analysis for skid mounted equipment
  - (c) Burner booms including the followings
    - (i) Design conditions
    - (ii) Combined load cases and limit states for all design and operating conditions
    - (iii) Equipment list

- (iv) Equipment technical specifications
  - (v) Assumptions used in the design analysis of the burner flare boom structure and associated components
  - (vi) Applicable codes and standards
  - (vii) Design analysis methodology for the burner flare boom structure and associated components, and component analyses including computer modeling and computer program used
  - (viii) Material specifications
  - (ix) Arrangement drawings
  - (x) Structural drawings
  - (xi) Structural analysis report
  - (xii) Base plate and anchor bolt plan
- (H) In addition to plans and data required by (B) to (G), following drawings are to be submitted, as applicable.
- (a) Electric equipment plans and data in accordance with **Ch 2, 204. 2** (1) (B) (c) of the Rules.
  - (b) Control system drawing including the following.
    - (i) Arrangement plans showing location of units controlled, instrumentation and control devices
    - (ii) Specifications for control and instrumentation equipment
    - (iii) Set points for control system components
    - (vi) Control system detail including the followings
      - Details on hierarchy of controls: primary, secondary, emergency
      - Volumetric capacity calculations for the accumulator systems, primary and secondary
      - Reservoir, pumps and prime movers of hydraulic power unit (HPU) reservoir details and arrangements
      - Hydraulic, pneumatic, and electrical schematics
      - Details of pressure relief system
    - (v) FMEA for computer-based systems
    - (vi) Calculations for control systems demonstrating the system's ability to react adequately to anticipated occurrences, including transients
    - (vii) Arrangements and details of control consoles/panels
    - (viii) Type and size of all electrical cables and wiring associated with the control systems, including voltage rating, service voltage and currents
    - (ix) Schematic plans and logic description of hydraulic and pneumatic control systems together with all interconnections, piping sizes and materials, including working pressures and relief-valve settings
    - (x) Description of all alarm and emergency tripping arrangements
    - (xi) Description of all special valves, actuators, sensors and relays
    - (xii) Shutdown logic and shutdown cause and effect charts
    - (xiii) Hydrocarbon and H<sub>2</sub>S gas detection system plans and data, including detectors, piping, set points, type of detectors, and location of alarm panels, and recalibration program for gas detectors
  - (c) Documentation for flexible hoses
    - (i) Internal and external design pressure, minimum and maximum design temperature
    - (ii) Material specifications
    - (iii) Design analysis
    - (iv) Prototype testing data
  - (d) Documentation for piping systems including the followings
    - (i) Piping & instruments diagrams
    - (ii) Piping specifications including material specifications
    - (iii) Design parameters such as pressure and temperature
    - (iv) Pipe stress and flexibility analyses
  - (e) Documentation for pressure-retaining equipment including the followings
    - (i) Design specifications including applicable design codes and standards
    - (ii) Design parameters such as design pressure of internal/external, maximum and minimum design temperature, loads, etc.
    - (iii) Design calculations
    - (iv) Dimensional drawings and fabrication details

- (v) Material specifications
- (f) Documentation for mechanical load-bearing equipment including the followings
  - (i) Design specifications including applicable codes and standards
  - (ii) Design parameters such as loads, temperature, environmental conditions, etc.
  - (iii) Design analysis and calculations
  - (iv) Dimensional drawings and fabrication details
  - (v) Material specifications
- (2) Plans and documents to be submitted for the approval of the Society at classification survey during construction are to comply with (3).
- (3) The Society may consider manufacturer's exceptions to parts of specified codes, and standards for drilling equipment with justifications through the followings.
  - (A) Stress calculations/analysis
  - (B) Historical performance/experience data
  - (C) Finite element modeling/analysis
  - (D) Novel features in accordance with **Ch 1, 103. 3**
  - (E) Testing

In this case, the manufacturer must provide details of the exceptions to parts or sections of recognized design standards in the "Design Basis" submittal and clearly stated in detail on the manufacturer's declaration of conformity

### 3. Certification of equipment

- (1) The manufactured equipment and components are to be verified for satisfactory compliance with the recognized codes and standards, and the requirements of the Annex.
- (2) Equipment and components of drilling systems are categorized as **Table 2.1** according to importance for safety.

**Table 2.1 Categorization of process equipment**

Equipment <sup>(3)</sup>		Category	
		Category 1 <sup>(1)</sup>	Category 2 <sup>(2)</sup>
Well control systems			
Blowout preventer systems	Accumulators	X	
	Acoustic control system	X	
	Autoshear system	X	
	BOP stack	X	
	BOP	X	
	Clamps	X	
	Hydraulic connector	X	
	Control system/console/panel	X	
	Control pods	X	
	Deadman system	X	
	Drilling spools	X	
	Hydraulic hoses and piping	X	
	Hydraulic power unit	X	
	MUX cable reels	X	
	Spacer spools	X	
	Test stump	X	
Lower marine riser package	Annular preventer	X	
	Emergency disconnect system	X	
	Flex/ball joint	X	
	Frame	X	
	Jumper hoses	X	
	Riser adapter	X	
	Hydraulic connector	X	

Equipment <sup>(3)</sup>		Category	
		Category 1 <sup>(1)</sup>	Category 2 <sup>(2)</sup>
Diverter systems	Control system/console/panel	X	
	Diverter house with annular sealing device	X	
	Hydraulic power unit	X	
	Piping system	X	
	Valves	X	
Choke and kill systems	Control system/console/panel	X	
	Connectors	X	
	Valves	X	
	Manifolds	X	
	Flexible hose	X	
	Piping systems	X	
	Kill unit	X	
	Hydraulic power unit	X	
Auxiliary equipments	Drill pipe safety valves	X	
	Drill string float valves	X	
	Non-return valve in drill string	X	
Marine drilling riser systems			
Marine drilling riser	Ball and flexible joints	X	
	Riser sections including joints	X	
	Riser tensioning unit	X	
	Telescopic arms	X	
Riser running equipment	Gimbal	X	
	Riser running tool	X	
	Riser spider	X	
Riser tensioning systems	Accumulators	X	
	Air/nitrogen buffer tanks	X	
	Compressor		X
	Dryers		X
	Control system/console/panel	X	
	Hydraulic cylinders	X	
	Hydraulic power unit	X	
	Nitrogen generator	X	
	Piping system	X	
	Pressure vessels	X	
	Riser tensioners	X	
	Guideline and podline tensioners	X	
	Riser tensioning unit	X	
	Telescopic arms	X	
	Sheaves	X	
Wire ropes		X	
Riser recoil	X		
Drill string compensating systems			
Drill string compensators	Accumulators	X	
	Compressor		X
	Dryers		X
	Compensator assembly	X	
	Control system/console/panel	X	
	Hydraulic cylinders	X	
	Piping systems	X	
	Pressure vessels	X	
	Sheaves	X	
	Wire ropes		X

Equipment <sup>(3)</sup>		Category	
		Category 1 <sup>(1)</sup>	Category 2 <sup>(2)</sup>
Bulk storage, transferring and mud circulating systems			
Bulk storage and transferring systems	Bulk storage tanks	X	
	Piping for transfer system	X	
Mud circulating systems	Degasser	X	
	Desander and Desilter		X
	Mud tanks		X
	Mud pumps	X	
	Agitator		X
	Trip tanks		X
	Shale shakers		X
	Chemical mixer		X
	Circulating head	X	
	Control system/console/panel	X	
	Charging pump	X	
	Swivel	X	
	Kelly	X	
	Kelly busing		X
	Kelly cock	X	
	Flow control valves	X	
	Internal BOP	X	
	Mud booster hoses	X	
	Mud booster piping	X	
	Mud-gas separator	X	
	Piping for circulating drilling fluid to the well	X	
	Piping for mud return		X
	Pulsation dampeners	X	
Rotary hoses	X		
Safety valves at mud pump	X		
Standpipe manifold	X		
Cementing systems	Cement pump	X	
	Cementing manifold	X	
	Flexible hoses	X	
	Cement pump discharge piping	X	
	Piping systems for mixing cement and suction to cement pump		X
	Pulsation dampeners	X	
	Safety valves	X	
Hoisting, lifting rotating and pipe handling systems			
Hoisting systems	Derrick and mast	X	
	Crown block including support beams	X	
	Deadline anchors	X	
	Drawworks	X	
	Drill line spoolers		X
	Drilling line		X
	Elevators	X	
	Links	X	
	Power swivel	X	
	Rotary swivel	X	
	Sheaves for crown block and traveling block	X	
	Traveling block including guide track and dolly	X	
	Travel block hook	X	

Equipment <sup>(3)</sup>		Category	
		Category 1 <sup>(1)</sup>	Category 2 <sup>(2)</sup>
Lifting systems	Base mounted winches	X	
	BOP handling crane	X	
	Crane type lifting equipment	X	
	Manrider winches	X	
	Personnel baskets	X	
	Pipe racking mechanism	X	
	Padeyes (permanent)	X	
Pipe handling systems	Bridge crane	X	
	Catwalk ramp	X	
	Finger board	X	
	Monkey board	X	
	Guide track and dolly	X	
	Horizontal to vertical equipment	X	
Pipe handling systems	Manipulator arms	X	
	Mechanical mousehole	X	
	Fixed mousehole		X
	stabbing board	X	
	Wire rope	X	
	Control system/console/panel	X	
	Hydraulic power unit	X	
	Kelly spinner		X
	Power slips		X
Iron roughneck/power tongs		X	
Rotary systems	Rotary table	X	
Well control systems			
Well test system	Control system/console/panel	X	
	Burner boom	X	
	High pressure pumps	X	
	Heat exchanger	X	
	Piping systems	X	
	Pressure vessels	X	
	Pumps for hydrocarbon liquid	X	
	Safety valves	X	
Equipment other than mentioned above			
Control systems	Drillers console	X	
	Components of control systems	X	
Piping systems	Class I piping systems and Class II piping systems as defined in <b>Pt 5, Ch 5 of Rules for the Classification of Steel Ships</b>	X	
	Class III piping systems defined in <b>Pt 5, Ch 5 of Rules for the Classification of Steel Ships</b>		X

Equipment <sup>(3)</sup>		Category	
		Category 1 <sup>(1)</sup>	Category 2 <sup>(2)</sup>
Pressure vessels	Class 1 pressure vessels and Class 2 pressure vessels as defined in <b>Pt 5, Ch 5</b> of <b>Rules for the Classification of Steel Ships</b>	X	
	Class 3 pressure vessels as defined in <b>Pt 5, Ch 5</b> of <b>Rules for the Classification of Steel Ships</b>		X
(Note)			
(1) Category 1 : Equipment for which the Society certificate is required.			
(2) Category 2 : Equipment for which the manufacturers' certificate is accepted.			
(3) Equipment includes prime movers			

(3) Category 1 equipment is to comply with the followings.

- (A) Plans and documents are to be submitted for the approval of the Society before the work is commenced. However, equipments design-approved in accordance with **Ch 4** of **Guidance for Approval of Manufacturing Process and Type Approval, Etc.** are not required drawing approval.
- (B) Tests required in (5) are to be carried out at the plant of manufacturer.
- (C) Prior to commencement of surveys, the Society is to discuss with the manufacturer at a kick off meeting the items listed as the followings.
  - (a) Confirmation of the main point of contacts for the manufacturer and the Society
  - (b) Review the project quality plans
  - (c) Review proposed manufacturing specification
  - (d) Review project manufacturing and delivery schedules
  - (e) Review and confirm project "hold-points"
  - (f) Review any proposed sub-contractor lists and qualifications
  - (g) Confirm specification, drawings and/or documentation associated with the manufacturing process
- (D) The attending Surveyor is to perform or verify the followings.
  - (a) To confirm that the facilities to manufacture, fabricate or repair drilling system and equipment have and maintain an effective quality control program effectively covering design, procurement, manufacturing and testing, and meeting the requirements of a recognized standard applied to their product
  - (b) Welder's qualifications
  - (c) Welding procedure specifications and corresponding weld procedure qualification records
  - (d) To verify material certificates
  - (e) To survey fit-up prior to major weldments
  - (f) To survey final weldments
  - (g) To witness, as far as deemed necessary, nondestructive examination tests of welds and to review records of nondestructive examinations.
  - (h) To review records of post-weld heat treatment, in particular for piping subjected to pressurized sour service and subject to NACE MR0175/ISO 15156 requirements
  - (i) To verify dimensions are as shown on approved drawings
  - (j) To check dimensional tolerances and alignment of mating surfaces
  - (k) To witness prototype testing of drilling equipment or components in accordance with the applicable API requirements.
  - (l) To witness pressure and proof-load testing of equipment and unit as specified in the fabrication procedures.
  - (m) To witness final testing and functional testing of subassemblies and completed units, as specified in the fabrication procedures.
  - (n) To verify all purged and pressurized systems, motor controllers, SCR banks, consoles and instrumentation and control panels are in compliance with approved drawings.
  - (o) To carry out other inspections as agreed upon during prefabrication meeting
  - (p) To review and approval final manufacturing Data Book and issue final survey report or certificate and confirm compliance with approved drawings.



- (E) The materials test report of the following components is to be made available to the attending Surveyor during the manufacturing process. In general, materials associated with equipment that require Surveyor's attendance in accordance with **Table 2.1** are to have complete traceability with materials test report
- (a) Materials of pressure-retaining components
  - (b) All bolts and nuts for fastening
  - (c) Materials of primary load-bearing parts.
  - (d) All piping, valves and fittings with an ANSI B16.5 Class 150 or greater.
- (4) For category 2 equipment, manufacturers' certificate containing the following data is to be submitted.
- (A) Equipment specification
  - (B) statement to confirm that their products are designed, manufactured and tested in accordance with the recognized codes and standards, and the requirements of this chapter
  - (C) Operating limitation of the equipment
  - (D) Test record
- (5) Equipment and components of drilling systems are to be tested in accordance with the following.
- (A) Pressure tests
    - (a) Pressure containing piping and components are to be subject to a hydrostatic pressure test at 1.5 times the design pressure, if not otherwise specified in recognized standards.
    - (b) For piping and component that cannot be hydraulically tested, alternative suitable test acceptable to the Society method may be applied.
    - (c) Well control equipment is to be subjected to the following hydraulic test.
      - (i) Hydrostatic tests of bodies in accordance with API Spec 16A 7.5.8.6.2
      - (ii) Hydrostatic tests of hydraulic operating systems in accordance with API Spec 16A 7.5.8.6.3
      - (iii) Closed preventer tests in accordance with API Spec 16A 7.5.8.7
      - (iv) Hydraulic connector tests in accordance with API Spec 16A 7.5.8.7.4
  - (B) Load tests
    - (a) Lifting appliance and load bearing components are to be subject to a load test.
    - (b) Load tests for Lifting appliance are to comply with **Pt 9, Ch 2, 205.** of **Rules for the Classification of Steel Ships** except that manriding equipment is to comply with the following.
      - (i) The load test at 2 times SWL is to be carried out.
      - (ii) Following brake capacity tests are to be carried out.
        - Static brake capacity test for all brakes operating simultaneously at 2 times SWL.
        - Static brake capacity test for each individual brake at 1.8 times SWL.
        - Dynamic brake capacity test for each individual brake at 1.25 times SWL.
      - (iii) Other load bearing components are to comply with applicable recognized standards.
  - (C) Functional tests
    - (a) All the equipment is to be subject to functional tests in accordance with applicable recognized standards.
    - (b) Well control equipment is to be tested as the following.
      - (i) Drift test is to be carried out in accordance with API Spec 16A 7.5.8.4.
      - (ii) Shear ram test to verify shear capacity is to be carried out in accordance with **Ch 4, 202.** and API Spec 16A 7.5.8.7.4.

#### 4. Onboard test

- (1) Onboard installation tests of all drilling systems are to be verified by the Surveyor and are to be in accordance with the Society agreed test procedures. The following surveys are to be carried out in attendance of the Surveyor.
- (A) Piping systems are to be visually examined, nondestructively examined and pressure-tested in accordance with **Ch 2** of the Rules or applicable API standards.
  - (B) Pressure tests conducted on Group I piping systems as specified in **Pt 5, Ch 6** of **Rules for the Classification of Steel Ships** are to be preferably recorded on test charts for the duration of their tests. Minimum time for holding pressure is to be 15 minutes.
  - (C) All pressure relief and safety valves are to be tested.
  - (D) Installed choke and kill systems are to be pressure-tested at rated working pressure and also subjected to a low-pressure test at 2.07 MPa. performance tests are to be carried out.

- (E) Assembly and installation of drilling derrick is to be examined, to include erection of derrick structure, welding and bolt torqueing, water table, crown block and turn-over sheaves assembly, guide rails for hoisting equipment, derrick mounted equipment and outfitting items, installation and pressure testing of drilling and related piping systems, overall dimensional control, and final alignment and bolting on the drill floor/substructure foundations.
- (F) Mud pump operational test is to be carried out.
- (G) Derrick
  - (a) Assembled and installed derrick is to be visually examined, including welding and bolt-torqueing, its water table, crown block and turnover sheaves assembly, guide rails for hoisting equipment, derrick mounted equipment, and outfitting items.
  - (b) Derrick dimensional control, final alignment and bolting on the drill floor/substructure foundations are to comply with manufacturer's specifications and tolerances.
  - (c) load test of the derrick structure is not required unless specified in the client's purchase order specification.
- (H) Drawwork
  - (a) As a minimum, the following tests are to be performed for all drawwork brakes in accordance with the Society-approved test specifications.
    - (i) Rotational check: Verify rotation for both directions.
    - (ii) Rotational test: 100% rated drum/motor speed in both directions for a period of at least five minutes. With minimum delay between operations, repeat this step three times or in accordance with manufacturer's specifications. Bearing temperature for motor, gearbox and drum are to be monitored and recorded.
    - (iii) Brake burnishing test: Burnishing test is to be performed for the primary brake with consideration to brake clamping force, drum speed, RPM, or motor speed. Temperature at calipers and motor are to be monitored and recorded. The burnishing results such as percentage of lining contact, bright surface, etc. and verification of "gapping", the distance between the brakes and the brake discs, is to be performed.
    - (iv) Brake verification: After the brake burnishing test, individual verification of each caliper is to be performed under drum/motor load. Motor amperage and voltage, hydraulic pressure, and loads, as applicable, associated with caliper slippage are to be monitored and recorded. Each caliper must demonstrate adequate capacity as designed.
    - (v) Dynamic brake holding test is to be performed at 100% rated load for a period of at least 5 minutes for the primary brake. This test is to include the following:
      - Drawwork is to stop its rotation within the timeframe as specified in the approved manufacturer's specifications, including the specified applied voltage and amperage
      - Monitor and confirm brake holding capability including the caliper pressure, as specified in the approved manufacturer's specification.
      - Monitor and record caliper pressure, temperature, and fluid flow.
      - Visual inspection of brakes and hydraulic leakage are to be performed.
      - This test may be carried out by using a reduced number of lines with corresponding rated load and in accordance with the drawworks approved manufacturer's testing procedures.
    - (vi) Emergency brake test is to be performed to simulate loss of hydraulic supply or primary brake failure and verify hydraulic, or air release spring set is functional. This test is to be performed at 100% rated load.
    - (vii) Electromagnetic braking system tests are to be performed for compliance with approved manufacturer's specifications. Additional provisions of the drawworks electromagnetic braking system are provided in **Ch 4, 603. 2**.
  - (b) On self-elevating units, deflection testing of the cantilever may also qualify as the static and structural testing of drawworks.
  - (c) On column-stabilized or surface type units, where a full rated load test may constitute increased risk or a safety concern to the unit or personnel, alternative testing methods such as load testing at a reduced number of lines with corresponding rated load may be considered on a case-by-case basis. Request for such consideration is to be submitted to the Society and agreed upon prior to commencement of the test.
- (I) Base-mounted winches and other lifting appliances
  - (a) Load test: After installation, the system is to be tested with a load equal to 125% of the rated capacity in the presence of the Surveyor. Satisfactory operation of power

- drives and brakes is to be demonstrated. After being tested, the system with all its components is to be visually examined for permanent deformation and failure.
- (b) Performance test: Testing in the presence of the Surveyor is to demonstrate that rated line pull can be achieved at rated speed with the outermost layer of wire on the drum.
  - (c) Brake holding test: It is to be demonstrated that the brakes have the ability to stop and hold 100% of the design load. Confirmatory testing to demonstrate the braking effect of variable frequency drive AC motors is to be carried out upon installation onboard.
- (J) Burner boom
- (a) The adequacy of the boom's slewing and topping gear is to be demonstrated by testing after the boom's installation on the drilling unit. The details of the test procedure are to be agreed upon with a attending Surveyor.
  - (b) Functional testing of the completed burner assembly is to be carried out by pressure testing from the flexible hose connection flange to the burner head.
- (K) Equipment associated with all hoisting, lifting, rotating, and pipe handling systems are to be tested in accordance with **Par 2**.
- (L) All drilling systems and equipment are to be checked for proper operation.
- (M) Control system and shutdowns are to be tested to the satisfaction of the Surveyor.
- (N) All wiring and electrical connections are to be checked for continuity and proper workmanship in accordance with the **Ch 6** of the Rules.
- (2) In addition to tests required in (1), All drilling systems are to be subject to pressure tests, load tests or functional tests according to their characteristics.
- (A) Testing of well control systems
- (a) The following equipments are to be subjected to a functional test.
    - (i) Blowout preventer systems: accumulator, acoustic control system, autoshear system, BOP stack, BOP, clamp, connector for wellhead, control system/console/panel, hydraulic control hoses, control pods, deadman system, hydraulic hose reels, hydraulic hoses and piping, hydraulic power unit, MUX cable reels
    - (ii) Lower marine riser package: annular preventer, emergency disconnect system, flex/ball joint, jumper hoses, riser adapter, riser connectors for BOP stack
    - (iii) Diverter systems: control system/console/panel, diverter house with annular sealing device, hydraulic power unit, valves
    - (iv) Choke and kill systems: control system/console/panel, connectors, valves, manifolds, flexible hose, emergency circulating pump, kill unit, hydraulic power unit
    - (v) Auxiliary equipments: drill pipe safety valves, drill string float valves, on-return valve in drill string
  - (b) The following equipments are to be subjected to a hydraulic test at rated working pressure.
    - (i) Blowout preventer systems: accumulators, acoustic control system, BOP stack, BOP, connector for wellhead, control system/console/panel(in case of hydraulic or pneumatic controls), hydraulic control hoses, control pods, drilling spools, hydraulic hose reels, hydraulic hoses and piping, hydraulic power unit, spacer spools, test stump
    - (ii) Lower marine riser package: annular preventer, emergency disconnect system, flex/ball joint, jumper hoses, riser adapter, riser connectors for BOP stack
    - (iii) Diverter systems: control system/console/panel(in case of hydraulic or pneumatic controls), diverter house with annular sealing device, hydraulic power unit, piping, valves
    - (iv) Choke and kill systems: control system/console/panel(hydraulic or pneumatic controls), connectors, valves, manifolds, flexible hose, piping systems, emergency circulating pump, hydraulic power unit
    - (v) Auxiliary equipments: drill pipe safety valves, drill string float valves, non-return valve in drill string
- (B) Testing of marine drilling riser system and associated components
- (a) The following equipments are to be subjected to a functional test.
    - (i) Marine drilling riser system: assembled marine drilling riser systems, all and flexible joints, hydraulic connectors, telescopic joint
    - (ii) Riser running equipment: gimbal, riser running tool, riser spider
    - (iii) Riser tensioning systems: accumulators, compressor, control system/console/panel, dryers, hydraulic cylinders, hydraulic power unit, nitrogen generator, piping system, riser tensioners, guideline and podline tensioners, riser tensioning unit, telescopic arms

- (b) The following equipments are to be subjected to a hydraulic test at rated working pressure.
  - (i) Marine drilling riser system: ball and flexible joints, tensioner ring
  - (ii) Riser running equipment: riser spider (used as elevators/lifting)
  - (iii) Riser tensioning systems: accumulators, air/nitrogen buffer tanks, control system/console/panel(in case of hydraulic or pneumatic controls), hydraulic cylinders, hydraulic power unit, nitrogen generator, piping system, pressure vessels, riser tensioners, guideline and podline tensioners, riser tensioning unit, telescopic arms
- (c) The following equipments are to be subjected to a pneumatic test in accordance with design codes and standards
  - (i) Riser tensioning systems: accumulators
- (C) Testing of drill string compensators
  - (a) The following equipments are to be subjected to a functional test.
    - (i) Drill string compensators: accumulators, compressors, dryers, compensator assembly, control system/console/panel, hydraulic cylinders, piping system
  - (b) The following equipments are to be subjected to a hydraulic test at rated working pressure.
    - (i) Drill string compensators: compensator assembly, control system/console/panel(in case of hydraulic or pneumatic controls), hydraulic cylinders, piping system, pressure vessels
  - (c) The following equipments are to be subjected to a pneumatic test in accordance with design codes and standards
    - (i) Drill string compensators: accumulators
- (D) Testing of bulk storage, transferring and mud circulating systems
  - (a) The following equipments are to be subjected to a functional test.
    - (i) Bulk storage and transferring systems: piping for transfer system
    - (ii) Mud circulating systems: agitators, chemical mixer, degasser, desander and desilter, piping systems, mud pumps, shale shakers, circulation head, control system/console/panel, charge pumps, swivel, kelly, kelly cocks, flow control valves, internal BOP, mixing pumps, mud booster hoses, mud booster piping, mud-gas separator, Piping for circulating drilling fluid to the well, pulsation dampeners, rotary hoses
    - (iii) Cementing systems: cement pump, centrifugal pumps for mixing cement, cementing manifold, flexible hoses, piping systems, pulsation dampeners, safety valves
  - (b) The following equipments are to be subjected to a hydraulic test at rated working pressure.
    - (i) Bulk storage and transferring systems: piping for transfer system
    - (ii) Mud circulating systems: degasser, piping systems(except piping from mud-gas separator to burners or vents), mud pumps, circulation head, control system/console/panel(in case of hydraulic or pneumatic controls), charge pumps, swivel, kelly, kelly bushing, kelly cocks, flow control valves, internal BOP, mud booster hoses, mud booster piping, mud-gas separator, piping for circulating drilling fluid to the well, rotary hoses, standpipe manifold
    - (iii) Cementing systems: cementing manifold, flexible hoses, cement pump discharge piping
  - (c) The following equipments are to be subjected to a pneumatic test in accordance with design codes and standards
    - (i) Bulk storage and transferring systems: bulk storage tanks
  - (d) The following equipments are to be subjected to a leak test
    - (i) Mud circulating systems: mud tank, trip tank
- (E) Testing of hoisting, lifting rotating and pipe handling system
  - (a) The following equipments are to be subjected to a functional test.
    - (i) Hoisting systems: crown block including support beams, drawworks, drill wireline spoolers, elevators, gears for hoisting equipment with rated power of 100 kW and over, hydraulic cylinders for overhead lifting, links, power swivel, rotary swivel, sheaves for crown block and traveling block, traveling block including guide track and dolly, travel block hook, wireline unit
    - (ii) Lifting systems: base mounted winches, BOP handling crane, crane type lifting equipment, manrider winches, personnel baskets, pipe racking mechanism
    - (iii) Pipe handling systems: bridge crane, catwalk ramp, finger board, monkey board, guide track and dolly, horizontal to vertical equipment, hydraulic or air slips, hy-

- draulic cathead, manipulator arms, mechanical mousehole, mechanical stabbing board, control system/console/panel, hydraulic power unit, Iron roughneck, kelly spinner, power slips, power tongs, tong suspension
- (iv) Rotary systems : rotary table
  - (b) The following equipments are to be subjected to a hydraulic test at rated working pressure.
    - (i) Hoisting systems: hydraulic cylinders for overhead lifting, power swivel, rotary swivel
    - (ii) Lifting systems: base mounted winches, BOP handling crane, crane type lifting equipment, manrider winches, personnel baskets, pipe racking mechanism
    - (iii) Pipe handling systems: bridge crane, catwalk ramp, horizontal to vertical equipment, hydraulic or air slips, hydraulic cathead, manipulator arms, mechanical mousehole, hydraulic power unit
  - (c) The following equipments are to be subjected to a load test in accordance with **Pt 9, Ch 2 of Rules for the Classification of Steel Ships**.
    - (i) Lifting systems: base mounted winches, BOP handling crane, pipe racking mechanism
    - (ii) Pipe handling systems: stabbing board
  - (d) The following manriding equipments are to be subjected to a load test at 200% of SWL, a static brake capacity test at 200% of SWL, a dynamic brake capacity test at 125% of SWL.
    - (i) Lifting systems: manrider winches, personnel baskets
  - (F) Testing of well test system
    - (a) The following equipments are to be subjected to a functional test.
      - (i) Well test equipments: burner boom, burner piping, control system/console/panel, electrical submersible pumps for overhauling of wells(pressure side), piping system, pressure vessels, pump, valves
    - (b) The following equipments are to be subjected to a hydraulic test at rated working pressure.
      - (i) Well test equipments: control system/console/panel(in case of hydraulic or pneumatic controls), electrical submersible pumps for overhauling of wells(pressure side), heat exchangers, piping system, pressure vessels, pumps, valves
  - (G) Testing of prime mover and miscellaneous
    - (a) The following equipments are to be subjected to a functional test.
      - (i) Prime mover: prime movers regardless of rated power
      - (ii) Miscellaneous: drillers console, control system components, BOP transporter
    - (b) The following equipments are to be subjected to a hydraulic test at rated working pressure.
      - (i) Miscellaneous: BOP transporter, expansion joints

## 5. Commissioning surveys of the drilling systems

- (1) Commissioning of all drilling systems is to be verified by an attending Surveyor and is to be in accordance with the Society agreed test procedures. The Surveyor are at a minimum to survey following items during the drilling system trials.
  - (A) Proper hook-up and testing of the entire drilling system equipment and components is completed prior to commissioning. This is to include all tests required in **Par 4**.
  - (B) Necessary safety precautions are taken during commissioning, which are to include checks of operational readiness of the fire and gas detection system, fire extinguishing system, ESD systems, unobstructed escape routes, etc.
  - (C) Necessary communication procedures are established prior to commissioning.
  - (D) Necessary emergency procedures are readily available to deal with any contingencies such as spillage, fire, and other hazards.
  - (E) Readiness of all utility support systems, including main and auxiliary sources for the drilling system, prior to commissioning. Random start-up and testing of the utility support systems to extent deemed necessary by the attending Surveyor.
  - (F) Readiness of the purged drilling system, and associated alarms and shutdowns, prior to commissioning, and random testing of the purged alarms systems during commissioning, to the satisfaction of the attending Surveyor.
  - (G) Proper operation of the mud level alarms while the drilling system is running, including random simulation of associated alarms.

- (H) Proper operation of the hazardous area access and ventilation system while the drilling system is running, including random simulation of associated alarms and shutdowns.
- (I) System's capability to control the flow of the well affluent in a stabilized manner, without undue control upsets, when drilling medium is introduced into the system.
- (J) Satisfactory functioning of all drilling systems installed onboard and covered under this Annex. This will include witnessing proper function of the following systems, as applicable, while simulating actual drilling operations to the extent possible and practicable, and to the satisfaction of the attending Surveyor.
  - (a) Well control system
  - (b) Marine drilling riser system
  - (c) Drill string compensation system
  - (d) Bulk storage, circulating and transfer system
  - (e) Hoisting, lifting, rotating and pipe handling system
  - (f) Well test system
  - (g) Miscellaneous support systems
- (K) Satisfactory testing of all ROV intervention functions on the subsea BOP stack during the stump test and testing at least one set of rams in initial test.
- (L) Satisfactory functional testing of autoshear, deadman, and EDS systems on the subsea BOP stack during the stump test.
- (M) Starting up of the permanent well test system, if applicable, including precautions taken to eliminate the risk of explosion or fire.
- (N) Post-commissioned drilling system is in stabilized and satisfactory functioning order for duration of at least 12 hours.
- (O) Satisfactory functioning of the emergency power equipment to ensure proper operations.

## 204. Classification Survey after Construction

### 1. General

At the Classification Survey after Construction, the examination of drilling systems is carried out as required for the Special Survey corresponding to the age of the unit in which drilling systems are installed and the actual scantlings, etc. of the main parts of drilling systems are to be measured as necessary.

### 2. Submission of plans and documents

At the Classification Survey after Construction, plans and documents as may be required for the Classification Survey during Construction are to be submitted. If plans and documents cannot be obtained, facilities are to be given for the Surveyor to take the necessary information from the unit in which drilling systems are installed.

## SECTION 3 Survey

### 301. General

1. Drilling systems classed with the Society are to be subjected to the following surveys to maintain the classification. Periodical surveys of drilling systems are to be carried out at periodical surveys of the unit in which the drilling systems are installed.
  - (1) Special Surveys
  - (2) Annual Survey
  - (3) Occasional Surveys
2. **Damage, failure and repair**
  - (1) Examination  
Damage, failure, deterioration or repair to the drilling system or components which affects Classification is to be submitted by the Owner for examination by the Surveyor at the first opportunity.
  - (2) Repairs  
Where repairs to the drilling system or components that may affect classification are planned in advance, a complete repair procedure, including the extent of the proposed repair and the need for the Surveyor's attendance, is to be submitted to and agreed upon by the Surveyor reason-

ably in advance. Failure to notify the Society in advance of the repairs may result in suspension of the drilling system's classification until such time as the repair is redone or evidence is submitted to satisfy the Surveyor that the repair was properly completed. This requirement applies also to repairs during voyage.

This requirement is not intended to include maintenance and overhaul to hull, machinery and equipment in accordance with recommended manufacturer's procedures and established marine practice and that does not require the Society's approval. Any repair as a result of such maintenance and overhauls that affects or may affect classification is to be noted in the ship's log and submitted to the Surveyors.

All repairs found necessary by the Surveyor are to be completed to his satisfaction.

3. All annual and special surveys are to be carried out in accordance with an examination and test plan developed by the Owner and agreed by the Society for periodical inspection and testing of the overall drilling system.
4. The examination and test plan is to explain how each system and equipment is to be examined and tested during annual and special survey.
5. Maintenance records of the drilling system are to be part of the record kept onboard the drilling unit.
6. When the Society is authorized to perform surveys on behalf of a governmental authority, or when requested by the Owner, items as specified by the governmental authority or the Owner will be surveyed. Reports indicating the results of such surveys will be issued.
7. Annual and special surveys are to be scheduled preferably when the Owner has scheduled an overhaul of the drilling system. Annual Surveys are to be scheduled to coincide with the overhaul and testing of the BOP.

### 302. Maintenance manuals/records

1. Maintenance records are to be kept and made available for review by the attending Surveyor. The maintenance records will be reviewed to establish the scope and content of the required Annual and Special Surveys that are to be carried out by the Surveyor.
2. During the service life of the drilling system, maintenance records are to be updated on a continuing basis.
3. The Owner is to inform the Society of any changes to the maintenance procedures and their frequencies as may be caused, for example, by changes or additions to the original drilling equipment.

### 303. Annual Survey

1. At each Annual Survey, the Surveyor is to verify the effectiveness of various systems and equipment by visual examination and testing, as appropriate. As a minimum, the following is to be carried out to the satisfaction of the attending Surveyor.
  - (1) Review of Owner's maintenance manual and relevant records to confirm that a suitable maintenance program has been followed, periodical testing requirements have been carried out and that any repairs, reconditioning or renewals of well control equipment, BOP controls, riser system, pressure vessels, electrical systems, drilling hoisting system or lifting devices were carried out according to the applicable standards and the requirements of this Annex.
  - (2) Review of database for approved changes made to the drilling system, and examination of this equipment to the extent deemed necessary by the attending Surveyor.
  - (3) Exposed surfaces of the derrick, drilling hoisting systems, lifting devices, burner booms, stabbing boards, racking platforms and drilling equipment foundations are to be examined and placed in satisfactory condition, as found necessary. The inspection of the derrick and related structural members will include the following.
    - (A) The general condition of the structure, especially bent, missing or abraded parts and lost corrosion protection coatings.
    - (B) Tightness of bolts.
    - (C) Condition of wire ropes and fittings.
  - (4) Examination of all mounting hardware and the structure of base-mounted winches and other lifting devices. Magnetic Particle Inspection may be carried out as deemed necessary by the attending Surveyor.

- (5) General external examination so far as accessible of the drilling systems as specified in **Ch 1, 102.** or damage, excess corrosion, fracturing or malfunctions.
- (6) Protective covers, insulation, shrouds and protective guards around moving parts are to be found in place and in functional condition.
- (7) Derrick walkways and ladders, drill floor and drill system machinery spaces to be surveyed with particular attention to fire and explosion hazards and confirmation that emergency escape routes are not blocked.
- (8) External examination of pressure vessels and their appurtenances, including safety devices, foundations, controls, relieving gear, piping systems, flexible hose, hydraulic hoses, insulation and gauges.
- (9) Examination of safety shutdown devices.
- (10) General examination of all electrical and instrumentation systems, including protective devices and cable supports.
- (11) Examination of mud and cement systems.
- (12) Examination of the BOP test log and maintenance records.
- (13) Testing of the BOP equipment in accordance with API RP 53
  - (A) Pressure and functional testing
  - (B) Control system testing
  - (C) Pressure testing if any shear rams were used in an emergency
- (14) Review BOP inspections and maintenance records in accordance with Section 17 and Section 18 of API RP 53.

### 304. Special Surveys

1. The Special Survey is to include all items listed under the Annual Survey.
2. In addition to **Par 1**, the followings are to be carried out to the satisfaction of the attending Surveyor.
  - (1) Review of Owner's maintenance records to verify periodical testing requirements have been carried out and that any repairs, reconditioning or renewals of well control equipment, BOP controls, riser system, pressure vessels, electrical systems, drilling hoisting system or lifting devices were carried out according to the applicable standards and the requirements of this Annex.
  - (2) Internal examination and thickness gauging of pressure vessels and pressure-retaining components, testing of relief valves and pressure piping systems, as considered necessary by the Surveyor.
  - (3) Hydrostatic testing of pressure vessels and other pressure-retaining components related to the drilling system to their maximum allowable working pressure.
  - (4) Hydrostatic testing of drilling system piping systems and flexible hoses to their maximum allowable working pressure.
  - (5) Examination and check of insulation resistance of motors that are part of the drilling system.
  - (6) Examination of rotating drilling machinery to verify suitable operation, free from excessive vibration.
  - (7) The blowout preventer is to be subjected to a complete performance test and pressure-tested to its maximum allowable working pressure.
  - (8) Examination of mud and cement pump fluid ends.
  - (9) Functional testing of derrick gear, drilling hoisting systems and derrick floor lifting devices.
  - (10) Close examination of the condition of welded joints on the derrick and associated structure, including nondestructive testing (including thickness gauging if required) of any suspect areas noted by the attending Surveyor.
  - (11) Examination of the equipment associated with the well control system and their maintenance records.
  - (12) Satisfactory functioning of the emergency power equipment to ensure proper operation. ↓



## CHAPTER 3 MATERIALS, WELDING AND NONDESTRUCTIVE EXAMINATION

### SECTION 1 Materials

#### 101. General

All materials are to be suitable for their intended service conditions and defined by recognized material standard.

#### 102. Materials of structural steels

Selection of structural steel materials associated with drilling structures is to comply with the following requirements.

1. Structural steels utilized for drilling structures are considered to be primary structural members or secondary structural members specified in **Ch 3** of the Rules.
2. Steel for plates, shapes and structural pipe sections is to be in accordance with requirements of API RP 2A-WSD or **Ch 3** of the Rules.
3. Where toughness is to be considered in material selection, the toughness testing criteria required in **Pt 2, Ch 1 of Rules for the Classification of Steel Ships** are to be met as a minimum for the principal structural load-bearing components of derricks, masts and burner booms. If there are more stringent requirements imposed in the application of API RP 2A-WSD or API Spec 4F, then these requirements are to be applied.
4. Bolts and nuts are to have corrosion characteristics comparable to the structural elements being joined and are to be manufactured and tested in accordance with recognized material standards.

#### 103. Materials of drilling equipment

Materials associated with drilling equipment and components is to comply with the following requirements.

1. Materials for drilling and well control equipment are to be selected in accordance to the applicable design codes with consideration to toughness, corrosion resistance, weldability and to be suitable for their intended service conditions.
2. All materials are to be defined by recognized standards.
3. Materials for drilling and well control equipment are categorized as follows.
  - (1) Mechanical load-bearing component
  - (2) Pressure-retaining equipment
  - (3) Piping under pressure load and external loads
4. Materials associated with drilling equipment or components are also to comply with the following specific criteria.
  - (1) **Material Properties**

To determine the suitability of a material to withstand design stresses, the ultimate tensile strength, specified minimum yield strength, elongation and reduction of area are to be specified in accordance with recognized material standards.
  - (2) **Toughness**
    - (A) Mechanical Load-Bearing Component
      - (a) Toughness testing for mechanical load-bearing components is to be performed in accordance with relevant API or applicable recognized standards.
      - (b) Charpy V-Notch (CVN) impact testing is to be performed at the required temperature in the relevant API or applicable standard or the minimum design temperature, whichever is lower. For a specified MDT above 0°C, Charpy V-Notch impact testing is to be performed at 0°C.
      - (c) The acceptance criteria of Charpy V-Notch impact testing is to be in accordance with the relevant API, ASME or applicable recognized standard.
      - (d) Material for mechanical load-bearing components not covered by, or not in full com-

pliance with API standards or applicable recognized standards, the following Charpy V-Notch criteria applies.

minimum yield strength of material (MPa)	Minimum Absorbed Energy (ave) (J)
$\sigma_Y \leq 450$	$\sigma_Y/10$
$450 < \sigma_Y \leq 690$	45
$690 < \sigma_Y$	Additional requirements may be necessary. <sup>(1)</sup>
Note :	
(1) Data related with toughness property at low temperature is to be submitted to the Society.	

- (e) Other CVN criteria or alternative test data, such as crack-tip opening displacement (CTOD), nil ductility transition (NDT) temperature, or related service experience will be considered if submitted to the Society prior to manufacturing.
- (f) It should be noted that additional requirements for toughness. The Society may require to include additional toughness requirements of other national and international regulatory bodies in the scope of the design review and fabrication inspection where deemed necessary by the Society.
- (B) Pressure-Retaining Equipment and Piping
- (a) Toughness testing for pressure-retaining equipment and piping is to be performed in accordance with the relevant API, ASME or applicable recognized standard.
- (b) Charpy V-Notch (CVN) impact testing is to be performed at the required temperature in the relevant API, ASME or applicable standard or the minimum design temperature, whichever is lower. For a specified MDT above 0°C, Charpy V-Notch impact testing is to be performed at 0°C.
- (c) The acceptance criteria of Charpy V-Notch impact testing is to be in accordance with the relevant API, ASME or applicable recognized standard.
- (d) Material for mechanical load-bearing components not covered by, or not in full compliance with API standards or applicable recognized standards, the following Charpy V-Notch criteria applies.

minimum yield strength of material (MPa)	Minimum Absorbed Energy (ave) (J)
$\sigma_Y \leq 450$	$\sigma_Y/10$ , (but not less than 27 (J))
$450 < \sigma_Y \leq 650$	50(1)
$650 < \sigma_Y$	Additional requirements may be necessary.(1)(2)
Note :	
(1) In addition, lateral expansion opposite the notch is not to be less than 0.38 mm.	
(2) Data related with toughness property at low temperature is to be submitted to the Society.	

- (e) Other CVN criteria or alternative test data, such as crack-tip opening displacement (CTOD), nil ductility transition (NDT) temperature, or related service experience will be considered if submitted to the Society prior to manufacturing.
- (f) It should be noted that additional requirements for toughness. The Society may require to include additional toughness requirements of other national and international regulatory bodies in the scope of the design review and fabrication inspection where deemed necessary by the Society.
- (3) Materials used in well control equipment or components that can potentially be exposed to sour or H<sub>2</sub>S service are to be selected within appropriate limits of chemical composition, heat treatment and hardness to resist sulfide stress cracking. For this purpose, selection of material is to be guided by applicable part of NACE MR0175/ISO 15156 (Materials for use in H<sub>2</sub>S containing environment in oil and gas production).

## 104. Corrosion Allowance

Where drilling systems are subjected to a corrosive or erosive environment, the design is to include corrosion allowances in accordance with the followings

1. The amount of additional material needed will be determined based on the predicted rate of corrosion and the design service life of the component.
2. In the absence of any standard allowance or submitted information, a corrosion allowance of 1.6 mm is to be utilized.

## 105. Forming and welding of materials

### 1. Forming

Forming of materials utilized in drilling equipment and components are to comply with the following requirements.

- (1) In general, for steel components, forming at temperatures around 205°C is to be avoided.
- (2) Where degradation of properties is unavoidable, complete post forming heat treatment may be required.
- (3) Suitable supporting data is to be provided to indicate compliance with the specified properties.
- (4) For materials with specified toughness properties that are to be formed beyond 3% strain on the outer fiber, data are to be provided indicating that the toughness properties meet the minimum requirements after forming. After straining, specimens used in toughness tests are to be subjected to an artificial aging treatment of 288°C for one hour.

### 2. Welding

- (1) Welding of drilling equipment and components is to be in accordance with **Sec 2**.
- (2) Generally, weldments subject to H<sub>2</sub>S service are not to exceed a hardness of 22 Rockwell C in weld metal or heat-affected zone (HAZ), see NACE MR0175/ISO 15156.

## 106. Manufacturing process

1. Wrought and cast products are to be procured in accordance with written specifications that, in addition to property requirements, specify the frequency, location, orientation and types of test specimens. Nondestructive examination is to be performed if required.

### 2. Rolled steels

Plates, shapes and bars may be supplied in the as-rolled, thermo-mechanically processed, normalized, or quenched and tempered condition, depending on the intended application.

### 3. Steel forgings

- (1) Requirements in **Pt 2, Ch 1, Sec 6 of Rules for the Classification of Steel Ships** is to be applied, except that a forging reduction ratio is to be not less than 3:1.
- (2) Where a net change in the cross section does not occur during a portion of the forging operation, the hot working ratio representing that portion will be evaluated as a complement to the forging reduction ratio.

### 4. Castings

- (1) In general, cast products are to be supplied in a heat-treated condition. Samples for testing are to be taken from integrally cast coupons or appropriately designed separately cast coupons.
- (2) These coupons are to be subjected to the same heat treatment as the casting.

## 107. Sealing materials

### 1. Elastomeric sealants

- (1) Materials used for sealing are to be suitable for the intended operating pressures and temperatures.
- (2) Age-sensitive materials for critical components are to have a defined storage life and be identified in storage as to month and year of manufacture.

### 2. Ring joint gaskets

- (1) Ring joint gaskets are to be of soft iron, low carbon steel or stainless steel, as required by the

design standard.

- (2) Gaskets that are coated with a protective coating material such as fluorocarbon or rubber for shipment and storage are to have the coatings removed prior to installation.

## 108. Traceability of the products and materials

All materials used for major mechanical components and pressure-retaining equipment are to be furnished with documentation that states the process of manufacture. The manufacturers are responsible for maintaining this documentation on file and, upon request, are to provide this information to the Society.

### 1. Certified materials test report

- (1) Chemical and mechanical properties for each heat
- (2) Heat treatment temperatures and time at temperature
- (3) Charpy impact values and temperatures
- (4) Hardness test readings (as applicable to NACE MR0175/ISO 15156)

### 2. Manufacturing processes

- (1) Welding records (including welding procedures specification(WPS) and Qualification)
- (2) Post weld heat treatment
- (3) Non-destructive examination results
- (4) Hardness test results (as applied to NACE MR0175/ISO 15156)
- (5) Dimensional check results
- (6) Hydrostatic pressure tests

## SECTION 2 Welding and Nondestructive Examination

### 201. General

1. All welds in the pressure boundary(vessel wall and pipe wall) of pressure-retaining equipment and piping systems and welds in mechanical load-bearing and structural components are to be made using approved welding procedures by qualified welders and are to be inspected utilizing approved procedures by qualified technicians.
2. Critical sections of primary components are to be examined for surface and volumetric flaws to the extent specified in the design code, but not to a lesser extent than that specified in this Section.
3. All welders and welding operators to be employed in the manufacturing of equipment are to be properly qualified and experienced in the work proposed and the manufacturer is to employ a sufficient number of skilled supervisors to ensure a thorough supervision and control of all welding operations.
4. Unless otherwise expressly specified in this Section, requirements of **Pt 2, Ch 2 of Rules for the Classification of Steel Ships** may applied.

### 202. Welding

#### 1. Welding procedures specification(WPS)

- (1) A written WPS is to be prepared in accordance with ASME or ANSI/AWS D1.1 Code depending on the equipment or component.
- (2) The WPS is to describe in detail all essential and nonessential variables to the welding process employed in the procedure.
- (3) Welding procedure specifications are to be qualified and the procedure qualification records(PQR) documenting the following data is to be submitted to the Society.
  - (A) Maximum hardness values (for well bore fluid service)
  - (B) Minimum and average toughness values for weld heat-affected zone and weld metal
  - (C) Minimum tensile strength
  - (D) Results from other tests required by the applicable code or standard

#### 2. Welders and welder performance qualification tests

- (1) Welders and welding operators are to be qualified by qualification tests conducted and evaluated

in accordance with the applicable code for each welding process and for each position used in production welding.

- (2) Welder/welding operator qualification records are to be submitted to the Society.

### 3. Post weld heat treatment

- (1) Accurate records of all heat treatments during fabrication, including rates of heating and cooling, hold time and soaking temperature are to be submitted to the Surveyor if required.
- (2) Alternative methods of stress relief will be subject to special consideration by the Society where post-weld heat treatment is not a requirement of the applicable manufacturing code.

## 203. Nondestructive examination

### 1. Non-destructive examination Procedures

NDE procedures specifying test method of each kind of nondestructive examination, extent of examination and acceptance criteria are to be submitted to the Society for review

### 2. Qualification of nondestructive technicians

- (1) The manufacturers are to certify that personnel performing and evaluating the non-destructive examination have been qualified and certified in accordance with the manufacturers' qualification system.
- (2) The manufacturers' qualification system for qualification and certification of personnel performing and evaluating the non-destructive examination examinations are to be written in accordance with American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A or equivalent.
- (3) Certification documents of non-destructive examination technicians are to be submitted to the Surveyor if required.

### 3. Timing of NDT

NDT should be conducted after Post Weld Heat Treatment

### 4. Extent of nondestructive examination

All weldments and other critical sections covered under **201.** are to be subjected to 100% visual examination and nondestructive examination for surface and volumetric defects in accordance with this Annex or the relevant design code.

- (1) All highly-stressed areas of forgings and castings of primary components used in well control are to be examined for flaws by methods capable of detecting and sizing significant internal defects.
- (2) Methods to detect surface flaws are also to be used in special applications. Substantiation is to be provided for areas exempted from examination in the terms of stress levels, quality control procedures at the foundry, forming or casting procedures, or documented historical data.
- (3) Repair welds are to be subject to 100% surface NDE.
- (4) All welds of structural members considered special are to be inspected 100% by the ultrasonic or radiographic method.
- (5) Twenty percent of all welds of structural members considered primary are to be inspected by the ultrasonic or radiographic method.
- (6) Welds of structural members considered to be secondary are to be inspected by the ultrasonic or radiographic method on a random basis.
- (7) In locations where ultrasonic test results are not considered reliable, the use of magnetic-particle or dye-penetrant inspection as a supplement to ultrasonic inspection is to be conducted.
- (8) Welds for mechanical load-bearing components or pressure-retaining equipment are to be examined by nondestructive methods capable of detecting and sizing significant surface and internal defects.

### 5. Methods of nondestructive examination and acceptance criteria

Methods of nondestructive examination and acceptance criteria is to be in accordance with the following **Table 3.1.**

**Table 3.1 Methods of nondestructive examination and acceptance criteria**

Kinds	Methods of nondestructive examination	Acceptance criteria
Magnetic Particle Examination	ASME Boiler and Pressure Vessel Code, Section V Article 7 ASTM E709	ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1, Appendix 6
Liquid Penetrant Examination	ASME Boiler and Pressure Vessel Code, Section V Article 6 ASTM E165	ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1, Appendix 8 ANSI/AWS D1.1, Section 6 Part C
Radiographic Examination	ASME Boiler and Pressure Vessel Code, Section V Article 2 ASTM E94/E446/E186/E280	ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1, Appendix 4 ANSI/AWS D1.1, Section 6 Part C
Ultrasonic Examination	ASME Boiler and Pressure Vessel Code Section V, Article 5 ASTM A388/E428/A609	ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1, Appendix 12 ANSI/AWS D1.1 Section 6 Part C API RP-2X
Hardness Testing	ASTM E10/E18/E92	NACE MR0175/ISO 15156

#### 204. Record retention

The manufacturer is to maintain the following records after completion, and these records are to be made available to the Surveyor upon request.

1. Weld Procedure Specification
2. Procedure Qualification Records
3. Welder/welding operator performance test records, including the date and test results and identification of work assigned to each welder
4. A record providing traceability and capable of identifying the welders who have carried out welding on particular part
5. Qualification records for all personnel performing nondestructive examinations and evaluating results of examination
6. Nondestructive Examination records, including radiographs ↓

## CHAPTER 4 DRILLING SYSTEMS

### SECTION 1 General

#### 101. General

1. The designer of the drilling system is to evaluate the system as a whole, taking account into the interfacing and interdependence of subsystems.
2. The required design plans and data to be submitted to the Society are in accordance with **Ch 2, Sec 2, 202**.

#### 102. Equipment layout

Equipment layout and work areas associated with the drilling activities are to be arranged with the following objectives.

1. Safety of personnel and operation
2. Separation of nonhazardous areas from those classified as hazardous areas
3. Separation of fuel and ignition source as far as practical
4. Minimizing the likelihood of uncontrollable releases of hydrocarbon to the environment
5. Minimizing the spread of flammable liquids and gases which may result in a hazardous event and facilitating rapid removal of any accumulations
6. Minimizing the probability of ignition
7. Minimizing the consequences of fire and explosions
8. Preventing fire escalation and equipment damage
9. Providing for adequate arrangements for escape and evacuation
10. Minimizing dropped objects hazards to personnel, equipment and structure
11. Protection of critical systems and equipment such the followings from damage during drilling operation
  - (1) Electrical cables and cableways
  - (2) Well control equipment
  - (3) Exhaust ducting and air intake ducting
  - (4) Control and shutdown systems
  - (5) Safety systems, fire-gas detection, and fire fighting equipment
12. Access for inspection and servicing equipments
13. Safe means of egress from all machinery spaces.
14. The installation of electrical equipment within hazardous areas is to be in compliance with **Ch 7** of the Rules. Combustion equipment and combustion engines are not to be located in hazardous areas.
15. Equipment arrangement drawings are to show the location of all equipment, living quarters, all machinery spaces, tanks, derrick, wellheads/moon pool, flare and vents, escape route, evacuation equipment, air intake, opening to close spaces, and any fire and barrier walls.
16. Additional requirements related to general arrangement and equipment layout are also to consider the applicable requirements of the Rules.

#### 103. Overpressurization protection

1. Systems that may have the potential of exposure to pressure greater than for which they are designed are to be protected by suitable pressure protection devices.
2. Designers are to decide design pressure taking into account of all condition encountered and select

suitable overpressure protection devices.

#### 104. Fire protection and fire extinction

Fire protection, fire extinction and hazardous area are to be in compliance with applicable requirements of **Ch 7** and **Ch 10** of the Rules.

#### 105. Acceptance of manufacturer's standards

Designs based on manufacturer's standards may also be accepted. In such cases, complete details of the manufacturer's standard and engineering justification are to be submitted to the Society for review.

1. The manufacturer is to demonstrate by way of testing or analysis that the design criteria employed results in a level of safety consistent with that of a recognized standard or code of practice.
2. Where strain gauge testing, fracture analysis, proof testing or similar procedures form a part of the manufacturer's design criteria, the procedure and results are to be submitted to the Society for review.
3. Historical performance data for drilling systems, subsystems, equipment or components is to be submitted to the Society for justification of designs based on manufacturer's standards.

## SECTION 2 Well Control System

### 201. General

1. The well control systems are consist of the following systems.
  - (1) Blowout preventer system
  - (2) Lower marine riser package (LMRP)
  - (3) Choke and Kill system
  - (4) Diverter system
  - (5) Auxiliary well control system
2. The well control systems are to be in compliance with recognized national standards or international standards in addition to requirements of this Annex.

### 202. Blowout preventer system

1. The BOP system typically consists of ram and annular type BOPs, BOP stack structural frame, accumulators, connectors, clamps, drilling spools, spacer spools, control systems/panels, control pods, umbilical, flexible hoses (choke, kill, mud booster and hydraulic), hydraulic hoses, MUX, cable reels, rigid piping, hydraulic power units, manifold, ROV interface, test stump and testing equipment.
2. **Blowout preventer stack**
  - (1) BOP stack configurations are to be in accordance with API RP 53 and requirements below.
  - (2) As a minimum, the BOP stack is to consist of the following preventers.
    - (A) One (1) annular preventer
    - (B) One (1) blind-shear ram preventer with mechanical locking device for fixed units
    - (C) Two (2) pipe ram preventers with mechanical locking device
    - (D) Two (2) shear rams for moored or dynamically-positioned units, one being a blind shear ram and the other to be a casing shear ram.
    - (E) All ram preventers are to be provided with locking devices
  - (3) The BOP stack configuration is to be able to close BOPs on all sizes of drill pipe, drill collars and casing that may be used within a drilling operation.
  - (4) The ram-type BOP positions and outlet arrangements on subsea BOP stacks are to provide reliable means to handle potential well control events. Specifically for floating operations, the arrangement is to provide means to:
    - (A) Close in on the drill string and on casing or liner and allow circulation
    - (B) Close and seal on open hole and allow volumetric well control operations



- (C) Strip the drill string using the annular BOP
- (D) Hang off the drill pipe on a ram-type BOP and control the wellbore
- (E) Shear logging cable or the drill pipe and seal the wellbore
- (F) Disconnect the riser from the BOP stack
- (G) Circulate the well after drill pipe disconnect
- (H) Circulate across the BOP stack to remove trapped gas
- (5) Systems of valves are to comply with the requirements of **Par 4**.
- (6) For subsea BOP, the use of drilling spools is not recommended in order to reduce the overall height of the subsea BOP stack arrangements.
- (7) Spacer spools are used to provide separation between two (2) drill-through components with equal sized end connections (nominal size designation and pressure rating). Typically, they are used to allow additional space between preventers to facilitate stripping, hang off, and/or shear operations but may serve other purposes in a stack as well.
- (8) Spacer spools for BOP stacks are to meet the following minimum specifications:
  - (A) Have a vertical bore diameter the same internal diameter as the mating equipment
  - (B) Have a rated working pressure equal to the rated working pressure of the mating equipment
  - (C) Are not to have any penetrations capable of exposing the wellbore to the environment, without dual isolation capabilities
- (9) The BOP equipment is to be designed for the specific drilling envelope, and suitable for the intended facility. BOP manufacturer is to specify and to attest BOP stack minimum and maximum capability with regard to the following including shearing and, pressure/temperature capabilities:
  - (A) Drill pipe, tool joint, casing sizes
  - (B) Wire lines
  - (C) Water depth
  - (D) Pressure
  - (F) Temperature
- (10) The BOP structural frame and lifting attachments are to be designed considering applicable loads as specified in **Ch 1, 104**, and in accordance with the requirements of API RP 2A-WSD or other recognized standards. Allowable stresses are to be in accordance with design standards and/or AISC.

### 3. Well control systems for blowout preventers

- (1) The control systems and components (hydraulic, pneumatic, electric, electro-hydraulic, etc.) are to comply with **Ch 6, Sec 2** and are to be in compliance with API Spec 16D, and API RP 53. This also includes response time, volumetric capacity of the accumulator system, hydraulic reservoir, pump system sizing and arrangements.
- (2) the hydraulic fluids volumetric capacity of the accumulator system, pump system and reservoir capacity for well control systems are to be in compliance with API Spec 16D, and API RP 53.
- (3) Well control systems and components are to comply with the functional requirements of API RP 53 for response time, pump system arrangements, and charging of accumulator systems.
- (4) BOP accumulators are to have sufficient usable hydraulic fluid volume to perform the following functions and after performing the following functions, the remaining pressure is to be 1.38 MPa(200 psi) or more above the minimum precharge pressure.
  - (A) For subsea BOP systems
    - (a) to close and open one annular-type preventer and all ram-type preventers from full-open position against zero wellbore pressure, and
    - (b) to open hydraulic control remote valve
    - (c) to close all ram locking devices
  - (B) For surface BOP systems
    - (a) to close one annular-type preventer, all ram-type preventers from a full-open position, and
    - (b) to open hydraulic control remote valve
- (5) The minimum precharge pressure for the BOP system is to be determined based on the following in accordance with API Spec 16D and API RP 53.
  - (A) BOP stack configuration and minimum required operator pressure
  - (B) Water depth
  - (C) Hydraulic fluid density
  - (D) Local regulations
  - (F) Operational sequence

- (6) Floating installations or dynamically-positioned units require the following independent secondary well control systems and safety features. These systems are to be designed in accordance with API Spec 16D.
  - (A) Deadman system
  - (B) Autoshear system
- (7) If installation is provided with acoustic control system, the system is to be designed in accordance with API Spec 16D. The acoustic control is to be a portable control unit, which can be handled by one person, and is to be available for the closing of the BOP in the event of evacuation from the facility.
- (8) For surface well control systems, a reserve supply of pressurized nitrogen gas can serve as a backup means to operate functions in the event that the pump system power supply is lost.
- (9) As a minimum, two (2) full-functioning well control panels are to be provided:
  - (A) One (1) well control panel is to be at driller's station or cabin and where it is protected from drilling activities.
  - (B) A second well control panel is to be located in a nonhazardous area, as defined in the **Ch 8** of the Rules and API RP 505, without having to cross the drill floor or cellar deck, and is to be arranged for easy access in case of emergency.
- (10) Well control panels are to be accessible and operable at all times.
- (11) Well control panels are to be mutually independent and simultaneously functional (i.e., directly connected to the control system, and not connected in series).
- (12) Control systems are to be arranged to ensure the operational capability upon loss of any single component. This will include the use of functionally independent actuation lines, input/output devices and the provision of system isolation.
- (13) The well control panels are to include controls for at least:
  - (A) Close or open of all rams, annular preventers, and choke and kill valves (hydraulic control remote valve) at BOP
  - (B) Diverter operations
  - (C) Disconnect of riser connector (floating installations)
  - (D) Emergency disconnect (DP units)
  - (E) Mechanical locking of rams
- (14) BOP stack is to be equipped with remotely operated vehicles (ROV) intervention equipment, which at the minimum allows the closing of one set of pipe ram, closing of one each blind-shear rams, and unlatching of the LMRP. These functions are to operate independently of the primary BOP control system.
- (15) ROV interface and/or receptacles are to mate with API 17H high-low stabs. Operated control systems and interventions are to be provided for subsea BOP stack for all installations.
- (16) For subsea BOP stack, adequate measure is to be provided to prevent accidental unlatching of the wellhead connector until the well is secure, such as two-hand function, two-step action, protective cover or equivalent.

#### 4. Design requirements of blowout preventer equipment

- (1) Surface and subsea, ram and annular blowout preventers, including workover and well servicing BOPs, ram blocks, annular packing units, valves, wellhead connectors, drilling spools, adapter spools and clamps are to be designed, fabricated and tested by the respective manufacturers for compliance with API Spec 6A, Spec 16A, Spec 16C, Spec 16D and the additional requirements of this Annex.
- (2) The working pressure of ram-type BOPs is to exceed the maximum anticipated surface pressure.
- (3) Hydraulically-operated wellhead, riser and choke and kill line connectors are to have redundant mechanisms for unlock and disconnect.
- (4) The secondary unlock and disconnect mechanism may be hydraulic or mechanical, but must operate independently of the primary unlocking and disconnect mechanism.
- (5) In addition to the design conditions/loads listed in **Ch 1, 104.**, the design of preventers is to consider the following loads, as applicable:
  - (A) The weight of a specified length of drill string suspended in the pipe ram preventer
  - (B) Loads induced from the marine drilling riser
- (6) On fixed units, if the tool joints cannot be sheared, the following is to be considered:
  - (A) Two (2) shear rams must be installed as for DP units, or
  - (B) Lifting or lowering of main hoisting system is to be possible in all operational conditions, including emergency operation. The main hoisting system is to be included in the emergency power source.

- (7) The blind-shear rams are to be capable to seal after shearing operation.
- (8) The shear rams are to be capable of shearing the largest section and highest-grade of tubulars (drill pipe, casing, wireline, etc) under the design conditions and at the rated working pressure.
- (9) The annular, pipe and blind ram BOP operator design pressure is to consider the following.
  - (A) Well bore pressure
  - (B) Rated working pressure of BOP
- (10) Procedures to test preventers during manufacturing and "on-site" are to be developed and submitted to the Society for review.
- (11) For subsea BOP and associated components such as valves, control system components, sealing components, elastomeric components, etc., are to be designed with consideration to marine conditions and external pressure gradient due to rated water depth.
- (12) All nonmetallic materials are to be suitable for the intended service conditions, such as temperature and fluid compatibility.
- (13) Materials are to be in accordance with **Ch 3, Sec 1**.
- (14) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.

#### **5. Operations and maintenance manuals for blowout preventer**

- (1) Blowout preventer manufacturers are to provide the Owner with product operations and maintenance manuals to assist in the safe operation of each assembly on each installation.
- (2) The manufacturer's recommended maintenance schedules are to be available for each component of the assembly. These schedules are to prescribe maintenance routines.

#### **203. Lower marine riser package(LMRP)**

1. Components of the lower marine riser package, including connectors, flex joints, and adapter spools are to be designed, fabricated, and tested by the respective manufacturers for compliance with API Spec 16F, API Spec 16R and API RP 16Q and the additional requirements of this Annex.
2. An annular BOP that is included in the LMRP is to be designed, fabricated, and tested in accordance with **202.** and API Spec 16A, API Spec 16D and API RP 53, and the additional requirements of this Annex.
3. Lower marine riser package disconnect arrangements are to be designed for all possible operating and loading conditions. The loading conditions of the LMRP are to consider the followings.
  - (1) Min/max riser angle
  - (2) External pressure due to static head
  - (3) Side loads
  - (4) Internal pressure
  - (5) Bending loads
  - (6) Min/max top tension
  - (7) Currents
4. The LMRP design is to consider the induced loads as defined in API Spec 16F and API RP 16Q, as a minimum, for the following modes.
  - (1) Installation
  - (2) Storage and maintenance
  - (3) Drilling
  - (4) Hang off
  - (5) Retrieval
  - (6) Drifting
5. For dynamically-positioned floating units, an emergency disconnect is to be provided.
6. The emergency disconnect is to initiate and complete disconnection in following sequence.
  - (1) Blind-shear drill string and/or casing
  - (2) Disconnect LMRP
  - (3) Close well
7. For the LMRP and associated components such as valves, control system components, sealing components, elastomeric components, etc., are to be designed with consideration to marine conditions and external pressure gradient due to rated water depth.
8. Adapter spools are used to connect drill-through equipment with different end connections, nominal size designation and/or pressure ratings to each other. Typical applications in a subsea stack are as

followings.

- (1) The connection between the LMRP and the lower stack
  - (2) The connection between the lowermost BOP and the wellhead connector
9. Adapter spools for BOP stacks are to meet the following minimum specifications.
- (1) A minimum vertical bore diameter equal to the internal diameter of the mating equipment
  - (2) A rated working pressure equal to the lowest rated end connection of the mating equipment
10. LMRP structural frame and lifting attachments are to be designed with consideration to all applicable loading conditions. Applicable structural design code and standard including loading conditions are provided in **202. 2** (10).

## 204. Choke and kill systems

### 1. General

- (1) The choke and kill system typically consist of would include the choke and kill manifolds, including their chokes, spools, flanges and valves, choke and kill lines, connectors and flexible hoses (drape hoses at moonpool area and jumper lines at LMRP), BOP stack fail-close valves, connecting piping from the cementing unit and drilling fluid manifold to the choke manifold, buffer tanks and control systems.
- (2) Piping, flexible hoses are to be in accordance with the applicable standards for chock and kill system listed **Ch 1, 101. 3** and **Ch 5**.
- (3) Materials are to be in accordance with the applicable standards for chock and kill system listed **Ch 1, 101. 3** and **Ch 3, Sec 1**.
- (4) Welding and non-destructive examination are to be in accordance with the applicable standards for chock and kill system listed **Ch 1, 101. 3** and **Ch 3, Sec 2**.

### 2. Choke and kill lines

- (1) Each choke and kill line from the BOP stack to the choke manifold is to be equipped with two (2) valves installed on the BOP stack.
  - (A) For surface BOP stacks, one of these two valves is to be arranged for remote hydraulic operation.
  - (B) For subsea BOP stacks, these two valves are to be arranged for remote hydraulic operation.
  - (C) Hydraulically-operated valves are to be fail-close valves to seal upon failure of the control system pressure.
- (2) The design pressure of the pipes, valves, flexible hoses, connectors, fittings, and the choke manifolds from the BOP stack to the isolation valve downstream of the choke is to be the same as that of the ram-type BOPs or greater.
- (3) The line connected to the lowermost outlet of the BOP is to be designated as the kill line. Placement of this outlet is to be below the lowermost pipe ram, or below the test ram, if installed.
- (4) One (1) choke line and one (1) kill line connection is to be located above the lower most ram BOP.
- (5) The choke line, that connects the BOP stack to the choke manifold, and lines downstream of the choke are to:
  - (A) Be as straight as practicable; turns, if required, are to be targeted
  - (B) Be firmly anchored to prevent excessive dynamic effect of fluid flow and the impact of drilling solids and/or vibration
  - (C) Supports and fasteners located at points where piping changes direction are to be capable of restraining pipe deflection in all operating conditions
  - (D) Have bore of sufficient size to prevent excessive erosion or fluid friction due to velocity

### 3. Components of choke and kill

- (1) For rated working pressure of 20.7 MPa(3000 psi) and above, only flanged, welded or clamped connections, and rated hammer unions are to be used. However. for choke end connections, only flanged, welded or clamped connections, and rated hammer unions are to be used, regardless of rated working pressure. Requirements in **Ch 5** are to apply to piping component.
- (2) For rated working pressure less than 69 MPa(10000 psi), the minimum size for the choke lines is to be 50.8 mm(2.0 inch) nominal diameter.
- (3) For rated working pressure of 69 MPa(10000 psi) and higher, the minimum size for the choke lines is to be 76.2 mm(3.0 inch) nominal diameter.

- (4) For high volume gas drilling operations, the minimum nominal diameter pipe size is to be 101.6 mm (4.0 inch) nominal diameter.
- (5) Minimum size for vent lines downstream of the choke is to be at least the same internal diameter as for the chokes end connections.
- (6) When buffer tanks are utilized, provisions are to be made to isolate a failure or malfunction without interrupting flow control.
- (7) All choke manifold valves subject to erosion from well control are to be full-opening and designed to operate in high pressure gas and abrasive fluid service.

#### 4. Arrangement of choke manifold

- (1) The choke and kill manifold assembly is to include the following:
  - (A) The choke manifold is to be designed for a minimum of three (3) chokes, of which at least one (1) is remotely controlled and one (1) is manual.
  - (B) Any one of the chokes is to be capable of being isolated and replaced while the manifold is in use.
  - (C) Choke and kill manifold is to permit pumping or flowing through either line.
  - (D) A remotely controlled adjustable choke and a manual choke system to permit control through either the choke or kill line.
  - (E) Tie-ins to both drilling fluid and cement unit pump systems.
- (2) Where changes in direction cannot be avoided downstream of the choke and kill manifolds, choke and kill lines are to be provided with targeted tees or elbows fitted with a doubler plate on the outside radius or elbows with a radius of 20 times the diameter of the pipe.
- (3) Each of the manifolds' inlet and outlet lines is to be fitted with a valve. A valve immediately upstream of each choke is to be provided on the manifolds. All valves are to be in compliance with API Spec 16C, API Spec 6A, and API RP 53, and the additional requirements of this Annex.
- (4) Lines downstream of the choke manifold are to permit flow direction either to a mud-gas separator, degasser, vent lines, or to test facilities, or emergency storage.
- (5) Alternate flow and flare routes downstream of the choke line are to be provided so that eroded, plugged, or malfunctioning parts can be isolated for repair without interrupting flow control.
- (6) In the event the capacity of the mud-gas separator is exceeded, the choke manifold is to have the capability to divert flow to alternate locations for safe discharge, such as vent lines, flare or overboard.
- (7) The bleed line (the vent line that bypasses the choke) is to be at least equal to or greater than the diameter to the choke line.
- (8) Additional provisions such as targeted flanges are to be provided to minimize erosion or abrasion from high velocity flow.
- (9) The Joule-Thompson effects are to be considered in the design and material selections of choke and kill manifold and downstream piping and associated components.

#### 5. Mud-gas separator

- (1) Mud-gas separator is to be designed and manufactured in accordance with ASME Boiler and Pressure Vessel Code, Section VIII and **Sec 8**.
- (2) Piping is to be in accordance with **Ch 5**.
- (3) Materials are to be in accordance with **Ch 3, Sec 1**.
- (4) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
- (5) Precautions are to be taken to prevent erosion at the point the drilling fluid and gas flow impinges on the vessel wall.
- (6) Mud-gas separator is to be vented to atmosphere through the vent line.
- (7) The vent line is to be sized and designed to minimize back pressure in order to assist with maximum separation of gas from the mud.
- (8) Mud-gas separator is to be provided with high level sensor or equivalent for notification of diverting flow to overboard or alternate route.
- (9) Mud-gas separator is to be equipped with the following means to prevent gas ingress through the mud discharge line and to monitor gas ingress.
  - (A) Means for pressure and temperature monitoring
  - (B) liquid seal of the following height
    - (a) a minimum of 3 m for general purpose drilling operations.
    - (b) a minimum 6 m for high pressure and high temperature operations.
- (10) For monitoring of liquid seals, the following means is to be provided.
  - (A) Measuring means for the differential pressure at the liquid seal, or
  - (B) Monitoring means for low-level of the mud-gas separator

- (11) Drain is to be provided at lowest point of the mud-gas separator
- (12) Sizing of the mud-gas separator is to be performed in accordance with SPE Paper No. 20430: Mud-Gas Separator Sizing and Evaluation.
- (13) Design pressure of the mud-gas separator is to be determined by the vent line being filled with mud at 2.2 SG, or the specified maximum mud weight.

## 6. Gas vents

- (1) Vent lines from mud-gas separator are to extend 4 m above the crown block.
- (2) The vent system is to be as straight as possible, free of obstructions, and is to be sized and arranged to minimize back pressure in the upstream equipment of vent line.
- (3) A bypass line to alternate locations for safe discharge, such as vent lines, flare or overboard (port and starboard), as applicable, must be provided in case of malfunction or in the event the capacity of the mud-gas separator is exceeded.
- (4) Overboard lines are to be directed for discharge in downwind directions and safe distance away from facility.

## 7. Choke and kill flexible hoses

- (1) Refer to the requirements contained in **Ch 5, 203**.
- (2) End connectors are to be in accordance with the applicable parts of **Ch 5**.

## 8. Control systems for choke and kill system

- (1) The control systems and components (hydraulic, pneumatic, electric, electro-hydraulic, etc.) are to comply with **Ch 6, Sec 2** and are to be in compliance with API Spec 16C, API Spec 16D, and API RP 53, and the additional requirements of this Chapter.
- (2) The choke control station is to be easily accessible and is to include all monitors necessary to furnish an overview of the well control situation.
- (3) A minimum of one remote control station is to be away from the choke manifold and protected to avoid any human and equipment hazards caused by leakage from the manifold.
- (4) Any remotely operated valve or choke is to be equipped with an emergency backup power source.
- (5) All remote control valves are to be provided with "open" and "close" indicators on the control panel.
- (6) Electrical systems are to be in accordance **Ch 6, Sec 1**.

## 205. Diverter system

1. The diverter system typically consists of annular sealing device (packer, housing), vent outlets, valves, power unit and piping, control systems/panels.

### 2. Diverter

- (1) A diverter with a securing element for closing around the drill string in the wellbore or open hole is to be provided when it is desired to divert wellbore fluids away from the rig floor.
- (2) The diverter is to be equipped with two (2) 254 mm (10 in) or larger lines that are to be piped to opposite sides of the rig floor. Alternative arrangements will be specially considered and justification in accordance with **Ch 1, 103**.

### 3. Diverter valve assembly

- (1) Valves in the discharge piping are to be of the full opening and full bore type.
- (2) Valves and their actuators are to be sized to be capable of operating the diverter valve under all design conditions.
- (3) During the operational tests at the manufacturer's plant, a full design differential pressure opening test is to be carried out for each valve and actuator combination.
- (4) The diverter valve assembly and a control system are to be designed to safely vent well bore fluids at the surface or subsea.

### 4. Control systems for diverters

- (1) The diverter control systems and components (hydraulic, pneumatic, electric, electrohydraulic, etc.) are to comply with **Ch 6, Sec 2** and are to be in compliance with API RP 64, API RP 53 and API Spec 16D. This also includes response time, volumetric capacity of the accumulator system, hydraulic reservoir, pump system sizing and arrangements.
- (2) Any remotely operated valve or choke is to be equipped with an emergency backup power source.

- (3) The diverter system is to be controlled from two (2) locations; one is to be located near the driller's console/workstation and the other is to be located at an accessible location away from the well activity area and reasonably protected from physical damage from drilling activities on the drill floor. Both controls are to be arranged for ready operation by the driller.
- (4) The control systems are to have interlocks so that the diverter valve opens before the annular element closes around the drill string.
- (5) When the diverter element close function is activated, the return flow to the mud system is to be isolated.
- (6) The range of diverter elements is to be suitable to seal on all sizes of drill string elements on which the diverter is required to operate.
- (7) A relief valve is required to prevent overpressurization of the diverter packer.
- (8) All valves are to be provided with "open" and "close" indicators.
- (9) Electrical systems are to be in accordance with **Ch 6, Sec 1**.

#### 5. Diverter piping

- (1) Pipe size, arrangement and support is to be determined with due consideration given to maximum pressure and maximum reaction loads, erosion resistance and the range of temperatures likely to be encountered in service.
- (2) Discharge pipe slope downward from the diverter valves.
- (3) Piping is to run as straight as practicable. Where changes in direction cannot be avoided, they are to be accomplished by employing targeted tees or elbows fitted with a doubler plate on the outside radius or elbows with a radius of 20 times the diameter of the pipe.
- (4) Piping is to run as straight as practicable. Where changes in direction cannot be avoided, they are to be accomplished by employing targeted tees or elbows fitted with a doubler plate on the outside radius or elbows with a radius of 20 times the diameter of the pipe.
- (5) Piping is to be in accordance with **Ch 5**.
- (6) Materials are to be in accordance with **Ch 3, Sec 1**.
- (7) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
- (8) Suitable pipe supports in accordance with ASME B31.3.

#### 206. Auxiliary well control system

1. Auxiliary well control equipment includes the upper and lower kelly valves, drill pipe safety valves, IBOPs, drill string float valves and kelly.
2. For drilling installation using a top drive system, an automated or manual drill pipe safety valve must be installed.
3. Materials are to be in accordance with **Ch 3, Sec 1**.
4. Auxiliary well control equipment is to be in compliance with API Spec 7-1, API RP 53 and **Sec 5**.

#### 5. Kelly valves

- (1) The drill string is to be equipped with two (2) kelly cocks, one of which is to be mounted below the swivel (upper kelly cock), and the other at the bottom of the power swivel or kelly (lower kelly cock).
- (2) The lower kelly cock is to be sized so that it can be run through the blowout preventer stack when the blowout preventers are not installed on the seabed.
- (3) Testing of kelly cocks are to be performed bi-directionally and at a low and high pressure, with the low pressure tests first.

#### 6. Drill pipe safety valves

- (1) A full-opening manual safety valve is to be available on the rig floor to be installed into the drill string immediately in the event of a kick occurring during a trip.
- (2) The wrench to operate the valve is to be readily accessible to the crew to perform this operation.

#### 7. Internal blowout preventer (IBOP)

- (1) An internal blowout preventer or check valve that sustains a back pressure is to be provided in the drill string.
- (2) IBOP is spring operated and is locked in the open position with a removable rod lock screw.

## 8. Drill string float valve

A float valve is to be installed just above the drill bit to protect the drill string from back flow or inside blowouts.

# SECTION 3 Marine Drilling Riser System

## 301. General

The marine drilling riser system consists of the followings.

- (1) Riser tensioning system and equipment
- (2) Telescopic joints
- (3) Pup joints
- (4) Riser joints
- (5) Buoyancy devices
- (6) Riser couplings
- (7) Ball and flex joints
- (8) Riser running and handling equipment
- (9) Riser recoil
- (10) Special equipment, including fill-up valves, mud boost system, drag reducing devices.

## 302. Riser tensioning system

1. The riser tensioning system typically consists of accumulators, air/nitrogen compressors, air/nitrogen dryers, control systems/panels, hydraulic cylinders, hydraulic power unit, piping, pressure vessels, tensioners, guideline, podline, wireline, sheaves for tensioners, telescopic arms, wire ropes, etc.
2. Component specific requirements
  - (1) The marine drilling riser system and associated components are to be designed and fabricated in accordance with applicable sections of API Spec 16F, API RP 16Q and API Spec 16R, and the additional requirements of this Section.
  - (2) The manufacturer is to establish a rated capacity through appropriate design analysis and prototype testing.
  - (3) Design analysis is to be submitted for review, showing that the drilling riser system and all associated components will not be overstressed at the rated capacity, either in axial loading or bending, overpressure at rated tensioning capacity in specified design conditions.
  - (4) Piping and hoses are to be in accordance with **Ch 5**.
  - (5) Materials are to be in accordance with **Ch 3, Sec 1**.
  - (6) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
  - (7) Load-carrying parts are to be in accordance with **Ch 6, 603. 5**.
  - (8) If the locking mechanism is in the load path, it is to be in accordance with **Ch 6, 603. 5**.
  - (9) Hydraulic and pneumatic cylinders are to be in accordance with **Sec 8, 802**.
3. Control systems for riser tensioning system
  - (1) Electrical systems are to be in accordance with **Ch 6, Sec 1**.
  - (2) Control systems are to be in accordance with **Ch 6, Sec 2**.
  - (3) Any remotely-operated valve is to be equipped with an emergency backup power source.
  - (4) Provisions for load monitoring are to be provided for riser tensioning system.
4. Riser tensioning system is to equipped with riser recoil system is to limit the upward acceleration of the riser when a emergency disconnect is made at the riser.

## 303. Marine drilling riser operating envelope

1. In order to provide a set of criteria for the drilling operation, an envelope of operating parameters is to be established, preferably in the form of a chart. The chart is to clearly show the limits not to be exceeded for each marine drilling riser type in use for any combination of applied loading conditions and the anticipated environmental conditions.



2. Where applicable, consideration is to be given to the limits on dynamically-positioned or turret-moored drill ships and the heading change limitations imposed by the length of the choke and kill lines, and restrictions with the slip joint fluid ring.
3. The development of the chart is to take into consideration all applicable loading conditions, load effects, mechanical stops or other limitations on the marine drilling riser system and any component of the drilling riser.
4. The drilling riser is to be designed so that the maximum stress intensity for the operating modes, as described in API RP 16Q, is not to be exceeded.
5. The design limits or combination thereof for consideration in the design and structural analysis of the drilling riser system are to consider:
  - (1) Maximum stress
  - (2) Strain
  - (3) Maximum deflection or curvature
  - (4) Temperature
  - (5) Fatigue for service life
  - (6) Hydrostatic collapse
  - (7) Maximum loading on specific components
6. The drilling riser loads and load effects are to be considered in the design and structural analysis of the marine drilling riser system in conjunction with the design limits indicated **Par 5**. The marine drilling riser loads effects are categorized as follows:
  - (1) Functional
    - (A) Nominal top tension
    - (B) Vessel constraints and/or offsets (DP, moored installations, etc.)
    - (C) Internal pressure
    - (D) External hydrostatic pressure
    - (E) Internally run tools
    - (F) Thermal
    - (G) Installation
    - (H) Vortex-induced vibration
    - (I) Weight of riser
    - (J) Hang-off
    - (K) Inertia
    - (L) Weight of attachments and/or tubing
    - (M) Weight of tubing contents and annulus mud
  - (2) Environmental
    - (A) Waves
    - (B) Wind
    - (C) Vessel motions
    - (D) Seismic
    - (E) Current
    - (F) Ice
  - (3) Accidental
    - (A) Small dropped objects
    - (B) Partial loss of station keeping capability
    - (C) Normal handling impacts
    - (D) Emergency disconnect
    - (E) Tensioner failure

### 304. Technical requirements

1. Marine drilling riser system is to be verified through global riser analysis.
2. The design analyses of the individual marine drilling riser components are to be performed using loads obtained from a global drilling riser analysis.
3. The marine drilling riser system and components are to be evaluated for the design conditions and service life criteria as indicated in **303**.
4. The individual components of the marine drilling riser system are to be adequately designed to

withstand stresses expected throughout the service life of the particular component. In design, consideration is to be given to the maximum stress, fatigue damage, maximum deflection and stability against column buckling.

5. The maximum permissible deflection of the drilling riser system is to be limited to that value which would cause interference with the passage of any downhole tools that would be used in the different operating modes.
6. The drilling riser running equipment, which includes the drilling riser running/handling tool, riser spider, gimbal and shock absorber (if applicable) is to be designed and rated in accordance with API Spec 8C and the additional requirements of this Annex.
7. The mud boost system is to be provided with safety relief valves capable of protecting system equipment with the lowest pressure rating, including the marine drilling riser.
8. Riser make-up and break-up equipment and procedures are to be subjected to the Society's review.

### 305. Design Documentation

Design documentation are to include the reports, calculations, plans, manuals and other documentation necessary to verify the global riser analysis and structural integrity of the individual riser components. Additional documentation may be required based on the relative complexity of the marine drilling riser system or relevant conditions in the geographic area of operation.

#### (1) Reports

- (A) Reports are to fully describe the loads and resulting stresses for the global drilling riser system, individual components, and the operating and environmental conditions that produce those loads and restrict the ability of the drilling riser system to meet its designed function.
- (B) The environmental reports are to be based on appropriate original data. Data from analogous areas may be considered. The information contained therein is to include all environmental phenomena that would affect the drilling riser system.
- (C) Data presented is to include tables that summarize wave height vs. percentage of time, wave height vs. direction, wave and overall current statistics for return periods of 1 year, 10 years and 50 years.
- (D) Fatigue data are to be included.
- (E) Design air and water temperature ranges are to be specified and to be suitable for operation of any system component.

#### (2) System Calculations

- (A) Design analyses are to be submitted that clearly demonstrate the capability of the marine drilling riser system to withstand the imposed loads for the intended operating envelope.
- (B) The operating envelope defines the range of individual operating conditions for which the drilling riser system is suitable and which also defines the boundaries for combinations of operating conditions within the acceptable ranges of individual conditions (e.g., the combination of offset, water depth, mud weight, etc.)
- (C) Details of the slip joint and flex joints, location and extent of any concentrated loads, details of riser joint are to be submitted to the Society.

#### (3) Arrangement plans and fabrication drawings

## SECTION 4 Drill String Compensation System

### 401. General

1. The drill string compensation system can be categorized as active heave compensation and passive heave compensation.
2. Theory of operation is to be included in design plans and data, and is to include the backup braking system and computer/control redundancy studies.

### 402. Drill string compensation system

1. The drill string compensation system typically consist of accumulators, air/nitrogen compressors, air/nitrogen dryers, compensators, control systems/panels, hydraulic cylinders, HPU, piping,

pressure vessels, sheaves, wire ropes, etc.

## 2. Component specific requirements

- (1) Pressure retaining equipments are to be in accordance with **Sec 8**.
- (2) Piping and hoses are to be in accordance with **Ch 5**.
- (3) Materials are to be in accordance with **Ch 3, Sec 1**.
- (4) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
- (5) Load-carrying parts are to be in accordance with **Ch 6, 603. 5**.
- (6) If the locking mechanism is in the load path, it is to be in accordance with **Ch 6, 603. 5**.
- (7) Hydraulic and pneumatic cylinders are to be in accordance with **Sec 8, 802**.

## 3. Control systems for drill string compensation

- (1) Electrical systems are to be in accordance with **Ch 6, Sec 1**.
- (2) Control systems are to be in accordance with **Ch 6, Sec 2**.
- (3) Any remotely-operated valve is to be equipped with an emergency backup power source.

# SECTION 5 Bulk Storage, Circulation and Transfer Systems

## 501. General

The bulk storage, circulation and transfer system equipment can be categorized as follows:

- (1) Bulk storage and transfer system
- (2) Cementing system
- (3) Mud return system
- (4) Well circulation system

## 502. Bulk storage and transfer system

1. Bulk storage and transfer system typically consist of bulk storage vessels, utility air system and transfer piping.
2. Provisions are to be made so that utility air used to transport cement or bulk mud is dried to a water dew point of at least 7°C below the minimum ambient air temperature.
3. All utility air piping is to be designed to be purged with dry air prior to transfer operations.
4. The utility air transfer piping is to be fitted with relief valves set at a pressure not greater than the working pressure of the bulk storage tanks.
5. Bulk storage vessels are to be fitted with safety relief valves or rupture disks piped to a safe relief area. Unless they are fitted with a relief line to an open area, the use of rupture disks is to be limited to tanks installed in open areas.
6. A P&ID or equivalent schematic of the bulk transfer system is to be clearly posted at the operator station to facilitate operation of the system during well kill circulation.
7. Piping systems are to be in accordance with **Ch 5**.
8. Materials are to be in accordance with **Ch 3, Sec 1**.
9. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
10. Electrical systems are to be in accordance with **Ch 6, Sec 1**.
11. Control systems are to be in accordance with **Ch 6, Sec 2**.

## 503. Cementing system

1. The cementing system typically consist of cement pump, centrifugal pumps for mixing cement, piping to and from cement pumps, pulsation dampeners and safety valves.
2. The cement pumps are to be arranged to be capable of emergency well kill circulation, using the drilling fluid transferred from the mud pits.
3. Cement pump installations or modifications to existing installations are to be subjected to the

Society's review.

4. The interconnect lines between systems that are used only for emergency well kill circulation are to be fitted with blind or spectacle flanges, lockable valves or similar devices that can be opened as needed, but positively isolate the systems during normal operations. These flanges are to be clearly identified and labeled on the P&ID.
5. The cement manifold is to be rated to the ram-type BOPs pressure rating.
6. Pressure-retaining equipment is to be in accordance with **Sec 8**.
7. Piping systems are to be in accordance with **Ch 5**.
8. Materials are to be in accordance with **Ch 3, Sec 1**.
9. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
10. Electrical systems are to be in accordance with **Ch 6, Sec 1**.
11. Control systems are to be in accordance with **Ch 6, Sec 2**.

#### 504. Mud return system

1. Mud return system typically consists of agitators, chemical mixers, degassers, shale shakers, desanders, desilters, centrifuges, mud tanks and piping systems.
2. The mud circulating piping system is to be arranged so that the mud reconditioning system may be run in a series with the degasser, desander, desilter and centrifuge.
3. **Degasser**
  - (1) Degasser is to be provided to separate entrained gas bubbles in the drilling fluid which are too small to be removed by the mud-gas separator.
  - (2) Degasser is to be designed and manufactured in accordance with ASME Section VIII Boiler and Pressure Vessel Code and **Sec 8**.
  - (3) Typically, the degasser is designed so that it can be operated under partial vacuum to assist in removing the entrained gas.
  - (4) Provisions are to be provided to vent gas to the appropriate location.
  - (5) The drilling fluid inlet line to the degasser is to be placed close to the drilling fluid discharge line from the mud-gas separator to reduce the possibility of gas breaking out of the drilling fluid in the pit.
4. Pressure-retaining equipment is to be in accordance with **Sec 8**.
5. Piping systems are to be in accordance with **Ch 5**.
6. Materials are to be in accordance with **Ch 3, Sec 1**.
7. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
8. Electrical systems are to be in accordance with **Ch 6, Sec 1**.
9. Control systems are to be in accordance with **Ch 6, Sec 2**.

#### 505. Well circulation system

1. Well circulation system typically consist of circulating head, kelly, kelly cock, mixing pump, mud pump, standpipe, standpipe manifold, standpipe manifold, rotary hose, swivel and piping systems.
2. High-pressure mud pumps are to be fitted with safety relief valves whose maximum setting is no higher than the maximum allowable pressure of the system. Relief lines from the mud system are to be self-draining.
3. Where rupture disk type pressure relief devices are installed, rupture disks are to be certified to meet a recognized standard and the disk assembly is to be subjected to survey in accordance with the manufacturer's specifications.
4. Rotary hoses in well circulation system are to be designed and constructed in accordance with **Ch 5, 204**. and 「API Spec 7K」 .

5. Piping systems are to be in accordance with **Ch 5**.
6. Materials are to be in accordance with **Ch 3, Sec 1**.
7. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
8. **Mud, cement and kill pumps**
  - (1) Fluid ends, pressure-retaining components, and mechanical load-bearing components including, but not limited to, gears, shafting, clevis linkages, gears of all types, keyways, splines, etc. are to be in compliance with API Spec 7K or equivalent recognized standard, and the additional requirements of this Annex.
  - (2) Materials, Welding and non-destructive examination used for major pressure-retaining equipment of the fluid ends and mechanical load-bearing components are to be in accordance with **Ch 3**.
  - (3) The fluid end and associated manifolds (suction and discharge) are to be hydrostatically tested as required by **Ch 2, 203**.
  - (4) Motor couplings and shafting are to comply with a recognized standard and be suitable for intended service in terms of maximum power and minimum operating temperature.
  - (5) Materials used for discharge manifold components on mud pumps designated as kill pumps must also comply with **Ch 3, 103. 4 (2)** regardless of minimum design temperature
  - (6) The mud pumps are to be equipped with pulsation dampening devices.
  - (7) Discharge high pressure piping to comply with ASME B31.3, or equivalent recognized standard, and **Ch 5**.
  - (8) The prime movers are to be in accordance with **Sec 9**.

## SECTION 6 Hoisting, Lifting, Rotating and Pipe Handling Systems

### 601. General

Requirements of this Section are to apply to the followings

- (1) Derricks
- (2) Hoisting system
- (3) Lifting system
- (4) BOP handling crane
- (5) Pipe handling system
- (6) Riser handling system
- (7) Rotary equipment
- (8) Miscellaneous system

### 602. Derricks

#### 1. General

- (1) Except as provided below, the design and fabrication of drilling derricks/masts are to be in accordance with API Spec 4F, the Rules and the additional requirements of this Article.
- (2) The following derrick/mast structural components are considered to be primary structure members specified in accordance with the **Ch 3** of the Rules.
  - (A) Upper section: crown shaft, main crown beam and water table beams
  - (B) Lower section: legs, "V" door beams, shoes and girths
  - (C) Main load path structural components
- (3) Materials are to be in accordance with **Ch 3, Sec 1**.
- (4) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
- (5) Complete Data Book, as specified in Annex A-A.3 SR3 of API Spec 4F, is to be provided for the Surveyor review.

#### 2. Design loads

For structural design of the derrick, design loads, definition of forces and loads, and applicable loading conditions are to be in accordance with API Spec 4F, and as specified below:

- (1) Structure failure consequences are to be categorized as medium or higher, as defined in API Spec 4F for the Structural Safety Level
- (2) The derrick design is to consider both fixed and pinned boundary conditions.
- (3) For fixed boundary condition, the Society allows a 20% increase in allowable stresses, as pro-

vided in API Spec 4F.

- (4) The Owner is required to specify the geographic region of operation, the static loads (dead weight, hook load, static rotary load, fluid load, setback loads, etc.) and dynamic loads (inertial load, dynamic amplification, erection, transportation, wind, transit, motion, acceleration, seismic, etc.) on the derrick, as required in API Spec 4F. Additionally, the following loads are also to be given consideration.
  - (A) The accumulation of ice and snow on a structure in increasing its dead load.
  - (B) The wind-induced load is to be included in the design analysis of the derrick structure and is to consider the following.
    - (a) The use of wind speeds higher than those provided in API Spec 4F, where required by the Owner, for regions not specified within API Spec 4F, KS B ISO 19901-1, or API Bull 2INT-MET.
    - (b) The minimum wind velocity for unrestricted offshore service for all normal drilling and transit conditions is not to be less than 36 m/sec(70 knots). For host structures other than mobile offshore drilling units, such as production unit or fixed structure, the transit conditions are to be in compliance with **Rules for the Classification of Fixed Offshore Structures**.
    - (c) For units unrestricted service, the wind speed to be considered in the survival case is not to be taken less than 51.4 m/sec(100 knots).
    - (d) When other static or dynamic loading conditions are proposed by the Owner/Operator, technical justification in accordance with **Ch 1, 103**, is to be applied, on a case-by-case basis.
  - (C) The use of a higher rated setback, where required by the operational demands of the Owner.
  - (D) For dynamic loading due to motion of the hull, all motion information is to be provided, as specified below, by the owner or designer as specified in API Spec 4F for installation, transit, operation, survival condition of the floating units, as applicable. The above conditions are not to be less than those specified in the Rules, **Rules for the Classification of Steel Ships** and **Rules for the Classification of Fixed Offshore Structures**.
    - (a) For the calculation of dynamic loading induced by floating hull motion, the vertical distance and the horizontal distance, where applicable, between the center of flotation of the host drilling unit and the center of gravity of the derrick are to be provided by the Owner to the derrick designer and are to be used in the calculations.
    - (b) The horizontal distance is to be considered in addition to the vertical distance in the transit condition for self-elevating drilling units.
    - (c) If motion analysis for floating structure is performed, the appropriate acceleration data from the analysis are to be provided for the Society's review.

### 3. Live loads for local structure and arrangements

- (1) The arrangement of members is to allow the free drainage of water from the structure.
- (2) The following are the minimum vertical live loads that are to be considered in the design of walkways.
  - (A) General traffic areas: 4,500 N/m<sup>2</sup>
  - (B) Working platforms: 9,000 N/m<sup>2</sup>
  - (C) Storage areas: 13,000 N/m<sup>2</sup>
- (3) It is to be noted that various national and international regulatory bodies have requirements for the loading, arrangement and construction of local structure such as guardrails, ladders and walkways.

### 4. Allowable stresses

- (1) To prevent excessive stresses in structural members and connections, or buckling, reference is to be made to the allowable stress limits given in the AISC or other recognized standard.
- (2) The extent to which fatigue has been considered in design is to be indicated in submitted design documentation.
- (3) For allowable stresses in plate structures, refer to **Par 5**.
- (4) Consideration is to be given in stress calculations to ensure that maximum stress loads include "Jarring Procedures".

### 5. Equivalent stress criteria for plate structures

For plate structures, members may be designed according to the equivalent stress criterion, where the equivalent stress is obtained from **Ch 3, 410**, of the Rules.

## 6. Bolted connections

- (1) Where bolted connections are used in the derrick, the design documentation, including torquing procedures, is to be submitted for the Society's review.
- (2) Bolted connections in the main load path such as on upper mast, foundation, and crown, etc. are to be provided with secondary retention or locking mechanism.
- (3) Bolted connection designs are to consider the following.
  - (A) Fatigue
  - (B) Design loading in accordance with **Par 2**.
  - (C) Allowable stress in accordance with AISC
- (4) Bolt torquing procedures are to include, but not limited to, sequencing, torque loads.
- (5) Bolt materials are to be selected with consideration to stress corrosion cracking, fatigue, marine environment.

## 603. Hoisting system

1. The hoisting system typically consists of crown block with its support beams, traveling block with its guide track and dolly, sheaves for crown block and traveling block, deadline anchors, drawworks, drilling hook, drilling line, drilling elevators, hydraulic cylinders for overhead lifting, pipe racking, power swivel, bells, and rotary swivel, wire rope and hoisting equipment gears.

### 2. Drawworks

- (1) Drawworks are to be provided with primary and emergency braking systems. Both braking systems are to be designed for full rated load at rated speed.
- (2) Drawworks emergency brakes are to be of a fail-safe design.
- (3) Anti-crown collision/upper limits, and lower limits are to be provided.
- (4) Zone management principle is to be followed for all hoisting activity in order to provide additional safety to personnel and collision safeguard associated with drilling activities. Zone management consideration can be any one or combinations of the following.
  - (A) Markings
  - (B) Strobe light
  - (C) Proximity sensors
  - (D) Alarms
- (5) Drawworks control is to be provided with deceleration parameters for upper and lower limits for the traveling block to safely stopping the load.
- (6) Drawworks construction is to comply with API Spec 7F for chains and sprockets.
- (7) All mechanical load-bearing components are to be in compliance with API Spec 7K.
- (8) The mechanical coupling between the drawworks drum and the electromagnetic brake is to be provided with a system to prevent unintentional disengagement.
- (9) Drawworks auxiliary brakes and all other electrical power and control systems are to be suitable for the intended hazardous area.
- (10) For hydrodynamic brake systems, detailed drawings and supporting calculations proving that the proposed braking system is as effective as other drawworks braking systems are to be submitted for the Society's review.
- (11) Electromagnetic dynamic brake systems are to be arranged to prevent inadvertent failure of the drawworks to suspend the derrick overhead load.
- (12) Electromagnetic systems are to include the following provisions.
  - (A) Cooling water temperature and flow indicators and alarms for abnormal or upset conditions.
  - (B) An automatically activated emergency stop system capable of applying full braking torque to stop and lower the full rated load by the application of friction brake or by connection of the electromagnetic brake to an alternative power supply (backup battery or UPS).
  - (C) A system that monitors either electrical faults within the system or the kinetic energy of the traveling block arranged to actuate the emergency stop system. Where a fault monitoring system is provided, provisions are to include the following:
    - (a) System must be provided with emergency power source.
    - (b) Brake coil current
    - (c) Monitors that initiate emergency stop upon detection of a preset brake coil current or a brake coil current varying in proportion to the driller's control lever position
    - (d) Brake coil leakage current detector
    - (e) Audible and visual alarms at driller's control panel to indicate when the limiting param-

ters of the auxiliary brake have been reached or when the emergency stop system has been activated.

- (f) In the case of AC motors using variable frequency drives for braking, an abnormality in any of the connected drives is to alarm to the driller's control station.

(D) A manual emergency stop button is to be installed within reach of the driller.

(13) Electrical systems are to be in accordance with **Ch 6, Sec 1**.

(14) Control systems are to be in accordance with **Ch 6, Sec 2**.

### 3. Power swivels, rotary swivel, and top drives

(1) Major mechanical load-bearing components are to be in accordance with **Par 5**.

(2) Pressure vessels are to be in accordance with **Sec 8**.

(3) Electrical systems are to be in accordance with **Ch 6, Sec 1**.

(4) Control systems are to be in accordance with **Ch 6, Sec 2**.

(5) Piping systems are to be in accordance with **Ch 5**.

(6) Gears and couplings are to comply with AGMA or equivalent and be suitable for their intended service in terms of maximum power rating, service life and minimum operating temperature.

### 4. Safety devices and instrumentation

(1) The hoisting equipment is to have a weight indicator installed and the display is to be easily read from the driller's console.

(2) A safety device is to be installed to prevent the traveling block from contacting the crown block. This safety device is to be designed to be fail-safe.

(3) Testing intervals for the safety devices are to be agreed upon by the Owner but is not to be less frequent than as specified by the drawworks manufacturer.

(4) If override to the uppermost limit of travel is provided, it is to be part of the testing, accordingly.

### 5. Hoisting equipment specific requirements

(1) Crown block, sheaves, traveling block, hook, rotary swivel, tubular goods elevators and other overhead hoisting equipment are to be designed in compliance with API Spec 8A or Spec 8C and the additional requirements of this Annex.

(2) The results of the prototype load test required in API Spec 8A or Spec 8C along with design calculations for the component tested are to be submitted.

(3) Materials for mechanical load-bearing or pressure-retaining equipment are to be in accordance with the material traceability and toughness requirements of **Ch 3, Sec 1**.

(4) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.

(5) Wire rope is to be designed in compliance with API Spec 9A.

(6) Main load-bearing weld connections are to be full penetration. Where partial-penetration welds are utilized, validation through design and fatigue analyses, manufacturing process and procedure qualifications are required.

(7) Lighting fixtures and other equipment installed in the derrick are to be secured against vibration to prevent falling.

(8) Gears having a rated power of 100 kW and over and that are part of the critical load path are to be designed, constructed, certified and installed in accordance with AGMA or equivalent. The Society is to review the design and the gears are to be constructed under the attendance of the Surveyor.

(9) Gears having a rated power of 100 kW and over, but not part of the critical load path, and all gears having a rated power of less than 100 kW are to be designed, constructed and equipped in accordance with recognized commercial and marine practice. Acceptance of such gears will be based on manufacturer's declaration stating compliance with a recognized standard, verification of gear nameplate data and subject to a satisfactory performance test after installation conducted in the presence of the Surveyor.

## 604. Lifting systems

1. The lifting system typically consists of cranes, base-mounted winches, personnel lifting systems and other lifting systems associated with drilling activities.

### 2. Cranes

(1) Cranes are to be designed, constructed, and tested in accordance with the requirements of API Spec 2C or **Pt 9, Ch 2, Sec 4** of **Rules for the Classification of Steel Ships**.



- (2) When alternate codes or standards are proposed, comparative analyses are to be provided to demonstrate an equivalent level of safety to the recognized standards as listed in this Annex and to be performed in accordance **Ch 1, Sec 1, 103**.
- (3) Design loads of the crane winches are to be the maximum rope tension based on the design loading or the load created by dynamic braking, in accordance with the above design code. In either case, the distribution of loading from the reeving system is to be taken into account.
- (4) Allowable stresses are to be in accordance with AISC or other recognized standard.
- (5) Drums and brakes are to be in accordance with API Spec 2C or **Pt 9, Ch 2, 702. 2** of **Rules for the Classification of Steel Ships**.
- (6) Wire ropes are to be in accordance with API Spec 2C and API Spec 9A.
- (7) Design loads of the crane cylinders are to be the loads applied by the crane boom. Allowable stresses or minimum scantlings are to be in accordance with **Pt 9, Ch 2** of **Rules for the Classification of Steel Ships**, or other recognized standard.
- (8) Zone management principle is to be followed for all lifting activity in order to provide additional safety to personnel and collision safeguard associated with drilling activities.
- (9) Electrical systems are to be in accordance with **Ch 6, Sec 1**.
- (10) Control systems are to be in accordance with **Ch 6, Sec 2**.
- (11) Pressure vessels are to be in accordance with **Sec 8**.
- (12) Piping systems are to be in accordance with **Ch 5**.
- (13) Materials are to be in accordance with **Ch 3, Sec 1**.
- (14) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.

### 3. Base-mounted winches and other lifting devices

- (1) Design loads considered in the design analyses are to include the following.
  - (A) Recommended single rope tension at specified speed, drum size and layers of wire rope
  - (B) Maximum load created by dynamic braking
  - (C) Dynamics created by drilling unit motion
- (2) Design standards and factors of safety
  - (A) Bases and other structural steel components are to be designed in accordance with AISC or other recognized standard. Allowable stress for bending, tension, shear and buckling are to be as specified herein.
  - (B) Factors of safety for wire rope, drums, shafts and other parts are as follows.
    - (a) Wire rope for lifting application is to be rated in accordance with API Spec 2C.
    - (b) Load-carrying member allowable stress is to be no greater than the following.

$$\begin{aligned}
 F_a &= 0.8 \sigma_{cr} \quad (\text{for flat members}) \\
 &= 0.65 \sigma_{cr} \quad (\text{for curved members}) \\
 F_b &= 0.75 \sigma_y \quad (\sigma_y < 0.7 \sigma_u) \\
 F_b &= 0.3(\sigma_y + \sigma_u) \quad (\sigma_y > 0.7 \sigma_u) \\
 F_c &= 0.5773 F_b
 \end{aligned}$$

where

$$\begin{aligned}
 F_a &= \text{allowable stress for buckling} \\
 F_b &= \text{allowable stress in tension or compression} \\
 F_c &= \text{allowable shear stress} \\
 \sigma_y &= \text{material yield stress} \\
 \sigma_u &= \text{material ultimate stress} \\
 \sigma_{cr} &= \text{critical buckling stress}
 \end{aligned}$$

- (c) In addition, any combined stresses are not to exceed  $\sigma_u$ .
- (3) Materials and fabrication
  - (A) All mechanical parts where failure could terminate the load-carrying capabilities of the systems are to be made of steel.
  - (B) Use of ductile iron for gears and drum and the use of aluminum for fabrication will be specially considered.
  - (C) Materials are to be in accordance with **Ch 3, Sec 1**.
  - (D) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
- (4) Drums
  - (A) The rope at its end is to be secured to the drum in such a manner that will not damage

any part of the rope and to have such a length that not less than 3 complete turns in case of an ungrooved drum, or 2 complete turns in case of a grooved drum are remaining on the drum when the complete working length of rope has been paid out.

- (B) The drum end flange diameter is to have an allowance corresponding to not less than 2.5 times the rope diameter as measured from the outer rim of the outermost layer of ropes in service condition. However, where rope disengagement prevention system is provided or in case of single layer winding on the drum, this requirement may be dispensed with.
  - (C) The pitch circle diameter of drum is to be not less than 18 times the rope diameter.
  - (D) Materials are to be in accordance with **Ch 3, Sec 1**.
  - (E) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
- (5) Wire ropes
- (A) Wire ropes are to be constructed in accordance with a recognized standard applicable to the intended service, such as API Spec 2C and API Spec 9A.
  - (B) Usage records such as ton-mile records are to be maintained and wire rope changed out in accordance with manufacturer's recommendations.
  - (C) Wire ropes used in non-manriding applications are to be replaced if damage exceeds manufacturer's specifications for their rated capacity or if damage could affect smooth passage through sheaves.
- (6) Brakes
- (A) The power operated braking system is to operate automatically upon loss of power or when the manoeuvring is returned to its neutral position.
  - (B) The braking system is to be able to exert a breaking torque 50 % in excess of the torque required when the safe working load is applied to the cargo handling appliances.
  - (C) Thermal capacity of the brakes is to be suitable for the intended services.
  - (D) Brake linings containing asbestos material are not to be used.
  - (E) Documentation and calculations for the braking affect of the AC motors are to be submitted when they are the only backup system to the disc brakes.

#### 4. Personnel lifting devices

Manriding winches are to comply with the general requirements of this Chapter. In addition, the following minimum criteria are to be complied with.

- (1) The personnel rated load is to be no greater than 20% of the load calculated in accordance with **Par 3**.
- (2) Control systems are, as a rule, to be of such design that controls automatically return to the neutral position when control operation by the operator is interrupted.
- (3) Regardless of ton-miles, wire ropes used in manriding applications are to be replaced if physical damage is visible.
- (4) All brakes are to be fail-safe.
- (5) Brakes are to set automatically upon loss of power or when the winch lever is returned to neutral.
- (6) A secondary brake is to be provided to prevent the load from falling in the event of failure of the primary automatic brake.
- (7) A clutch capable of disengaging is not to be fitted.
- (8) Devices are to be fitted to prevent the winch from overriding or underriding, and a secondary means of lowering personnel is to be provided in case of winch or power failure.
- (9) Wire rope for personnel lifting devices is to be in accordance with API Spec 2C and API Spec 9A.
- (10) Setting of upper limit is to provide at least a vertical clearance of six (6) feet from the upper block, and the lower limit is to be set so that the winch cannot be operated with number of wraps less than specified in **2 (4)**.
- (11) All winches are to be identified as "Manrider Only" and marked with their SWL.
- (12) Electrical systems are to be in accordance with **Ch 6, Sec 1**.
- (13) Control systems are to be in accordance with **Ch 6, Sec 2**.

#### 5. Lifting attachments and pad eyes

- (1) Design loads and test loads for lifting attachment are to be in accordance with the requirements of API Spec 2C and API RP 2A WSD, respectively.
- (2) Allowable stresses are to be in accordance with the specified design code and standard.

#### 6. Safety devices and instrumentation

- (1) All winches are to be marked with the maximum permissible load allowed for the winch and

its system components.

- (2) Where pneumatic winches are provided, the air supply lines are to be sized to operate the winch at safe working loads.
- (3) An air regulator and pressure relief valve, located upstream of the non-return valves, are to be provided to limit air supply pressure to the winch, and the supply lines serving the winches are to be fitted with appropriate non-return valves and water filters before the operating valves.

## 605. Pipe handling systems

### 1. General

- (1) The pipe handling systems typically consists of elevators, finger boards, stabbing boards, iron roughnecks, cranes, winches, and wire ropes.
- (2) Foundations and storage racks are to be designed to withstand the maximum anticipated setback load of the racked pipe, drill collars and other intended loads.
- (3) All storage racks are to be designed to prevent drill collars, pipe and other tubulars from being released from the rack. Racking stands are to have provision for drainage.
- (4) Major mechanical load-bearing components are to be in accordance with **603. 5**.
- (5) Hydraulic and pneumatic cylinders are to be in accordance with **Sec 8, 802**.
- (6) Mechanized pipe handling systems are to have their safety controls verified on computer-based racking systems.
- (7) Indexing of all mechanical movement must be verified by operational testing. This procedure is to be carried out in all available fingerboard configurations, and system safety verified.
- (8) Cranes and winches are to be in accordance with **603**.
- (9) Zone management principle is to be provided to protect personnels and equipments from all pipe handling activity.
- (10) All safety functions are to be provided with visual and audible indicators.
- (11) Electrical systems are to be in accordance with **Ch 6, Sec 1**.
- (12) Control systems are to be in accordance with **Ch 6, Sec 2**.

### 2. Stabbing boards

- (1) Rails, masts, guides and runners
  - (A) The rails and masts supporting the stabbing board are to be securely attached to their supports, designed so that they are unable to open under operating conditions and capable of supporting the stabbing board in the event of the operation of the safety gear.
  - (B) The guides and runners are to be designed so that in the event of a roller or wheel failure, the platform cannot become detached from the mast.
  - (C) Upper and lower limits are to be provided and tested before use.
- (2) Controls and safety
  - (A) The controls are to be arranged to stop the platform if the raising and lowering handle is released.
  - (B) Two (2) independent locking devices are to be provided. One (1) locking device is to be engaged when the lifting handle is in neutral and the second is to engage upon failure of the hoisting system.
  - (C) Fail-safe upper and lower limit switches are to be provided, as applicable.
  - (D) All platforms are to be fitted with sufficient anchoring points for safety harnesses.
  - (E) A non-slip surface and adequate handrails, midrails and toe-plates are to be provided on the platform.
  - (F) The platform is to be fitted with a lock latch mechanism that secures it when it is not in motion.
  - (G) Additionally, adequate safety gear of the progressive type is to be provided, and designed so that it will be engaged within free fall conditions.
  - (H) Where two-point operation is used, the operator station in the basket is to override the remote.
  - (I) A safety override at the remote station is to be installed for use in the event that the work performing personnel are incapacitated.
- (3) Hoisting
  - (A) Hoisting is to be arranged for both raising and lowering of the platform. The arrangement is not to be such that it is possible to lower the platform by brake only.
  - (B) Means of lowering the man to the drill floor must be provided that will function in case of failure of the normal hoisting mechanism.

- (C) A speed-controlling device is to be provided which is designed to prevent the raising and lowering of the platform at speeds in excess of the tripping speed.
- (D) The factor of safety for rope or chain is not to be less than 10.
- (E) If rack and pinion systems are used, they are to be designed so that the failure of either a rack or pinion will not cause the platform to fall.
- (F) The hoisting system is to incorporate sufficient rope so that there are at least five (5) full turns of rope remaining on the winding drum when the platform is at its maximum level.
- (G) The equipment associated with the operation of the stabbing board is to be securely anchored to the derrick structure.
- (H) The anchorages for rope or chain are to be designed such that they will not be adversely affected by corrosion.

### 606. Rotary system

1. The rotary system typically consists of master bushing and the rotary table, including its skid adapters and driving unit.
2. The rotary table and its components are to comply with the following requirements.
  - (1) All mechanical load-bearing components are to be in compliance API Spec 7K.
  - (2) Load-bearing beams are to be in accordance with **Ch 3, Sec 1, 102**.
  - (3) Materials are to be in accordance with **Ch 3, Sec 1**.
  - (4) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
  - (5) The rotary table transmission and associated motor couplings and shafting are to comply with a recognized standard and be suitable for the intended service in terms of maximum power and minimum operating temperature.
  - (6) Electrical systems are to be in accordance with **Ch 6, Sec 1**.
  - (7) Control systems are to be in accordance with **Ch 6, Sec 2**.

### 607. Miscellaneous equipment

1. Miscellaneous equipments in the drilling system could include manual tongs, horizontal BOP transporter/skidders, power slips, power tongs, catwalk, mechanical mousehole and any other handling devices used to aid in the transfer of drilling tubulars and marine drilling riser between the rotary table and storage areas.
2. Major mechanical load-bearing components are to be in accordance with **603. 5**.
3. Hydraulic and pneumatic cylinders are to be in accordance with **Sec 8, 802**.
4. Horizontal BOP transporters are to be designed with consideration of loads, inertia, stability, pulling requirements, etc.
5. All tongs are to be capable of being securely attached to the derrick mast or back-up post and anchored by appropriate means such as a wire rope line or stiff arm that will have a breaking strength greater than the force exerted by the tongs.
6. Safety lines on tongs are to be positioned in such a manner that the tongs cannot rotate beyond anticipated limits.
7. Power tong pressure systems are to be equipped with safety relief valves that are to be set no higher than the maximum working pressure of the system.
8. Suitable NDE on all drill pipe handling and auxiliary equipment are to be carried out on a regular basis and records maintained for review by the attending Surveyors.
9. Electrical systems are to be in accordance with **Ch 6, Sec 1**.
10. Control systems are to be in accordance with **Ch 6, Sec 2**.
11. Piping systems are to be in accordance with **Ch 5**.
12. Materials are to be in accordance with **Ch 3, Sec 1**.
13. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.

## SECTION 7 Well Test System

### 701. General

1. Well test systems are the facilities installed on units for the purpose of evaluating the quality and/or quantity of the well fluid to determine whether the well is to be completed for production or plugged and abandoned.
2. Well test systems consist of well control equipment, process pressure vessels, piping and electrical components, control systems, burners and gas flares and burner/flare booms.
3. Systems mounted permanently for at least 30 months on the unit and are intended for extended tests or early production are also to comply with **Guidance for Floating Offshore Production Units**.
4. Temporary well test system (for less than 30 months), including burner booms, burners, well test equipment, process pressure vessels, piping, burners and gas flares, and control/safety systems are also to comply with the requirements of this Section.
5. In addition to the requirements of this Section, skid-mounted packaged equipment is to be in accordance with **Sec 10**.
6. Individual well test equipment and skid-mounted equipment structural interface with the drilling unit is to be verified for structural adequacy in accordance with the Rules.

### 702. Well test system

1. Well control equipment such as flowheads, test trees and emergency shut down valves are to be suitable for the intended pressure. Design and fabrication are to be in accordance with recognized standards such as API Spec 6A, API Spec 16C, API Spec 6D, and API Spec 6AV1.
2. Pressure-retaining equipment such as separators, heaters, treaters, nitrogen storage, surge and transfer tanks, etc., are to be in accordance with **Sec 8, 801**.
3. At least two (2) relief valves or the equivalent are to be provided on test separators. The relief valve vent lines are to be led outboard at least 120 pipe diameters or connected to a suitable hydrocarbon disposal facility in accordance with **703. 2**.
4. Well test oil/gas separators are to be in compliance with the requirements of API Spec 12J.
5. Piping systems are to be in accordance with **Ch 5**.
6. Materials are to be in accordance with **Ch 3, Sec 1**.
7. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
8. Flexible hoses are to be designed and constructed in accordance with **Ch 5, 204**.
9. Pumps handling hydrocarbon pumps are to be in compliance with the requirements of API Std. 610.
10. Control systems are to be in accordance with **Ch 6, Sec 2**.
11. Electrical components are to be certified for use for their intended service and classified areas as outlined in with **703. 5**. Electrical installations are to be in accordance with **Ch 6, Sec 1**.
12. The well test system burner/flare boom structure is to be in compliance with **703**.
13. Skid structures are to be in accordance with **Sec 10**.

### 703. Burner/Flare booms

#### 1. Design loads

- (1) The loads to be considered in the design of a boom structure are to include:
  - (A) Dead weight of structure, piping, fittings, rigging, snow and ice, walkways, guard rails, etc.
  - (B) Wind loads
  - (C) Thermal and impulsive loads resulting from the use of the flare

- (D) Vessel motion-induced loads
- (2) The values of all design loads are to be listed in the submitted design documentation.
- (3) Loads resulting from vessel motions and wind loads can be established using the procedures given in API Spec 4F.
- (4) The derivation of loading conditions to be used in the design is to give due account of the operational requirements of the Owner, and are to reflect both the operational and stowed modes of the boom.

## 2. Hydrocarbon disposal facilities

- (1) The sizing and design of the hydrocarbon disposal equipment (flare, flare tips, scrubber, piping, pump, atomization equipment, etc.) are to follow the principles of API Std. 521.
- (2) Two (2) flares are to be provided on opposite sides of the installation to dispose hydrocarbon in an appropriate downwind direction.
- (3) Flares and burner booms are to be arranged such that the incident heat on critical surfaces does not exceed 1500 BTU/hr/ft<sup>2</sup>.
- (4) In cases where crude oil is burned and atomization is used, atomization medium supply lines are to be provided with a non-return valve or some other approved means of preventing back-flow of hydrocarbon into nonhazardous piping systems.
- (5) Gas flare tip flow rate is generally not to exceed 0.5 Mach. (See API STD 521).

## 3. Surface safety systems

- (1) A system of automatic and manual controls together with shutdown and operating procedures are to be provided in accordance with the principles of API RP 14C with due consideration given to the normal manning during well test operations.
- (2) The following specific requirements are to be applied.
  - (A) Process system pressure, level and temperature are to be monitored.
  - (B) Gas detection is to be provided in process areas.
  - (C) Visual and audible alarms are to be set at 20% and 60% lower explosive limit and in the presence of H<sub>2</sub>S 10 PPM and 15 PPM.
  - (D) Fire-fighting equipment is to be adequate to water deluge process components with at least 10.2 ℓ per minute per square meter of component surface area.
  - (E) The arrangement of process components onboard is to allow for complete access to process controls and ingress for fire extinguishing agents.
  - (F) H<sub>2</sub>S gas detection systems are to be provided.
  - (G) Each well injection line is to be provided with a check valve located at a flowhead or test tree.

## 4. Hazardous areas

- (1) Hazardous areas are to be in accordance with **Ch 7** of the Rules and API RP 505.
- (2) Hazardous areas are to be in accordance with the following requirements.
  - (A) Hatches, companionways and ventilators within ten feet of classified areas are to be secured gas tight for the duration of the test program.
  - (B) Electrical equipment within classified areas is to be suitable for the hazard or de-energized.
  - (C) Areas around valves and ball and socket hammer unions are to be designated as Zone 2 for a distance of 1 m.
  - (D) Fired heaters and diesel driven machinery are to have air intakes located at least 3 m from any classified area.
  - (E) Exhausts are to be equipped with spark arresting devices and are to discharge outside classified areas.

## 5. Operational procedures are to be submitted to the Society and are to include the following.

- (1) Production test plan
- (2) Manning requirements
- (3) Equipment operations and testing procedures
- (4) Process startup and shutdown procedures
- (5) Fire-fighting procedures
- (6) Emergency evacuation procedures

## SECTION 8 Pressure-Retaining Equipment

### 801. Pressure vessels

1. The requirements in this article are to apply to accumulators, heat exchangers, pulsation dampeners, oil-gas separators, mud-gas separator, degasser.
2. Pressure vessels are to be designed, constructed, and tested in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1 or Div. 2. Alternative design codes and standards will be specially considered by the Society with justifications in accordance with **Ch 1, Sec 1, 103**.
3. Well test oil/gas separators are to be in accordance with the requirements of API Spec 12J.
4. Materials are to be in accordance with **Ch 3, Sec 1**.
5. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
6. The design is also to ensure that stresses due to acceleration forces arising out of the motion of the installation, stresses due to external nozzle loads and moments, and stresses due to any other applicable external forces, such as winds, are within the limits allowed by the design code.
7. All pressure vessels, accumulators, heat exchangers, and separators are to be suitably supported and properly secured to skid structure or rig floor.

### 802. Hydraulic cylinders

1. Design and manufacturing are to be based upon the strength criteria of the ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1 or Div. 2, National Fluid Power Association or other recognized standards.
2. Hydraulic cylinders that are part of overhead hoisting equipment are to be in accordance with **603.5**.
3. Materials are to be in accordance with **Ch 3, Sec 1**.
4. Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.

## SECTION 9 Prime Mover

### 901. Internal Combustion Engines

1. Engines and their installations are to be in accordance with NFPA Std. No. 37.
2. The recommended service applications together with curves showing the recommended maximum standard brake horsepower within the recommended speed range for each service are to be submitted.
3. Testing is to be performed under an approved quality assurance program or in the presence of the Surveyor.

### 902. Electrical prime mover

1. All rotating machines (if any) 100 kW and above are to be of drawing approval and tested in the presence of and inspected by the Surveyor at the plant of the manufacturer.
2. For machines of less than 100 kW, the tests may be carried out by the manufacturer under the attendance of the Surveyor and whose certificate of tests may be acceptable.

## SECTION 10 Skid Mounted Equipment

### 1001. General

1. A typical list of skid-mounted equipment operations includes the following.
  - (1) Utilities and instrument air
  - (2) Sea water
  - (3) Chemical injection
  - (4) Pressure Wash
  - (5) Nitrogen generation and charging
  - (6) Cementing skid
  - (7) Hydraulics/Pneumatic pumping units
  - (8) Well test equipment
  - (9) Other temporary equipment
2. Skid mounted equipment are to comply with the following requirements.
  - (1) Pressure retaining equipments are to be in accordance with **Sec 8**.
  - (2) Piping systems are to be in accordance with **Ch 5**.
  - (3) Materials are to be in accordance with **Ch 3, Sec 1**.
  - (4) Welding and non-destructive examination are to be in accordance with **Ch 3, Sec 2**.
  - (5) Electrical systems are to be in accordance with **Ch 6, Sec 1**.
  - (6) Control systems are to be in accordance with **Ch 6, Sec 2**.

### 1002. Skid structures

1. Skid structures for drilling system equipment packaged units are to be sufficiently rigid to support the mounted equipment and piping and, as required, to permit lifting during shipment without damage to the equipment or piping.
2. Structural design calculations for skid units with a center of gravity height of more than 1.5 m, or a maximum operating weight in excess of 10 tons calculated in dry conditions, are to be submitted to the Society.
3. Lifting attachment and/or pad eyes, including the attachment to the skid structure are to be designed in accordance with the requirements of API RP 2A WSD and **Pt 9, Ch 2, Sec 9 of Rules for the Classification of Steel Ships**.
4. Load testing of the lifting attachment and/or pad eyes, including the attachment to the skid structure is to be performed in accordance with **Ch 3, 203**.

### 1003. Drip pans

1. Drip pans are to be provided to contain liquid spills and leaks from skid-mounted equipment and piping, and to drain the liquid with adequate slope into open drain systems.
2. A minimum 150 mm coaming around the entire perimeter of a skid is to be provided.
3. Spill containment with less than 150 mm coaming arrangement is subject to special consideration.
4. Calculations showing sufficient spillage containment for the skid are to be submitted for verification.
5. Skid beams that extend above the drip pan may be considered as meeting the coaming requirement, provided that the drip pan is seal-welded to the skid beams. ↓



## CHAPTER 5 PIPING SYSTEMS

### SECTION 1 General

#### 101. General

1. The requirements of this Chapter apply to piping systems and/or associated components that form part of the drilling systems, as follows:
  - (1) Blowout preventer control and closing unit
  - (2) Choke and kill
  - (3) Diverter
  - (4) Well circulation
  - (5) Bulk mud and cement
  - (6) Well test
  - (7) Vent system
  - (8) Hydraulic piping
2. Unless expressly specified otherwise, piping systems, **Ch 5, 203.** of the Rules is to be complied with.
3. The manufacturer is to submit to the Society for approval P&IDs, piping specifications, design plans and data, and calculations for each piping system associated with the drilling systems listed in **Par 1.**
4. Pressure-temperature ratings of valves and pipe fittings are to be in compliance with ASME B31.3, Chapter II, Paragraph 302.2 or recognized national or international standards.
5. In addition to the requirements of **Par 2 to Par 4,** individual subsystems used for drilling systems are to be complied with the specific requirements contained in **Ch 4.**

### SECTION 2 Design Criteria

#### 201. Piping systems

1. Piping and piping components are to be designed to withstand the maximum stress that could arise from the most severe combination of pressure, temperature, and other loads or service conditions as referenced in **Par 6.**
2. The minimum design wall thickness of pipes is to be in accordance with the followings.
  - (1) Wall thickness of pipes for ordinary piping having pressure not in excess of that allowed by ASME B16.5 PN 420(Class 2500) is to be calculated according to ASME B31.3, Chapter II, paragraph 304.
  - (2) Wall thickness of pipes for high pressure piping having pressure in excess of that allowed by ASME B16.5 PN 420(Class 2500)) is to be calculated according to ASME B31.3, Chapter IX, paragraph K304.
  - (3) In addition to Subparagraph (1) and (2), recognized national or international standards may be complied with.
3. Pipe stress and flexibility analysis are to be performed in accordance with ASME B31.3 or recognized national or international standards for all applicable service conditions for the following piping systems.
  - (1) Choke and kill system
  - (2) High-pressure mud and cement system
  - (3) Main hoisting system (hydraulic)
  - (4) Well test piping system (permanent)
4. Expansion joints are not to be used in high-pressure well control piping systems.
5. When used, expansion joints or bellows in piping systems are to be provided with shields to pre-

vent mechanical damage and are to be properly aligned and secured.

6. The piping design is to account for, relative to the fluid being transported, internal and external pressures, transient vibrational stresses, fluid velocity and associated erosional effects, hydraulic hammer, transient temperature excursions, outside imposed impact forces and pressure pulsations, and low temperature service considerations, as applicable.
7. The design wall thickness of all piping is to account for the following allowances.
  - (1) Mill under-tolerances (12.5% of nominal piping thickness)
  - (2) Allowances for threads. The nominal thread depth (dimension h of ASME B1.20.1 or equivalent) is to be applied. For machined surface or grooves where the tolerance is not specified, the tolerance is to be assumed to be 0.5 mm in addition to specified depth of the cut.
  - (3) Corrosion allowance. 3 mm is to be applied for mud or cement piping.

#### 8. Alternative criteria

- (1) The Society is prepared to consider other applicable design references, alternative design methodology and industry practice for piping system and piping component designs, on a case-by-case basis, with justifications through novel features as indicated **Ch 1, Sec 1, 103**.
- (2) Piping components whose dimensions are not specified by recognized standards, design details including dimensional drawings, stress calculations and material data are to be submitted to the Society for approval.
- (3) The extent of nondestructive examination tests, service temperatures, material ductility and special fabrication methods are also to be considered for alternative design criteria.

## 202. Type of connections

### 1. General

- (1) Piping and connections with outside diameter of 51 mm and above are to be made by butt-weld, flanged or screwed union.
- (2) Connections for smaller piping sizes than 51 mm and not intended for corrosive fluids can be welded or screwed and seal welded.
- (3) For piping system rated at 20.7 MPa (3000 psi) or above, such as high-pressure mud system, choke and kill system, cement system or well test system, threaded connections are not to be used.

### 2. Socket welds

- (1) All socket-welding connections are to be identified and specially approved by the Society.
- (2) Socket-welding of piping connections intended for corrosive services is not to be used.

### 3. Threaded connections

- (1) Threaded connections are only to be used for instrumentation, vents, drains, or similar purposes and are not to be greater than 12.4 mm.
- (2) Threaded connections are not to be used in systems subjected to bending or vibrational loads.
- (3) Flared or other approved screwed connectors by the Society may be used in higher-pressure service.
- (4) All screwed connections are to be evaluated, considering the following.
  - (A) Pipe outer diameter and thread allowance
  - (B) Fluid type, corrosion and fluid leakage risk
  - (C) High level of vibration, pressure pulse

### 4. Quick connect fittings

Hammer lock, hammer union or other quick connect type specialty fittings are to have a rated pressure not less than the pipe system design pressure and are to conform to applicable piping codes or alternative standards.

## 203. Flexible hoses

1. Typical uses for flexible hoses and hydraulic hoses within the well control and drilling system are:
  - (1) Rotary and vibratory hoses
  - (2) Cementing hoses
  - (3) Riser choke and kill flexible hoses, drape hoses, and jumper hoses

- (4) Hydraulic hoses for control functions, fluid power and hydraulic fluid transfers
- (5) Hydrocarbon hoses for well testing

## 2. Flexible hoses for rotary and vibratory

- (1) Rotary and vibratory hoses for drilling services are to comply with the design, and manufactured in API Spec 7K, and the additional requirements specified in this Annex, and to be suitable for their intended service
- (2) For rotary and vibratory hoses, design verification/prototype testing are to be performed in accordance with Clause 5 of API Spec 7K.

## 3. Flexible hoses for Choke and kill

- (1) Choke, kill and auxiliary flexible hose (drapes and jumpers) are to comply with the design, material, quality control, and prototype testing requirements specified in API Spec 16C, API Spec 16F, and the additional requirements specified in this Annex.
- (2) Drape hoses at the telescopic joint are to be able to accommodate the relative movement between the riser and the drilling unit.
- (3) Jumper hoses for flex/ball joints are to be able to accommodate the relative movement between the riser and the BOP stack.
- (4) Flexible hoses for subsea services are to be designed to withstand the external pressure for the operational depth without deforming.

## 4. Hydraulic hoses for control

- (1) Hydraulic hoses utilized for well control functions are to comply with the requirements of **Annex 5–9 of Rules for the Classification of Steel Ships**, API Spec 16D and recognized industry standards.
- (2) Hydraulic hoses utilized for drilling system control and hydraulic fluid transfer are to comply with the requirements of **Annex 5–9 of Rules for the Classification of Steel Ships** or recognized industry standards.

## 5. Gas decompression is to be considered for all flexible lines and hoses being used for conditions where gases or vapor can be present at pressure.

## 6. Fire resistance

- (1) Flexible lines/hydraulic hoses used for well control and are above the water line are to be fire-resistant.
- (2) All flexible lines located in hazardous areas, irrespective of fluid category, are to be fire-resistant.
- (3) Flammable fluids are classified as follows.
  - (A) Any fluid, regardless of its flash point, able to support a flame.
  - (B) Fuel oil, lubricating oil, and hydraulic oil (unless the hydraulic oil is specifically specified as nonflammable).
- (4) Flexible lines/hydraulic hoses located subsea are not required to be fire-resistant.
- (5) Fire resistance tests of flexible lines/hydraulic hoses are to be in accordance with API Spec 16C and API Spec 16D.

## 7. End connections for flexible lines are to be designed and fabricated to the requirements of **201**, and applicable recognized codes and standards.

## 8. Isolation valves are to be provided to prevent potential uncontrolled release of flowing medium from flexible lines to minimize the hazard.

## 9. Material requirements for flexible hoses, including end fittings when exposed to wellbore fluids or a corrosive/erosive environment, are to be in accordance with **Ch 3, Sec 1** and applicable design codes and standards.

## 10. Nonmetallic materials used in the manufacturing of flexible line and/or hydraulic hose assemblies are to be suitable for the intended service conditions such as temperature and fluid compatibility.

## 11. Flexible hoses are to be accessible for on-site inspection.

## 12. Flexible hoses are to be type approved by the Society.

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## SECTION 3 Materials, Welding and Nondestructive Examination

### 301. Materials

Materials are to be in accordance with the applicable design codes and standards and **Ch 3, Sec 1**. Composite materials where used in drilling piping system applications are to be of fire resistant construction and are to be designed and tested to ASME Boiler and Pressure Vessel Code, Section X.

### 302. welding and nondestructive examination

Welding and NDE are to be in accordance with the applicable design codes and standards and the requirements of **Ch 3, Sec 2**. ↓

## CHAPTER 6 ELECTRICAL EQUIPMENT AND CONTROL SYSTEM

### SECTION 1 Electrical Equipment

#### 101. General

1. Electrical systems and equipment are to comply with the Rules and API RP 14FZ.
2. Compliance with industry standards, such as the following, will be specially considered.
  - (1) API RP 2003
  - (2) IEEE Std. 242
  - (3) IEEE C37.06.1
  - (4) IEEE C37.20.6
  - (5) IEEE Std. 45
  - (6) IEEE Std. 142
  - (7) NFPA 70
  - (8) NFPA 496
  - (9) API RP 500
  - (10) API RP 505
3. The Society is prepared to consider other industry standards and practices for electrical equipment, on a case-by-case basis, with justifications through novel features and comparative analyses to be provided to demonstrate equivalent level of safety to the recognized standards as listed in this Annex, performed in accordance with **Ch 1, Sec 1, 103**.
4. All electrical components are to be designed to meet safe operating conditions by accounting for maximum and minimum temperatures and vibrations expected during service.
5. Electrical equipment installed in a hazardous area is to be tested in works having the adequate apparatus for testing and inspection and to be type approved by the Society.

### SECTION 2 Control Systems

#### 201. General

1. The following requirements are to apply to well control systems, drilling systems and control systems.
  - (1) The control system (hydraulic, pneumatic, electric, electro-hydraulic, acoustic, etc.) is to be designed where no single control system component failure is to lead to a failure of the controlled system or loss of control.
  - (2) Transfer between control stations is to comply with the following requirements.
    - (A) Transfer between control stations only applies to drilling control systems and does not apply to BOP, EDS, choke and kill, and diverter control systems.
    - (B) Transfers between control stations are to comply with the following.
      - (a) When control of the system or equipment is possible from more than one control location, control is to be possible only from one control location at a time.
      - (b) Clear method to transfer control between stations is to be provided.
      - (c) At each control location, there is to be an indicator showing which location is in control.
  - (3) Maximum control system voltages: 250 VAC 50 Hz or 60 Hz or *d.c.* voltage is to be the highest voltage in any of the control system panels.
  - (4) All safety functions are to be provided with visual and audible indicators.

#### 2. Logic circuit features

- (1) Logic circuit is to comply with the following principles:
  - (A) When logic circuits are used for sequential startup or for operating individual components, indicators are to be provided at the control console to show the successful completion of the sequence of operations by the logic circuit and start-up and operation of the component.

If some particular step is not carried out during the sequence, the sequence is to stop at this point.

- (B) Manual override is to be fitted in vital functions to permit control in the case of failure of a logic circuit.

## 202. Control systems for well control equipment

1. Control systems for well control include the BOP, EDS, choke and kill and diverter control systems. These control systems are to comply with the following requirements:
  - (1) The control system (hydraulic, pneumatic, electric, electro-hydraulic, acoustic, etc.) is to be designed where no single control system component failure is to lead to a failure of the controlled system, loss of control or loss of well control.
  - (2) The control system and components are to be in compliance with API Spec 16C, API Spec 16D and with applicable recommended practices such as API RP 53, API RP 59, and API RP 64.
  - (3) **Ch 4, 202. 3, 203. 9 and 204. 5** are to apply to control system requirements for individual well control systems and/or equipment.
  - (4) FMEA, FMECA or similar analysis is also to be conducted to determine compliance with (1) to (3) and **Ch 4, Sec 2**.

## 203. Electrical Control Systems and Computer-Based Systems

### 1. Electrical control systems

- (1) Electrical control systems are to comply with **Pt 6, Ch 2, 204. 4 of Rules for the Classification of Steel Ships**.
- (2) In addition, electrical control systems are to comply with **204**.

### 2. Computer-based Systems

- (1) Computer-based systems are to comply with **Pt 6, Ch 2, 201. 7**.
- (2) In addition, computer-based systems are to comply with the following.
  - (A) **Fail Safe** Computer-based systems are to be designed such that any of the system's components will not cause unsafe operation of the system or equipment being controlled.
  - (B) **Failure Modes and Effects Analysis (FMEA)** An FMEA is to be used to determine that any component failure will not result in the complete loss of control, the shutdown of the system or equipment being controlled, or other unsafe situation.
  - (C) **Failure Mode, Effects and Criticality Analysis (FMECA)** An FMECA is an extension of the FMEA to include a criticality analysis that is used to identify the probability of failure modes against the severity of their consequences.
  - (D) **Safety Integrity**
    - (a) When computer-based systems have safety-related control functions and the associated failure modes identified in the FMEA/FMECA result in an undesirable situation, special consideration may be given, provided the appropriate level of safety integrity has been provided.
    - (b) The appropriate level is to be determined by the application of recognized industry standard, such as the IEC 61508 Series or the ANSI/ISA 84 Series.
    - (c) Documentation in accordance with the relevant industry standard is to be submitted for review to justify the appropriate safety integrity levels.

## 204. Safety systems

1. Means are to be provided to indicate the cause of the safety action.
2. Alarms are to be given at each control location, including any local manual control positions, upon the activation of a safety system.
3. Drilling systems or equipment shutdown by a safety system is to be designed not to restart automatically, unless first actuated by a manual reset.
4. Systems are to have the following:
  - (1) Redundant processor, memory, and networks

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- (2) Local and remote I/O modules are to fail in a predetermined fashion when there is loss of communications with the CPU.
  - (3) Input and Output points are to be diagnostic type, where the program will read the diagnostic status of the I/O and perform safe actions. The program is to notify the operator if a point fails.
  5. All shutdowns are to be executed in a predetermined logical manner, as specified in the "Shutdown Logic", and are to indicate or execute actions to:
    - (1) Limit the severity of the incident
    - (2) Protect personnel
    - (3) Limit environmental impact
    - (4) Escape, muster, and evacuation process
  6. Shutdown is not to result in adverse cascade effects, which result from activation of other protection devices to maintain the facility in a safe condition.
  7. The shutdown systems are to be designed to provide that any ongoing operations can be terminated safely when a shutdown is activated.
  8. Adequate measure is to be provided to prevent accidental unlatching of the wellhead connector, emergency disconnect, and LMRP, such as two-hand function, two-step action, protective cover or equivalent.
  9. Control panels are to be clearly labeled. ↓

## Annex 2 Technical Provisions of Means of Access

### 101. General

1. In application of **Ch 3, Sec 2** of the Rules, the details follow this Annex.
2. In the context of the above requirement, the deviation shall be applied only to distances between integrated PMA that are the subject of paragraph 2.1.2 of **Table 1**.

Deviations should not be applied to the distances governing the installation of underdeck longitudinal walkways and dimensions that determine whether permanent access are required or not, such as height of the spaces and height to elements of the structure (e.g. cross-ties).

### 102. Definitions

1. Rung means the step of a vertical ladder or step on the vertical surface.
2. Tread means the step of an inclined ladder or step for the vertical access opening.
3. Flight of an inclined ladder means the actual stringer length of an inclined ladder. For vertical ladders, it is the distance between the platforms.
4. Stringer means:
  - (1) the frame of a ladder; or
  - (2) the stiffened horizontal plating structure fitted on the side shell, transverse bulkheads and/or longitudinal bulkheads in the space. For the purpose of ballast tanks of less than 5 m width, the horizontal plating structure is credited as a stringer and a longitudinal permanent means of access, if it provides a continuous passage of 600 mm or more in width past frames or stiffeners on the side shell or longitudinal or transverse bulkhead. Openings in stringer plating utilized as permanent means of access shall be arranged with guard rails or grid covers to provide safe passage on the stringer or safe access to each transverse web.
5. Vertical ladder means a ladder of which the inclined angle is 70° and over up to 90°. A vertical ladder shall not be skewed by more than 2°.
6. Overhead obstructions mean the deck or stringer structure including stiffeners above the means of access.
7. Distance below deck head means the distance below the plating.
8. Cross deck means the transverse area of the main deck which is located inboard and at both sides of a transverse bulkhead. Between large hatches/holds or between moonpool opening and hatches/holds of a drillship or column stabilized unit.
9. Hold means any dry space other than a machinery space located within the hull of surface units and self-elevating units or within the upper hull, columns or pontoons of column-stabilized units. Dry storage spaces and void spaces are considered holds.

### 103. Technical provisions

1. Structural members subject to the close-up inspections and thickness measurements of the MODU's structure referred to in **Ch 3, Sec 2** of the Rules, except those in double bottom spaces, shall be provided with a permanent means of access to the extent as specified in **Table 1**. Approved alternative methods may be used in combination with the fitted permanent means of access, provided that the structure allows for its safe and effective use.

In application of this paragraph, the permanent means of access to a space can be credited for the permanent means of access for inspection.

2. Permanent means of access should as far as possible be integral to the structure of the MODU, thus ensuring that they are robust and at the same time contributing to the overall strength of the structure of the MODU.
3. Elevated passageways forming sections of a permanent means of access, where fitted, shall have a minimum clear width of 600 mm, except for going around vertical webs where the minimum clear



width may be reduced to 450 mm, and have guard rails over the open side of their entire length. Sloping structures providing part of the access shall be of a non-skid construction. Guard rails shall be 1,000 mm in height and consist of a rail and an intermediate bar 500 mm in height and of substantial construction. Stanchions shall be not more than 3 m apart.

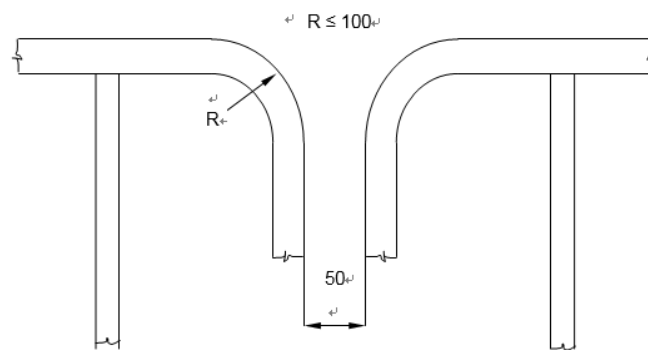
In application of this paragraph, the details are as follows.

- (1) Sloping structures are structures that are sloped by 5 or more degrees from horizontal plane when a unit is in upright position at even-keel.
- (2) Guard rails are to be fitted on the open side. For stand alone passageways guard rails are to be fitted on both sides of these structures.
- (3) Discontinuous top handrails are allowed, provided the gap does not exceed 50 mm. The same maximum gap is to be considered between the top handrail and other structural members (i.e. bulkhead, web frame, etc.).

The maximum distance between the adjacent stanchions across the handrail gaps is to be 350 mm where the top and mid handrails are not connected together and 550 mm when they are connected together.

The maximum distance between the stanchion and other structural members is not to exceed 200 mm where the top and mid handrails are not connected together and 300 mm when they are connected together.

When the top and mid handrails are connected by a bent rail, the outside radius of the bent part is not to exceed 100 mm (see Figure below).



- (4) Non-skid construction is such that the surface on which personnel walks provides sufficient friction to the sole of boots even if the surface is wet and covered with thin sediment.
  - (5) “Substantial construction” is taken to refer to the designed strength as well as the residual strength during the service life of the unit. Durability of passageways together with guard rails is to be ensured by the initial corrosion protection and inspection and maintenance during services.
  - (6) For guard rails, use of alternative materials such as GRP is to be subject to compatibility with the liquid carried in the tank. Non-fire resistant materials are not to be used for means of access to a space with a view to securing an escape route at a high temperature.
  - (7) Requirements for resting platforms placed between ladders are equivalent to those applicable to elevated passageways.
4. Access to permanent means of access and vertical openings from the MODU’s bottom shall be provided by means of easily accessible passageways, ladders or treads. Treads shall be provided with lateral support for the foot. Where the rungs of ladders are fitted against a vertical surface, the distance from the centre of the rungs to the surface shall be at least 150 mm. Where vertical manholes are fitted higher than 600 mm above the walking level, access shall be facilitated by means of treads and hand grips with platform landings on both sides.

In application of this paragraph, where the vertical manhole is at a height of more than 600 mm above the walking level, it shall be demonstrated that an injured person can be easily evacuated.

5. Permanent inclined ladders shall be inclined at an angle of less than 70°. There shall be no obstructions within 750 mm of the face of the inclined ladder, except that in way of an opening this clearance may be reduced to 600 mm. Resting platforms of adequate dimensions shall be provided,

normally at a maximum of 6 m vertical height. Ladders and handrails shall be constructed of steel or equivalent material of adequate strength and stiffness and securely attached to the structure by stays. The method of support and length of stay shall be such that vibration is reduced to a practical minimum. In holds, ladders shall be designed and arranged so that stores handling difficulties are not increased and the risk of damage from stores handling gear is minimized.

In application of this paragraph, the details are as follows.

- (1) MA for access to ballast tanks and other tanks:
  - (A) Tanks and subdivisions of tanks having a length of 35 m or more with two access hatchways:
    - (a) First access hatchway: Inclined ladder or ladders are to be used.
    - (b) Second access hatchway:
      - (i) A vertical ladder may be used. In such a case where the vertical distance is more than 6 m, vertical ladders are to comprise one or more ladder linking platforms spaced not more than 6 m apart vertically and displaced to one side of the ladder. The uppermost section of the vertical ladder, measured clear of the overhead obstructions in way of the tank entrance, is not to be less than 2.5 m but not exceed 3.0 m and is to comprise a ladder linking platform which is to be displaced to one side of a vertical ladder. However, the vertical distance of the upper most section of the vertical ladder may be reduced to 1.6 m, measured clear of the overhead obstructions in way of the tank entrance, if the ladder lands on a longitudinal or athwartship permanent means of access fitted within that range; or
      - (ii) Where an inclined ladder or combination of ladders is used for access to the space, the uppermost section of the ladder, measured clear of the overhead obstructions in way of the tank entrance, is to be vertical for not less than 2.5 m but not exceed 3.0m and is to comprise a landing platform continuing with an inclined ladder. However, the vertical distance of the upper most section of the vertical ladder may be reduced to 1.6 m, measured clear of the overhead obstructions in way of the tank entrance, if the ladder lands on a longitudinal or athwartship permanent means of access fitted within that range. The flights of the inclined ladders are normally to be not more than 6 m in vertical height. The lowermost section of the ladders may be vertical for the vertical distance not exceeding 2.5 m.
  - (B) Tanks less than 35 m in length and served by one access hatchway an inclined ladder or combination of ladders are to be used to the space as specified in (1) (ii) above.
  - (C) In double hull spaces of less than 2.5 m width the access to the space may be by means of vertical ladders that comprises one or more ladder linking platforms spaced not more than 6 m apart vertically and displaced to one side of the ladder. The uppermost section of the vertical ladder, measured clear of the overhead obstructions in way of the tank entrance, is not to be less than 2.5 m but not exceed 3.0m and is to comprise a ladder linking platform which is to be displaced to one side of a vertical ladder. However, the vertical distance of the upper most section of the vertical ladder may be reduced to 1.6 m, measured clear of the overhead obstructions in way of the tank entrance, if the ladder lands on a longitudinal athwartship permanent means of access fitted within that range. Adjacent sections of the ladder are to be laterally offset from each other by at least the width of the ladder (see paragraph 20 of MSC/Circ.686).
  - (D) Access from deck to a double bottom space may be by means of vertical ladders through a trunk. The vertical distance from deck to a resting platform, between resting platforms or a resting platform and the tank bottom is not to be more than 6 m unless otherwise approved by the Society.
- (2) MA for inspection of the vertical structure:
 

Vertical ladders provided for means of access to the space may be used for access for inspection of the vertical structure.

Unless stated otherwise in Table 1, vertical ladders that are fitted on vertical structures for inspection are to comprise one or more ladder linking platforms spaced not more than 6 m apart vertically and displace to one side of the ladder. Adjacent sections of ladder are to be laterally offset from each other by at least the width of the ladder (paragraph 20 of MSC/Circ.686).
- (3) Obstruction distances
 

The minimum distance between the inclined ladder face and obstructions, i.e. 750 mm and, in way of openings, 600 mm specified in paragraph 5 is to be measured perpendicular to the face of the ladder.

6. The width of inclined ladders between stringers shall not be less than 400 mm. The treads shall be equally spaced at a distance apart, measured vertically, of between 200 mm and 300 mm. When steel is used, the treads shall be formed of two square bars of not less than 22 mm by 22 mm in section, fitted to form a horizontal step with the edges pointing upward. The treads shall be carried through the side stringers and attached thereto by double continuous welding. All inclined ladders shall be provided with handrails of substantial construction on both sides, fitted at a convenient distance above the treads.

In application of this paragraph, the details are as follows.

- (1) Vertical height of handrails is not to be less than 890 mm from the centre of the step and two course handrails are to be provided.
  - (2) The requirement of two square bars for treads specified in this paragraph, is based upon the specification of construction of ladders in paragraph 3(e) of Annex 1 to resolution A. 272(VIII), which addresses inclined ladders. In application of paragraph 4, allows for single rungs fitted to vertical surfaces, which is considered for a safe grip. For vertical ladders, when steel is used, the rungs are to be formed of single square bars of not less than 22 mm by 22 mm for the sake of safe grip.
  - (3) The width of inclined ladders for access to a hold is to be at least 450 mm to comply with the Australian AMSA Marine Orders Part 32, Appendix 17.
  - (4) The width of inclined ladders other than an access to a hold is to be not less than 400 mm.
  - (5) The minimum width of vertical ladders is to be 350 mm and the vertical distance between the rungs is to be equal and is to be between 250 mm and 350 mm.
  - (6) A minimum climbing clearance in width is to be 600 mm other than the ladders placed between the hold frames.
  - (7) The vertical ladders are to be secured at intervals not exceeding 2.5 m apart to prevent vibration.
7. For vertical ladders or spiral ladders, the width and construction should be in accordance with international or national standards accepted by the Society.
8. No free-standing portable ladder shall be more than 5 m long.
9. Alternative means of access include, but are not limited to, such devices as:
- (1) hydraulic arm fitted with a stable base;
  - (2) wire lift platform;
  - (3) staging;
  - (4) rafting;
  - (5) robot arm or remotely operated vehicle (ROV);
  - (6) portable ladders more than 5 m long shall only be utilized if fitted with a mechanical device to secure the upper end of the ladder;  
A mechanical device such as hooks for securing at the upper end of a ladder is to be considered as an appropriate securing device if a movement fore/aft and sideways can be prevented at the upper end of the ladder.
  - (7) other means of access, approved by and acceptable to the Society. Means for safe operation and rigging of such equipment to and from and within the spaces shall be clearly described in the MODU's Structure Access Manual.
10. For access through horizontal openings, hatches or manholes, the dimensions shall 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 shall 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 shall be placed as close as possible to the deck or hatch coaming. Access hatch coamings having a height greater than 900 mm shall also have steps on the outside in conjunction with the ladder. In application of this paragraph, the details refer to **Ch 3, 204. 1** of the Guidances.
11. 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 clear opening shall be not less than 600 mm x 800 mm at a height of not more than 600 mm from the passage bottom plating unless gratings or other foot holds are provided.

In application of this paragraph, the details refer to **Ch 3, 204. 2** of the Guidances.

12. The Society may approve, in special circumstances, smaller dimensions for the openings referred to in paragraphs 10 and 11, if the ability to traverse such openings or to remove an injured person can be proved to the satisfaction of the Society.

13. Access ladders to large holds and other similar spaces shall be:

- (1) Where the vertical distance between the upper surface of adjacent decks or between deck and the bottom of the hold is not more than 6 m, either a vertical ladder or an inclined ladder. Either a vertical or an inclined ladder or a combination of them may be used for access to a large hold where the vertical distance is 6 m or less from the deck to the bottom of the hold.
- (2) Where the vertical distance between the upper surface of adjacent decks or between deck and the bottom of the hold is more than 6 m, an inclined ladder or series of inclined ladders at one end of the hold, except the uppermost 2.5 m of a hold measured clear of overhead obstructions and the lowest 6 m may have vertical ladders, provided that the vertical extent of the inclined ladder or ladders connecting the vertical ladders is not less than 2.5 m. The second means of access at the other end of the hold may be formed of a series of staggered vertical ladders, which should comprise of one or more ladder linking platforms spaced not more than 6 m apart vertically and displaced to one side of the ladder. Adjacent sections of ladder should be laterally offset from each other by at least the width of the ladder. The uppermost entrance section of the ladder directly exposed to a hold should be vertical for a distance of 2.5 m measured clear of overhead obstructions and connected to a ladder-linking platform.

\* Adjacent sections of vertical ladder need to be installed so that the following provisions are complied with (refer to figure 1 and figure 2):

- The minimum "lateral offset" between two adjacent sections of vertical ladder, is the distance between the sections, upper and lower, so that the adjacent stringers are spaced of at least 200 mm, measured from half thickness of each stringer.
- Adjacent sections of vertical ladder shall be installed so that the upper end of the lower section is vertically overlapped, in respect to the lower end of the upper section, to a height of 1500 mm in order to permit a safe transfer between ladders.
- No section of the access ladder shall be terminated directly or partly above an access opening.

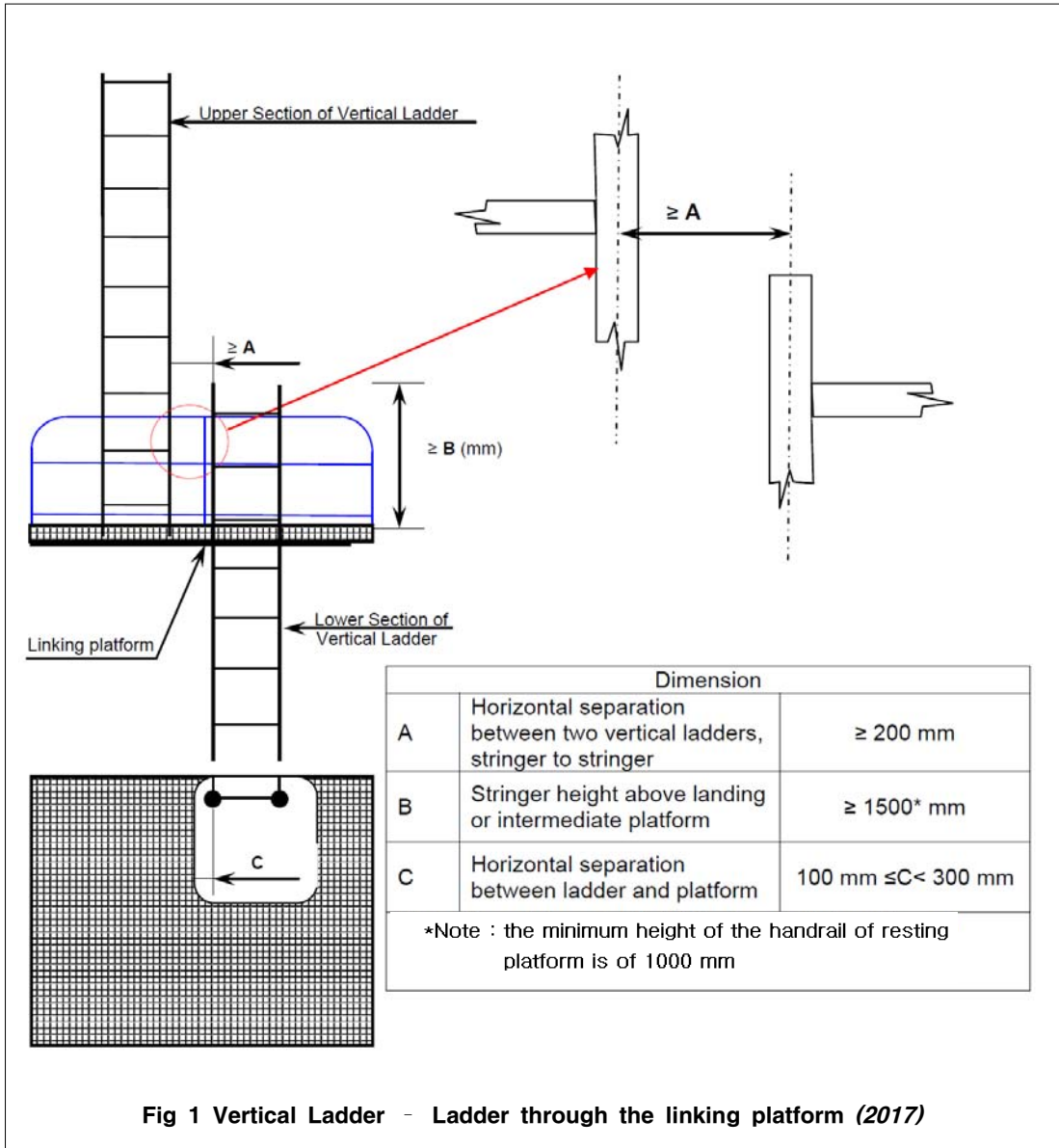


Fig 1 Vertical Ladder - Ladder through the linking platform (2017)

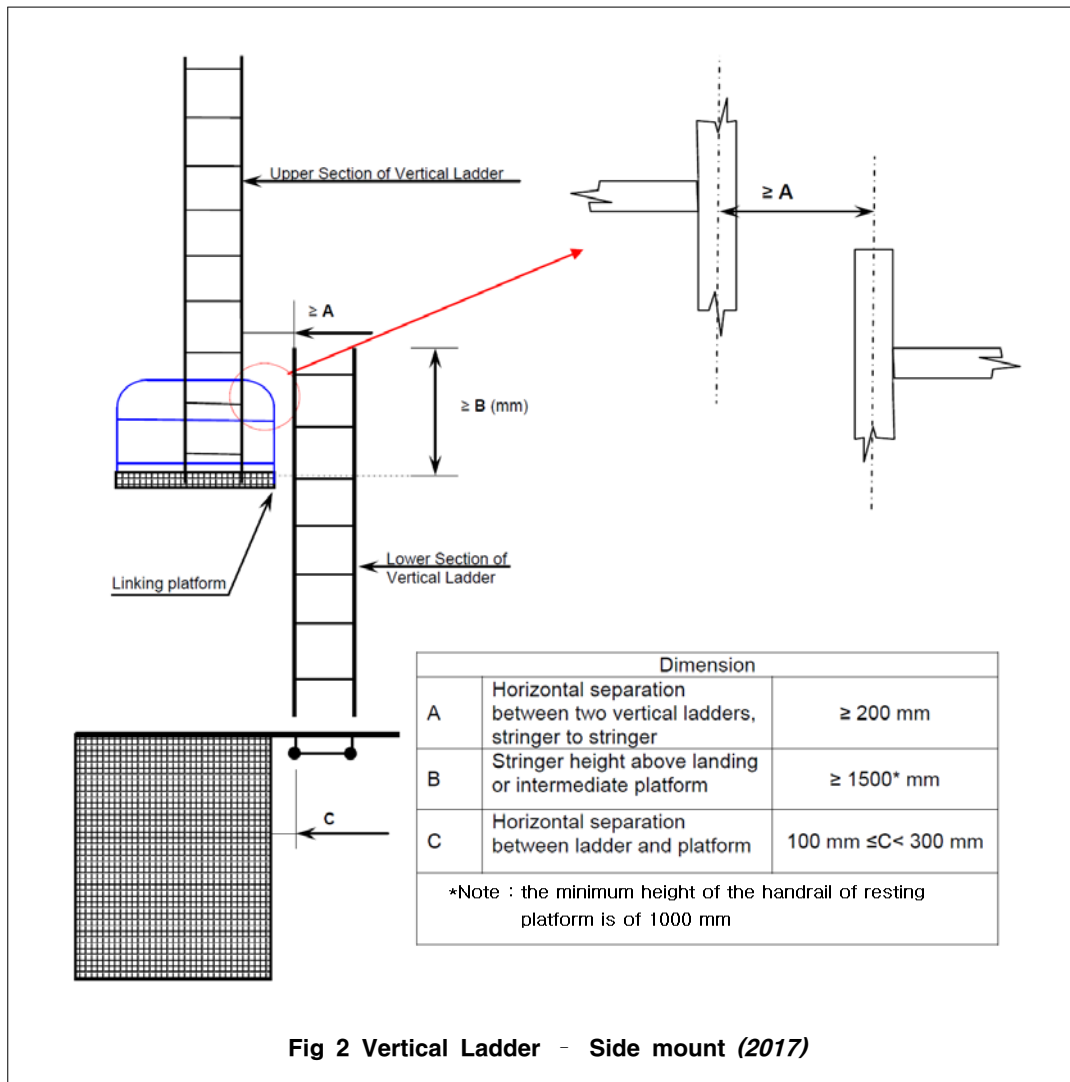


Fig 2 Vertical Ladder - Side mount (2017)

- (3) A vertical ladder may be used as a means of access from a deck to a tank or space below, where the vertical distance is 6 m or less between the deck and the longitudinal means of access in the tank or the stringer or the bottom of the space immediately below the entrance. The uppermost entrance section from deck of the vertical ladder of the tank should be vertical for a distance of 2.5 m measured clear of overhead obstructions and comprise a ladder linking platform, unless landing on the longitudinal means of access, the stringer or the bottom within the vertical distance, displaced to one side of a vertical ladder.
- (4) Unless allowed in .3 above, an inclined ladder or combination of ladders should be used for access to a tank or a space where the vertical distance is greater than 6 m between the deck and a stringer immediately below the entrance, between stringers, or between the deck or a stringer and the bottom of the space immediately below the entrance.
- (5) In case of .4 above, the uppermost entrance section from deck of the ladder should be vertical for a distance of 2.5 m clear of overhead obstructions and connected to a landing platform and continued with an inclined ladder. The flights of inclined ladders should not be more than 9 m in actual length and the vertical height should not normally be more than 6 m. The lowermost section of the ladders may be vertical for a distance of not less than 2.5 m.
- (6) In narrow spaces of less than 2.5 m width, the access to the space may be by means of vertical ladders that comprise of one or more ladder linking platforms spaced not more than 6 m apart vertically and displaced to one side of the ladder. Adjacent sections of ladder should be laterally offset from each other by at least the width of the ladder.
- (7) A spiral ladder is considered acceptable as an alternative for inclined ladders. In this regard, the uppermost 2.5 m can continue to be comprised of the spiral ladder and need not change over to vertical ladders.

14. The uppermost entrance section from deck of the vertical ladder providing access to a tank should be vertical for a distance of 2.5 m measured clear of overhead obstructions and comprise a ladder linking platform, displaced to one side of a vertical ladder. The vertical ladder can be between 1.6 m and 3 m below deck structure if it lands on a longitudinal or athwartship permanent means of access fitted within that range. In this paragraph, deck is defined as “weather deck”. ↓

Table 1 Means of access

1. Water ballast tanks, except those specified in the right column, and other tanks	2. Water ballast tanks of less than 5m width
<b>access to the underdeck and vertical structure</b>	
1.1 For tanks of which the height is 6 m and over containing internal structures, permanent means of access shall be provided in accordance with .1 to .6:	2.1 For water ballast tanks of less than 5 m width (including double side spaces above the upper knuckle point of the bilge hopper sections in surface units), permanent means of access are to be provided in accordance with .1 to .3:
.1 continuous athwartship permanent access arranged at each transverse bulkhead on the stiffened surface, at a minimum of 1.6 m to a maximum of 3 m below the deck head;	.1 where the vertical distance between horizontal uppermost stringer and deck head is 6 m or more, one continuous longitudinal permanent means of access shall be provided for the full length of the tank with a means to allow passing through transverse webs installed at a minimum of 1.6 m to a maximum of 3 m below the deck head with a vertical access ladder at each end of the tank;
.2 at least one continuous longitudinal permanent means of access at each side of the tank. One of these accesses shall be at a minimum of 1.6 m to a maximum of 6 m below the deck head and the other shall be at a minimum of 1.6 m to a maximum of 3 m below the deck head;	.2 continuous longitudinal permanent means of access, which are integrated in the structure, at a vertical distance not exceeding 6 m apart; and
3. access between the arrangements specified in .1 and .2 and from the deck above the tanks to either .1 or .2;	.3 plated stringers shall, as far as possible, be in alignment with horizontal girder
4. continuous longitudinal permanent means of access which are integrated in the structural member on the stiffened surface of a longitudinal bulkhead, in alignment, where possible, with horizontal girders of transverse bulkheads are to be provided for access to the transverse webs unless permanent fittings are installed at the uppermost platform for use of alternative means, as defined in <b>103. 9</b> , for inspection at intermediate heights;	2.2 For pre-load tanks in self-elevating units, reference is made to 1.3.
.5 for MODUs having cross-ties which are 6 m or more above tank bottom, a transverse permanent means of access on the cross-ties providing inspection of the tie flaring brackets at both sides of the tank, with access from one of the longitudinal permanent means of access in .4; and	2.3 For ballast tanks in columns of column-stabilized units of which the vertical distance between each watertight flat or between horizontal stringers/non-tight flats is 6 m and over, one permanent means of access shall be provided for the full length of the tank in accordance with 2.1. (Note: In columns, longitudinal means the perimetral direction of the column and transversal means the radial direction of the column).



Table 1 Means of access (continued)

1. Water ballast tanks, except those specified in the right column, and other tanks	2. Water ballast tanks of less than 5m width
<b>access to the underdeck and vertical structure</b>	
.6 alternative means as defined in <b>103. 9</b> may be provided as an alternative to .4 for tanks other than ballast tanks of which the height is less than 17 m.	<b>For surface units (ship- or barge-type) and pontoons in column-stabilized units:</b>  2.4 For bilge hopper sections of which the vertical distance from the tank bottom to the upper knuckle point is 6 m and over, one longitudinal permanent means of access shall be provided for the full length of the tank. It shall be accessible by vertical permanent means of access at each end of the tank.
1.2 For tanks of which the height is less than 6 m, alternative means as defined in <b>103. 9</b> or portable means may be utilized in lieu of the permanent means of access.	2.4.1 The longitudinal continuous permanent means of access may be installed at a minimum 1.6 m to maximum 3 m from the top of the bilge hopper section. In this case, a platform extending the longitudinal continuous permanent means of access in way of the webframe may be used to access the identified structural critical areas.
1.3 Pre-load tanks in self-elevating units are normally kept empty for a long duration when the unit is in elevated mode. For such tanks if due to their shape it is not practicable to fit permanent means of access mentioned in 1.1 above, the Society may permit the provision of alternative means defined in <b>103. 9</b> provided that the tank height is less than 17 m.	2.4.2 Alternatively, the continuous longitudinal permanent means of access may be installed at a minimum of 1.2 m below the top of the clear opening of the web ring allowing a use of portable means of access to reach identified structural critical areas.
1.4 For ballast tanks in columns of column-stabilized units, longitudinal means the perimetral direction of the column and transversal means the radial direction of the column.	2.5 Where the vertical distance referred to in 2.4 is less than 6 m, alternative means as defined in <b>103. 9</b> or portable means of access may be utilised in lieu of the permanent means of access. To facilitate the operation of the alternative means of access, in-line openings in horizontal stringers shall be provided. The openings shall be of an adequate diameter and shall have suitable protective railings.
<b>Fore and aft peak tanks in surface units</b>	
1.5 For fore and aft peak tanks with a depth of 6 m or more at the centre line of the collision and aft end bulkheads, a suitable means of access shall be provided for access to critical areas such as the under-deck structure, stringers, collision and aft end bulkheads and side shell structure.	
1.5.1 Stringers of less than 6 m in vertical distance from the deck head or a stringer immediately above are considered to provide suitable access in combination with portable means of access.	
1.5.2 In case the vertical distance between the deck head and stringers, stringers or the lowest stringer and the tank bottom is 6 m or more, alternative means of access as defined in <b>103. 9</b> shall be provided.	

Table 1 Means of access (continued)

3. Holds	4. Critical Structural Areas
3.1 For holds under main deck of which the height is 6 m and over, permanent means of access shall be fitted to provide access to the overhead structure at both sides of the cross deck and in the vicinity of the centreline. Each means of access shall be accessible from the hold access or directly from the main deck and installed at a minimum of 1.6 m to a maximum of 3 m below the deck.	4.1 Permanent means of access shall be fitted to provide access to overhead and vertical structures identified as critical structural areas as defined in <b>Ch 3, 203. 2</b> of the Rules and located at a height of 6 m or more from the bottom of the space.
3.2 An athwartship permanent means of access fitted on the transverse bulkhead at a minimum 1.6 m to a maximum 3 m below the cross-deck head is accepted as equivalent to 3.1.	4.1.1 When permanent means of access to critical structural areas are not covered by sections 1, 2 and 3 above, continuous permanent access arranged at the bulkhead on the stiffened surface is to be provided at a maximum of 3 m below the critical structural area, but not higher than 1.6 m below the deck, throughout the extent of the critical structural area.
3.3 Access to the permanent means of access to overhead structure of the cross deck may also be via the uppermost stringer.	4.2 For critical structural areas located at a height of less than 6 m from the bottom of the space, alternative means of access as defined in <b>103. 9</b> are to be provided.
3.4 Alternatively, movable means of access as defined in <b>103. 9</b> , may be utilized for access to the overhead structure of the cross deck if its vertical distance is 17 m or less above the bottom of the hold.	4.3 Suitable means of access into the interior of the horizontal braces in column stabilized units shall be provided. For access through vertical openings, the requirements of <b>103. 11</b> shall be applied.
<p>(Notes)</p> <ol style="list-style-type: none"> <li>1. In application of 1.1 of this table, the details are as follows. <ol style="list-style-type: none"> <li>1) For tanks containing oil products other than crude oil (e.g. fuel oil, diesel oil, base oil) where lower corrosion is expected, section 1.1 is not to be applied. For tanks containing products considered corrosive (e.g. brine, drilling mud), section 1.1 is to be applied.</li> <li>2) Sub-paragraphs .1, .2 and .3 define access to underdeck structure, access to the uppermost sections of transverse webs and connection between these structures.</li> <li>3) Sub-paragraphs .4, .5 and .6 define access to vertical structures only and are linked to the presence of transverse webs on longitudinal bulkheads.</li> <li>4) If there are no underdeck structures (deck longitudinals and deck transverses) but there are vertical structures in the tank supporting transverse and longitudinal bulkheads, access in accordance with sub-paragraphs from .1 through to .6 is to be provided for inspection of the upper parts of vertical structure on transverse and longitudinal bulkheads.</li> <li>5) If there is no structure in the tank, section 1.1 is not to be applied.</li> <li>6) The vertical distance below the overhead structure is to be measured from the underside of the main deck plating to the top of the platform of the means of access at a given location.</li> <li>7) The height of the tank is to be measured at each tank. For a tank the height of which varies at different bays, item 1.1 is to be applied to such bays of a tank that have height 6 m and over.</li> </ol> </li> <li>2. In application of 1.1.2 of this table, there is need to provide continuous longitudinal permanent means of access when the deck longitudinals and deck transverses are fitted on deck but supporting brackets are fitted under the deck.</li> <li>3. In application of 1.1.3 of this table, means of access to tanks may be used for access to the permanent means of access for inspection.</li> </ol>	

Table 1 Means of access (continued)

<p>(Notes) (continued)</p> <p>4. In application of 1.1.4 of this table, the details are as follows.</p> <p>The permanent fittings required to serve alternative means of access such as wire lift platform, that are to be used by crew and surveyors for inspection shall provide at least an equal level of safety as the permanent means of access stated by the same paragraph. These means of access shall be carried on board the unit and be readily available for use without filling of water in the tank.</p> <p>Therefore, rafting is not to be acceptable under this provision.</p> <p>Alternative means of access are to be part of Access Manual.</p> <p>5. In application of 2.1 of this table, the details are as follows.</p> <p>Paragraph 2.1.1 represents requirements for access to underdeck structures, while paragraph 2.1.2 is a requirement for access for survey and inspection of vertical structures on longitudinal bulkheads (transverse webs).</p> <p>6. In application of 2.1.1 of this table, the details are as follows.</p> <ol style="list-style-type: none"> <li>1) For a tank, the vertical distance between horizontal upper stringer and deck head of which varies at different sections, item 2.1.1 is to be applied to such sections that fall under the criteria.</li> <li>2) The continuous permanent means of access may be a wide longitudinal, which provides access to critical details on the opposite side by means of platforms as necessary on web frames. In case the vertical opening of the web frame is located in way of the open part between the wide longitudinal and the longitudinal on the opposite side, platforms shall be provided on both sides of the web frames to allow safe passage through the web frame.</li> <li>3) Where two access hatches are required by <b>Ch 3, 202. 2</b> of the Rules, access ladders at each end of the tank are to lead to the deck.</li> </ol> <p>7. In application of 2.1.2 of this table, the details are as follows.</p> <p>The continuous permanent means of access may be a wide longitudinal, which provides access to critical details on the opposite side by means of platforms as necessary on webframes. In case the vertical opening of the web is located in way of the open part between the wide longitudinal and the longitudinal on the opposite side, platforms shall be provided on both sides of the web to allow safe passage through the web.</p> <p>A “reasonable deviation”, as noted in MODU TP, paragraph 1.4, of not more than 10% may be applied where the permanent means of access is integral with the structure itself.</p> <p>8. In application of 2.2 of this table, the details are as follows.</p> <ol style="list-style-type: none"> <li>1) Permanent means of access between the longitudinal continuous permanent means of access and the bottom of the space is to be provided.</li> <li>2) The height of a bilge hopper tank located outside of the parallel part of the unit is to be taken as the maximum of the clear vertical distance measured from the bottom plating to the hopper plating of the tank.</li> <li>3) The foremost and aftmost bilge hopper ballast tanks with raised bottom, of which the height is 6 m and over, a combination of transverse and vertical MA for access to the upper knuckle point for each transverse web is to be accepted in place of the longitudinal permanent means of access.</li> </ol> <p>9. In application of 3.1 of this table, the details are as follows.</p> <ol style="list-style-type: none"> <li>1) Means of access shall be provided to the crossdeck structures of the foremost and aftermost part of the each hold.</li> <li>2) Interconnected means of access under the cross deck for access to three locations at both sides and in the vicinity of the centreline is to be acceptable as the three means of access.</li> <li>3) Permanent means of access fitted at three separate locations accessible independently, one at each side and one in the vicinity of the centreline is to be acceptable.</li> <li>4) Special attention is to be paid to the structural strength where any access opening is provided in the main deck or cross deck.</li> </ol> <p>10. In application of 3.3 of this table, particular attention is to be paid to preserve the structural strength in way of access opening provided in the main deck or cross deck.</p> <p>11. In application of 3.4 of this table, the movable means of access to the underdeck structure of cross deck need not necessarily be carried on board the unit. It is sufficient if it is made available when needed.</p>
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CLASSIFICATION OF  
MOBILE OFFSHORE DRILLING UNITS**

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