# D5 Column stabilized drilling units

(1979)
(Rev. 1 1987)
(Rev. 2 1990)
(Rev. 3 1996)

## D5.1 General

D5.1.1 This section applies to the unit type as defined in D2.2.2

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

(i) Suitable reduction of the allowable stress levels for combined loadings given in D3.
(ii) Detailed investigation of the fatigue properties.

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

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

## D5.2 Upper structure

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

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

D5.2.3 Deckhouses fitted to the upper structure are to be designed in accordance with the Rules, with due consideration given to their location and to the environmental conditions in which the unit will operate.

## D5.3 Columns, lower hulls and footings

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

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

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D5.3.2

(a) Where columns, lower hulls or footings are designed with stiffened plating, the minimum scantlings of plating, framing, girders, etc., may be determined in accordance with the requirements for tanks as given in D7. Where an internal space is a void compartment, the design head used in association with the above is not to be less that that corresponding to the maximum allowable waterline of the unit in service. In general, the scantlings are not to less than required for watertight bulkheads in association with a head equivalent to the maximum damaged waterline, and for all areas subject to wave immersion, a minimum head of 6,0 m (20 ft) should be used.

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

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

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

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

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

D5.3.3 Bracing members

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

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

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

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

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

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### D5.4 Wave clearance

D5.4.1 Afloat condition
Unless deck structures are designed for wave impact, to the satisfaction of the Society, reasonable clearance between the deck structures and the wave crests is to be ensured for all afloat modes of operation, taking into account the predicted motion of the unit relative to the surface of the sea. Calculations, model test results, or prototype experiences are to be submitted for consideration.

D5.4.2 On-bottom condition

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

### D5.5 Structural Redundancy

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

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

2. Structural redundancy will be based on the applicable requirements of D3.3, D3.4, D3.5, and D3.6, except:
   a. Maximum calculated stresses in the structure remaining after the loss of a slender bracing member are to be in accordance with D3.5 in association with usage factors not exceeding 1.0. This criteria may be exceeded for local areas, provided redistribution of forces due to yielding or buckling is taken into consideration.
   b. When considering environmental factors, a one year return period may be assumed for intended areas of operations. (see D3.3.1)

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

### D5.6 Damage Stability

D5.6.1 In assessing the damage stability of column stabilized drilling units as required by D3.7.3, the following assumed damage conditions apply.

(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 3.0 m occurring at any level between 5.0 m above and 3.0 m below the drafts 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 taking into account the actual operating conditions. However, the extent of required damage region should be at least 1.5 m above and below the draft in question.
(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 hulls or footings should be assumed to be damaged when operating in a transit condition in the same manner as indicated in D5.6.1 (1), (2), (4) and having regard to their shape, either D5.6.1 (3) or between effective watertight bulk-

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heads.

(6) If damage of a lesser extent results in a more severe damage equilibrium condition, such a lesser extent shall 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 to preclude the progressive flooding of other spaces which are intended to be intact.

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