CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION FMOBILE OFFSHORE UNITS

PART THREE STABILITY, SUBDIVISION AND LOAD LINE

CONTENTS

CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.1 Application

1.1.1.1 Unless provided otherwise, this part applies to the various types of units as defined in Section 1, Chapter 2 of PART ONE.

1.1.1.2 In addition to the requirements of this part, the stability, subdivision and LOAD LINE of the unit are to comply with the other relevant requirements of the Administration.

1.1.2 Categories and definitions of stability for the units

1.1.2.1 The requirements for stability are different according to the various conditions of the unit. The stability of the unit may be divided into the following four categories (as applicable):

(1) Intact stability;

(2) Damage stability;

(3) On-bottom stability;

(4) Descending and ascending stability.

1.1.2.2 The intact stability of a unit is the ability of this floating unit to resist external overturning moments by means of its righting moment induced by the inclination of the unit.

1.1.2.3 The on-bottom stability of a unit is the ability of that submersible unit or with legs penetrating the seabed to counteract the capsizing and sliding of the unit caused by the environmental forces, under combined actions of buoyancy, weight and seabed reaction.

1.1.2.4 The descending and ascending stability of a unit is the ability of that unit to move smoothly and in a controlled manner from floating condition to resting condition or vice versa, by changing its buoyancy through ballasting and deballasting.

1.1.2.5 The damage stability of a unit is the ability of a damaged unit, under the action of a specified wind pressure, to keep itself from continuous flooding by means of the righting moment induced by the inclination of that damaged unit.

1.1.3 Plans and information

1.1.3.1 Plans and information to be submitted for approval

When it is intended to build a unit to be classed with CCS, the following plans and information are to be submitted in quadruplicate to CCS for approval before commencement of construction. The scope of submitted plans and information may be required to broaden for approval if considered necessary by CCS.

(1) Intact stability calculations;

(2) Damage stability calculations;

(3) Descending and ascending stability calculations, if applicable;

(4) On-bottom stability calculations, if applicable;

(5) Freeboard calculations, if applicable;

(6) Load line marks and scale;

(7) Calculations and curves for permissible height of center of gravity;

(8) Arrangement of watertight and weathertight doors, scuttles and other openings together with their watertight and weathertight closing appliances;

(9) Extent of external watertight and weathertight integrity, if applicable;

(10) Plans and information to be submitted for information:

① Lines plan;

② Hydrostatic curves;

③ Cross curves of stability;

④ Capacity plan;

⑤ Plan of watertight boundaries of spaces.

Section 2 STABILITY CATEGORIES TO BE CHECKED FOR VARIOUS UNITS

1.2.1 General requirements

1.2.1.1 The intact stability and the damage stability are to be checked for all units.

1.2.1.2 The on-bottom stability is to be checked for self-elevating units; the on-bottom stability and the descending and ascending stability are to be checked for submersible units and those column-stabilized units required to operate in an on-bottom mode.

CHAPTER 2 STABILITY

Section 1 INCLINING TEST

2.1.1 General requirements

2.1.1.1 An inclining test is to be required for the first unit of those manufactured by the same manufacturer in same batch according to the same design plans when the unit is as near to completion as possible, so as to determine accurately the light ship data (weight and position of centre of gravity).

2.1.1.2 For successively manufactured units which are produced in the same batch according to the same design plans, the light ship data of the first unit of the series may be accepted in lieu of an inclining test, provided the difference in light ship displacement or position of centre of gravity due to weight changes for minor differences in structure, machinery, outfitting or equipment, verified by the results of a lightweight survey, are less than 1% of the values of the light ship displacement and principal horizontal dimensions as determined for the first of the series. Extra care is to be given to the detailed weight calculation and comparison with the original unit of a series of column-stabilized 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.

2.1.1.3 The results of the inclining test, or lightweight survey and inclining experiment adjusted for weight differences, are to be submitted to CCS for approval before being included in the operating manual.

2.1.1.4 A record of all changes to machinery, structure, outfit and equipment that affect the light ship data, is to be maintained in the operating manual or a light ship data alterations log and be taken into account in daily operations.

2.1.1.5 For column-stabilized units, a lightweight survey or inclining test is to be conducted at the first renewal survey. If a lightweight or position of centre of gravity survey is conducted and it indicates a change from the calculated light ship displacement in excess of 1% of the operating displacement and/or the difference in position of centre of gravity in excess of 1% of the principal horizontal dimensions, an inclining test is to be conducted.

2.1.1.6 For column-stabilized units, if the lightweight survey or inclining test at the first renewal survey demonstrated that the unit was maintaining an effective weight control programme, and at succeeding renewal surveys this is confirmed by the records under paragraph 2.1.1.4, light ship displacement may be verified in operation by comparison of the calculated and measured draughts. Where the difference between the expected displacement and the actual displacement based upon draught readings exceed 1% of the operating displacement, a lightweight survey is to be completed in accordance with paragraph 2.1.1.5.

2.1.1.7 Where any alteration is made to a unit such that the stability is substantially affected, a new inclining test is to be conducted.

2.1.1.8 Inclining test or lightweight survey is to be carried out in the presence of a CCS surveyor.

Section 2 RIGHTING MOMENT AND WIND HEELING MOMENT

2.2.1 General requirements

2.2.1.1 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 draughts corresponding to afloat modes of operation, including those in transit conditions (as shown in Fig. 2.2.1.1), taking into account the maximum deck cargo and equipment in the most unfavorable position as applicable and the free surface of liquids in tanks. 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.

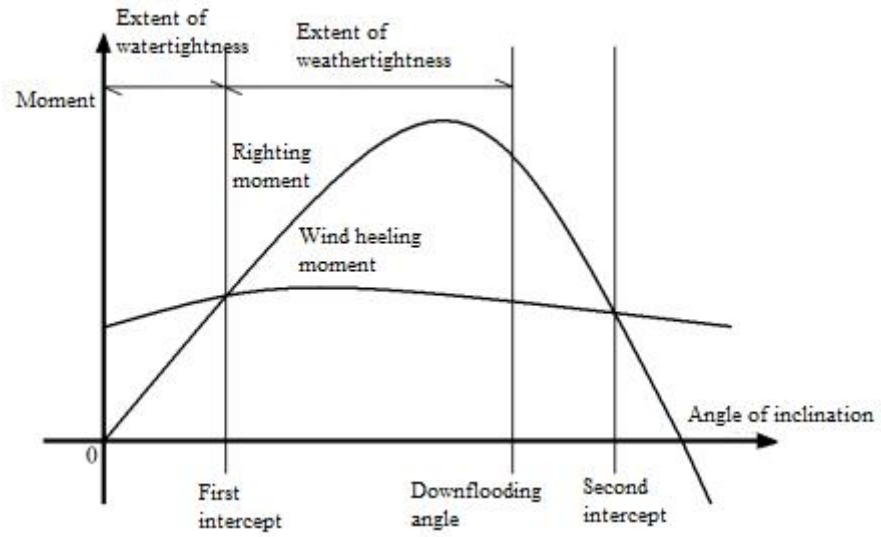


Fig. 2.2.1.1 Typical Hydrostatic Curves in Intact Condition

2.2.1.2 Where drilling equipment is of the nature that it can be lowered and stowed, additional wind heeling moment and righting moment curves may be required, and such data is to clearly indicate the position of such equipment.

2.2.1.3 The wind heeling moment curve is to 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 the vessel's heel.

2.2.1.4 The wind heeling moment M_q acting on the unit is to be determined by the following formula:

$$M_q = FZ \qquad \text{kN} \cdot \text{m}$$

Where: F – wind force, see Section 2 of Chapter 2 of PART TWO, in kN;

Z – lever for wind force, in m.

2.2.1.5 The lever for the wind force is to be taken vertically from the centre of lateral resistance of the underwater body to the centre of pressure of the areas subject to wind loading. The effect of dynamic positioning thruster, if fitted, is to be considered in the calculation.

2.2.1.6 Wind forces are to be considered from any direction relative to the unit and the value of the wind velocity is to be as follows:

(1) in general, a minimum wind velocity of 36m/s (70kn) is to be used for transit conditions and normal operating conditions;

(2) a minimum wind velocity of 51.5m/s (100kn) is to be used for survival conditions;

(3) For units with a service restriction notation, the wind velocity for transit conditions and normal operating conditions may be reduced as appropriate to not less than 25.8m/s (50kn), and the operating restriction is to be included in the operating manual.

2.2.2 Wind tunnel tests

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

Section 3 INTACT STABILITY

2.3.1 General stability criteria

2.3.1.1 The intact stability of a unit in each mode of operation is to meet the following criteria (see Fig. 2.2.1.1):

(1) For surface and self-elevating units, the area under the righting moment curve to the second intercept or angle of flooding, whichever is less, is to be not less than 40% in excess of the area under the wind heeling moment curve to the same limiting angle;

(2) For column-stabilized units, the area under the righting moment curve to the second intercept or angle of flooding is not to be less than 30% in excess of the area under the wind heeling moment curve to the same limiting angle;

(3) For submersible units, the area under the righting moment curve to the second intercept or angle of flooding, whichever is less, is to be not less than 40% in excess of the area under the wind heeling moment curve to the same limiting angle;

(4) In all cases, the righting moment curve is to be positive over the entire range of angles from upright to the second intercept. In the full range of draughts corresponding to afloat modes of operation, the initial metacentric height corrected for free surface is to be not less than 0.15m.

2.3.1.2 The capability is to be provided to change the mode of operation of the unit to that of survival, with a sustained wind velocity of not less than 51.5m/s, in a reasonable period of time for the particular unit. In all cases, the limiting wind velocities are to be specified and instructions are to be included in the operating manual for changing the mode of operation by redistribution of the variable load and equipment, by changing draughts, or both, and the approximate length of time required. For these operating procedures and the length of time required, both operating conditions and transit conditions are to be considered.

2.3.2 Alternative stability criteria

2.3.2.1 Alternative stability criteria may be considered acceptable provided an equivalent level of safety is maintained and if they are demonstrated to afford adequate positive initial stability. The following will be considered at least by CCS in determining the adequacy of alternative criteria submitted for review:

(1) Environmental conditions representing realistic winds (including gusts) and waves appropriate for worldwide service in various modes of operations;

(2) Dynamic response of a unit. Where appropriate, the analysis is to include the results of wind tunnel tests, wave tank model tests and nonlinear simulation. Any wind and wave spectra used are to cover sufficient frequency ranges to ensure that critical motion responses are obtained;

(3) Potential for flooding, taking into account dynamic responses and wave profile;

(4) Susceptibility to capsizing considering the unit’s restoration energy, static inclination due to mean wind velocity and maximum dynamic responses;

(5) an adequate safety margin to account for uncertainties.

Section 4 DAMAGE STABILITY

2.4.1 General requirements

2.4.1.1 The calculation of damage stability is to be carried out in the worst anticipated service condition and 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.

2.4.1.2 In damage stability calculations, the permeability for each space or part thereof is to be in general as indicated in Table 2.4.1.2:

Permeability of Compartments **Table 2.4.1.2**

Space	Permeability
Appropriated to stores	0.95
Occupied by accommodation	0.95
Occupied by machinery	0.85
Occupied by void compartment	0.95
Intended for liquids	0.00 or 0.95*
(*Whichever results in the more severe requirements.)	

2.4.1.3 The ability to reduce the angle of inclination to compensate for damage incurred, by pumping out or by ballasting other compartments, etc., is not to be considered as alleviating the above requirements.

2.4.2 Damage stability criteria

2.4.2.1 Surface and self-elevating units

(1) The units are to have sufficient freeboard, reserve buoyancy and stability to withstand the flooding from the sea of any compartment consistent with the damage assumption set out in 2.4.4.1 or 2.4.4.2, for any operating or transit conditions. And under the additional overturning moment of a 25.8m/s (50kn) sustained wind superimposed from any direction, the damage waterline is to be below the lower edge of any opening through which progressive flooding may take place, taking the combined effects of sinking, trim and heel into account.

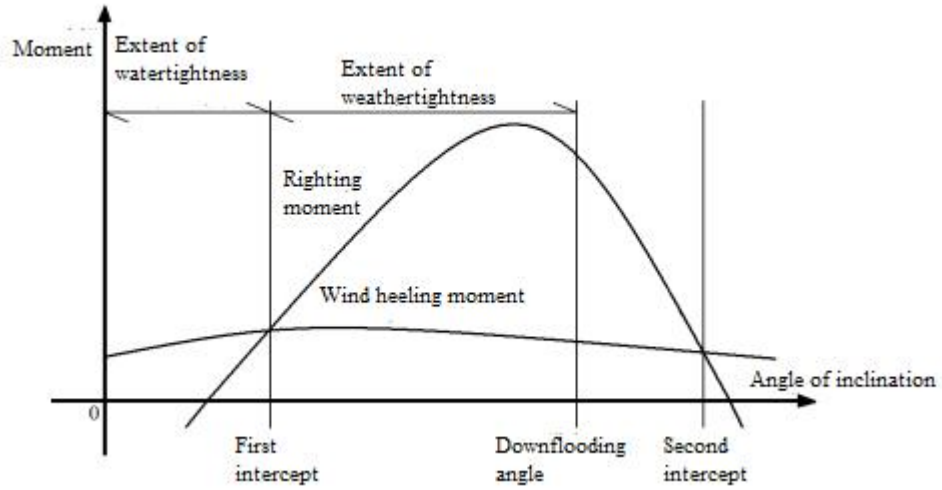


Fig. 2.4.2.1 (1) Typical Hydrostatic Curves in Damage Condition

(2) The residual stability for self-elevating units after the flooding of any single compartment is to meet the following formula (see Fig. 2.4.2.1 (2)):

$$RoS = \theta_m - \theta_s \geq Max\left\{\left(7^\circ + 1.5\theta_s\right) \ , \ 10^\circ\right\}$$

Where: RoS – range of stability, in degrees;

θ_m – vanishing angle of stability, in degrees;

θ_s – angle of list after flooding of a singe compartment, in degrees.

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

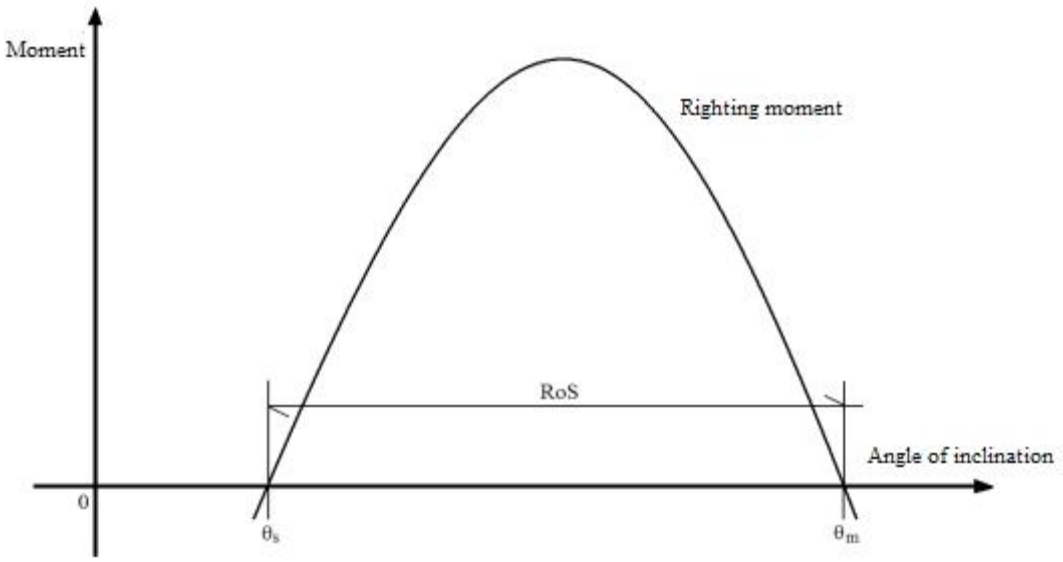


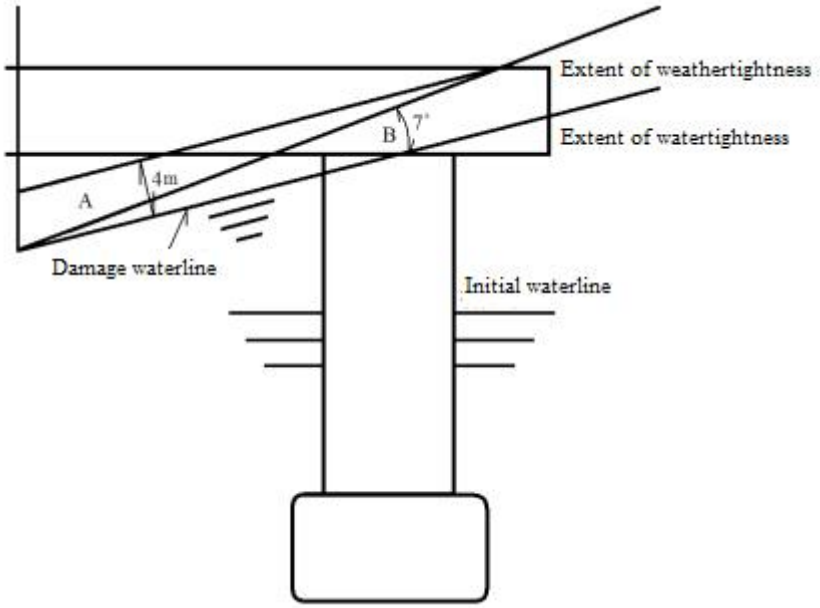
Fig. 2.4.2.1(2) Schematic Diagram of the Range of Residual Stability for Self-elevating Units after Downflooding of a Single Compartment

2.4.2.2 Column-stabilized units

(1) The units are to have sufficient freeboard and watertight subdivisions to provide sufficient buoyancy and stability to meet the following requirements for any operating or transit conditions under the overturning moment of a 25.8m/s (50kn) sustained wind superimposed from any direction:

① The angle of inclination after the damage set out in 2.4.4.3 is to be not greater than 17°, see Fig. 2.4.2.2(2);

② Any openings below the damage waterline are to be made watertight, and openings within the range of 4m above the damage waterline are to be made weathertight, see Fig. 2.4.2.2(1).



A - 4 m zone of weathertight integrity
B - 7° zone of weathertight integrity

Fig. 2.4.2.2(1) Schematic Diagram of Standard Requirement for the Range of Weathertightness for Semi-submersible Units after Damage

③ The righting moment curve, subject to the damage set out above is to have, from the first intercept to the lesser of the extent of weathertight integrity required by ② and the second intercept, a range of at least 7°. Within this range, the righting moment curve is to reach a value of at least twice the wind heeling moment curve, both being measured at the same angle. See Fig. 2.4.2.2(1) and 2.4.2.2(2).

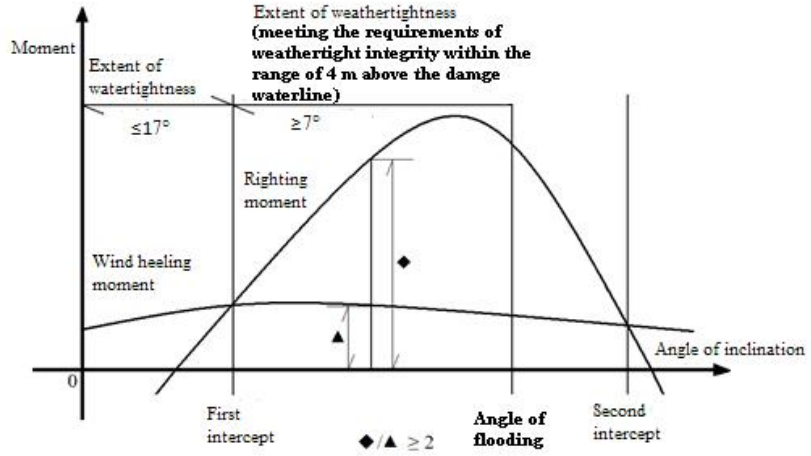


Fig. 2.4.2.2(2) Schematic Diagram of Damage Stability Requirement for Semi-submersible Units

(2) The units are to have sufficient buoyancy and stability to withstand, in any operating or transit conditions, the flooding of any single watertight compartment located 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, complying with the following (as shown in Fig. 2.4.2.2(3)):

① The angle of list after flooding of a single watertight compartment is to be not greater than 25°;

② Any openings below the final waterline corresponding to the angle of list is to be made watertight;

③ A range of positive stability for righting moment from the angle of list to the angle of flooding or vanishing angle of stability is to be provided of at least 7° in these conditions.

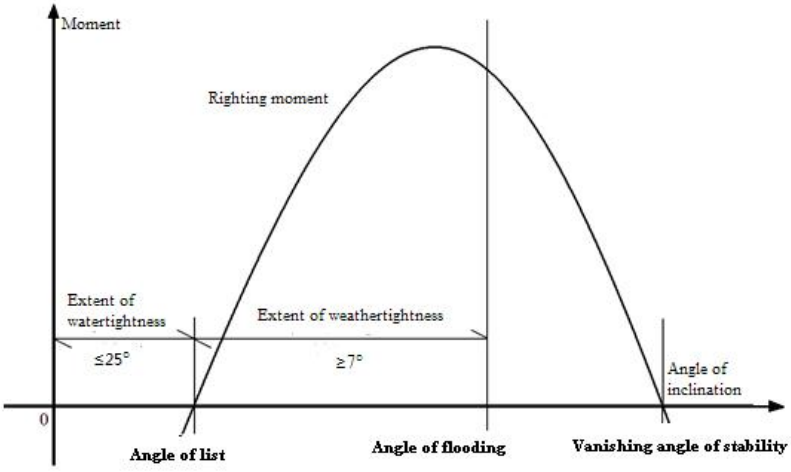


Fig. 2.4.2.2(3) Schematic Diagram of Residual Stability Requirement for Semi-submersible Units after Downflooding of a Single Compartment

2.4.2.3 Submersible units

The damage stability requirements for the submersible units are the same as given in 2.4.2.1(1), and the extent of damage is to comply with 2.4.4.4.

2.4.3 Alternative stability criteria

Alternative stability criteria may be considered acceptable provided an equivalent level of safety is maintained. The following are to be considered at least in determining the acceptability of such criteria:

(1) The extent of damage as set out in 2.4.4;

(2) On column-stabilized units, the flooding of any watertight compartment as set out in 2.4.2.2(2);

(3) The provision of an adequate margin against capsizing.

2.4.4 Extent of damage

2.4.4.1 Surface-type units

(1) In assessing the damage stability of surface-type units, the following extent of damage is to be assumed to occur between effective watertight bulkheads:

① Horizontal penetration: 1.5m;

② Vertical extent: bottom shell 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 is to be not less than 3.0m; where there is a lesser distance, one or more of the adjacent bulkheads are to be disregarded.

(3) If damage of a lesser extent than in (1) results in a more severe condition, such lesser extent is to be assumed.

(4) All piping, ventilating systems, trunks, etc., within this extent of damage referred to in (1) are to be assumed damaged. Positive means of closure are to be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.

2.4.4.2 Self-elevating units

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

① Horizontal penetration: 1.5m;

② Vertical extent: bottom shell 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 is to be not less than 3.0 m; where there is a lesser distance, one or more of the adjacent bulkheads are to be disregarded.

(3) If damage of a lesser extent than in (1) results in a more severe condition, such lesser extent is to be assumed.

(4) Where a bottom mat is fitted, the above 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 1.5m vertically of the waterline, and the difference in horizontal dimension of the upper hull and mat is less than 1.5m in any area under consideration.

(5) All piping, ventilating systems, trunks, etc., within this extent of damage referred to in (1) are to be assumed damaged. Positive means of closure are to be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.

(6) The recessed ends and sides of the drilling slot need not be subject to horizontal penetration if warning signs be posted on each side of the unit stating that no boats be allowed inside the drilling slot. Instructions to this effect are to be included in the operating manual.

2.4.4.3 Column-stabilized units

(1) In assessing the damage stability of column-stabilized units, the following extent of damage is to be assumed:

① Only those columns, lower hulls and bracings on the periphery of the unit are to be assumed to be damaged and the damage is to be assumed in the exposed portions of the columns, lower hulls and bracing;

② Columns and braces are to be assumed to be flooded by damage having a vertical extent of 3.0m occurring at any level between 5.0m above and 3.0m below the drafts specified in the operating manual. Where a watertight flat is located within this region, the damage is to be assumed to have occurred in both compartments above and below the watertight flat in question. Lesser distances above or below the draughts may be applied to the satisfaction of CCS, taking into account the actual operating conditions. However, the extent of required damage region is to be at least 1.5m above and below the draft specified in the operating manual;

③ No vertical bulkhead is to 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 is to be disregarded;

④ Horizontal penetration of damage is to be assumed to be 1.5m.

(2) Lower hulls or footing are to be assumed to be damaged when operating in a transit condition in the same manner as indicated in (1)①, ②, ④above and having regard to their shape, either (1)③ or 2.4.4.2(2).

(3) If damage of a lesser extent than in (1) and (2) results in a more severe condition, such lesser extent is to be assumed.

(4) All piping, ventilating systems, trunks, etc., within this extent of damage are to be assumed damaged. Positive means of closure are to be provided at watertight boundaries to preclude the progressive flooding of other spaces which are intended to be intact.

2.4.4.4 Submersible units

The assumed extent of damage of submersible units is to be as given in 2.4.4.1

Section 5 ON-BOTTOM STABILITY

2.5.1 Anti-overturning stability

2.5.1.1 When resting on the seabed, the units are to have adequate ability to withstand the overturning moment of the combined environmental forces as appropriate. Taking into account the dynamic amplification effect (see 4.4.1.7 of PART TWO) and P-△ effect (see 4.7.1.6 of PART TWO), the anti-overturning stability of the unit is to comply with the following:

$$\frac{M_k}{M_q} \geq K_q$$

where: M_k – anti-overturning moment of the unit when resting on the seabed, in kN·m;

M_q – heeling moment of the unit when resting on the seabed, in kN·m;

K_q – anti-overturning safety factor, see Table 2.5.1.1.

Anti-Overturning Safety Factor **Table 2.5.1.1**

Condition	Submersible unit	Self-elevating unit	Self-elevating unit
		independent leg	mat
Normal operation	1.6	1.1	1.3
Survival	1.4	1.1	1.3

2.5.1.2 In the calculation, the minimum value of the unit's loading is to be taken, giving consideration to the most unfavorable eccentricity of loading and mounting, but not to any favorable soil effect (e.g. adhesion, suction, pile-pulling force) on the unit.

2.5.1.3 In calculating heeling moment, consideration is to be given to the effects of the most unfavorable superposition of wind loading, wave loading and current loading, among which the articulated point of lever is to be taken as follows:

(1) for self-elevating units with independent legs

① such units without spudcans are to be considered articulated 3m below the seabed, or any other appropriate articulated point may be taken according to actual penetration of legs;

② such units with spudcans are to be considered articulated at half of the maximum penetration below the seabed or that of the spudcan height, whichever is less.

(2) for self-elevating units with bottom mats, submersible units and other types of units, the articulated point is to be taken at the soil of the seabed.

2.5.2 Anti-sliding stability

When resting on the seabed, the units are to have adequate ability to withstand horizontal sliding under horizontal loads as appropriate. Where the soil of seabed is poor, the sliding area is to be taken as the contact area or profile of the mat or lower hull with the soil, without considering the sliding in the deep bottom soil.

The anti-sliding stability of the units is to comply with the following:

$$\frac{R_H}{F_H} \geq K_H$$

Where: R_H – anti-sliding force, in kN, including adhesion and friction of the soil, passive soil pressure, anti-sliding force generated by anti-sliding device;

F_H – sliding force, in kN, including all horizontal forces acting on the unit;

K_H – anti-sliding safety factor, not to be less than 1.4 for normal operating conditions and not to be less than 1.2 for survival conditions.

2.5.3 Bearing capacity of bottom soil

When the units are resting on the seabed under the environmental loads and gravity loads as appropriate, the bottom soil stresses of the seabed are to be less than the bearing capacity of the bottom soil and excessively uneven settlement is to be prevented.

2.5.4 Effect of scouring

For units intended to rest on the seabed, the effect of scouring of the seabed soil by current is to be considered. For the integral lower hull or mat, 20% of the bottom-bearing area may be considered washed away due to scouring. For the non-integral lower hull or mat, if deeply buried, no loss of the bottom-bearing area need be considered. For a unit provided with anti-scouring device, the loss of the bottom-bearing area is to be appropriately determined according to the results of hydraulic model testing.

Section 6 DESCENDING AND ASCENDING STABILITY

2.6.1 Modes of descending and ascending

2.6.1.1 Two different modes may be applied for descending and ascending a unit. With the first mode, no or

very slight inclination will be observed during the descending and ascending of the unit, thus the effect of the inclination can be neglected, and this is called the even mode of descending and ascending. With the second mode, the unit will pitch to a certain degree during the descending in a controlled manner, so one end of the unit touches the seabed first and then the other end lowers slowly with the first end as a pivoting point; alternatively, when the unit is ascending from the on-bottom condition, one end will first ascend with the other end as a pivoting point and then let the other end ascend to even the unit. Since there is obvious pitch with this mode of descending and ascending, it is called the heeling mode.

2.6.2 Descending and ascending stability

2.6.2.1 Throughout the descending process, the initial metacentric height, corrected for the free surface of liquid, is to be not less than 0.15m for the even mode and not less than 0.05m for the heeling mode.

2.6.2.2 Where the requirements of 2.6.2.1 are complied with, the ballasting process for descending the unit may be applied inversely as a deballasting process to get the on-bottom unit to ascend.

Where the requirements of 2.6.2.1 are not complied with, temporary measures are to be taken to meet it, with the consent of CCS.

2.6.2.3 The calculated water depth for descending and ascending stability is to take into account the depth of the unit penetrating the seabed.

CHAPTER 3 LOAD LINE

Section 1 GENERAL PROVISIONS

3.1.1 General requirements

3.1.1.1 The minimum freeboard of units is in general to comply with the International Convention on LOAD LINE, 1966. The minimum freeboard of certain units which cannot be computed by the normal methods laid down by the Load Line Convention is to be determined on the basis of meeting applicable intact stability, damage stability and structural requirements for transit conditions and the relevant operations while afloat.

3.1.1.2 The requirements of the International Convention on LOAD LINE, 1966 with respect to weathertightness and watertightness of decks, superstructures, deckhouses, doors, hatchway covers, ventilators, air pipes, scuppers, inlets and discharges and other openings, etc. are to be complied with for all units in the afloat conditions. However, openings in the upper deck of column-stabilized units are to be specially considered according to intact and damage stability requirements.

3.1.l.3 In general, heights of hatch and ventilator coamings, air pipes, door sills, etc., in exposed positions and their means of closing are to be determined by consideration of both intact and damage stability requirements.

3.1.1.4 For units in intact afloat conditions, all openings which may be submerged before the first intercept as shown in Fig. 2.1.1.1 are to be fitted with watertight closing appliances, and all openings of flooding which may be submerged from the first intercept to the angle of inclination at which the required area under the intact righting arm curve is achieved are to be fitted with weathertight closing appliances.

3.1.1.5 Special consideration is to be given to the position of openings which cannot be closed in emergency cases, such as air intakes for emergency generators, having regard to the intact righting arm curves and final waterline after assumed damage.

3.1.2 LOAD LINE marks

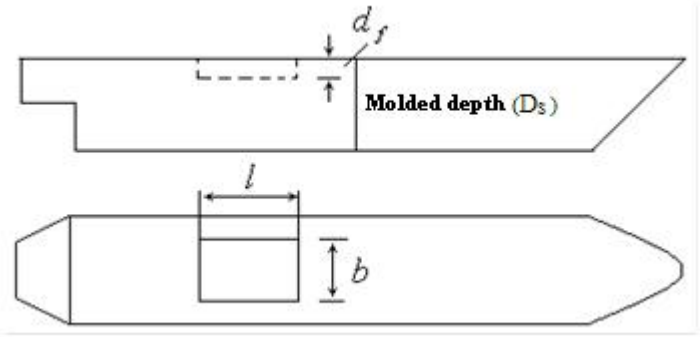
3.1.2.1 The load line marks of a unit are to be placed at locations on the structure visible to the person in charge of mooring, lowering or otherwise operating the unit, in compliance with relevant statutory requirements of the Administration.

3.1.2.2 Where it is necessary to assign a greater than minimum freeboard to meet intact or damage stability requirements or for any other restriction imposed by the Administration, Regulation 6(6) of the International Convention on LOAD LINE, 1966 is to apply. When such a freeboard is assigned, seasonal marks above the centre of the ring is not to be marked and any seasonal marks below the centre of the ring is to be marked. If a unit is assigned a greater than minimum freeboard at the request of the owner, regulation 6(6) need not apply.

3.1.3 Correction for moon-pools

3.1.3.1 Where open wells/recesses are arranged in the freeboard deck and such wells/recesses do not extend to sides of the unit, a correction equal to the volume of the well/recess to the freeboard deck divided by the waterplane area at $0.85D_S$ is to be added for the lost buoyancy to the freeboard obtained after all other corrections have been applied, except bow height correction, as shown in Fig. 3.1.3.1. And where such freeboard corrected for the lost buoyancy is greater than the minimum freeboard determined by the moulded depth measured to the bottom of the well/ recess, this minimum freeboard may be applied. Free surface effects of the flooded well or recess are to be taken into account in stability calculations.

The molded depth calculated for freeboard (D_S) is the molded depth amidunits (D) plus the thickness of the freeboard deck stringer plate..



Freeboard addition equal to $\frac{l \times b \times d_f}{A_W}$; A_W : waterplane area at $0.85D_S$

Fig. 3.1.3.1 Schematic Diagram of Freeboard Correction

3.1.3.2 Where moon-pools are arranged within the hull in open communication with the sea, the volume of the moon-pool is not to be included in calculation of any hydrostatic properties.

An addition is to be made to the geometric freeboard if the moon-pool has a larger cross-sectional area above the waterline at $0.85D_S$ than below, corresponding to the lost buoyancy. This addition for the excess portion above the $0.85D_S$ waterline is to be made as prescribed in 3.1.3.1 for wells/recesses.

If an enclosed superstructure contains part of the moon-pool, deduction is to be made for the effective length of the superstructure.

3.1.3.3 The procedure described in 3.1.3.1 or 3.1.3.2 is to apply in cases of small notches or relatively narrow cut-outs at the stern of the unit.

3.1.3.4 Narrow wing extensions at the stern of the unit is to be considered as appendages and excluded for the determination of length (L) and for the calculation of freeboards.

Section 2 ASSIGNING OF LOAD LINE

3.2.1 Self-elevating units

3.2.1.1 LOAD LINE are to be assigned to self-elevating units as calculated in accordance with the International Convention on LOAD LINE, 1966. The freeboard of the units which due to their configuration cannot be computed by the normal methods laid down by the International Convention on LOAD LINE, 1966 is to be determined according to 3.1.1.1.

Self-elevating units are not to be subject to that Convention while they are supported by the seabed or are in the process of lowering or raising their legs.

3.2.1.2 In general, it is impossible for the bow height and reserve buoyancy of self-elevating units to be in compliance with Regulation 39 (1), (2) and (5) of the International Convention on LOAD LINE, 1966. In such circumstances, the requirements of this Regulation may be appropriately relaxed. However, special consideration is to be given to each towing of the units according to the intended course, distance and weather conditions.

3.2.1.3 For self-elevating units fitted with a large bottom mat or similar supporting structure, the mat or similar supporting structure is to be excluded in the calculation of freeboard. The effects of mat or similar supporting structure are, however, always to be taken into account in the evaluation of the stability of the unit since its vertical position relative to the upper hull may be critical.

3.2.2 Surface-type units

LOAD LINE are to be assigned for surface-type units as calculated in accordance with the International Convention on LOAD LINE, 1966, and all conditions specified in that Convention for the assignment of

freeboard are to be complied with.

3.2.3 Column-stabilized units

3.2.3.1 It is impracticable to calculate the geometric freeboard of this type of units in accordance with the International Convention on LOAD LINE, 1966. Therefore their freeboard is to be determined on the basis of meeting applicable intact stability, damage stability and structural requirements for transit conditions and the relative operations while afloat.

3.2.3.2 For column-stabilized units, the freeboard for relative operations while afloat is to be assigned in addition to that for transit conditions. The freeboard for relative operations is to comply with the minimum air gap (or permissible maximum sinking depth) between wave crests and deck structures, in addition to the above stability and structural requirements.

3.2.3.3 The enclosed deck structure of each column-stabilized unit is to be made weathertight.

3.2.3.4 Windows, sidescuttles and portlights, including those of the non-opening type, or other similar openings are not to be located below the deck structure of column-stabilized units.

3.2.4 Submersible units

3.2.4.1 LOAD LINE are to be assigned to submersible units as calculated in accordance with the International Convention on LOAD LINE, 1966, and all conditions specified in that Convention for the assignment of freeboard are to be complied with except the minimum bow height.

3.2.4.2 Submersible units are not to be subject to that Convention while they are in the process of descending or ascending, or are in the on-bottom condition.

3.2.4.3 For submersible units with service area restricted in Bohai Sea or similar shallow waters, the requirements of freeboard may be appropriately relaxed with the consent of the Administration, provided they meet the applicable intact stability, damage stability and structural requirements for transit conditions.

CHAPTER 4 WATERTIGHT AND WEATHERTIGHT INTEGRITY

Section 1 GENERAL PROVISIONS

4.1.1 General requirements

4.1.1.1 The number of openings in watertight subdivisions are to be kept to a minimum compatible with the design and proper working of the unit. Where penetrations of watertight decks and bulkheads are necessary for access, piping, ventilation, electrical cables, etc., arrangements are to be made to maintain the watertight integrity of the enclosed compartments.

4.1.1.2 Where valves are provided at watertight boundaries to maintain watertight integrity, these valves are to be capable of being operated from a pump room or other normally manned space, a weather deck, or a deck which is above the final waterline after flooding. In the case of a column-stabilized unit this would be the central ballast control station. Valve position indicators are to be provided at the remote control station.

4.1.1.3 For self-elevating units, the valves of ventilation system required to maintain watertight integrity are to be kept closed when the unit is afloat. Necessary ventilation in this case is to be arranged by alternative approved methods.

4.1.1.4 The closing appliances required to maintain watertight integrity 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.

Section 2 OPENINGS RELATED TO WATERTIGHT INTEGRITY

4.2.1 Internal openings

4.2.1.1 Doors and hatch covers required for watertight integrity which are used during the operation of the unit while afloat are to be capable of being remotely controlled from the central ballast control station as well as being operable locally from both sides of the bulkhead. Open/shut indicators are to be provided at the control station. In addition, the doors provided to ensure watertight integrity of internal openings used at sea is to be sliding watertight type, and give audible and visual alarms when shut. The engines, controls and indicators are to function well in the case of main power failure. Special consideration is to be given to reducing the effect arising from failure of control systems. Each power-driven watertight sliding door is to be provided with an independent manual mechanical device which can be used to open or close the door manually from any side of the door.

4.2.1.2 Doors or hatch covers in self-elevating units required for watertight integrity, or doors placed above the deepest load line draft in column-stabilized units, which are normally closed while the units are afloat may be of the quick acting type and are to 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 is to be affixed to each such door or hatch cover stating that it is not to be left open while the unit is afloat.

4.2.1.3 The means to ensure the watertight integrity of internal openings which are intended only to provide access for inspection and are kept permanently closed during the operation of the unit, while afloat, is to comply with the following:

(1) A signboard to the effect that the opening is always to be kept closed while afloat is to be affixed to each such door or hatch cover; however, manholes fitted with close bolted covers need not be so marked;

(2) Opening and closing of such doors or hatch covers are to be noted in the unit’s logbook, or equivalent;

(3) For self-elevating units, all such openings are to have been witnessed closed before the unit becomes waterborne.

4.2.2 External openings

4.2.2.1 External openings fitted with appliances to ensure watertight integrity, 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. These openings include air pipes, ventilators, ventilation intakes and outlets, non-watertight hatches and weathertight doors. Openings that are normally closed and fitted with appliances to ensure weathertight integrity, such as side scuttles of the non-opening type, manholes and small hatches, may be submerged. Small hatches, normally used for access by personnel, are to be closed by approved quick-acting watertight covers of steel or equivalent material. An alarm system (e.g. light signals) is to be arranged showing personnel, both locally and at a central position, whether the covers in question are open or closed. In addition, a signboard to the effect that the closing appliance is to be closed while the unit is afloat, and is only to be used temporarily, is to be affixed to each such cover. But above mentioned small hatches allowed to immerse into water are not to be regarded as emergency exits.

4.2.2.2 External openings fitted with appliances to ensure watertight integrity, which are kept permanently closed while afloat, are to comply with the requirements of 4.2.1.3.

4.2.2.3 Where flooding of chain lockers or other buoyant volumes may occur, the openings to these spaces are to be considered as looding points in stability calculations.

Section 3 EXTERNAL OPENINGS RELATED TO WEATHERTIGHT INTEGRITY

4.3.1 General requirements

4.3.1.1 External openings of which the lower edge is submerged, such as air pipes, ventilators, ventilation intakes and outlets, non-watertight side scuttles, small hatches, companionways and doors are to be fitted with suitable weathertight closing appliances in the following two cases:

(1) the unit in intact afloat condition is inclined within the range from the angle of inclination corresponding to the first intercept in Fig.2.2.1.1 to an angle complying with the relevant requirements of 2.3.1.1;

(2) the column-stabilized unit in damage afloat condition is inclined within the range corresponding to an angle complying with the weathertight integrity requirements of 2.4.2.2(1)②, ③and 2.4.2.2(2)③.

4.3.1.2 External openings fitted with appliances to ensure weathertight integrity, which are kept permanently closed while afloat, are to comply with the following:

(1) A signboard to the effect that the opening is always to be kept closed while afloat is to be affixed to each such opening;

(2) For self-elevating units, all such openings are to have been witnessed closed before the unit becomes waterborne.