CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF FLOATING DOCKS

2009

Effective from July 1 2009

Beijing

CONTENTS

CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.1 Application

1.1.1.1 The Rules applies to the following two types of steel floating docks operating fixedly in sheltered waters:

(1) Caisson type: in which the bottom caisson and both wing walls are continuous and inseparable.

(2) Pontoon type: in which the wing walls are continuous and the bottom is formed of non-continuous pontoons. The pontoons may be either permanently attached to the wing walls or may be detachable.

CCS will, however, give special consideration to other types of floating docks.

1.1.1.2 The Rules applies to the floating dock contracted for construction on or after the date of entry into force of the Rules, including the floating dock converted from a ship.

1.1.1.3 Those not covered in the Rules are to comply with the applicable requirements of CCS Rules for Classification of Sea-going Steel Ships.

1.1.1.4 The statutory requirements for the floating dock in towing condition are to comply with the relevant provisions of the Administration.

1.1.2 Definitions

1.1.2.1 In addition to those defined in 1.1.2.2, the relevant definitions in CCS Rules for Classification of Sea-going Steel Ships apply to the Rules.

1.1.2.2 Unless expressly provided otherwise, for the purpose of the Rules (see Figure 1.1.2.2):

(1) *The length*, L_D, in m, means the distance from the aft end of the aftermost pontoon to the fore end of the forward pontoon, but is exclusive of non-integral end platforms or swing bridges.

(2) *Breadth* B_D, in m, means the breadth measured between the outer surfaces of the outer side plating in way of the maximum breadth,

where:*breadth of inner wing wall* means the moulded breadth measured from the outside (toward the centerline) of the inner wing wall;
clear inner breadth means the clear moulded breadth obtained by deducting the maximum extended length of the suspended structure from the breadth of inner wing wall.

(3) *Depth* D_D, in m, means the vertical distance measured from the outer surface of the bottom framing to the lower surface of the uppermost deck plating at inner side of outer wing wall.

(4) *Working draught* d_D, in m, means the draught while the lifting capacity of the dock is equal to the displacement, in t, of the heaviest ship that the dock is designed to lift on level trim.

(5) *Maximum submerged draught* d_{max}, in m, means the maximum draught to which the floating dock is allowed to be submerged on level trim.

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① For the definition of "contract for construction", see 2.5.1.2 of Chapter 2 of PART ONE of CCS Rules for Classification of Sea-going Steel Ships.

(6) *Wing wall* means continuous box type construction longitudinally located above the pontoon decks on both sides of the floating dock. The outside plating and inside plating are referred to as outer wing wall and inner wing wall respectively.

(7) *Pontoon* means the structure extends between and under the wing walls.

(8) *Pontoon deck* means the uppermost deck of the caisson type or pontoon type floating dock on which the ship to be docked is lifted and repairing work or underwater operation is carried out.

(9) *The top deck* means the uppermost continuous deck extending over the length of the wing walls.

(10) *Safety deck* means the deck extending over the length of the wing walls located below the top deck and above the ballast tank, which is watertight at the position of ballast tank.

(11) *Air cushion* means a cushion formed between the safety deck and ballast water surface during water ingress to the ballast tank where certain amount of air can not escape.

(12) *The rest water* means the ballast water in the tanks which the pumps cannot discharge.

(13) *Compensating ballast water* means the ballast water remaining in excess of the rest water which may be used to adjust the trim and heel and to limit the deflection of the dock by counter-acting the ship-induced longitudinal bending moment when the nominal lifting capacity is utilized.

(14) *The lifting capacity* F_L of the dock is equal to the displacement, in t, of the heaviest ship that the dock is designed to lift in normal service.

(15) *Conditions of class* means the specific measures, repairs and surveys required to be taken within a specified period for the maintenance of class.

(16) *Major alteration* means alterations or modifications for increasing main scantlings and/or lifting capacity of the existing floating dock.

(17) *Dock lightweight* means the weight including pontoons, wing walls, supporting blocks, cranes, all machinery and outfit, and end closing plate/working platform.

(18) *The light displacement of the dock* is its complete weight including pontoons, wing walls, supporting blocks, cranes, all machinery, outfit, full supply of consumables for operation of end closing plate/working platform and the dock (fuel oil, fresh water etc.), compensating ballast water (if required) and rest water.

(19) *Sheltered waters* means the areas of the sea, river or lake alongshore or similar water areas, which forms a comparatively good sheltered condition with little wave.

(20) *An initial classification survey* means the examination of compliance, for a floating dock requesting to be classed with CCS, of its documentation and of the design, configuration, technical condition and management of its structure and equipment with CCS rules and regulations for classification and other technical requirements recognized by it, prior to assigning CCS class and classification certificates to it for the first time. The initial classification surveys of new floating docks are to be carried out in accordance with the requirements of Section 4 of this Chapter - Surveys During Construction.

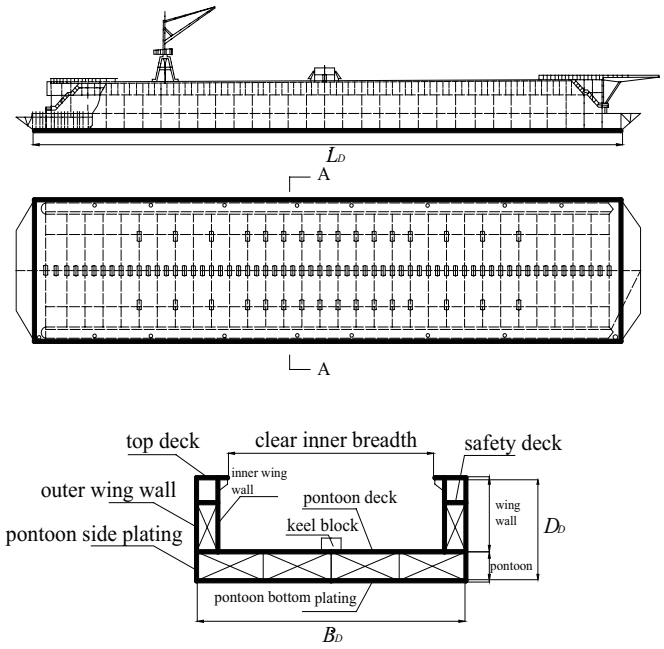

Figure 1.1.2.2 Illustration of typical caisson type floating dock and each part

Section 2 SCOPE AND CONDITIONS FOR CLASSIFICATION

1.2.1 General requirements

1.2.1.1 Floating docks built in accordance with the Rules or with alternative arrangements equivalent thereto, will be assigned a class and included in the Register Book after satisfactory surveys and will continue to be classed so long as they are found, upon examination at the prescribed surveys after construction, to be maintained in a fit and efficient condition and in accordance with the requirements of the Rules.

1.2.1.2 Classification will be conditional upon compliance with CCS's requirements in respect of both hull (including equipment) and machinery (including boilers, pressure vessels, engines, compressors, pumping arrangements, control and electrical equipment, etc.) essential to the safety and operation of the floating dock.

1.2.1.3 For floating docks operating in environmental conditions more severe than those specified in 1.1.1.1, the technical documents complying with the relevant requirements for strength, stability and other requirements under such environmental conditions are to be submitted to CCS for approval.

1.2.1.4 The dock securing arrangements are not considered to be classification items. Notwithstanding the above, the local strength of the dock structure in way of structural strength is considered a classification item. At the request of the owner, an appraisal of these arrangements including possible certification may be undertaken by CCS as an additional service. However, vibratory performance and motion characteristics of the dock at its operation site are not considered to be classification responsibility.

1.2.1.5 Alternative arrangements, materials and equipment if proposed will be considered by CCS for acceptance on the basis of structural equivalency.

1.2.1.6 The stability, fire safety are the conditions of classification of floating docks and are to comply with the requirements of the Rules, with attention being paid to the relevant requirements of the flag State Administration, if any.

1.2.2 Characters of Classification and Class Notations

1.2.2.1 The floating docks in compliance with the requirements in the Rules and classed with CCS, will be assigned either of the following characters of classification and class notations as applicable:

(1) The floating docks have been constructed under the surveys of CCS:

★CSA Floating Dock with F_L (XXX t)

(2) The floating docks have been constructed under the surveys of a classification society recognized by CCS and that they have been found, after examination and survey, to be in compliance with the classification requirements of CCS:

★CSA Floating Dock with F_L (XXX t)

1.2.2.2 Where the port of construction is not the port of operation and the equipment is not fully installed, the class will not be assigned until the dock has received a complete and satisfactory sets of surveys following its arrival and installation at its port of operation.

1.2.2.3 Where novel design or construction of a floating dock or its machinery has been approved by CCS, an appropriate special notation will be affixed and entered in the Register Book.

Section 3 PLANS AND DOCUMENTS

1.3.1 General requirements

1.3.1.1 For new floating docks intended for classification, the applicant is to submit plans and documents as specified in 1.3.2 to 1.3.5 in triplicate to CCS for approval prior to commencement of construction of the floating dock. The plans and documents submitted for approval may be extended as deemed necessary by CCS.

1.3.1.2 Floating docks which have not been built under the surveys of CCS, but which are submitted for classification, plans and documents of the items marked with * as specified in 1.3.2 to 1.3.5, are to be submitted in triplicate to CCS for approval.

1.3.2 Hull

1.3.2.1 The following plans and documents of hull are to be submitted for approval (for special structures and arrangements, the plans and documents submitted for approval may be extended as required):

*(1) General arrangement;

*(2) Principal transverse sections;

*(3) Construction profile, including structural plan of caissons or pontoons, wing walls, top deck, safety deck and, for pontoon type docks, pontoon boundary plating and the plating across the base of the wing walls in way of the pontoon gaps;

(4) Scantlings and section modulus calculations according to the Rules (including strength of longitudinal, transverse and local areas);

*(5) Stability and freeboard calculations, and plan of working and maximum submerged draught mark;

(6) Welding, including type and size of welds;

(7) Full details of the type and proposed arrangement of deflection monitoring equipment;

*(8) Pedestals and stanchion of the crane;

*(9) Arrangement of ballast, fresh water and oil tanks (including their capacity tables);

*(10) Dock lightweight and center of gravity calculations (where applicable).

1.3.2.2 The following plans and documents of hull are to be submitted for information:

(1) Hydrostatic curves and sinkage curves;

(2) Structural plans of deck room and control house;

(3) Specifications of hull and equipment;

(4) Operating manual.

1.3.2.3 The following data are to be included in the documents as listed in 1.3.2.1 and 1.3.2.2:

(1) Design lifting capacity;

(2) Maximum submerged draught, the draught to the top of keel block and working draught;

(3) Dock lightweight (all parts included) and the position of the center of gravity;

(4) Height of the keel block;

(5) Proposed distance of air pipe openings below the safety deck or the pontoon/caisson deck, as applicable (the value may be given after the sinkage trials);

(6) The calculated head assumed for the design of boundary bulkheads (see for detail 2.4.2).

1.3.3 Machinery

1.3.3.1 The following plans and documents of machinery are to be submitted for approval:

*(1) Arrangement of machinery spaces and pump rooms;

*(2) Schematic drawing of inlets and overboard discharge piping systems of pontoons;

*(3) Arrangement of bilge piping;

*(4) Arrangement of air pipes, sounding pipes and overflow pipes;

*(5) Oil fuel piping system for auxiliary engines;

(6) Lubricating oil piping system for auxiliary engines;

(7) Cooling water piping system for auxiliary engines;

(8) Arrangement of scuppers and overboard discharge pipes and fittings;

(9) Arrangement of exhaust pipes for auxiliary engines;

(10) Arrangement of ventilation system for machinery spaces;

(11) Schematic drawing of hydraulic system;

*(12) Arrangement of compressed air piping.

1.3.3.2 The following plans and documents of machinery are to be submitted for information:

(1) Specifications of machinery;

(2) List of machinery.

1.3.4 Electrical installations

1.3.4.1 The following plans and documents of electrical installations are to be submitted for approval:

(1) Electrical loading calculations;

(2) Short-circuit current calculations of electrical system;

*(3) Electrical power distribution diagrams;

(4) Arrangement of electrical power equipment;

(5) Schematic diagrams and arrangement of lighting;

(6) Schematic diagrams and arrangement of internal communication systems;

(7) Diagrams of switchboard.

1.3.4.2 The following plans and documents of electrical installations are to be submitted for information:

(1) Specifications of electrical installations.

1.3.5 Fire protection, detection and extinction

1.3.5.1 The following plans and documents of fire protection, detection and extinction are to be submitted for approval:

*(1) Fire zones and compartmentation bulkheads and decks and specifications of material employed;

*(2) Construction of fire protection bulkheads, decks;

*(3) Ventilation systems including dampers and their control positions;

*(4) Arrangement of fixed fire-extinguishing systems with calculation for quantities of fire-extinguishing media used;

*(5) Arrangement and calculations of water fire-extinguishing system;

*(6) Arrangement of fixed fire detection and fire alarm systems;

*(7) Fire control plan (including arrangement of all fire fighting systems and appliances).

Section 4 SURVEY DURING CONSTRUCTION

1.4.1 General requirements

1.4.1.1 When applying for classification of a new floating dock, including the one undergoes a major alteration, the applicant is to submit a written application prior to the commencement of construction. The responsibilities of both parties, characters of classification and particulars of the floating dock are to be clearly specified in the application or contract/agreement. A separate application for the plan approval may be accepted. In any case, the applicant is to provide the appropriate “date of contract for construction”.

1.4.1.2 The shipbuilder of the floating dock is to be assessed and examined prior to commencement of construction in accordance with Chapter 4 of PART ONE of CCS Rules for Classification of Sea-going Steel Ships.

1.4.2 Examination of plans and documents

1.4.2.1 When it is intended to build a floating dock for classification with CCS, constructional plans and all necessary particulars of the hull and machinery, are to be submitted (see for detailed list of documents in Section 3 of this Chapter). Any subsequent modifications or additions to the scantlings, arrangements or equipment shown on the approved plans are also to be submitted for approval. Details of the anticipated dock operating environment are to be included in the submitted data.

1.4.2.2 Where the proposed construction of any part of the hull or machinery is novel in design, or involves the use of unusual material, it is to be satisfied that it is at least as effective as that required in the Rules. Special tests or examinations before and during service may be required as deemed necessary by CCS. In such cases a suitable notation may be entitled (see also 1.2.2.3).

1.4.3 Surveys

1.4.3.1 For floating docks entitled to the notation referred to in 1.2.2.1(1), from the commencement of the work until the completion of the floating dock, the Surveyors are to examine the materials, manufacture process and arrangements. Any items found not to be in accordance with the Rules and/or the approved plans, or any material, manufacture process or arrangement found to be unsatisfactory, are to be rectified.

1.4.3.2 New machinery for a floating dock classed is to be constructed and installed under CCS's survey. The survey during construction of the machinery is to relate to the period from the commencement of the work until the final test under working conditions. Any items not in accordance with the Rules and/or the approved plans, or any material, manufacture process or arrangement found to be unsatisfactory, are to be rectified.

1.4.3.3 The date of completion of the survey during construction of a floating dock built under CCS's inspection will normally be taken as the date of completion of construction to be entered in the Register Book. If the period between launching and completion is, for any reason, unduly prolonged, the dates of launching and completion may be separately indicated in the Register Book.

1.4.4 Testing

1.4.4.1 General requirements

Each ballast tank, oil tank, fresh water tank and cofferdam is to be tested by a combination of leak tests and structural tests.

1.4.4.2 Leak tests

(1) Each ballast tank is to be tested for leaks by means of a soapy solution examination while the tank is subjected to an air pressure of 0.015 MPa. Prior to inspection, it is recommended that the air pressure in the tank is raised to 0.02 MPa and kept at this level for about 1 hour to reach a stabilized state, with a minimum number of personnel required for the operation in the vicinity of the tank, and then lowered to the test pressure. Precautions are to be taken to prevent excess pressure during the test.

(2) Air testing is normally to be carried out before a protective coating is applied. However, subject to careful inspection by the Surveyors, a complete protective coating may be applied prior to air testing except internally in way of welds made by processes other than automatic.

(3) Equivalent proposals for testing will be considered by CCS.

1.4.4.3 Structural tests

(1) Selected ballast tanks are to be hydraulically tested with the design head. Three tanks are to be tested, one port, one starboard, and one middle tank, each at a different point along the length of the dock. Where the scantlings of a tank boundary are based on the maximum differential head in service, care is to be taken to ensure test heads do not exceed the design differential head.

(2) Oil tanks, fresh water tanks and cofferdams are to be separately tested by filling with water to the test head.

(3) When water testing on the building berth or dock is undesirable, testing is to be carried out afloat. The testing afloat is to be so arranged that each tank can successively be examined while being subjected to the head of water. Care is to be taken that the arrangements adopted for testing tanks afloat do not impose undue longitudinal stress on the dock.

(4) Where a preservative coating is to be applied to the internal structure of a tank, the water testing may take place after the application of internal and/or external coatings, provided that the structure is carefully examined to ensure that all welding and structural stiffening are completed prior to the application of the coating. The cause of any discolouration or disturbance of the coating is to be ascertained and any deficiencies repaired.

1.4.4.4 Sinkage trials and dock lightweight surveys

On the completion of the dock, sinkage trials and lightweight surveys are to be carried out in the presence of a CCS Surveyor, to determine:

(1) minimum top deck freeboard of the dock;

(2) actual lifting capacity of the dock;

(3) lightweight of the dock, longitudinal center of gravity and transverse center of gravity;

(4) built-in permanent deflection and light displacement in normal condition. Normal condition means fresh water tanks and the dock's fuel tanks are to be full and all ballast water is to be emptied so far as possible, only rest-water remaining. Ship-oil tanks are to be empty and the travelling cranes may be so positioned that the draughts forward and aft are equal. The density of the water and the draughts forward and aft of the dock and port and starboard of mid of the dock are to be recorded. The built-in permanent deflection in the normal condition is to be measured and the light displacement is to be evaluated.

(5) For the purpose of sagging deflection:

① equal amounts of water are to be admitted to corresponding tanks on either side of the middle of the length;

② the sagging bending moment so produced is to equal that evaluated in Chapter 2;

③ the deflection meter readings are to be recorded and adjustment of the meters is then to be made, by allowing for the permanent deflection, the sagging deflection is obtained.

1.4.5.5 Lightweight vertical center of gravity

(1) The position of the vertical center of gravity by an inclining test is to be carried out upon completion of the first floating dock. Where it is difficult to calculate an accurate vertical center of gravity by inclining test, the vertical center of gravity is to be determined by calculation, provided (2) and (3) below are to be complied with.

(2) In determining the position of vertical center of gravity by calculation, lightweight vertical center of gravity prone to safety is to be given for the calculation of lightweight and center of gravity, e.g. the vertical center of gravity of deck plating may be assumed to be at the upper edge of the deck, the vertical center of gravity of bottom structure (including bottom plating) of pontoon may be assumed to be at the upper edge of bottom plating framing, and the vertical center of gravity of side plating may be assumed to be at the higher position of the structure.

(3) In determining the position of vertical center of gravity by calculation, the vertical center of gravity is to additionally be modified based on the difference between the lightweight and calculated weight obtained from the survey. Where the weight is reduced, it is to be assumed that the vertical center of gravity of the reduced weight is at the bottom of the dock, and where the weight is increased, it is to be assumed that the vertical center of gravity of the increased weight is at the top of the dock.

(4) Based on the approved lightweight vertical center of gravity of the first floating dock, the lightweight vertical center of gravity of a sister floating dock may be determined by modification as specified in (3), taking into account the weight difference between the dock lightweight of sister floating docks and the first one.

Section 5 SURVEY AFTER CONSTRUCTION

1.5.1 General requirements

1.5.1.1 For the purpose of maintaining the validity of certificates, floating docks which have been classed with CCS are to be subject to various periodical surveys after construction as specified in 1.5.2 of this Section.

1.5.1.2 It is the responsibility of the owner to apply to CCS for surveys after construction and to make preparations and take safety precautions for surveys.

1.5.1.3 If any damage or defect affecting the validity of certificates is found at any of the surveys, the Surveyor is:

(1) to inform the owner or his representative of the recommendations in time when he deems necessary. When such recommendations are not dealt with, the Surveyor is to report this to the Headquarters of CCS immediately;

(2) in the conditions other than that in (1) above, to issue a list of noncompliance with the condition of class to the owner or his representative. The owner or his representative is to take measures in time to remove such noncompliance and apply to CCS for confirmation of the effectiveness of the measures taken.

1.5.1.4 In addition to the requirements of this Section, the survey after construction of the floating docks is to comply with the applicable requirements of PART ONE of CCS Rules for Classification of Sea-going Steel Ships.

1.5.1.5 Plans and documents related to major alteration of a floating dock are to be submitted to CCS for approval. Where any ship is converted to a floating dock, the converted floating dock is to comply with the requirements of the Rules from the date on which the contract for major alteration is signed.

1.5.2 Types and periods of surveys

1.5.2.1 Annual/biennial survey: For floating docks operating in sea water conditions (including sea-river combination, the same below), an annual survey is to be carried out within 3 months before or after each anniversary date of the certificate. For floating docks operating in fresh water conditions, a biennial survey is to be carried out in the operation period of every 2 years. The biennial survey is to be completed within 6 months before the second anniversary of the certificate.

1.5.2.2 Special survey: For floating docks operating in sea water conditions, the first special survey is to be completed within 5 years from the date of initial classification survey and thereafter within 5 years from the credited date of the previous special survey. For floating docks operating in fresh water conditions, the first special survey is to be completed within 6 years from the date of initial classification survey and thereafter within 6 years from the credited date of the previous special survey. The interval between special surveys may be reduced by CCS according to the actual technical condition of the floating dock.

1.5.2.3 Continuous survey: For floating docks, continuous survey may be carried out in lieu of special survey as requested by the owner. The owner is to prepare the plan for continuous survey and submit it to CCS for approval. The plan is to ensure that all the items are completed within the specified period of special survey prior to its due date.

1.5.2.4 Survey of the outside of the dock's bottom (drydocking survey or equivalent underwater inspection): For floating docks over 10 years of age, a survey of the outside of the dock's bottom is to be carried out at least once within the interval of one special survey. Unless the survey is carried out in dry dock or on a slipway, the owner's proposals for examination of the underwater portion of the dock are to be submitted to CCS, and one or more of the following could be used:

(1) underwater photography;

(2) underwater television;

(3) diver's report;

(4) report of ultrasonic gauging of plating;

(5) careening for partial examination of bottom plating above water surface.

The underwater survey is to be carried out in conjunction with the special survey. The extent of the examination is to be agreed and the number, size and location of these areas are to be to the Surveyor's satisfaction. The areas to be examined of the underwater portion of the dock are to be cleaned and descaled prior to the examination.

Each proposal submitted by the owner is to include a report on the conditions in which the dock operates prior to underwater surveys, including at least:

(1) type of coating;

(2) whether or not corrosion control are adopted;

(3) water area in service (whether fresh or salt, clear or dirty water);

(4) other relevant factors.

1.5.3 Hull surveys

1.5.3.1 At each annual/biennial survey, the following parts are to be examined, to ensure they are in good condition:

(1) structures above the light waterline (such as exposed inner walls, shell plating, pontoon deck, etc.);

(2) safety and top decks;

(3) supporting blocks and their foundations;

(4) casings and skylights;

(5) companionways and ladders, hatchways and man-holes with their closing and securing arrangements;

(6) air pipes, overboard scuppers and discharges;

(7) hinged gangways;

(8) guard rails and stanchions;

(9) connections in way of gaps between two adjacent pontoons for pontoon type docks;

(10) working and maximum submerged draught mark.

1.5.3.2 Special survey is to include compliance with annual/biennial survey requirements in 1.5.3.1. Effect is also to be given to the following requirements:

(1) Pontoon and side wall tanks are to be cleaned and examined internally and tested by a head sufficient to give the maximum pressure that can be experienced in service. For floating docks over 15 years of age, oil fuel tanks forming part of the main structure are to be examined internally.

(2) Spaces above safety deck are to be examined internally, and battens, lining and pipe casings are to be removed as required.

(3) Where the surface of plating is covered with cement, composition or wood sheathing the covering is to be examined and sounded. If cement or composition is found to be not adhering to the plating it is to be removed for examination of the plating. Where wood sheathing is deteriorated or badly worn it is to be removed for examination of the plating.

(4) The efficient condition of the means of communication between control position and machinery spaces, are to be ascertained.

(5) Where fitted, sounding pipes are to be examined and the thick steel plate fitted below each sounding pipe is to be in satisfactory condition.

(6) The Surveyor may require to ascertain the thickness of the materials in any portion of the structure where signs of wastage are evident or wastage is normally found. Any parts of the structure which are found defective or materially reduced in scantlings are to be made good to the Surveyor's satisfaction.

(7) At the first special survey for the dry dock having reached 24 years of age, and at every two intervals thereafter, the thickness of the structure are to be determined by an approved method to assess the general condition. Two belts of gaugings are to be made within the 0.5 L_D midlength of the dry dock.

1.5.4 Machinery and electrical installations surveys

1.5.4.1 The surveys of boilers, machinery, electrical installations and control engineering systems are to be in accordance with the relevant requirements of Chapter 5, PART ONE of CCS Rules for Classification of Sea-going Steel Ships, so far as these are applicable.

CHAPTER 2 HULL STRUCTURE

Section 1 GENERAL PROVISIONS

2.1.1 General requirements

2.1.1.1 This Chapter applies to steel floating docks with two types as specified in 1.1.1 of the Rules. CCS will, however, give special consideration to other types of floating docks.

2.1.1.2 For those for structures not covered in this Chapter the applicable requirements of PART TWO of CCS Rules for Classification of Sea-going Steel Ships are to be complied with.

2.1.1.3 Deflection meters are to be arranged in accordance with 2.2.5 of this Chapter to monitor the maximum longitudinal deflection over the length of the dock. Where alternative method is used, prior agreement of CCS is to be sought.

2.1.1.4 At least a safety deck complying with watertight requirements is to be arranged in way of the ballast tank below the top deck in the wing wall so as to form the boundary of the top of the ballast tank.

2.1.1.5 The strength for supporting structures corresponding to cranes and towing equipment are to be checked and adequately stiffened in accordance with Section 6 of this Chapter.

2.1.2 Materials

2.1.2.1 Steels used for the structural members of the dock are to comply with the relevant requirements of CCS Rules for Classification of Sea-going Steel Ships.

2.1.2.2 For floating docks designed to operate in special conditions of air temperatures over -20℃, the grade A steel is acceptable to hull structure. The design temperature is to be taken as the lowest mean daily average air temperature in the area of operation (statistical mean over a minimum of 20 years).

2.1.2.3 Materials and welding consumables are to comply with the relevant requirements of CCS Rules for Materials and Welding.

2.1.3 Direct calculations

2.1.3.1 Where direct calculation is applied to check the strength of the structure, all relevant information are to be submitted to CCS for approval.

2.1.3.2 Where the spacing of transverse bulkheads of the pontoon exceeds $B_D/6$, the transverse strength of pontoon structure is to be checked by direct calculation in accordance with Appendix 1, in addition to that specified by the rules according to Section 2.

Section 2 LONGITUDINAL STRENGTH

2.2.1 General requirements

2.2.1.1 The longitudinal strength is to be calculated, in accordance with this Section, for the assumption when the docked ship of length L_s (described in 2.2.2.3) is supported on the keel blocks, the center of the ship's length being over the mid-length of the dock, and the freeboard at the pontoon deck is at least equal to that given in 3.2.1.1.

2.2.1.2 The structural members to be included in the calculation of the section modulus is to have same section within 0.4 L_D amidships of the dock hull, and is to be longitudinally continuous. In no case is the crane rail to be included in the section modulus calculation.

2.2.1.3 The plate panels and longitudinals subject to longitudinal bending moment and shear stresses are to be checked for buckling, see 2.2.7 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.2.2 Loads

2.2.2.1 Full weight of the docked ship is assumed to be supported on blocks in accordance with 2.2.1.1 (see Figure 2.2.2.1), and the loads are to be distributed in accordance with 2.2.2.2 or 2.2.2.3(2). Dock buoyancy distribution may be assumed to be uniform over the length of the dock.

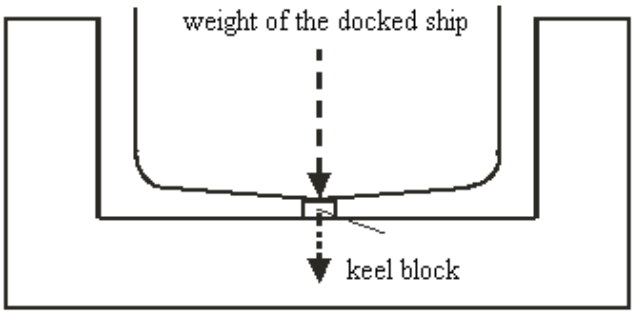

Figure 2.2.2.1 Weight of the docked ship assumed to be supported on blocks

2.2.2.2 The longitudinal strength is to be determined according to the most severe load condition that may appear in the service. Generally, it is to be investigated for the condition corresponding to the shortest vessel intended to be lifted and supported at the maximum lifting capacity of the dock. If the condition is not clearly determined, the assumption of 2.2.2.3 may be adopted.

2.2.2.3 Generally, the length and weight curve for docked ship is assumed as:

(1) the ship's length L_s, in m, may be taken as follows:

$$L_S = \begin{cases} 0.80L_D & \text{for} \quad F_L < 40000\,\text{t} \\ 0.0576F_L^{0.2483}L_D & \text{for} \quad 40000\,\text{t} \leqslant F_L < 70000\,\text{t} \\ 0.92L_D & \text{for} \quad F_L \geqslant 70000\,\text{t} \end{cases}$$

where: F_L—— lifting capacity of the floating dock, in t;
L_D—— dock length, in m;

(2) the weight curve $q(x)$ of the ship may be taken as a rectangle with a superimposed parabola $q_2(x)$ of half the area of the rectangle q_1, the length of each area being L_s (see Figure 2.2.2.3(2)).

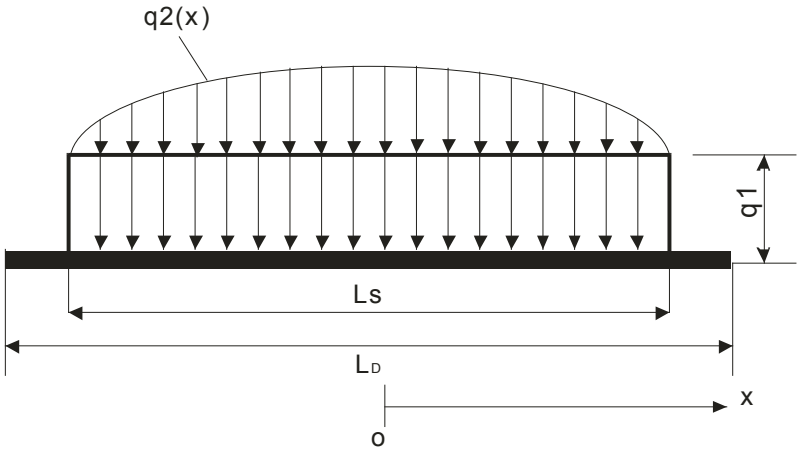

Figure 2.2.2.3(2) Weight curve over the length of the docked ship L_s

where: L_D —— Dock length, in m;

L_s —— Assumed length of ship, in m, see 2.2.2.3(1);

q_1 ——The rectangular loading distribution over the length of the ship L_s, in kN/m, $q_1 = \frac{2}{3} \cdot \frac{9.81F_L}{L_S}$;

$q_2(x)$ —— The parabolic loading distribution over the length of the docked ship L_s, in kN/m,

$$q_2(x) = \frac{9.81F_L}{2L_s}(1 - Cx^2)$$ where, C — $4/L_s^2$;

x —— Longitudinal coordinate with its origin at $L_D/2$(coincide with $L_s/2$) along the length of the dock, in m, positive forwards.

2.2.2.4 The longitudinal bending moment M_s of the floating dock in even ballasting condition may be obtained from the following equation in accordance with 2.2.1.1 and 2.2.2.3:

$$M_s = \begin{cases} 0.327F_LL_D & \text{for} \quad F_L < 40000\,\text{t} \\ 1.23(1 - 0.0528F_L^{0.2483})F_LL_D \quad \text{kN} \bullet \text{m} & \text{for} \quad 40000\,\text{t} \leqslant F_L < 70000\,\text{t} \\ 0.192F_LL_D & \text{for} \quad F_L \geqslant 70000\,\text{t} \end{cases}$$

where: F_L —— Lifting capacity of the floating dock, in t;

L_D —— Dock length, in m.

2.2.3 Longitudinal bending strength

2.2.3.1 For operation modes defined in 2.2.2.4, the permissible longitudinal bending stresses [σ] are not to exceed $137/K$, N/mm^2 (K — material factor, not to be taken less than 0.72, see Section 5 in Chapter 1 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships).

2.2.3.2 Where provision is made for the normal operation of the dock to be complemented by the differential emptying of the ballast compartments for reducing the maximum longitudinal bending moment, in addition to complying with the requirement of 2.2.3.1, the permissible longitudinal bending stresses [σ] are not to exceed $215/K$, N/mm^2 with ballast water evenly distributed over the dock length, where K — material factor, see 2.2.3.1.

2.2.3.3 Where the longitudinal bending moment in towing condition is greatly affected by the environment, the analysis for the longitudinal bending moment is to be carried out taking into account the draught in towing condition, route and environment. The maximum longitudinal bending stresses are not to exceed permissible stresses [σ]=$175/K$, N/mm^2 en route, where K — material factor (see 2.2.3.1).

2.2.4 Longitudinal shear strength

2.2.4.1 The shear strength of the following transverse sections are at least to be checked over the length of the dock L_D:

(1) supporting blocks at ends of the shortest docked ship in lifting condition;

(2) opening of wing walls (such as accesses) and other weak shear area;

(3) where maximum shear stress occurs corresponding to the condition specified in (1).

2.2.4.2 The maximum shear stress of a section is to be taken while calculating the shear stress τ, the value may be obtained by one of the following method:

(1) 1.2τ N/mm^2, where: $\tau = 10Q/A$;

(2) in accordance with 2.2.6.4 in Chapter 2 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships,

where: Q —— the shear stress at the transverse section considered, in kN, in which the shear stresses by gravity loads and buoyancy loads are combined through area integration of the weight curve from the aft to the section. Where the weight of the dock and the buoyancy are assumed to be evenly distributed over the length of the dock, the value of Q may be simplified as the difference between the weight of the ship and the buoyancy caused (the buoyancy distribution equals to 9.81 F_L/L_D, in kN/m, where: F_L is the lifting capacity, in t, L_D is the length of the dock, in m);

A —— the shear area calculated at the transverse section considered, in cm^2, which is the effective longitudinal shear area, namely the sum of sectional area of inner and outer wing walls, side plating of pontoon and longitudinal bulkhead plating.

2.2.4.3 Corresponding to the floating dock operating in the mode specified in 2.2.3.1, the permissible shear stresses at transverse section $[\tau] = 95/K$, in N/mm^2, where K — material factor, see 2.2.3.1.

2.2.4.4 Corresponding to the floating dock operating in the mode specified in 2.2.3.2, the permissible shear stresses at transverse section are also to be assumed as evenly distributed in addition to the requirements of 2.2.4.3, and the permissible shear stress $[\tau] = 120/K$, in N/mm^2, where K — material factor, see 2.2.3.1.

2.2.5 Deflection control system

2.2.5.1 The type of indicators and the detailed arrangement of monitoring and methods for limiting the dock deflections in service are to be submitted for approval. In general, these methods are to include arrangements for visual and audible warning, and procedures for ballast control to prevent maximum allowable deflections being exceeded.

2.2.5.2 In principle, one deflection monitoring system is to be fitted for the length of dock L_D being 90 m and above. And two completely independent deflection monitoring systems are to be fitted for the length of dock L_D being 180 m and above.

2.2.5.3 One of the two deflection monitoring systems required is to be of the hydraulic type. The readings of one of the systems installed are to be displayed on an indicator board in the control room of the dock.

2.2.5.4 The deflection monitoring systems are to be capable of outputting deflections over the length of the dock L_D.

2.2.5.5 Generally, the floating dock is to be launched by sliding in transverse direction. Where sliding in longitudinal direction is needed for some special reasons, the longitudinal strength is to be checked for the most severe load condition likely to occur and submitted to CCS for approval.

Section 3 TRANSVERSE STRENGTH

2.3.1 General requirements

2.3.1.1 The transverse strength is to be calculated in accordance with this Section. For direct calculation, see 2.1.3.2.

2.3.1.2 The attached plating is to be considered in the section modulus for the primary transverse members. The effective width of the attached plating is to be determined complying with the relevant requirements in Section 2 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.3.1.3 Where other methods are used, detailed specifications are to be provided.

2.3.1.4 The plate panels and transverses subject to transverse bending moment and shear stresses are to be checked for buckling, see 2.2.7 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.3.1.5 The end transverse strength of the pontoon is not to be lower than that of the mid-portion of the pontoon.

2.3.2 Loads

2.3.2.1 The primary transverse strength members of the dock, throughout its length L_D, is to be suitable for the sum of the following load components (generally, the weight of the keel block and the hydrostatic pressure effect on horizontal action may be neglected), see Figure 2.3.2.1 for a typical mode of loading:

(1) self-weight of the dock (including the weight of wing wall q_{wall} and weight of pontoon $q_{pontoon}$);

(2) docked ship weight P, maximum ship weight ordinate obtained from the ship weight curve given in 2.2.2.3: $1.167\frac{9.81F_L}{L_S}$ N/m；

(3) external hydrostatic pressure p_{s-deck} due to given draught. The most severe condition normally occurs when the draught is equal to the depth to the top of the keel blocks (i.e. the bottom of the docked ship is just lifted above the water surface);

(4) internal hydrostatic pressure p_{s-tank} due to the level of evenly distributed ballast associated with the draught as in (3);

(5) hydrostatic pressure of the outside of dock's bottom $p_{s-outbottom}$;

(6) wing wall reactions R_1, R_2 required to give equilibrium on the section under consideration. These reactions at inner and outer wing walls may be taken as equal (i.e. $R_1 = R_2$).

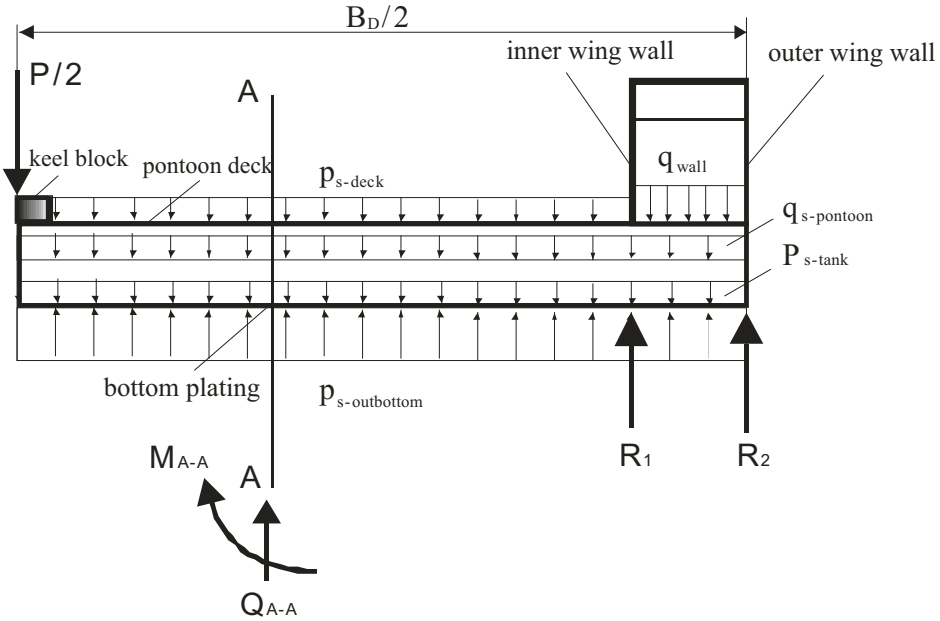

Figure 2.3.2.1 Typical mode of cross-section loading of floating dock

2.3.2.2 The transverse bending moment M_{A-A} and shear force Q_{A-A} on the longitudinal section A-A (see Figures 2.3.2.1 and 2.3.3.1) at the breadth of the dock may be obtained based on 2.3.2.1 and Figure 2.3.2.1.

2.3.3 Calculation model

2.3.3.1 The transverse bending strength and shear strength of some typical longitudinal sections taken over the transverse length (where symmetrical, only half the breadth may be taken) of the pontoon are to be checked. The spacing of transverse bulkheads (*l-TBHD*) is to be taken as the longitudinal length of the section calculated, and the weak points of transverse strength are to be included in the check point of the section. See Figure 2.3.3.1.

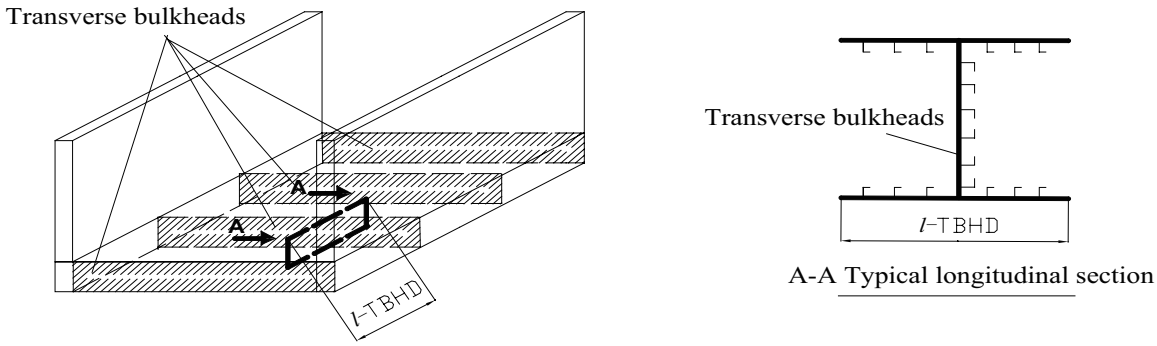

Figure 2.3.3.1 The extent of longitudinal section for calculation of transverse strength and typical longitudinal section

2.3.3.2 When lifting at maximum capacity with a ship length less than that of the dock, the sections clear of the ship will experience transverse hogging due to the combination of loads in 2.3.2.1(1), (3), (4), (5) and (6). Hence, this loading case is also to be examined for the sections concerned. The most severe condition will usually occur when the ballast depth is at a minimum (i.e. rest water only).

2.3.4 Transverse strength

2.3.4.1 The compressive and tensile stresses computed for the load conditions given in 2.3.2 are not to exceed the permissible stress $[\sigma]$= 170 N/mm^2. The mean shear stress at any section through the web plating of the primary transverse members is not to exceed the permissible shear stress $[\tau]$ = 95 N/mm^2 (for the calculation of maximum shear stress, refer to 2.2.4.2, however the cross-section part is to be regarded as longitudinal section), and the Von Mises combined stress σ_e at any point are not to exceed the permissible equivalent stress $[\sigma_e]$ =180 N/mm^2 (where $\sigma_e = \sqrt{\sigma^2 + 3\tau^2}$, σ, τ — the compressive and tensile stresses and shear stress at the calculation point respectively).

2.3.4.2 Particular care is to be given to the maintenance of transverse strength standard (not to be lower than that of 2.3.4.1) in end sections of floating docks with swim ends where the pontoon depth is reduced.

Section 4 LOCAL STRENGTH

2.4.1 General requirements

2.4.1.1 Scantlings of the hull structural members are to be adequate to meet the requirements for longitudinal strength, transverse strength and direct calculation (where necessary), and not to be less than that specified in this section.

2.4.1.2 The section modulus for the members is that with attached plating. The effective width of the attached plating is to be determined complying with the relevant requirements in Section 2 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships. Where the attached plating is of varying thickness, the mean thickness over the appropriate span is to be used.

2.4.1.3 Primary structural members, such as longitudinals, beams and side frames, are to keep continuous. If discontinuing in a position, they are to be bracketed. The scantlings of bracket are to comply with relevant requirements of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.4.2 Tank plating

2.4.2.1 The thickness of boundary plating t in ballast tanks, oil tanks, freshwater tanks, sewage tanks, void spaces and non-watertight pillar bulkhead is not to be less than that obtained from the following equation:

$$t = t_0 + 2.5 \quad \text{mm}$$

where: $t_0 = 3.9s\sqrt{h}$ m, when *l*/*s* is less than 4, the thickness obtained from the above formula is to be multiplied by the factor: $\left(1.1 - \frac{s}{2.5l}\right)$;

s —— stiffener spacing, in m;

h —— calculated head, in m, taken as in Table 2.4.2.1;

l —— the span of stiffeners, in m.

Table 2.4.2.1

Location of members	Calculated head *h* (m)	Remarks
1. Boundary plating subjected to external hydrostatic pressure and internal hydrostatic pressure on both sides, such as wing walls and shell plating of pontoon	Maximum difference of water level obtained from the submergence curve	
2. Longitudinal and transverse watertight bulkheads separating ballast tanks together with the boundary	Maximum pressure difference between both sides	
3. Spacing of air cushion, such as the safety deck, wing walls and bulkhead plating of wing walls	Internal head on the cushion side: difference of water level under maximum submerged depth The head is the difference between inner and outer pressure	Requirements of 1 and 2 above are to be complied with
4. Void tank watertight boundaries	The vertical distance from the calculated members to maximum submerged depth level	Requirements of 3 above are to be complied with
5. Oil tanks, fresh water tanks and bilges other than that mentioned above	Relevant requirements for tanks in PART TWO of CCS Rules for Classification of Sea-going Steel Ships	
Notes: 1. It is recommended that another 0.5 m be added on the basis of the head *h* obtained from above. 2. The minimum head *h* of 2, 3, 4 above is to be taken as 3.5 m.		

2.4.2.2 The minimum thickness of the plating is to be 7.5 mm.

2.4.3 Stiffener on boundary plating

2.4.3.1 For all tank stiffeners, longitudinals, beams and side frames defined in 2.4.2.1 subjected to lateral pressure, the minimum section modulus *W* is not to be less than that obtained from the following equation:

$$W = 7shl^2 \quad \text{cm}^3$$

where: *s* —— stiffener spacing, in m;

l —— the span in m between effective supporting members;

h —— calculated head ,in m, see 2.4.2.1, measured from the mid span.

2.4.4 Top deck plating

2.4.4.1 The scantlings of top deck are to be determined as required for longitudinal strength. For outside the 0.4 L_D mid-length the plate thickness may be gradually reduced, and the thickness is not to be less than the following equation:

$t = 10s$ mm (over the 0.4 L_D mid-length of the dock)

$t = 7.8s + 2.2$ mm, and not to be less than 6.5 mm (0.1 L_D from each end of the dock)

where: *s* —— spacing of longitudinal in m.

2.4.4.2 The thickness of top deck plating over the 0.4 L_D mid-length of the dock is to be greater than that of the end of the dock.

2.4.4.3 The opening of the top deck is to be strengthened and compensated appropriately in accordance with PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.4.5 Top deck longitudinals and beams

2.4.5.1 The top deck should, in principle, be stiffened longitudinally for the middle 0.4 L_D. The scantlings of the longitudinals are to be gradually reduced to the dock ends.

2.4.5.2 The scantlings of the longitudinals are to be determined as required for longitudinal strength and not to be less than the following equation:

$$W = Csl^2 \quad \text{cm}^3$$

where: C —— 14.5 for longitudinal beam within 0.4 L_D amid-length, 5.4 for transverse beam and longitudinal beam at the fore and aft end. The C value for longitudinals between the mid-length and end of the dry dock may be obtained by interpolation between the two above indicated values.
s —— spacing of longitudinal or transverse beams in m;
l —— span of longitudinal or transverse beams in m.

2.4.6 Safety deck plating

2.4.6.1 The thickness of plating of the safety deck, is to be not less than:

$$t = t_0 + 2.5 \quad \text{mm where } l/s < 4,\ t_0 \text{ is to be multiplied by the factor: } (1.1 - \frac{s}{2.5l})$$

where: $t_0 = 3.4s\sqrt{h}$ mm;
s —— stiffener spacing, in m;
l —— overall length of beam or longitudinal between support points, in m;
h —— height from top of safety deck beam to top of upper deck beam at side, in m.

2.4.6.2 Special consideration is to be given to the plate thickness where the deck subjected to the air cushion and cargo/equipment, in addition to 2.4.6.1.

2.4.6.3 The minimum thickness of the plating is to be 7.5 mm.

2.4.7 Longitudinals and beams of safety deck

2.4.7.1 The section modulus W of each safety deck longitudinals or transverse beam is to be obtained from the following equation:

$$W = 4.5shl^2 \quad \text{cm}^3$$

where: W, s, h, l —— same as defined in 2.4.6.1.

2.4.7.2 Special consideration is to be given to the scantlings where the deck subjected to the air cushion and cargo/equipment, in addition to 2.4.7.1.

2.4.8 Webs, transverses, floors and girders

2.4.8.1 For primary supporting members such as webs, transverses, floors and girders, the minimum section modulus W is not to be less than that obtained from the following equation:

$$W = 7bhl^2 \quad \text{cm}^3$$

where: b —— supporting width, in m, spacing of primary supporting members;
l —— calculated span, in m;
h —— calculated head, in m, see 2.4.3.1, measured from the mid span.

2.4.9 Bracing bars

2.4.9.1 The sectional area, web and face plate of bracing bars, where fitted between inner and outer wing walls and in caisson, are to be determined according to 2.4.9.4 and 2.4.9.5. In addition, end reinforcement may be determined according to the relevant requirements for pillars in Chapter 2 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.4.9.2 The loading P on the horizontal bracing bar is not to be less than that obtained from the following equation:

$$P = p \quad \text{kN}$$

where: $p = 9.8shl_1$, in which:

h —— maximum differential head, in m;
s —— spacing of bracing bars, in m;
l_1 —— vertical distance between the mid-point of the spans of two members immediately over and under the horizontal bracing bars, in m, see Figure 2.4.9.3.

2.4.9.3 The loading P on the diagonal bracing bars is not to be less than that obtained from the following equation：

(1) For diagonal bracing bar 1 (see Figure 2.4.9.3):

$$P = \frac{p \sin\beta}{\sin(\alpha + \beta)} \quad \text{kN}$$

where: P —— see 2.4.9.2, h— measured from the bottom of the diagonal bracing bar to the water level under maximum pressure difference.
α, β —— angles between the diagonal bracing bars with scarphing arrangements and water line, (º), see Figure 2.4.9.3;

(2) For diagonal bracing bar 2 (see Figure 2.4.9.3):

$$P = \frac{p \sin\alpha}{\sin(\alpha + \beta)} \quad \text{kN}$$

where: P, α and β —— same as defined in (1).

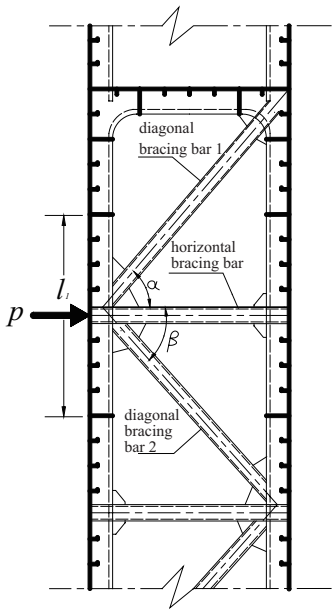

Figure 2.4.9.3 Vertical distance l_1 between the mid-point of the spans of two members immediately over and under the diagonal bracing bars

2.4.9.4 The cross-section area A of diagonal bracing bars is not to be less than that obtained from the following formula:

$$A = \frac{P}{12.26 - 5.10\frac{l}{r}} \qquad \text{cm}^2$$

where: P —— load, in kN, supported by the diagonal bracing bars under consideration, to be determined by 2.4.9.2 and 2.4.9.3;
l —— the effective length of diagonal bracing bars, in m, to be taken as 0.8 times the whole length of diagonal bracing bars;
r —— minimum radius of gyration of the section of diagonal bracing bars; in cm.

2.4.9.5 The built or rolled-section diagonal bracing bars are to comply with the following requirements:

(1) The web thickness t of I or channel section diagonal bracing bars is not to be less than the lesser of the following:

$$t = \frac{br}{60l} \qquad \text{mm}$$

$$t = \frac{b}{55} \qquad \text{mm}$$

where: b —— web depth of built or rolled-section diagonal bracing bars, in mm;
l, r —— same as defined in 2.4.9.4 of this Section.

The minimum web thickness of I or channel section pillars is not to be less than 7 mm.

(2) The thickness t of flanges of angle or channel sections is not to be less than the lesser of the following:

$$t = \frac{br}{20l} \qquad \text{mm}$$

$$t = \frac{b}{18} \qquad \text{mm}$$

where: b —— length of flange of angle or breadth of face plate of channel sections, in mm;
r, l —— same as defined in 2.4.9.4 of this Section.

(3) The thickness t of face plate of I sections is not to be less than the lesser of the following:

$$t = \frac{br}{40l} \qquad \text{mm}$$

$$t = \frac{b}{40} \qquad \text{mm}$$

where: b —— breadth of face plate of I sections, in mm;
r, l —— same as defined in 2.4.9.4 of this Section.

2.4.10 Local strength of the structure in way of keel blocks and supporting structure

2.4.10.1 The loading to be taken (over the whole length of the dock) by the keel blocks and supporting structure is to be determined by 2.2.2.1, 2.2.2.2, 2.2.2.3 and 2.3.2. For strength criteria, refer to 2.3.4. For direction calculation, refer to the criteria set out in Appendix 1.

2.4.11 Platforms extending from ends of dock

2.4.11.1 The loading on these structures is generally to be assumed as 5.75 kN/m^2, permissible stresses [σ] are to be 60 N/mm^2 and the permissible shear stresses [τ] are to be 35 N/mm^2. If a heavier loading is anticipated or required, the plans are to be marked accordingly. The local strength is to be calculated where necessary.

2.4.12 Swing bridges at end of dock

2.4.12.1 The loading on this connecting bridge is generally to be assumed as 3.59 kN/m^2, permissible stresses [σ] are to be 60 N/mm^2 and the permissible shear stresses [τ] are to be 35 N/mm^2. If a heavier loading is anticipated or required, the plan is to be marked accordingly. The local strength is to be calculated where necessary.

Section 5 WELDING

2.5.1 General requirements

2.5.1.1 The plans to be submitted for approval are to indicate clearly details of the welded connections of main structural members, including the type and size of welds. This requirement includes welded connections to steel castings. The information to be submitted is to include the following:

(1) whether weld sizes given are throat thicknesses or leg lengths;

(2) grades and thicknesses of materials to be welded;

(3) location, types of joints;

(4) sequence of welding of assemblies and joining up of assemblies.

2.5.1.2 Prior to the commencement of the production, the shipbuilders or manufacturers are to submit the welding procedures intended for use to CCS for approval according to Chapter 3 of PART THREE of CCS Rules for Materials and Welding.

2.5.1.3 The welders or welding operators are to hold a “Qualification Certificate of Welders” issued or accepted by CCS and engage in welding operation appropriate to their qualified range of work.

2.5.1.4 Non-destructive testing personnel are to hold a “Qualification Certificate of Ship’s NDT Personnel” issued or accepted by CCS, and can only engage in the non - destructive testing appropriate to their qualified range of work.

2.5.2 Butt welds

2.5.2.1 Abrupt change of section is to be avoided where plates of different thicknesses are to be butt welded and the edge of the thick plate is to be tapered so as to ensure an uniform transition if the difference between thicknesses is equal to or greater than 4 mm. The width of taper is not to be less than 4 times the difference between thicknesses. If the difference between thicknesses is less than 4 mm, the profile of welds may be uniformly sloped within the width of the welds.

2.5.3 Lap and plug welds

2.5.3.1 Overlaps are generally not to be used to connect plates which may be subjected to high tensile or compressive loading, and alternative arrangements are to be considered. Where, however, plate overlaps are adopted, the width of the overlap (b) is not to exceed four times nor be less than three times the thickness of the thinner plate and the joints are to be positioned as to allow adequate access for completion of sound welds, see Figure 2.5.3.1. The faying surfaces of lap joints are to be in close contact and both edges of the overlap are to have continuous fillet welds.

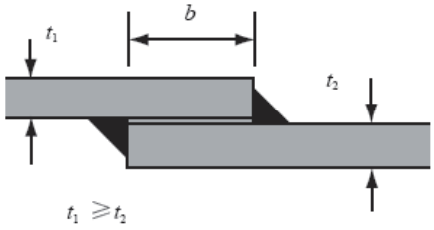

Figure 2.5.3.1 Lap welds

2.5.3.2 For the connection of plating to internal webs, where access for fillet welding is not practicable, the closing plating is to be attached by slot fillet welds to face plates fitted to the webs. Slots are to have a minimum length of 75 mm and a minimum width of twice the plating thickness, with well rounded ends. The distance between slots is not to exceed 150 mm. Slots are normally not to be filled with welding.

2.5.4 Fillet welds

2.5.4.1 T-connections are generally to be made by fillet welds on both sides of steel floating docks. The types and application of fillet welds for structural connections are to be as shown in Table 1.4.4.1 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships. Where the connection is highly stressed, deep penetration or full penetration welding may be required.

2.5.4.2 The throat thickness of fillet welds and the fillet leg length are to be determined from the following formula:

(1) The throat thickness h of fillet welds is to be determined from the following formula:

$$h = w_t t_p d/l \quad \text{mm}$$

where: t_p —— thickness of the thinner plate of the abutting plates, in mm;
d —— pitch of weld fillets, in mm, i.e. the distance between start positions of successive weld fillets for intermittent welding;
l —— the length of weld fillet, in mm, and is not to be less than 75 mm;
w_t—— weld factor. The weld factors used for hull structures are as specified in Table 1.4.4.2 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships. Where an approved automatic deep penetration procedure is used, the weld factor may be 85% of the value given in the Table.

(2) The fillet leg length K is not to be less than the value obtained from the following formula:

$$K = \sqrt{2}\, w_t t_p d/l \quad \text{mm}$$

where: t_p, w_t, d and l are the same as defined in (1) above.

2.5.4.3 Where the thickness of the abutting member of T-connection (e.g. the web of a stiffener or longitudinal) is greater than 15 mm and exceeds the thickness of the table member (e.g. plating), the welding is to be double continuous and the throat thickness of the weld is to be not less than the greatest of the following:

(1) 0.21 × thickness of the table member (thickness of the table member need not be greater than 25 mm);

(2) 0.21 (0.27 in tanks) × half the thickness of the abutting member;

(3) as required by Table 1.4.4.4(2) of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.5.4.4 Except as permitted by 2.5.4.2 and 2.5.4.3 of this Section, the throat thickness of all fillet welds is to comply with the requirements for the limits of throat thickness and the minimum value of throat thickness as shown in Table 1.4.4.4(1) and 1.4.4.4(2) of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.5.4.5 Continuous welding is to be adopted in the following locations, and may be used elsewhere if desired:

(1) boundaries of weathertight decks and erections;

(2) boundaries of tanks and watertight compartments;

(3) all lap welds in tanks;

(4) primary and secondary members to bottom shell;

(5) primary and secondary members to plating in way of end connections, and end brackets to plating in the case of lap connections;

(6) where 2.5.4.3 applies;

(7) fillet welds where higher tensile steel is used;

(8) other connections or attachments, where considered necessary, and in particular the attachment of minor fittings to higher tensile steel plating (e.g. stiffeners, etc.).

2.5.4.6 Where intermittent welding is used, the welding is to be made continuous in way of brackets, lugs and scallops and at the orthogonal connections with other members.

2.5.5 Welding of primary structure

2.5.5.1 Weld factors for the connections are to be as required in Table 1.4.4.8 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.5.5.2 The throat thickness limits given in 1.4.4.4 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships are to be complied with.

2.5.6 Welding of primary and secondary member end connections

2.5.6.1 The welding of primary and secondary member end connections is to comply with the requirements in 1.4.4.9 to 1.4.4.12 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.5.7 Welding consumables and equipment

2.5.7.1 All welding consumables are to be approved by CCS and are to be suitable for the type of joint and grade of steel as required by Chapter 2 of PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

2.5.7.2 Welding plant and appliances are to be suitable for the purpose intended and are to be maintained in an efficient condition. Effective facilities for protecting consumables are to be provided close to working areas.

2.5.8 Welding procedures

2.5.8.1 The surfaces of all parts to be welded are to be clean, dry and free from rust, scale and grease.

2.5.8.2 Tack welding is to be carried out in accordance with the approved welding procedures, and the quality requirements are to be met.

2.5.8.3 Reasonable assembling process and welding sequence are to be employed to minimize the stress and welding deformation. The weld joints are to be arranged as down-hand (flat) position.

2.5.8.4 Welding is to proceed systematically, with each welded joint being completed in correct sequence without undue interruption. Where practicable, welding is to commence at the center of a joint and proceed outwards, or at the center of an assembly and progress outwards towards the perimeter, so that each part has freedom to move in one or more directions.

2.5.8.5 Welds are to be made flush in way of the faying surface where stiffening members, attached by continuous fillet welds, cross the completely finished butt or seam welds. Similarly, butt welds in webs of stiffening members are to be completed and made flush with the stiffening member before the fillet weld is made. The ends of the flush portion are to run out smoothly without notches or sudden changes of section. Where these conditions cannot be complied with, a scallop is to be arranged in the web of the stiffening member. Scallops are to be of a size, and in a position, that a satisfactory return weld can be made.

2.5.9 Inspection of welds

2.5.9.1 Effective arrangements are to be provided by the Builder for the visual inspection of finished welds to ensure that all welding has been satisfactorily completed.

2.5.9.2 All finished welds are to be sound and free from cracks and substantially free from lack of fusion, incomplete penetration, slag inclusion and porosity. The surfaces of completed welds are to be reasonably smooth and substantially free from undercut and over-lap. Care is to be taken to ensure that the specified dimensions of fillet welds have been achieved and that both excessive reinforcement and under-fill of welds is avoided.

2.5.9.3 In addition to visual inspection, welded joints are to be subjected to non-destructive examination, by radiography, magnetic particle, dye penetrant, ultrasonics or other approved methods as appropriate. Radiographic examination is generally to be used on butt welds. Where it is proposed to substitute ultrasonic examination for radiography, details of these arrangements are to be submitted for approval.

2.5.9.4 Particular attention is to be paid to highly stressed items. Magnetic particle inspection is to be used at ends of fillet welds, T-joints and other joints where welds join or cross in main structural members. Where this can not be done due to the narrow spacing, dye penetrant is to be employed.

2.5.9.5 The location and number of welds to be examined by non-destructive examination is to be agreed between the Builder and the Surveyor. The density of radiographs is to be decreased in number with the decrease of material grade. For material grades reference is made to the definition in Chapter 1 of PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

2.5.9.6 The number (n) of radiographic examination for the welds in the strength deck and shell within 0.6 L_D mid-length of the dock may be calculated by the following formula:

$$N = 0.25(i + 0.1W_T + 0.1W_L)$$

where: i —— amount of intersections of butt welds within 0.6 L_D mid-length of the dock ;
W_T —— whole length of transverse welds within 0.6 L_D mid-length of the dock, in m;
W_L —— whole length of longitudinal welds joining the blocks within 0.6 L_D mid-length of the dock, in m.

Butt welds of longitudinals at bottom, inner and outer wing walls and top deck are to be examined as follows:

within 0.4 L_D mid-length of the dock - one in ten;
outside 0.4 L_D mid-length of the dock - one in twenty.

2.5.9.7 A plan of the proposed areas to be examined and the methods to be employed is to be submitted for approval.

2.5.9.8 Radiographic and other test records of non-destructive examination are to be made available to the Surveyor for assessment.

2.5.9.9 Unacceptable weld defects detected by visual or non-destructive examinations are to be completely removed and, where necessary, rewelded using approved welding consumables and procedures. The repair is to be re-examined for further defects.

Section 6 ADDITIONAL ITEMS

2.6.1 Air pipes under safety deck

2.6.1.1 The maximum draught of the dock may be controlled by fitting air pipes under the safety deck and/or the center pontoons.

2.6.2 Cranes

2.6.2.1 The all-up weight of cranes, and the arrangement of wheels and rails, are to be indicated on the plans, so that local strength requirements due to these loads may be taken into account. In particular, the buckling strength of the topside supporting hull structure are to be checked.

2.6.3 Structural strengthening below mooring and anchoring equipment

2.6.3.1 The effects of mooring and anchoring equipment on the hull structure are to be considered, and supporting members are to be strengthened appropriately.

2.6.3.2 Where mooring-dolphins or dolphin locks are used, the supporting members at the ends of the units are to be strengthened.

2.6.3.3 For hollow bollards, bitts and similar structures, watertight closing plates are to be fitted at the lower end below the deck.

Appendix 1 Direct Calculation and Check of Transverse Strength of Floating Dock

Section 1 General Provisions

1.1.1 Application

1.1.1.1 The method applies only to the check of transverse strength of floating dock carried out in accordance with 2.1.3.2 of this Chapter.

Section 2 Loads

2.1.1 Loads and load conditions

2.1.1.1 The following items are to be included at least in the design load:

(1) self weight of floating dock;

(2) the docked ship weight assumed only to be supported by keel blocks;

(3) hydrostatic pressure on the outbottom and outside of the pontoon;

(4) hydrostatic pressure on the pontoon deck when the pontoon deck is under water;

(5) hydrostatic pressure in the ballast tank.

For the loads above, see for detail 2.3.2 of this Chapter.

2.1.1.2 Calculation conditions are to include at least:

(1) condition 1: operation condition;

(2) condition 2: on level trim; and the top of the keel blocks are just submerged by the water when the floating dock is lifting at maximum capacity;

(3) condition 3: the severe conditions likely to occur while distributing ballast water when the floating dock sinks or rises.

2.1.1.3 The bending moment of hull girder is not to be applied on both ends of the model.

2.1.1.4 While applying the gravity loading of the docked ship to the dock, the coordinate of the maximum value of the weight curve is to be assumed to be at the center of the model.

Section 3 Structural Model

3.1.1 Coordinate system and extent of model

3.1.1.1 Coordinate system

The coordinate of the finite element model is taken as right-hand system, i.e.:

x measured in longitudinal direction, positive forwards;
y measured in transverse direction, positive to port from the centerline;
z measured in vertical direction, positive upwards from baseline.

3.1.1.2 Extent of model

Longitudinal direction: “1/2+1+1/2” hold length;
Transverse direction: whole breadth of the dock;
Vertical direction: whole depth of the dock.

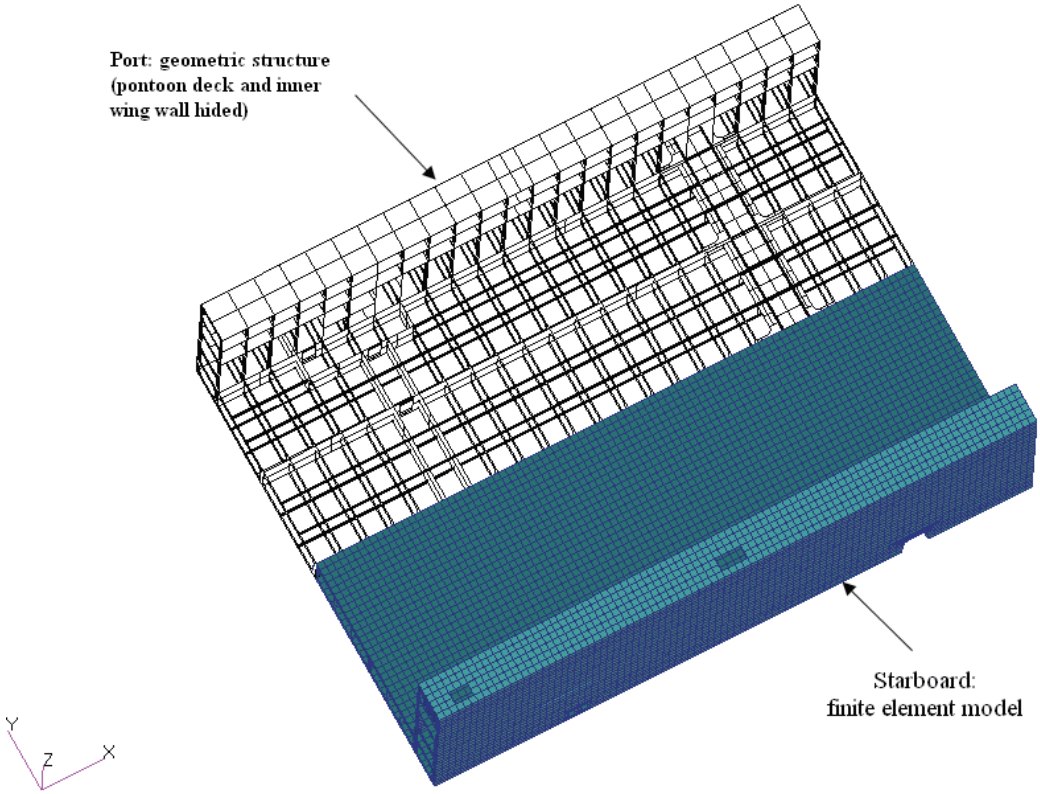

Figure 3.1.1.2 Hold model of floating dock

3.1.2 Model element and meshing

3.1.2.1 All longitudinals and transverse structures of the whole wing wall and pontoon are to be included in the finite element model. All primary plating such as wing walls, top decks, safety decks, decks and platforms, pontoon decks and bottom plating, bulkhead plating, etc., as well as webs and girders are simulated plate elements. Frames on plating such as longitudinal stiffeners, beams and frames are simulated beam elements, with the eccentric section properties for connection of plating. Faceplate of members is simulated rod element, with faceplate transverse section area as the rod transverse section area, this also applies to the stiffener on the web. Where necessary, the connecting arrangements of pontoon are to be simulated completely (for example: toes of supporting brackets and the connected vertical stiffeners are to be simulated plate elements). In addition, the trusses in the model are to be simulated rod elements.

3.1.2.2 The meshing is to be performed as follows:

1 element for each spacing of longitudinals in transverse and vertical direction;
1 element for each spacing of frames in longitudinal direction;
triangular elements are to be avoided as practicable as possible.

3.1.3 Boundary conditions

3.1.3.1 The displacement of nodes within the intersection of outer wing wall and bottom of the pontoon is to be constrained. Constraints of displacement along x, y and z axis, i.e. $\delta_x = \delta_y = \delta_z = 0$ are applied on one side, and constraints of displacement along x and z axis are applied on the other side, i.e. $\delta_x = \delta_z = 0$. See Figure 3.1.3.1.

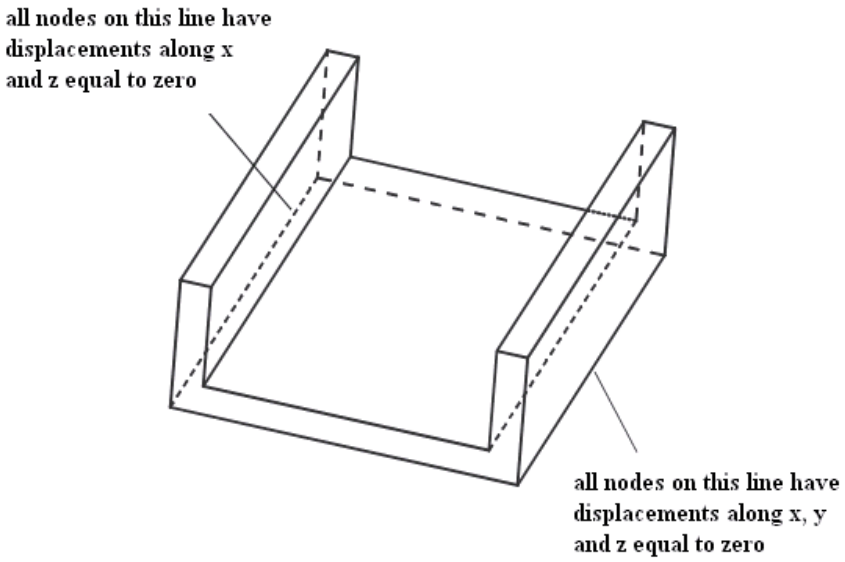

Figure 3.1.3.1 Specification on boundary constraints of model

Section 4 Strength Assessment

4.1.1 General requirements

4.1.1.1 The structural stress of the mid portion of the model is to be taken for the strength assessment of primary structural members, such as top deck and inner and outer wing walls (for the loading of crane on the top deck and similar situation), pontoon deck, bottom plating and main structure of pontoon (bulkheads, web beams, web frames, girders, bottom floors and trusses in transverse sections). The stresses near the constraints of model need not be considered.

4.1.1.2 For floors and beam webs, the mean shear stress of total height of the web may be taken as the calculated shear stress.

4.1.2 Yielding strength assessment

4.1.2.1 The calculated stresses of structural components are not to exceed the permissible stresses specified in Table 4.1.2.1(1) and Table 4.1.2.1(2) under each condition.

Permissible stresses of plate elements **Table 4.1.2.1(1)**

Structural component	$[\sigma_e]$	$[\tau]$
Plate element	185/K	100/K

Permissible stresses of rod elements **Table 4.1.2.1(2)**

Structural component	$[\sigma_{rod}]$
Rod elements for simulating the faceplate on transverse frame web	176/K
Trusses in transverse sections	141/K

where: $[\sigma_e]$ —— equivalent stress of plate element (i.e. Von Mises stress), in N/mm^2,

where: $\sigma_e = \sqrt{\sigma_x^2 + \sigma_y^2 - \sigma_x\sigma_y + 3\tau_{xy}^2}$, based on the membrane direct axial of the element evaluated at the element centroid:

σ_x —— element stress in x direction, in N/mm^2;

σ_y —— element stress in y direction, in N/mm^2;

τ_{xy} —— element shear stress in xy plane, in N/mm^2;

τ —— mean stress based on the total height of web, in N/mm^2;

σ_{rod} —— axial stress of rod element (excluding the bending stresses), in N/mm^2;

K—— material factor, see 2.2.3.1 of this Chapter.

4.1.3 Criteria for buckling strength

4.1.3.1 The stability of plate panels and trusses in transverse sections specified in 4.1.1.1 is to be checked. For checking methods and criteria, refer to CCS Guidelines for Direct Strength Analysis of Oil Tanker, where the safety factor of buckling strength is taken as 1.0.

CHAPTER 3 STABILITY, FREEBOARD AND WORKING, MAXIMUM SUBMERGED DRAUGHT MARK

Section 1 STABILITY

3.1.1 Stability

3.1.1.1 For the purpose of this Chapter, the check and calculation of the stability is to:

(1) take into account the effect of free surface of liquids in the tanks of the floating dock as well as of the ship to be docked;

(2) take into account the floating dock loaded with 100% of fuel, fresh water and other consumables.

3.1.1.2 The longitudinal and transversal initial metacentric height (GM) of the floating dock under the following conditions are not to be less than 1.0 m:

(1) the maximum submerged draught;

(2) the submerged draught to the top of keel block assuming full weight of the docked ship equal to the design lifting capacity supported on blocks;

(3) supporting a ship having the working draught.

3.1.1.3 Under the condition of 3.1.1.2(3), taking 3.2.1.2 into account, any part of the pontoon deck is not to be submerged due to wind heeling moment specified in 3.1.1.4.

3.1.1.4 The wind heeling moment M_f is to be calculated from the following formula:

$$M_f = 0.001\,PA_fZ \quad \text{kN·m}$$

where: Z —— calculated wind pressure lever, in m, it is the vertical distance between the center of the windage area and the actual waterline;

A_f —— dock and docked ship's windage area, in m^2, it is the projected lateral area of all parts on the centerline plane above the actual waterline;

P —— calculated wind pressure, in Pa, it is to be determined by Table 3.1.1.4, depending upon the calculated wind pressure lever Z.

Table 3.1.1.4

Calculated wind pressure lever Z（m）	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Calculated wind pressure P（Pa）	228	248	268	284	301	314	326
Calculated wind pressure lever Z（m）	4.5	5.0	5.5	6.0	6.5	≥7.0	
Calculated wind pressure P（Pa）	336	343	350	357	363	368	

Note: Intermediate values are to be obtained by linear interpolation.

Section 2 FREEBOARD AND WORKING, MAXIMUM SUBMERGED DRAUGHT MARK

3.2.1 Freeboard to the pontoon deck

3.2.1.1 The freeboard to the pontoon deck at the centerline of the dock, when at the working draught, is not to be less than 300 mm. When the pontoon deck at the inner side walls is lower than that at the center, the freeboard to the pontoon deck at the inner side walls is not to be less than 75 mm, and the freeboard at the centerline is not to be less than 300 mm.

3.2.1.2 The above limits however, assume the traveling crane(s) are positioned so as to give no trim. When crane(s) are moved to the forward end or after end of the dock, any part of the pontoon deck is not to be submerged.

3.2.2 Freeboard to the top deck

3.2.2.1 The freeboard to the top deck, at the maximum submerged draught, is not to be less than 1.0 m.

3.2.3 Tightness of openings and protection of crew

3.2.3.1 The flush openings, skylights on the top deck are to be provided with steel watertight closing appliances.

3.2.3.2 Air pipes on top deck to the ballast tanks are only to be provided with suitable closing appliances and the height of inlet point above the top deck is not to be less than 250 mm. The pipes can also be led from the wing walls with the inlet point more than 3.3 m above the maximum submerged draught. Rail fences are to be fitted in the openings of the pipes.

3.2.3.3 For openings on the top deck to the spaces below, weathertight closing appliances are to be fitted except specified in 3.2.3.1 and 3.2.3.2. The height of the lower edge of the openings above the top deck is not to be less than 250 mm. Where the height of top deck above the maximum submerged waterline is more than 3.3 m, only suitable closing appliances are to be provided for such openings.

3.2.3.4 Non-opening type sidescuttles may be fitted on the wing walls below the top deck. The lower edge of such scuttles is to be at least 1 m above the maximum submerged waterline or the safety deck (whichever is higher) and inside deadlights are to be provided to ensure adequate strength and watertightness. Where the lower edge of sidescuttles is 3.3 m above the maximum submerged waterline, the sidescuttles may be of opening type and inside deadlights are to be provided to ensure adequate strength and weathertightness.

3.2.3.5 Efficient passages are to be fitted between the wing walls. Bulwarks (if applicable) or handrails are to be fitted on all exposed decks, platforms, passageways and access ladders accessible to crew.

3.2.3.6 Adequate drainage facilities are to be provided on the pontoon deck.

3.2.3.7 In respect to the requirements for piping and valves used in discharging water overboard and the requirements for arrangements of accommodation spaces, the maximum submerged draught is to be considered the uppermost load waterline or summer load waterline.

3.2.4 Working draught and maximum submerged draught mark

3.2.4.1 The working draught line is to be marked on both sides of side plating of the bow and stern pontoons. The working draught mark is to be a line of 25 mm in width and 450 mm in length. The upper edge of the line is to be flush with the working draught waterline. The working draught is indicated by the letter *W* above the left end and the letter *D* above the right end of that line, each measuring 115 mm in height and 75 mm in width.

3.2.4.2 The maximum submerged draught is to be marked on both wing walls in bow and stern. The maximum submerged draught mark is to be a line of 25 mm in width and 450 mm in length. The upper edge of the line is to be flush with the maximum submerged draught waterline. The maximum submerged draught is indicated by the letter *M* above the left end and the letter *D* above the right end of that line, each measuring 115 mm in height and 75 mm in width.

3.2.4.3 Prior to marking the working draught and maximum submerged draught of a floating dock, compliance of the floating dock with the strength, stability and freeboard requirements and other special requirements for operation of floating docks is to be confirmed and indicated in the instruction for marking working draught.

3.2.4.4 Limitations on sea conditions for operations of the floating dock are to be clearly defined, compliance of the floating dock with the strength, stability and freeboard requirements and other special requirements for its operation summarized in the instruction for marking working draught, and a marking sketch showing the working draught line is to be attached thereto.

CHAPTER 4 MACHINERY INSTALLATLONS

Section 1 GENERAL PROVISIONS

4.1.1 General requirements

4.1.1.1 In addition to this Chapter, the machinery installations are to comply with the applicable requirements for cargo ships as specified in PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

4.1.2 Central control rooms of floating docks

4.1.2.1 The central control rooms of floating docks are to comprise the following installations:

(1) the control devices for ballast pumps, the suction and overboard discharge fittings of ballast system;

(2) monitoring instruments for heeling, trim and deflection of the dock;

(3) equipment indicating the operation of pumps and the position (open/closed) of the suction and discharge valves of ballast system;

(4) alarm devices on limit values of heel, trim and deflection;

(5) level indicators of ballast tanks;

(6) necessary inter-communication facilities.

Section 2 PIPING SYSTEMS

4.2.1 Ballast systems

4.2.1.1 The arrangements for the ballast piping system are to be such that at least two independent motor pumps are available for each buoyancy compartment to effectively discharge the ballast water.

4.2.1.2 Valves provided with efficient means of closing are to be fitted on the ship sides in the suction and overboard discharge pipeline of ballast tanks, such valve of water discharge pipeline is to be non-return or the non-return valve is to be fitted otherwise.

4.2.2 Bilge systems

4.2.2.1 The internal diameter d_2 of branch bilge suction pipes fitted in machinery spaces is not to be less than the value determined by the following formula, but the actual internal diameter of branch bilge suction pipes may be rounded off to the acceptable nearest standard size:

$$d_2 = 25 + 2.15\sqrt{A} \quad \text{mm}$$

where: A —— maximum cross section of the compartment, in m^2.

4.2.2.2 The internal diameter d_1 of the bilge main is to be calculated according the following formula. However, the actual internal diameter of the bilge main may be rounded off to the acceptable nearest standard size:

$$d_1 = \sqrt{2}\, d_2 \quad \text{mm}$$

where: d_2 —— calculated value of internal diameter of branch bilge suction pipes, in mm.

4.2.3 Air and sounding pipes

4.2.3.1 Where air pipes of ballast tank extend below the top plate of ballast tank and form the air cushion, the air pipes are to be increased properly in thickness. The requirements for the thickness of the air pipes extending through ballast tanks in Table 2.2.2.6(1) of PART THREE of CCS Rules for Classification of Sea-going Steel Ships are at least to be met, and the air pipes are to be effectively secured.

4.2.3.2 The sounding pipes of ballast tank are to be led above the top deck. Where the maximum submerged draught is lower than the safety deck, the sounding pipes may be led above the safety deck and fitted with self-closing devices.

CHAPTER 5 ELECTRICAL INSTALLATIONS

Section 1 GENERAL PROVISIONS

5.1.1 General requirements

5.1.1.1 In addition to this Chapter, the electrical installations of floating docks are to comply with the applicable requirements in PART FOUR of CCS Rules for Classification of Sea-going Steel Ships.

5.2.2 Earthing

5.1.2.1 Every docked ship is to be earthed to the floating dock hull through at least two earthing conductors and two flexible copper cables, having a cross-sectional area of not less than 70 mm^2 each.

5.1.2.2 To connect the dock hull to the shore earthing system, at least two earthing conductors and two flexible copper cables having a cross-sectional area of not less than 70 mm^2 each, are to be provided on the floating dock.

Where cathodic protection from corrosion is employed for the floating dock and the circuits of the floating dock are electrically separated from the shore circuits, the earthing of the floating dock may be dispensed with.

5.1.3 Installation of cables

5.1.3.1 Cables may be installed on tray plates welded directly to the dock plating (above the maximum submerged draught) subject to agreement by CCS.

5.1.4 Submersion and emersion system of the floating dock

5.1.4.1 Remote control for valves of the submersion and emersion system are not to hinder manual opening and closing of valves. An inter-locking device is also to be provided to prevent the remote control in case of the valve change-over to manual control.

5.1.4.2 Running indicators of motors for driving valves are to be provided at a position where the valves are located and at the central control console.

5.1.4.3 Control devices for ballast pump motors are to be provided by the side of the motors and in the control station.

Section 2 ELECTRICAL POWER SOURCES AND DISTRIBUTION

5.2.1 Main electrical power source

5.2.1.1 The following systems may be employed as main electrical power sources of floating docks:

(1) generating sets;

(2) a shore electrical power system.

5.2.1.2 At least two generating sets are to be provided as a main electrical power of an autonomous floating dock. For a non-autonomous floating dock, it is allowed that a shore electrical power system may be employed as the only main electrical power source. Where the main electrical power consists of the generating sets and the shore connection, the generating sets are to be interlocked with the shore connection so as to prevent the simultaneous supply.

5.2.1.3 The capacity of a main electrical power source is to be sufficient to ensure the following operation conditions of a floating dock:

(1) submersion;

(2) docking (undocking) of the ship;

(3) emersion;

(4) other conditions in accordance with the docking purpose.

5.2.1.4 The power of main generating sets of an autonomous floating dock is to be such that in case of failure of any one of generating sets, the rest of the generating set(s) can ensure normal power supply for valves, fire pumps, communication, alarming and lighting.

5.2.1.5 Where the high-voltage electrical power is supplied to a non-autonomous floating dock from the shore electrical power system by one high-voltage feeder, a low-voltage supply feeder is to be additionally provided. In this case, the low-voltage supply feeder is to continue its power supply to the floating dock when the dock is mooring and no repairs are carried out, and at least such supply for valves, fire pumps, communication, alarming and lighting is to be maintained.

5.2.1.6 Where the high-voltage electrical power is supplied to a non-autonomous floating dock from the shore by two independent feeders, a low-voltage supply feeder need not be provided. And one of the feeders is at least to ensure the supply for submersion and emersion system of the floating dock, fire pumps, communication, alarming and lighting.

5.2.1.7 When the floating dock is supplied from the shore low-voltage electrical power system, two feeders and two shore power connection boxes are to be provided, one of them is to supply the consumers specified in 5.2.3.5 and the other to supply at least the consumers specified in 5.2.1.5.

5.2.1.8 The arrangement and construction of the shore power supply cables are to be such as to ensure:

(1) absence of mechanical stresses in cables during submersion and emersion of the floating dock;

(2) prevention of transmission of mechanical stresses to terminals intended for connection of cables or wires.

5.2.2 Emergency sources of electrical power

5.2.2.1 Every floating dock is to be provided with an independent emergency source of electrical power.

5.2.2.2 The emergency source of electrical power is to be installed on the level above the safety deck of the floating dock.

5.2.2.3 The emergency source of electrical power is to be sufficient and at least to ensure supply of the following consumers for 3 h:

(1) lighting in machinery spaces, control station, inside and outside passageways and accesses;

(2) internal communication and alarming system of the floating dock.

5.2.3 Power distribution

5.2.3.1 One-wire system with dock's hull return is not to be employed on a floating dock except for welding circuits and devices for monitoring and measuring insulation resistance.

5.2.3.2 The supply voltage for a floating dock is generally not to exceed 15,000 V.

5.2.3.3 High-voltage electrical installation of a floating dock is to be located in special spaces and comply with the requirements of relevant national standards and rules.

5.2.3.4 The docked ships are to be fed from the stationary switchboards installed in the floating dock.

5.2.3.5 The following consumers are to be supplied by separate feeders from the main switchboard bus-bars:

(1) the system of monitoring and controlling the dock submersion and emersion;

(2) the ballasting system essential to the safety of the dock and fire pumps;

(3) welding equipment;

(4) switchboards for supply of the docked ships.

Section 3 LIGHTING AND INTERNAL COMMUNICATION

5.3.1 Lighting

5.3.1.1 A main electrical lighting system is to provide illumination throughout those parts of the floating dock normally accessible to and used by personnel and is to comply with the relevant requirements in Section 7 of Chapter 2 in PART FOUR of CCS Rules for Classification of Sea-going Steel Ships.

5.3.1.2 The lighting for main switchboards, pump room, central control room, meeting room and passageways is to be supplied by two final sub-circuits.

5.3.1.3 The emergency lighting is to be fitted in the spaces specified in 5.2.2.3(1) and to comply with the relevant requirements in Section 7 of Chapter 2 in PART FOUR of CCS Rules for Classification of Sea-going Steel Ships.

5.3.2 Internal Communication

5.3.2.1 Telephones between the central control room and the spaces where the following equipment is located are to be provided:

(1) mooring winches;

(2) emergency generating sets;

(3) main switchboards;

(4) main generating sets;

(5) high-voltage transformers;

(6) manual control for valves of the submersion and emersion system of the floating dock;

(7) fire-extinguishing station.

5.3.2.2 At least one telephone set which can be connected with the shore telephone system is to be provided on the floating dock.

5.3.2.3 General alarm system is to be actuated from the central control room and the space (if provided) intended for the personnel on duty.

5.3.2.4 The floating dock is to be provided with a public address system.

CHAPTER 6 FIRE PROTECTION, DETECTION AND EXTINCTION

Section 1 GENERAL PROVISIONS

6.1.1 General requirements

6.1.1.1 This Chapter applies to floating docks operating at those settled locations where there is no available, professional fire service. However, where such fire service can be provided in the operating area, consideration may be given by CCS to effectiveness of the fire service under the equivalent conditions as required in this Chapter.

6.1.1.2 This Chapter applies to the minimum fire protection, detection and extinction for floating docks, excluding the equipment for fire fighting that may occur on docked ships.

6.1.1.3 Attention is to be given to be given to any relevant statutory requirements of the flag State Administration, in addition to the requirements of this Chapter.

6.1.1.4 Fire protection of the floating dock is also to comply with the applicable requirements in PART SIX of CCS Rules for Classification of Sea-going Steel Ships. Particularly, the performance standards of the relevant systems, equipment and material and testing methods are to comply with International Code for Fire Safety Systems and International Code for Application of Fire Test Procedures, as appropriate.

Section 2 FIRE PROTECTION

6.2.1 General requirements

6.2.1.1 The pontoons, wing walls, super structures, bulkheads, decks, deckhouses and gangways are to be of steel or other material which has structural and fire integrity properties equivalent to steel.

6.2.1.2 Pipes conveying oil or combustible liquids are to be of approved material having regard to the fire-risk. Materials readily rendered ineffective by heat are not to be used for overboard scuppers, sanitary discharges and other outlets which are close to the waterline and where the failure of the material in the event of fire would give rise to dangers of flooding.

6.2.1.3 All internal bulkheads, ceilings and linings are to be constructed of non-combustible materials. Corridor bulkheads are to be constructed of steel or to ‘B’ Class standards.

6.2.1.4 All exposed surfaces in corridors and stairway enclosures and surfaces in concealed or inaccessible spaces are to have low flame-spread characteristics. Bulkheads, ceilings and linings may have combustible veneer, provided that such veneer is not to exceed 2.0 mm in thickness within any such space except corridors, stairway enclosures and control stations, where it is not to exceed 1.5 mm.

6.2.1.5 Paints, varnishes and other finishes used on exposed interior surfaces are not to be capable of producing excessive quantities of smoke and toxic products during a fire.

6.2.1.6 Bulkheads of galley, paint stores, lamp rooms and other compartments containing materials which would constitute a fire hazard are to be of steel or equivalent material.

6.2.1.7 Deck coverings within accommodation spaces on the decks forming the crown of machinery spaces are to be of approved materials which will not readily ignite, or give rise to toxic or explosive hazards at elevated temperatures.

Section 3 FIXED FIRE-EXTINGUISHING AND FIRE DETECTION SYSTEMS

6.3.1 Water fire-extinguishing systems

6.3.1.1 The capacity of fire pumps is to be determined in accordance with the quantity of water required for the operation of the water fire-extinguishing system of the cargo ship whose displacement corresponds to the design lifting capacity of the floating dock.

The capacity of fire pumps is to be determined in accordance with the quantity of water required for the operation of the water fire-extinguishing system of the cargo ship whose displacement corresponds to the largest lifting capacity of the floating dock.

6.3.1.2 The fire pumps and associated piping and fire main are to be so designed that a minimum pressure can be maintained sufficient to produce two jets of water of 12 m through nozzles specified in the Rules with the quantity of water specified in 6.3.1.1 through any adjacent hydrants. The minimum pressure required is to be obtained from fire hydrants at the top deck when the floating dock is in its fully risen position.

6.3.1.3 The diameter of the fire main is to be based on the required capacity of the fire pump or pumps, and the diameters of the water service pipes are to be sufficient to ensure an adequate supply of water for the simultaneous operation of at least two fire hoses using any of the hydrants. In general, the diameter of the fire main is not to be less than that required by the following formula and may be rounded off to the acceptable nearest standard size:

$$d = \frac{L_D}{1.2} + 25 \quad \text{mm}$$

where: d —— internal diameter of the fire main, in mm. The diameter of the fire main need not exceed 125 mm but in no case is it to be less than 50 mm;
L_D —— length of the floating dock, in m.

6.3.1.4 The wash deck line may be used as a fire main provided that the requirements of this Section are satisfied.

6.3.1.5 In floating docks of less than 1000 t design lift, are to be provided with one fixed power pump and one hand operated pump. For floating docks of 1000 t design lift and over, at least two independently driven fixed power pumps are to be provided, preferably one pump being placed in each wing.

6.3.1.6 In floating docks of 2000 t design lift and over, if a fire in any one compartment could put all the pumps out of action, there is to be an alternative means of providing water for fire-fighting. This alternative means is to be a fixed emergency pump independently driven by a diesel engine, or other approved means. This emergency pump is to be capable of supplying two jets of water of not less than 12 m. The pump is to be located in a readily accessible position which is not likely to be rendered in accessible position which is not likely to be rendered inaccessible by a fire in the compartment containing the main fire pumps. The pump is to be provided with its own sea suction. A valve is to be provided for isolating the main fire pumps. This isolating valve is to be situated in a readily accessible position outside that compartment. However, if shore-based firefighting appliances are readily available, consideration may be given to dispensing with the emergency pump at the discretion of CCS.

6.3.1.7 In the machinery spaces containing a total power of 735 kW and over, two hydrants are to be provided, and in the machinery spaces where the total power is less than 735 kW, one hydrant will be accepted. If it is difficult to arrange those hydrants in the machinery spaces, such hydrants may be arranged near the accesses outside the machinery spaces subject to agreement by CCS.

6.3.1.8 The number of fire-hoses to be provided, each completed with couplings and nozzles, is to be one for each 32 m in length of each wing of the dock and one spare, but in no case less than a total of six (three on each wing) for floating docks of 1000 t design lift and over, and not less than a total of four for floating docks less than 1000 t design lift. These numbers do not include any hoses required in any engine or boiler room. If necessary, the number of hoses is to be increased to ensure that hoses insufficient number are available and accessible at all times.

6.3.2 Fixed fire-extinguishing systems

6.3.2.1 For the machinery spaces containing diesel engines or gas turbines with a total power of 735 kW and over, or for spaces where oil-fired boilers with steam pressure exceeding 0.35 MPa are situated, or in spaces containing oil fuel units or settling tanks, any one of the following types of fixed fire-extinguishing systems is to be provided：

(1) a pressurized water-spraying system;

(2) a fire-smothering gas system;

(3) a foam system supplemented, if necessary, by a fixed or mobile pressurized water of foam spraying system to fight fires above floor plates.

The fixed fire-extinguishing systems of the above type (2) are to be installed in all spaces where the flash point of the oil fuel is less than 60℃ (closed cup test). If the engine and boiler rooms are not entirely separate, or if fuel oil can drain from the boiler room into the engine room into the engine room bilges, the combined engine and boiler rooms are to be considered as one compartment.

6.3.2.2 For flammable liquid lockers of a deck area of 4 m^2 and more, and flammable liquid lockers which give access to accommodation spaces, one of the fixed arrangements as specified below are to be provided:

(1) a CO_2 system, designed for 40% of the gross volume of the space;

(2) a dry powder system, designed for at least 0.5 kg powder/m^3;

(3) a pressure water-spraying or an automatic sprinkler system, designed for 5 *l*/m^2·min.The pressure water-spraying system may be connected to the ship's fire main.

Systems or arrangements other than those mentioned in (1), (2), (3) above may be accepted by CCS provided that relevant technical and test data are provided.

6.3.3 Fire detection systems

6.3.3.1 Where it is proposed to apply a remote centralized control system for the essential machinery of 735 kW and over, and it is intended that the engine and/or boiler rooms will be periodically unattended, an approved fire detection system is to be provided in these spaces.

6.3.3.2 The alarm system is to initiate audible and visible alarm signals at the central control room. Where it is intended that the engine and/or boiler rooms will not be continuously manned, the alarm system is to initiate audible and visible signals at the station from which the machinery is controlled.

Section 4 FIRE FIGHTING APPLIANCES

6.4.1 The extinguishers

6.4.1.1 The central control rooms, accommodation and service spaces are to be provided with a sufficient number of portable fire-extinguishers to ensure that at least one extinguisher will be readily available for use in every compartment of the crew spaces.

6.4.1.2 For galleys, and for spaces containing domestic boilers, one portable fire-extinguisher suitable for dealing with oil fires or fires in electric cooking equipment is to be provided.

At least one CO_2 portable fire extinguisher sized to provide a minimum volume of free gas equal to 40% of the gross volume of the space is to be provided in the paint locker. The extinguisher may be discharged through a port on the wall of the locker without having to enter into the protected space. The required portable fire extinguisher is to be stowed adjacent to the port.

6.4.1.3 There are to be at least two approved portable foam fire extinguishers, or other approved medium suitable for extinguishing oil fires, in each firing space of each boiler room and each space in which a part of the oil fuel installation is situated. In addition, there is to be 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 extinguishers need not exceed 45 *l* of any one boiler room.

6.4.1.4 In each firing space there is to be a receptacle containing at least 0.28 m^3 of sand, sawdust impregnated with soda, or other approved dry material and a scoop for distributing this material. Alternatively, an approved portable extinguisher may be substituted therein.

6.4.1.5 For all machinery spaces containing diesel engines or gas turbines with a total power of not less than 375 kW, a foam extinguisher with at least 45 *l* capacity or the equivalent is to be provided in every engine space. In addition, one approved portable foam extinguisher for each 735 kW of the engine power output or part thereof is to be provided.

The total number of portable extinguishers so supplied is not to be less than two but need not exceed six.

6.4.1.6 For machinery spaces containing diesel engines or gas turbines with a total power of less than 375 kW, a foam extinguisher with 45 *l* capacity need not be provided in every engine space and only two foam extinguishers or the equivalent are to be provided.

6.4.2 Alternative to the extinguisher

6.4.2.1 For similar situations, the following equivalent extinguishers may be taken as the alternative:

Foam extinguisher	Carbon dioxide
135 *l*	40 kg
45 *l*	23 kg
9 *l*	6 kg

6.4.3 Emergency escape breathing device

6.4.3.1 At least two emergency escape breathing devices are to be carried in accommodation and service spaces. The devices are to be situated near the stairway ready for use.

6.4.3.2 At least one emergency escape breathing device is to be carried on each deck or near the stairways in machinery spaces. The total number of emergency escape breathing devices so supplied in machinery spaces is not to be less than two.