PARTE II RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF SHIPS IDENTIFIED BY THEIR MISSIONS

TITLE 43 DREDGERS AND MUD BARGES

SCTION 1 NAVAL ARCHITECTURE

CHAPTERS

CONTENTS

CHAPTER A
SCOPE

CHAPTER CONTENTS

A1. SCOPE

100. Application

101. The present Title 43 applies to dredgers and barges with cargo hopper destined for open sea navigation.

102. Similar units such as (non self-propelled) hopper barges and stone dumping vessels etc., which are capable of discharging their cargo in a quick and efficient manner, may be treated as dredgers.

103. Pontoons of bucket-dredgers and the like will be reviewed by Part II, Title 11, Section 1 or especially in each case.

200. Proportions and dimensions

201. Special proportions will be examined in each case.

A2. DEFINITIONS

100. Terms

101. In addition of the terms of the Part II, Title 11, Section 1 are here used the following.

a. **Bottom doors:** bottom gates or valves with mechanical or hydraulic opening device for discharging the material of the hopper.

b. **Cargo** means dredgings and entrained water.

c. **Convention** means International Convention on Load Lines, 1966

d. **Dredger** is a self-propelled vessel capable of loading dredgings at sea and fitted with bottom doors or similar means for discharging or dumping the dredgings to sea. Dredgings are generally self-loaded, and are carried in one or more integral hoppers to the place of discharge. Similar units such as (non self-propelled) hopper barges and stone dumping vessels etc., which are capable of discharging their cargo in a quick and efficient manner, may be treated as dredgers.

e. **Dredgings** are materials consisting of soil, sand, gravel, or rock with a bulk density up to 2200 kg/m3.

f. **Dredging draught:** see subchapter H1.

g. **Level of transhipment:** top of overflow or opening in the hopper coaming, which limits the level and, consequently, the cargo pressure.

h. **Product density:** bulk density of the material or mixture to dredge, transporting or storing in hopper and unloading. The applicable formulas of Part II, Title 11, Section 1 are to be used multiplied by the value of this density.

i. **Spud poles:** A spud is a large pole that can anchor a ship while allowing a rotating movement around the point of anchorage

j. **SWBM:** Sea Water Bending Moment

CHAPTER B
DOCUMENTS, REGULATIONS AND STANDARDS

CHAPTER CONTENTS

B1. DOCUMENTS FOR INFORMATION AND CERTIFICATION

100. Documents

101. The present Title 43, Section 1 list of required documents for approval and for information is additional to those in Part II, Title 11, Section 1, Chapter B.

102. Where RBNA certification is not required for the dredging equipment, the following documents are to be submitted for information:

a. General arrangement for dredging equipment

b. Specification and calculations adequate for the calculation of the efforts in the dredging equipment foundations

c. Calculation of SWBM and shear forces in sailing and working conditions

103. Where RBNA certification is required, the following plans and specifications are to be submitted for approval:

a. Construction of suction inlet tube

b. Gantry foundations

c. Bottom door and cylinder integrations

d. Overflow

e. Calculation of clearances

f. Hinges, chocks and cylinder integrations

g. Integration of spuds

h. Couplings

i. Integration cutter ladder

j. Integration anchor booms

k. Foundation excavator

l. General arrangement of the dredging equipment

m. Specification of the dredging equipment operation test

n. Calculation of SWBM and shear forces in sailing

o. and working conditions

p. Design loads on all components of the dredging Equipment

200. Construction documents

201. The construction documents are to be part of the ship's files to be assembled during construction and to be submitted to the surveyor. Those documents are part of RBNA final report for newbuildings.

300. Information to the Master [IMO Circular Letter 2285]

The master shall be provided with written information, which may be supplemented by other media, as follows:

301. Sufficient information, in a format approved by the RBNA, to enable the master to arrange for the loading and ballasting of the dredger so as to avoid the creation of any unacceptable stresses in the ship's structure. The information shall define any sea state restrictions in terms of maximum significant wave height when operating at dredging load line.

302. Sufficient information, in a format approved by the RBNA, to enable the master by rapid and simple means to ensure compliance with the intact and damage stability requirements of this Title 43. The following items shall be included:

a. Hydrostatic data for a range of draughts from lightship to dredging load line.

b. Tank and hopper filling calibrations detailing volumes, centroids and free surface inertia's, and including the volumes of hoppers above spillways.

c. Righting lever curves for the loading conditions as specified in subchapter H3 for each of the specified densities.

d. The particulars of those loading conditions showing the fulfilment of the criteria in subchapter H5 of the present Title 43, Section 1.

e. A summary of the required and attained subdivision indices resulting from the probabilistic damaged stability calculations in accordance with subchapter H6 of the the present Title 43, Section 1.

f. Relevant information for the master for which damage cases of flooding of main compartments the dredger will remain afloat at dredging draught and at unloaded draught, described on a wheelhouse poster and derived from the calculations made in accordance with the present Title 43.

g. Instructions concerning the closure of watertight doors and valves.

h. Instructions concerning the operation of cross-flooding arrangements where fitted.

i. Instructions on maintaining dry bilge's in void spaces.

j. All other data and aids which might be necessary to maintain stability after damage.

k. Note: A curve of minimum operational metacentric heights (GM) against draught or of maximum allowable vertical centres of gravity (KG) against draught is not required if the dredger meets the relevant intact and damage stability requirements for all possible loading conditions as defined in subchapter H3.

303. Information on the adjustment of the overflow systems in order to avoid submergence of the dredging load line

and to assure compliance with the intact stability requirements.

304. Clear instructions for the operation of the dumping system, the dredge pumps and the dredge valves in case of emergency. A copy of these instructions shall be permanently posted at the navigating bridge.

305. Clear instructions on sea state limitations to be observed and on procedures with regard to wave height prediction.

306. Plans showing clearly for each deck and hold the boundaries of the watertight compartments, the openings therein with their means of closure and position of any associated controls, and the arrangements for the correction of any list due to flooding. Such plans shall also be made available to watchkeeping officers of the dredger and shall be permanently exhibited or readily available on the navigating bridge.

B2. REGULATIONS OF THE NATIONAL AND INTERNATIONAL ADMINISTRATION

100. Dredgers under 500 GT for open sea navigation

101. For Brazilian Flag vessels:

NORMAM 01

NORMAM 02 Annex 6-N: Special requirements for dredgers.

102. For Foreign Flag vessels:

National Regulations or, in the absence of those, IMO regulations.

200. Dredgers of 500 GT and over for open sea navigation

201. Relevant IMO instruments

202. IMO Circular Letter 2285

B3. CLASS REQUIREMENTS

100. Class requirements

101. The present Title 43 applies to all dredgers as defined in A1.101 above.

102. The requirements of the present Title 43 are in general applicable to all dredgers.

103. Specific requirements for dredgers of GT < 500 are specified where applicable.

104. **Important Note**: in no case the requirements of the standards to be applied are to be less than those presented in the present Title 43.

CHAPTER C
NAVIGATION ENVIRONMENT

CHAPTER CONTENTS

C1. NAVIGATION ZONES

100. Application

101. Dredgers are certified to operate in ports, docks and navigation channels.

102. However, dredgers may be certified for Inland Navigation or for Open Sea Navigation, depending upon the requirements of the zones in which the dredger operates or depending of the zones the dredger crosses when sailing between ports.

103. The present Title 43 covers dredgers engaged in open sea navigation.

CHAPTER D
ACTIVITIES/SERVICES

CHAPTER CONTENTS

D1. ACTIVITIES/SERVICES

100. Operating Characteristics

101. The service consists of gathering the dredging materials and discharging or dumping them at sea, to shore or onto auxiliary mud barges or other process.

200. Features of the product to be carried

201. The basic feature is the bulk density of the product or mixture to be carried, which must be defined in the design documents.

CHAPTER E CONFIGURATIONS

CHAPTER CONTENTS

E1. BASIC ARRANGEMENT

100. Location of cargo space

101. The general configuration of hopper dredgers is of hopper amidships along the centerline, with side tanks.

FIGURE F.E1.101.1 – HOPPER WITH CONICAL BOTTOM VALVES FOR DISCHARGING

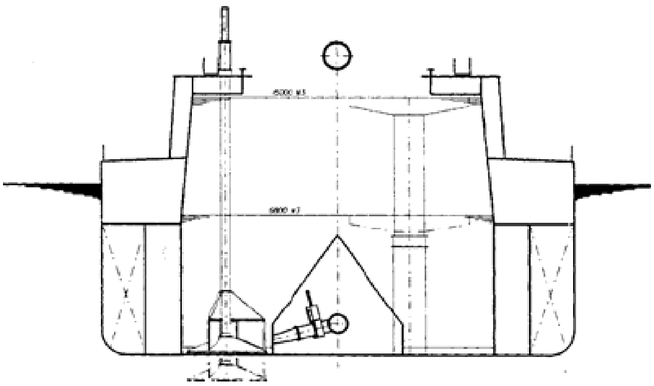


FIGURE F.E1.101.2 – INCLINED HOPPER WITH FLAT BOTTOM SWINGING DOORS FOR DISCHARGING

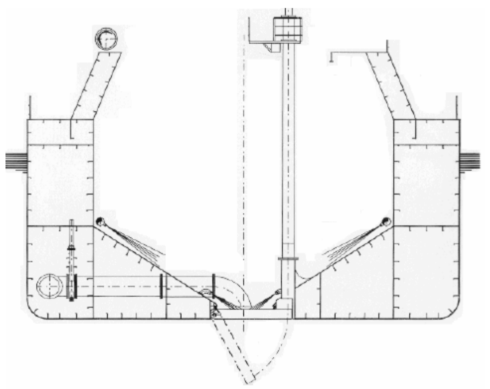
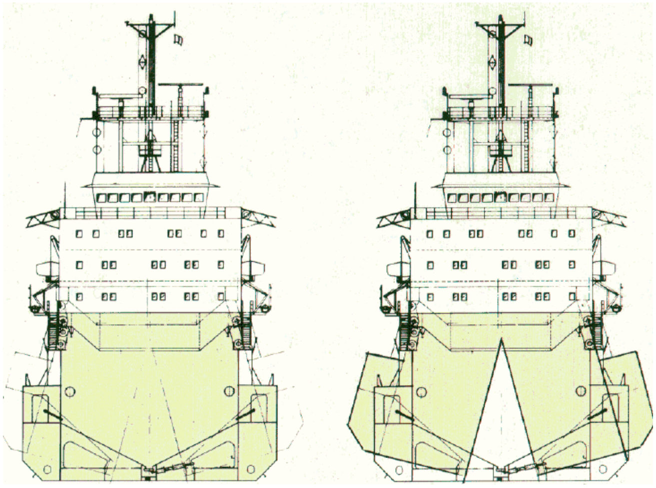


FIGURE F.E1.101.3 – SPLIT HOPPER



Guidance

Mechanical Dredger

Mechanical dredgers come in a variety of forms, each involving the use of grab or bucket to loosen the in-situ material and raise and transport it to the surface.

Bucket Dredger*A Bucket Dredger is a stationary dredger, fixed on anchors and moved while dredging along semi-arcs by winches. It has an endless chain of buckets that fill while scraping over the bottom. The buckets are turned upside down and empty moving over the tumbler at the top. The dredged material is loaded in barges.*

Bucket ladder dredgers *usually comprise a rectangular pontoon with a central well in which a heavy steel frame or ladder is suspended. The ladder supports an endless chain of buckets, each of which is equipped with a cutting edge. By rotating the bucket chain about flat-sided wheels (known as tumblers) at each end of the ladder, material can be loosened and transported. A small proportion of the dredgers of this type are self-propelled. The propulsion machinery is used to move the vessel from site to site, but is not used in the extraction operation. In operation, a bucket ladder dredger is held accurately in position by up to six moorings or anchors and the bucket ladder moved from side to side to excavate material.*

Grab Dredger *is a stationary dredger, moored on anchors or on spud-poles. The dredging tool is a grab normally consisting of two half-shells operated by wires or (electro)-hydraulically. The grab can be mounted on a dragline or on a hydraulic excavator of the backhoe type. Grab dredgers, sometimes called clamshells, can exist in pontoon and self-propelled forms, the latter usually including a hopper within the vessel. The self-propelled grab hopper dredger is basically a ship which has one or more dredging cranes mounted around a receiving hopper. The size of this type of dredger is expressed in terms of the hopper capacity and can range from 100 to about 2,500 m³.*

Backhoe Dredger *is a stationary dredger, moored on anchors or on spud-poles. A backhoe dredger is a hydraulic excavator equipped with a half open shell. This shell is filled moving towards the machine. Usually the dredged material is loaded in barges.*

Backhoe/Dipper Dredger *again consist of a rectangular pontoon, on which is mounted the excavator unit. The excavator can be either an integral part of the dredger or a proprietary mobile type adapted for marine working. Material is excavated using a bucket of size compatible with the in-situ strength of the material being dredged. The excavated material is either loaded into barges or placed ashore. The size of a backhoe dredger is described by the bucket capacity, which can vary between 0.5 and 13 m³. Breakout forces in excess of 90 t can be exerted by the larger machines, and because of the very high horizontal loads developed by the jigging action the backhoe dredger usually works on spuds. These are heavy pile-like structures which can be dropped into the sea-bed by the dredger. Two spuds are mounted at the digging end of the backhoe pontoon to provide resistance and one backhoe excavator is very efficient and has good vertical and horizontal control; carefully worked it will produce a smooth profile.*

Hydraulic Dredger

The principal feature of all dredgers in this category is that the loosened material is raised from its in-situ state in suspension through a pipe system connected to a centrifugal pump.

Suction Dredger *is a stationary dredger used to mine for sand. The suction pipe is pushed vertically into a sand deposit. If necessary water jets help to bring the sand up. It is loaded into barges or pumped via pipeline directly to the reclamation area. The normal measures of size are the diameter of the offloading pipe, which can vary between 100 and 1,000 mm, or the installed horsepower.*

Cutter Suction Dredger *is a stationary dredger which makes use of a cutter head to loosen the material to be dredged. It pumps the dredged material via a pipeline ashore or into barges. While dredging the cutter head describes arcs and is swung around the spud-pole powered by winches. The cutter head can be replaced by several kinds of suction heads for special purposes, such as environmental dredging.*

Trailing Suction Hopper Dredger *is a self-propelled ship which fills its hold or hopper during dredging, while following a pre-set track. The hopper can be emptied by opening bottom doors or valves (offloading) or by pumping its load off ashore. This kind of dredger is mainly used in open water: rivers, canals, estuaries and the open sea. Trailing suction hopper dredgers, commonly known simply as 'hoppers' or 'trailers', have a hull in the shape of a conventional ship, and are both highly seaworthy and able to operate without any form of mooring or spud. They are equipped with either single or twin (one on each side) trailing suction pipes. The measure of size of a hopper or trailer dredger is the hopper capacity. This may range from a few hundred cubic metres to over 40,000 m³ - increasingly larger vessels have been constructed in recent years to allow economic transport of the dredged material, especially for reclamation projects.*

The suction pipe terminates in a drag-head, which may be of the plain type or may incorporate a water jet system, blades or teeth, or other means of dislodging compacted material. The function of the drag-head is to allow the material to flow to the suction inlet as efficiently as possible.

A trailing suction hopper dredger operates very much like a floating vacuum cleaner. It sails slowly over the area to be dredged filling its hopper as it proceeds. On completion of loading the dredger sails to the relocation site where the cargo can be offloaded, either by opening the doors or valves in the hopper bottom, by using the dredging pump to deliver to a shore pipeline, or directly to shore by using a special bow jet. This last technique is known as "rainbowing" and is commonly used for reclamation and beach nourishment.

Barge Unloading Dredgers *are used to transfer material from hopper barges to shore, usually for reclamation. A barge unloader is basically a pontoon supporting a suction pump for the unloading, and a high pressure water pump used to fluidise the barge contents by jetting. The mixture is then pumped through a pipeline to the point of reclamation or relocation.*

End of guidance

CHAPTER G
CAPABILITIES AND COMPARTMENTING

CONTENTS OF CHAPTER

G1. HULL SUBDIVISION

100. Main transverse bulkheads

101. to 104. -See Part II, Title 11, Section 1

105. The hopper may be only one.

106. The maximum spacing of bulkheads on the sides of the hopper is to meet the following:

a. $\leq$ L/3 + 3 m; and

b. damage stability criterion, as Chapter H.

CHAPTER H
LOADING CONDITIONS, BUOYANCY AND STABILITY

CHAPTER CONTENTS

H1. LOAD LINE

100. Load line marks
[NORMAM 02 ANNEX 06-N and IMO Circular Letter 2285]

101. **Load line marks** means the load lines assigned to the vessel in accordance with the IMO ILLC/66 to sail between ports.

102. The following marks are to be permanently marked on both sides of the dredger at a vertical distance from the upper edge of the deck line as calculated in accordance with IMO Convention ILLC/66

a. tropical

b. summer

103. The assessment of conformity of physical conditions with the existing regulations is carried out by RBNA.

200. Dredging load line
[NORMAM 02 ANNEX 06-N]

201. **Dredging load line means** is a horizontal line of 300 mm length and 25 mm width permanently marked on both sides of the dredger, centred at midship and at a vertical distance from the upper edge of the deck line equal to half the summer load line calculated in accordance with the IMO Convention ILOLC/66.

202. The dredging load line is indicated by the upper edge of that line to be marked DR, and the dredging fresh water load line by the upper edge of that line to be marked DRF. The lines should be painted in a colour contrasting with the colour of the hull.

203. The dredging load line is calculated from International Convention on Load Lines with attendance to intact and damage stability criteria, defined as follows, and the criteria for analysis of structural strength. See Section 2 of this Title 43 for structural strength and subchapter H5, in what follows, for stability.

202. The dredging load line is half the freeboard for ships type B, if there is no damage stability study.

203. The dredging freeboard is half the freeboard for ships type B minus 60 mm, if there is damage stability study of one compartment at a time.

204. The dredging freeboard is half the freeboard for ships type A, if there is damage stability study of two adjacent compartments at a time

Guidance

a. Type A ship is one which: is designed to carry only liquid cargoes in bulk; has a high integrity of the exposed deck with only small access openings to cargo compartments, closed by watertight gasketed covers of steel or equivalent material; and has low permeability of loaded cargo compartments.

b. Type B: those that do not fit the type A.

End of guidance

300. Specific Load Line Provisions

301. The structural resistance of the vessel shall be adequate to the operational draught corresponding to the assigned load line.

302. A draught indicator is to be provided on the bridge with indication of the corresponding load line.

303. All doors located below the freeboard deck shall be of the sliding type capable of operation from both sides of the doors and also form a station located above the freeboard deck. Indicators of the open/closed position of the doors are to be fitted on the bridge.

304. Where the stability calculations show that the door steps will remain above the damage water line, such doors need not be of the sliding type nor are they subject to the requirements of H1.302 above.

[**IMO Circular letter 2285**]

305. No bulwarks shall be fitted on the freeboard deck abreast of any hopper which is an open hopper.

307. A safe access from the fore end to the aft end of the dredger shall be provided for the protection of the crew. Where the access is located above the freeboard deck it shall be at least as high as the difference between the summer freeboard and the dredging load line freeboard.

308. Means for overflow of process water shall be arranged as follows:

a. over the spill-out edge of the hopper coaming; or

b. through overflow ducts or spillways in the hopper walls; or

c. through adjustable overflows.

H3. LOADING CONDITIONS [IMO Circular letter 2285]

100. Loading conditions to be assumed for the calculations of the intact stability

101. <u>State of cargo: liquid</u>.

The calculations are to be carried out for each of the loading conditions a. and b. considering:

the ship loaded to the dredging load line,

the cargo as a liquid

a. the hopper(s) fully loaded with a homogeneous cargo of density rm up to the spill-out edge of the hopper:

   rm = M1/V1 with:

   M1 = mass of cargo in the hopper when loaded at the dredging load line, in kg.

   V1 = volume of the hopper at the spill-out edge of the hopper , in m3

   The stability calculations are made for the conditions of stores and fuel equal to 100% and 10% and an intermediate condition if such a condition is more critical than both 100% and 10%.

b. the hopper(s) filled or partly filled with a homogeneous cargo of densities equal to 1000, 1200, 1400, 1600, 1800, 2000 kg/m3 .

   When the dredging load line cannot be reached due to the density of the cargo, the hopper is to be considered filled up to the spill-out edge of the hopper .

   The stability calculations are made for the condition of stores and fuel that is the most critical to meet the stability criteria in the stability calculations for density rm as described in a).

102. <u>State of cargo: solid</u>

The stability calculations are to be carried out for each of the conditions a. and b. considering:

the ship loaded to the dredging load line

the cargo as solid

a. the hopper(s) fully loaded with a homogeneous cargo of density rm up to the spill-out edge of the hopper, as calculated in H3.101.a).

   The stability calculations are made for the conditions of stores and fuel equal to 100%, 10% and an intermediate condition if such a condition is more critical than both 100% and 10%.

b. the hopper(s) filled or partly filled with a homogeneous cargo of densities equal to 1400, 1600, 1800, 2000, 2200 kg/m3 which are greater than r_m

   The stability calculations are made for the condition of stores and fuel that is the most critical to meet the stability criteria in the stability calculations for density r_m as described in a).

c. for dredgers with bottom doors or similar means at port side and at starboard side, an additional calculation is to be made for asymmetric discharging as described below:

   The dredger is assumed to be loaded to the dredging load line with solid cargo of a density equal to 1900 kg/m3; when discharging, 20% of the total hopper load is assumed to be discharging only at one side of the longitudinal centre line of the hopper, horizontally equally distributed at the discharging side.

   In this situation:

   the angle of equilibrium should not exceed 25°

   the righting lever GZ within the 30° range beyond the angle of equilibrium should be at least 0.10 m

   the range of stability should not be less than 30°

103. <u>No cargo</u>.

Stability calculations are to be carried out for the hopper(s) with no cargo, the bottom dumping system being open to sea, and with stores and fuel at each of 100% and 10% and an intermediate condition if such a condition is more critical than both 100% and 10%.

For split hopper dredgers, an additional stability calculation is to be made in split hull configuration, with stores and fuel at each of 100% and 10% and an intermediate condition if such a condition is more critical than both 100% and 10%.

H5. STABILITY

100. Weight distribution
-See Part II, Title 11, Section 1

200. Free surface
-See Part II, Title 11, Section 1

300. Intact stability assessment for dredgers under500 GT

301. The stability assessment is carried out by comparison with the criteria adopted by the NORMAM 01, by the National Administrations or, missing those, by the RBNA, but shall not be less than those of H5.400 below.

400. Intact stability assessment for dredgers of 500 GT and over
[IMO Circular letter 2285]

401. The intact stability of the ship is to be sufficient to comply with the criteria indicated in H5.403 below for each of the loading conditions of H3 above in accordance with the calculation method described in H5.402.

402. **Calculation Method**

The calculation of the righting lever curves shall take into account:

a. the change of trim due to heel

b. in the case of an open hopper the inflow of seawater or outflow of liquid cargo and sea water over the spill-out edge of the hopper,

c. the inflow of seawater through any overflow, spillway or freeing port, either at the lower edge of the opening or at the cargo/ seawater interface, whichever is the lower.

d. outflow of the cargo only occurs over the spill-out edge of the hopper where this edge has a length of at least 50% of the maximum hopper length at a constant height above the freeboard deck on both sides of the hopper.

403. **Intact Stability Criteria**

The dredger shall meet the following intact stability criteria in the conditions of loading (excepting asymmetric discharge) stipulated in H3 above:

a. The area under the righting lever curve shall not be less than 0.07 m.rad up to an angle of 15° when the maximum righting lever GZ_{max} occurs at 15° and not be less than 0.055 m.rad up to an angle of 30° when the maximum righting lever GZ_{max} occurs at 30° or above;

b. Where the maximum righting lever GZmax occurs at angles of between15° and 30°, the corresponding area under the righting lever curve shall be $0.055+0.001(30°-\Theta_{max}**)$ m.rad;

c. The area under the righting lever curve between the angles of heel of 30° and 40°, or between 30° and Θ_f (*) if this angle is less than 40°, shall not be less than 0.03 m.rad;

d. The righting lever GZ shall be at least 0.20 m at an angle of heel equal to or greater than 30°;

e. The maximum righting lever GZmax shall occur at an angle of heel not less than 15°; and

f. The initial metacentric height GM_0 as corrected for the free surface effect of tanks and hopper(s) containing liquids, shall not be less than 0.15 m.

* Θ_f is the angle of heel, in degrees, at which openings in the hull, superstructure or deckhouses which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

** Θ_{max} is the angle of heel, in degrees, at which the righting lever curve reaches its maximum.

404. **Weather Criterion**

a. The dredger shall comply with the weather criterion of the IMO Code on Intact Stability 2008, as adopted with Res. MSC.267(85) Chapter 2.3 at the summer load line taking into account the following loading condition:

a.1. state of the cargo: liquid

a.2. stores and fuel: 10%

a.3. hopper(s) loaded with a homogeneous cargo up to the spill-out edge of the hopper where the density of such cargo equals or exceeds 1000 kg/m3; where this condition implies a lighter cargo than 1000 kg/m3 the hopper is considered to be partially filled with a cargo of density equal to 1000 kg/m3.

b. In addition to the weather criterion requirement at the summer load line, the dredger shall comply with the weather criterion of the IMO Code on Intact Stability

2008, as adopted with Res. MSC.267(85) Chapter 2.3 at the dredging load line, assuming a reduced wind pressure of P = 270 N/m2.

405. The intact stability computer program shall be acceptable to the Administration and the Classification Society in the conditions of Part II, Title 11, Section 1, Chapter J.

H6. DAMAGE STABILITY [IMO Circular letter 2285]

100. Damage stability for all dredgers

101. Part B-1 of Chapter II-1 of SOLAS 1974 as amended by MSC.47(66) and as further amended and modified by H6.200, H6.300 and H6.400 of the present Title 43 Section 1, shall be complied with.

200. Calculation Method

201. The calculation of the righting lever curves shall take into account:

a. the change of trim due to heel.

b. in the case of an open hopper the inflow of seawater or outflow of liquid cargo and sea water over the spill-out edge of the hopper.

c. the inflow of seawater through any overflow, spillway or freeing port, either at the lower edge of the opening or at the cargo/seawater interface, whichever is the lower. Adjustable

d. overflows operated from the navigation bridge, may be considered to be located at the highest position.

e. outflow of the cargo only occurs over the spill-out edge of the hopper where this edge has a length of at least 50% of the maximum hopper length at a constant height above the freeboard deck on both sides of the hopper.

f. the sliding of the cargo surface in the hopper, in transverse and longitudinal direction according to the following shifting law:

The cargo surface is assumed to be plane, and

$\Theta r = \Theta g$ for $\rho \leq 1400$ (liquid cargo)

$\Theta r = \Theta g(2000-\rho)/600$ for $1400 < \rho < 2000$ (sliding cargo)

$\Theta r = 0$ for $\rho \geq 2000$ (solid cargo)

with

ρ[kg/m3] cargo density

Θr [degrees] shifting angle of the cargo surface

Θg [degrees] angle of heel or angle of trim

202. The damage stability calculations shall take into account all the possible progressive floodings. A progressive flooding is an additional flooding of spaces interconnected with those assumed to be damaged.

Such additional flooding may occur through openings or pipes as indicated in the following conditions:
internal progressive flooding via:

a. pipes and connected valves which are located within the assumed damage, where no valves are fitted outside the damage zone,

b. pipes, even if located outside the damage zone, where all the following conditions apply:

c. the pipe connects a damaged space to one or more intact spaces

d. the pipe is below a damage waterline at all points between the connected spaces

e. the pipe has no valves between the connected spaces

f. all internal doors other than - remotely operated sliding watertight doors

g. watertight access doors required to be normally closed at sea external progressive flooding via:

h. external openings where a damage waterline, taking into account sinkage heel and trim, immerses the lower edge of the sill or coaming and where the openings are not fitted with watertight means of closure. Such non watertight openings include air pipes whether or not fitted with automatic weathertight closure, ventilators, hatch covers whether or not fitted with weathertight means of closure. Openings which may be assumed watertight include manhole covers, flush scuttles and small watertight hatch covers which maintain the high integrity of the deck, side scuttles of the non opening type.

When progressive flooding may occur, the additional flooding of spaces which were not previously assumed to be damaged, is to be considered for the damage stability calculations.

However, major internal progressive flooding when the ship cannot survive the additional flooding, is not permitted. In such a case, arrangements are to be provided to limit the progressive flooding.

205. The intact stability computer program shall be acceptable to the Administration and the Classification Society in the conditions of Part II, Title 11, Section 1, Chapter J.

300. Loading Conditions

301. The attained subdivision index A_U is to be calculated for the unloaded draught du and corresponding trim, assuming the dredger is loaded with 50% stores and fuel, no cargo in the hopper(s), and the hopper(s) in direct communication with the sea.

302. The attained subdivision index A_L is to be calculated for each cargo density defined in H6.302.a and H6.302.b below assuming the dredger is loaded at dredging load line dL, with 50% stores and fuel. The damage stability calculations are to be performed taking into account the initial trim of the dredging load line and an assumed permeability of the cargo filled hopper space of 0 % and a permeability of the space above the cargo equal to 100%.

a. the design density ρ_d corresponding to the dredging load line where:

$\rho_d = M_2/V_2$

M_2 [kg] mass of cargo in the hopper when loaded at dredging load line with stores and fuel at 50%.

V_2 [m^3] volume of the hopper at the highest overflow position

b. each density ρi greater than ρ_d, defined by:

ρ_i = 2200- i.200 where i = [0, 1, 2, 3,.6]

400. Damage Stability Criteria

The dredger shall comply with the following criteria:

A ≥ R for each cargo density defined in H6.302

AU ≤ 0.7R

AU ≤ 0.7R for each cargo density defined in H6.302

where

Required Subdivision Index R = $(0.002+0.0009L_s)^{1/3}$ for L_s ≥ 100 m

Required Subdivision Index R = 1- $1/[1+(L_s/100)\{R_0/(1-R_0)\}]$ for Ls < 100 m

with R_0 is the value of R calculated in accordance with the formula R = $(0.002+0.0009L_s)^{1/3}$

Ls [m] = subdivision length of the ship

Attained Subdivision Index A= 0.5(AU + AL)

AU = attained subdivision index at unloaded draught d_u

AL = attained subdivision index at loaded draught d_L and cargo densities defined in H6.302

CHAPTER I
PROPULSION PERFORMANCE

CHAPTER CONTENTS

I1. PROPULSION POWER

100. Selection of propulsion

101. - See Part II, Title 11, Section 1

102. - See Part II, Title 11, Section 1

103. The propulsive system is selected for free speed and speed of dredging.

CHAPTER T
INSPECTIONS AND TESTS

CHAPTER CONTENTS

T3. NAVIGATION TESTING

100. Propulsion and maneuvering performance

101 and 102. - See Part II, Title 11, Section 1

103. For auto propelled dredgers the navigation test at dredging speed together with course variation shall be included during sea trials.

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