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# Guidelines for Preparation of Loading Manuals

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# Chapter 1 GENERAL PROVISIONS

## 1.1 General requirements

1.1.1 The Guidelines for Preparation of Loading Manuals (hereinafter referred to as the Guidelines) provides the contents, approval conditions, forms and examples for ship's leading manuals for the purpose of supplying designers and shipping companies with assistance in preparing loading manuals for ships engaged on international voyages, ship masters with instructions in mastering and controlling loading of ships such that the stability and strength of ships are kept in permissible ranges under the assigned loaded conditions and that the ships are, suitable for a safe navigation, and the Surveyors with basis in examining the loading manuals.

1.1.2 The requirements of the Guidelines for the contents, examination and inspection of the loading manuals are in conformity with the corresponding provisions of the international conventions, codes and those of IACS. The relevant requirements of an Administration of flag States simultaneously are also to be complied with where otherwise required by" the Administration.

## 1.2 Contents of loading manuals

1.2.1 For sea- going ships of 65 m or over in length, the loading manual is to contain:

(1) ship's type and its principal parameters;

(2) the loading conditions on which the design of the ship has been based, including permissible values of still water bending moment and shear force;

(3) the calculation results of permissible values of still water bending moments, shear forces and where applicable, of torsional and lateral loads;

(4) the allowable local leading for the structure (hatch covers, decks, double bottom etc. ) ;

(5) stability information.

1.2.2 For hulk carriers, ore carriers and combination carriers of 150 m or over in length, the locating manual is to contain:

(1) ship's type and its principal parameters;

(2) the loading conditions on which the design of the ship has been based, including permissible values of still water bending moment and shear force;

(3) the calculation results of permissible values of still water bending moments, shear forces and where applicable, of torsional loads;

(4) for single side skin hulk carriers contracted for construction on or after 1 July 1998, intended for the carriage of bulk cargoes in a density, of 1.0 $t/m^3$ or above, envelope results and permissible still water bending moments and shear forces in the hold flooded condition are to be provided;

(5) the cargo bold(s) or combination of cargo holds that might be empty at full draught, ff no cargo hold is allowed to be empty at full draught, this should be clearly stated in the loading manual;

(6) maximum allowable and minimum required mass of cargo of each hold as a function of the drought at mid - hold position; maximum allowable and minimum required mass of cargo of any two adjacent holds as a function of the mean draught in way of these holds. This mean draught is the average of the two mid- hold positions;

(7) maximum allowable tank top loading together with specification of the nature of the cargo for cargoes other than bulk cargoes;
(8) maximum allowable load on deck and hatch covers. If the ship is not approved to carry load on deck or hatch covers, this should be clearly stated in the loading manual;
(9) the maximum rate of ballast change together with the advice of the Port Authorities that a load plan is to he agreed with the terminal on the basis of the achievable rotes of change of ballast;
(10) loading/unloading sequences;
(11) stability information.

### 1.3 Conditions of approval of loading manuals

1.3.1 For sea - going ships of 65 m or over in length, the requirements are as follows:
(1) loading manuals are to be based upon the finished data of the ship;
(2) the manual is to include the design loading and ballast conditions upon which the approval of the hull scantlings is based;
(3) the stability information in loading manuals is to include the loading conditions required in Chapter 2 and comply with the requirements of International Maritime Organization (hereinafter referred to as IMO) or the Administration of flag States;
(4) loading manuals are to be prepared in a language understood by the users. If this language is not English, a translation into English is to be included;
(5) where any modification of the ship results in the changes to its main data and usage, a new loading manual is to be prepared in accordance with the requirements in (1) to (4) above and submitted for approval.

1.3.2 In addition to complying with the requirements given in 1.3.1, bulk carriers, ore carriers and combination carriers of 150 m or over in length contracted for construction on or after 1 July 1998, are to comply with the requirements in 2.3.1 of Chapter 2.

### 1.4 Basis for Preparation of Loading Manuals

1.4.1 The Guidelines are prepared based on the following documents:
(1) Reg. II - 1, VI and XII of International Convention for the Safety of Life at Sea (SOLAS) ;
(2) Appendix [ to the International Convention on Load Lines, 1966;
(3) S1, S1A, S17, S19, S21, S22, S23 and S25 of the Unified Requirements (UR) of the International Associations of Classification Societies (IACS) ;
(4) IMO Resolutions A.749 (18), A.514 (13) and A.320 (IX);
(5) Rules and Regulations for the Construction and Classification of Sea- going Steel Ships by CCS (hereinafter referred to as the Rules).

### 1.5 Inspection

1.5.1 At each annual and special, survey, the Surveyor is to check that the approved loading manual by the Society is available on beard.

### 1.6 Instructions

1.6. 1 Loading manuals described in the Guidelines have included the contents of the loading information booklets for the existing bulk carriers of 150 m or over in length. If loading information booklet and loading manual are not consolidated, the loading information booklet, including loading/unloading sequences may be prepared with reference to Appendix 4.

1.6.2 Entrusted by the users, the Society may undertake related technical service work.

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# Chapter 2 LOADING CONDITIONS

## 2.1 General requirements

2.1.1 It is to be checked that the loading manuals are to contain the loading conditions according to the requirements of this Chapter and based upon the contents in 1.2 of Chapter 1.

2.1.2 The loading conditions in this Chapter are the minimum ones needed.

2.1.3 The loading conditions applicable to ships of 65 m or over in length are to contain the design loading and ballast conditions, subdivided into departure and arrival conditions, and ballast exchange at sea conditions, where applicable, upon which the approval of the hull scantlings by the Society is based.

## 2.2 Loading conditions are to comply with the requirements of 2.2.2.3, 2.2.2.6 and 2.2.2.7of Chapter 2, PART TWO of the Rules.

## 2.3 Additional requirements for loading conditions

2.3.1 In addition to the requirements given in 2.2.1 and 2.2.5, for bulk carriers, ore carriers and combination carriers of 150 m or over in length contracted for construction on or after 1 July 1998, the following loading conditions, subdivided into departure and arrival conditions, as appropriate, are to include:

(1) alternate light and heavy cargo loading conditions at maximum drought, where applicable;
(2) homogeneous light and heavy cargo loading conditions at maximum draught;
(3) ballast conditions. For cargo holds designated as ballast water holds, it is to be strengthwise acceptable that the ballast holds are filled when the topside wing, hopper and double bottom tanks are empty. In addition, both general and heavy ballast conditions are to be considered;
(4) short voyage conditions where the ship is to be loaded to maximum draught but with limited amount of bunkers;
(5) multiple port loading/unloading conditions;
(6) deck cargo conditions, where applicable;
(7) typical loading sequences where the ship is loaded from commencement of cargo loading to reaching full deadweight capacity, for homogeneous conditions, relevant part load conditions and alternate conditions where applicable. Typical unloading sequences for these conditions are also to be included. The typical loading/unloading sequences are also to be developed to not exceed applicable strength limitations. The typical loading sequences are also to be developed paying due attention to loading rote and the deballasting capability. Reference may be made to examples for Loading Sequence Summary Forms in Tables 1.7.2 (1), (2), (3) and (4) of Appendix 1;
(8) typical sequences for change of ballast at sea, where applicable.

# Chapter 3 LONGITUDINAL STRENGTH OF SHIPS

## 3.1 General requirements

3.1.1 Ship's longitudinal strength covered in this Chapter is to contain the following requirements:

(1) permissible values of still water bending moment and shear force of the ship;

(2) calculated values of still water bending moment and shear force of the ship under the loading conditions as specified in Chapter 2.

3.1.2 The permissible values of still water bending moment and shear force are to include both sea and harbour conditions.

3.1.3 In general, values of still water moment and shear force in way of the main transverse bulkheads within the range of the engine room bulkhead and the collision bulkhead are to be indicated but the values of still water bending moment and shear force in way of at least three transverse sections within the range of 0.4 *L* amidships are to be indicated.

3.1.4 For bulk carriers, ore carriers and combination carriers of 150 m or over in length, the additional requirements as specified in 4.5 of Chapter 4 of the Guidelines are to be taken into account.

## 3.2 Still water bending moments

3.2.1 Permissible values of still water bending moments:

Permissible values of still water bending moments in way of hull transverse sections are to be determined according to the Rules.

3.2.2 The still water bending moment in way of any transverse section corresponding to each loading condition are to be determined in accordance with the calculation method as specified in the Rules and its value not greater than the permissible values as required.

## 3.3 Still water shear forces

3.3.1 Permissible values of still water shear forces in way of hull sections are to be determined according to the Rules.

3.3.2 Shear stress in the structural members produced by the still water shear force corresponding to each loading condition may be calculated in accordance with the method as specified in the Rules. The sum of the shear stress and that caused by wave shear force are to be not greater than the permissible stress as specified in the Rules, and also comply with the requirements for yield strength of the members.

## 3.4 Additional requirements relating to bulk carriers

3.4.1 For single side skin bulk carriers of 150m or over in length, contracted for construction on or after 1

July 1998 and intended for the carriage of solid bulk cargoes, typical loading sequences are to be provided as required. For bulk carriers of 150m or over in length intended to be assigned harmonized notation BC - A or BC - B and contracted for construction on or after 1 July 2003, longitudinal strength in the flooded condition are to be calculated in accordance with the requirements of 8.9.1 of Chapter 8, PART TWO of the Rules.

(1) Still water bending moments:

① Permissible values of still water bending moments are to be calculated from the following formulae :

$$\overline{M}_s(+) = \overline{M} - 0.8M_w(+) \quad \text{kN·m}$$
$$\overline{M}_s(-) = -\overline{M} - 0.8M_w(-) \quad \text{kN·m}$$

where: combined bending moment $\overline{M}$ , hogging bending moment $M_w(+)$ and sagging bending moment $M_w$, ( - ) are to be determined by the related formulae in the Rules respectively.

② Still water bending moment corresponding to each loading condition is to be calculated in accordance with the Rules taking respectively each hold flooded condition into consideration and envelope results be provided.

(2) Still water shear forces may be determined as specified in the Rules or obtained from the following formulae:

① Permissible values of still water shear forces

$$\overline{F}_s(+) = [\tau] \cdot \frac{I \cdot t_s}{0.5 \cdot s} \cdot 10^{-2} - 0.8F_w(+) \quad \text{kN}$$
$$\overline{F}_s(-) = -[\tau] \cdot \frac{I \cdot t_s}{0.5 \cdot s} \cdot 10^{-2} - 0.8F_w(-) \quad \text{kN}$$

where: $F_w$— wave shear force, in kN, calculated in accordance with the formulae as specified in the Rules;

$[\tau]$ — permissible shear stress, to be taken as 110 MPa;

$I$ — moment of inertia of the athwartships section under consideration about its horizontal neutral axis, in cm4 ;

$S$ — at the athwartships section under consideration, the first moment of area about the horizontal neutral axis for the effective longitudinal members, in em3;

$t_s$ — thickness of side shell plating about neutral axis, in nm

② Still water shear force corresponding to each loading condition is to be calculated in accordance with the Rules taking respectively each hold flooded condition into consideration and envelope results be provided.

(3) Loading sequences

① Bulk carriers as specified in 3.4.1 are to prepare the typical loading/unloading sequences as shown in Tables 1.7.2(1), (2), (3) and (4) for the purposes of controlling and preventing the still water bending moments and still water shear forces from exceeding the values throughout the processes of loading/unloading. And the requirements for local strength in Chapter 4 are also to be considered at the same time.

② Loading/unloading sequences are to be subject to approval of the Society.

③ Loading/unloading sequences are to include:

(a) from commencement of cargo loading of ships in ballast condition to reaching non - homogeneous fully loaded departure condition;

(b) from commencement of cargo unloading of ships in non - homogeneous fully loaded condition to reaching ballast departure condition;

(c) from commencement of cargo loading of ships in ballast condition to reaching homogeneous fully loaded departure condition;

(d) from commencement of cargo unloading of ships in homogeneous fully loaded condition to reaching ballast departure condition.

④ Points for attention in preparation of loading sequences:

(a) the working conditions selected for loading sequences are to be in corresponding to the typical working conditions for loading solid bulk cargoes in the Loading Manual;

(b) the prepared loading/unloading sequences can not be substituted for the master's experiences with respect to the loading/unloading, the master may re - prepare loading/unloading sequences based upon the cargo properties, loading/unloading rates, ballast or de – ballast rates, draughts of the ships and longitudinal strength of hull girders;

(c) where preparing loading/unloading sequences, the loading computers onboard are to be in full use so as to ensure that:

- still water bending moments and shear forces along the ship length are within permissible values in harbour conditions;
- cargo weight in each hold is within permissible values at the corresponding draughts in harbour condition;
- the loading limit on inner bottom and other corresponding permissible local loading are not exceeded;
- the still water bending moments and shear forces along the ship length in final departure conditions are within the permissible values.

(d) loading sequences of holds are those amidships first, and then those at stern and at bow alternatively so that the longitudinal strength of hull girder is ensured and that a bit larger trim can be prevented.

(e) deballasting sequences of ballast tanks are, in general, the same as those for loading cargoes, i.e. where cargo loading is carried out in a hold, deballasting commences in the adjacent ballast tank, in the process of cargo loading, due attention is to be paid to the ballasting/deballasting rate and capacity so as to ensure ballasting operation to be fit for cargo loading operations.

3.4.2 For double side skin bulk carriers, ore carriers and combination carriers of 150 m or over in length contracted for construction on or after 1 July 1998, still water bending moments, permissible still water bending moments, still water shear forces and permissible still water shear forces are to be calculated in accordance with the requirements in 3.2 and 3.3 of this Chapter. Loading/unloading sequences as specified in 3.4.1 (3) of this Chapter are to also be provided.

3.4.3 For single side skin bulk carriers of 150 m or over in length contracted for construction prior to 1July 1998, loading/unloading sequences as specified in 3.4.1 (3) of this Chapter are to be provided not later than 1 July 1999.

### 3.5 Permissible values of still water bending moments and shear forces of ships in harbour operations

3.5.1 Permissible values of still water bending moments and shear forces of ships in harbour operations may be properly increased, the increased values may be taken as 50% .the wave bending moment and 50% the wave

shear force as specified in the Rules respectively.

### 3.6 Additional requirements for bulk carrier assigned harmonized notations

3.6.1 For bulk carriers of 150m or over in length contracted construction on or after 1 July 2003, and requesting harmonized notation BC - A, BC - B or BC - C, longitudinal strength check should be carried out in accordance with the design conditions as designated by the following corresponding harmonized notations:

(1) BC- C

Homogeneous cargo loaded condition where the cargo density corresponds to all cargo holds, including hatchways, being 100% full at maximum draught with all ballast tanks empty.

(2) BC—B

As required for BC - C, plus: homogeneous cargo loaded condition with cargo density 3.0 t/$m^3$, and the same filling rate in all cargo holds at maximum draught with all ballast tanks empty.

In cases where the cargo density applied for this design loading condition is less than 3.0 t/$m^3$, the maximum density of the cargo that the vessel is allowed to carry is to be indicated with the additional notation (maximum cargo density x. y t/$m^3$ )

(3) BC—A

As required for BC - B, plus: at least one cargo loaded condition with specified holds empty, with cargo density 3.0 t/$m^3$, and the same filling rate in all loaded cargo holds at maximum draught with all ballast tanks empty.
The combination of specified empty holds is to be indicated with the annotation (holds a, b .... may be empty).

In such cases where the design cargo density applied is less than 3.0 t/$m^3$, the maximum density of the cargo that the vessel is allowed to carry is to be indicated within the annotation, e.g. (holds a, b, ....may be empty, with maximum cargo density x. y t/$m^3$) .

"Loading rote" here refers to result of mass of cargo in cargo hold being divided by capacity of the cargo hold. In calculation of capacity of cargo hold, it is to be measured to top of hatch coaming.

# Chapter 4 LOCAL STRENGTH OF SHIPS

## 4.1 General requirements

4.1.1 The permissible values of local loading in this Chapter are those on hatch covers, deck and double bottoms.

4.1.2 For bulk carriers, ore carriers and combination carriers of 150 m or over in length, the additional requirements as specified in 4.5 of this Chapter are to be taken into account.

## 4.2 Permissible loading values on hatch covers

Permissible loading values on hatch covers are to be determined by the method as specified in the Rules.

## 4.3 Permissible loading values on deck

Permissible loading values on deck are to be determined by the method specified in the Rules

.

## 4.4 Permissible loading values on double bottoms

The permissible loading values on double bottoms may be, in general, determined by means of direct calculations.

## 4.5 Additional requirements for bulk carriers

4.5.1 For bulk carriers, ore carriers and combination carriers of 150 m or over in length contracted for construction on or after 1 July 2003, and requesting harmonized notation BC - A, BC - B or BC - C, notes, computation and curves are to be included in the loading manuals in accordance with the requirements of this Section.

4.5.2 Loading manual is to describe the cargo hold(s) or combination of cargo holds that might be empty at full draught. If no cargo hold is allowed to be empty at full draught, this should be clearly stated in the loading manual.

4.5.3 Loading manual is to include the maximum allowable load on deck and hatch covers. If the ship is not approved to carry load on deck or hatch covers, this should be clearly, stated in the loading manual.4.5.4 Loading manual is to include the maximum allowable and minimum required cargo mass in each hold, as a function of the draught at mid - hold position. They may be calculated by the following formulae and curves be drawn as shown in Fig. 1.8.1 and Fig. 1.8.2 of Appendix 1. Local strength of cargo hold are to be checked in accordance with the requirements in Guidelines for Direct Strength Analysis of Bulk Carriers.

(1) Definitions

$T$ —summer load line draught, in m;

$\rho$ — density of sea water, 1.025 t/m$^3$;

$A_{HN}$—equivalent bottom area of cargo hold, in m$^2$ , to be calculated according to $V_{HN} / h_{HN}$;

$V_{HN}$ —capacity of cargo hold, measured from central longitudinal plane to deck line, in m$^3$

$h_{HN}$— height of cargo hold in central longitudinal plane measured from inner bottom to dekline, in m;

$T_{HB}$— draught at mid - hold position in heavy ballast condition, in m;

$d$ — draught at mid - hold position, in m, $0 \leqslant d \leqslant T$;

$M$ — the cargo mass in a cargo hold, in t, $0 \leqslant M \leqslant M\,\max$;

$M_H$— the actual cargo mass in a cargo hold corresponding to a homogeneously loaded condition at maximum draught, in t;

$M_{Full}$: the cargo mass in a cargo hold corresponding to cargo with virtual density (homogeneous mass/hold cubic capacity, minimum 1.0 t/m$^3$) filled to the top of the hatch coaming. $M_{Full}$ is in no case to be less than $M_H$;

$M_{HD}$: the maximum cargo mass allowed to be carried out in a cargo hold according to design loading condition(s) with specified holds empty at maximum drought;

$M_{DB\text{-}F}$ : fuel loading capacity of fuel oil tanks (if any) in the double bottom in way of cargo hold, in t

(2) Harmonized notation BC- B (No MP) or BC - C (no MP)

Maximum allowable cargo mass at sea condition:

$$M = M_{max} + \rho \ A_{HN}(d - T) \quad \text{t}$$

Maximum allowable cargo mass in harbour condition:

$$M = M_{max} + \rho \ A_{HN}(d - 0.67T) \quad \text{t}$$

Minimum required cargo mass at sea condition:

$$M = M_{min} + \rho \ A_{HN}(d - T) \quad \text{t}$$

Minimum required cargo mass in harbour condition:

$$M = (M_{min} - 0.15M_{max}) + \rho \ .A_{HN}(d - T) \quad \text{t}$$

where: $M_{max} = M_{Full}$

$M_{min}$, to be $\rho \ .A_{HN}(T - T_{HB})$ or $0.5M_H$, whichever the smaller.

(3) Heavy cargo hold with harmonized notation BC - A (no MP)

Maximum allowable cargo mass at sea condition:

$$M = (M_{max} + 0.1M_H - M_{DB\text{-}F}) + \rho \cdot A_{HN}(d - T) \quad t$$

Maximum allowable cargo mass in harbour condition:

$$M = (M_{max} + 0.1M_H - M_{DB\text{-}F}) + \rho \cdot A_{HN}(d - 0.67T) \quad t$$

Minimum required cargo mass at sea condition:

$$M = M_{min} + \rho \cdot A_{HN}(d - T) \quad t$$

Minimum required cargo mass in harbour condition:

$$M = (M_{min} - 0.15M_{max}) + \rho \cdot A_{HN}(d - T) \quad t$$

where : $M_{max} = M_{HD} + M_{DB\text{-}F}$

$M_{min}$, to be $\rho \cdot A_{HN}(T - T_{HB})$ or $0.5M_H$, whichever the smaller.

(4) Empty hold with harmonized notation BC - A(no MP)

Maximum allowable cargo mass at sea condition:

$$M = M_{max} + \rho \cdot A_{HN}(d - T) \quad t$$

Maximum allowable cargo mass in harbour condition:

$$M = M_{max} + \rho \cdot A_{HN}(d - 0.67T) \quad t$$

Minimum required cargo mass at sea condition:

$$M = 0 \quad t$$

Minimum required cargo mass in harbour condition:

$$M = 0 \quad t$$

where: $M_{max} = M_{Full}$

(5) Harmonized notation BC - B or BC – C

Maximum allowable cargo mass at sea condition:

$$M = M_{max} + \rho \cdot A_{HN}(d - 0.67T) \quad t$$

Maximum allowable cargo mass in harbour condition:

$$M = 1.15M_{max} + \rho \cdot A_{HN}(d - 0.67T) \quad t$$

Minimum required cargo mass at sea condition:

$$M = M_{min} + \rho \cdot A_{HN}(d - T) \quad t$$

Minimum required cargo mass in harbour condition:

$$M = (M_{min} - 0.15M_{max}) + \rho \cdot A_{HN}(d - T) \quad t$$

where: $M_{max} = M_{Full}$

$M_{min}$ to be 0.17 $\rho$ . $A_{HN}T$, $\rho$ . $A_H(T - T_{HB})$ or 0 .5$M_H$ , whichever the smallest.

(6) Heavy cargo hold with harmonized notation BC- A

Maximum allowable cargo mass at sea condition:

$$M = (M_{max} + 0.1M_H - M_{DB\text{-}F}) + \rho \cdot A_{HN}(d - T) \quad t$$

Maximum allowable cargo mass in harbour condition:

$$M = (M_{max} + 0.1M_H - M_{DB\text{-}F}) + \rho \cdot A_{HN}(d - 0.67T) \quad t$$

Minimum required cargo mass at sea condition:

$$M = M_{min} + \rho \cdot A_{HN}(d - T) \quad t$$

Minimum required cargo mass in harbour condition:

$$M = (M_{min} - 0.15M_{max}) + \rho \cdot A_{HN}(d - T) \quad t$$

where: $M$max = $M_{HD}$+ $M_{DB\text{-}F}$

$M_{min}$ to be 0.17 $\rho$ . $A_{HN}T$, $\rho$ .$A_{HN}(T - T_{HB})$ or 0.5 $M_H$ , whichever the smallest.

(7) Empty hold with harmonized notation BC – A

Maximum allowable cargo mass at sea condition:

$$M = M_{max} + \rho \cdot A_{HN}(d - 0.67T) \quad t$$

Maximum allowable cargo mass in harbour condition:

$$M = 1.15M_{max} + \rho \cdot A_{HN}(d - 0.67T) \quad t$$

Minimum required cargo mass at sea condition:

$$M = 0 \quad t$$

Minimum required cargo mass in harbour condition:

$$M = 0 \quad t$$

*where:* $M_{max} = M_{HD} + M_{DB\text{-}F}$

4.5.5 Loading manual is to include the maximum allowable and minimum required cargo mass in any two adjacent cargo holds, as a function of the draught at mid - hold position. They may be calculated by the following formula and curves be drawn as shown in Fig. 1.8.3 of Appendix 1. Local strength of cargo hold are to be checked in accordance with the requirements in Guidelines for Direct Strength Analysis of Bulk Carriers.

(1) Definitions

$A_H$ — equivalent bottom area of two adjacent cargo holds, $A\,1_{HN} + A\,2_{HN}$ to be taken;

$A1_{HN}$, $A2_{HN}$ — equivalent bottom areas of two adjacent cargo holds respectively, see $A_{HN}$ in 4.5.4 ( 1 ) for definition;

$M\,1_{Full}$, $M\,2_{Full}$ — cargo mass in two adjacent cargo holds $M_{Full}$ respectively;

$M\,1_H$, $M\,2_H$ — actual cargo mass in two adjacent cargo holds $M_H$ respectively;

$M\,1_{HD}$, $M\,2_{HD}$ — maximum allowable cargo mass in two adjacent cargo holds $M_{HD}$ respectively;

$M\,1_{DB\text{-}F}$, $M\,2_{DB\text{-}F}$ — fuel loading capacity in two adjacent cargo holds $M_{DB\text{-}F}$ respectively;

$d$ — drought at mid - hold position of two holds, in m, $0 \leqslant d \leqslant T$;

$M$—the cargo mass in a cargo hold, in t, $0 \leqslant M \leqslant M_{max}$;

$T$, $\rho$, $M_H$, $M_{Full}$, $M_{HD}$, $M_{DB\text{-}F}$ — same to 4.5.4. (1).

(2) Harmonized notation BC - A, BC - B or BC – C

Maximum allowable cargo mass at sea condition:

$$M = M_{max} + \rho \cdot A_H(d - 0.67T) \quad t$$

Maximum allowable cargo mass in harbour condition:

$$M = 1.15M_{max} + \rho \cdot A_H(d - 0.67T) \quad t$$

Minimum required cargo mass at sea condition:

$$M = \rho \cdot A_H(d - 0.75T) \quad t$$

Minimum required cargo mass in harbour condition:

$$M = -0.15M_{max} + \rho \cdot A_H(d - 0.75T) \quad t$$

where: $M\text{max} = M1_{Full} \sim + M2_{Full}$

(3) Two adjacent heavy loading holds with harmonized notation BC – A

Maximum allowable cargo mass at sea condition:

$$M = (M_{max} + 0.1M1_H + 0.1M2_H - M1_{DB-F} - M2_{BD\text{-}DF}) + \rho \cdot A_H(d - T)$$

Maximum allowable cargo mass in harbour condition:

$$M = 1.15M_{max} + \rho \cdot A_H(d - T) \quad t$$

Minimum required cargo mass at sea condition:

$$M = \rho \cdot A_H(d - 0.75T) \quad t$$

Minimum required cargo mass in harbour condition:

$$M = -0.15M_{max} + \rho \cdot A_H(d - 0.75T) \quad t$$

where: $M_{max} = M1_{HD} + M2_{HD} + M1_{DB\text{-}F} + M2_{DB\text{-}F}$

# Chapter 5 STABILITY INFORMATION

## 5.1 General requirements

5.1.1 Stability information are to include：

(1) Intact stability；

(2) Damage stability(where applicable)；

(3) Stability for the carriage of grains in bulk(where applicable).

5.1.2 For stability information to be covered in the loading manual，reference may be made to the requirements in 2.2 of Chapter 2.

5.1.3 For preparation of stability calculation，criteria and stability information，attention is also to be given to the relevant provisions of IMO or the Administration of flag States.

## 5.2 Intact stability

5.2.1 Loading Conditions are to include at least：

(1) the loading conditions as specified in Chapter 2：

(2) the loading conditions requested for check by the shipowners；

(3) the loading conditions as specified by the Administration of flag States (where applicable).

5.2.2 The stability criteria are to comply with：

(1) the criteria specified by the Administration of flag States (where applicable)；

(2) the requirements of the Rules by the Society.

5.2.3 The loading calculations in each loading condition are required as follows：

(1) calculations to be made according to the following categories：

① cargoes；

② spares and fuel；

③ fresh water；

④ ballast / ballast water.

(2) For calculation forms，reference may be made to Tables 5.2.3(1) and (2).

**Cargo Hold** **Table5.2.3(1)**

| Compartment | Frame | Capacity ($m^3$) | Weight (t) | Longitudinal coordinate of centre gravity(LCG) Xg (m) | Vertical coordinate of centre 0f gravity(VCG) Zg (m) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| Total | | | | | |

Spares and fuel, fresh or ballast Water Table 5.2.3(2)

| No. | Compartment | Rate of loading (%) | Weight (t) | LCG Xg (m) | Transverse coordinate of centre of gravity(TCG) Yg (m) | VCG Zg (m) | Free surface moment i* $\rho$ (t—m) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Total | | | | | | | |

The amount of spares and fuel are to be taken as 100％for departure，50％for mid—way (where applicable) and 10％for arrival respectively.

Where the stability of a ship is not in compliance with the requirements and permanent ballast necessary，effective means are to be provided so as to ensure the reliability of the ballast subject to agreement of the Society.

5.2.4 Stability calculations in each loading condition are to include：

(1) list of loaded weight calculations，,see Table 5.2.4(1)；

(2) list of intact stability calculations，see Table 5.2.4(2).

5.2.5 The summary table of stability calculations in all loading conditions Rig required as follows：

(1) that all loading conditions covered in 5.2.1 are to be included；

(2) for the form and minimum contents of summary table，see Table 5.2.5.

### 5.3 Damage stability of single side skin bulk carriers of 150 m or over in length

5.3.1 The requirements of this Section apply to single side skin bulk carriers of 150 m or over in length contracted for construction prior to l July 1998；however，the requirements of this Section may be considered applicable to the bulk carries. of which the reduced freeboards are assigned in accordance with Regulation 27(7)of the International Convention on Load Lines，1966 (being adopted on 5 April 1966)：and be also applicable to the bulk carriers，ore carriers and combination carriers of 150 m or over in length contracted for construction on or after 1 July 1998.The requirements of this Section may also be considered applicable to the bulk carriers，of which the reduced freeboards are assigned in accordance with the provisions equivalent to Regulation 27(8)of 1966ILL Convention adopted by IMO A.320(IX)，as amended by IMO A.514(13)，where

applicable.

5.3.2 Damage stability is required as follows：

(1) Single side skin bulk carriers of 150 m or over in length contracted for construction prior to 1 July 1998, intended for the carriage of solid bulk cargoes having a density of 1.78 t / $m^3$ or above，when loaded to the summer load line, are to be able to withstand flooding of hold No.1 in all loading conditions and remain afloat in a satisfactory condition of equilibrium，as specified in(3)below.

(2) Single side skin bulk carriers of 150 m or over in length contracted for construction on or after l July 1998. intended for the carriage of solid bulk cargoes having a density of 1.0 t / $m^3$ or above，when loaded to the summer load line, are to be able to withstand flooding of any one hold in all loading conditions and remain afloat in a satisfactory condition of equilibrium as specified in (3) below.

(3) The condition of equilibrium after flooding are to satisfy the condition of equilibrium laid down in；in the Appendix to Resolution A.320(IX) (equivalent to Regulation 27 of the International Convention on：Load Lines，1966)，as amended by IMO Resolution A.514(13).The assumed flooding need only take into account flooding of the cargo hold space. The permeability of loaded hold are to be assumed as 0.9and the permeability of an empty hold are to be assumed as 0.95，unless a permeability relevant to a particular cargo is assumed for the volume of a flooded hold occupied by cargo and a permeability of 0.95 is assumed for the remaining empty volume of the hold.

5.3.3 Calculations ale required as follows：

(1) by means of a fixed displacement of water；

(2) the utmost adverse condition of damage stability at starboard or port side are to be taken into account for every loading condition；

(3) for the form of calculated results，reference may be made to Table 5.3.3.

**5.4 Stability for the carriage of grain in bulk**

5.4.1 Stability calculations are to be in accordance with the requirements in Chapter VI of SOLAS.

5.4.2 For the preparation of stability information，reference may be made to the contents and forms in Appendix 2.

L01—FULL LOAD DEP.
WEICHT LOADS

**Example for list of loaded weight calculations** **table 5.2.4(1)**

| LOAD ID. CODE | Names of tanks | Weight (t) | Vertical coordinate of centre of gravity (VCG)to baseline (BL) (m) | Vertical moment (tm) | Longi. coordinate of centre of gravity (LCG) amidships (MID) (m) | Longi. moment(tm) | F.S.M DENS*I (tm) |
|---|---|---|---|---|---|---|---|
| Hdots | Heavy d. oil tk.(S) | 395.0 | 0.881 | 348.0 | —41.586 | —16426.5 | 0.0 |
| Hdotp | Heavy d. oil tk.(P) | 395.0 | 0.881 | 348.0 | —41.586 | —16426.5 | 0.0 |
| Fstap | Aft f. oil st. tk.(P) | 148.8 | 11.446 | 1703.2 | —77.073 | —11468.5 | 145.4 |
| Fstas | Aft f. oil st. tk.(S) | 148.8 | 11.446 | 1703.2 | —77.073 | —11468.5 | 145.5 |
| Fostp | Fuel oil store tk.(P) | 191.9 | 9.977 | 1914.6 | —61.210 | —11746.2 | 0.0 |
| Fosts | Fuel oil store tk.(S) | 121.7 | 9.977 | 1214.2 | —61.210 | —7449.3 | 0.0 |
| Fuel oil | | 1401.2 | 5.16l | 7231.1 | —53.515 | —74985.3 | 290.9 |
| Iost | Lub. oil clean tk. | 23.6 | 13.368 | 315.5 | —81.500 | —1923.4 | 0.0 |
| Lost | Lub..oil store tk. | 31.5 | 13.368 | 421.1 | —81.500 | —2567.3 | 0.0 |
| Lubricating oil | | 55.1 | 13.368 | 736.6 | —81.500 | —4499.6 | 0.0 |
| Fwftp | Fore f. water tk.(P) | 284.0 | 10.612 | 3013.8 | 77.293 | 21951.2 | 270.6 |
| Fwfts | Fore f. water tk. (S) | 272.4 | 10.612 | 2890.7 | 77.293 | 21054.6 | 270.6 |
| Dwtp | Aft d. water tk.(P) | 72.I | 13.970 | 1077.2 | —84.402 | —6085.4 | 0.0 |
| Dwts | Aft d. water tk.(S) | 72.1 | 13.965 | 1006.9 | —84.401 | —6085.3 | 0.0 |
| fresh water | | 700.6 | 11.303 | 7918.6 | 44.012 | 30835.1 | 541.3 |
| Hold l | Cargo hold 1 | 5958.9 | 8.876 | 52891.2 | 62.520 | 372550.4 | 0.0 |
| Hold 2 | cargo hold 2 | 7445.3 | 8.906 | 66307.8 | 37.551 | 279578.5 | 0.0 |
| Hold 3 | cargo hold 3 | 7516.7 | 8.906 | 66\|943.7 | 11.15l | 83818.7 | 0.0 |
| H01d 4 | Cargo hold 4 | 7516.7 | 8.906 | 66943.7 | —15.249 | —114622.2 | 0.0 |
| Hold 5 | Cargo hold 5 | 7475.6 | 9.013 | 67377.6 | —41.648 | —311343.8 | 0.0 |
| Bulk grain | | 35913.2 | 8.923 | 320464.1 | 8.631 | 309981.6 | 0.0 |
| Deadweight | | 38070.1 | 8.835 | 336350.4 | 6.8I | 261340.1 | 832.2 |
| Light shipweight | | 10005.0 | 9.800 | 98049.0 | —9.000 | —90045.0 | |
| Displacement | | 48075.1 | 9.036 | 434399.4 | 3.563 | 171295.1 | 832.2 |

## EXAMPLE FOR LIST OF INTACT STABILTY CALULATION

**Intact stability<IMO>：**

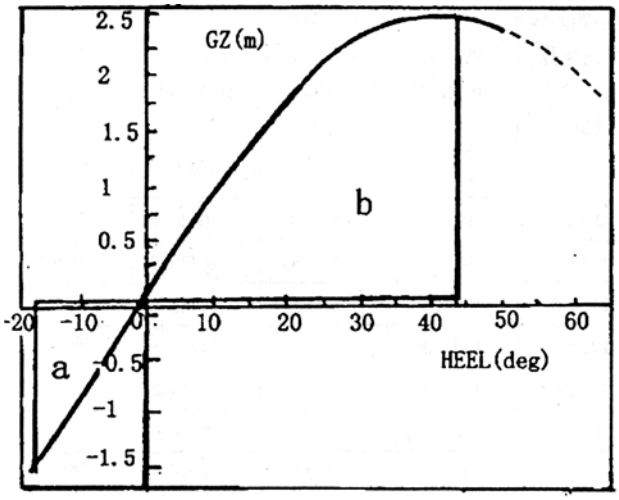



**Table 5.2.4(2)**

| Heeling angle (deg) | Righting ever(GZ) (m) |
|---|---|
| 0. 0 | 0. 000 |
| 5. 0 | 0. 386 |
| 12. 0 | 0. 958 |
| 20. 0 | 1. 696 |
| 30. 0 | 2. 300 |
| 40. 0 | 2. 482 |
| 50. 0 | 2. 351 |
| 60. 0 | 1. 917 |

CALCUlATl0N OF GZ—CURVE IS BASED ON 0m TRIM

| DISPLACEMENT and EQUILIBRIUM PARAMA'IERS | | |
|---|---|---|
| LCG 3.563m | DISPLACEMENT 48075.1t | |
| VCG 9.036m | DRAUGH AT AP 10.199m | |
| FREE SURFACE CORR 0.017m | DRAUGHT AT FP 9.755m | |
| CORRECTED VCG 9.053m | MEAN DRAUGHI 9.977m | |
| KMX GZ 13.449m | TRLM 0 .444m | |
| ANGLE OF FLOODING 43.5deg | | |
| STABIUTY CHARACIERS | ACTUAL VALUE | CRITERIA |
| CORRECTED GM | 4.396m | (>0.150) |
| GZ AT 30 deg OF HEEL | 2.300m | (>0.200) |
| MAX GZ 2.482m | AT 40.6 deg | (>25.0) |
| AREAS UNDER GZ—CURVE：0—30.0 deg | 0.639 m·rad | (>0.055) |
| 0—40.0 deg | 1.062 m·rad | (>0.090) |
| 30—40.0 deg | 0.423 m·rad | (>0.0301) |
| SEVERE WIND AND ROLLING CRITERION(WEATHER CRITERION) | | |
| THE STEADY WIND HEEUNG LEVER | Lw1=0.023m | |
| ROLLING PERIOD | T=11.28 sec | |
| HEEL ANGLE UNDER ACTION OF STEADY WIND | Q0：0.29 deg(=<14.89) | |
| ROLLANGLETOWINDWARD DUE TOWAVEACTION | Q1=18.21 deg | |
| UNDER THESE CIRCUMSTANCES | a=0.235 m·rad<br>b=1.188 m·rad<br>b / a=5.06(>=1.0) | |

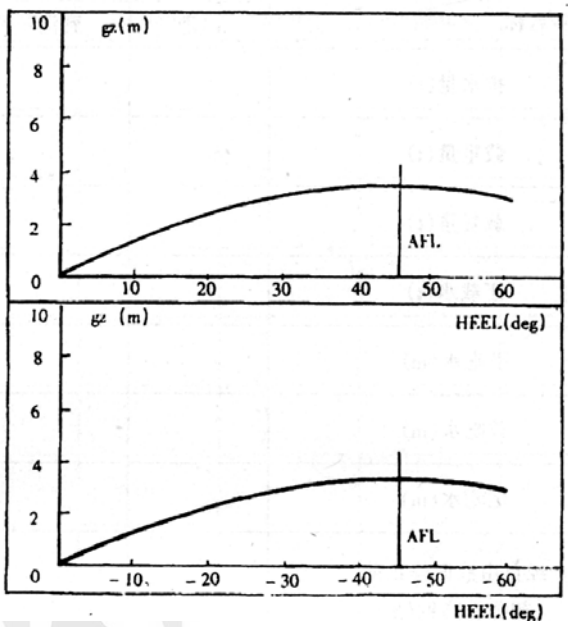
**Example for summary table of stability in all loading conditions Table 5.2.5#**

| Loaded con. / Items | | | | | | |
|---|---|---|---|---|---|---|
| | Departure | Arrival | Departure | Arrival | Departure | Arrival |
| Displacement(t) | | | | | | |
| Deadweight(t) | | | | | | |
| Cargo loaded(t) | | | | | | |
| Ballast water(t) | | | | | | |
| Mean draught(m) | | | | | | |
| Draught at FP(m) | | | | | | |
| Draught at AP(m) | | | | | | |
| Initial metacentric height prior to free surface correction (m) | | | | | | |
| Initial metacentric height after free surface correction (m) | | | | | | |
| Height of centre of gravity after free surface correction(m) | | | | | | |
| Permissible height of centre of gravity (m) | | | | | | |
| Whether stability is satisfactory or not | | | | | | |

# EXAMPLE FOR DAMAGE STABILTY CALCULATIONS Table 5.3.3

**Damage Stability**

| To STARBOARD | HEELING ANGIE (deg) | RIGHTING LEVER (gz) (m) |
|---|---|---|
| | 0.0 | 0.00 |
| | 10.0 | 1.141 |
| | 20.0 | 2.293 |
| | 30.0 | 3.021 |
| | 40.0 | 3.345 |
| | 50.0 | 3.313 |
| | 60.0 | 3.001 |
| TO PORT | HEELING ANGLE (deg) | RIGHTING LEVER (gz) (m) |
| | 0.0 | 0.00 |
| | —10.0 | 1.141 |
| | —20.0 | 2.293 |
| | —30.0 | 3.021 |
| | —40.0 | 3.345 |
| | —50.0 | 3.313 |
| | —60.0 | 3.001 |




| DISPLACEMENT AND EQUILIBRIUM PARAMATERS | | | |
|---|---|---|---|
| DISPLACEMENT | 48 061.9t | DRAUGHT AT AP | 9.203m |
| LCG | 3.295m | DRAUGHT AT FP | 12.209m |
| FREE SURFACE CORR. | 0.017m | MEAN DRAUGHT | 10.706m |
| VCG(FSM corrected) | 7.065m | TRIM | —3.006m |
| Blind Length Ahead | 99.9m | HEEL ANGLE | 0.0deg |
| Port—Prop. Immer. | 214.3% | GM | 6.425m |
| Starb—prop. Immer.. | 214.3% | | |

| ITEM | TO STARBOARD | TO PORT | CRITERIA |
|---|---|---|---|
| FLOODING ANGLE(deg) | 45.2 | —45.1 | |
| $GZ_{max}$ (m) | 2.293 | 2.293 | 0.1 000 |
| POSITIVE RANGE(deg) | >20.0 | >20.0 | 20.0 |
| AREA OF GZS(m·rad) | 0.4011 | 0.4011 | 0.0175 |

| ID. CODE | NAME OF COMPARTMENT | TYPE | LIQUID OUTFLOW(t) | WATER INGRESS(t) |
|---|---|---|---|---|
| Hold 1 | cargo hold l | DC | | 3616.4 |

| DOWN—FLOODING POINT | LONGITUDINAL ORDINATE TO AMIDSHIP | TRANSVERSE ORDINATE TO MIDSHIPS | VERTICAL ORDINATE TO BASELINE | DISTANCE TO WATER LINE |
|---|---|---|---|---|
| Starboard | —72.500 | 10.200 | 19.700 | 10.238 |
| Port | —71.500 | —l0.200 | 19.700 | 10.221 |

# APPENDIX 1 DETAILS OF LOADING MANUAL.

## 1.1 General requirements

1.1.The contents of loading manuals are to be categorized as follows：

(1) identification information；

(2) basis for preparation；

(3) terms definitions，symbols or units to be used；

(4) instructions；

(5) common data；

(6) information on operation restrictions for loading and ballast.

1.1.2 The contents of this Appendix or Appendix 3 (Examples) may be referred in preparation of loading manuals.

1.1.3 loading manuals are to be prepared in a language understood by the users. If the language is not English，a translation into English is to be included.

## 1.2 Identification information

1.2.1 Identification information are to include：

(1) name，type／purpose of the ship；

(2) shipyards where ships ale constructed；

(3) date of construction／keels laying／alterations of the ship；

(4) ship’s class；

(5) registered number；

(6) flag State；

(7) port of registry；

(8) IMO number；

(9) parameters of main dimensions；

(10) tonnage；

(11) other information，where necessary.

## 1.3 Basis for preparation

1.3.1 The conventions，codes，roles or relevant documents of the Administration of flag States used as the basis of the contents of the loading manuals are to be indicated.

1.3.2 Loading manuals are to generally include the criteria contents as required in intact stability，the permissible values of still water bending moments and shear forces as required in the Rules and the permissible local loading on deck，hatch covers and inner bottom plating.

## 1.4 Term definitions，symbols and units

1.4.1 Terms, symbols and units adopted in the loading manuals are to be by means of standard or internationally common / conventional ones.

1.4.2 The terms, symbols and units are to be generally indicated in a form of a list.

## 1.5 Instruction

1.5.1 The loading manual is to be so prepared as to enable the master to use it conveniently.

1.5.2 Where necessary, model examples are to be prepared for use.

## 1.6 Common information data

1.6.1 Common information data are to include as follows:

(1) loaded cargo information(kinds, density, physical and chemical properties, etc.);

(2) ships general conditions(navigation areas, sea conditions, etc.);

(3) general arrangement or schematic diagram of compartments(indicating types and locations of main compartments), as shown in Fig.1.6.1(1);

(4) capacity plan or table (indicating the capacity and centre of gravity of each hold, etc.), as shown in Fig.1.6.1(2);

(5) information on freeboard, load lines and draft scales;

(6) information on liquid tanks(indicating capacity, centres of gravity and sounding tables and free surface data for liquid tanks), as shown in Tables 1.6.1(1) and (2);

(7) hydrostatic tables or plans as shown in Tables 1.6.1 (3) and (4), where trim conditions are not taken into account in hydrostatic tables. Bonjean curves are to be included;

(8) moulded draught plus file thickness of flat plate keels or capacity tables at moulded draughts;

(9) calculation method of displacements(including the draught mark locations corresponding to corrected draught values, corrected displacements due to correction of deformation, correction of trim, density of sea water $\gamma$=1.025 t / $m^3$ and examples for displacement calculations);

(10) draught correction tables(due to trim at stem);

(11) variations of displacement capacities due to trim water lines;

(12) draught variations on frames per 100 ton loading;

(13) Cross-curve tables or plans as shown in Table 1.6.1(5);

(14) flooding angle curves, as shown in Fig.1.6.1(3), indicating the positions of downflooding and watertight points;

(15) windage area, centroid of area-draught relationship curves;

(16) curves of limit heights of centres of gravity;

(17) distinguishing table for small tanks with free surfaces;

(18) heeling moment table for free surface at large inclination angles;

(19) general table of various loading conditions and stabilities;

(20) light shipweight table (indicating the distribution of light shipweight, longitudinal and vertical positions of centre of gravity of the light ship);

(21) hull structural cross-sectional characteristics table (indicating the properties of the structural changes);

(22) inclination test reports;

(23) arrangement of ballast piping;

(24) information on various loading conditions and stability calculations;

(25) information on general longitudinal strength calculations in various loading conditions (this may be prepared together with that in (24) above);

(26) information on damage stability calculations (where applicable);

(27) information on calculations of permissible local loading on hatch covers, deck and double bottoms;

(28) calculation information on functional relationship between maximum and minimum deadweights of each cargo hold and draughts;

(29) typical loading / unloading sequence table (at least examples for loading / unloading sequences of homogeneous and alternate cargo loading).

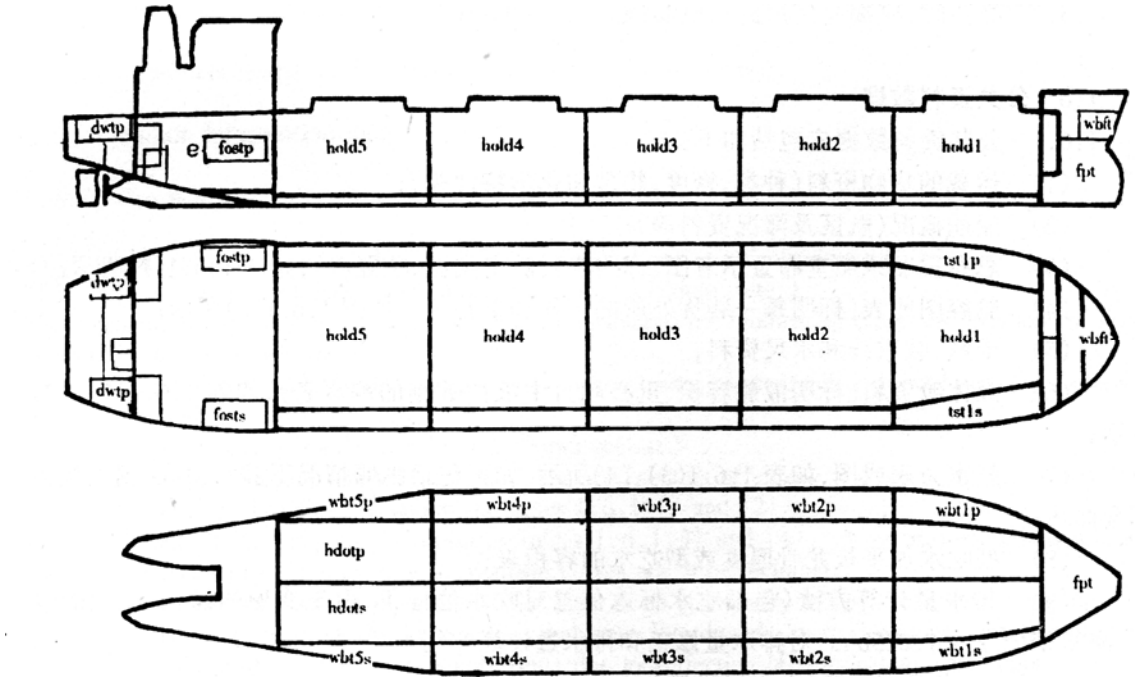
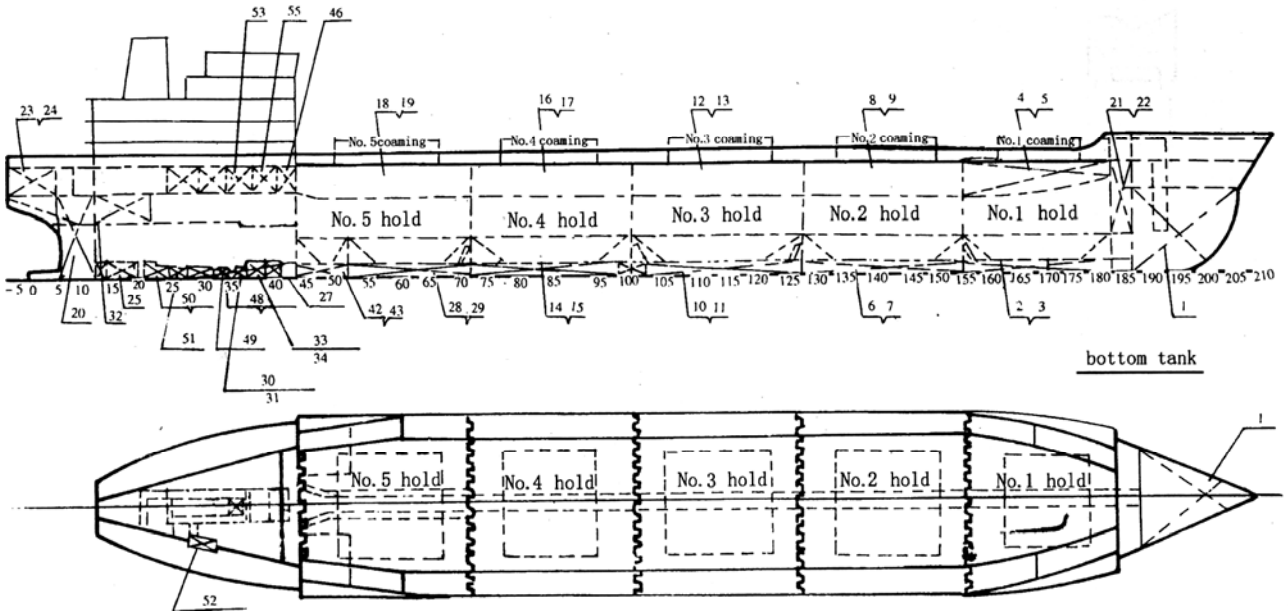



**Fig.1.6.1(1) Schematic diagram of compartment arrangement**

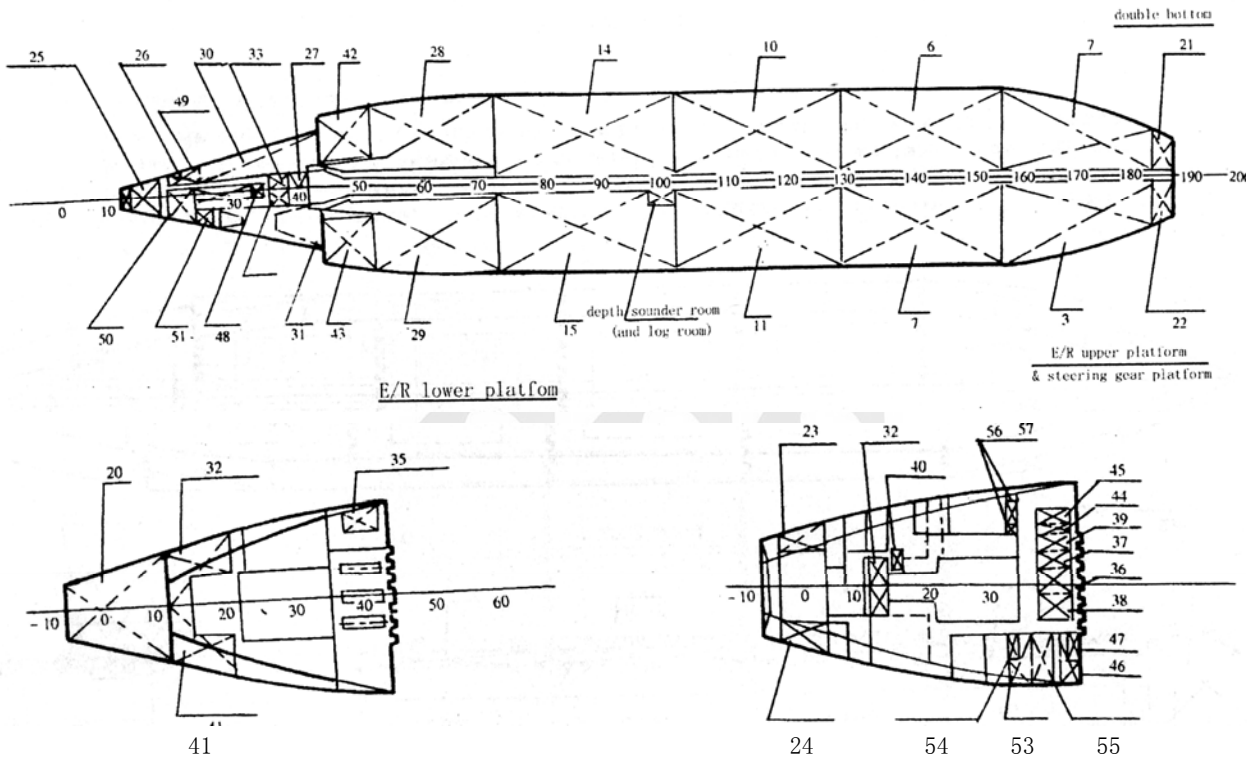
**Liquid cargo tanks** **Table 1.6.1(1)**

| Compartment | Frame | Capacity ($m^3$) | Longitudinal coordinate of centre of gravity $X_g$ (m) | Transverse coordinate of Centre of gravity $Y_g$ (m) | Vertical coordinate of centre of gravity $Z_g$ (m) | Free surface moment $i^* \rho$ (t·m) |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |




l—forepeak tank(ballast water tank) 2,3—No.1 ballast tanks 4,5—No.1 topside tanks(P&S) 67—No.2 ballast water tanks 8,9—No.2 topside tanks l0,11—No.3 ballast water tanks 12,13—No.3 topside tanks 14,15—No.4 ballast water tanks 16,17—No.4(topside tanks) 18,19—No.5 topside tanks(P&S) 20—afterpeak(ballast)tank 23,24—stern fresh water tanks 25—bilge tank 27—sludge tank(Central) 28,29—fuel oil tanks(P&S) 30—aft fuel oil tank(P) 31—aft fuel oil tank(S) 32—fuel oil sludge tank 33—fuel oil sludge tanks(Central&P) 34—fuel dirty oil tank(Central&S) 42,43—heavy diesel oil tanks 46—light diesel oil store tank 48—lub-oil overflow tank(Central) 49—lub-oil circulating tank(Central) 50—dirty lub-oil tank 51—lub-oil sludge tank(Central & P) 52—lub-oil sludge tank 53—lub-oil overflow tank 55—lub-oil store tank

**Fig.1.6.1(2)a Tank capacity**




2—No.1 ballast water tank(p) 3—No.1ballast waster tank (P) 7—NO.3 ballast water tank(P) l0—No.3 ballast water tank(P)
11—No.3ballast water tank(S) 14— No.4 ballast water tank (s) 20—afterpeak (ballast water)tank 23—aft fresh water tank
24—No fresh water tank(S) 25—distilled water tank 27—bilge tank 28—fuel oil tank(P) 29—fuel oil tank(S) 30—aft fuel oil tank(P)
31—aft fuel oil tank(S) 32—fuel oil deep tank 33—fuel oil sludge tank 34—dirty fuel oil tank 35—fuel oil sludge tank
36—fuel oil daily service tank for main engine 37— fuel oil daily serve tank for auxiliaries 38—fuel oil setting tank for main engine 39—fuel oil daily service tank
40—daily service oil tank for auxiliary boiler oil store tank 41—heavy diesel oil deep tank 42—heavy diesel oil tank(P) 43—heavy diesel oil tank (S) 44—heavy diesel oil daily service tank 45—heavy diesel oil setting tank 46—light diesel oil store tank 47—light diesel oil daily service tank 48—lub-oil sludge tank 49—lub-oil circulating tank
50—dirty lub-oil tank(S) 51—sludge tank 53—clean lub-oil tank 54—lub-oil store tank for auxiliary machineries 55—lub-oil store tank 56,57—cylinder oil store tank

Fig. 1. 6. 1(2)b Tank capacity

**Capacity sounding table** **Table 1.6.1(2)**

NAME OF COMPARTMENT (ID CODE):

LOCATION:

CAPACITY COEFF.:

| Depth sounded (m) | Capacity (m) | Longitudinal coordinate of centroid Lcg (m) | Transverse coordinate of centroid Tcg (m) | Vertical coordinate of centroid Vcg (m) | Moment of inertia of free surface F.S.I ($m^4$) |
|---|---|---|---|---|---|
| | | | | | |
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Hydrostatic table obtained under no inclination condition are to include the parameters listed in Table 1.6.1(3).

**Table 1.6.1(3)**

| Draught D (m) | Displacement Disp. (t) | Displacement volume Disv. ($m^3$) | Tons per cm draught Tpm (t/cm) | Trimming moment per cm Mct (t·m/cm) | Vertical Coordinate of Transverse stability Kmt (m) | Longitudinal coordinate centre of buoyancy Lcb (m) | Longitudinal coordinate of centre of floatation Lcf (m) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
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Hydrostatic table obtained under inclination conditions are to include the parameters listed in Table 1.6.1(4).

**Table 1.6.1(4)**

| Draught<br>d<br>(m) | Displacement<br>Disp.<br>(t) | Vertical coordinate of<br>Transverse stability<br>Kmt<br>(m) | Longitudinal coordinate<br>of centre of buoyancy<br>Lcb<br>(m) |
|---|---|---|---|
| | | | |
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**Cross-curves** **Table 1.6.1(5)**

| Heeling angle(deg) / Displacement (t) | 10 | 20 | 30 | 40 | 50 | 60 |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
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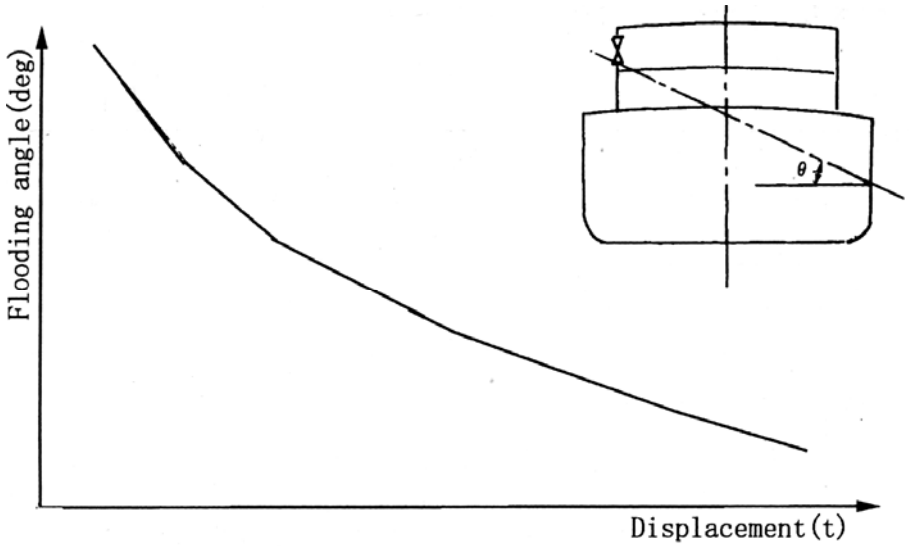



Fig.1.6.1(3) **Flooding angle curve**

## 1.7 Information on operation limitations

1.7.1 Information on operation limitations are to include the following data，figures，tables and document :

(1) documents as necessary instructions for the master in the safety operations of loading／unloading，arranging the loading weight distribution and ballast；

(2) data and information on safety navigation.

1.7.2 Information on operation limitations are to include the following contents：

(1) the maximum draught stated in the certificate of load line；

(2) loading sequences in compliance with the requirements in Chapter 3 as shown in Tables1.7.2(1)，(2)，(3)and(4)；

(3) height limitation of cargo stowed on deck and trimming limitation due to sightlines；

(4) minimum fore and aft draughts to be kept in severe sea condition；

(5) minimum bow height to be kept corresponding to the maximum fore draught；

(6) curves of permissible height of centre of gravity or curves of minimum initial metacentric height(intact and／or damage stabilities)as shown in Fig.1.7.2(1)；

(7) summary table of intact stabilities in various loading conditions；

(8) plans and tables of still water bending moments and shear forces，permissible still water bending moments and shear forces under various loading conditions，as shown in Fig.1.7.2(2) and Table 1.7.2(5)；

(9) plans or summary tables of permissible local loading on hatch covers，deck and double bottoms；

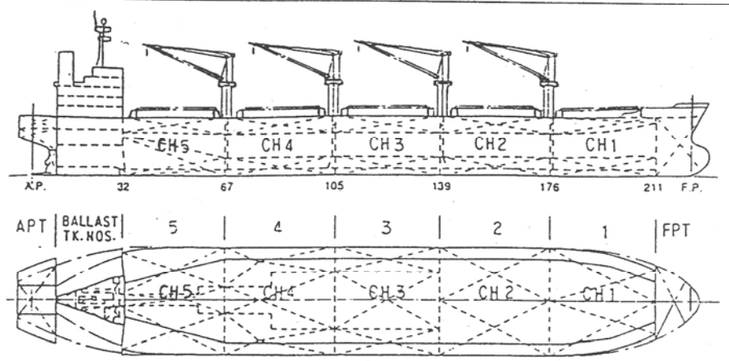
(10) functional curves or tables between maximum and minimum dead weights of each cargo hold and draughts，as shown in Fig.1.7.2(3).

# Examples of Loading and Unloading Sequence Tables

## 装载顺序表实例

装载顺序(Loading Sequence)

| Vessel Name: | Yard: | Yd.No.: | Id Number: |
|---|---|---|---|




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Volume of Hold, Vn ($m^3$) | | | | | | | |
| Height of Hold, h (m) | | | | | | | |

| | Hold content at commencement of loading/discharging | | | | | | |
|---|---|---|---|---|---|---|---|
| Cargo mass | 8,177 | 9,299 | 8,947 | 9,304 | 7,902 | | |
| Density ($t/m^3$) | 0.7626 | 0.7626 | 0.7626 | 0.7626 | 0.7626 | | |
| Grade | | | | | | | |

| | CARGO OPERATIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| Pour No./Grade | Hold 5 | Hold 4 | Hold 3 | Hold 2 | Hold 1 | | |
| 1 | | | 8,947 | | | | |
| 2 | | 9,299 | | | | | |
| 3 | | | | | 7,902 | | |
| 1 | 8,177 | | | | | | |
| 5 | | | | 9,304 | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| Draft Survey (for loading): | Total cargo onboard(mt): 43,629 | | | Remaining cargo to be loaded (mt): 0 | | | |
| n−1 | | | | | | | |
| n | | | | | | | |

Hold content at end of loading/discharging

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cargo mass | 8,177 | 9,299 | 8,947 | 9,304 | 7,902 | | |

| | |
|---|---|
| Total mass loading/discharging (mt) | 43,629 |

| Double Bottom | Maximum occuring values among all conditions above | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Net Load | | | | | | | | tonnes |
| % allowable | | | | | | | | |
| Net load in two adjacent holds | | | | | | | | tonnes |

**Table 1.7.2(1)**

**表 1.7.2(1)**

HOMOGENEOUS CARGO LOADING

NORMAL BALLAST COND. ARR. 10% BUNKER
——→ FULLY LOADED COND. DEP. FULL BUNKER (S.F.=47.05 CF/LT)

| Port (specific of typical): | Condition at commencement of loading/discharging: | |
|---|---|---|
| Total mass of cargo to be loaded/discharged: 43 629 | Condition at end of loading/discharging: | |
| Dock water density ($t/m^3$): | Maximum loading/discharging rate: | Average loading/discharging rate: |
| Number of loaders/dischargers: | Maximum ballasting/deballasting: 1,220 | Average ballasting/deballasting rate: |

Note: During each pour it has to be controlled that allowable limits for hull girder shear forces, bending moments and mass in holds are not exceeded.
Loading/discharging operations may have be paused to allow ballasting/deballasting in order to keep actual values within limits.

| | Ballast content at commencement of loading/discharging | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wings or peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
| Wings/Peaks | 412 | 2,780 | 2,464 | 0 | 2,108 | 3,104 | 2,330 | 564 |

| | BALLAST OPERATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wings of peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
| Wings/Peaks | | | | | 2,108 | | | |
| Wings/Peaks | | | 2,464 | | | | | |
| Wings/Peaks | | | | | | | 2,330 | 564 |
| Wings/Peaks | 412 | 2,780 | | | | | | |
| Wings/Peaks | | | | | | 3,104 | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Total amount of bunkers onboard (mt): 1,769 | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |

Ballast content at end of loading/discharging

| Wings of peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
|---|---|---|---|---|---|---|---|---|
| Wings/Peaks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Net Load on double bottom = Mh − T × B × lc × ρ (mt)
where: Mh = Mass in hold + mass in DB (mt)
B = Breadth moulded (m)
lc = Length of hold from bulkhead to bulkhead (m)
T = Draught (m)

| Commencement of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F.(%) | Maximum B.M.(%) |
| 6-52 | 2-86 | 3-66 | 32.9 | 67.2 |

| Values at end of pour (from harbour to sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F.(%) | Maximum B.M.(%) |
| 7-73 | 2-41 | 5-32 | -48.0 | 22.7 |
| 10-81 | 5-57 | 5-24 | -58.6 | -50.8 |
| 8-87 | -0-19 | 9-06 | 43.0 | -19.3 |
| 11-96 | 3-89 | 8-07 | 40.6 | 18.9 |
| 11-18 | -0-16 | 11-34 | -18.4 | -15.3 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Values at end of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F.(%) | Maximum B.M.(%) |
| 11-87 | 0-51 | 11 36 | 21.3 | -37.9 |

Approved by

Place, date, stamp and sign

# Examples of Loading and Unloading Sequence Tables

## 装 载 顺 序 表 实 例

卸载顺序(Unloading Sequence)

| Vessel Name: | Yard: | Yd. No.: | Id Number: |
|---|---|---|---|

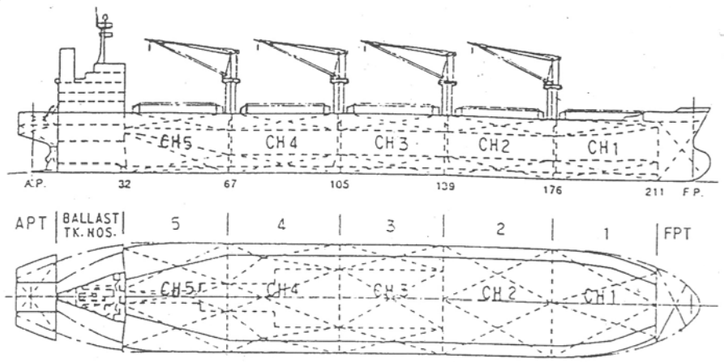



Table 1.7.2(2)

表 1.7.2(2)

HOMOGENEOUS CARGO UNLOADING

FULLY LOADED COND. ARR. 10% BUNKER (S.F.=47.05 CF/LT)
——→ NORMAL BALLAST COND. DEP. FULL BUNKER

| Port (specific of typical): | Condition at commencement of loading/discharging: | |
|---|---|---|
| Total mass of cargo to be loaded/discharged: 43,629 | Condition at end of loading/discharging: | |
| Dock water density (t/m³): | Maximum loading/discharging rate: | Average loading/discharging rate: |
| Number of loaders/dischargers: | Maximum ballasting/deballasting: 1,220 | Average ballasting/deballasting rate: |

Note: During each pour it has to be controlled that allowable limits for hull girder shear forces, bending moments and mass in holds are not exceeded.
Loading/discharging operations may have be paused to allow ballasting/deballasting in order to keep actual values within limits.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Volume of Hold, Vn (m³) | | | | | | | |
| Height of Hold, h (m) | | | | | | | |

| | Hold content at commencement of loading/discharging | | | | | | |
|---|---|---|---|---|---|---|---|
| Cargo mass | 8,177 | 9,299 | 8,947 | 9,304 | 7,902 | | |
| Density (t/m³) | 0.7626 | 0.7626 | 0.7626 | 0.7626 | 0.7626 | | |
| Grade | | | | | | | |

| | Ballast content at commencement of loading/discharging | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wings or peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
| Wings/Peaks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Commencement of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | B.M. (%) |
| 11 29 | 0 0 | 11-29 | -20.1 | -25.6 |

| | CARGO OPERATIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| Pour No./Grade | Hold 5 | Hold 4 | Hold 3 | Hold 2 | Hold 1 | | |
| 1 | | | | 9,304 | | | |
| 2 | 8,177 | | | | | | |
| 3 | | | | | 7,902 | | |
| 4 | | 9,299 | | | | | |
| 5 | | | 8,947 | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| Draft Survey (for loading): | Total cargo onboard (mt): 0 | | | Remaining cargo to be loaded (mt): 0 | | | |
| n--1 | | | | | | | |
| n | | | | | | | |

| | BALLAST OPERATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wings of peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
| Wings/Peaks | | | | | | 3.104 | | |
| Wings/Peaks | 412 | 2,786 | | | | | | |
| Wings/Peaks | | | | | | | 2,330 | 2,004 |
| Wings/Peaks | | | 2,464 | | | | | |
| Wings/Peaks | | | | | 2,108 | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Total amount of bunkers onboard (mt): 1,769 | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |

| Values at end of pour (from harbour to sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | B.M. (%) |
| 11 96 | 3 89 | 8.07 | 40.6 | 18.9 |
| 8 87 | -0.19 | 9 06 | 43.0 | -19.3 |
| 9-94 | 3-32 | 6 62 | 53.9 | -33.1 |
| 6-85 | 0 16 | 6-69 | -40.3 | 26.6 |
| 5-60 | 0-56 | 5-04 | -40.9 | 55.6 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Hold content at end of loading/discharging | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cargo mass | 0 | 0 | 0 | 0 | 0 | | |

| Ballast content at end of loading/discharging | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wings of peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
| Wings/Peaks | 412 | 2,786 | 2,464 | 0 | 2,108 | 3,104 | 2,330 | 2,004 |

| Values at end of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | B.M. (%) |
| 6-55 | 1 63 | 4-92 | -45.6 | 86.5 |

| | Total mass loading/discharging (mt) | | | | | | |
|---|---|---|---|---|---|---|---|

| Double Bottom | Maximum occuring values among all conditions above | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Net Load | | | | | | | | tonnes |
| % allowable | | | | | | | | |
| Net load in two adjacent holds | | | | | | | | tonnes |

Net Load on double bottom = Mh − T × B × lc × ρ (mt)
where: Mh = Mass in hold + mass in DB (mt)
B = Breadth moulded (m)
lc = Length of hold from bulkhead to bulkhead (m)
T = Draught (m)

Approved by

Place, date, stamp and sign

# Examples of Loading and Unloading Sequence Tables

## 装载顺序表实例

装载顺序(Loading Sequence)

**Table 1.7.2(3)**

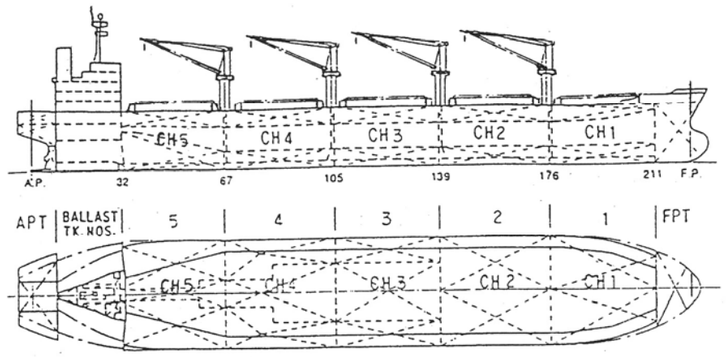
**表 1.7.2(3)**

IRON-ORE CARGO LOADING

NORMAL BALLAST COND. ARR. 10% BUNKER

——→ IRON-ORE LOADED COND. DEP. FULL BUNKER (S.F.=15 CF/LT)

| Vessel Name: | Yard: | Yd.No.: | Id Number: |
|---|---|---|---|




| Port (specific of typical): | Condition at commencement of loading/discharging: | |
|---|---|---|
| Total mass of cargo to be loaded/discharged: 43,629 | Condition at end of loading/discharging: | |
| Dock water density (t/m³): | Maximum loading/discharging rate: | Average loading/discharging rate: |
| Number of loaders/dischargers: | Maximum ballasting/deballasting: 1,220 | Average ballasting/deballasting rate: |

Note: During each pour it has to be controlled that allowable limits for hull girder shear forces, bending moments and mass in holds are not exceeded.
Loading/discharging operations may have be paused to allow ballasting/deballasting in order to keep actual values within limits.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Volume of Hold, Vn (m³) | | | | | | | |
| Height of Hold, h (m) | | | | | | | |

| | Hold content at commencement of loading/discharging | | | | | | |
|---|---|---|---|---|---|---|---|
| Cargo mass | 14,243 | 0 | 15,597 | 0 | 13,789 | | |
| Density (t/m³) | 2.392 | | 2.392 | | 2.392 | | |
| Grade | | | | | | | |

| | Ballast content at commencement of loading/discharging | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wings or peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
| Wings/Peaks | 412 | 2,780 | 2,464 | 0 | 2,108 | 3,104 | 2,330 | 564 |

| Commencement of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | Maximum B.M. (%) |
| 6-52 | 2-86 | 3-66 | 32.9 | 67.2 |

| | CARGO OPERATIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| Pour No./Grade | Hold 5 | Hold 4 | Hold 3 | Hold 2 | Hold 1 | | |
| 1 | | | 12,000 | | | | |
| 2 | 10,000 | | | | | | |
| 3 | | | | | 10,000 | | |
| 4 | 4,243 | | | | | | |
| 5 | | | | | 3,789 | | |
| 6 | | | 3,597 | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| Draft Survey (for loading): | Total cargo onboard(mt): 43,629 | | | Remaining cargo to be loaded (mt): 0 | | | |
| n−1 | | | | | | | |
| n | | | | | | | |

| | BALLAST OPERATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wings of peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
| Wings/Peaks | | | | | 2,108 | | | |
| Wings/Peaks | 412 | 2,780 | | | | | | −1,440 |
| Wings/Peaks | | | | | | | 2,330 | 2,004 |
| Wings/Peaks | | | 2,464 | | | | | |
| Wings/Peaks | | | | | | 3,104 | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Total amount of bunkers onboard (mt): 1,769 | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |

| Values at end of pour (from harbour to sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | Maximum B.M. (%) |
| 8-26 | 2-17 | 6-09 | -68.2 | -50.1 |
| 11-92 | 5-97 | 5-95 | 52.2 | 28.0 |
| 10-07 | 0-07 | 10-00 | 58.7 | 31.4 |
| 11-79 | 2-78 | 9-01 | 78.5 | 54.8 |
| 10-80 | 0-52 | 10-28 | 91.5 | 76.0 |
| 11-26 | 0-0 | 11-26 | 79.2 | 59.2 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | Hold content at end of loading/discharging | | | | | | |
|---|---|---|---|---|---|---|---|
| Cargo mass | 14,243 | 0 | 15,597 | 0 | 13,789 | | |

| Total mass loading/discharging (mt) | | 43,629 |
|---|---|---|

Ballast content at end of loading/discharging

| Wings of peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
|---|---|---|---|---|---|---|---|---|
| Wings/Peaks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Values at end of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | Maximum B.M. (%) |
| 11-96 | 0-68 | 11-28 | 92.0 | 87.0 |

| Double Bottom | Maximum occuring values among all conditions above | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Net Load | | | | | | | | tonnes |
| % allowable | | | | | | | | |
| Net load in two adjacent holds | | | | | | | | tonnes |

Net Load on double bottom = Mh − T × B × lc × p (mt)
where: Mh = Mass in hold + mass in DB (mt)
B = Breadth moulded (m)
lc = Length of hold from bulkhead to bulkhead (m)
T = Draught (m)

Approved by

Place, date, stamp and sign

# Examples of Loading and Unloading Sequence Tables

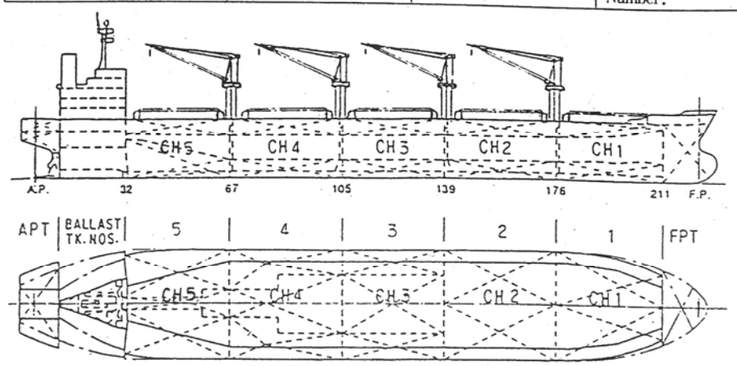
## 装载顺序表实例

**Table** 1.7.2(4)

**表 1.7.2(4)**

卸载顺序(Unloading Sequence)

| Vessel Name: | Yard: | Yd.No.: | Id Number: |
|---|---|---|---|




IRON-ORE CARGO UNLOADING

IRON-ORE LOADED COND. ARR. 10% BUNKER (S.F.=15 CF/LT)
——→ NORMAL BALLAST COND. DEP. FULL BUNKER

| Port (specific of typical): | Condition at commencement of loading/discharging: | |
|---|---|---|
| Total mass of cargo to be loaded/discharged: 43,629 | Condition at end of loading/discharging: | |
| Dock water density (t/m³): | Maximum loading/discharging rate: | Average loading/discharging rate: |
| Number of loaders/dischargers: | Maximum ballasting/deballasting: 1,220 | Average ballasting/deballasting rate: |

Note: During each pour it has to be controlled that allowable limits for hull girder shear forces, bending moments and mass in holds are not exceeded.
Loading/discharging operations may have be paused to allow ballasting/deballasting in order to keep actual values within limits.

| | Hold 5 | Hold 4 | Hold 3 | Hold 2 | Hold 1 | | |
|---|---|---|---|---|---|---|---|
| Volume of Hold, Vn (m³) | | | | | | | |
| Height of Hold, h (m) | | | | | | | |
| **Hold content at commencement of loading/discharging** | | | | | | | |
| Cargo mass | 14,243 | 0 | 15,597 | 0 | 13,789 | | |
| Density (t/m³) | 2.392 | | 2.392 | | 2.392 | | |
| Grade | | | | | | | |
| **CARGO OPERATIONS** | | | | | | | |
| Pour No./Grade 1 | | | 3,597 | | | | |
| 2 | | | | | 3,789 | | |
| 3 | 4,243 | | | | | | |
| 4 | | | | | 10,000 | | |
| 5 | 10,000 | | | | | | |
| 6 | | 12,000 | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| Draft Survey (for loading): | Total cargo onboard(mt): 0 | | | Remaining cargo to be loaded (mt): 0 | | | |
| n−1 | | | | | | | |
| n | | | | | | | |
| **Hold content at end of loading/discharging** | | | | | | | |
| Cargo mass | 0 | 0 | 0 | 0 | 0 | | |
| Total mass loading/discharging (mt) | | | | | | | 43,629 |

| Double Bottom | Maximum occuring values among all conditions above | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Net Load | | | | | | | | tonnes |
| % allowable | | | | | | | | |
| Net load in two adjacent holds | | | | | | | | tonnes |

| Wings or peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
|---|---|---|---|---|---|---|---|---|
| **Ballast content at commencement of loading/discharging** | | | | | | | | |
| Wings/Peaks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **BALLAST OPERATIONS** | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | 3,104 | | |
| Wings/Peaks | | | 2.464 | | | | | |
| Wings/Peaks | | | | | | | 2,330 | 2,004 |
| Wings/Peaks | 412 | 2,780 | | | | | | |
| Wings/Peaks | | | | | 2,108 | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Total amount of bunkers onboard (mt): 1,769 | | | | | | | | |
| Wings/Peaks | | | | | | | | |
| Wings/Peaks | | | | | | | | |

Ballast content at end of loading/discharging

| Wings of peak | APT | WBT 5 | WBT 4 | Hold 3 | WBT 3 | WBT 2 | WBT 1 | FPT |
|---|---|---|---|---|---|---|---|---|
| Wings/Peaks | 412 | 2,780 | 2.464 | 0 | 2,108 | 3,104 | 2,330 | 2,004 |

Net Load on double bottom = Mh − T × B × lc × p (mt)
where: Mh = Mass in hold + mass in DB (mt)
B = Breadth moulded (m)
lc = Length of hold from bulkhead to bulkhead (m)
T = Draught (m)

| Commencement of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | Maximum B.M. (%) |
| 11-26 | 0-0 | 11-26 | 97.6 | 90.1 |

| Values at end of pour (from harbour to sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | Maximum B.M. (%) |
| 10-80 | 0-52 | 10-28 | 91.5 | 76.0 |
| 11-79 | 2-78 | 9-01 | 78.5 | 54.8 |
| 10-07 | 0-07 | 10-00 | 58.7 | 31.4 |
| 11-92 | 5-97 | 5-95 | 52.2 | 28.0 |
| 7-38 | -0-07 | 7-45 | -60.6 | -31.0 |
| 5-60 | 0-56 | 5-04 | -40.9 | 55.6 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Values at end of loading/discharging (sea) | | | | |
|---|---|---|---|---|
| T aft (m) | Trim (m) | T fwd (m) | Maximum S.F. (%) | Maximum B.M. (%) |
| 6-55 | 1-63 | 4-92 | -45.6 | 86.5 |

Approved by

Place, date, stamp and sign

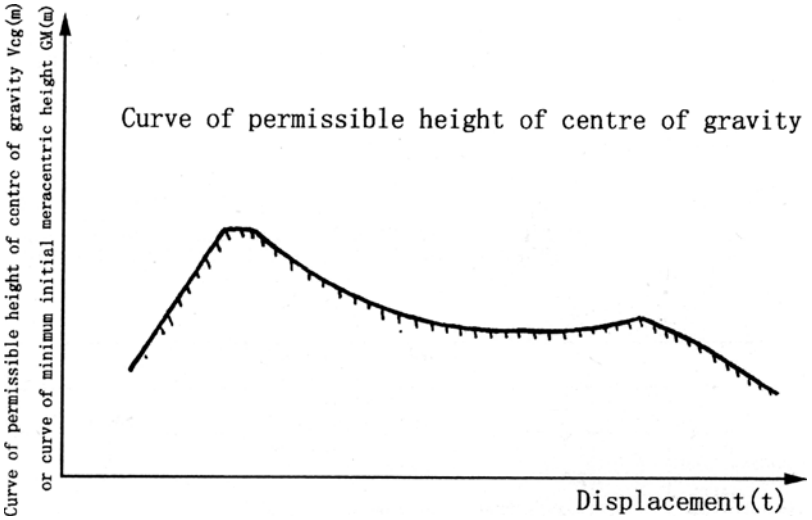



**Fig.1.7.2(1) Curve of permissible height of centre of gravity or curve of minimum initial metacentric height**

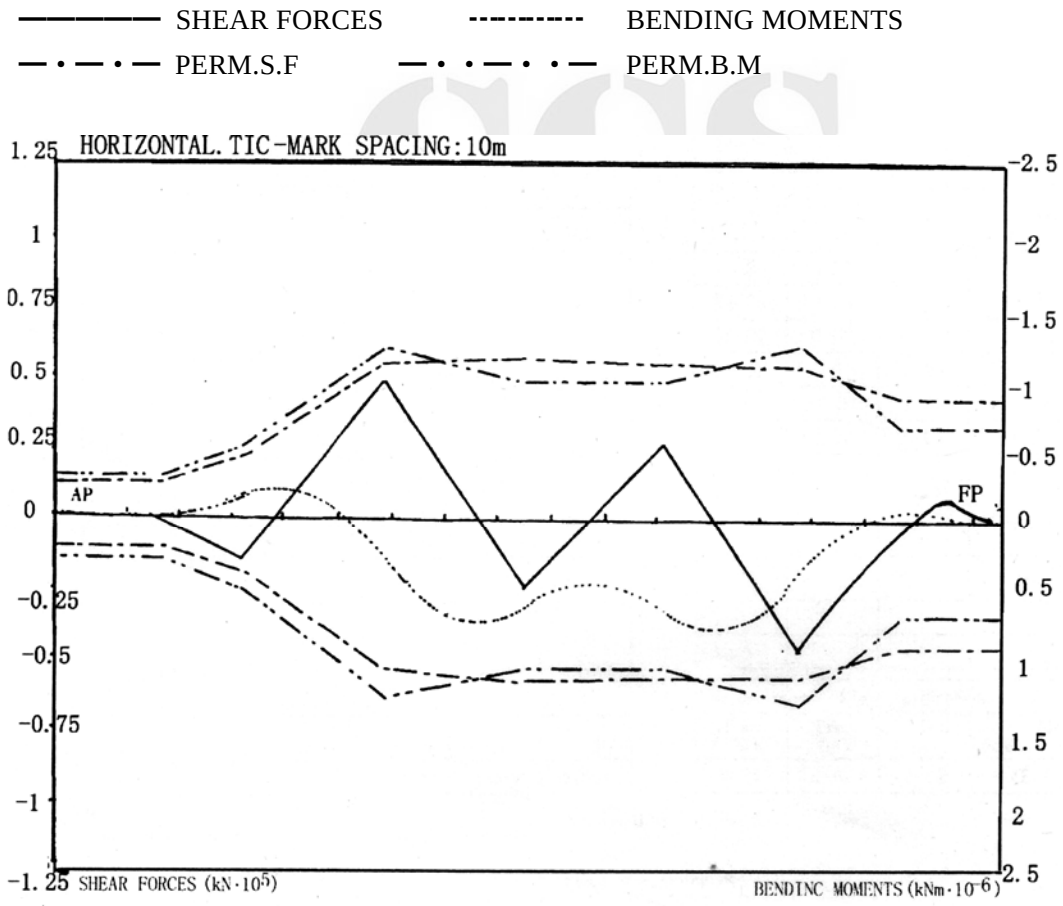



**Fig.1.7.2(2) Diagram of still water bending moments and shear forces. permissible still water bending moments and shear forces**

**Percentage table of permissible and actual**
**still water bending moments and shear forces**

**Table 1.7.2(5)**

| SECTION | | SHEAR FORCES | | BENDING MOMENTS | |
|---|---|---|---|---|---|
| FRAME | DISTANCE TO AP GLOBAL (m) | ACTUAL (%) | ALLOWED (kN) | ACTUAL (%) | ALLOWED (KNm) |
| F—8+0.2 | -4.600 | 0.0 | 12 050.4 | 0.0 | 305 219.1 |
| F 2 | 1.200 | 2.8 | -1l 374.2 | 0.2 | -281 522.8 |
| F 8+0.057 | 4.857 | 3.4 | -11 374.2 | 0.5 | -281 522.8 |
| F 16+0.06 | 10.260 | 0.0 | 12 050.4 | 1.3 | -28l 522.8 |
| F 22+0.15 | 15.150 | 5.8 | -11 374.2 | 0.7 | -281 522.8 |
| F 31+0.15 | 22.350 | 44.1 | -14 257.4 | 7.4 | -352 885.6 |
| F 42 | 31.000 | 72.4 | -18 833.5 | 23.7 | -466 149.4 |
| F 5I+0.565 | 38.766 | 0.0 | 28 547.7 | 27.9 | -649 158.3 |
| F 61+0.4 | 46.600 | 49.0 | 38 328.8 | 12.4 | -855 077.3 |
| F 72+0.35 | 55.350 | 79.0 | 49 253.0 | 12.8 | l 154 759.0 |
| F 81+0.3 | 62.500 | 69.8 | 54 178.6 | 37.0 | l 226 889.0 |
| F 92+0.25 | 71.250 | 25.6 | 55 100.0 | 59.0 | 1 155 862.0 |
| F10l+0.05 | 78.250 | 8.8 | -55 620.4 | 65.0 | 1 099 040.0 |
| F ll0 | 85.400 | 42.9 | -56 590.0 | 58.7 | l 041 000.0 |
| F l9+0.15 | 92.750 | 18.1 | -55 955.2 | 46.6 | 1 041 000.0 |
| F127+0.75 | 99.750 | 6.1 | 55 062.6 | 44.4 | l 041 000.0 |
| F 138+0.7 | 108.500 | 37.2 | 54 131.2 | 54.3 | l 041 000.0 |
| F149+0.063 | 116.664 | 24.6 | 53 800.3 | 68.2 | 1 084 295.0 |
| F 157+0.5 | 123.500 | 9.9 | -54 735.5 | 67.0 | l 145 148.0 |
| F 168+0.45 | 132.250 | 53.6 | 55 053.6 | 50.3 | 1 223 036.0 |
| F 178+0.35 | 139.950 | 76.0 | -54 215.1 | 25.8 | 1 22l 215.0 |
| F 191 | 148.700 | 42.1 | -48 940.8 | 5.1 | 947 291.6 |
| F 203+0.35 | 157.450 | 9.2 | -43 666.5 | 8.7 | —648 333.3 |
| F 212 | 163.400 | 15.2 | 42 874.7 | 7.5 | —648 333.3 |
| F 223 | 170.000 | 7.4 | 42 874.7 | 1.3 | —648 333.3 |
| F 236 | 177.800 | 0.0 | 42 874.7 | 0.0 | —648 333.3 |

**1.8 Example drawing of maximum allowable and minimum required cargo mass as function of draughts:**

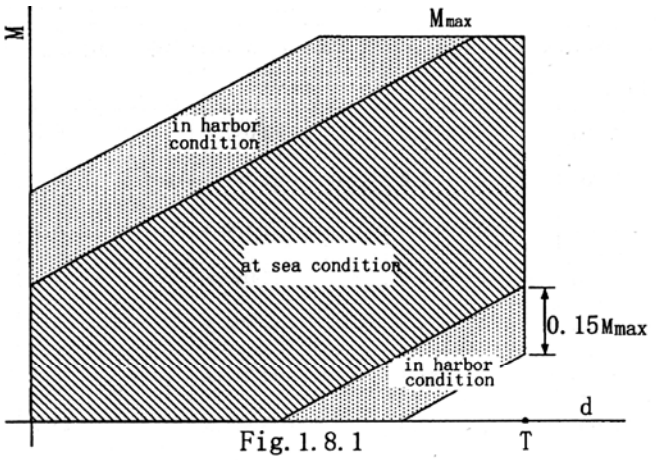


Fig. 1.8.1

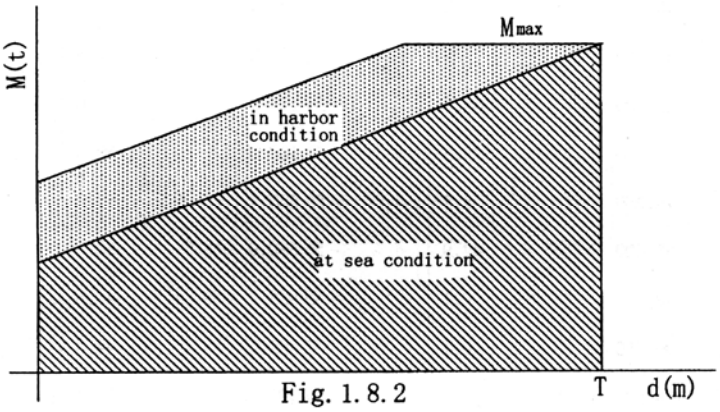


Fig. 1.8.2

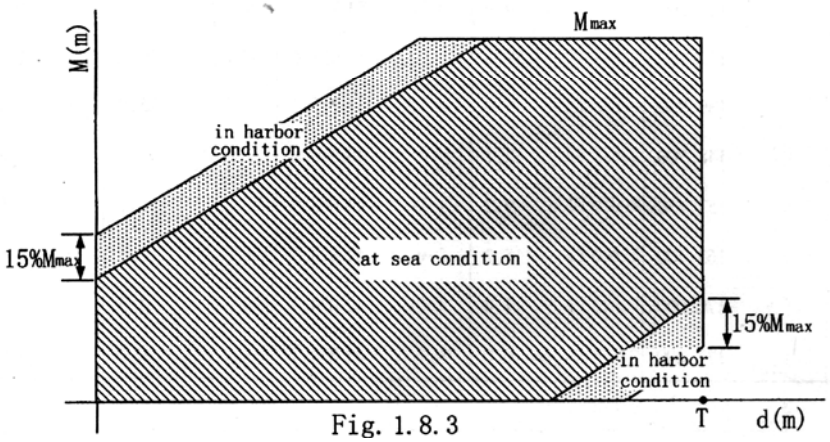


Fig. 1.8.3

**Notes for Fig.1.8.1 to Fig.1.8.3：**

Length overall： 289.0 m

Length between perpendiculars： 279.0 m

Moulded breadth： 45.0 m

Summer load line draught： 18.1 m

Notation： BC—A

One heavy loading hold (Fig.1.8.1)：

maximum allowable cargo mass at sea condition：

$M=(M_{max}+0.1M_H—M_{DB—F})+\rho \cdot A_{HN}(d—T)$ t

maximum allowable cargo mass in harbour condition：

$M=(M_{max}+0.1M_H—M_{DB—F})+\rho \cdot A_{HN}(d—0.67T)$ t

minimum required cargo mass at sea condition：

$M$：$M_{min}+\rho \cdot A_{HM}(d—T)$ t

minimum required cargo mass in harbor condition：

$M=(M_{min}—0.15M_{max})+\rho \cdot A_{HN}(d—T)$ t

where：$M_{max}=M_{HD}+M_{DB—F}$

$M_{min}$ to be $0.17\rho \cdot A_{HN}$， $\rho \cdot A_{HN}(T—T_{HB})$ or $0.5M_H$， whichever the smallest，

$T$：18.1m $V_{HN}$=21828m$^3$ $h_{HN}$=23.3m $T_{HB}$=8.94m

$M_H$=19592t $M_{HD}$=37250t $M_{DB—F}$=0t

One empty hold(Fig.1.8.2)：

maximum allowable cargo mass at sea condition：

$M=M_{max}+\rho \cdot A_{HN}(d—0.67T)$ t

maximum allowable cargo mass in harbour condition：

$M=1.15M_{max}+\rho \cdot A_{HN}(d—0.67T)$ t

minimum required cargo mass at sea condition：

$M$=0 t

minimum required cargo mass in harbor condition：

$M$=0 t

where：$M_{max}=M_{Full}$

$T$=18.1m $V_{HN}$=21712m$^3$ $h_{HN}$=23.3m $M_{Full}$=21977t

Two adjacent cargo holds (Fig.1.8.3)：

maximum allowable cargo mass at sea condition：

$M=M_{max}+\rho \cdot A_H(d-0.67T)$ t

maximum allowable cargo mass in harbour condition：

$M=1.15M_{max}+\rho \cdot A_H(d-0.67T)$ t

minimum required cargo mass at sea condition：

$M=\rho \cdot A_H(d-0.75\ T)$ t

minimum required cargo mass in harbor condition：

$M=-0.15M_{max}+\rho \cdot A_H(d-0.75T)$ t

where：$M_{max}=M1_{Full}+M2_{Full}$

$T$=18.1m $A1_{HN}$=931.8m$^2$ $A2_{HN}$=936.8m$^2$

$M1_{Full}$=21977t $M2_{Full}$=22094t

Functional drawings of Figs.1.8.1 to 1.8.3 may be drawn according to above formulas.

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# Appendix 2

## MAIN CONTENTS AND FORM OF INFORMATION ON STABILITY CALCULATIONS FOR THE CARRIAGE OF GRAIN IN BULK

### 2.1 General requirements

2.1.1 Information on stability calculations for the carriage of grain in bulk onboard are to contain the following items:

(1) instructions;

(2) principal data;

(3) stability criteria, calculation steps and evaluation;

(4) schematic diagram of holds and liquids;

(5) capacities, centers of gravity and free surface moments of liquid tanks:

① fuel oil tanks:

② diesel oil tanks;

③ lub-oil tanks;

④ fresh water tanks:

⑤ ballast water tanks:

(6) summary table of stability calculations under various loading conditions:

(7) tables of capacities, volume centroid and heeling moments of volumes of fully loaded holds (with or without trimming at ends of cargo holds);

(8) curves of grain volumes, centres of gravity and heeling moments of volumes of partly loaded holds;

(9) permissible heeling moment table;

(10) loading conditions calculation table;

(11) hydrostatic parameters table;

(12) curves of angles of flooding;

(13) curves of permissible height of centre of gravity.

2.1.2 Information on stability calculations for the carriage of grains in bulk are to be prepared in a language understood by the users. If this language is not English, a translation into English is to be included.

### 2.2 Basis for preparation

2.2.I The conventions, codes, rules or relevant documents of the Administration of flag States used as the basis of the contents of this information are to be included.

2.2.2 The preparation of this information are to generally list the required criteria and calculation steps.

### 2.3 Forms

2.3.1 For principal data, reference may be made to Table 2.3.1 of this Appendix.

2.3.2 For cargo holds and liquid tanks, reference may be made to Schematic diagram in Fig.1.6.1 (2) of Appendix 1.

2.3.3 For capacities，centres of gravity and free surface moments of liquid tanks，reference may be made to Table 1.6.1(1) of Appendix 1.

2.3.4 For summary table of stabilit3r calculations under various loading conditions，reference my be made to Table 2.3.4 of this Appendix.

2.3.5 For tables of capacities，volume centroid and heeling moments of volumes of fully loaded holds (with or without trimming at ends of cargo holds)，reference may be made to Tables 2.3.5(1) and (2) of this Appendix.

2.3.6 For curves of grain volumes, centres of gravity and heeling moments of volumes of partly loaded holds，reference may be made to Table 2.3.6 of this Appendix.

2.3.7 For permissible heeling moments, reference may be made to Table 2.3.7 of this Appendix.

2.3.8 For loading conditions calculation table, reference may be made to Table 2.3.8 of this Appendix.

2.3.9 For hydrostatic parameters and curves of flooding angles，reference may be made to Tables 1.6.1(3) and(4) and Fig.1.6.1(3) of Appendix 1 respectively.

2.3.10 For curves of permissible height of centre of gravity, reference may be made to Fig.2.3.10 of dais Appendix.

**Principal date** **Table 2.3.1**

| | |
|---|---|
| Ship’s type | |
| Length overall(m) | |
| Distance between perpendiculars(m) | |
| Moulded breadth(m ) | |
| Moulded depth(m) | |
| Moulded depth to 2nd deck(m) | |
| Fully loaded draught(m) | |
| Fully loaded displacement(m) | |
| Deadweight(t) | |
| Light shipweight(t) | |
| Centre of gravity of lightship (m) | |
| Vertical centre of gravity KG (m) | |
| Longitudinal centre of gravity (m) | |

Note：The longitudinal centres of gravity, of buoyancy and of floatation are to be taken as the positive for forward amidships section and the negative for after amidships section.

Summary table of stability calculations under various loading conditions table 2.3.4

| loading condition / Items | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Dept. | Arr. | Dept. | Arr. | Dept. | Arr. | Dept. | Arr. |
| Displacement(t) | | | | | | | | |
| Deadweight(t) | | | | | | | | |
| Cargoes loaded(t) | | | | | | | | |
| Ballast water(t) | | | | | | | | |
| Draught at FP(m) | | | | | | | | |
| Draught at AP(m) | | | | | | | | |
| Inertial metacentric height after Correction of free surfaces(m) | | | | | | | | |
| Height of centre of gravity, after correction of free surfaces(m) | | | | | | | | |
| Permissible centre of gravity(m) | | | | | | | | |
| Grain calculated heeling moment(t·m) | | | | | | | | |
| Grain permissible heeling moment(t·m) | | | | | | | | |
| Stability whether satisfactory or not | | | | | | | | |

Table for capacities，volume centroid and heeling moments of volumes of fully loaded holds

**1. Trimming at ends of cargo holds** **Table 2.3.5(1)**

| Cargo hold | Frame | Capacity | Vertical coordinate of centroid | Longitudinal coordinate of centroid | Volume heeling moment |
|---|---|---|---|---|---|
| | | ($m^3$) | (m) | (m) | ($m^4$) |
| | | | | | |
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**Note**：The values of longitudinal coordinate of centroid for forward amidships section are to be taken as the positive and as the negative for after amidships section.

**2. No trimming at ends of cargo holds** **Table 2.3.5(2)**

| Cargo hold | Frame | Capacity | Vertical coordinate of centroid | Longitudinal coordinate of centroid | Volume heeling moment |
|---|---|---|---|---|---|
| | | ($m^3$) | (m) | (m) | ($m^4$) |
| | | | | | |
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**Note**：The values of longitudinal coordinate of centroid for forward amidships section are to betaken as the positive and as the negative for after amidships section.

**Table 2.3.6 Curves of grain volumes，centres of gravity and volume heeling moments of partly loaded holds**

Depth of grain surface to inner bottom (m)

| Hold No |
| --- |
| Volume($m^3$) |
| Height of centre of gravity(m) |
| Volume heeling moment($m^4$) |

Depth of grain surface to top of hatch coaming plate

**Permissible heeling moments** **Table 2.3.7**

| Displacement / KG(m) | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
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# Loading Conditions Calculation Table

**Loading Conditions** **Stowage factor: $m^3/t$** **Table 2.3.8**

| Items | Weight | Height of centre of gravity | Vertical moment | Centre of Gravity to amidships section | Longitudinal moment | Free surface moment | Inclining moment of grains |
|---|---|---|---|---|---|---|---|
| | (t) | (m) | (t·m) | (m) | (t·m) | (t·m) | (t·m) |
| Light ship | | | | | | | |
| Constant | | | | | | | |
| Crews and food stuffs | | | | | | | |
| Fuel and lub. oil | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Total | | | | | | | |
| Fresh water | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Total | | | | | | | |
| Ballast water | | | | | | | |
| | | | | | | | |
| Total | | | | | | | |
| Cargo hold | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Total | | | | | | | |
| Deadweight | | | | | | | |
| Displacement | | | | | | | |

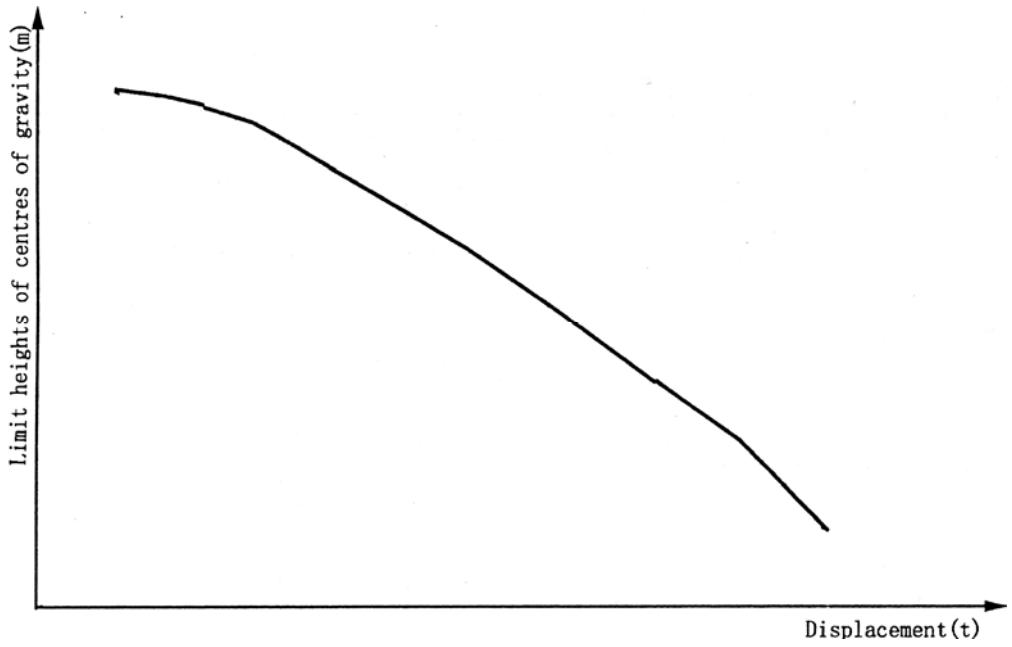



Fig.2.3.10 Curve of permissible height of centre of gravity

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# Appendix 3

# Contents of Loading Manual (Example)


1 Introduction
2 Symbols, definitions and units Information Category 1A……
3 Ship's particulars…….

4 Information on cargo spaces ……
4.1 Bulk cargo capacity……...
4.2 Permissible load per area……..
4.3 Capacity for 20'containers in holds……..
4.4 Capacity for 40'containers in holds……..
4.5 Capacity for 20'containers on deck……..
4.6 Capacity for 40'containers on deck……..
4.7 ZG—values for containers in hold and on deck ……
4.8 YC—values for containers in hold and on deck ……
4.9 Maximum permissible stack loads……
4.10 Stacking height on deck……..

5.1 Summary table of operational tanks…….
5.2 Summary table of ballast tanks…….
5.3 Location of tanks……...
5.4 Sounding table of large tanks……

6 Hydrostatic table……..
7 Cross-curves of stability……
8 Angle of flooding Information Category 1B……...

9 Information on draught marks…….
9.1 Positions of draught marks……
9.2 Correction of readings for trim……
9.3 Correction of readings for deflection……

10 Correction of mean draught for hog or sag……
1l Parameters in trimmed conditions……
11.1 Displacement volumes in trimmed conditions……
11.2 KM in trimmed conditions……
11.3 XG in trimmed conditions……

12 In-service inclination test Information Category 2A……

13 Lightship particulars Information Category 2B……

14 Load line and stability criteria……
14.1 Load line particulars……
14.2 Stability criteria……

15 Sheer force and bending moments。……
15.1 Permissible shear forces and bending moments……

16 Trim restrictions due to SOLAS-sightlines……

17 Tank distribution under loading conditions……
17.1 Case for 100％ fuel and store……
17.2 Case for 50％ fuel and store……
17.3 Case for 10％ fuel and store……
17.4 Ballast in double bottom tanks……

18 Summary table of loading conditions……
18.1 Calculation table of loading conditions……
18.2 Comments on loading conditions……

19 Loading conditions……
19.1 Various loading conditions……
19.2 Additional requirements for loading conditions in SIA of IACS Unified Requirements(where applicable……

20 Guidance to masters……
20.1 Instructions of this manual……
20.2 Operation of the ship……
20.3 Control of stability, trim and longitudinal strength……

# Appendix 4

## Preparation of Loading Information Booklets for Existing Bulk Carders

4.1 General requirements

(1) To be familiar with the contents of loading manuals：

(2) To collect relevant loading records by means of consultation with the shipowner and the master or officers，so as to prepare practicable loading information booklets and typical loading and unloading sequences；

(3) Evaluation information to be available on flooding damage stability of the first hold, dimensions of structural members of corrugated bulkhead separating the first and second holds after flooding and permissible loading in the first hold after flooding；

(4) Information on rate，capacity and normal rate of ballast water pumps onbeard：

(5) Information on confirmation of restrictions of alternate loadings selected for the captains：

(6) the booklet is to be prepared in a language understood by the crew. If the language is not English, a translation into English is to be included.

4.2 Principal contents of loading information booklets

(1) Stability information as required by Reg.II—1 / 22 of SOLAS；

(2 ) Ballast and deballast rate and capacity；

(3) Permissible loading on inner bottom plating in holds (t / $m^2$)：

(4) Maximum permissible loading capacity of each hold：

(5) General loading instructions with respect to the hull structure including the restrictions 0f the most unfavourable operation conditions for cargo loading and unloading，ballasting and in the process of navigation；

(6) Any special restrictions such as the most unfavourable operation conditions newly applied by the flag State or its recognized organization；

(7) Where strength calculations is required, the maximum permissible load and moment on the hull during cargo loading and unloading and in the process of navigation；

(8) To show the compliance with the requirements in Reg.XIl/4 (i.e. for damage stability after flooding 0f the first hold)，Reg.XII / 6(i.e. for structural strength after flooding of the first hold l and Reg.XII / 7 (for enhanced survey)of SOLAS，if appropriate：

(9) Any restrictions for carrying solid bulk cargoes having a density of 1.78 t / $m^3$ and above in compliance with the requirements in Reg.XII / 4 (i.e. for structural strength after flooding of the first hold) are to be identified and recorded on this manual；

(10) Where preparation of loading / unloading sequences are made，restrictions of loading rate，deballast rate and related structure strength are to be taken into account.