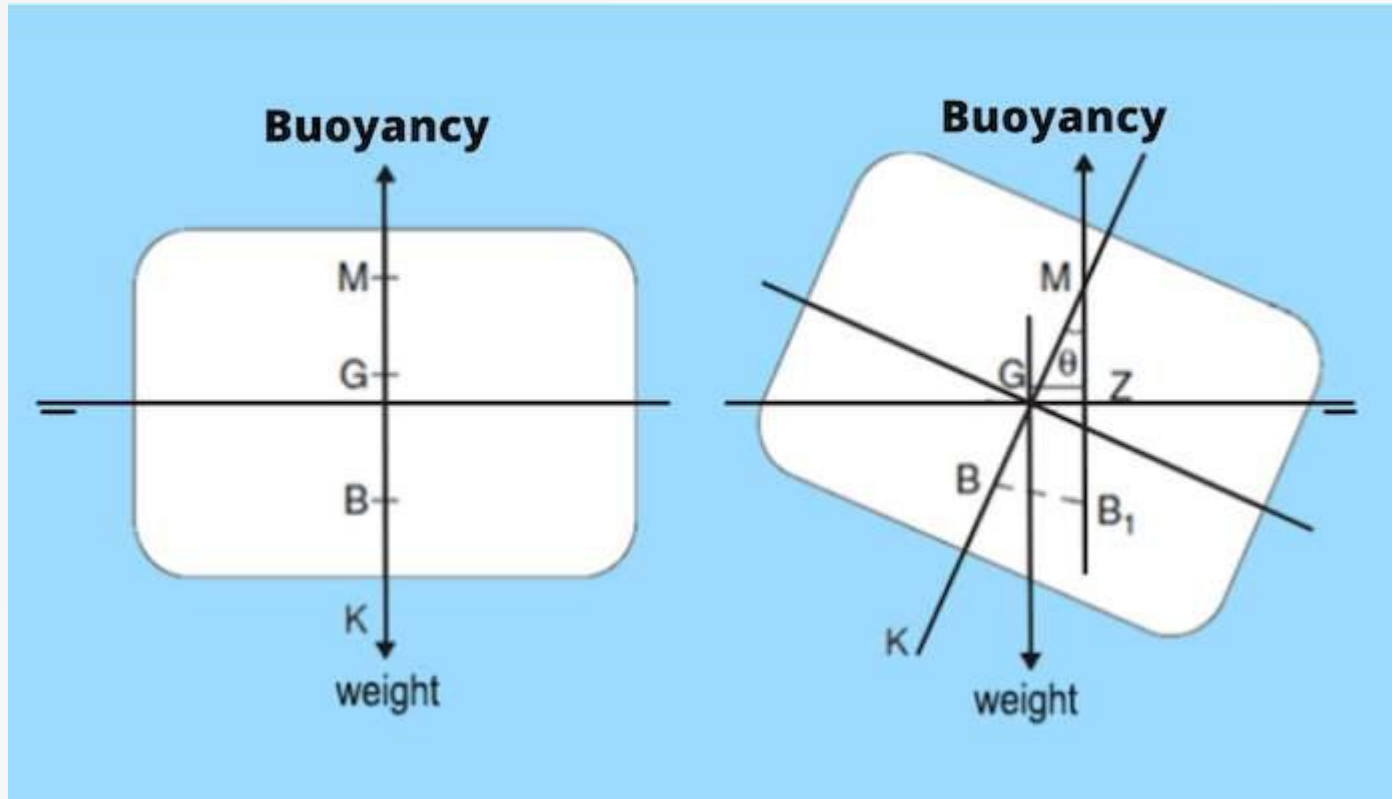


SHIP STABILITY



My Biodata



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Tasikmalaya, Jawa Barat

Pre- test

- 1. What different Deadweight and Displacement?
- 2. What the meaning trim and free board?
- 3. If vessel proceeding from Sea water to Fresh water, the draft of vessel will be decreasing or increasing?
- 4. What do you know TPC and FWA?
- 5. Maximum Tropical draft 8.2 M DWT 8,800 MT, Summer draft 8.10 M, vessel departure from Singapore by mean draft 8.2 M will be going to Shanghai if TPC: 45, how to arrange vessel safely entering port.

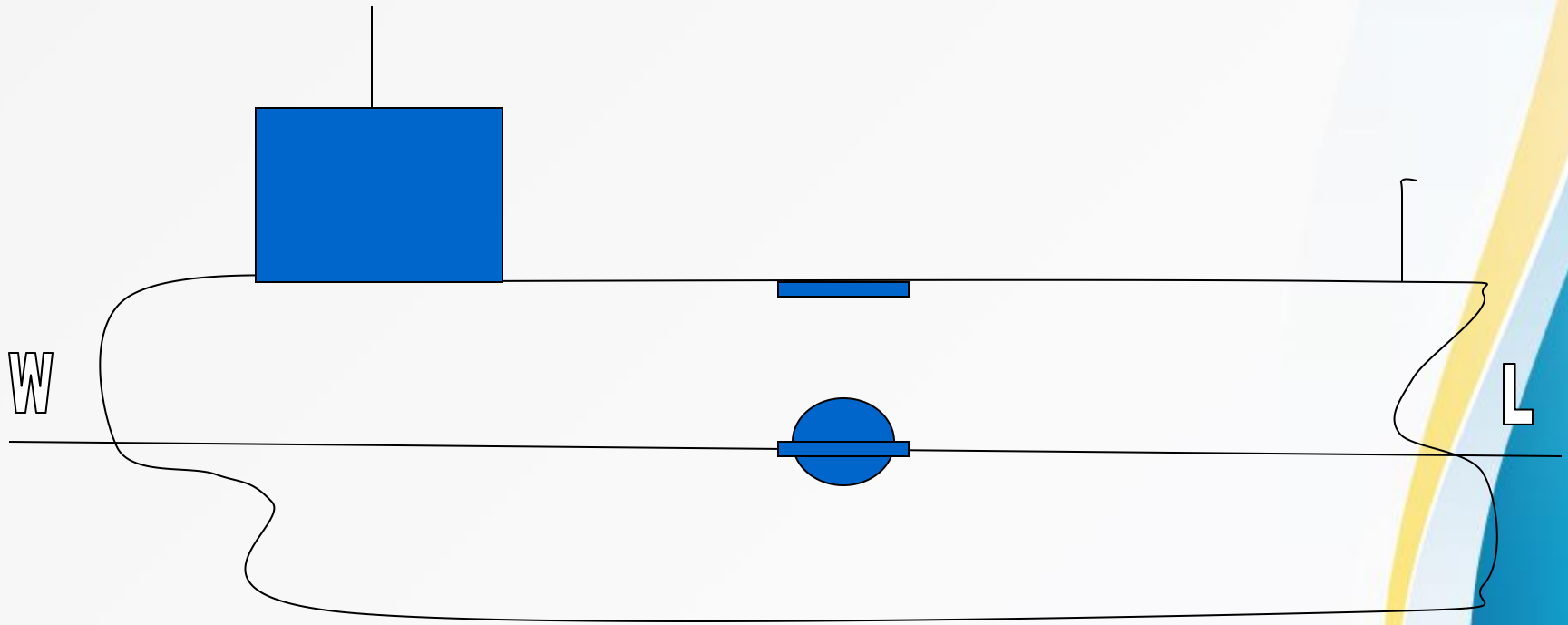
Remember the following:

"I'm Safe"

- **I** - Illness (are you suffering from any illness that will affect your ability to work?)
- **M** - Medication (are you taking any medication that may have side effects?)
- **S** - Stress (are you suffering from stress?)
- **A** - Alcohol (have you consumed alcohol within the last 24 hrs?)
- **F** - Fatigue (are you sufficiently rested?)
- **E** - Eating (have you eaten well?)

REFER TO

1. Damage stability requirements of regulation 27 of the 1966 Load Line convention
2. SOLAS Chapter II-1 Subdivision and Damage Stability Reg 25-1 to Reg 25-6
3. EOHS GBLT – 0800 Cargo Operating Procedure
0800.7. Loading / Discharging, 9. Stability



CARGO OPERATING PROCEDURE

EOHS GBLT-0800-7:

7. LOADING AND DISCHARGING

- B4 accepting the cargo and b4 starting to load it, the Master or the Ch Off will fill up and sign a Tank History (last 3 cargoes).
- Ch Off shall prepare a Cargo Loading/Discharging Plan as per Form D-13/D-14. The cargo to be loaded must be listed in te Certificate of Fitness.
- If the cargo is not listed in the Certificate of Fitness, The company mus be notified. No unlisted cargo is to be loaded until confirmation from the company is received.
- Cargo loading/discharging plan shall be signed and approved by Master.
- A copy of the approval load/discharge plan shall be forwarded to the office as early As possible prior to the operation.
- Comparison of actual and calculated draft / trim and regular interval to ensure Operations carried out as planned.

CARGO OPERATING PROCEDURE

EOHS GBLT-0800-9

The load/ballast condition of vessel must always be below the maximum Still water stress limits as defined in the Stability Book. This must always be taken into consideration when planning discharge and/or ballasting Operations.

Chief officer has calculate stability of vessel for loading & discharging into Number of stages. In each stage of his calculation, the following must be Included but not limited to:

- Cargo to be loaded/discharge
- Forward and aft draft
- Trim
- Maximum SF and BM in procentage
- GoM
- Displacement

TERMINOLOGY IN STABILITY

- **Deadweight (DWT):** The total mass of cargo, fuel (mfo + mdo), lub oil, fresh water, ballast water, constant etc., that ship can carry.
- Example Frabandari DWT : 8800 MT at tropical area with mean draft is 8.20 M

FO : 250 MT

DO : 50 MT

L/O : 8 MT

FW : 150 MT

BW : 30 MT (ballast unpumping)

Constant : 50 MT (ship inventory, crew, etc)

Total : 538 MT

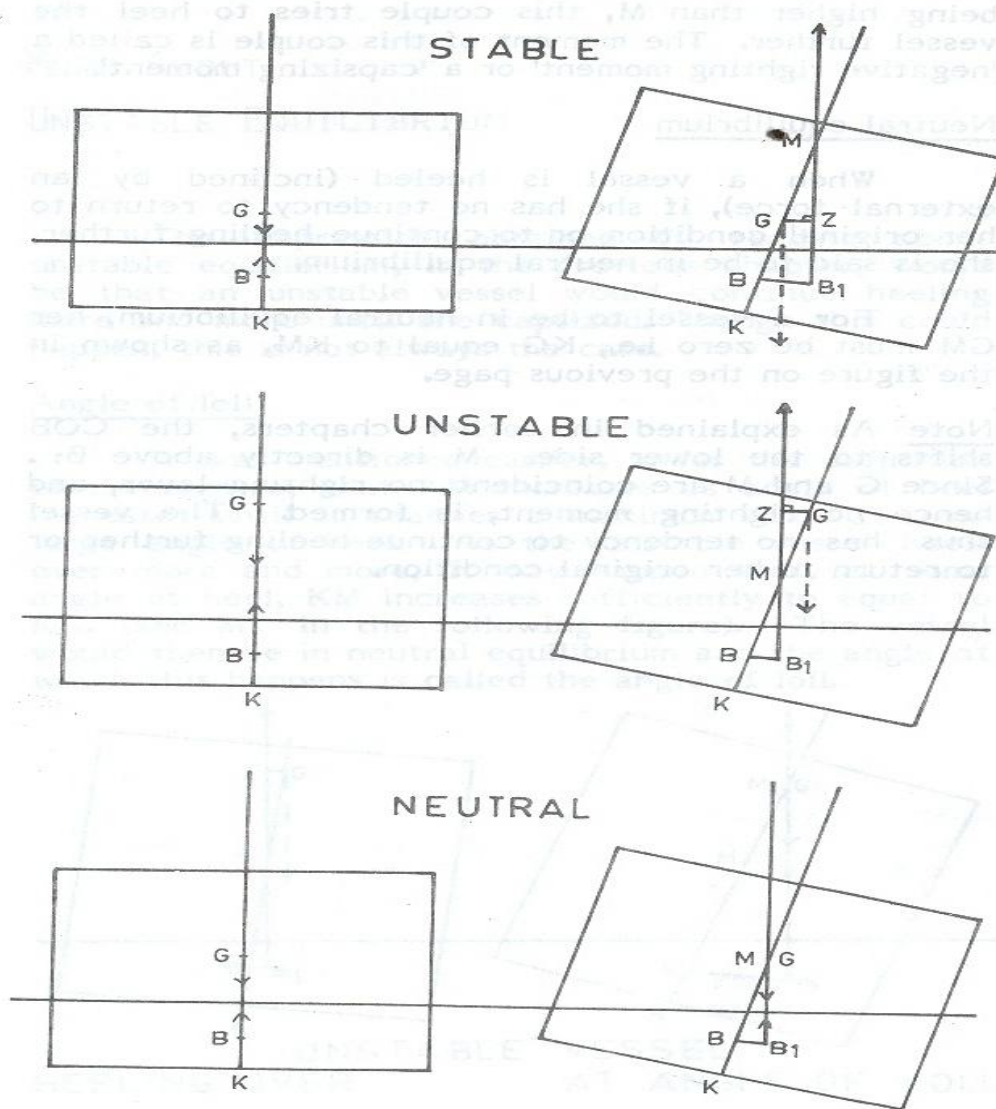
How much cargo can be loading?

DISPLACEMENT

- Light displacement is the mass of empty ship without any cargo, fuel, l/o, ballast water, fresh water, feed water in tanks, consumable stores and crew and their effects.
- Present displacement is the mass of the ship at present, it is the sum of the light displacement of the ship and everything on board at present.

STABILITY POSITIVE, NEGATIVE AND NETRAL

EQUILIBRIUM OF SHIP

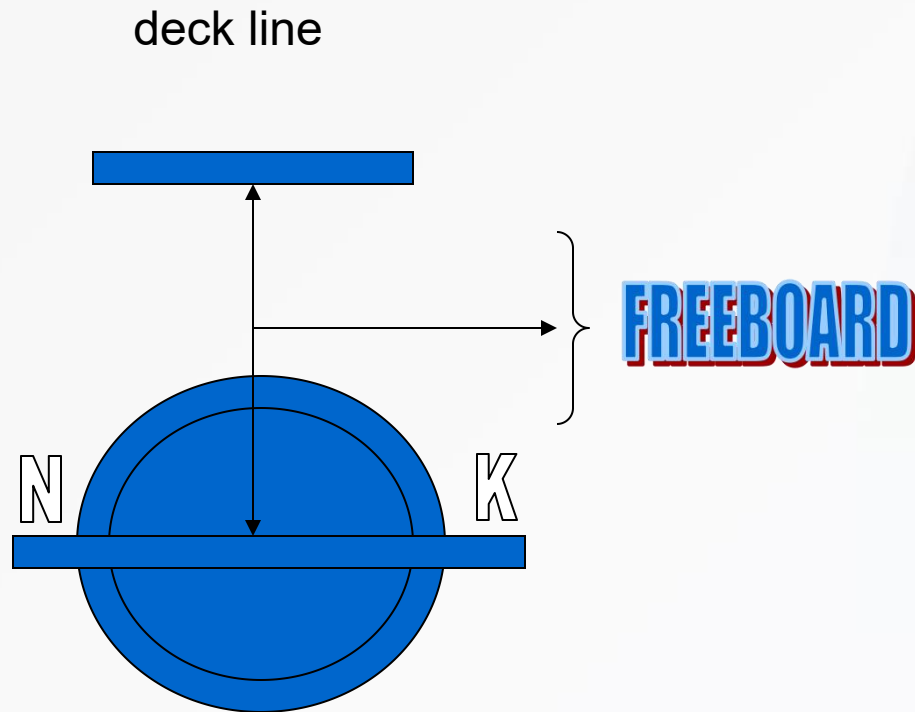


Metacentric Height : G M

- It is the vertical distance between the centre of gravity and the metacentre.
- GM positive when G is below M
- GM negative when G is above M
- GM neutral when G same with M

FREEBOARD

- The freeboard assigned is the distance measured vertically downwards amidships from the upper edge of the deck line to the upper edge of the load line



EFFECT OF DENSITY ON DRAFT & DISPLACEMENT

- When a ship goes from SW to FW, her draft would increase and vice versa.
- Example consider a ship of 10000 tonnes displacement.

$W = \rho \times \text{volume} \times \text{density of water displaced}$

In salt water

$$10000 = V_{sw} \times 1.025 \text{ or } V_{sw} = 10000/1.025 = 9756\text{m}^3$$

In fresh water

$$10000 = V_{fw} \times 1 \text{ or } V_{fw} = 10000 \text{ m}^3$$

Fresh Water Allowance

- FWA is the increase in draft when a ship goes from SW to FW and vice versa.
- $$FWA = \frac{W}{40 TPC}$$
- W : is the displacement of the ship in salt water, expressed in tonnes
- TPC : is the tonnes per centimetre immersion in salt water
- FWA : is the fresh water allowance in centimetres

Example FWA calculation

$$\begin{array}{rcccccl} \text{DRAFT} & W & \text{TPC} & \frac{W}{40 \text{ TPC}} & = \text{FWA} \\ \text{m} & \text{t} & \text{tcm}^{-1} & & \text{cm} \\ 3.000 & 5478 & 20.90 & \frac{5478}{40 \times 20.9} & = 6.6 \end{array}$$

Ship her draft 3.000 m carrying cargo 5478 t in salt water
And goes to FW any increas her draft to be 3.066 m

$$\begin{array}{rcccccl} 5.000 & 9788 & 22.08 & \frac{9788}{40 \times 22.08} & = 11.1 \end{array}$$

Ship her draft 5.000 m carrying cargo 9788 t in salt water
And goes to fw water any increas her draft to be 5.111 m

DOCK WATER ALLOWANCE

- **DWA** : is the increase in draft when a ship goes from salt water to dock water and vice versa.
- Change of Draft : Change of Relative Density x FWA
- When ship goes from SW to FW (change of RD of .025) she increases her draft by FWA. So for any change of RD between 1.025 and 1.000, linear interpolation may be done
- EXAMPLE :

$$\text{Change of Draft} = \frac{\text{Change of RD}}{.025} \times \text{FWA}$$

SW	TO	FW	Change of RD	Change of Draft
1.025		1.017	.008	$\frac{0.008}{0.025} \times \text{FWA}$

SUPPOSE THE UNDERWATER VOLUME OF A CERTAIN SHIP AT 7 M DRAFT IS 14000 M³

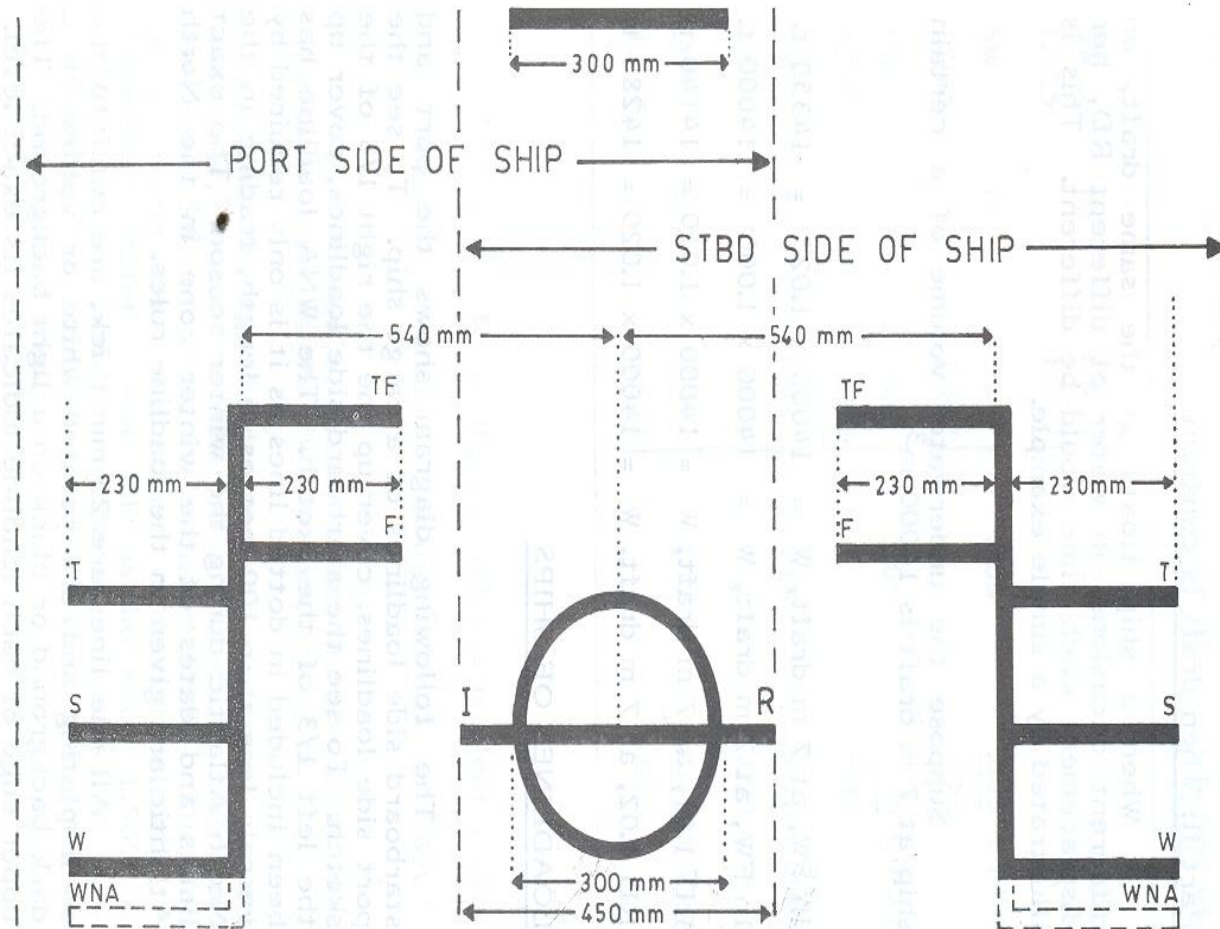
- In SW, at 7 m draft, $W = 14000 \times 1.025 = 14350 \text{ t}$
- In FW, at 7 m draft, $W = 14000 \times 1.000 = 14000 \text{ t}$
- RD 1.01, at 7 m draft, $W = 14000 \times 1.010 = 14140 \text{ t}$
- RD 1.02 at 7 m draft, $W = 14000 \times 1.020 = 14280 \text{ t}$

EXAMPLE FWA AND DWA

- A Ship load displacement is 16000 t and TPC is 20, If She is in DW of RD 1.010 find by how much she may immerse her loadline so that she will not be overload when she goes to sea.
- $$\text{FWA} = \frac{W}{40 \cdot \text{TPC}} = \frac{16000}{40 \times 20} = 20 \text{ cm}$$

$$\begin{aligned} \text{DWA} &= \frac{(1.025 - \text{dd})}{.025} \times \text{FWA} = \frac{(1.025 - 1.010)}{.025} \times 20 \\ &= 12 \text{ cm} \end{aligned}$$

LOAD LINE SHIP / PLIMSOL MARK



DIMENSION

- The vertical distance between the upper edges of S and T (and also between S and W) is $\frac{1}{48}$ of the summer draft of the vessel.
- Example Summer draft is 7.00 M
- $7 \times \frac{1}{48} = 0.1458 \text{ m}$
Tropical draft = 7.1458 m
Winter draft = 6.8542 m

LOADING COMPUTER

- 1. OPEN LOADSTAR (DOUBLE CLICK)
- 2. MOVE CURSOR TO SELECT CONDITION (for example Full Load Case SG= 0.7664 Dep) ENTER
- 3. Y ENTER
- 4. INPUT DENSITY (for example SG: 0.7664) ENTER
- 5. DENSITY OF SEA WATER 1.025 OR FW 1.010 ENTER
- 6. TANK CLASS SELECTION CONSIST OF:
 - CONSTANT
 - DIESEL OIL
 - FRESH WATER
 - WATER BALLAST
 - FUEL OIL
 - LUBRICATING OIL
 - T.C.F.W.T
 - CARGO

MOVE CURSOR SELECT TANK CLASS CONDITION ONE BY ONE AND THEN INPUT ENTER

CLICK F3 FUNCTION GO BACK TO TANK CLASS SELECTION

LOADING COMPUTER

- FUNCTION SELECTION:
- F1 : CONDITION SELECT
- F2 : DENSITY OF SEA WATER / FRESH WATER
- F3 : TANK CLASS
- F4 : TANK CLASS FRESH WATER
- F5 : RESULT OF TRIM CALCULATION
- F6 : RESULT OF TRIM CALCULATION
- F7 : RESULT OF LONGITUDINAL STRENGTH CALCULATION (AT OCEAN / AT HARBOR)
- F8 : RESULT OF LONGITUDINAL STRENGTH CALCULATION
- F11: RESULT OF STABILITY CALCULATION (
 - - IMO A.749 (18) CHAPTER 3.1
 - - IMO A.749 (18) CHAPTER 3.2
 - - MINIMUM GOM
- PRINT RESULT ENTER Y / N

TERIMA KASIH

