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\*Working copies of these pages are available to the candidate.

U.S. Department  
of Transportation  
  
United States  
Coast Guard



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COMDTPUB P16721.31

**2 NOV 1989**

COMMANDANT PUBLICATION P16721.31

Subj: Merchant Marine Deck Examination Reference Book, STABILITY DATA  
REFERENCE BOOK.

1. PURPOSE. This publication contains reference material that may be needed by an applicant during an examination for a merchant marine deck license.
2. DISCUSSION.
  - a. Applicants for merchant marine deck licenses taking an examination to determine their professional qualifications may be required to answer examination questions which are based on the material in this publication.
  - b. The Coast Guard has converted to a computerized random generation system for creating examination modules. To streamline the process of creating module test booklets, where possible, the reference material needed to answer exam questions has been incorporated in Deck Examinations Reference Books. This allows applicants to view both the exam question and the reference material at the same time.
  - c. Copies of this publication will be provided by the Regional Examination Centers (RECs) when applicants take an examination. This publication is available to the general public but only copies provided by the RECs may be used when completing an examination.
  - d. The August 1989 edition of this publication contains all material required by questions in the question bank as of August 1989.

DISTRIBUTION - SOL No. 128

|   | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z |
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• NON-STANDARD DISTRIBUTION:

### INSTRUCTIONS

1. Some of the questions in the deck examination booklets require the use of trim and stability reference material to answer the question. All of the material necessary to these questions is contained in the appropriate Merchant Marine Deck Examination Reference Book.

2. If a question requires the use of trim / stability reference materials, it will be specifically stated in the stem of the question. For example, if the question in your examination booklet is, "The sailing drafts are: FWD 24' - 03", AFT 25' - 03" and the GM is 5.5 feet. Use the information in Section 1, the blue pages of the Stability Data Reference Book, to determine the available righting arm at 30 degrees inclination.", you must use Section 1 (the blue pages) of The Merchant Marine Deck Examination Reference Book, STABILITY DATA REFERENCE BOOK to answer the question.

3. The Merchant Marine Deck Examination Reference Book, STABILITY DATA REFERENCE BOOK, has three (3) sections. Each section has its own index and is color coded as follows:

1. Selected Stability Curves.....Blue Pages
2. Trim and Stability Book - S.S.American Mariner...White Pages
3. Trim and Stability Book - S.S.Northland.....Salmon Pages

4. Applicants taking an examination who wish to make a comment or protest concerning any material in this publication should complete a Comment/Protest form for the question involved and give it to the examiner.

5. Individuals not taking an examination who wish to make a comment on any material in this publication should send a written comment, citing this publication and the appropriate page, and paragraph or illustration commented on, to:

Commandant (G-MVP-5)  
U.S. Coast Guard  
STABILITY DATA REFERENCE BOOK  
2100 Second Street SW  
Washington, DC 20593-0001

All written comments submitted by the general public will be reviewed prior to revising this publication. A heavy workload precludes the Merchant Marine Examination Branch from discussing comments over the telephone or responding to written comments. Your comments are welcomed and you will receive a letter or postcard indicating your comments were received.

APPROVED  
Subject to comments in  
Comments, 3rd Coast Guard District (gum)  
letter of

JAN 28 1982

*ALL*  
COAST GUARD DISTRICT, 3rd Coast Guard District  
AT THE OFFICE OF THE DISTRICT COMMANDER  
AND THE OFFICE OF THE DISTRICT ATTORNEY

## S/S NORTHLAND

### LOADING, TRIM & STABILITY BOOKLET

#### DEDICATED CLEAN BALLAST TANK CONFIGURATION

IN ACCORDANCE WITH IMCO REGULATION 13A OF 1978 PROTOCOL TO MARPOL 1973

PRODUCTS LOADING CONDITIONS

CRUDE OIL LOADING CONDITIONS

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NOTES TO MASTER AND PRINCIPAL PARTICULARS

1. The following cargo tanks are piped for either crude oil or clean sea water ballast (after crude oil washing):  
Cargo Tank No. 6 P, S, & CL  
Cargo Tank No. 7 P & S  
Cargo Tank No. 8 CL  
Cargo Tank No. 9 CL
2. The above-noted tanks are NOT to be used for either products cargo or sea water ballast when carrying products.
3. A light ship plus clean sea water ballast condition is included herein to demonstrate compliance with the requirements of Regulation 13A of the International Conference on Tanker Safety and Pollution Prevention, 1978.
4. The Products Loading Conditions herein are predicated on a maximum draft at bow or stern of 38.50' for transit of the Panama Canal.

5. Principal Particulars:

|                                       |               |
|---------------------------------------|---------------|
| Length Overall-----                   | 736' - 3-3/4" |
| Length Between Perpendiculars-----    | 705' - 0"     |
| Breadth Moulded-----                  | 102' - 0"     |
| Depth Moulded-----                    | 50' - 0"      |
| Full Load Draft Summer Freeboard----- | 39' - 9-3/4"  |
| Full Loaded Displacement-----         | 62,160        |
| Deadweight-----                       | 49,339        |

INSTRUCTIONS FOR COMPLETION OF TRIM AND STABILITY LOADING CONDITION FORM

1. Blank forms for calculation of trim and stability for conditions not covered by this booklet are:

Sheet 81A Summary Sheet  
81B Details of Ship's Deadweight  
81C Details of Cargo Loading  
81D Details of Sea Water Ballast

2. Enter weights and free surface on Sheets 81B, 81C and 81D as applicable. Compute moments and totals and enter on Summary Form, Sheet 81A, and compute summary totals. Take care to enter longitudinal moments as + for Aft, - for Forward.

3. For the displacement, Sheet 81A, read mean draft from Sheet 7, Curves of Form. At this draft, read Curves of Form data for  $K_M$ ,  $LCB$ ,  $M_T$  and  $LCF$ . Enter these data on Sheet 81A.

4. Transverse Stability

Subtract the total  $VCG$  ( $=K_M$ ) from  $K_M$  to obtain the  $GM$  uncorrected for free surface. Divide the total free surface by the displacement to obtain the free surface correction and subtract this value from the uncorrected  $GM$ . The final result is the  $GM$  corrected for free surface, which must be at least 1.2 FT (to suit max req'd weather criteria  $GM$  at INCO Ballast Draft per superseded Stability Booklet).

5. Trim

Subtract the total  $LCG$  from the  $LCB$  to obtain the trimming lever. Trim is by stern if  $LCG$  is aft of  $LCB$  and by bow otherwise. Compute trim by multiplying displacement by trimming lever and dividing by product ( $M_{T1} \times 12''$ ). For drafts of 32 FT or greater and/or small trim, the effect of  $LCF$  on trim is small and forward and aft drafts can be computed by adding or subtracting (to suit trim by bow or stern) half the trim from the mean draft. For large trim at drafts less than 32 feet compute draft at bow = mean draft - trim  $X$  ( $352.5 - LCF$ )/705. The draft &  $LCF$  values are treated algebraically; i.e., the minus signs in the expression change to plus for trim by bow and/or  $LCF$  aft of amidships. Draft at stern is draft at bow - trim.

INSTRUCTIONS FOR COMPLETION OF FORMS TO DETERMINE HOGGING AND SAGGING NUMERALS

1. Sheet 81E is the form for computing longitudinal bending stress numerals. The resulting numeral should not exceed 100.
2. The weights entered on Sheets 81B, 81C and 81D, divided by 100 and as applicable, are entered in the "Tons/100" column of Sheet 81E for departure and arrival conditions. Multiply the "Tons/100" by the Hogging and Sagging Factors for all weights entered in lines 1-27 and enter totals on line 28, "Total Deadweight."
3. Line 29 gives the light ship value for "Tons/100" and the associated hogging and sagging numerals. The light ship value includes weights for spare tailshaft and stowage as given on Sheet 81B ( $[12821 + 29]/100 = 128.50$ ). Add lines 28 and 29 to obtain line 30 displacement and hogging and sagging numerals for departure and arrival conditions.
4. Enter the "Tons/100" deadweight from line 28 in line 31. "Numeral" columns for both hogging and sagging, and subtract from line 30. The resulting values in line 32 must not exceed 100.

# TANK CAPACITIES AND CENTERS OF GRAVITY

| CARGO TANKS | FRS     | BBL'S<br>98% FULL | VCG ABV.<br>MLD BL | LCG<br>FROM # | FUEL OIL TANKS    | FRS      | CAPACITY<br>CUBIC FT | F.O.-TONS<br>37.23 CL.FT./LT<br>98% FULL | VCG ABV.<br>MLD BL | LCG<br>FROM # |
|-------------|---------|-------------------|--------------------|---------------|-------------------|----------|----------------------|------------------------------------------|--------------------|---------------|
| NO. 1 CL    | 102-107 | 15,878            | 26.13              | 227.5F        | SETTLER (P)       | 58-60    | 8459                 | 222.5                                    | 37.83              | 205.3A        |
| NO. 1 P/S   | 102-107 | 15,460            | 27.53              | 226.4F        | SETTLER (S)       | 58-60    | 8441                 | 222.5                                    | 37.83              | 205.3A        |
| NO. 2 CL    | 97-102  | 15,878            | 26.13              | 187.5F        | DEEP TANK (P)     | 58-60    | 17436                | 459.0                                    | 29.83              | 203.8A        |
| NO. 2 P/S   | 97-102  | 18,244            | 26.33              | 187.1F        | DEEP TANK (S)     | 58-60    | 17436                | 459.0                                    | 29.83              | 203.8A        |
| NO. 3 CL    | 93-97   | 15,878            | 26.13              | 147.5F        | DEEP TANK (P)     | 108-120  | 52426                | 1354.0                                   | 29.53              | 267.6F        |
| NO. 3 P/S   | 93-97   | 20,094            | 25.93              | 147.5F        | DEEP TANK (S)     | 108-120  | 57457                | 1513.0                                   | 28.13              | 265.1F        |
| NO. 4 CL    | 89-93   | 15,878            | 26.13              | 107.5F        |                   |          | 161655               | 4230.0                                   | 29.7               | 114.6F        |
| NO. 4 P/S   | 89-93   | 20,254            | 25.93              | 107.5F        |                   |          |                      |                                          |                    |               |
| NO. 5 CL    | 85-89   | 15,866            | 26.13              | 67.5F         |                   |          |                      |                                          |                    |               |
| NO. 5 P/S   | 85-89   | 20,254            | 25.93              | 67.5F         |                   |          |                      |                                          |                    |               |
| NO. 6 CL    | 81-85   | 15,855            | 26.13              | 27.5F         | FRESH WATER TANKS | FRS      | CAPACITY<br>CUBIC FT | TONS<br>100% FULL                        | VCG ABV.<br>MLD BL | LCG<br>FROM # |
| NO. 6 P/S   | 81-85   | 20,254            | 25.93              | 27.5F         | POTABLE (P)       | 13-17    | 1569.5               | 43.60                                    | 48.53              | 322.4A        |
| NO. 7 CL    | 77-81   | 15,867            | 26.13              | 12.5A         | POTABLE (S)       | 13-17    | 1118.9               | 31.08                                    | 48.51              | 321.5A        |
| NO. 7 P/S   | 77-81   | 20,254            | 25.93              | 12.5A         | POTABLE CL        | 88-90    | 1089.0               | 30.25                                    | 57.43              | 90.0F         |
| NO. 8 CL    | 73-77   | 15,867            | 26.13              | 52.5A         | DISTILLED (P)     | 39-45    | 2160.0               | 60.00                                    | 42.73              | 258.5A        |
| NO. 8 P/S   | 73-77   | 20,254            | 25.93              | 52.5A         |                   |          | 5937.4               | 164.93                                   |                    |               |
| NO. 9 CL    | 69-73   | 15,850            | 26.13              | 92.5A         | BALLAST TANKS     |          |                      |                                          |                    |               |
| NO. 9 P/S   | 69-73   | 20,066            | 25.95              | 92.5A         | FORE PEAK         | Stem-130 | 26198                | 748.5                                    | 22.03              | 323.0F        |
| NO. 10 CL   | 65-69   | 15,857            | 26.13              | 132.3A        | AFT PEAK          | Stem-17  | 13801                | 394.3                                    | 36.53              | 333.8A        |
| NO. 10 P/S  | 65-69   | 19,364            | 26.23              | 132.3A        | DEEP TANK (P)     | 120-130  | 30623                | 874.9                                    | 29.13              | 295.1F        |
| NO. 11 CL   | 61-65   | 15,850            | 26.13              | 172.5A        | DEEP TANK (S)     | 120-130  | 30521                | 872.0                                    | 29.13              | 295.1F        |
| NO. 11 P/S  | 61-65   | 17,244            | 26.93              | 172.5A        |                   |          |                      |                                          |                    |               |
|             |         | 386,956           | 26.2               | 26.4F         | COFFERDAMS        |          |                      |                                          |                    |               |
|             |         |                   |                    |               | FWD               | (P)      | 107-108              | 134.4                                    | 27.93              | 249.0F        |
|             |         |                   |                    |               | FWD               | (S)      | 107-108              | 203.8                                    | 27.93              | 249.0F        |
|             |         |                   |                    |               | AFT               | (P)      | 60-61                | 119.7                                    | 31.13              | 194.0A        |
|             |         |                   |                    |               | AFT               | (S)      | 60-61                | 119.7                                    | 31.13              | 194.0A        |

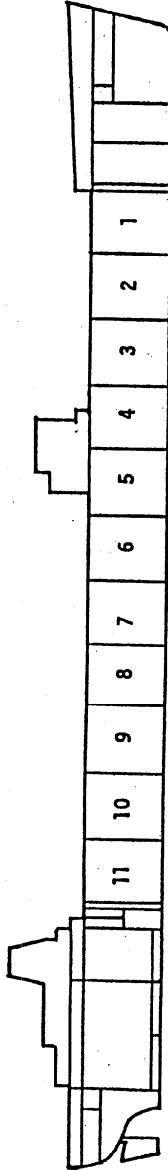
NOTES: VCG's of slack cargo & deep tanks are obtained by multiplying the VCG's shown by % fullness of tank.

# VERTICAL MOMENTS OF FREE SURFACE OF LIQUIDS - FT TONS

| NO. | I (FT <sup>4</sup> ) | CARGO TANKS                      |                                  |                                  |                                  | FUEL, FRESH WATER, BALLAST & WASH WATER |                       |                    |           | I (FT <sup>4</sup> ) | I/S   |        |
|-----|----------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|-----------------------------------------|-----------------------|--------------------|-----------|----------------------|-------|--------|
|     |                      | 61° API<br>(48.93)<br>(CF/T) I/S | 40° API<br>(43.58)<br>(CF/T) I/S | 30° API<br>(41.04)<br>(CF/T) I/S | 14° API<br>(35.97)<br>(CF/T) I/S | S.W.<br>(35.00)<br>(CF/T) I/S           | FUEL OIL              | SETTLER (P) OR (S) | FR. 58-60 |                      |       | 11,450 |
| 1   | CL                   | 283,940                          | 5804                             | 6515                             | 6920                             | 8114                                    | SETTLER (P) OR (S)    | FR. 58-60          |           | 11,450               | 308   |        |
| 1   | (P) OR (S)           | 52,000                           | 1060                             | 1190                             | 1264                             | 1482                                    | AFT BUNKER (P) OR (S) | FR. 108-120        |           | 30,500               | 819   |        |
| 2   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    | FWD BUNKER (P)        | FR.                |           | 160,051              | 4299  |        |
| 2   | (P) OR (S)           | 77,000                           | 1588                             | 1783                             | 1893                             | 2220                                    | FWD BUNKER (S)        |                    |           | 160,051              | 4299  |        |
| 3   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    | FRESH WATER           |                    |           |                      |       |        |
| 3   | (P) OR (S)           | 81,100                           | 1658                             | 1862                             | 1977                             | 2318                                    |                       |                    |           |                      |       |        |
| 4   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    | STEERING RM (P)       | FR. 13-17          |           | 15,768               | 438   |        |
| 4   | (P) OR (S)           | 81,290                           | 1662                             | 1866                             | 1982                             | 2323                                    | STEERING RM (S)       | FR.                |           | 10,728               | 298   |        |
| 5   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    | DISTILLED (P)         | FR. 37-45          |           | 9,324                | 259   |        |
| 5   | (P) OR (S)           | 81,290                           | 1662                             | 1866                             | 1982                             | 2323                                    | UNDER BRIDGE          | FR. 88 1/2-90 1/2  |           | 2,160                | 60    |        |
| 6   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    | S.W. BALLAST          |                    |           |                      |       |        |
| 6   | (P) OR (S)           | 81,290                           | 1667                             | 1866                             | 1982                             | 2323                                    |                       |                    |           |                      |       |        |
| 7   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    | FORE PEAK             | Stem FR. - 130     |           | 109,060              | 3,116 |        |
| 7   | (P) OR (S)           | 81,290                           | 1662                             | 1866                             | 1982                             | 2323                                    | AFT PEAK              | FR. 17 - Stern     |           | 160,335              | 4,581 |        |
| 8   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    | BALLAST (P) OR (S)    | FR. 120-130        |           | 55,510               | 1,586 |        |
| 8   | (P) OR (S)           | 81,290                           | 1662                             | 1866                             | 1982                             | 2323                                    |                       |                    |           |                      |       |        |
| 9   | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    |                       |                    |           |                      |       |        |
| 9   | (P) OR (S)           | 81,290                           | 1662                             | 1866                             | 1982                             | 2323                                    |                       |                    |           |                      |       |        |
| 10  | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    |                       |                    |           |                      |       |        |
| 10  | (P) OR (S)           | 81,100                           | 1658                             | 1862                             | 1977                             | 2318                                    |                       |                    |           |                      |       |        |
| 11  | CL                   | 283,940                          | 5804                             | 6517                             | 6920                             | 8114                                    |                       |                    |           |                      |       |        |
| 11  | (P) OR (S)           | 77,930                           | 1593                             | 1789                             | 1900                             | 2227                                    |                       |                    |           |                      |       |        |

1. To obtain the free surface correction to GM in any condition of loading, add the I/B values of all slack tanks and divide by the displacement of vessel.

2. Values of I/S for different API cargo may be obtained by either dividing tabular values of I (FT<sup>4</sup>) by corresponding density of cargo in tank, or by interpolation.



37'-0" DRAFT

|     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| FWD | -2.0 | -1.7 | -1.4 | -1.1 | -0.9 | -0.7 | -0.3 | 0    | +0.3 | +0.6 | +1.0 | +1.3 | +1.6 | +1.9 | +2.2 | +2.6 | +2.9 | +3.1 | +3.3 | FWD |
| AFT | +3.4 | +3.1 | +2.8 | +2.5 | +2.3 | +2.1 | +1.8 | +1.4 | +1.1 | +0.8 | +0.5 | +0.2 | -0.2 | -0.5 | -0.8 | -1.1 | -1.4 | -1.7 | -1.9 | AFT |

27'-0" DRAFT

|     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| FWD | -2.4 | -2.1 | -1.7 | -1.4 | -1.2 | -0.9 | -0.6 | -0.2 | +0.2 | +0.5 | +0.9 | +1.3 | +1.6 | +2.0 | +2.4 | +2.7 | +3.1 | +3.3 | +3.6 | FWD |
| AFT | +4.0 | +3.7 | +3.4 | +3.0 | +2.8 | +2.5 | +2.1 | +1.7 | +1.3 | +1.0 | +0.6 | +0.2 | -0.2 | -0.6 | -1.0 | -1.3 | -1.7 | -2.0 | -2.3 | AFT |

CHANGE IN DRAFTS IN INCHES FOR EACH 100 TONS ADDED

EXAMPLE: Add 500 Tons in No. 11 Tank

Original Drafts FWD 34'-6"  
Correction 5(-0.7)=-3 1/2"  
New Drafts FWD 34'-2 1/2"

AFT 33'-6"  
5(+2.1)=+10 1/2"  
AFT 34'-4 1/2"

NOTE

1. For discharging, reverse + and - signs in the table
2. Corrections for intermediate drafts may be interpreted from the table.



### LOADING SUMMARY

CONDITION:

**LEGEND**

CARGO

BALLAST WATER

FRESH WATER

FUEL OIL

| DESCRIPTION                   | L. TONS | VCG ABOVE BL (FT) | VERTICAL MOMENT (FT TONS) | LCG FROM B FT (+ = AFT) | LONGITUDINAL MOMENT (FT TONS) | FREE SURFACE (FT TONS) |
|-------------------------------|---------|-------------------|---------------------------|-------------------------|-------------------------------|------------------------|
| LIGHT SHIP                    | 72821   | 32.23             | 413,221                   | 23.06 A                 | 295,652                       |                        |
| SHIP'S DEADWEIGHT - SHEET 81B |         |                   |                           |                         |                               |                        |
| CARGO - SHEET 81C             |         |                   |                           |                         |                               |                        |
| CLEAN S.W. BALLAST- SHEET 81D |         |                   |                           |                         |                               |                        |
| TOTALS                        |         |                   |                           |                         |                               |                        |

**STABILITY**

MEAN DRAFT AT LCF

KM

KG

GM (uncorr)

F.S. correction

GM AVAILABLE

**TRIM**

LCF

LCB

LCG

TRIM LVR

MT 1"

TRIM

DRAFT - FP

DRAFT - AP

DETAILS OF SHIP'S DEADWEIGHT - CONDITION

| DESCRIPTION                 | L. TONS | VCG<br>ABOVE BL<br>(FT) | VERTICAL<br>MOMENT<br>(FT TONS) | LCG<br>FROM B FT<br>(+ = AFT) | LONGITUDINAL<br>MOMENT<br>(FT TONS) | FREE<br>SURFACE<br>(FT TONS) |
|-----------------------------|---------|-------------------------|---------------------------------|-------------------------------|-------------------------------------|------------------------------|
| CREW & EFFECTS - DECK HOUSE | 3       | 68.23                   | 205                             | 90.0 F                        | - 270                               | -                            |
| CREW & EFFECTS - AFT HOUSE  | 7       | 56.23                   | 394                             | 256.0 A                       | 1792                                | -                            |
| SPARE TAIL SHAFT & STOWAGE  | 29      | 8.23                    | 239                             | 298.5 A                       | 8656                                | -                            |
| TOTAL CONSTANTS             | (39)    | 21.5                    | (838)                           | 261.0 A                       | (10178)                             | -                            |
| STORES - FORWARD            |         | 54.23                   |                                 | 307.0 F                       |                                     | -                            |
| - DECK HOUSE                |         | 54.23                   |                                 | 90.0 F                        |                                     | -                            |
| - AFT HOUSE                 |         | 54.23                   |                                 | 276.3 A                       |                                     | -                            |
| FRESH WATER - UNDER BRIDGE  |         | 57.43                   |                                 | 90.0 F                        |                                     |                              |
| - DISTILLED                 |         | 42.73                   |                                 | 258.5 A                       |                                     |                              |
| - STEERG GR RM (P)          |         | 48.53                   |                                 | 322.4A                        |                                     |                              |
| - STEERG GR RM (S)          |         | 48.53                   |                                 | 321.5A                        |                                     |                              |
| FUEL OIL - AFT BUNKER (P)   |         | 29.83                   |                                 | 203.8A                        |                                     |                              |
| - AFT BUNKER (S)            |         | 29.83                   |                                 | 203.8A                        |                                     |                              |
| - SETTLER (P)               |         | 37.83                   |                                 | 205.3A                        |                                     |                              |
| - SETTLER (S)               |         | 37.83                   |                                 | 205.3A                        |                                     |                              |
| - FWD BUNKER (P)            |         | 29.53                   |                                 | 267.6F                        |                                     |                              |
| - FWD BUNKER (S)            |         | 28.13                   |                                 | 265.1F                        |                                     |                              |
| TOTALS                      |         |                         |                                 |                               |                                     |                              |

| DESCRIPTION | L. TONS | VCG ABOVE BL (FT) | VERTICAL MOMENT (FT TONS) | LCG FROM # FT (+ = AFT) | LONGITUDINAL MOMENT (FT TONS) | FREE SURFACE (FT TONS) |
|-------------|---------|-------------------|---------------------------|-------------------------|-------------------------------|------------------------|
| NO.1 CL     |         | 26.13             |                           | 227.5 F                 |                               |                        |
| NO.1 P/S    |         | 27.53             |                           | 226.4 F                 |                               |                        |
| NO.2 CL     |         | 26.13             |                           | 187.5 F                 |                               |                        |
| NO.2 P/S    |         | 26.33             |                           | 187.1 F                 |                               |                        |
| NO.3 CL     |         | 26.13             |                           | 147.5 F                 |                               |                        |
| NO.3 P/S    |         | 25.93             |                           | 147.5 F                 |                               |                        |
| NO.4 CL     |         | 26.13             |                           | 107.5 F                 |                               |                        |
| NO.4 P/S    |         | 25.93             |                           | 107.5 F                 |                               |                        |
| NO.5 CL     |         | 26.13             |                           | 67.5 F                  |                               |                        |
| NO.5 P/S    |         | 25.93             |                           | 67.5 F                  |                               |                        |
| NO.6 CL     |         | 26.13             |                           | 27.5 F                  |                               |                        |
| NO.6 P/S    |         | 25.93             |                           | 27.5 F                  |                               |                        |
| NO.7 CL     |         | 26.13             |                           | 12.5 A                  |                               |                        |
| NO.7 P/S    |         | 25.93             |                           | 12.5 A                  |                               |                        |
| NO.8 CL     |         | 26.13             |                           | 52.5 A                  |                               |                        |
| NO.8 P/S    |         | 25.93             |                           | 52.5 A                  |                               |                        |
| NO.9 CL     |         | 26.13             |                           | 92.5 A                  |                               |                        |
| NO.9 P/S    |         | 25.93             |                           | 92.5 A                  |                               |                        |
| NO.10 CL    |         | 26.13             |                           | 132.5 A                 |                               |                        |
| NO.10 P/S   |         | 26.23             |                           | 132.3 A                 |                               |                        |
| NO.11 CL    |         | 26.13             |                           | 172.5 A                 |                               |                        |
| NO.11 P/S   |         | 26.93             |                           | 172.9 A                 |                               |                        |
| TOTALS      |         |                   |                           |                         |                               |                        |

| CONDITION:                         |         |                         |                                 |                               |                                     |                              |
|------------------------------------|---------|-------------------------|---------------------------------|-------------------------------|-------------------------------------|------------------------------|
| DETAILS OF CLEAN SEA WATER BALLAST |         |                         |                                 |                               |                                     |                              |
| DESCRIPTION                        | L. TONS | YCG<br>ABOVE BL<br>(FT) | VERTICAL<br>MOMENT<br>(FT TONS) | LCG<br>FROM B FT<br>(+ = AFT) | LONGITUDINAL<br>MOMENT<br>(FT TONS) | FREE<br>SURFACE<br>(FT TONS) |
| ORIGINAL CLEAN BALLAST TANKS:      |         |                         |                                 |                               |                                     |                              |
| FORE PEAK                          |         | 22.03                   |                                 | 323.0 F                       |                                     |                              |
| AFT PEAK                           |         | 36.53                   |                                 | 333.8 A                       |                                     |                              |
| DEEP TANK, P/S                     |         | 29.13                   |                                 | 295.1 F                       |                                     |                              |
| NO. 6 SIDE TANK P/S                |         | 25.93                   |                                 | 27.5 F                        |                                     |                              |
| TANKS CONVERTED TO CLEAN BALLAST:  |         |                         |                                 |                               |                                     |                              |
| NO. 6 TANK, CL                     |         | 26.13                   |                                 | 27.5 F                        |                                     |                              |
| NO. 7 SIDE TANK, P/S               |         | 25.93                   |                                 | 12.5 A                        |                                     |                              |
| NO. 8 TANK, CL                     |         | 26.13                   |                                 | 52.5 A                        |                                     |                              |
| NO. 9 TANK, CL                     |         | 26.13                   |                                 | 92.5 A                        |                                     |                              |
| FORWARD COFFERDAM                  |         | 27.93                   |                                 | 249.0 F                       |                                     |                              |
| AFT COFFERDAM                      |         | 31.13                   |                                 | 194.0 A                       |                                     |                              |
|                                    |         |                         |                                 |                               |                                     |                              |
|                                    |         |                         |                                 |                               |                                     |                              |
|                                    |         |                         |                                 |                               |                                     |                              |
| TOTALS                             |         |                         |                                 |                               |                                     |                              |

LONGITUDINAL BENDING STRESSES (PSI)