

TRIM & STABILITY CALCULATION

(Drg. No. SHM/261/018 Rev00, 26 November 2020)

VESSEL 20M MEDIUM CRAFT for BSF

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BUILDER SHM

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Prepared by:

Industries Research and Services
Kochi 682 025

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2021

PART-1

INSTRUCTIONS TO MASTER

Refer IF

1.0 GENERAL PARTICULARS

Length OA(Hull)	- 20.282 m
Length WL	- 19.376 m
Breadth MLD.	- 5.000 m
Depth	- 2.946 m
Draft	- 1.110 m
Displacement	- 57.76 t
Speed	- 25.00 knots
Officer	- 4 Nos
Crew	- 18 Nos
Engine	- 1600HP x2
FO Capacity	- 9000 lt
FW Capacity	- 5000x1 lt
Builder	- SHM

1.1 STABILITY CRITERIA

This ship is not required to comply with Schedule 3, Part 1 of the MS Load Line Rules (1979). However stability criteria mentioned the above said rules have been adopted. It is most important to ensure that in any sailing condition the stability complies at least with the following minimum criteria:

REGULATION:

Intact Stability Criteria in accordance with International Code on Intact Stability, 2008 (2008 IS Code)

CRITERIA

1.1.1 Intact Stability (Primary Criterion)

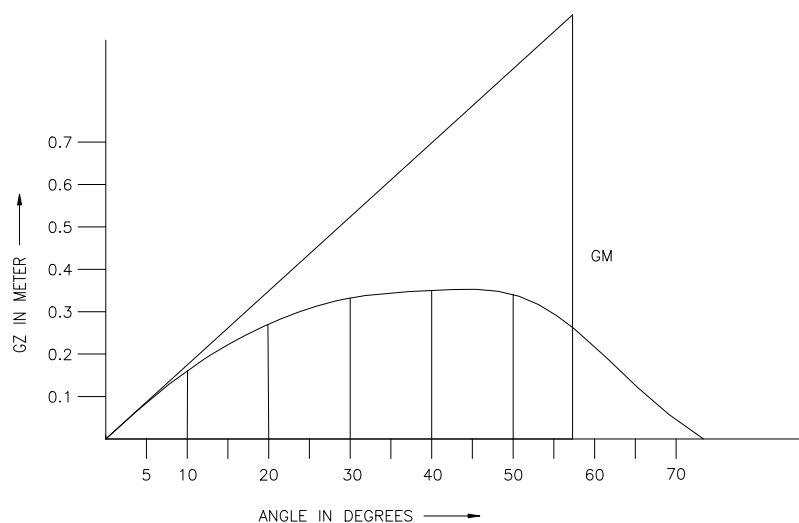
- a. The Initial Metacentric Height (G_0M) should not be less than 0.15 meters.
- b. The Righting lever (GZ) should be at least 0.2 meters at an angle of heel equal to or greater than 30° .
- c. The maximum Righting lever (GZ) should occur at an angle of heel equal to or greater than 25° .
- d. The area under the Righting lever (GZ) curve should not be less than:

0.055 meter radians up to an angle of 30° Angle of Heel.

0.090 meter radians up to an angle of heel of 40° of flooding (θ_f) if this angle is less than 40° .

The angle of flooding (θ_f) is the angle at which lower edge of any openings in the hull, superstructure or deckhouses, being openings which cannot be closed watertight and which are likely to cause progressive flooding are immersed.

0.03 meter radians between the angle of heel of 30° and 40° or between 30° and θ_f if θ_f is less than 40° .



1.1.2 Weather Criterion

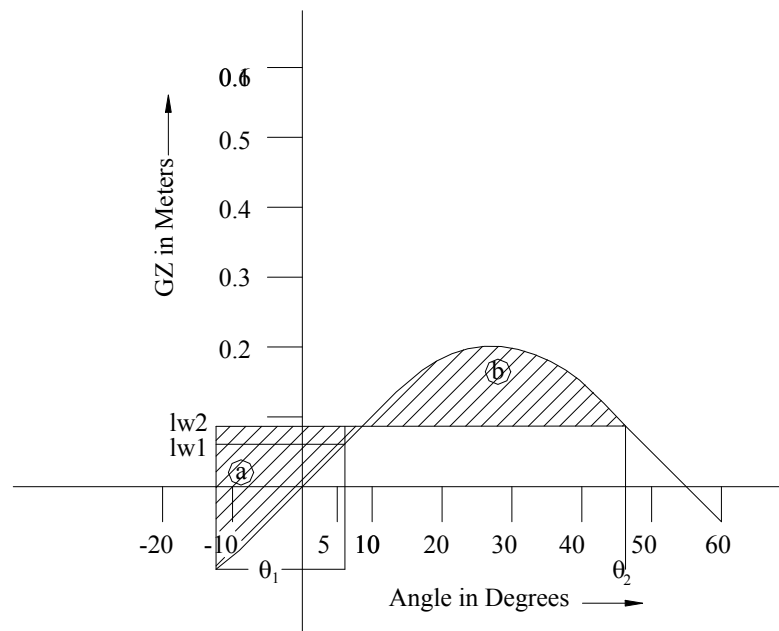
The ability of a ship to withstand the combined effects of beam wind and rolling should be demonstrated for each standard condition of loading, with reference to the figure as follows:

The ship subjected to a steady wind pressure acting perpendicular to the ship's centerline which results in the steady wind heeling lever (l_{w1}).

From the resultant angle of equilibrium (θ_0), the ship is assumed to roll (θ_1) to windward. The angle of heel under the action of steady wind (θ_1) to be limited to 16° or 80% of angle of deck immersion whichever is less.

The ship is subjected to gust wind pressure which results in heeling lever (l_{w2}).

Under these circumstances area "b" should be greater than area "a". Free surface effects should be accounted for the standard conditions of loading.



Weather Criteria Contd.

The angles in the above criteria are defined as follows:

θ_0 = angle of heel under the action of steady wind.
 θ_1 = angle of roll to windward due to wave action.
 θ_2 = angle of down flooding (θ_f) or 50° or whichever is less, where
 θ_f = angle of heel up to which the openings in the hull, superstructures or deckhouses which cannot be closed watertight immerse. In applying this criterion the small openings through which progressive flooding cannot take place need not to be considered as open.

θ_c = angle of second intercept between wind heeling lever and GZ curves.

The wind heeling levers $lw1$ and $lw2$ referred in 1.1.2 is a constant value at all angles of inclination and is calculated as follows:

$$lw1 = P \times A \times Z / (1000 \times 9.81 \times \text{Disp.})$$

$$lw2 = 1.5 lw1$$

$$\text{where } P = 160 \text{ N/m}^2$$

- A = Projected lateral area of the portion of the ship and deck cargo above the waterline (M²)
- Z = Vertical distance from the center of A to the center of underwater lateral area or approximately to a point at one half of the draft (m).
- Disp. = Displacement (t)

..... Continued

The angle of roll (θ_1) referred to in **1.1.2** should be calculated as follows:

$$\theta_1 = 109 \times k \times X_1 \times X_2 \times \sqrt{r \times s}$$

where, X_1 = Factor as shown in Table 1
 X_2 = Factor as shown in Table 2
 s = Factor as shown in Table 4
 k = Factor as follows:
 $k = 1.0$ for round-bilged ship having no bilge or bar keels.
 $k = 0.7$ for ship having sharp bilges.
 $k =$ as shown in Table 3 for a ship having bilge keels, a bar keel or both.
 $r = 0.73 + 0.6 \text{ OG/d}$
where, OG = distance between the center of gravity and the waterline, if it is below.
 d = mean moulded draft of the ship (m)

Table 1		Table 2		Table 3		Table 4	
B/d	X_1	CB	X_2	$Ak \times 100 / (L \times B)$	k	T	s
≤ 2.4	1	≤ 0.45	0.75	0	1	≤ 6	0.1
2.5	0.98	0.5	0.82	1	0.96	7	0.098
2.6	0.96	0.55	0.89	1.5	0.95	8	0.093
2.7	0.95	0.6	0.95	2	0.88	12	0.065
2.8	0.93	0.65	0.97	2.5	0.79	14	0.053
2.9	0.91	≥ 0.70	1	3	0.74	16	0.044
3	0.9			3.5	0.72	18	0.038
3.1	0.88			≥ 4.0	0.7	≥ 20	0.035
3.2	0.86						
3.3	0.84						
3.4	0.82						
≥ 3.5	0.8						

Intermediate values in table 1-4 should be obtained by linear interpolation

Rolling period, $T = 2 \times CB / \sqrt{GM}$ (seconds)
where, $C = 0.373 + 0.023 \times (B/d) - 0.043 \times (L/100)$

The symbols in the above tables and formula for rolling period are defined as follows:

L = waterline length of the ship (m).
B = moulded breadth of the ship (m).
d = moulded draft of the ship (m).
CB = block coefficient.
Ak = total overall area of the bilge keels OR area of the lateral projection of the bar keel, OR sum of these areas (M²).
GM = metacentric height corrected for free surface effect (m).

1.2 OPERATIONAL PROVISIONS AGAINST CAPSIZING

1.2.1 General precautions against capsizing

Compliance with the stability criteria does not ensure immunity against capsizing, regardless of the circumstances, or absolve the master from his responsibilities. Masters should therefore exercise prudence and good seamanship having regard to the season of the year, weather forecasts and the navigational zone and should take the appropriate action as to speed and course warranted by the prevailing circumstances.

Care should be taken that the cargo allocated to the ship is capable of being stowed so that compliance with the criteria can be achieved. If necessary, the amount should be limited to the extent that ballast weight may be required.

Before a voyage commences, care should be taken to ensure that the cargo, cargo handling cranes and sizeable pieces of equipment have been properly stowed or lashed so as to minimize the possibility of both longitudinal and lateral shifting, while at sea, under the effect of acceleration caused by rolling and pitching.

A ship, when engaged in towing operations, should possess an adequate reserve of stability to withstand the anticipated heeling moment arising from the tow line without endangering the towing ship. Deck cargo on board the towing ship should be so positioned as not to endanger the safe working of the crew on deck or impede the proper functioning of the towing equipment and be properly secured. Tow line arrangements should include towing springs and a method of quick release of the tow.

The number of partially filled or slack tanks should be kept to a minimum because of their adverse effect on stability. The negative effect on stability of filled pool tanks should be taken into consideration.

The stability criteria contained in Section 1.1, set minimum values, but no maximum values are recommended. It is advisable to avoid excessive values of metacentric height, since these might lead to acceleration forces which could be prejudicial to the ship, its complement, its equipment and to safe carriage of the cargo. Slack tanks may, in exceptional cases, be used as a means of reducing excessive values of metacentric height. In such cases, due consideration should be given to sloshing effects.

Regard should be paid to the possible adverse effects on stability where certain bulk cargoes are carried. In this connection, attention should be paid to the IMO Code of Safe Practice for Solid Bulk Cargoes.

1.2.2 Operational precautions in heavy weather

All doorways and other openings, through which water can enter into the hull or deckhouses, forecastle, etc., should be suitably closed in adverse weather conditions and accordingly all appliances for this purpose should be maintained on board and in good condition.

Weathertight and watertight hatches, doors, etc., should be kept closed during navigation, except when necessarily opened for the working of the ship and should always be ready for immediate closure and be clearly marked to indicate that these fittings are to be kept closed

except for access. Hatch covers and flush deck scuttles in fishing vessels should be kept properly secured when not in use during fishing operations. All portable deadlights should be maintained in good condition and securely closed in bad weather.

Any closing devices provided for vent pipes to fuel tanks should be secured in bad weather.

1.2 3 Ship handling in heavy weather

In all conditions of loading necessary care should be taken to maintain a seaworthy freeboard.

In adverse weather, the speed of the ship should be reduced if propeller emergence, shipping of water on deck or heavy slamming occurs.

Special attention should be paid when a ship is sailing in following, quartering or head seas because dangerous phenomena such as parametric resonance, broaching to, reduction of stability on the wave crest, and excessive rolling may occur singularly, in sequence or simultaneously in a multiple combination, creating a threat of capsizing. A ship's speed and/or course should be altered appropriately to avoid the above-mentioned phenomena.

Reliance on automatic steering may be dangerous as this prevents ready changes to course which may be needed in bad weather.

Water trapping in deck wells should be avoided. If freeing ports are not sufficient for the drainage of the well, the speed of the ship should be reduced or the course changed, or both.

Freeing ports provided with closing appliances should always be capable of functioning and are not to be locked.

Masters should be aware that steep or breaking waves may occur in certain areas, or in certain wind and current combinations (river estuaries, shallow water areas, funnel shaped bays, etc.). These waves are particularly dangerous, especially for small ships.

In adverse weather, the lateral wind pressure may cause a considerable angle of heel. If anti-heeling measures (e.g., ballasting, use of anti-heeling devices, etc.) are used to compensate for heeling due to wind, changes of the ship's course relative to the wind direction may lead to dangerous angles of heel or capsizing. Therefore, heeling caused by the wind should not be compensated with anti-heeling measures, unless, subject to the approval by the Administration, the vessel has been proven by calculation to have sufficient stability in worst case conditions (i.e. improper or incorrect use, mechanism failure, unintended course change, etc.). Guidance on the use of anti-heeling measures should be provided in the stability booklet.

Use of operational guidelines for avoiding dangerous situations in adverse weather conditions or an on-board computer based system is recommended. The method should be simple to use.

High-speed craft should not be intentionally operated outside the worst intended conditions and limitations specified in the relevant certificates, or in documents referred to therein.

1.3 INSTRUCTION TO MASTER REGARDING RESTRICTION OF OPERATION

The vessel is designed for operation up to sea state 3 and survivability up to sea state 5. However, master should exercise prudence and should take the appropriate action as to speed and course warranted by the prevailing circumstances.

Master should take precaution to avoid excessive heel due to passenger crowding and high speed turns.

1.4 METHOD OF USING TRIMMED HYDROSTATICS.

For any loading condition we get the displacement and LCG. Intermediate loading condition is worked out at trim= 0.0m, thus a trim for that particular loading condition is carried out. The new hydrostatic particulars are then computed at the Nearest Trim to the one obtained above. These hydrostatic particulars are then used to work out the condition. The final trim is then obtained using the following formula.

$$\text{Trim}_{\text{Final}} = (\text{LCG} - \text{LCB}_{\text{Trim Nearest}}) \times \Delta / (\text{MCT}_{\text{Trim Nearest}} \times 100) + \text{Trim}_{\text{Nearest}}$$

Refer to Section 2.6 for terminologies used.

1.5 NOTES ON USE OF FREE SURFACE MOMENTS

Provided a tank is completely filled with liquid, no movement of the liquid is possible and the effect on the ship's stability is precisely the same as if the tank contained solid material.

Immediately a quantity of liquid is withdrawn from the tank the situation changes completely and the stability of the ship is adversely affected by what is known as the free surface effect. This adverse effect on the stability is due to the virtual rise in KG of the ship and therefore loss in GM.

$$\begin{aligned} &\text{Loss in GM or rise in VCG (m) due to Free surface effects} \\ &= \frac{\text{Free surface moment (Tonne meter)}}{\text{Displacement of the ship in Tonnes}} \end{aligned}$$

Refer to **Section 2.5** for free surface moment for various tanks. A worked out example is given in **Section 1.6**.

1.6 EXAMPLE SHOWING USE OF CROSS CURVES OR KN VALUES

The purpose of the cross curves is to enable statical stability curves to be drawn for the ship in any sailing condition

This example gives how to calculate effective KG, draw GZ Curve and find area under GZ Curve. Also refer to **Section 1.7** for determining GZ values for any trimmed condition using KN Values given in **Section 2.9**

The Vertical Centre of Gravity (VCG) or KG is measured from base line. The lowest point of the hull is on the base line.

Example: Assume the displacement of the ship to be 45.00 Tonnes, the Vertical Centre of Gravity (VCG) from keel is 2.105 m at even keel.

The Righting lever $GZ = KN - (KG_{eff} \times \sin \theta)$

where, KN = Cross curve ordinate

KG_{eff} = Centre of gravity from keel corrected for free surface effects

θ = Angle of inclination in degrees

F.S.C = 0.033m

KG = 2.072m

KG_{eff} = KG + FSC = 2.105m

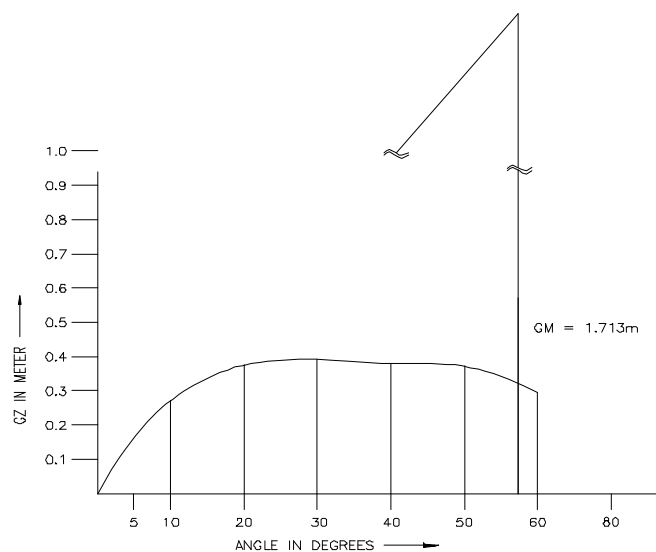
KMt = 3.818 m (from hydrostatic curves in section 2.7)

GM = KMt - KG_{eff} = 1.713 m

GZ Curve Offsets

(From section 2.9)

Angle (θ)	0	10	20	30	40	50	60
KN (m)	0	0.6370	1.0950	1.4440	1.7330	1.9840	2.1190
GZ (m)	0	0.2715	0.3750	0.3915	0.3799	0.3715	0.2960



Calculation of Area under GZ Curve up to 30 degrees

Heel	GZ	SM	GZ x SM
0	0.0000	1	0.0000
10	0.2715	3	0.8144
20	0.3750	3	1.1251
30	0.3915	1	0.3915
		$\Sigma(\text{GZ x SM})$	2.3311

Spacing = 0.17453 radians (10 degrees)

$$\begin{aligned}
 \text{Area up to 30 degrees} &= (3/8) \times \text{Spacing} \times \Sigma(\text{GZ x SM}) \\
 &= (3/8) \times 0.17453 \times 2.3311 \\
 &= 0.15257 \text{ m.rad}
 \end{aligned}$$

Calculation of Area under GZ Curve up to 40 degrees

Heel	GZ	SM	GZ x SM
0	0.0000	1	0.0000
10	0.2715	4	1.0859
20	0.3750	2	0.7501
30	0.3915	4	1.5660
40	0.3799	1	0.3799
		$\Sigma(\text{GZ x SM})$	3.7819

Spacing = 0.17453 radians (10 degrees)

$$\begin{aligned}
 \text{Area up to 40 degrees} &= (1/3) \times \text{Spacing} \times \Sigma(\text{GZ x SM}) \\
 &= (1/3) \times 0.17453 \times 3.7819 \\
 &= 0.22002 \text{ m.rad}
 \end{aligned}$$

1.7 SAMPLE CALCULATION SHOWING DETERMINION OF GZ VALUES AT TRIMMED CONDITIONS, USING TRIMMED KN VALUES

The booklet has KN Values or Cross Curves (**Section 2.9**) for Even Keel, 0.3m aft trim, 0.2m aft trim, 0.1m aft trim, 0.1m fwd trim, and 0.2m fwd trim

KN Values can be interpolated for intermediate trims using the tables and from the KN values GZ values can be determined. Following is an worked out example.

Assuming Displacement = 45.97 t

Trim = 0.214 m aft trim

$KG_{\text{Fluid}} = 2.100 \text{ m}$

Step1- Identify appropriate table

In this case the tables for 0.20m trim by aft and 0.30m trim by aft is to be used.

KN Values for displacements 45t and 47t is to be read.

Step2 -Read KN Values for displacements 45t and 47t for 0.20m trim by aft and interpolate for $\Delta = 45.97\text{t}$

	Heel Angles (deg)					
Δ	10	20	30	40	50	60
45.00	0.6310	1.0960	1.4500	1.7430	1.9860	2.1070
47.00	0.6210	1.0870	1.4420	1.7380	1.9790	2.0990

Interpolated values for $\Delta = 45.97\text{t}$

45.97	0.6262	1.0916	1.4461	1.7406	1.9826	2.1031
-------	--------	--------	--------	--------	--------	--------

Sample interpolation for 10 degrees heel

$$\text{For } \Delta = 45.97\text{t} \quad KN_{10 \text{ degree}} = 0.6310 + (0.6210 - 0.6310) \times (45.97 - 45.00) / (47.00 - 45.00) \\ = 0.6262 \text{ m}$$

Step3- Read KN Values for displacements 45t and 47t for 0.30m trim by aft and interpolate for $\Delta = 45.97\text{t}$

	Heel Angles (deg)					
Δ	10	20	30	40	50	60
45.00	0.6270	1.0960	1.4520	1.7470	1.9860	2.0990
47.00	0.6160	1.0870	1.4450	1.7420	1.9780	2.0910

Interpolated values for $\Delta = 45.97\text{t}$

45.97	0.6217	1.0916	1.4486	1.7446	1.9821	2.0951
-------	--------	--------	--------	--------	--------	--------

Step4- Interpolate KN Values for trim= 0.214m trim by aft from values calculated 0.20m trim by aft and 0.30m trim by aft in Step2 and Step3

	Heel Angles (deg)					
	10	20	30	40	50	60
0.20m by aft	0.6262	1.0916	1.4461	1.7406	1.9826	2.1031
0.30m by aft	0.6217	1.0916	1.4486	1.7446	1.9821	2.0951
0.214m by aft	0.6255	1.0916	1.4465	1.7411	1.9825	2.1020

Sample interpolation for 10 degrees heel

For trim = 0.214m by aft

$$\text{KN}_{10 \text{ degree}} = 0.6262 + (0.6217 - 0.6262) \times (0.214 - 0.20) / (0.30 - 0.20) \\ = 0.6255 \text{ m}$$

Step5- Determine GZ Values from KN Values obtained from Step4

GZ Values

Heel Angles (deg)					
10	20	30	40	50	60
0.2609	0.3734	0.3965	0.3913	0.3738	0.2833

$$\text{GZ} = \text{KN} - \text{KG}_{\text{Fluid}} \times \sin(\theta)$$

Sample for 10 degrees

$$\text{GZ} = 0.6255 - 2.100 \times \sin(10) = 0.2609 \text{ m}$$

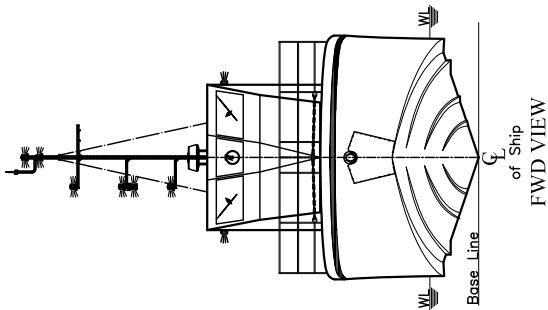
1.8 METRIC CONVERSION TABLE

Multiply by	To convert	To obtain	-----
0.03937	Millimeters	Inches	25.4
0.3937	Centimeters	Inches	2.54
3.2808	Meters	Feet	0.3048
2.2046	Kilograms	Pounds	0.45359
0.0009842	Kilograms	Tons (2240 Pounds)	1016.047
0.9842	Metric Tons (1000 KG)	Tons (2240 Pounds)	1.016
2.4998	Metric Tons/Centimeter (of immersion)	Tons per inch (of immersion)	0.4
8.2014	Metric Ton Meter (Moment to change trim by one centimeter)	Foot Ton units (Moment to change trim by one inch)	0.122
57.3	Radians	Degrees	0.01745
187.9767	Meter Radians	Feet Degrees	0.0053
0.534	Kilometers	Nautical miles	1.852
To Obtain		To convert	Multiply by above

PART-2

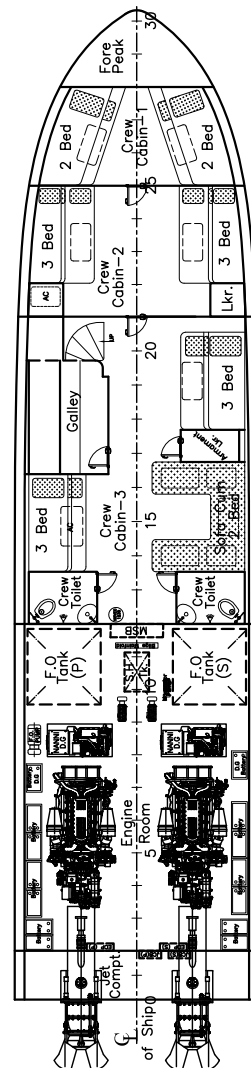
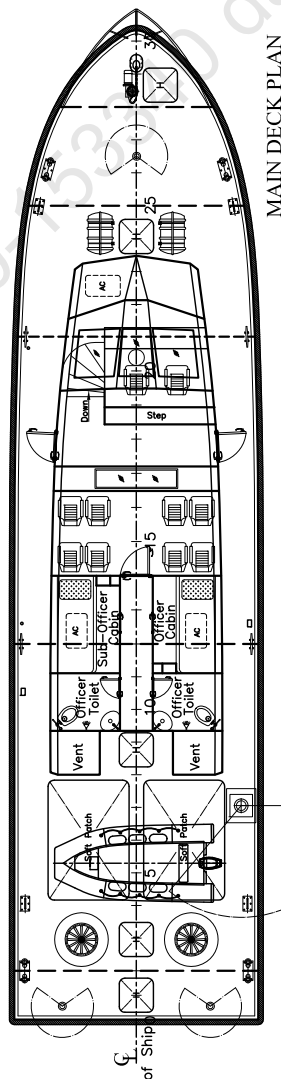
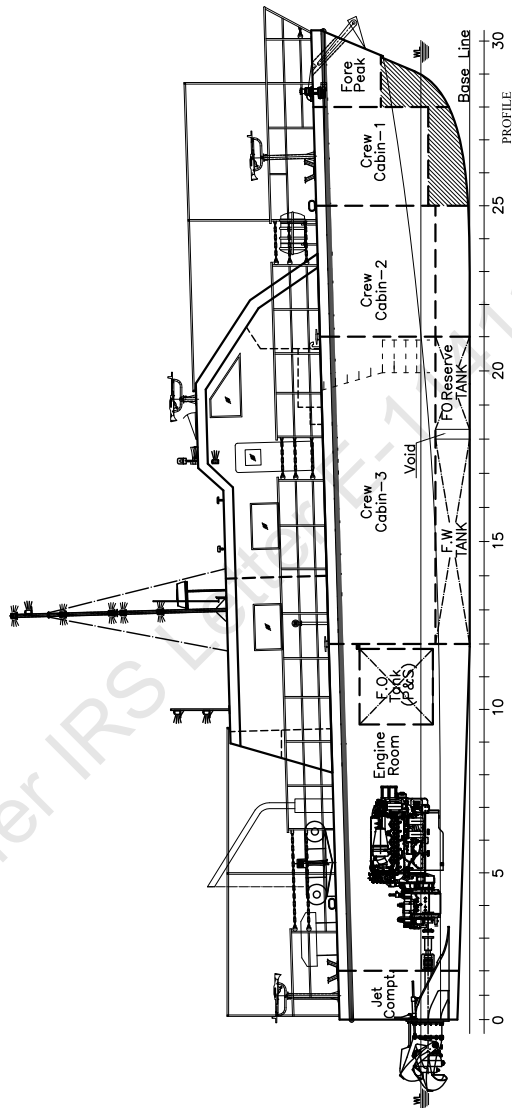
**DATA REQUIRED FOR STABILITY ASSESS-
MENT**

2.1 GENERAL ARRANGEMENT



MAIN PARTICULARS

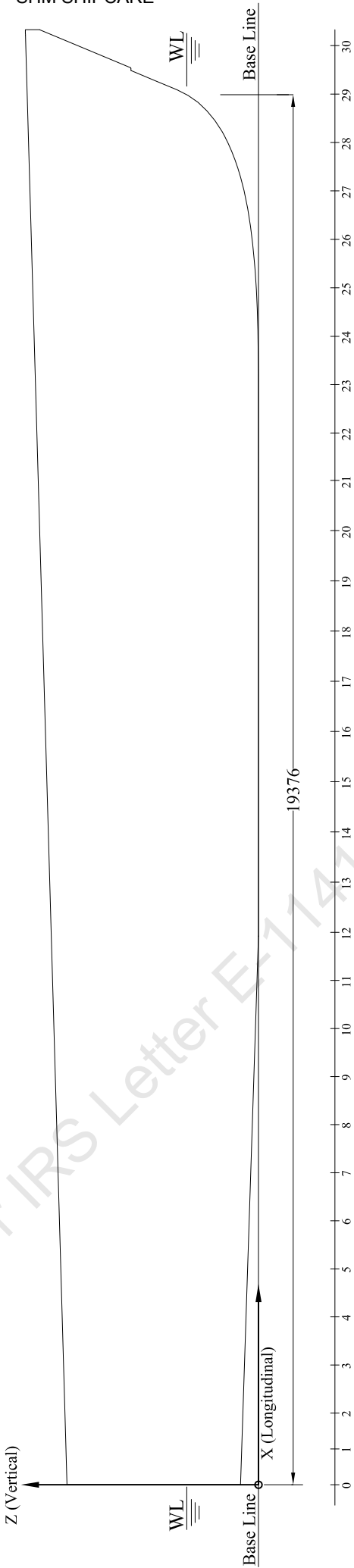
LENGTH OVERALL	22.150 M
HULL LENGTH	20.282 M
BEAM MOULDED	5.000 M
BEAM (EXTREME)	5.130 M
DEPTH MOULDED	2.946 M
LWL	19.376 M
DRAFT	1.110 M
SPEED @85%AMCR	25 KNOTS
COMPLEMENT	22 NOS.
OFFICER	4 NOS.
CREW	18 NOS.
SEA STATE	OPERATIONAL SEA STATE - 3
SURVIVABILITY SEA STATE	- 5
MAIN ENGINE	2 x CAT 32 ACERT 1600BHP
PROPULSION	2 x WATER JET DOEN DI 200-AWJ
GEARBOX	2 x REINTJES WVS 430/L RATIO 1.485:1
GENERATOR	2 x NANNI QLS47T 37.8 Kw, 50Hz
FUEL CAPACITY	9000 LITERS
FRESH WATER CAPACITY	5000 LITERS



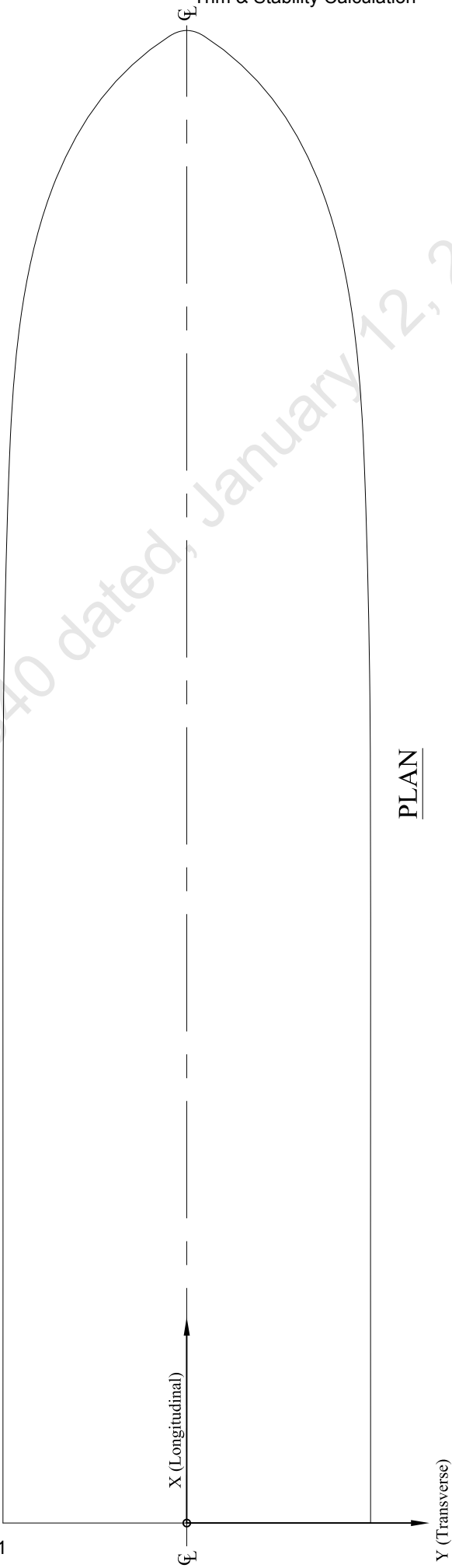
2.2 REFERENCE AXIS

Yard No.261
SHM SHIPCARE

SHM-261-018 Rev.00
Trim & Stability Calculation

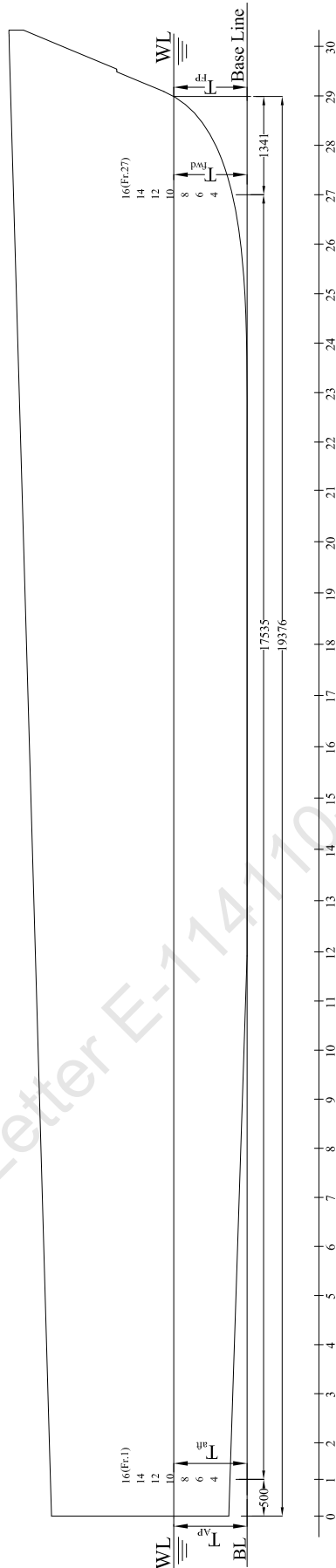


PROFILE



PLAN

PROFILE



DRAFT MEASUREMENT AND TRIM CALCULATION

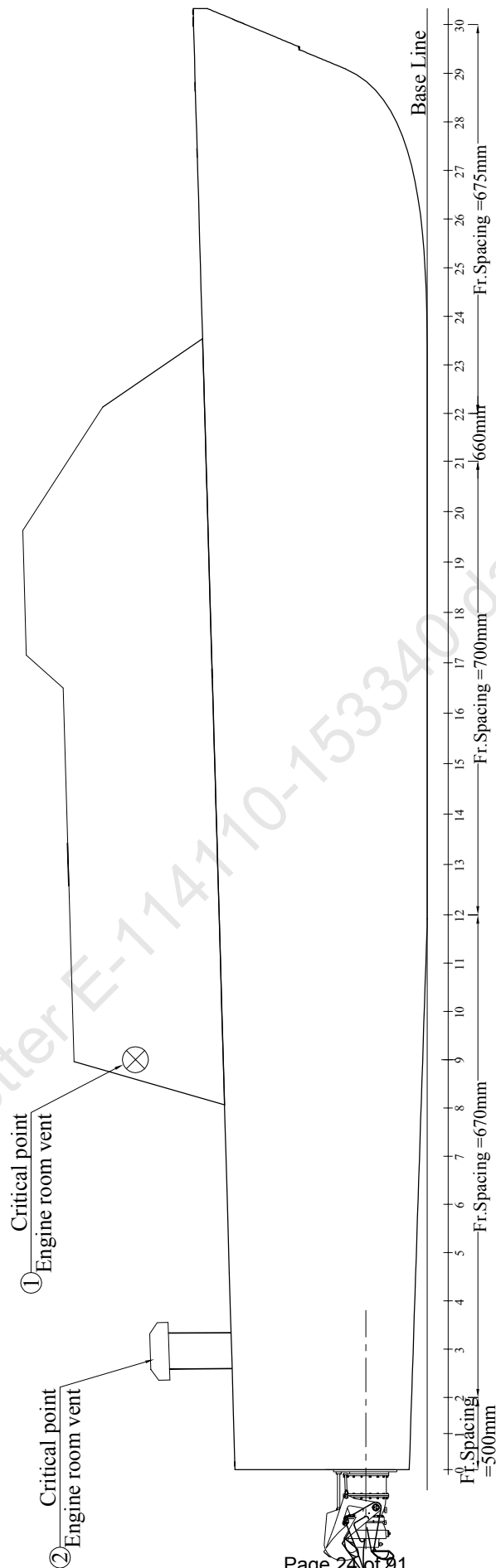
$$\frac{T_{AP} = T_{AFT} - (T_{FWD} - T_{AFT}) \times 0.500}{17.535}$$

$$T_{FP} = \frac{T_{FWD} + (T_{FWD} - T_{AFT}) \times 1.341}{17.535}$$

$$= \frac{\mathbf{T}_{\text{Ap}} + \mathbf{T}_{\text{FP}}}{2}$$

$$\text{Trim} = T_{\text{Ap}} - T_{\text{FP}}$$

2.4 LOCATION OF DOWN FLOODING POINT



PROFILE

Item No.	Description	L (m)	T (m)	V (m)	Side
①	Engine room vent	5.690f	1.780	3.711	P & S
②	Engine room vent	1.650f	1.395	3.315	P & S

TANK SOUNDINGS ARE NOT PART OF THIS APPROVAL
2.5 TANK CAPACITY

TANK CHARACTERISTICS

No Trim, No Heel

Tank: FOTK.P, Contents: DIESEL OIL at 0.870 Specific Gravity
FO TANK.P

Ref Ht	Load	Volume CU. METERS	Weight METRIC TON	Center of Gravity			GML	FSM m. -MT
				LCG	TCG	VCG		
-915	.050	0.180	0.16	6.625f	1.490p	0.877	2.669	0.418
-990	.100	0.360	0.31	6.625f	1.490p	0.915	1.335	0.418
-1065	.150	0.541	0.47	6.625f	1.490p	0.952	0.890	0.418
-1140	.200	0.721	0.63	6.625f	1.490p	0.990	0.667	0.418
-1215	.250	0.901	0.78	6.625f	1.490p	1.027	0.534	0.418
-1290	.300	1.081	0.94	6.625f	1.490p	1.065	0.445	0.418
-1365	.350	1.261	1.10	6.625f	1.490p	1.103	0.381	0.418
-1440	.400	1.442	1.25	6.625f	1.490p	1.140	0.334	0.418
-1515	.450	1.622	1.41	6.625f	1.490p	1.178	0.297	0.418
-1590	.500	1.802	1.57	6.625f	1.490p	1.215	0.267	0.418
-1665	.550	1.982	1.72	6.625f	1.490p	1.253	0.243	0.418
-1740	.600	2.162	1.88	6.625f	1.490p	1.290	0.222	0.418
-1815	.650	2.342	2.04	6.625f	1.490p	1.328	0.205	0.418
-1890	.700	2.523	2.19	6.625f	1.490p	1.365	0.191	0.418
-1965	.750	2.703	2.35	6.625f	1.490p	1.403	0.178	0.418
-2040	.800	2.883	2.51	6.625f	1.490p	1.440	0.167	0.418
-2115	.850	3.063	2.66	6.625f	1.490p	1.478	0.157	0.418
-2190	.900	3.243	2.82	6.625f	1.490p	1.515	0.148	0.418
-2265	.950	3.424	2.98	6.625f	1.490p	1.553	0.140	0.418
	1.000	3.604	3.14	6.625f	1.490p	1.590		

Ref point heights in mm.---Other distances in METERS.-----
FOTK.P Reference Point: Long.= 0.000 Trans.= 0.000 Vert.= 0.000

TANK SOUNDINGS ARE NOT PART OF THIS APPROVAL

TANK CHARACTERISTICS

No Trim, No Heel

Tank: F0TK.S, Contents: DIESEL OIL at 0.870 Specific Gravity
F0 TANK.S

Ref Ht	Load	Volume CU. METERS	Weight METRIC TON	Center of Gravity			GML	FSM m. -MT
				LCG	TCG	VCG		
-915	.050	0.180	0.16	6.625f	1.490s	0.877	2.669	0.418
-990	.100	0.360	0.31	6.625f	1.490s	0.915	1.335	0.418
-1065	.150	0.541	0.47	6.625f	1.490s	0.952	0.890	0.418
-1140	.200	0.721	0.63	6.625f	1.490s	0.990	0.667	0.418
-1215	.250	0.901	0.78	6.625f	1.490s	1.027	0.534	0.418
-1290	.300	1.081	0.94	6.625f	1.490s	1.065	0.445	0.418
-1365	.350	1.261	1.10	6.625f	1.490s	1.103	0.381	0.418
-1440	.400	1.442	1.25	6.625f	1.490s	1.140	0.334	0.418
-1515	.450	1.622	1.41	6.625f	1.490s	1.178	0.297	0.418
-1590	.500	1.802	1.57	6.625f	1.490s	1.215	0.267	0.418
-1665	.550	1.982	1.72	6.625f	1.490s	1.253	0.243	0.418
-1740	.600	2.162	1.88	6.625f	1.490s	1.290	0.222	0.418
-1815	.650	2.342	2.04	6.625f	1.490s	1.328	0.205	0.418
-1890	.700	2.523	2.19	6.625f	1.490s	1.365	0.191	0.418
-1965	.750	2.703	2.35	6.625f	1.490s	1.403	0.178	0.418
-2040	.800	2.883	2.51	6.625f	1.490s	1.440	0.167	0.418
-2115	.850	3.063	2.66	6.625f	1.490s	1.478	0.157	0.418
-2190	.900	3.243	2.82	6.625f	1.490s	1.515	0.148	0.418
-2265	.950	3.424	2.98	6.625f	1.490s	1.553	0.140	0.418
	1.000	3.604	3.14	6.625f	1.490s	1.590		

Ref point heights in mm.---Other distances in METERS.-----

F0TK.S Reference Point: Long.= 0.000 Trans.= 0.000 Vert.= 0.000

TANK SOUNDINGS ARE NOT PART OF THIS APPROVAL

TANK CHARACTERISTICS

No Trim, No Heel

Tank: FORESVTK.C, Contents: DIESEL OIL at 0.870 Specific Gravity
FO RESERVE.C

Ref Ht	Load	Volume CU. METERS	Weight METRIC TON	Center of Gravity			GML	FSM m. -MT
				LCG	TCG	VCG		
-145	.050	0.090	0.08	13.057f	0.000	0.097	3.766	0.044
-205	.100	0.180	0.16	13.057f	0.000	0.137	2.655	0.123
-252	.150	0.271	0.24	13.055f	0.000	0.168	2.274	0.259
-289	.200	0.361	0.31	13.053f	0.000	0.193	1.920	0.393
-323	.250	0.451	0.39	13.056f	0.000	0.216	1.686	0.475
-355	.300	0.541	0.47	13.056f	0.000	0.237	1.507	0.607
-384	.350	0.632	0.55	13.056f	0.000	0.256	1.393	0.762
-411	.400	0.722	0.63	13.056f	0.000	0.273	1.303	0.929
-437	.450	0.812	0.71	13.056f	0.000	0.290	1.251	1.143
-460	.500	0.902	0.79	13.055f	0.000	0.306	1.191	1.382
-483	.550	0.993	0.86	13.054f	0.000	0.321	1.113	1.587
-505	.600	1.083	0.94	13.055f	0.000	0.335	1.060	1.751
-526	.650	1.173	1.02	13.056f	0.000	0.349	0.990	1.797
-547	.700	1.263	1.10	13.058f	0.000	0.363	0.942	1.860
-567	.750	1.354	1.18	13.059f	0.000	0.376	0.885	1.906
-588	.800	1.444	1.26	13.061f	0.000	0.388	0.834	1.921
-609	.850	1.534	1.33	13.063f	0.000	0.401	0.792	1.946
-629	.900	1.624	1.41	13.064f	0.000	0.413	0.749	1.949
-650	.950	1.714	1.49	13.065f	0.000	0.425	0.709	1.949
	1.000	1.805	1.57	13.067f	0.000	0.436		

Ref point heights in mm.---Other distances in METERS.-----

FORESVTK.C Reference Point: Long.= 0.000 Trans.= 0.000 Vert.= 0.000

TANK SOUNDINGS ARE NOT PART OF THIS APPROVAL

TANK CHARACTERISTICS

No Trim, No Heel

Tank: FWTK.C, Contents: FRESH WATER at 1.000 Specific Gravity
FW TANK.C

Ref	Ht	Load	Volume CU. METERS	Weight METRIC TON	Center of Gravity			GML	FSM m.-MT
					LCG	TCG	VCG		
-139	.050		0.252	0.25	9.800f	0.000	0.093	22.199	0.212
-197	.100		0.504	0.50	9.800f	0.000	0.131	15.681	0.597
-241	.150		0.756	0.76	9.802f	0.000	0.161	13.312	1.147
-278	.200		1.008	1.01	9.805f	0.000	0.186	11.089	1.681
-311	.250		1.261	1.26	9.803f	0.000	0.208	9.888	2.344
-341	.300		1.513	1.51	9.802f	0.000	0.227	9.024	3.080
-369	.350		1.765	1.76	9.801f	0.000	0.246	8.354	3.891
-394	.400		2.017	2.02	9.801f	0.000	0.263	7.822	4.808
-418	.450		2.269	2.27	9.802f	0.000	0.279	7.390	5.658
-441	.500		2.521	2.52	9.806f	0.000	0.294	6.786	5.841
-464	.550		2.773	2.77	9.810f	0.000	0.308	6.176	5.863
-487	.600		3.025	3.03	9.813f	0.000	0.322	5.668	5.885
-510	.650		3.277	3.28	9.816f	0.000	0.336	5.239	5.907
-533	.700		3.530	3.53	9.818f	0.000	0.349	4.870	5.929
-556	.750		3.782	3.78	9.819f	0.000	0.362	4.551	5.951
-579	.800		4.034	4.03	9.821f	0.000	0.375	4.272	5.973
-602	.850		4.286	4.29	9.822f	0.000	0.388	4.025	5.995
-624	.900		4.538	4.54	9.823f	0.000	0.400	3.806	6.017
-647	.950		4.790	4.79	9.824f	0.000	0.412	3.610	6.039
	1.000		5.042	5.04	9.825f	0.000	0.425		

Ref point heights in mm.---Other distances in METERS.-----

FWTK.C Reference Point: Long.= 0.000 Trans.= 0.000 Vert.= 0.000

TANK SOUNDINGS ARE NOT PART OF THIS APPROVAL

TANK CHARACTERISTICS

No Trim, No Heel

Tank: SEWAGTK.C, Contents: SEWAGE at 1.025 Specific Gravity
 SEWAGE TANK.C

Ref Ht	Load	Volume CU. METERS	Weight METRIC TON	Center of Gravity			GML	FSM m. -MT
				LCG	TCG	VCG		
-410	.050	0.010	0.01	7.250f	0.000	0.397	0.834	0.022
-435	.100	0.020	0.02	7.250f	0.000	0.410	0.417	0.022
-460	.150	0.030	0.03	7.250f	0.000	0.422	0.278	0.022
-485	.200	0.039	0.04	7.250f	0.000	0.435	0.209	0.022
-510	.250	0.049	0.05	7.250f	0.000	0.447	0.167	0.022
-535	.300	0.059	0.06	7.250f	0.000	0.460	0.139	0.022
-560	.350	0.069	0.07	7.250f	0.000	0.472	0.119	0.022
-585	.400	0.079	0.08	7.250f	0.000	0.485	0.104	0.022
-610	.450	0.089	0.09	7.250f	0.000	0.497	0.093	0.022
-635	.500	0.099	0.10	7.250f	0.000	0.510	0.083	0.022
-660	.550	0.108	0.11	7.250f	0.000	0.522	0.076	0.022
-685	.600	0.118	0.12	7.250f	0.000	0.535	0.070	0.022
-710	.650	0.128	0.13	7.250f	0.000	0.547	0.064	0.022
-735	.700	0.138	0.14	7.250f	0.000	0.560	0.060	0.022
-760	.750	0.148	0.15	7.250f	0.000	0.572	0.056	0.022
-785	.800	0.158	0.16	7.250f	0.000	0.585	0.052	0.022
-810	.850	0.167	0.17	7.250f	0.000	0.597	0.049	0.022
-835	.900	0.177	0.18	7.250f	0.000	0.610	0.046	0.022
-860	.950	0.187	0.19	7.250f	0.000	0.622	0.044	0.022
	1.000	0.197	0.20	7.250f	0.000	0.635		

Ref point heights in mm.---Other distances in METERS.-----

SEWAGTK.C Reference Point: Long.= 0.000 Trans.= 0.000 Vert.= 0.000

2.6 HYDROSTATIC TERMINOLOGY

Following is the list of Abbreviations used in Hydrostatic tables

SL. No.	Abbreviation or Term	Expansion	Remarks
1	KG	Vertical Center of Gravity of the vessel from Keel	Measured from baseline
2	KML	Longitudinal Metacentric height from Keel	Measured from baseline
3	KMT	Transverse Metacentric height from Keel	Measured from baseline
4	LCB	Longitudinal Center of Buoyancy	Measured from Frame 0
5	LCF	Longitudinal Center of Floatation	Measured from Frame 0
6	LCF Draft	Draft at Longitudinal Center of Floatation	
7	Moment/deg Trim	Moment needed to change a degree trim	
8	VCB	Vertical Center of Buoyancy	Measured from baseline
9	VCG	Vertical Center of Gravity	Measured from baseline
10	Weight/cm	Weight needed per cm immersion	
11	WPA	Water Plane Area	

2.7 HYDROSTATIC TABLES

(Even Keel, 0.30m Aft, 0.20m Aft, 0.10m Aft, 0.10m Fwd & 0.20m Fwd)

HYDROSTATIC PROPERTIES

No Trim, No Heel, Fixed VCG = 0.000

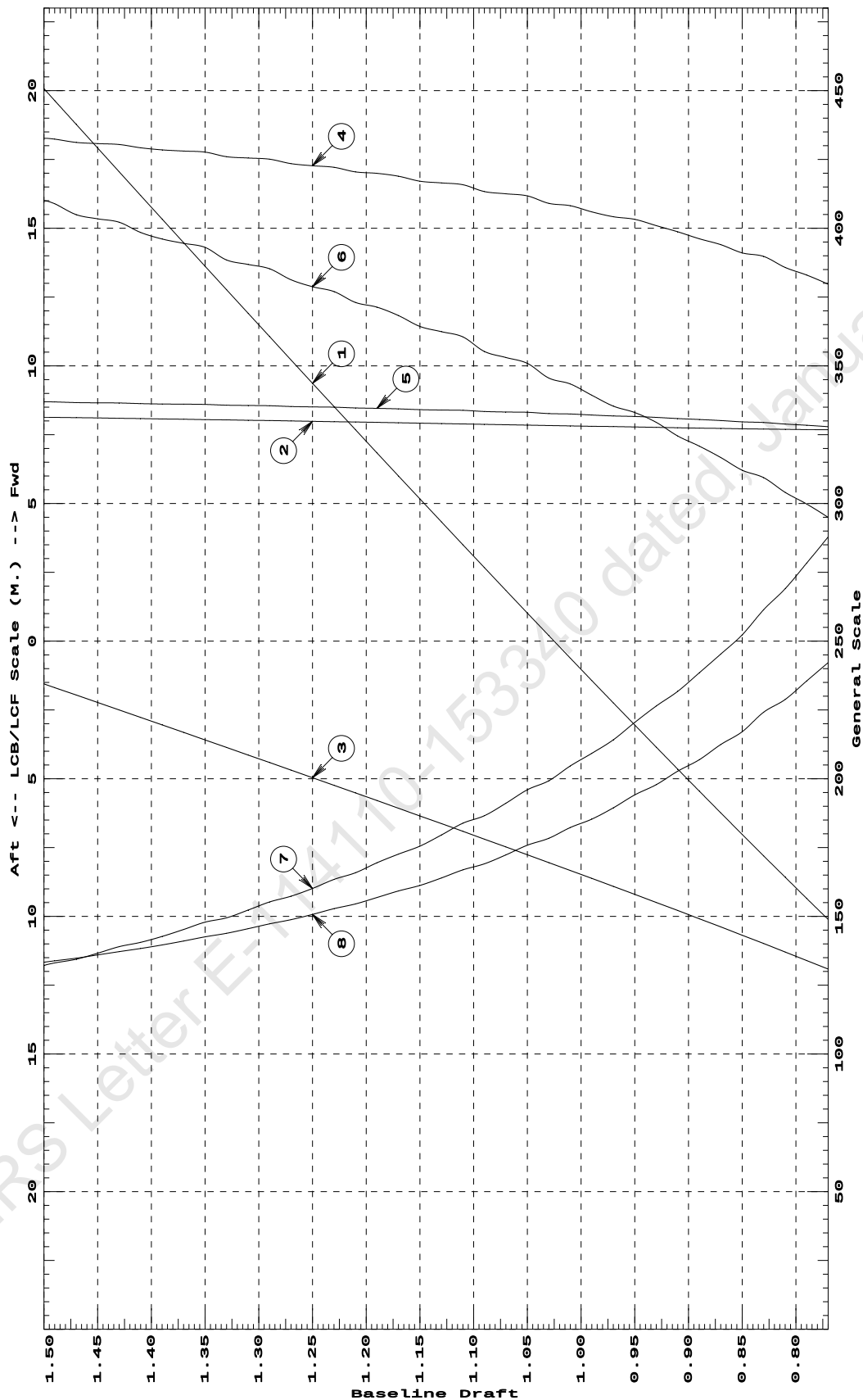
LCF Draft	Displacement Weight(MT)	Buoyancy-Ctr.		Weight/ cm	Moment/ cm trim		KML	KMT
-----	-----	LCB	VCB	-----	LCF	-----	-----	-----
0.770	29.78	7.679f	0.523	0.76	7.791f	0.88	57.57	4.844
0.790	31.30	7.686f	0.536	0.77	7.843f	0.90	55.67	4.710
0.810	32.84	7.695f	0.548	0.77	7.885f	0.91	53.81	4.576
0.830	34.39	7.704f	0.561	0.78	7.944f	0.93	52.29	4.484
0.850	35.95	7.715f	0.573	0.78	7.967f	0.94	50.46	4.342
0.870	37.52	7.727f	0.585	0.79	8.013f	0.95	49.06	4.249
0.890	39.11	7.739f	0.597	0.79	8.051f	0.96	47.69	4.138
0.910	40.70	7.752f	0.608	0.80	8.088f	0.97	46.35	4.055
0.930	42.29	7.765f	0.620	0.80	8.129f	0.99	45.28	3.957
0.950	43.90	7.779f	0.632	0.81	8.164f	1.00	44.10	3.883
0.970	45.52	7.793f	0.644	0.81	8.181f	1.01	42.83	3.788
0.990	47.14	7.807f	0.655	0.81	8.214f	1.02	41.85	3.707
1.010	48.77	7.821f	0.667	0.82	8.250f	1.03	40.94	3.646
1.030	50.40	7.835f	0.678	0.82	8.265f	1.04	39.86	3.567
1.050	52.04	7.849f	0.690	0.82	8.312f	1.05	39.20	3.517
1.070	53.69	7.864f	0.701	0.83	8.326f	1.06	38.22	3.447
1.090	55.34	7.878f	0.712	0.83	8.341f	1.07	37.31	3.382
1.110	57.00	7.892f	0.724	0.83	8.384f	1.08	36.77	3.338
1.130	58.66	7.906f	0.735	0.83	8.396f	1.09	35.91	3.279
1.150	60.33	7.920f	0.746	0.83	8.408f	1.09	35.11	3.225
1.170	62.00	7.933f	0.757	0.84	8.439f	1.10	34.53	3.185
1.190	63.68	7.947f	0.768	0.84	8.459f	1.11	33.89	3.137
1.210	65.36	7.960f	0.779	0.84	8.469f	1.12	33.18	3.091
1.230	67.05	7.974f	0.791	0.84	8.499f	1.13	32.68	3.056
1.250	68.74	7.987f	0.802	0.85	8.509f	1.14	32.03	3.015
1.270	70.43	8.000f	0.813	0.85	8.524f	1.14	31.47	2.976
1.290	72.13	8.012f	0.824	0.85	8.553f	1.16	31.05	2.946
1.310	73.83	8.025f	0.835	0.85	8.562f	1.16	30.46	2.911
1.330	75.53	8.037f	0.846	0.85	8.570f	1.17	29.89	2.877
1.350	77.24	8.049f	0.856	0.86	8.602f	1.18	29.58	2.851
1.370	78.95	8.061f	0.867	0.86	8.609f	1.18	29.05	2.821
1.390	80.67	8.073f	0.878	0.86	8.616f	1.19	28.54	2.792
1.410	82.38	8.085f	0.889	0.86	8.630f	1.20	28.11	2.767
1.430	84.10	8.096f	0.900	0.86	8.654f	1.21	27.80	2.744
1.450	85.82	8.107f	0.911	0.86	8.659f	1.21	27.33	2.720
1.470	87.55	8.118f	0.922	0.86	8.666f	1.21	26.89	2.697
1.490	89.28	8.129f	0.932	0.86	8.690f	1.23	26.62	2.677
1.500	90.14	8.135f	0.938	0.87	8.695f	1.23	26.43	2.667

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.

Trim is per 19.38m.

Draft is from Baseline.

HYDROSTATIC PROPERTIES at LEVEL TRIM



- ① Displacement 1=.2 MT
- ② LCB (use top scale)
- ③ VCB (KB) 1=.004 M.
- ④ Immersion 1=.002 MT/cm
- ⑤ WPA 1=.195 Sq.M.
- ⑥ LCF (use top scale)
- ⑦ KML 1=.2 M.
- ⑧ KMT 1=.02 M.

Specific Gravity = 1.025 Assumed KG = 0.00 M.
Trim is per 19.376 M. "K" = Base plane

HYDROSTATIC PROPERTIES

Trim: Aft 0.300/19.376, No Heel, Fixed VCG = 0.000

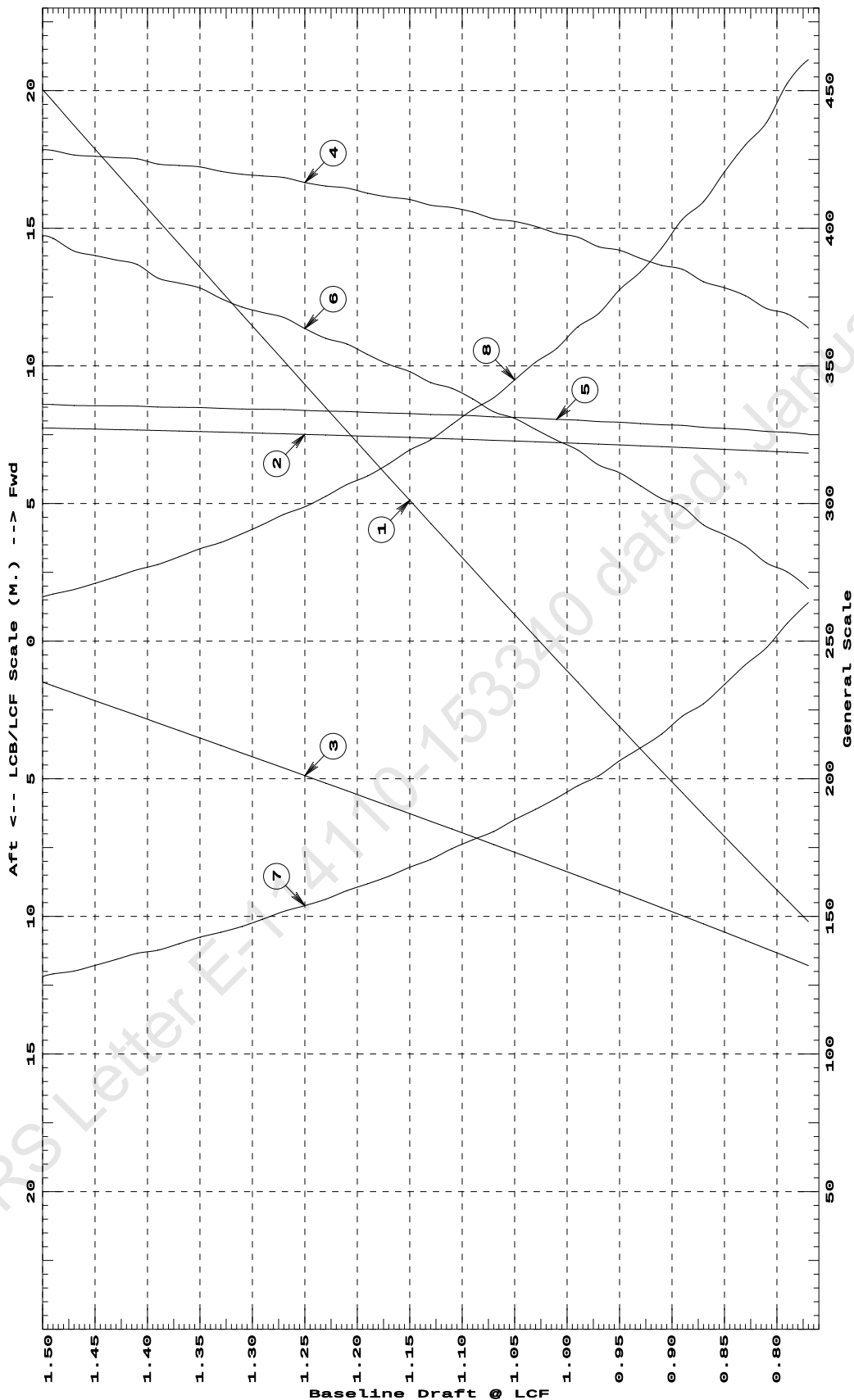
LCF	Displacement	Buoyancy-Ctr.		Weight/	Moment/			
Draft---	Weight(MT)---	LCB----	VCB-----	cm-----	LCF----	cm trim----	KML-----	KMT
0.770	29.62	6.831f	0.528	0.73	7.513f	0.81	52.80	4.612
0.790	31.16	6.866f	0.541	0.74	7.585f	0.83	51.31	4.527
0.810	32.68	6.900f	0.553	0.74	7.618f	0.84	49.52	4.384
0.830	34.25	6.935f	0.565	0.75	7.687f	0.85	48.29	4.303
0.850	35.81	6.968f	0.577	0.76	7.731f	0.87	46.85	4.205
0.870	37.36	7.001f	0.589	0.76	7.766f	0.88	45.46	4.097
0.890	38.98	7.034f	0.601	0.77	7.836f	0.90	44.55	4.033
0.910	40.55	7.065f	0.613	0.77	7.862f	0.91	43.25	3.928
0.930	42.16	7.096f	0.624	0.78	7.906f	0.92	42.24	3.842
0.950	43.77	7.127f	0.636	0.78	7.953f	0.93	41.31	3.777
0.970	45.37	7.157f	0.647	0.79	7.976f	0.94	40.22	3.690
0.990	47.02	7.187f	0.659	0.79	8.031f	0.96	39.48	3.641
1.010	48.65	7.215f	0.670	0.80	8.058f	0.97	38.59	3.564
1.030	50.29	7.243f	0.682	0.80	8.096f	0.98	37.78	3.513
1.050	51.93	7.271f	0.693	0.80	8.130f	0.99	37.03	3.449
1.070	53.57	7.297f	0.704	0.81	8.148f	1.00	36.17	3.384
1.090	55.24	7.323f	0.716	0.81	8.189f	1.01	35.56	3.341
1.110	56.90	7.349f	0.727	0.82	8.219f	1.03	34.92	3.286
1.130	58.55	7.374f	0.738	0.82	8.234f	1.03	34.14	3.231
1.150	60.23	7.398f	0.749	0.82	8.268f	1.04	33.57	3.194
1.170	61.90	7.422f	0.760	0.82	8.285f	1.05	32.91	3.144
1.190	63.58	7.445f	0.771	0.83	8.312f	1.06	32.37	3.101
1.210	65.28	7.468f	0.783	0.83	8.344f	1.07	31.87	3.069
1.230	66.95	7.490f	0.794	0.83	8.356f	1.08	31.25	3.026
1.250	68.65	7.512f	0.805	0.83	8.381f	1.09	30.78	2.988
1.270	70.36	7.533f	0.816	0.84	8.413f	1.10	30.36	2.961
1.290	72.05	7.554f	0.827	0.84	8.423f	1.11	29.80	2.924
1.310	73.74	7.574f	0.837	0.84	8.435f	1.11	29.27	2.890
1.330	75.45	7.594f	0.848	0.84	8.455f	1.12	28.85	2.859
1.350	77.17	7.613f	0.859	0.84	8.483f	1.13	28.49	2.836
1.370	78.87	7.632f	0.870	0.85	8.493f	1.14	28.01	2.806
1.390	80.58	7.651f	0.881	0.85	8.503f	1.15	27.55	2.779
1.410	82.32	7.669f	0.892	0.85	8.539f	1.16	27.31	2.759
1.430	84.04	7.687f	0.903	0.85	8.547f	1.17	26.87	2.734
1.450	85.75	7.704f	0.913	0.85	8.555f	1.17	26.44	2.710
1.470	87.47	7.721f	0.924	0.85	8.563f	1.18	26.03	2.688
1.490	89.22	7.738f	0.935	0.86	8.594f	1.19	25.82	2.671
1.500	90.08	7.746f	0.940	0.86	8.598f	1.19	25.62	2.661

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.

Trim is per 19.38m.

Draft is from Baseline.

HYDROSTATIC PROPERTIES at 0.3 M. AFT TRIM



- ① Displacement 1=.2 MT
- ② LCB (use top scale)
- ③ VCB (KB) 1=.004 M.
- ④ Immersion 1=.002 MT/cm
- ④ WPA 1=.195 Sq.M.
- ⑤ LCF (use top scale)
- ⑥ Moment/Trim 1=.003 M.-MT/cm
- ⑦ KML 1=.2 M.
- ⑧ KMT 1=.01 M.

Specific Gravity = 1.025 Assumed KG = 0.00 M.
Trim is per 19.376 M. "K" = Base plane

HYDROSTATIC PROPERTIES

Trim: Aft 0.200/19.376, No Heel, Fixed VCG = 0.000

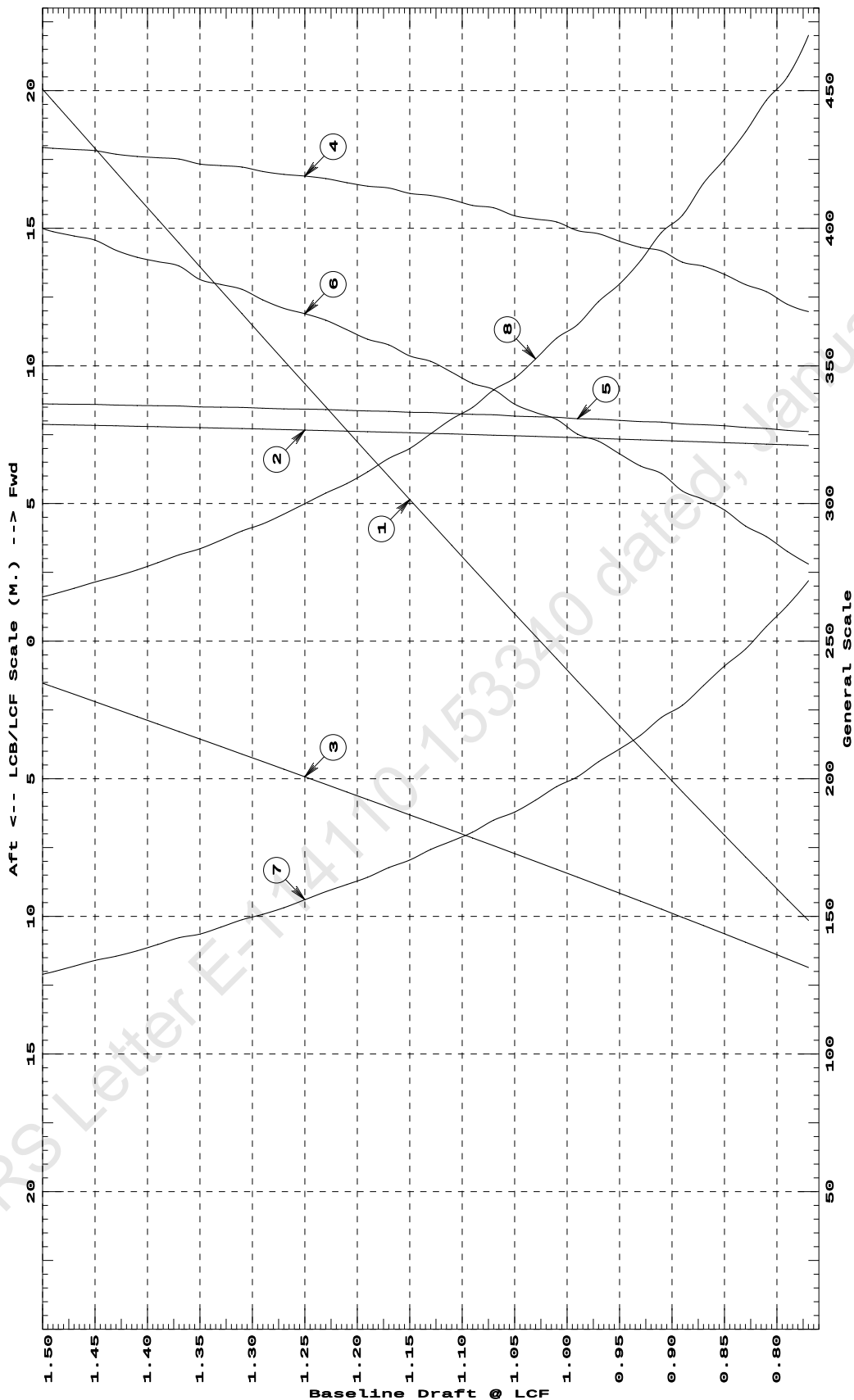
LCF	Displacement	Buoyancy-Ctr.		Weight/	Moment/			
Draft----	Weight(MT)-----	LCB-----	VCB-----	cm-----	LCF-----	cm trim-----	KML-----	KMT
0.770	29.71	7.106f	0.526	0.74	7.613f	0.83	54.39	4.701
0.790	31.23	7.132f	0.538	0.74	7.658f	0.85	52.59	4.550
0.810	32.78	7.159f	0.550	0.75	7.723f	0.86	51.06	4.465
0.830	34.32	7.185f	0.563	0.76	7.762f	0.88	49.43	4.350
0.850	35.90	7.212f	0.575	0.77	7.822f	0.89	48.19	4.251
0.870	37.46	7.238f	0.587	0.77	7.864f	0.90	46.77	4.164
0.890	39.03	7.263f	0.598	0.78	7.890f	0.91	45.35	4.048
0.910	40.64	7.290f	0.610	0.78	7.956f	0.93	44.46	3.985
0.930	42.23	7.315f	0.622	0.79	7.978f	0.94	43.16	3.882
0.950	43.84	7.340f	0.634	0.79	8.018f	0.95	42.16	3.798
0.970	45.47	7.365f	0.645	0.80	8.061f	0.97	41.24	3.734
0.990	47.08	7.389f	0.657	0.80	8.082f	0.98	40.15	3.650
1.010	48.72	7.414f	0.668	0.80	8.133f	0.99	39.43	3.601
1.030	50.35	7.437f	0.680	0.81	8.152f	1.00	38.45	3.525
1.050	51.98	7.460f	0.691	0.81	8.175f	1.01	37.58	3.456
1.070	53.65	7.483f	0.703	0.81	8.223f	1.02	36.99	3.413
1.090	55.29	7.505f	0.714	0.82	8.238f	1.03	36.12	3.350
1.110	56.95	7.527f	0.725	0.82	8.274f	1.04	35.48	3.307
1.130	58.62	7.549f	0.736	0.82	8.303f	1.05	34.86	3.254
1.150	60.29	7.570f	0.747	0.83	8.316f	1.06	34.09	3.200
1.170	61.97	7.590f	0.759	0.83	8.349f	1.07	33.54	3.164
1.190	63.64	7.610f	0.770	0.83	8.362f	1.08	32.85	3.115
1.210	65.32	7.630f	0.781	0.83	8.386f	1.09	32.31	3.072
1.230	67.01	7.649f	0.792	0.84	8.413f	1.10	31.80	3.038
1.250	68.70	7.668f	0.803	0.84	8.428f	1.11	31.21	3.000
1.270	70.39	7.687f	0.814	0.84	8.440f	1.11	30.63	2.961
1.290	72.09	7.705f	0.825	0.84	8.460f	1.12	30.15	2.926
1.310	73.80	7.723f	0.836	0.84	8.489f	1.13	29.75	2.900
1.330	75.50	7.740f	0.847	0.85	8.498f	1.14	29.22	2.867
1.350	77.20	7.757f	0.858	0.85	8.508f	1.14	28.71	2.836
1.370	78.93	7.774f	0.869	0.85	8.544f	1.16	28.45	2.813
1.390	80.64	7.790f	0.879	0.85	8.551f	1.16	27.96	2.785
1.410	82.35	7.806f	0.890	0.85	8.560f	1.17	27.49	2.759
1.430	84.06	7.822f	0.901	0.85	8.575f	1.18	27.11	2.735
1.450	85.80	7.837f	0.912	0.86	8.599f	1.19	26.80	2.715
1.470	87.52	7.852f	0.923	0.86	8.606f	1.19	26.38	2.692
1.490	89.24	7.867f	0.934	0.86	8.614f	1.20	25.97	2.670
1.500	90.11	7.874f	0.939	0.86	8.620f	1.20	25.80	2.661

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.

Trim is per 19.38m.

Draft is from Baseline.

HYDROSTATIC PROPERTIES at 0.2 M. AFT TRIM



- 1 Displacement 1=.2 MT
- 2 LCB (use top scale)
- 3 VCB (KB) 1=.004 M.
- 4 Immersion 1=.002 MT/cm
- 5 LCF (use top scale)
- 6 Moment/Trim 1=.003 M.-MT/cm
- 7 KML 1=.2 M.
- 8 KMT 1=.01 M.

Specific Gravity = 1.025 Assumed KG = 0.00 M.
Trim is per 19.376 M. "K" = Base plane

HYDROSTATIC PROPERTIES

Trim: Aft 0.100/19.376, No Heel, Fixed VCG = 0.000

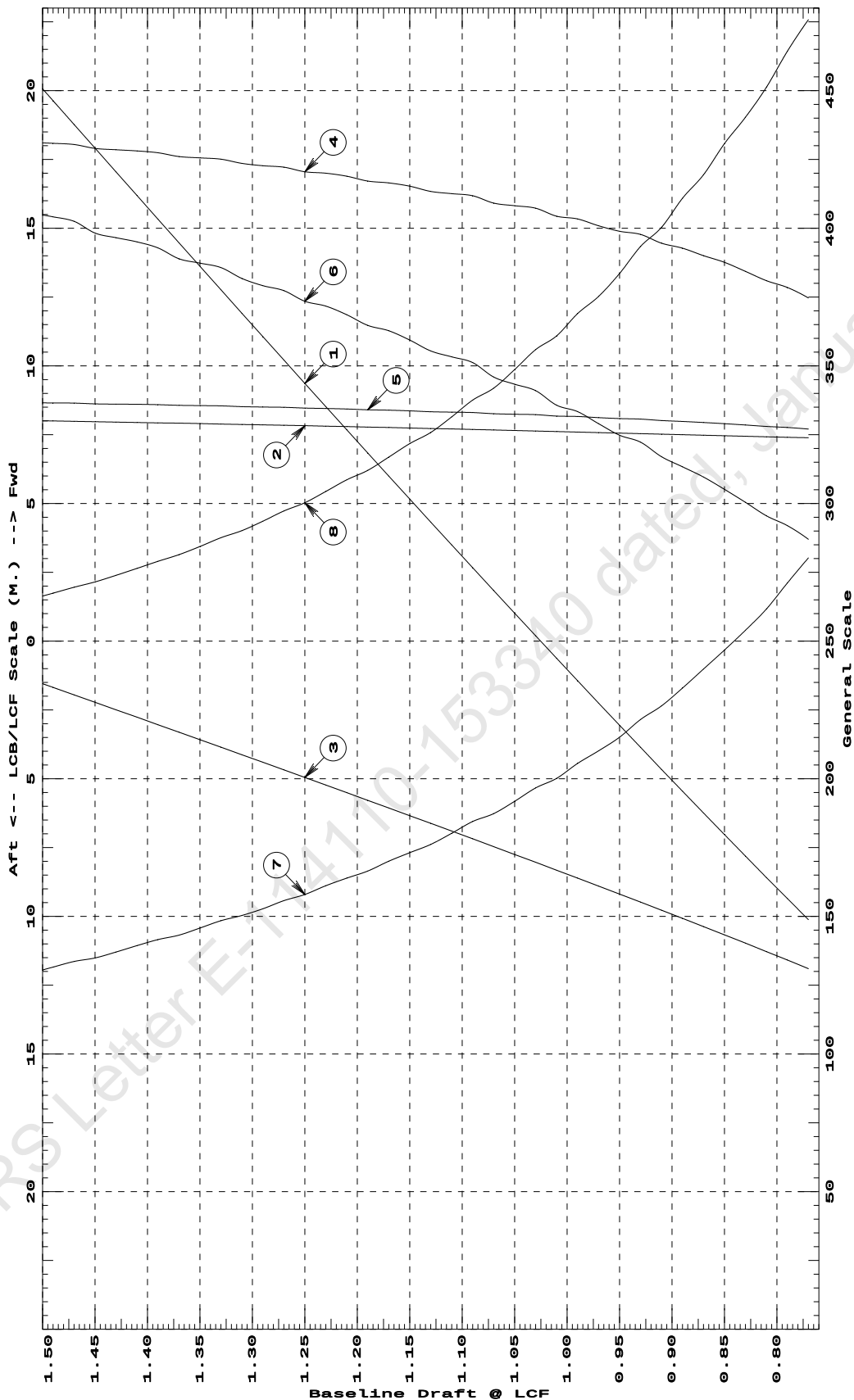
LCF Draft	Displacement Weight(MT)	Buoyancy-Ctr.		Weight/ cm	Moment/ cm trim		KML	KMT
-----	-----	LCB	VCB	-----	LCF	-----	-----	-----
0.770	29.76	7.389f	0.524	0.75	7.707f	0.86	56.05	4.757
0.790	31.29	7.406f	0.536	0.76	7.761f	0.88	54.23	4.643
0.810	32.82	7.423f	0.549	0.76	7.798f	0.89	52.33	4.513
0.830	34.38	7.442f	0.561	0.77	7.850f	0.90	50.79	4.403
0.850	35.94	7.460f	0.573	0.78	7.899f	0.92	49.35	4.308
0.870	37.51	7.480f	0.585	0.78	7.942f	0.93	47.97	4.194
0.890	39.09	7.499f	0.597	0.79	7.981f	0.94	46.59	4.109
0.910	40.68	7.518f	0.609	0.79	8.013f	0.95	45.30	4.004
0.930	42.28	7.538f	0.621	0.80	8.064f	0.97	44.30	3.934
0.950	43.89	7.558f	0.632	0.80	8.085f	0.97	43.02	3.836
0.970	45.50	7.577f	0.644	0.80	8.120f	0.99	42.03	3.753
0.990	47.13	7.596f	0.656	0.81	8.161f	1.00	41.12	3.690
1.010	48.75	7.615f	0.667	0.81	8.178f	1.01	40.03	3.609
1.030	50.39	7.634f	0.679	0.81	8.227f	1.02	39.33	3.559
1.050	52.03	7.653f	0.690	0.82	8.243f	1.03	38.36	3.487
1.070	53.67	7.672f	0.701	0.82	8.261f	1.04	37.46	3.419
1.090	55.33	7.690f	0.713	0.82	8.307f	1.05	36.89	3.376
1.110	56.99	7.708f	0.724	0.83	8.321f	1.06	36.04	3.315
1.130	58.65	7.726f	0.735	0.83	8.335f	1.07	35.23	3.258
1.150	60.32	7.743f	0.746	0.83	8.368f	1.08	34.63	3.218
1.170	61.99	7.761f	0.758	0.83	8.391f	1.09	34.01	3.169
1.190	63.67	7.777f	0.769	0.83	8.403f	1.09	33.30	3.121
1.210	65.35	7.794f	0.780	0.84	8.434f	1.11	32.78	3.086
1.230	67.04	7.810f	0.791	0.84	8.455f	1.12	32.23	3.044
1.250	68.73	7.826f	0.802	0.84	8.465f	1.12	31.59	3.003
1.270	70.43	7.842f	0.813	0.84	8.494f	1.13	31.15	2.973
1.290	72.12	7.858f	0.824	0.85	8.504f	1.14	30.56	2.936
1.310	73.82	7.873f	0.835	0.85	8.520f	1.15	30.06	2.902
1.330	75.53	7.888f	0.846	0.85	8.548f	1.16	29.69	2.876
1.350	77.23	7.902f	0.857	0.85	8.557f	1.16	29.15	2.844
1.370	78.93	7.917f	0.868	0.85	8.565f	1.17	28.64	2.814
1.390	80.66	7.931f	0.879	0.85	8.591f	1.18	28.31	2.790
1.410	82.38	7.945f	0.889	0.86	8.604f	1.19	27.88	2.764
1.430	84.09	7.958f	0.900	0.86	8.611f	1.19	27.41	2.739
1.450	85.81	7.972f	0.911	0.86	8.619f	1.19	26.98	2.715
1.470	87.54	7.985f	0.922	0.86	8.647f	1.21	26.73	2.696
1.490	89.27	7.998f	0.933	0.86	8.655f	1.21	26.31	2.674
1.500	90.13	8.004f	0.938	0.86	8.657f	1.21	26.10	2.664

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.

Trim is per 19.38m.

Draft is from Baseline.

HYDROSTATIC PROPERTIES at 0.1 M. AFT TRIM



- 1 Displacement 1=.2 MT
- 2 LCB (use top scale)
- 3 VCB (KB) 1=.004 M.
- 4 Immersion 1=.002 MT/cm
- 5 WPA 1=.195 Sq.M.
- 6 LCF (use top scale)
- 7 Moment/Trim 1=.003 M.-MT/cm
- 8 KML 1=.2 M.
- 9 KMT 1=.01 M.

Specific Gravity = 1.025 Assumed KG = 0.00 M.
Trim is per 19.376 M. "K" = Base plane

HYDROSTATIC PROPERTIES

Trim: Fwd 0.100/19.376, No Heel, Fixed VCG = 0.000

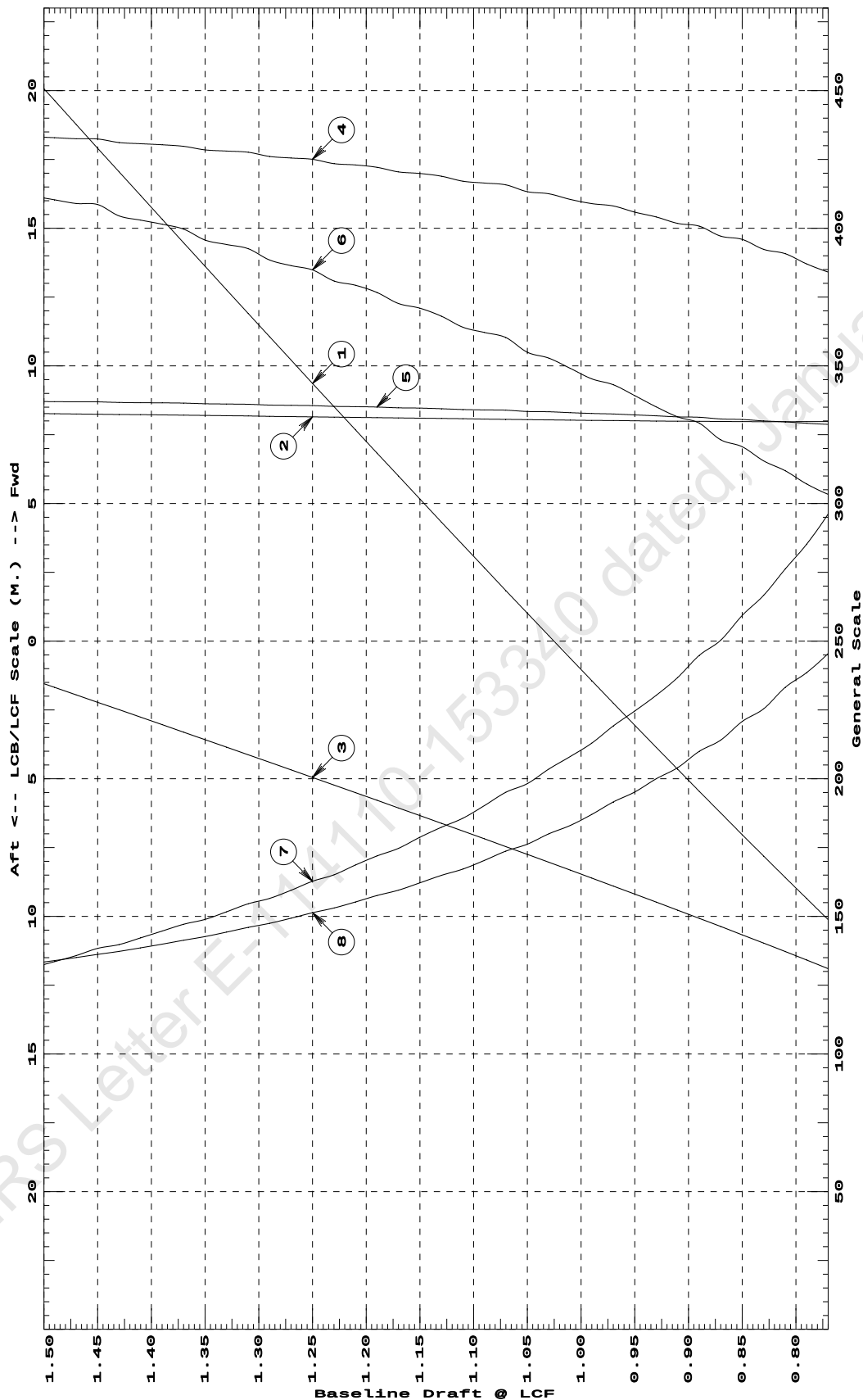
LCF	Displacement	Buoyancy-Ctr.		Weight/	Moment/			
Draft	Weight(MT)	LCB	VCB	cm	LCF	cm trim	KML	KMT
0.770	29.76	7.978f	0.524	0.77	7.875f	0.91	59.24	4.911
0.790	31.29	7.974f	0.537	0.77	7.916f	0.92	57.05	4.772
0.810	32.83	7.973f	0.549	0.78	7.969f	0.94	55.23	4.664
0.830	34.38	7.973f	0.561	0.78	7.998f	0.95	53.34	4.509
0.850	35.94	7.976f	0.573	0.79	8.053f	0.96	51.86	4.416
0.870	37.51	7.980f	0.585	0.79	8.073f	0.97	50.07	4.281
0.890	39.09	7.984f	0.597	0.80	8.132f	0.99	48.96	4.199
0.910	40.68	7.991f	0.609	0.80	8.149f	0.99	47.36	4.081
0.930	42.28	7.997f	0.621	0.81	8.185f	1.01	46.07	4.000
0.950	43.89	8.005f	0.632	0.81	8.218f	1.02	44.92	3.904
0.970	45.50	8.013f	0.644	0.82	8.254f	1.03	43.84	3.832
0.990	47.13	8.021f	0.656	0.82	8.269f	1.04	42.59	3.741
1.010	48.75	8.030f	0.667	0.82	8.298f	1.05	41.62	3.661
1.030	50.39	8.040f	0.679	0.83	8.331f	1.06	40.70	3.600
1.050	52.03	8.049f	0.690	0.83	8.345f	1.06	39.65	3.525
1.070	53.67	8.059f	0.701	0.83	8.390f	1.08	39.02	3.474
1.090	55.33	8.069f	0.713	0.83	8.401f	1.09	38.05	3.407
1.110	56.99	8.079f	0.724	0.83	8.413f	1.09	37.13	3.344
1.130	58.65	8.089f	0.735	0.84	8.445f	1.10	36.47	3.299
1.150	60.32	8.099f	0.746	0.84	8.464f	1.11	35.75	3.244
1.170	62.00	8.109f	0.758	0.84	8.474f	1.12	34.94	3.191
1.190	63.67	8.119f	0.769	0.84	8.505f	1.13	34.39	3.152
1.210	65.35	8.129f	0.780	0.85	8.521f	1.14	33.74	3.105
1.230	67.04	8.139f	0.791	0.85	8.529f	1.14	33.02	3.061
1.250	68.73	8.149f	0.802	0.85	8.558f	1.15	32.55	3.027
1.270	70.42	8.159f	0.813	0.85	8.567f	1.16	31.90	2.987
1.290	72.12	8.169f	0.824	0.85	8.578f	1.17	31.31	2.949
1.310	73.81	8.179f	0.835	0.86	8.606f	1.18	30.92	2.920
1.330	75.53	8.189f	0.846	0.86	8.614f	1.18	30.33	2.885
1.350	77.24	8.198f	0.857	0.86	8.622f	1.19	29.78	2.853
1.370	78.93	8.207f	0.868	0.86	8.647f	1.20	29.43	2.827
1.390	80.66	8.217f	0.879	0.86	8.657f	1.20	28.93	2.799
1.410	82.38	8.226f	0.889	0.86	8.664f	1.21	28.43	2.771
1.430	84.10	8.235f	0.900	0.86	8.671f	1.21	27.96	2.746
1.450	85.81	8.245f	0.911	0.86	8.697f	1.23	27.68	2.724
1.470	87.54	8.253f	0.922	0.87	8.696f	1.23	27.15	2.701
1.490	89.27	8.262f	0.933	0.87	8.702f	1.23	26.72	2.679
1.500	90.14	8.266f	0.938	0.87	8.705f	1.23	26.50	2.668

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.

Trim is per 19.38m.

Draft is from Baseline.

HYDROSTATIC PROPERTIES at 0.1 M. FWD TRIM



- ① Displacement 1=.2 MT
- ② LCB (use top scale)
- ③ VCB (KB) 1=.004 M.
- ④ Immersion 1=.002 MT/cm
- ⑤ WPA 1=.195 Sq.M.
- ⑥ LCF (use top scale)
- ⑦ Moment/Trim 1=.003 M.-MT/cm
- ⑧ KML 1=.2 M.
- ⑨ KMT 1=.02 M.

Specific Gravity = 1.025 Assumed KG = 0.00 M.
Trim is per 19.376 M. "K" = Base plane

HYDROSTATIC PROPERTIES

Trim: Fwd 0.200/19.376, No Heel, Fixed VCG = 0.000

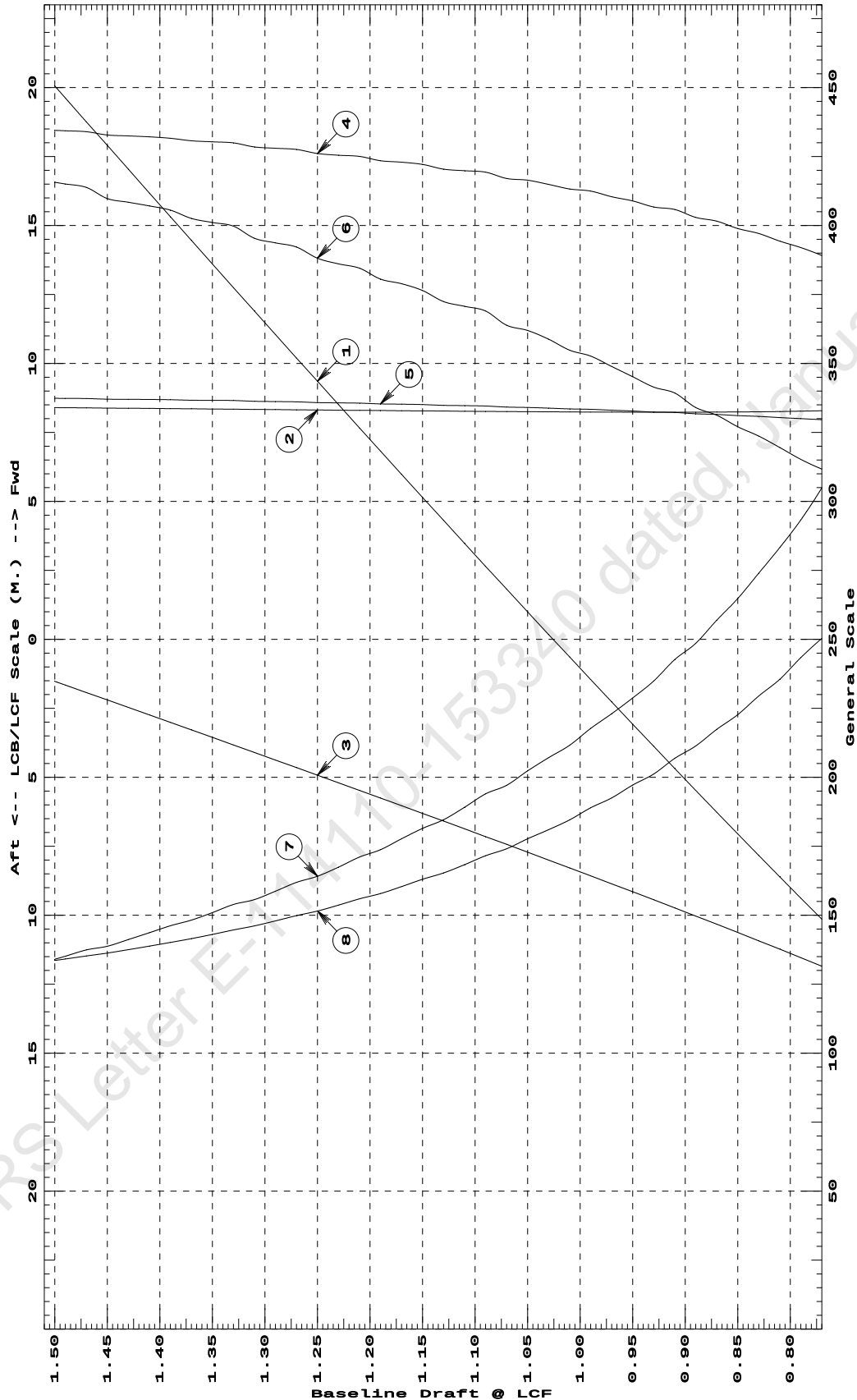
LCF	Displacement	Buoyancy-Ctr.		Weight/	Moment/			
Draft	Weight(MT)	LCB	VCB	cm	LCF	cm trim	KML	KMT
0.770	29.71	8.285f	0.526	0.78	7.961f	0.94	60.98	5.006
0.790	31.24	8.270f	0.538	0.78	8.000f	0.95	58.65	4.867
0.810	32.78	8.259f	0.551	0.79	8.040f	0.96	56.65	4.710
0.830	34.33	8.250f	0.563	0.79	8.081f	0.97	54.80	4.590
0.850	35.89	8.243f	0.575	0.80	8.111f	0.98	52.96	4.454
0.870	37.47	8.239f	0.587	0.80	8.152f	0.99	51.39	4.348
0.890	39.06	8.236f	0.599	0.81	8.176f	1.00	49.71	4.227
0.910	40.64	8.234f	0.611	0.81	8.224f	1.02	48.53	4.137
0.930	42.25	8.234f	0.622	0.81	8.240f	1.02	46.98	4.024
0.950	43.85	8.235f	0.634	0.82	8.274f	1.04	45.75	3.944
0.970	45.47	8.237f	0.646	0.82	8.303f	1.05	44.61	3.850
0.990	47.08	8.240f	0.657	0.82	8.336f	1.06	43.54	3.779
1.010	48.72	8.244f	0.669	0.83	8.350f	1.06	42.33	3.692
1.030	50.36	8.247f	0.680	0.83	8.381f	1.08	41.42	3.620
1.050	51.99	8.252f	0.691	0.83	8.406f	1.09	40.46	3.555
1.070	53.65	8.257f	0.703	0.83	8.418f	1.09	39.42	3.482
1.090	55.29	8.262f	0.714	0.84	8.459f	1.11	38.80	3.431
1.110	56.96	8.268f	0.725	0.84	8.469f	1.11	37.83	3.367
1.130	58.63	8.274f	0.737	0.84	8.479f	1.12	36.92	3.306
1.150	60.29	8.280f	0.748	0.84	8.510f	1.13	36.29	3.261
1.170	61.96	8.287f	0.759	0.85	8.525f	1.14	35.54	3.208
1.190	63.65	8.293f	0.770	0.85	8.534f	1.14	34.75	3.158
1.210	65.32	8.300f	0.781	0.85	8.563f	1.15	34.22	3.119
1.230	67.02	8.307f	0.792	0.85	8.572f	1.16	33.49	3.073
1.250	68.71	8.314f	0.803	0.85	8.583f	1.16	32.83	3.031
1.270	70.39	8.321f	0.814	0.86	8.611f	1.18	32.38	2.997
1.290	72.10	8.328f	0.825	0.86	8.619f	1.18	31.74	2.959
1.310	73.80	8.335f	0.836	0.86	8.627f	1.19	31.14	2.923
1.330	75.50	8.341f	0.847	0.86	8.656f	1.20	30.78	2.893
1.350	77.21	8.349f	0.858	0.86	8.662f	1.20	30.19	2.861
1.370	78.93	8.356f	0.869	0.86	8.669f	1.21	29.65	2.830
1.390	80.64	8.362f	0.880	0.86	8.687f	1.22	29.23	2.803
1.410	82.36	8.369f	0.890	0.86	8.695f	1.22	28.73	2.777
1.430	84.08	8.376f	0.901	0.86	8.701f	1.23	28.23	2.751
1.450	85.81	8.383f	0.912	0.87	8.706f	1.23	27.76	2.726
1.470	87.52	8.389f	0.923	0.87	8.731f	1.24	27.48	2.705
1.490	89.25	8.396f	0.934	0.87	8.735f	1.25	27.03	2.683
1.500	90.12	8.399f	0.939	0.87	8.738f	1.25	26.81	2.672

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.

Trim is per 19.38m.

Draft is from Baseline.

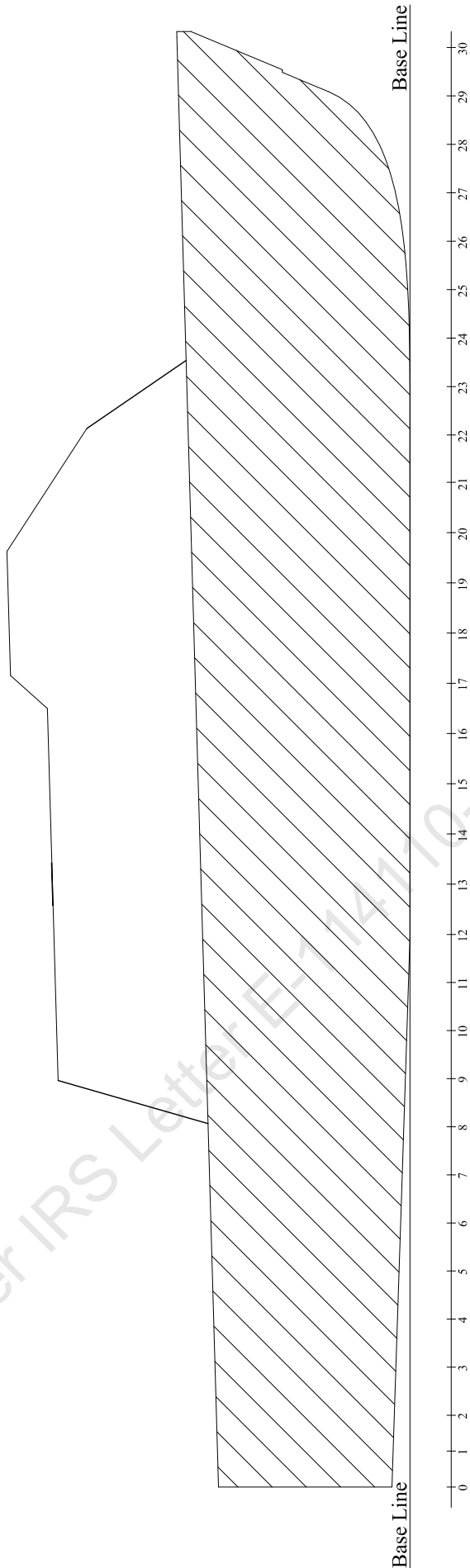
HYDROSTATIC PROPERTIES at 0.2 M. FWD TRIM



- 1 Displacement 1=.2 MT
- 2 LCB (use top scale)
- 3 VCB (KB) 1=.004 M.
- 4 Immersion 1=.002 MT/cm
- 4 WPA 1=.195 Sq.M.
- 5 LCF (use top scale)
- 6 Moment/Trim 1=.003 M.-MT/cm
- 7 KML 1=.2 M.
- 8 KMT 1=.02 M.

Specific Gravity = 1.025 Assumed KG = 0.00 M.
Trim is per 19.376 M. "K" = Base plane

2.8 EXTEND OF VOLUME CONSIDERED FOR COMPUTATION OF CROSS CURVES



PROFILE

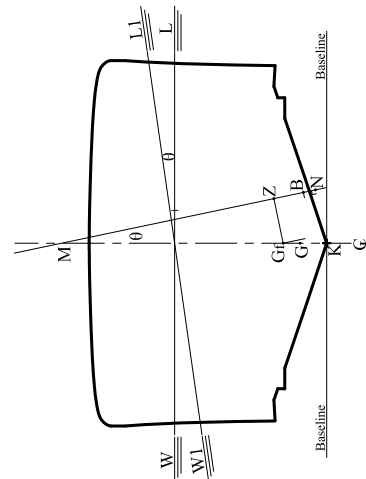


ILLUSTRATION OF RIGHTING LEVER

ABBREVIATION

- K : TOP OF KEEL (Baseline)
- G : CENTRE OF GRAVITY
- G_f: CENTRE OF GRAVITY AFTER FREE SURFACE CORRECTION
- B : CENTRE OF BUOYANCY
- M : TRANSVERSE METACENTRE

RIGHTING LEVER = $GZ = KN - KG_f \times \sin \theta$

2.9 KN VALUES & DOWN FLOODING ANGLES FOR
(Even Keel, 0.30m Aft, 0.20m Aft, 0.10m Aft, 0.10m Fwd & 0.20m Fwd)

CROSS CURVES OF STABILITY

Showing righting arms in heel at VCG = 0.00

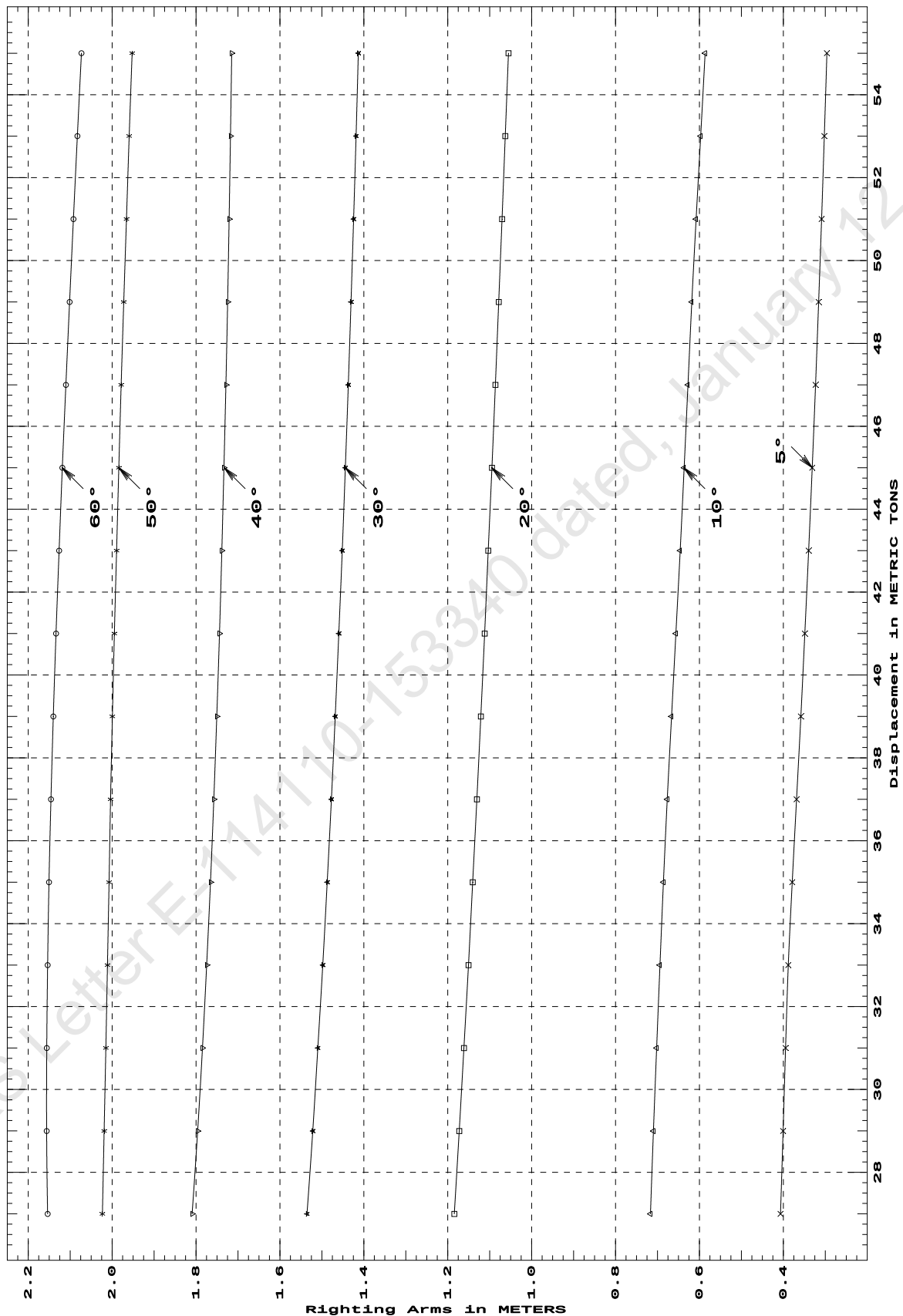
Trim: zero at zero heel (trim righting arm held at zero)

Displacement METRIC TONS	Heel Angles in Degrees				
	5.00s	10.00s	20.00s	30.00s	40.00s
27.00	0.407s	0.717s	1.185s	1.536s	1.809s
29.00	0.401s	0.710s	1.173s	1.522s	1.796s
31.00	0.395s	0.702s	1.161s	1.510s	1.785s
33.00	0.388s	0.694s	1.151s	1.498s	1.775s
35.00	0.379s	0.686s	1.140s	1.487s	1.766s
37.00	0.368s	0.677s	1.131s	1.477s	1.758s
39.00	0.358s	0.667s	1.121s	1.468s	1.750s
41.00	0.349s	0.656s	1.112s	1.460s	1.744s
43.00	0.340s	0.646s	1.103s	1.452s	1.738s
45.00	0.331s	0.637s	1.095s	1.444s	1.733s
47.00	0.323s	0.627s	1.087s	1.437s	1.729s
49.00	0.316s	0.618s	1.078s	1.430s	1.725s
51.00	0.309s	0.608s	1.071s	1.424s	1.721s
53.00	0.302s	0.597s	1.063s	1.419s	1.718s
55.00	0.296s	0.586s	1.055s	1.413s	1.715s

Displacement METRIC TONS	Heel Angles		@ Flooding	
	50.00s	60.00s	Arm	Angle
27.00	2.023s	2.154s		
29.00	2.019s	2.156s		
31.00	2.015s	2.156s		
33.00	2.011s	2.154s		
35.00	2.007s	2.150s		
37.00	2.004s	2.146s		
39.00	1.999s	2.140s		
41.00	1.995s	2.134s		
43.00	1.989s	2.126s		
45.00	1.984s	2.119s		
47.00	1.978s	2.110s		
49.00	1.972s	2.102s		
51.00	1.966s	2.092s		
53.00	1.959s	2.083s		
55.00	1.953s	2.073s		

Distances in METERS.---Specific Gravity = 1.025.---

CROSS CURVES OF STABILITY - Stbd Heel
 at LEVEL TRIM (initial)



Specific Gravity = 1.025 Assumed KG = 0.00 M.
 "K" = Base plane

CROSS CURVES OF STABILITY

Showing righting arms in heel at VCG = 0.00

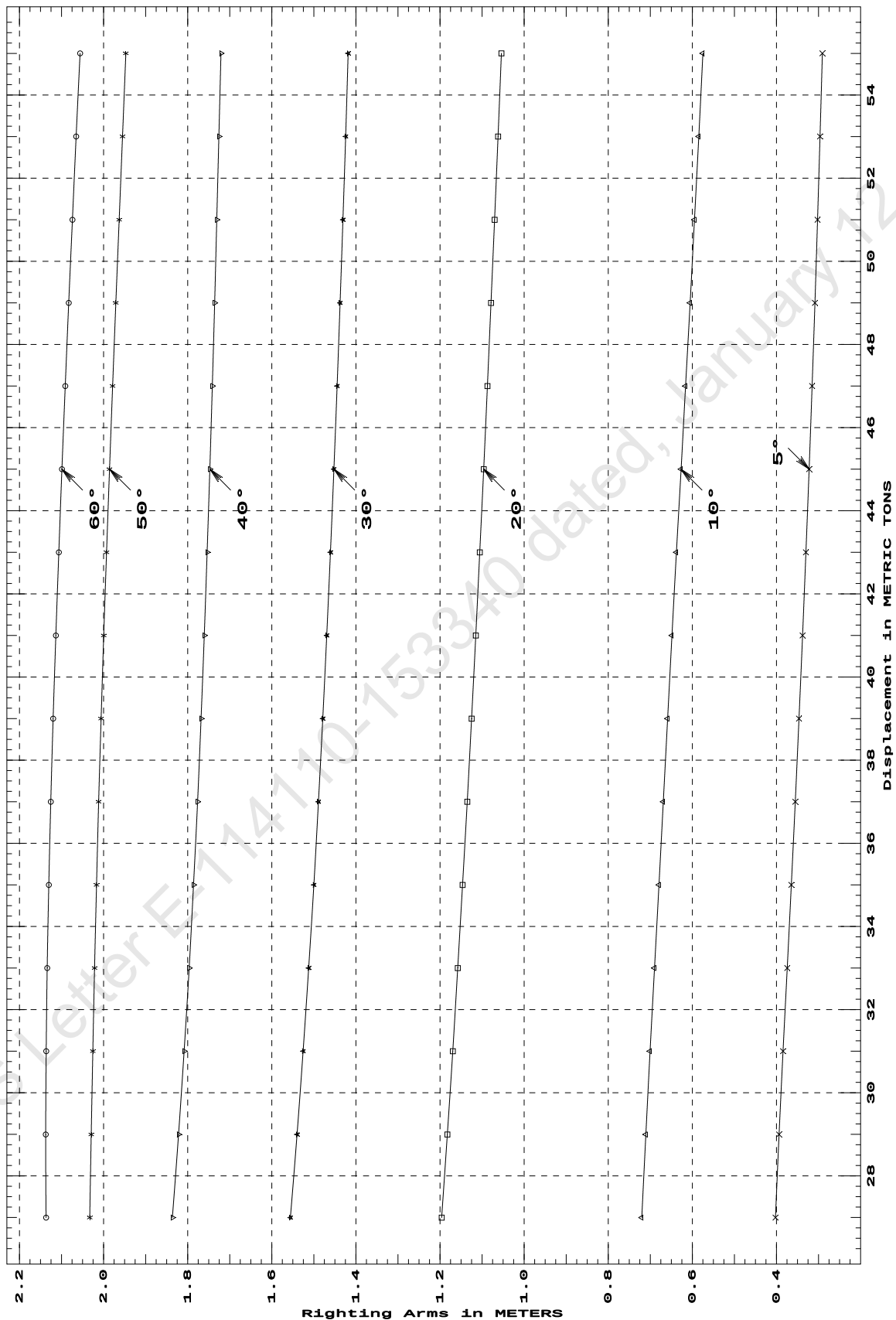
Trim: Aft 0.300/19.376 at zero heel (trim righting arm held at zero)

Displacement METRIC TONS	Heel Angles in Degrees				
	5.00s	10.00s	20.00s	30.00s	40.00s
27.00	0.402s	0.720s	1.196s	1.556s	1.836s
29.00	0.394s	0.711s	1.183s	1.540s	1.822s
31.00	0.384s	0.700s	1.170s	1.526s	1.809s
33.00	0.374s	0.690s	1.158s	1.512s	1.797s
35.00	0.365s	0.679s	1.146s	1.500s	1.786s
37.00	0.355s	0.669s	1.135s	1.489s	1.777s
39.00	0.346s	0.659s	1.125s	1.479s	1.768s
41.00	0.338s	0.648s	1.115s	1.469s	1.761s
43.00	0.330s	0.638s	1.106s	1.461s	1.754s
45.00	0.322s	0.627s	1.096s	1.452s	1.747s
47.00	0.315s	0.616s	1.087s	1.445s	1.742s
49.00	0.309s	0.605s	1.079s	1.438s	1.736s
51.00	0.302s	0.595s	1.070s	1.431s	1.731s
53.00	0.296s	0.585s	1.062s	1.424s	1.726s
55.00	0.291s	0.575s	1.054s	1.418s	1.721s

Displacement METRIC TONS	Heel Angles		@ Flooding Arm Angle
	50.00s	60.00s	
27.00	2.033s	2.137s	
29.00	2.029s	2.138s	
31.00	2.026s	2.137s	
33.00	2.021s	2.134s	
35.00	2.017s	2.130s	
37.00	2.012s	2.126s	
39.00	2.006s	2.120s	
41.00	2.000s	2.114s	
43.00	1.993s	2.107s	
45.00	1.986s	2.099s	
47.00	1.978s	2.091s	
49.00	1.971s	2.083s	
51.00	1.963s	2.074s	
53.00	1.955s	2.065s	
55.00	1.947s	2.056s	

Distances in METERS.---Specific Gravity = 1.025.---

CROSS CURVES OF STABILITY - Stbd Heel
 at 0.3 M. AFT TRIM (initial)



Specific Gravity = 1.025 Assumed KG = 0.00 M.
 "K" = Base plane

CROSS CURVES OF STABILITY

Showing righting arms in heel at VCG = 0.00

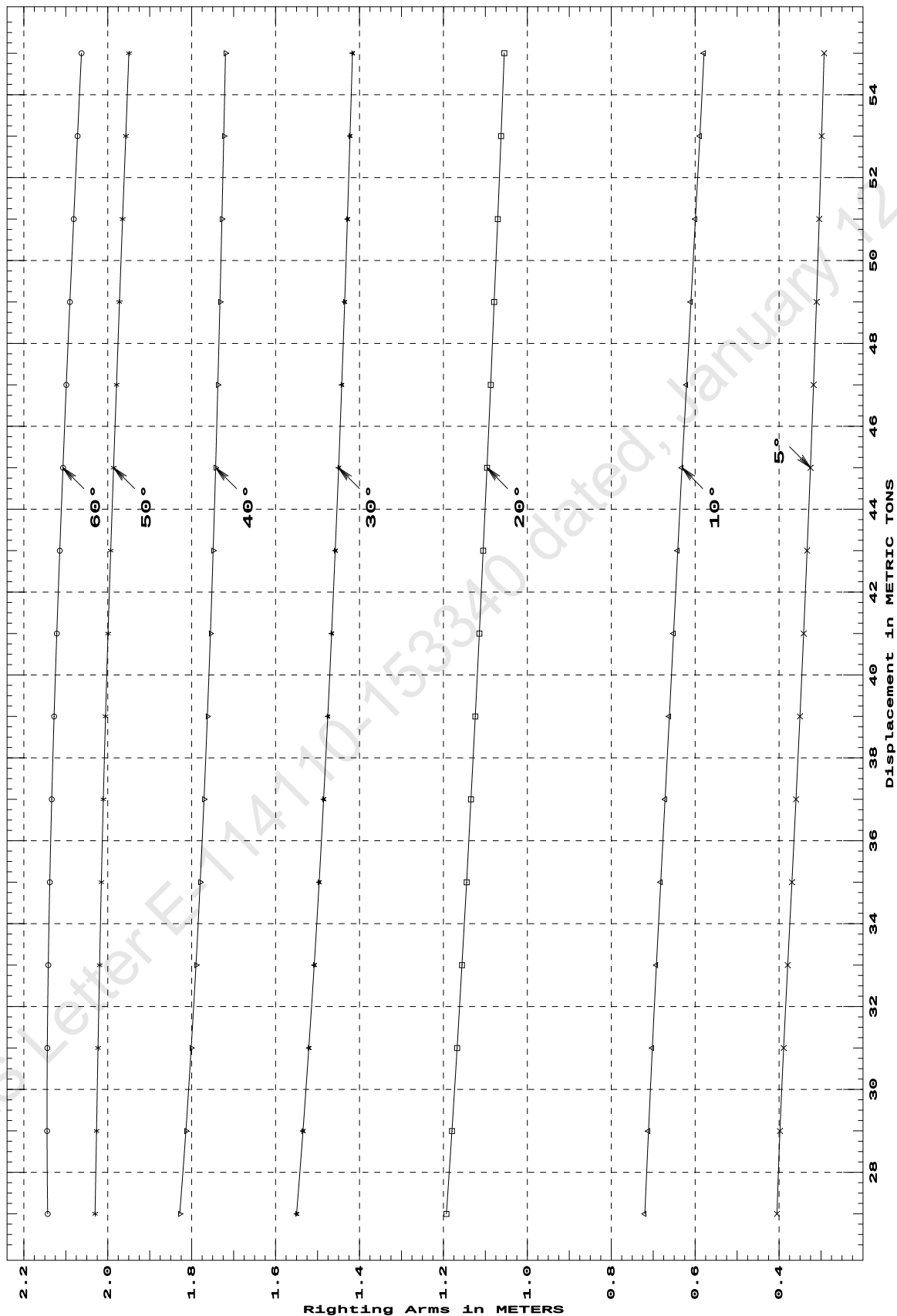
Trim: Aft 0.200/19.376 at zero heel (trim righting arm held at zero)

Displacement METRIC TONS	Heel Angles in Degrees				
	5.00s	10.00s	20.00s	30.00s	40.00s
27.00	0.405s	0.720s	1.193s	1.550s	1.828s
29.00	0.398s	0.711s	1.180s	1.535s	1.814s
31.00	0.389s	0.702s	1.168s	1.521s	1.801s
33.00	0.379s	0.692s	1.156s	1.508s	1.790s
35.00	0.369s	0.682s	1.145s	1.496s	1.780s
37.00	0.360s	0.672s	1.134s	1.486s	1.771s
39.00	0.350s	0.662s	1.124s	1.476s	1.763s
41.00	0.342s	0.652s	1.115s	1.466s	1.755s
43.00	0.333s	0.642s	1.105s	1.458s	1.749s
45.00	0.325s	0.631s	1.096s	1.450s	1.743s
47.00	0.318s	0.621s	1.087s	1.442s	1.738s
49.00	0.311s	0.610s	1.079s	1.435s	1.733s
51.00	0.305s	0.599s	1.071s	1.429s	1.728s
53.00	0.298s	0.589s	1.063s	1.423s	1.724s
55.00	0.293s	0.579s	1.055s	1.417s	1.719s

Displacement METRIC TONS	Heel Angles		@ Flooding	
	50.00s	60.00s	Arm	Angle
27.00	2.030s	2.143s		
29.00	2.027s	2.145s		
31.00	2.023s	2.144s		
33.00	2.019s	2.142s		
35.00	2.015s	2.138s		
37.00	2.011s	2.133s		
39.00	2.005s	2.128s		
41.00	1.999s	2.121s		
43.00	1.993s	2.114s		
45.00	1.986s	2.107s		
47.00	1.979s	2.099s		
49.00	1.972s	2.090s		
51.00	1.965s	2.081s		
53.00	1.957s	2.072s		
55.00	1.950s	2.063s		

Distances in METERS.---Specific Gravity = 1.025.---

CROSS CURVES OF STABILITY - Stbd Heel
at 0.2 M. AFT TRIM (initial)



Specific Gravity = 1.025 Assumed KG = 0.00 M.
"K" = Base plane

CROSS CURVES OF STABILITY

Showing righting arms in heel at VCG = 0.00

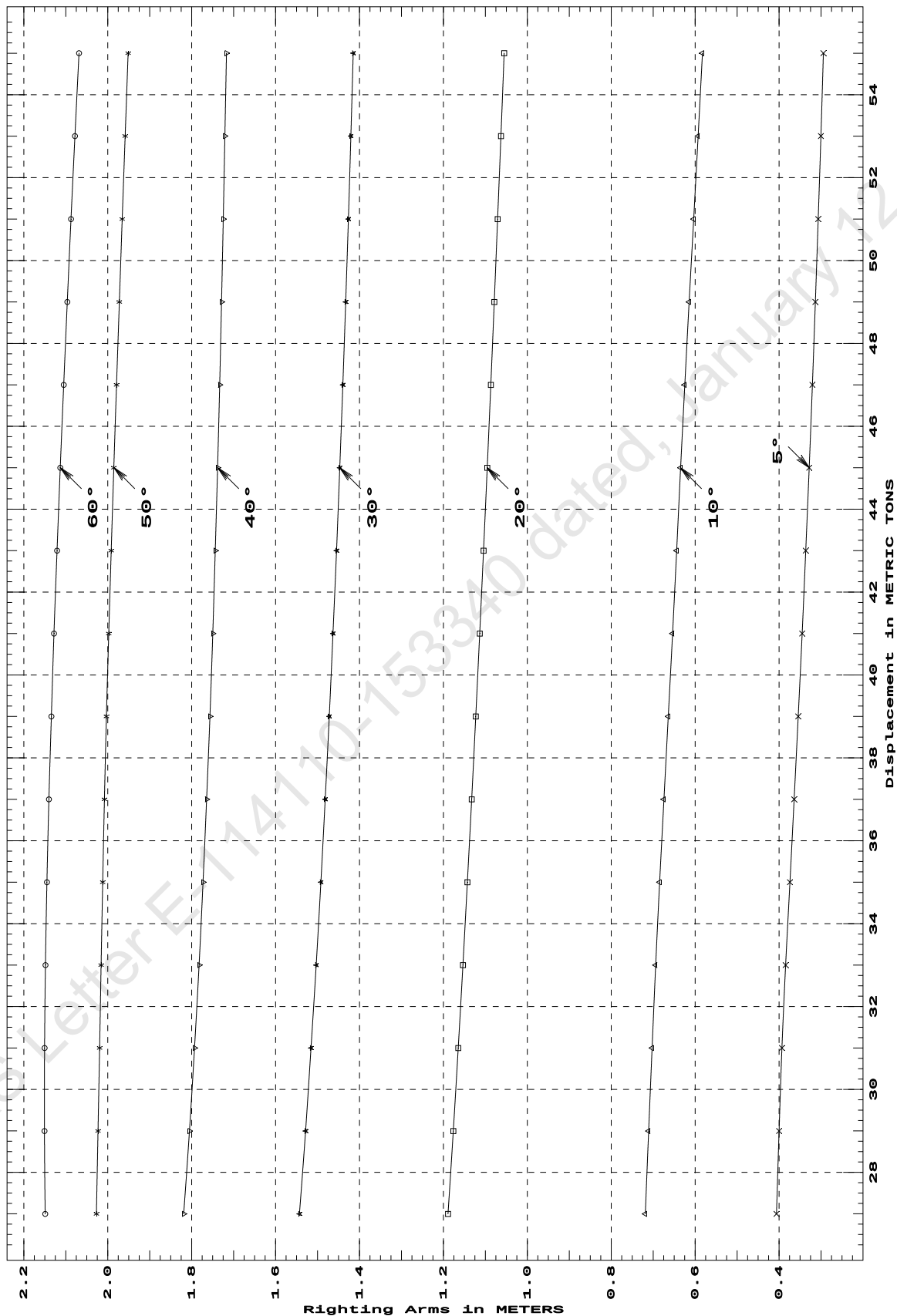
Trim: Aft 0.100/19.376 at zero heel (trim righting arm held at zero)

Displacement METRIC TONS	Heel Angles in Degrees				
	5.00s	10.00s	20.00s	30.00s	40.00s
27.00	0.406s	0.719s	1.189s	1.543s	1.819s
29.00	0.400s	0.711s	1.177s	1.529s	1.805s
31.00	0.393s	0.703s	1.165s	1.516s	1.793s
33.00	0.384s	0.694s	1.154s	1.503s	1.782s
35.00	0.374s	0.685s	1.143s	1.492s	1.773s
37.00	0.364s	0.674s	1.133s	1.482s	1.764s
39.00	0.354s	0.664s	1.123s	1.472s	1.757s
41.00	0.345s	0.654s	1.114s	1.463s	1.750s
43.00	0.336s	0.644s	1.105s	1.455s	1.744s
45.00	0.328s	0.635s	1.096s	1.447s	1.738s
47.00	0.321s	0.625s	1.087s	1.440s	1.733s
49.00	0.313s	0.614s	1.079s	1.433s	1.729s
51.00	0.307s	0.604s	1.071s	1.427s	1.725s
53.00	0.300s	0.593s	1.063s	1.421s	1.721s
55.00	0.294s	0.583s	1.055s	1.415s	1.717s

Displacement METRIC TONS	Heel Angles		@ Flooding	
	50.00s	60.00s	Arm	Angle
27.00	2.027s	2.149s		
29.00	2.023s	2.151s		
31.00	2.019s	2.151s		
33.00	2.016s	2.148s		
35.00	2.012s	2.145s		
37.00	2.008s	2.140s		
39.00	2.003s	2.134s		
41.00	1.998s	2.128s		
43.00	1.992s	2.121s		
45.00	1.985s	2.113s		
47.00	1.979s	2.105s		
49.00	1.972s	2.096s		
51.00	1.966s	2.087s		
53.00	1.959s	2.078s		
55.00	1.951s	2.069s		

Distances in METERS.---Specific Gravity = 1.025.---

CROSS CURVES OF STABILITY - Stbd Heel
at 0.1 M. AFT TRIM (initial)



Specific Gravity = 1.025 Assumed KG = 0.00 M.
"K" = Base plane

CROSS CURVES OF STABILITY

Showing righting arms in heel at VCG = 0.00

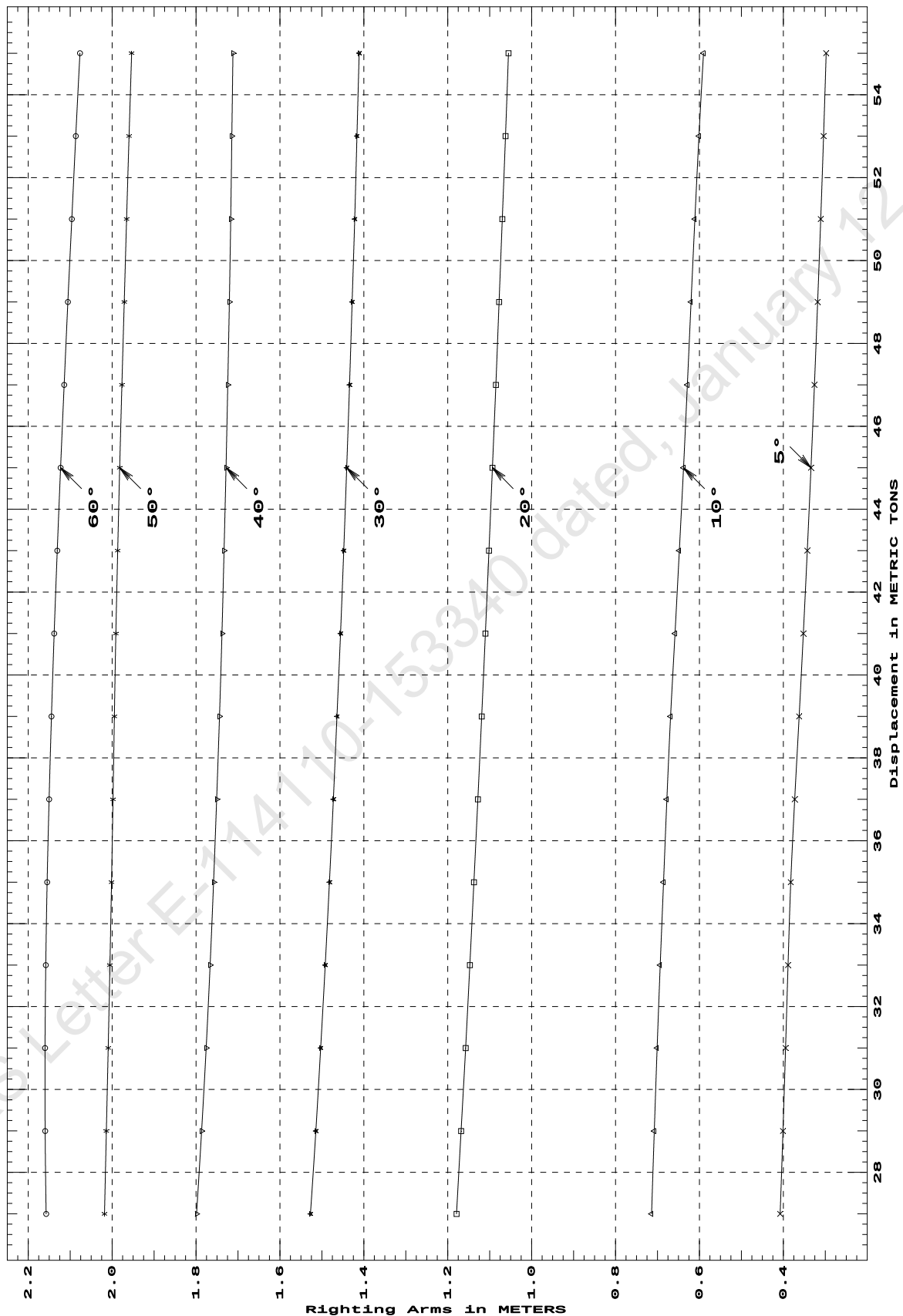
Trim: Fwd 0.100/19.376 at zero heel (trim righting arm held at zero)

Displacement METRIC TONS	Heel Angles in Degrees				
	5.00s	10.00s	20.00s	30.00s	40.00s
27.00	0.408s	0.714s	1.179s	1.527s	1.799s
29.00	0.401s	0.708s	1.168s	1.515s	1.787s
31.00	0.395s	0.701s	1.157s	1.503s	1.776s
33.00	0.389s	0.693s	1.147s	1.492s	1.767s
35.00	0.382s	0.686s	1.138s	1.482s	1.758s
37.00	0.373s	0.678s	1.128s	1.473s	1.751s
39.00	0.362s	0.669s	1.119s	1.464s	1.744s
41.00	0.352s	0.658s	1.110s	1.456s	1.738s
43.00	0.343s	0.648s	1.102s	1.448s	1.733s
45.00	0.334s	0.638s	1.093s	1.441s	1.728s
47.00	0.326s	0.629s	1.085s	1.434s	1.724s
49.00	0.318s	0.620s	1.078s	1.428s	1.721s
51.00	0.311s	0.611s	1.070s	1.422s	1.717s
53.00	0.304s	0.601s	1.063s	1.416s	1.715s
55.00	0.298s	0.590s	1.055s	1.411s	1.712s

Displacement METRIC TONS	Heel Angles		@ Flooding	
	50.00s	60.00s	Arm	Angle
27.00	2.018s	2.157s		
29.00	2.014s	2.160s		
31.00	2.010s	2.160s		
33.00	2.005s	2.158s		
35.00	2.002s	2.155s		
37.00	1.998s	2.150s		
39.00	1.995s	2.145s		
41.00	1.991s	2.138s		
43.00	1.987s	2.131s		
45.00	1.982s	2.123s		
47.00	1.977s	2.114s		
49.00	1.971s	2.105s		
51.00	1.966s	2.096s		
53.00	1.960s	2.087s		
55.00	1.953s	2.077s		

Distances in METERS.---Specific Gravity = 1.025.---

CROSS CURVES OF STABILITY - Stbd Heel
at 0.1 M. FWD TRIM (initial)



Specific Gravity = 1.025 Assumed KG = 0.00 M.
"K" = Base plane

CROSS CURVES OF STABILITY

Showing righting arms in heel at VCG = 0.00

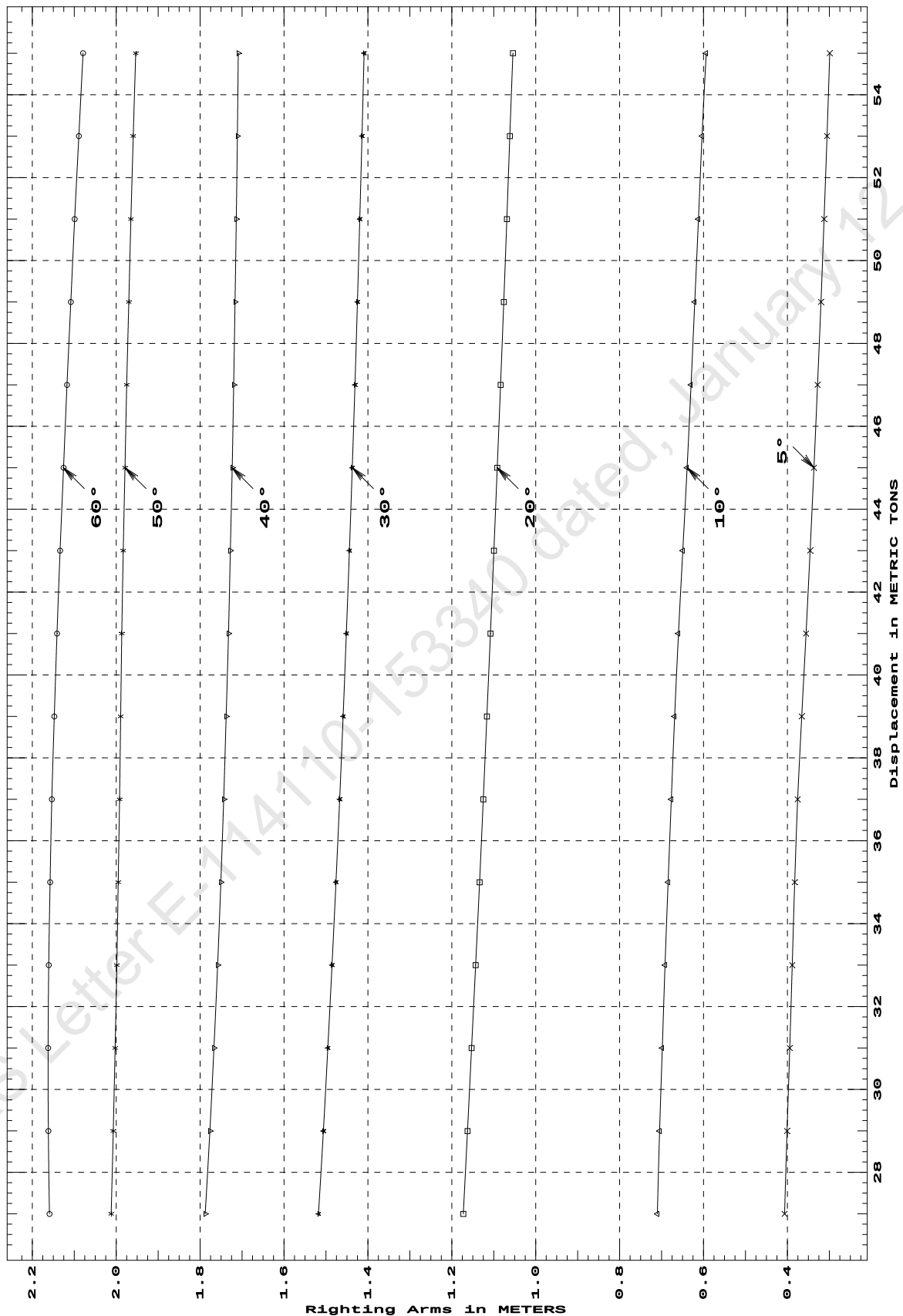
Trim: Fwd 0.200/19.376 at zero heel (trim righting arm held at zero)

Displacement METRIC TONS	Heel Angles in Degrees				
	5.00s	10.00s	20.00s	30.00s	40.00s
27.00	0.407s	0.710s	1.173s	1.518s	1.788s
29.00	0.401s	0.705s	1.163s	1.506s	1.777s
31.00	0.395s	0.699s	1.153s	1.496s	1.767s
33.00	0.389s	0.692s	1.143s	1.486s	1.758s
35.00	0.383s	0.685s	1.134s	1.476s	1.751s
37.00	0.376s	0.677s	1.125s	1.468s	1.744s
39.00	0.366s	0.669s	1.117s	1.459s	1.738s
41.00	0.356s	0.660s	1.108s	1.451s	1.733s
43.00	0.346s	0.649s	1.100s	1.444s	1.728s
45.00	0.337s	0.639s	1.092s	1.437s	1.724s
47.00	0.328s	0.630s	1.084s	1.431s	1.720s
49.00	0.320s	0.621s	1.076s	1.425s	1.717s
51.00	0.313s	0.612s	1.069s	1.419s	1.714s
53.00	0.306s	0.604s	1.062s	1.414s	1.711s
55.00	0.300s	0.594s	1.055s	1.409s	1.709s

Displacement METRIC TONS	Heel Angles		@ Flooding Arm Angle
	50.00s	60.00s	
27.00	2.012s	2.159s	
29.00	2.007s	2.162s	
31.00	2.003s	2.162s	
33.00	1.999s	2.161s	
35.00	1.995s	2.158s	
37.00	1.992s	2.153s	
39.00	1.989s	2.148s	
41.00	1.987s	2.141s	
43.00	1.983s	2.134s	
45.00	1.979s	2.126s	
47.00	1.975s	2.117s	
49.00	1.970s	2.108s	
51.00	1.965s	2.099s	
53.00	1.959s	2.089s	
55.00	1.954s	2.079s	

Distances in METERS.---Specific Gravity = 1.025.---

CROSS CURVES OF STABILITY - Stbd Heel
 at 0.2 M. FWD TRIM (initial)



Specific Gravity = 1.025 Assumed KG = 0.00 M.
 "K" = Base plane

PART-3

ASSESSMENT OF STABILITY UNDER VARIOUS LOADING CONDITION

3.0 SUMMARY OF LOADING CONDITION

CONDITION No.	01	02	03
Description	Light Ship	Full load de- parture	Full load arri- val
Displacement	42.21	57.76	45.93
Lightship (T)	42.21	42.21	42.21
Dead Weight(T)	0.00	15.55	3.71
Draft AP (m) from baseline @ 0 f	1.039	1.174	1.064
Draft FP (m) from baseline @ 19.376f	0.773	1.046	0.852
Draft (m) midship	0.906	1.110	0.958
Trim(m)	0.267A	0.128A	0.212A
KG(m)	2.024	1.862	2.065
FSC(m)	0.000	0.131	0.035
KG _{Fluid} (m)	2.024	1.993	2.100
Area under the righting lever curve between 0° – 30° (≥ 0.055 m rad)	0.1677	0.1412	0.1497
Area under the righting lever curve between 0° – 40° (≥ 0.090 m rad)	0.2470	0.2150	0.2187
Area under the righting lever curve between 30° – 40° (≥ 0.030 m rad)	0.0793	0.0739	0.0690
Minimum righting lever at 30°(≥ 0.2 m)	0.451	0.412	0.397
Angle of maximum righting lever (≥ 25°)	37.33	41.92	30.00
Initial metacentric height (≥ 0.15 m)	1.849	1.294	1.607
IMO Severe Weather Criteria, b/a >1 (120 N/sq.m)	--	4.11	2.685
Angle from pre roll to abs 16 deg or 80% DK immersion	--	14.48	14.32

3.1 LIGHT SHIP HYDROSTATIC PROPERTIES

Trim: Aft 0.267/19.376, No Heel, VCG = 2.024

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/
Draft----	Weight(MT)----	LCB-----	VCB-----	cm-----
0.930	42.21	7.170f	0.624	0.78
				7.946f
				0.89
				40.69
				1.851

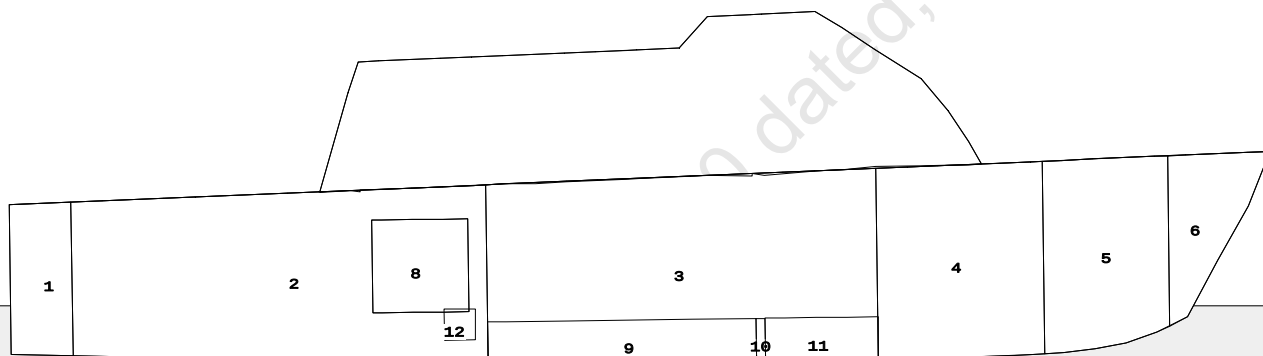
Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.
 Trim is per 19.38m.

Draft is from Baseline.

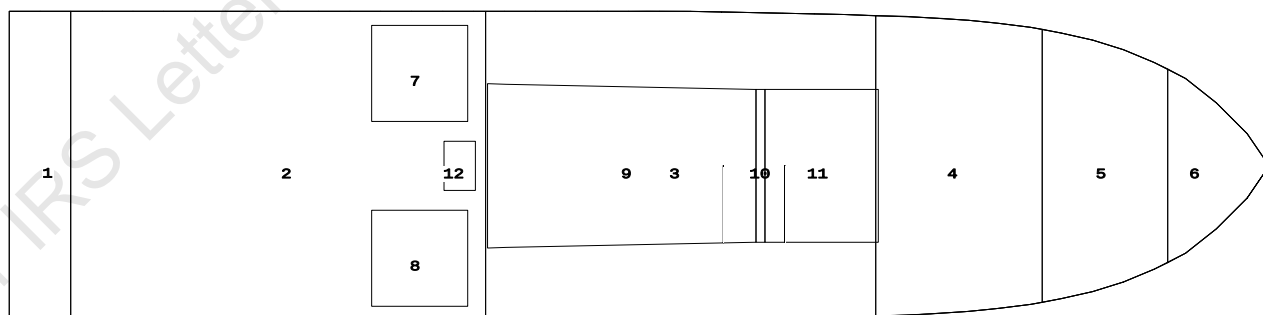
Midship Draft(m)
 Baseline Draft @ 9.688f = 0.906

Condition Graphic - Draft: 0.773 @ 19.376f, 1.039 @ 0.000 Heel: zero

Profile View



Plan View



Tanks

1 JETCOMP.C....0% unknown Intact
 2 ERCOMP.C....0% unknown Intact
 3 CREWCAB3.C...0% unknown Intact
 4 CREWCAB2.C...0% unknown Intact

5 CREWCAB1.C...0% unknown Intact
 6 FPCOMP.C....0% unknown Intact
 7 FOTK.P.....0% DIESEL OIL Intact
 8 FOTK.S.....0% DIESEL OIL Intact
 9 FWTK.C.....0% FRESH WATER Intact

10 VOID.C.....0% unknown Intact
 11 FORESVTK.C...0% DIESEL OIL Intact
 12 SEWAGTK.C....0% SEWAGE Intact

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 0.773 @ 19.38f, 1.039 @ 0.00

Trim: Aft 0.267/19.376, Heel: zero

Part-----	Weight(MT)----	LCG-----	TCG-----	VCG-----	FSM-----
WEIGHT	42.21	7.189f	0.000	2.024	
Load-----	SpGr-----	Weight(MT)----	LCG-----	TCG-----	VCG-----
Total Tanks----->		0.00			0.00
Deadweight Loaded--->		0.00			
	Displ(MT)----	LCB-----	TCB-----	VCB-----	
HULL	1.025	42.21	7.170f	0.000	0.624

Righting Arms: 0.000 0.000
Distances in METERS.-----Moments in m.-MT.

RIGHTING ARMS vs HEEL ANGLE

LCG = 7.189f TCG = 0.000 VCG = 2.024

Origin	Degrees of	Displacement	Righting Arms	Flood Pt
Depth---	Trim----	Heel----	Weight(MT)----	in Trim--in Heel--> Area--Height
1.039	0.79a	0.00	42.196	0.000 0.000 0.0000 2.298(2)
1.038	0.83a	5.00s	42.209	0.000 0.158 0.0069 2.166(2)
1.028	0.93a	10.00s	42.206	0.000 0.292 0.0267 2.021(2)
0.919	1.01a	20.00s	42.211	0.000 0.417 0.0906 1.747(2)
0.715	0.92a	30.00s	42.210	0.000 0.451 0.1677 1.484(2)
0.518	0.79a	37.33s	42.210	0.000 0.454 0.2258 1.295(2)
0.436	0.73a	40.00s	42.196	0.000 0.454 0.2470 1.228(2)
0.435	0.73a	40.02s	42.192	0.000 0.454 0.2471 Dk/MargImm.
0.106	0.55a	50.00s	42.195	0.000 0.445 0.3256 0.971(1)
-0.200	0.76a	60.00s	42.207	0.000 0.360 0.3970 0.590(1)
-0.484	1.19a	70.00s	42.210	0.000 0.190 0.4462 0.199(1)
-0.622	1.43a	75.09s	42.200	0.000 0.085 0.4585 -0.000(1)
-0.723	1.62a	78.92s	42.209	0.000 0.000 0.4614 -0.150(1)
-0.751	1.67a	80.00s	42.210	0.000 -0.024 0.4612 -0.191(1)

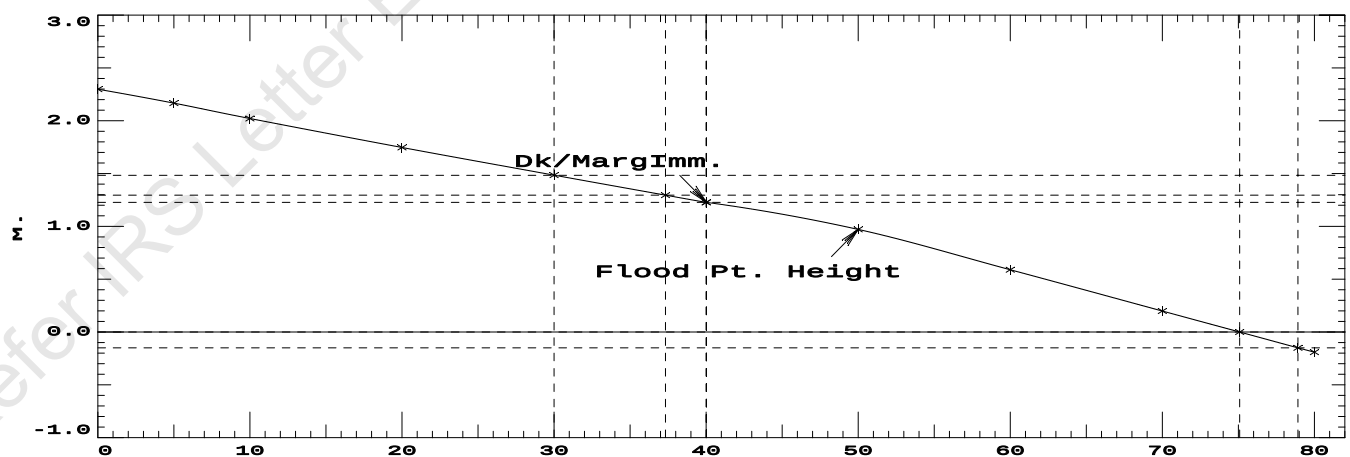
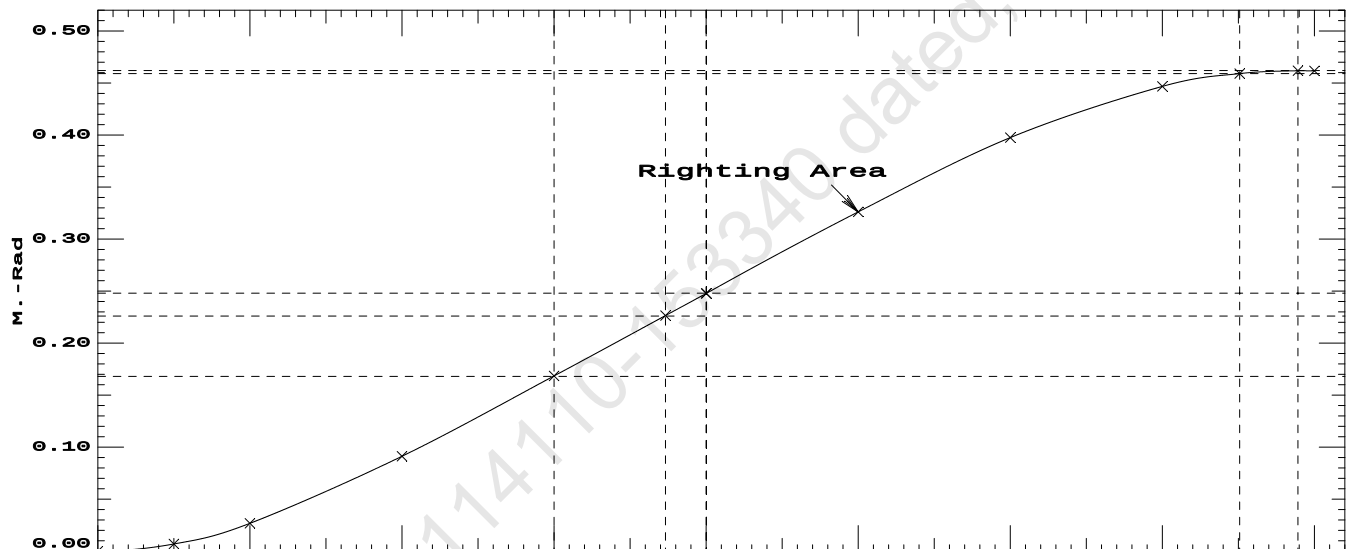
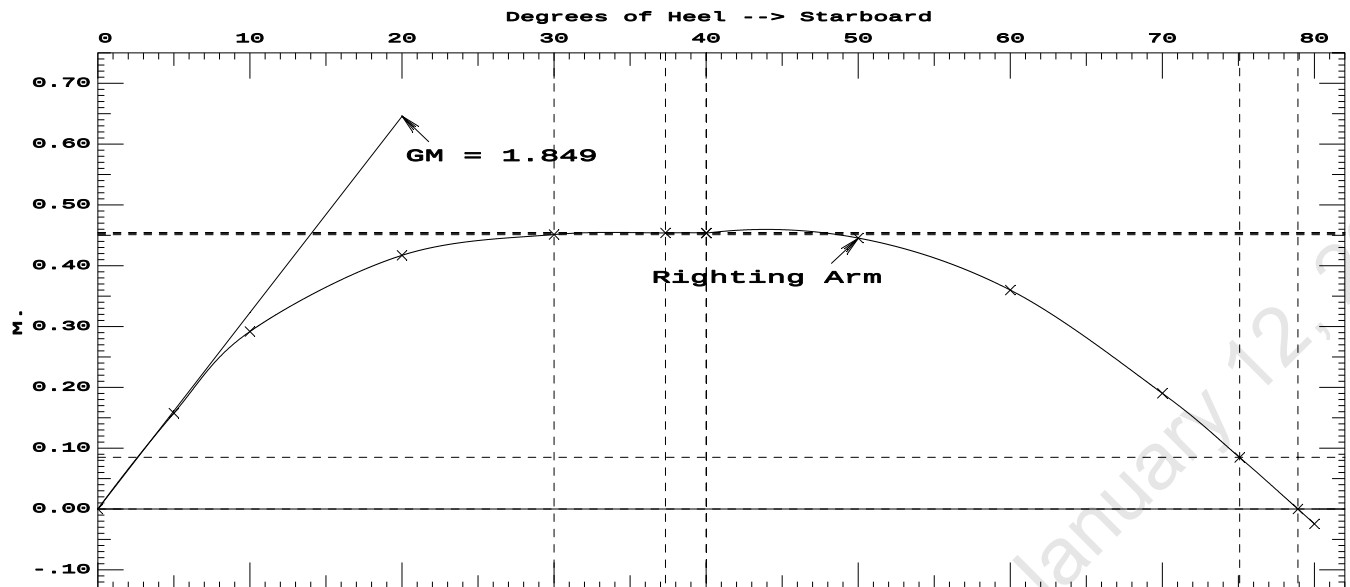
Distances in METERS.-----Specific Gravity = 1.025.-----Area in m.-Rad.

Note: No tank loads are present.

Critical Points-----LCP-----TCP-----VCP

(1) Engine air vent1	FLOOD	5.690f	1.780	3.711
(2) Engine air vent2	FLOOD	1.650f	1.395	3.315

LIM-----	STABILITY CRITERION-----	Min/Max-----	Attained
(1) Area from abs 0 deg to abs 30	>	0.0550 m.-Rad	0.1677 P
(2) Area from abs 0 deg to abs 40 or Flood	>	0.0900 m.-Rad	0.2470 P
(3) Area from abs 30 deg to abs 40 or Flood	>	0.0300 m.-Rad	0.0793 P
(4) Righting Arm at abs 30 deg	>	0.200 m.	0.451 P
(5) Absolute Angle at MaxRA	>	25.00 deg	37.33 P
(6) GM Upright	>	0.150 m.	1.849 P



3.2 FULL LOAD DEPARTURE HYDROSTATIC PROPERTIES

Trim: Aft 0.128/19.376, No Heel, VCG = 1.862

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/
Draft----	Weight(MT)----	LCB-----	VCB-----	cm-----
1.119	57.76	7.666f	0.729	0.83
8.318f	1.00	33.49	1.293	

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.
Trim is per 19.38m.

Draft is from Baseline.

True Free Surface included.

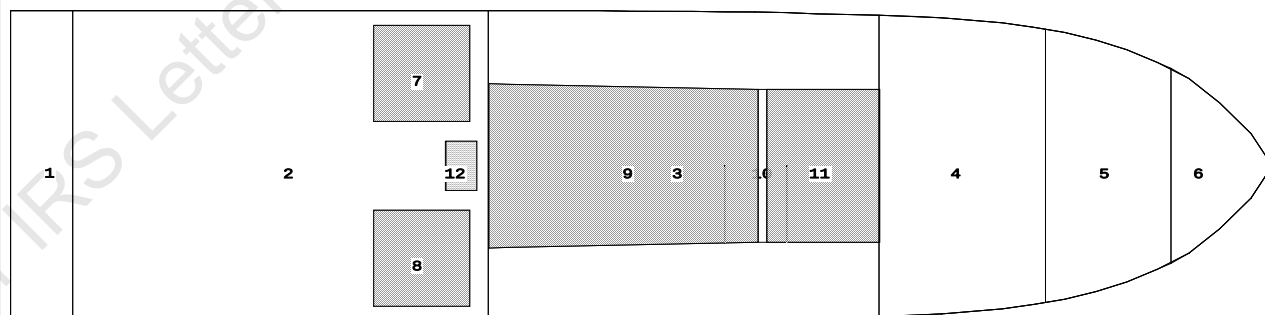
Midship Draft(m)
Baseline Draft @ 9.688f = 1.110

Condition Graphic - Draft: 1.046 @ 19.376f, 1.174 @ 0.000 Heel: zero

Profile View



Plan View



Tanks

1 JETCOMP.C....0% unknown Intact
2 ERCOMP.C....0% unknown Intact
3 CREWCAB3.C...0% unknown Intact
4 CREWCAB2.C...0% unknown Intact

5 CREWCAB1.C...0% unknown Intact
6 FPCOMP.C....0% unknown Intact
7 FOTK.P.....98% DIESEL OIL Intact
8 FOTK.S.....98% DIESEL OIL Intact
9 FWTK.C.....98% FRESH WATER Intact

10 VOID.C.....0% unknown Intact
11 FORESVTK.C..98% DIESEL OIL Intact
12 SEWAGTK.C...10% SEWAGE Intact

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 1.046 @ 19.38f, 1.174 @ 0.00

Trim: Aft 0.128/19.376, Heel: zero

Part-----			Weight(MT)----	LCG-----	TCG-----	VCG-----	
LIGHT SHIP			42.21	7.189f	0.000	2.024	
22 Nos persons			1.65	10.500f	0.000	3.946	
stores & provision			0.75	12.000f	0.000	1.550	
arms & ammunitions			0.50	8.000f	0.000	4.000	
Total Fixed----->			45.11	7.399f	0.000	2.108	
	Load-----	SpGr-----	Weight(MT)---- <th>LCG-----</th> <th>TCG-----</th> <th>VCG-----</th> <th>FSM-----</th>	LCG-----	TCG-----	VCG-----	FSM-----
FOTK.P	0.980	0.870	3.07	6.624f	1.490p	1.575	0.42
FOTK.S	0.980	0.870	3.07	6.624f	1.490s	1.575	0.42
FWTK.C	0.980	1.000	4.94	9.804f	0.000	0.420	4.76
FORESVTK.C	0.980	0.870	1.54	13.062f	0.000	0.432	1.95
SEWAGTK.C	0.100	1.025	0.02	7.247f	0.000	0.410	0.02
Total Tanks----->			12.65	8.651f	0.000	0.983	7.56
Deadweight Loaded--->			15.55	8.988f	0.000	1.422	
Total Weight----->			57.76	7.673f	0.000	1.862	
			Displ(MT)---- <th>LCB-----</th> <th>TCB-----</th> <th>VCB-----</th> <td></td>	LCB-----	TCB-----	VCB-----	
HULL		1.025	57.76	7.666f	0.000	0.729	

Righting Arms: 0.000 0.000
Distances in METERS.-----Moments in m.-MT.

RIGHTING ARMS vs HEEL ANGLE

Total CG: LCG = 7.673f TCG = 0.000 VCG = 1.862

Free Surface Adjustment: 0.131

Adjusted CG: LCG = 7.674f TCG = 0.000 VCG = 1.993

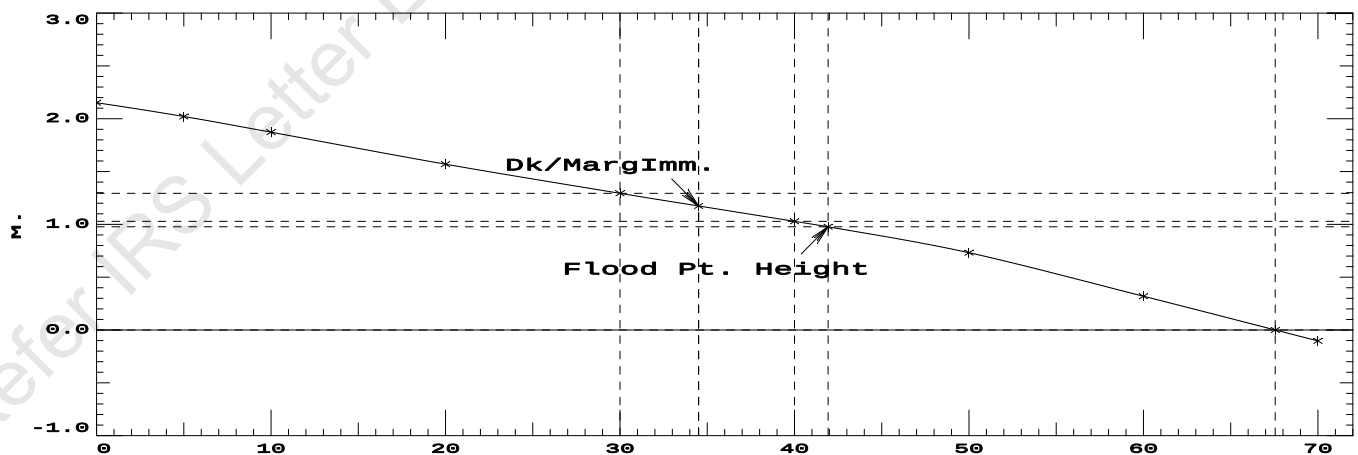
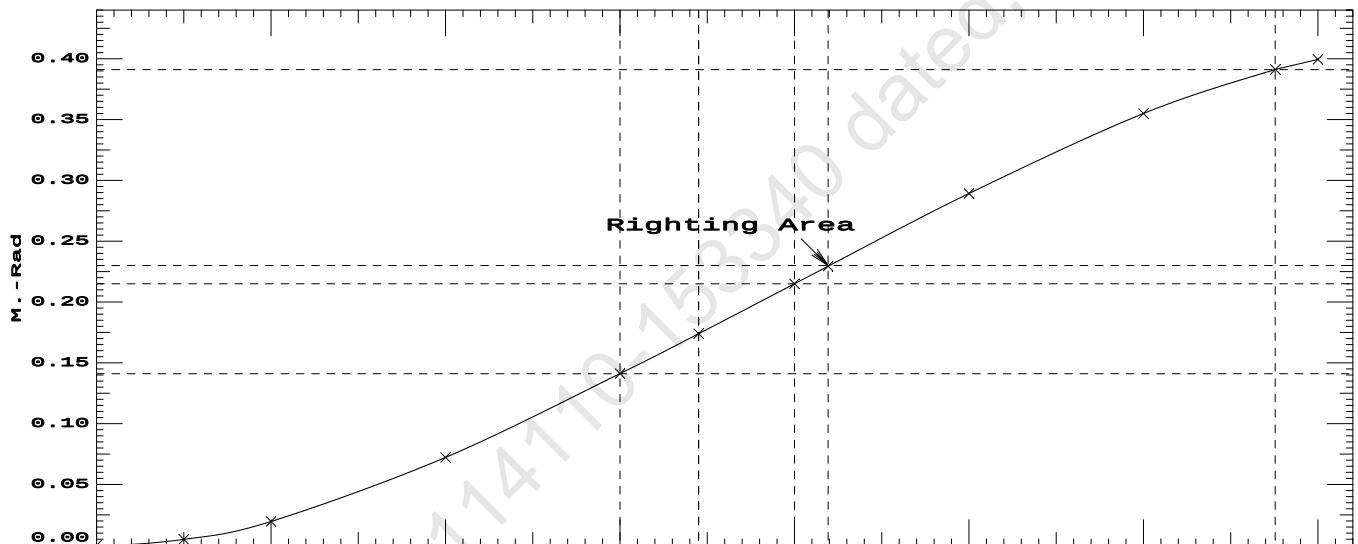
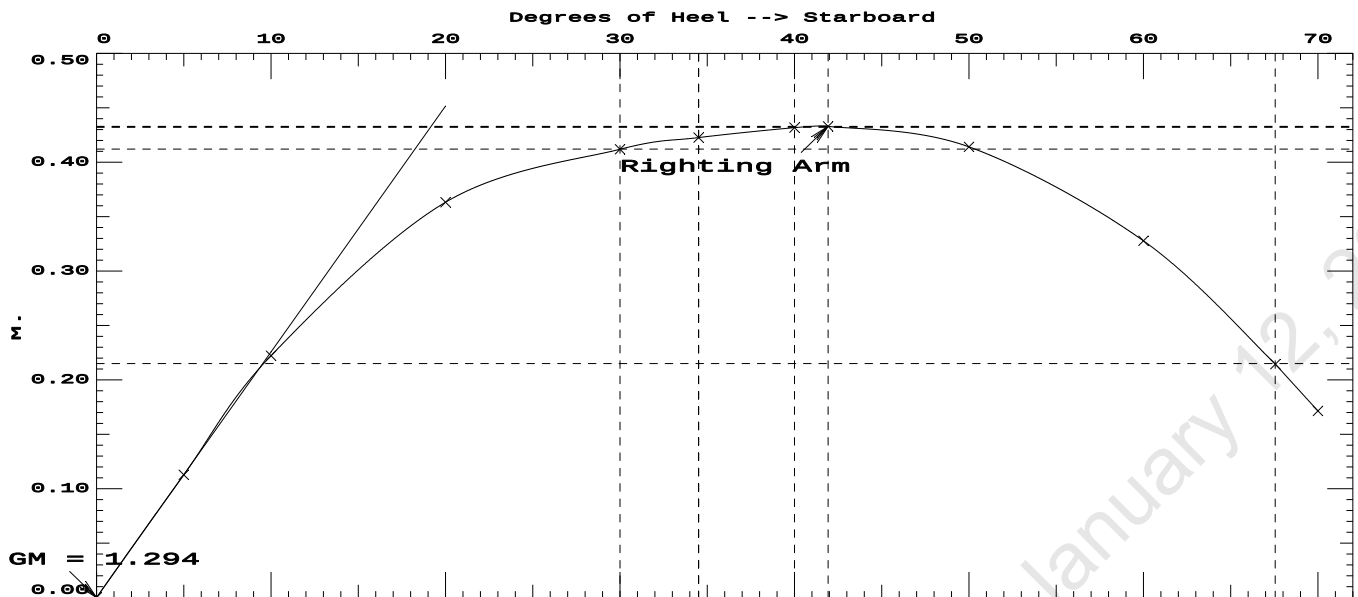
Origin	Degrees of	Displacement	Righting Arms	Flood Pt
Depth---Trim---	Heel---	Weight(MT)----	in Trim--in Heel---	Area--Height
1.174 0.38a	0.00	57.756	0.000 0.000	0.0000 2.152(2)
1.172 0.40a	5.00s	57.756	0.000 0.113	0.0049 2.021(2)
1.163 0.47a	10.00s	57.754	0.000 0.222	0.0196 1.873(2)
1.085 0.61a	20.00s	57.773	0.000 0.363	0.0722 1.570(2)
0.896 0.57a	30.00s	57.756	0.000 0.412	0.1412 1.294(2)
0.782 0.52a	34.51s	57.740	0.000 0.423	0.1740 Dk/MargImm.
0.626 0.45a	40.00s	57.756	0.000 0.432	0.2150 1.029(2)
0.570 0.45a	41.92s	57.755	0.000 0.433	0.2296 0.977(2)
0.339 0.49a	50.00s	57.755	0.000 0.414	0.2896 0.732(1)
0.063 0.69a	60.00s	57.754	0.000 0.328	0.3554 0.319(1)
-0.134 0.96a	67.56s	57.752	0.000 0.214	0.3916 -0.000(1)
-0.195 1.06a	70.00s	57.755	0.000 0.171	0.3998 -0.103(1)

Distances in METERS.-----Specific Gravity = 1.025.-----Area in m.-Rad.

Note: The Weight and Center of Gravity used for the righting arms above include tank loads. However, the tank load centers were NOT ALLOWED TO SHIFT with heel and trim changes. Rather, a constant Free Surface Moment of 7.6 m.-MT was applied to artificially modify the CG.

Critical Points-----	LCP-----	TCP-----	VCP-----
(1) Engine air vent1	FLOOD	5.690f	1.780
(2) Engine air vent2	FLOOD	1.650f	1.395

LIM-----	STABILITY CRITERION-----	Min/Max-----	Attained
(1) Area from abs 0 deg to abs 30	>	0.0550 m.-Rad	0.1412 P
(2) Area from abs 0 deg to abs 40 or Flood	>	0.0900 m.-Rad	0.2150 P
(3) Area from abs 30 deg to abs 40 or Flood	>	0.0300 m.-Rad	0.0739 P
(4) Righting Arm at abs 30 deg	>	0.200 m.	0.412 P
(5) Absolute Angle at MaxRA	>	25.00 deg	41.92 P
(6) GM Upright	>	0.150 m.	1.294 P



SEVERE WEATHER CRITERIA

Roll angle = 17.67 degrees.

IMO parameters:

K = 0.700	X1 = 0.800	X2 = 0.862	Cb = 0.527
L = 19.248	B = 5.000	D = 1.110	BDR = 4.504
VCG = 1.862	Draft = 1.119	WG = 0.738	R = 1.129
T = 4.1	C = 0.937	GM = 1.294	S = 0.100

HEELING MOMENT specification

Lateral Plane Method

Wind pressure (includes gust factor 1.500) toward starboard

Baseline draft: 1.046 @ 19.38f, 1.174 @ 0.00

Trim: Aft 0.128/19.376, Heel: zero

Part-----	LPA*SF-----	HCP-----	Arm----	Pressure-----	Moment
HULL	36.5	0.947	1.468	0.02447	1.31
SS.C	21.1	2.914	3.435	0.02447	1.78
Total wind heeling moment to starboard----->					3.09
Distances in METERS.-----Pressure in MT/Sqm.-----					Moment in m.-MT

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

Fixed CG: LCG = 7.399f TCG = 0.000 VCG = 2.108

Origin	Degrees of	Displacement	Residual Arms	Res. Flood Pt
Depth---Trim---	Heel---	Weight(MT)---	in Trim--in Heel---	Area--Height
1.129 0.57a 16.15p	57.774	0.000	-0.411	0.0000 1.684(2)
1.160 0.49a 11.15p	57.772	0.000	-0.321	-0.0319 1.837(2)
1.170 0.41a 6.15p	57.753	0.000	-0.203	-0.0550 1.988(2)
1.174 0.38a 1.52s	57.749	0.000	-0.018	-0.0697 PreRoll
1.173 0.38a 2.25s	57.755	0.000	0.000	-0.0699 2.095(2)
1.172 0.39a 3.85s	57.755	0.000	0.039	-0.0693 2.053(2)
1.148 0.55a 13.85s	57.745	0.000	0.268	-0.0423 1.753(2)
1.130 0.57a 16.00s	57.753	0.000	0.302	-0.0316 1.689(2)
1.022 0.61a 23.85s	57.754	0.000	0.384	0.0161 1.463(2)
0.949 0.59a 27.61s	57.753	0.000	0.408	0.0422 80% DeckImm
0.799 0.52a 33.85s	57.753	0.000	0.437	0.0884 1.192(2)
0.514 0.44a 43.85s	57.755	0.000	0.466	0.1675 0.923(2)
0.481 0.44a 45.00s	57.766	0.000	0.467	0.1769 0.890(2)
0.338 0.49a 50.00s	57.755	0.000	0.458	0.2173 0.733(1)
0.062 0.68a 60.00s	57.753	0.000	0.385	0.2919 0.319(1)
-0.135 0.95a 67.57s	57.751	0.000	0.280	0.3364 -0.000(1)
-0.196 1.06a 70.00s	57.752	0.000	0.239	0.3473 -0.102(1)
Distances in METERS.-----Specific Gravity = 1.025.-----Area in m.-Rad.				

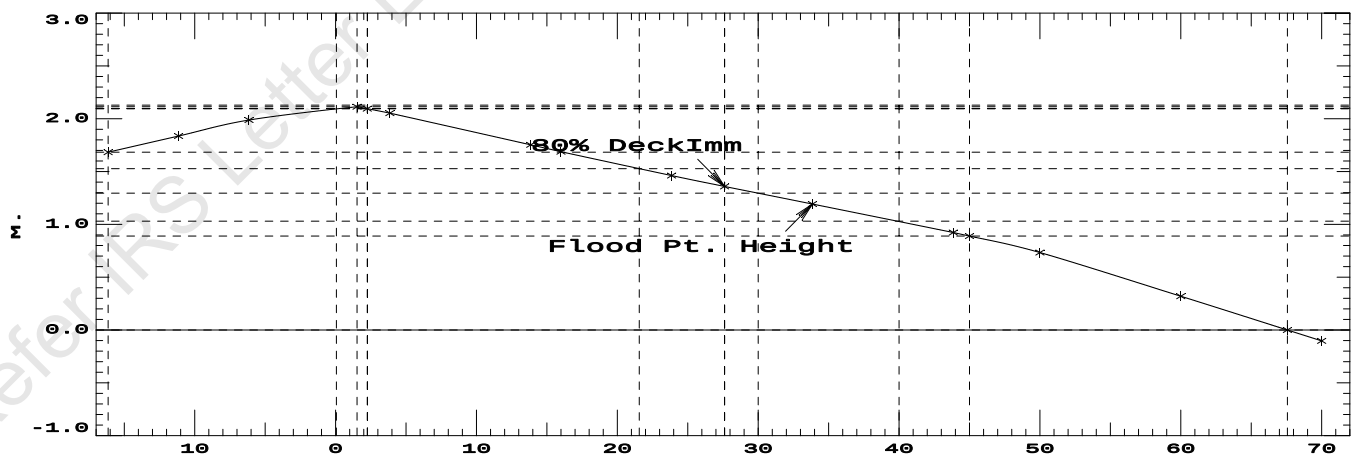
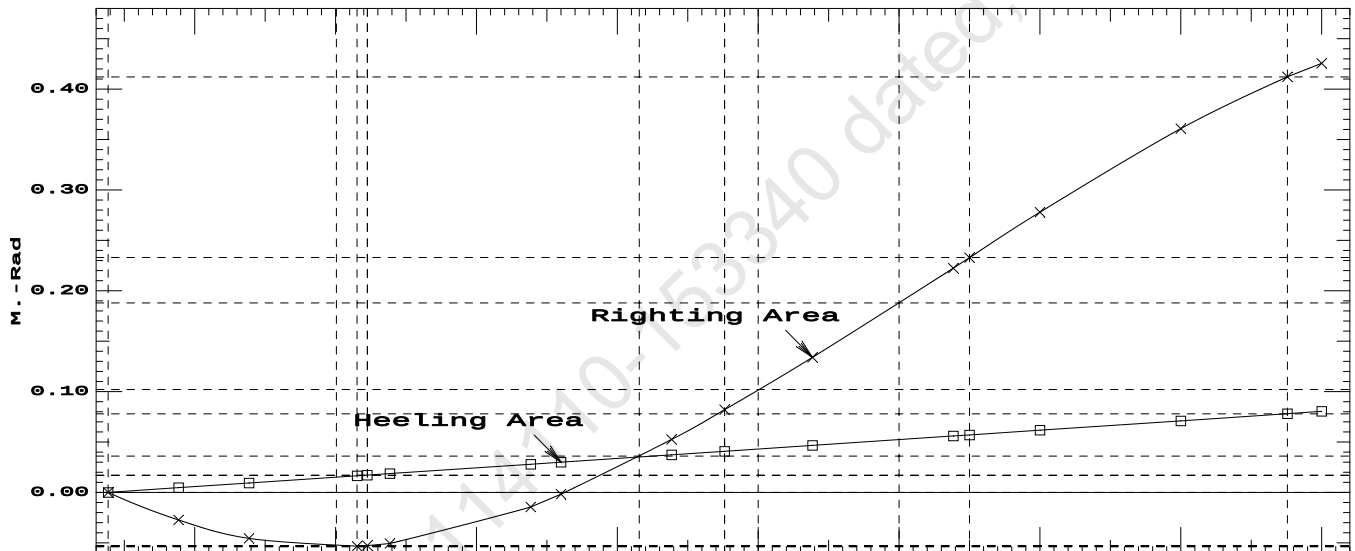
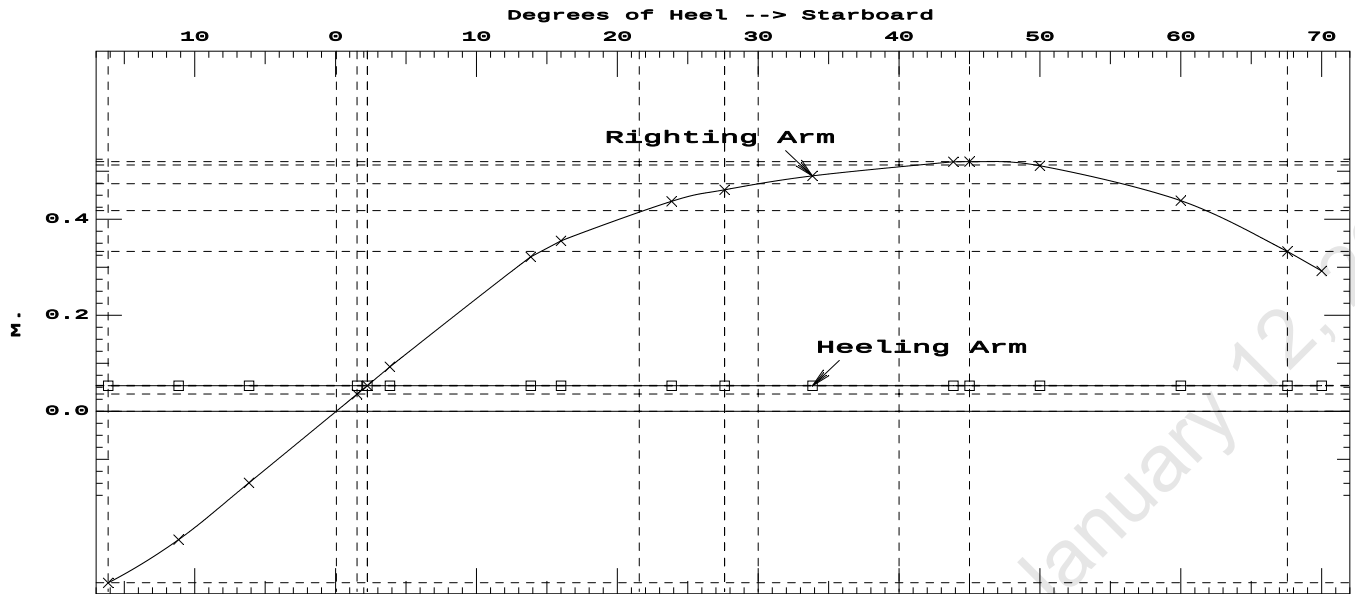
Note: The Center of Gravity shown above is for the Fixed Weight of 45.11 MT. As the tank load centers shift with heel and trim, the total Center of Gravity varies. The righting arms shown above include the effect of the C.G. variation.

Note: The Residual Righting Arms shown above are in excess of the wind heeling arms derived from these moments (in m.-MT):
Stbd heeling moment = 3.09 (constant)

Critical Points-----	LCP-----	TCP-----	VCP
(1) Engine air vent1	FLOOD 5.690f	1.780	3.711
(2) Engine air vent2	FLOOD 1.650f	1.395	3.315

LIM-----	STABILITY CRITERION-----	Min/Max-----	Attained
(1) Res. Ratio from Roll to abs 50 deg or Flood	>	1.000	4.110 P
(2) Angle from PreRoll to abs 16 deg or 80% Dk Imm	>	0.00 deg	14.48 P

Refer IRS Letter E-114110-153340 dated, January 12, 2021



3.3 FULL LOAD ARRIVAL HYDROSTATIC PROPERTIES

Trim: Aft 0.212/19.376, No Heel, VCG = 2.065

LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/
Draft----	Weight(MT)----	LCB-----	VCB-----	cm-----
0.976	45.93	7.348f	0.649	0.80
8.062f	0.91	38.59	1.608	

Distances in METERS.-----Specific Gravity = 1.025.-----Moment in m.-MT.
Trim is per 19.38m.

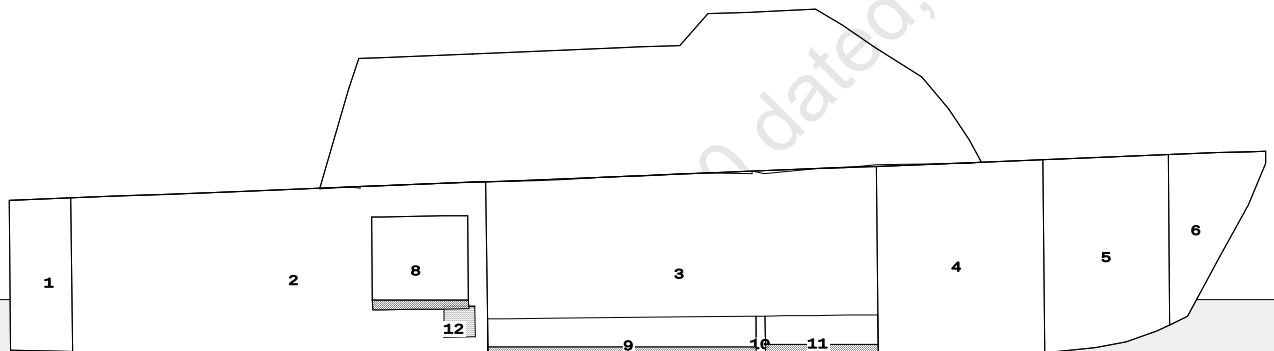
Draft is from Baseline.

True Free Surface included.

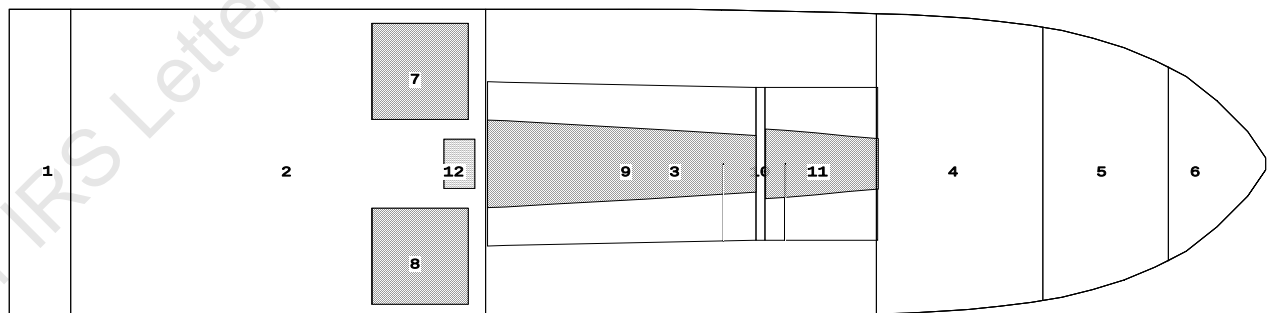
Midship Draft(m)
Baseline Draft @ 9.688f = 0.958

Condition Graphic - Draft: 0.852 @ 19.376f, 1.064 @ 0.000 Heel: zero

Profile View



Plan View



Tanks

1 JETCOMP.C....0% unknown Intact
2 ERCOMP.C....0% unknown Intact
3 CREWCAB3.C...0% unknown Intact
4 CREWCAB2.C...0% unknown Intact

5 CREWCAB1.C...0% unknown Intact
6 FPCOMP.C....0% unknown Intact
7 FOTK.P.....10% DIESEL OIL Intact
8 FOTK.S.....10% DIESEL OIL Intact
9 FWTK.C.....10% FRESH WATER Intact

10 VOID.C.....0% unknown Intact
11 FORESVTK.C..10% DIESEL OIL Intact
12 SEWAGTK.C...98% SEWAGE Intact

WEIGHT and DISPLACEMENT STATUS

Baseline draft: 0.852 @ 19.38f, 1.064 @ 0.00

Trim: Aft 0.212/19.376, Heel: zero

Part-----			Weight(MT)-----	LCG-----	TCG-----	VCG-----	
LIGHT SHIP			42.21	7.189f	0.000	2.024	
22 Nos persons			1.65	10.500f	0.000	3.946	
arms & ammunitions			0.50	8.000f	0.000	4.000	
stores & provision			0.08	12.000f	0.000	1.550	
Total Fixed----->			44.43	7.329f	0.000	2.117	
	Load-----	SpGr-----	Weight(MT)-----	LCG-----	TCG-----	VCG-----	FSM-----
FOTK.P	0.100	0.870	0.31	6.610f	1.490p	0.915	0.42
FOTK.S	0.100	0.870	0.31	6.610f	1.490s	0.915	0.42
FWTK.C	0.100	1.000	0.50	9.630f	0.000	0.132	0.62
FORESVTK.C	0.100	0.870	0.16	13.028f	0.000	0.137	0.12
SEWAGTK.C	0.980	1.025	0.20	7.249f	0.000	0.630	0.02
Total Tanks----->			1.49	8.399f	0.000	0.529	1.60
Deadweight Loaded--->			3.71	9.352f	0.000	2.536	
Total Weight----->			45.92	7.364f	0.000	2.065	
			Displ(MT)-----	LCB-----	TCB-----	VCB-----	
HULL		1.025	45.93	7.348f	0.000	0.649	

Righting Arms: 0.000 0.000

Distances in METERS.-----Moments in m.-MT.

RIGHTING ARMS vs HEEL ANGLE

Total CG: LCG = 7.364f TCG = 0.000 VCG = 2.065

Free Surface Adjustment: 0.035

Adjusted CG: LCG = 7.364f TCG = 0.000 VCG = 2.100

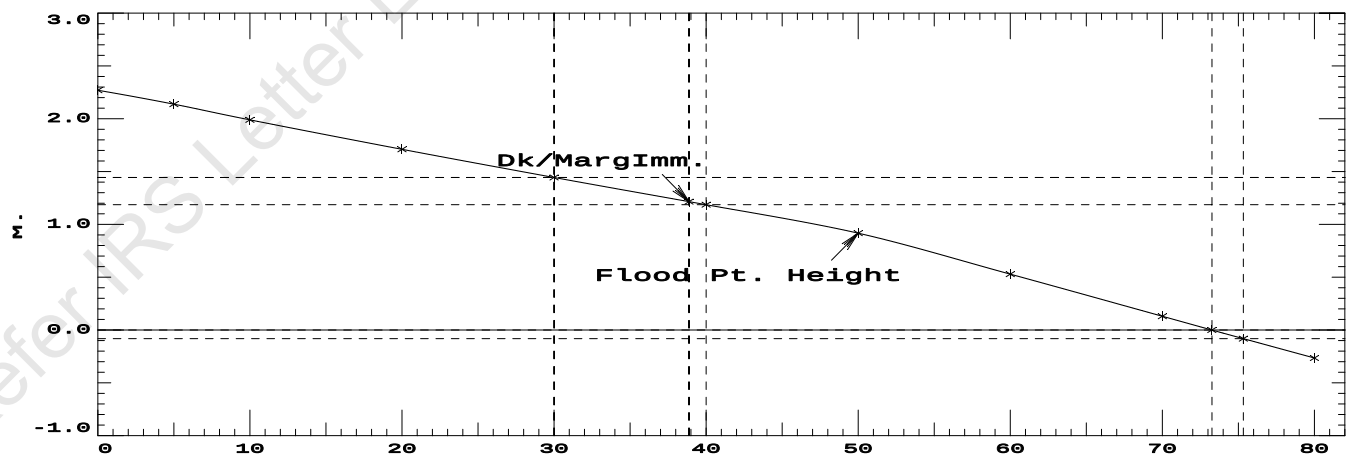
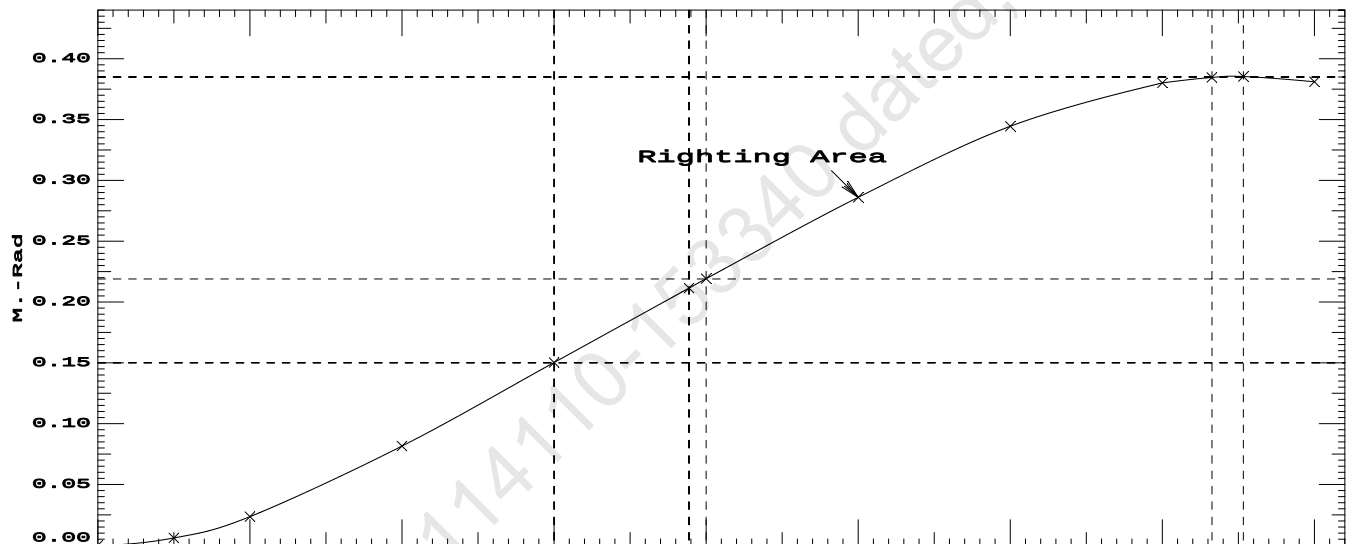
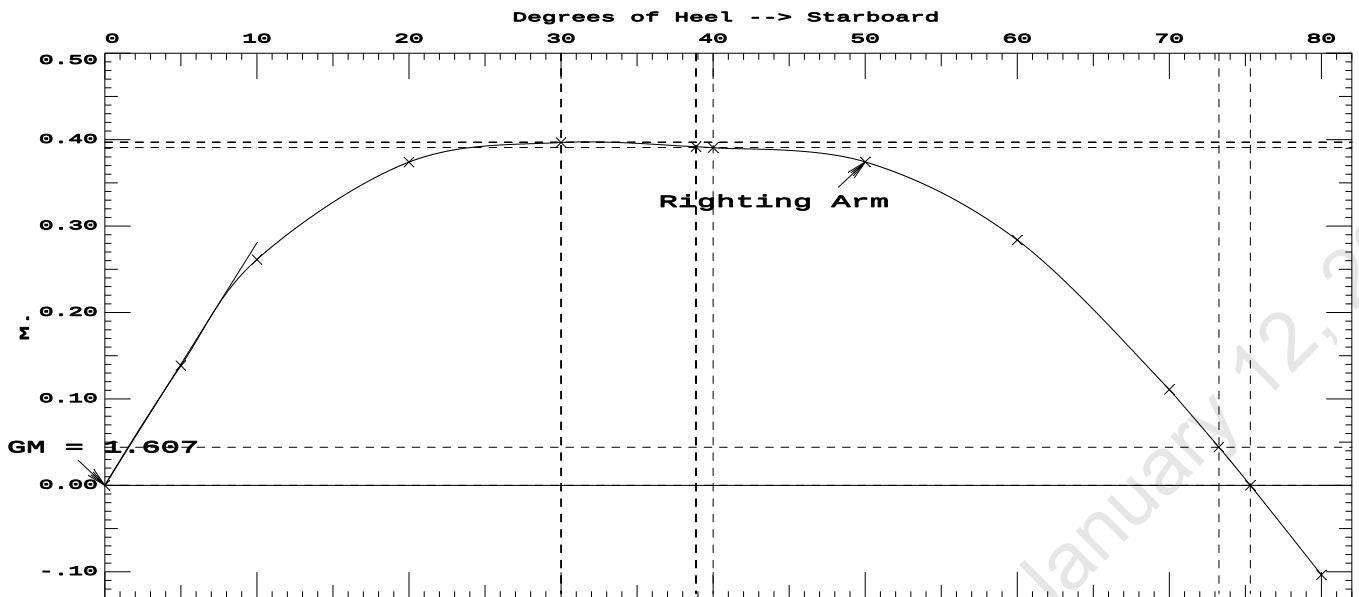
Origin	Degrees of	Displacement	Righting Arms	Flood Pt
Depth---	Trim---	Heel---	Weight(MT)---	Area--Height
1.063	0.63a	0.00	45.908	0.0000 2.269(2)
1.062	0.66a	5.00s	45.921	0.0000 2.138(2)
1.054	0.76a	10.00s	45.917	0.0000 1.990(2)
0.952	0.85a	20.00s	45.913	0.0000 1.710(2)
0.751	0.77a	30.00s	45.922	0.0000 1.444(2)
0.508	0.61a	38.87s	45.908	0.0000 0.2110 Dk/MargImm.
0.473	0.59a	40.00s	45.922	0.0000 0.2187 1.186(2)
0.149	0.45a	50.00s	45.922	0.0000 0.374 0.2856 0.917(1)
-0.150	0.64a	60.00s	45.920	0.0000 0.284 0.3441 0.528(1)
-0.429	1.05a	70.00s	45.921	0.0000 0.111 0.3798 0.130(1)
-0.516	1.20a	73.26s	45.916	0.0000 0.044 0.3842 0.000(1)
-0.571	1.30a	75.32s	45.917	0.0000 0.000 0.3850 -0.082(1)
-0.691	1.52a	80.00s	45.903	0.0000 -0.104 0.3808 -0.266(1)

Distances in METERS.-----Specific Gravity = 1.025.-----Area in m.-Rad.

Note: The Weight and Center of Gravity used for the righting arms above include tank loads. However, the tank load centers were NOT ALLOWED TO SHIFT with heel and trim changes. Rather, a constant Free Surface Moment of 1.6 m.-MT was applied to artificially modify the CG.

Critical Points-----	LCP-----	TCP-----	VCP-----
(1) Engine air vent1	FLOOD	5.690f	1.780 3.711
(2) Engine air vent2	FLOOD	1.650f	1.395 3.315

LIM-----	STABILITY CRITERION-----	Min/Max-----	Attained
(1) Area from abs 0 deg to abs 30	>	0.0550 m.-Rad	0.1497 P
(2) Area from abs 0 deg to abs 40 or Flood	>	0.0900 m.-Rad	0.2187 P
(3) Area from abs 30 deg to abs 40 or Flood	>	0.0300 m.-Rad	0.0690 P
(4) Righting Arm at abs 30 deg	>	0.200 m.	0.397 P
(5) Absolute Angle at MaxRA	>	25.00 deg	30.00 P
(6) GM Upright	>	0.150 m.	1.607 P



SEVERE WEATHER CRITERIA

Roll angle = 18.50 degrees.

IMO parameters:

K = 0.700	X1 = 0.800	X2 = 0.808	Cb = 0.489
L = 19.143	B = 5.000	D = 0.958	BDR = 5.220
VCG = 2.065	Draft = 0.976	WG = 1.082	R = 1.408
T = 3.8	C = 0.970	GM = 1.608	S = 0.100

HEELING MOMENT specification

Lateral Plane Method

Wind pressure (includes gust factor 1.500) toward starboard

Baseline draft: 0.852 @ 19.38f, 1.064 @ 0.00

Trim: Aft 0.212/19.376, Heel: zero

Part-----	LPA*Sf-----	HCP-----	Arm----	Pressure-----	Moment
HULL	39.4	1.027	1.474	0.02447	1.42
SS.C	21.1	3.069	3.516	0.02447	1.82
Total wind heeling moment to starboard----->					3.24
Distances in METERS.-----Pressure in MT/Sqm.-----					Moment in m.-MT

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

Fixed CG: LCG = 7.329f TCG = 0.000 VCG = 2.117

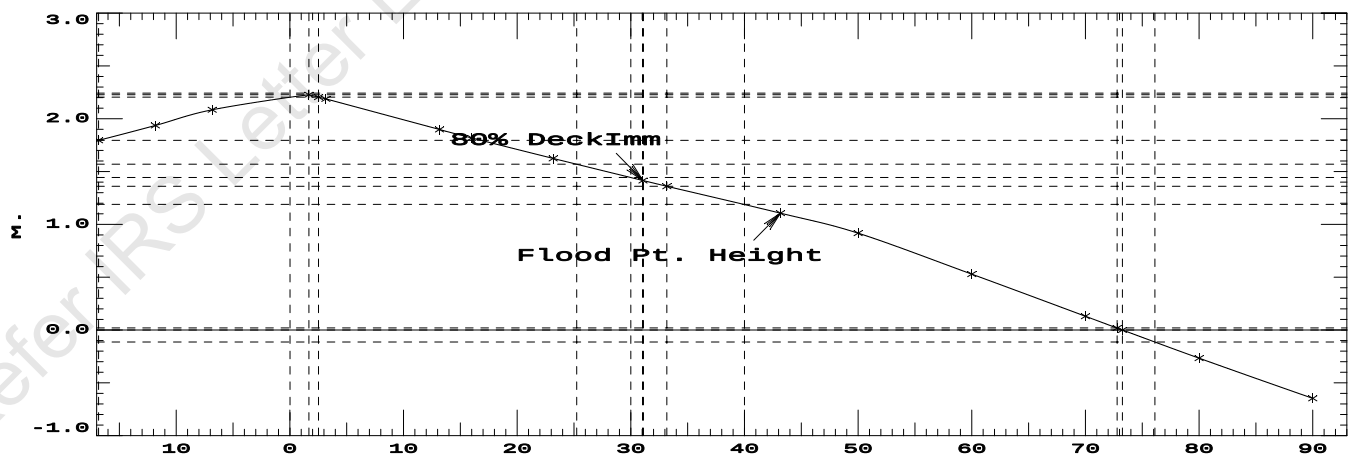
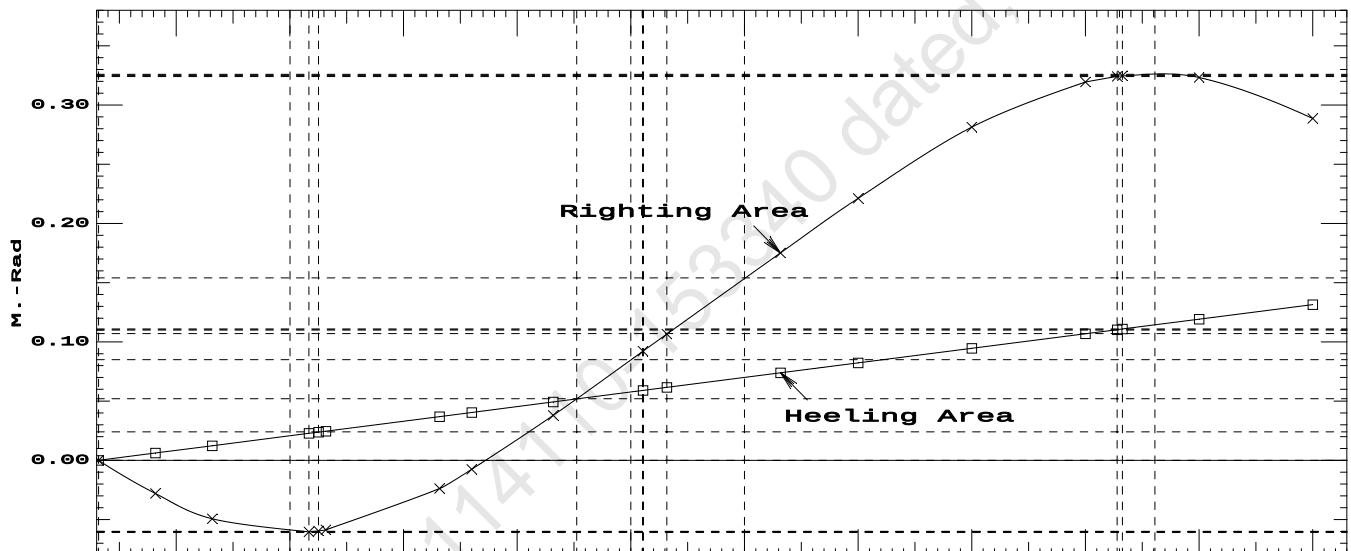
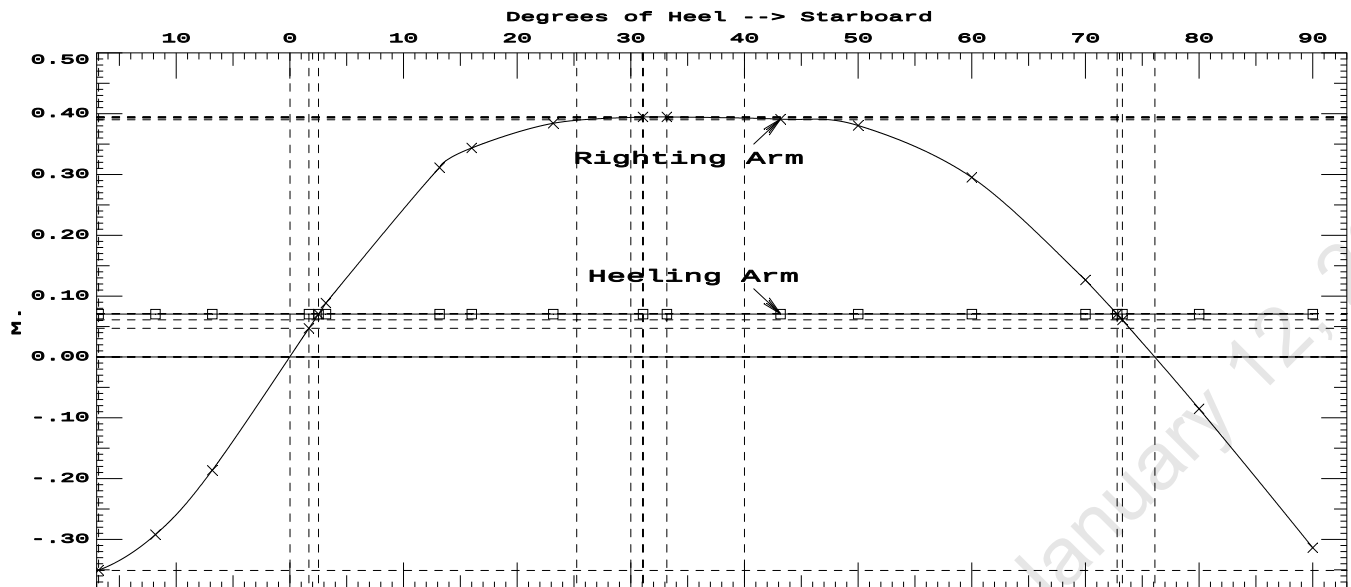
Origin	Degrees of	Displacement	Residual Arms	Res. Flood Pt
Depth---Trim---	Heel---	Weight(MT)---	in Trim--in Heel---	Area--Height
0.998	0.85a	16.83p	45.931	0.000 -0.421 0.0000 1.796(2)
1.045	0.79a	11.83p	45.920	0.000 -0.363 -0.0342 1.937(2)
1.060	0.69a	6.83p	45.916	0.000 -0.257 -0.0616 2.085(2)
1.063	0.63a	1.68s	45.922	0.000 -0.024 -0.0832 PreRoll
1.063	0.63a	2.52s	45.922	0.000 0.000 -0.0834 2.205(2)
1.063	0.64a	3.17s	45.922	0.000 0.018 -0.0833 2.188(2)
1.035	0.81a	13.17s	45.934	0.000 0.241 -0.0599 1.898(2)
1.008	0.84a	16.00s	45.921	0.000 0.273 -0.0473 1.818(2)
0.898	0.84a	23.17s	45.922	0.000 0.314 -0.0098 1.624(2)
0.725	0.76a	31.08s	45.923	0.000 0.324 0.0346 80% DeckImm
0.671	0.72a	33.17s	45.923	0.000 0.324 0.0465 1.361(2)
0.372	0.52a	43.17s	45.940	0.000 0.320 0.1029 1.106(2)
0.149	0.45a	50.00s	45.922	0.000 0.310 0.1406 0.917(1)
-0.150	0.64a	60.00s	45.920	0.000 0.225 0.1884 0.528(1)
-0.429	1.05a	70.00s	45.921	0.000 0.056 0.2138 0.130(1)
-0.504	1.18a	72.79s	45.916	0.000 0.000 0.2151 0.019(1)
-0.516	1.20a	73.26s	45.928	0.000 -0.010 0.2151 -0.000(1)
-0.690	1.52a	80.00s	45.928	0.000 -0.156 0.2055 -0.266(1)
-0.933	2.00a	90.00s	45.921	0.000 -0.384 0.1586 -0.647(1)
Distances in METERS.-----Specific Gravity = 1.025.-----Area in m.-Rad.				

Note: The Center of Gravity shown above is for the Fixed Weight of 44.43 MT. As the tank load centers shift with heel and trim, the total Center of Gravity varies. The righting arms shown above include the effect of the C.G. variation.

Note: The Residual Righting Arms shown above are in excess of the wind heeling arms derived from these moments (in m.-MT):
Stbd heeling moment = 3.24 (constant)

Critical Points-----		LCP----	TCP----	VCP
(1) Engine air vent1	FLLOOD	5.690f	1.780	3.711
(2) Engine air vent2	FLLOOD	1.650f	1.395	3.315

LIM-----		STABILITY CRITERION-----		Min/Max-----	Attained
(1) Res. Ratio from Roll to abs 50 deg or Flood	>	1.000			2.685 P
(2) Angle from PreRoll to abs 16 deg or 80% Dk Imm	>	0.00	deg		14.32 P



ANNEXURE-1
LIGHTSHIP SURVEY REPORT



Yard No.261
SHM SHIPCARE

IRCLASS
Indian Register of Shipping
CIN: U61100MH1975NPL018244

SHM-261-018 Rev.00
Trim & Stability Calculation
52 A, Adi Shankaracharya Marg, Opp. Powai Lake,
Powai, Mumbai - 400 072, India
Phone : +91 22 30519400 / +91 22 7119 9400
Fax : +91 22 2570 3611
E-mail : ho@irclass.org ★ Website : www.irclass.org

Our ref: E-113851-152922

26-November-2020

Company : SHM SHIPCARE

Dear Sir/Madam,

Your document (detailed below) has been reviewed.

Project Details	
Project number	NC002204
Project name	SHM SHIPCARE - 256-264
Project Manager	S Velmurugan
Project In-Charge	

Document Details	
Plan No.	SHM-261-017
Plan Title	Light Ship survey report Yard 261
Rev.No.	00
Upload.No.	1
Submitted Date	24-November-2020
Review Status	Approved
Parent Plan Title	

Notes

1. The review status Approved indicates:

Following lightship particulars are approved for yard no. 261 based on the lightship survey conducted on 23-11-2020.

Lightship Weight: 42.210 T

Lightship L.C.G.: 7.189 m forward of transom (Fr.0)

Lightship V.C.G.: 2.024 m above baseline (value taken from approved Inclining experiment report for Yard No. 256)

Lightship T.C.G.: 0.000 m off centerline

Lightship particulars as in the approved inclining experiment report for yard no. 256 are as follows:

Lightship Weight: 41.59 T

Lightship L.C.G.: 7.262 m forward of transom (Fr.0)

Lightship V.C.G.: 2.024 m above baseline

Lightship T.C.G.: 0.000 m off centerline

The lightship values obtained during lightship survey for yard 261 were compared to lightship particulars in approved inclining experiment report for yard 256 as per 2008 Intact Stability Code, Chapter 8, Sec 8.1.2 and the percentage deviations in displacement and LCG values are found in order.

Percentage deviations are as stated below:

- 1.491 % in case of displacement (required less than 2 % of the lightship weight of the lead ship)
- 0.377 % in case of LCG position (required less than 0.5 % of L).

Stability Booklet prepared based on the approved Lightship particulars should be submitted for approval. Copy of the approved lightship survey report and sister ship's inclining experiment report should form part of the stability booklet.

Yard No.261
Thanking you,
Yours Sincerely,
SHM SHIPCARE

For INDIAN REGISTER OF SHIPPING

Parvathi Rajalakshmi
Principal Surveyor

SHM-261-018 Rev.00
Trim & Stability Calculation

This is an electronically published document and does not require signature.

Refer IRS Letter E-114110-153340 dated, January 12, 2021

LIGHTSHIP SURVEY REPORT
(Drg. No. SHM-261-017 Rev00, 24 November 2020)
Yard No.261 of SHM Ship Care

<u>Content</u>	<u>Sheet No</u>
1.1 Vessel Details	02
1.2 Location Details	02
1.3 Witnessed by	02
1.4 Environment Details	02
1.5 Draft Mark Readings	02
1.6 Determination of Draft at AP and FP	03
1.7 Determination of Displacement and LCG	04
1.8 Determination of Lightship Weight and LCG	
• 1.8.1 List of Weights to Go	05
• 1.8.2 List of Weights to Come	05
• 1.8.3 Lightship Estimation	05
1.9 Comparison of Lightship with Approved Stability Booklet of Sister Vessel, Yard No. 256	05
Appendix - I As Measured Hydrostatics (GHS output)	

SEE LETTER : E-113851-152922

Prepared By:
Vijith V
Naval Architect
Industries Research and Service
35/194, Palarivattom
Kochi-682 025



FOLLOWING LIGHTSHIP PARTICULARS ARE APPROVED:

LIGHTSHIP WEIGHT: 42.210 T

LIGHTSHIP L.C.G.: 7.189 M FORWARD OF TRANSOM (FR.0)

**LIGHTSHIP V.C.G.: 2.024 M ABOVE BASELINE (VALUE TAKEN FROM
APPROVED INCLINING EXPERIMENT REPORT FOR YARD NO. 256)**

LIGHTSHIP T.C.G.: 0.000 M OFF CENTERLINE

1.0 LIGHTSHIP SURVEY REPORT

1.1 Vessel Details

Vessel Name - GANGA (BSF/2018/MC-01)
Yard No. - 261
Vessel Type - Patrol
Length WL - 19.376m
Breadth - 5.00m
Depth - 2.946m

1.2 Location Details

Date: 23-11-2020
Time: 11.00 hours to 13.00 hours
Place: Quay side of SHM yard at Ghodbunder

1.3 Witnessed by:

Mr. H B Patil, Surveyor, Indian Register of Shipping
Mr. Chandan Dawankar, SHM

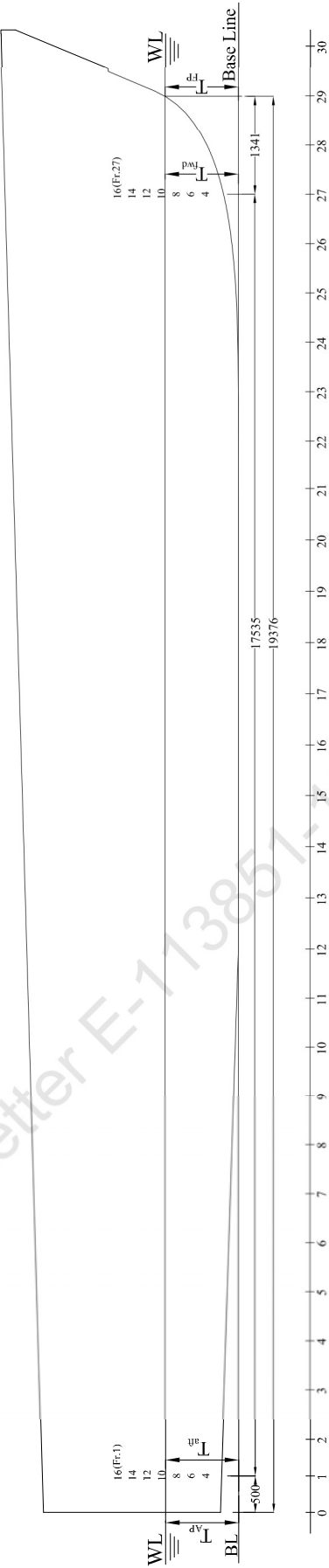
1.4 Environment Details

Water density - 1.012 t/cu.m
Current - Slack
Wind - Calm
Water temp. - 27 deg

1.5 Draft Mark Readings

	Port	Stbd	Mean	Remarks
Aft	1.17	1.17	1.17	
Forward	0.895	0.895	0.895	

1.6 Determination of Draft at AP and FP



PROFILE

DRAFT MEASUREMENT AND TRIM CALCULATION

$$T_{AP} = \frac{T_{AFT} - (T_{FWD} - T_{AFT}) \times 0.500}{17.535}$$

$$T_{FP} = \frac{T_{FWD} + (T_{FWD} - T_{AFT}) \times 1.341}{17.535}$$

$$T_{mid} = \frac{T_{AP} + T_{FP}}{2}$$

$$Trim = T_{AP} - T_{FP}$$

1.7 Determination of Displacement and LCG

Determination of Mean Baseline Draft

Location	Port	Starboard	Mean (m)	Remarks
T _{AFT}	1.17	1.17	1.17	Ref: Section 1.5
T _{FWD}	0.895	0.895	0.895	Ref: Section 1.5

Determination of Draft at Perpendiculars

Location	Base line Draft	Remarks
T _{AP}	1.1778	$1.17 - (0.895 - 1.17) \times 0.5 / 17.535$ (Refer Section 1.6)
T _{FP}	0.8740	$0.895 + (0.895 - 1.17) \times 1.341 / 17.535$ (Refer Section 1.6)

Determination of As measured Values

For T_{AP} = 1.1778m and T_{FP} = 0.8740m

Displacement - 51.31t
LCG - 7.264m

Values calculated for using model in GHS. Refer to Appendix-I for GHS results.

Longitudinal Center of Gravity (LCG) is measured positive forward from transom.

1.8 Determination of Lightship Weight and LCG

1.8.1 List of Weights to Go

Sl. No.	Item	Weight (t)	LCG (m)	Longitudinal Moment (Tm)
1	FO tank port	3.140	6.625	20.8025
2	FO tank stbd	3.140	6.625	20.8025
3	FW (C)	2.820	9.811	27.6670
	Total	9.100	7.612	69.2720

1.8.2 List of Weights to Come

Sl. No.	Item	Weight (t)	LCG (m)	Longitudinal Moment (Tm)
1	Nil	0.000	0.000	0.000
	Total	0.000	0.000	0.000

1.8.3 Lightship Estimation

Sl. No.	Item	Weight (t)	LCG (m)	Longitudinal Moment (Tm)
1	Displacement during survey	51.3100	7.264	372.7158
2	Weights to go	-9.1000	7.612	-69.2720
3	Weights to come	0.0000	0.000	0.0000
	Lightship weight	42.2100	7.189	303.4438

1.9 Comparison of Lightship with Approved Stability Booklet of Sister Vessel, Yard No. 256

Sl. No.	Description	Approved booklet	Present	Difference	% Difference	LIMIT Remarks
1	Lightship (t)	41.59	42.2100	0.6200	1.491	2%
2	LCG (m)	7.262	7.189	-0.073	-0.377	0.5% of L

LCG – Longitudinal Center of Gravity measured from transom.

The Lightship Weight and LCG are within limits mentioned in SOLAS Chapter II – 1, Regulation 5

Appendix - I As Measured Hydrostatics

HYDROSTATIC PROPERTIES

Trim: Aft 0.304/19.376, No Heel, VCG = 0.000

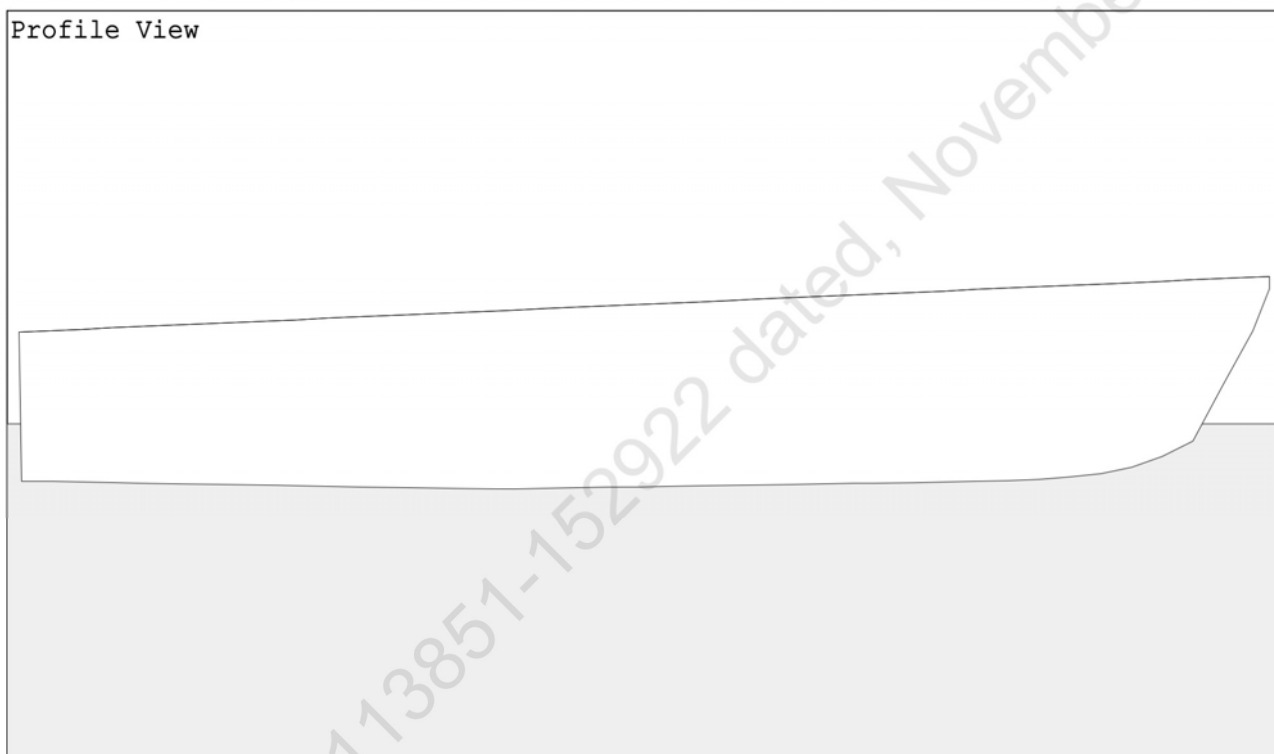
LCF	Displacement	Buoyancy-Ctr.	Weight/	Moment/
Draft----	Weight (MT)----	LCB-----VCB-----	cm-----	LCF---cm trim---GML-----GMT
1.050	51.31	7.264f 0.694	0.79	8.128f 0.98 37.00 3.448

Distances in METERS.-----Specific Gravity = 1.012.-----Moment in m.-MT.
 Trim is per 19.38m.

Draft is from Baseline.

Condition Graphic - Draft: 0.874 @ 19.376f, 1.178 @ 0.000 Heel: zero

Profile View



Plan View



LIGHT-SHIP SURVEY PROCEDURE AND REPORTING FORMAT

Part I



Pre requisites for Conducting Light-Ship Survey
(To be provided /confirmed by Builder/Owner/Operator/Consultant prior commencement of Light-Ship Survey)

Name Of Builder/owner rep conducting trial	SHM SHIPCARE
Hull Number/Vessel name	Yard No.261 Ganga(BSF/2018/MC-01)
Type of Vessel (Cargo/passenger)	Patrol Boat
Location of Vessel	Vasai Creek, Ghodbunder
Date of Proposed Light-Ship Survey	23-11-2020
Draft of Vessel and trim	Aft: 1.17m, Fwd: 0.895m Trim: 0.275m Aft
Depth of Water	4.00 Meters
Anticipated tide on date of survey	calm
Weather prediction for proposed date	calm
Availability of following reports from builder/Owner/Owners rep	
Copy of Approved Inclining experiment report	☒ YES ☐ NO
Details of Periodical Draft Survey report/any Draft Survey report conducted after the approval of Final TSB.	☒ YES For Yard No.260/Teesta ☐ NO (BSF/2018/MC-05)
Declaration of weights to go on	☒ YES ☐ NO
Declaration of weights to go off - tank contents - Loose items	☒ YES ☐ NO





Facilities/Arrangement for conduct of Light-Ship Survey	
Availability of boat to take draft reading	☒ YES ☐ NO
Availability of draft mark plan/approved document like Prelim TSB/Final TSB for confirming location of draft marks	☒ YES ☐ NO
Safety Requirements- lighting, gas freeing, accessibility of areas requiring inspection as part of Survey	☒ YES ☐ NO
Availability of sounding tapes, hydrometer etc	☒ YES ☐ NO
Closing/isolating cross connected tanks	☒ YES ☐ NO
Removal of gangway during draft reading/experiment	☒ YES ☐ NO
Permanent ballast used ? ; if any and its details	☐ YES ☒ NO
If vessel has any list, reason for the list is established.	☐ YES ☒ NO
A trial is conducted to see whether the vessel's draft corresponding to the loading condition is matching with the approved hydrostatics.	☒ YES ☐ NO

NOTE : The responsibility of the IRS Surveyor is to verify that the survey is conducted according to accepted procedures and that all basic measurements and data are correctly taken and recorded. The responsibility for making preparation, conducting lightship survey and preparing report rest with owner/operator.

Confirm Readiness for test

Chandan Dawankar

Name & Signature of Shipyard /Owners rep

[Signature]
H.B. Pakh
23/11/20



[illegible]

LCG: Longitudinal Center of Gravity from AP/Transom/Midship/Frame -----



[illegible]

Page 87 of 91



[illegible]

[illegible]

LCG: Longitudinal Center of Gravity from AP/Transom/Midship/Frame -----



LIGHTSHIP SURVEY PROCEDURE AND REPORTING FORMAT

Part II

REPORTING FORM FOR LIGHTSHIP SURVEY

Attending Surveyor should witness Light-Ship Survey only if the Part-I submitted by Owner/Builder/Operator/Consultant is found satisfactory



General Particulars

Name of Vessel	Ganga(BSF/2018/MC-01)
Builder/ Owner	SHM SHIPCARE
Yard Number/ IR Number	261
Type of Vessel	Passenger ☐ Non Passenger ☒ ☐ ☒
Date(dd/mm/yyyy);Local Time of inspection/test	23-11-2020, 10.30 AM
Wind / Weather condition	Calm
Location of Test	Vasai Creek, Ghodbunder
Depth of water where vessel is moored, m	4.00 M
Method of reading Draft(By Boat-Y/N)	Yes

Location of Draft Marks	Frame Number	Draft Reading (Port side),m	Draft Reading (STBD Side),m
Aft	Fr.1	1.17 m	1.17 m
Midship	—	—	—
Forward	Fr.27	0.895 m	0.895 m

Note : Recommended to attach Photographs of draft; as record

Density of Water

Results of 3 samples from Forward, Aft and Mid of the vessel		
Sample 1: (ford)	1.012	t/m3
Sample 2: (mid)	1.012	t/m3
Sample 3: (aft)	1.012	t/m3

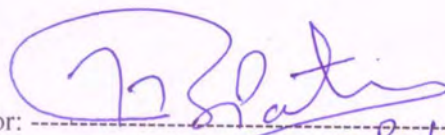


Verification of weights to go on / go off /re-location	SEE PART 1
Note: See Part 1 (the sheet for recording the above data) , verify and endorse.	

Special Comments on Light Ship Survey, if any.
NIL

Attending surveyor to forward both forms Part 1 and Part 2 together with completed attachments 1 and 2 to HO.

Name & designation of Attending Surveyor: _____



H.B. Patil



IRS
23/11/2020