

6-5 CALCULATION OF TRIM AND STABILITY

CONDITION NAME : A1.GRAIN LOAD CONDITION (TRIMMED) SF=42 DEP.(FULL BUNKER)

ITEM	(%)	WEIGHT (MT)	LCG (M)	L.MOMENT (MT-M)	VCG (M)	V.MOMENT (MT-M)	FREE SURFACE MOMENT (MT-M)
LIGHT WEIGHT		12628	8.92	112642	11.14	140676	-
D.W. CONSTANT		343	83.66	28695	13.24	4541	-
PROV. & CONSUM.		*	*	*	*	*	-
FRESH WATER (S.G. = 1.0000 MT/M ³)							
F.W.T.	100%	208	107.45	22361	18.02	3750	271
D.W.T.	100%	208	107.45	22361	18.02	3750	271
SUB TOTAL		416		44722		7499	541
FUEL OIL (S.G. = 0.9500 MT/M ³)							
No.1 F.O.T.	96%	265	-5.19	-1375	0.81	215	638
No.2 F.O.T. (P)	96%	279	21.21	5915	0.81	226	673
No.2 F.O.T. (S)	96%	256	20.69	5289	0.81	207	633
No.3 F.O.T. (P)	96%	278	48.11	13386	0.81	226	665
No.3 F.O.T. (S)	96%	294	48.95	14400	0.81	239	709
No.4 F.O.T. (P)	96%	178	72.54	12880	0.81	144	394
No.4 F.O.T. (S)	96%	178	72.54	12880	0.81	144	394
No.5 FO/DO.MGOT	96%	242	78.26	18908	18.97	4583	395
SUB TOTAL		1969		82282		5984	4500
DIESEL OIL (S.G. = 0.8800 MT/M ³)							
No.1 D.O.T.	96%	118	73.96	8710	18.97	2234	193
No.2 D.O.T.	96%	106	82.98	8798	18.97	2011	173
SUB TOTAL		224		17508		4246	366
CARGO (S.G. = 0.8543 MT/M ³ , S.F. = 42.00 CF/LT)							
No.1 CARGO HOLD	100%	12052	-85.26	-1027520	11.24	135463	-
No.2 CARGO HOLD	100%	13154	-57.54	-756931	11.18	147009	-
No.3 CARGO HOLD	59%	6913	-30.61	-211611	7.67	52995	-
No.4 CARGO HOLD	100%	11228	-5.39	-60487	11.28	126644	-
No.5 CARGO HOLD	100%	11738	19.85	233030	11.29	132502	-
No.6 CARGO HOLD	100%	13151	46.79	615353	11.17	146940	-
No.7 CARGO HOLD	100%	10981	73.35	805498	11.69	128373	-
SUB TOTAL		79218		-402667		869926	0
BALLAST WATER (S.G. = 1.0250 MT/M ³)							
F.P.T.		*	*	*	*	*	-
No.1 W.B.T. (P)		*	*	*	*	*	-
No.1 W.B.T. (S)		*	*	*	*	*	-
No.2/3 W.B.T. (P)		*	*	*	*	*	-
No.2/3 W.B.T. (S)		*	*	*	*	*	-
No.4 W.B.T. (P)		*	*	*	*	*	-
No.4 W.B.T. (S)		*	*	*	*	*	-
No.5/6 W.B.T. (P)		*	*	*	*	*	-
No.5/6 W.B.T. (S)		*	*	*	*	*	-
No.7 W.B.T. (P)		*	*	*	*	*	-
No.7 W.B.T. (S)		*	*	*	*	*	-
A.P.T.		*	*	*	*	*	-
No.4 HOLD (W.B.)		*	*	*	*	*	-
SUB TOTAL		0		0		0	0
OTHERS (S.G. = 1.0000 MT/M ³)							
GRAY W.T. (P)		*	*	*	*	*	-
SUB TOTAL		0		0		0	0
GRAND TOTAL		94798		-116817		1032872	5408

DISPLACEMENT	MT	94798	TKM	M	13.65	
DRAFT AT C.F.	M	14.49	VCG	M	10.90	
DRAFT	FORE	M	13.83	GM	M	2.75
	AFT	M	15.09	GGo	M	0.06
	MEAN	M	14.46	GoM	M	2.69
TRIM (AFT)	M	1.26	TCG	M	-	
T.P.C.	MT	71.11	HEELING ANGLE	DEG	-	
LCG (FORE)	M	-1.23	PROPELLER IMM.	%	165	
LCB (FORE)	M	-1.21	FORE DRAFT / LPP	%	6.16	
H.B.G	M	-0.02	TRIM / LPP	%	0.56	
M.T.C.	MT-M	1239.55	Max. AIR DRAFT	M	35.41	
LCF (AFT)	M	4.62	N.B.VISIBILITY	M	197.40	

GRAIN HEELING MOMENT

COMPARTMENT	WEIGHT (MT)	VOLUME (M ³)	(%)	FACTOR	MOMENT (MT-M)
No.1 CARGO HOLD	12052	14107	100.00%	1.00	1162
No.2 CARGO HOLD	13154	15397	100.00%	1.00	1100
No.3 CARGO HOLD	6913	8092	58.89%	1.12	27083
No.4 CARGO HOLD	11228	13143	100.00%	1.00	788
No.5 CARGO HOLD	11738	13740	100.00%	1.00	842
No.6 CARGO HOLD	13151	15394	100.00%	1.00	1045
No.7 CARGO HOLD	10981	12854	100.00%	1.00	901
TOTAL	79218	92727			32921

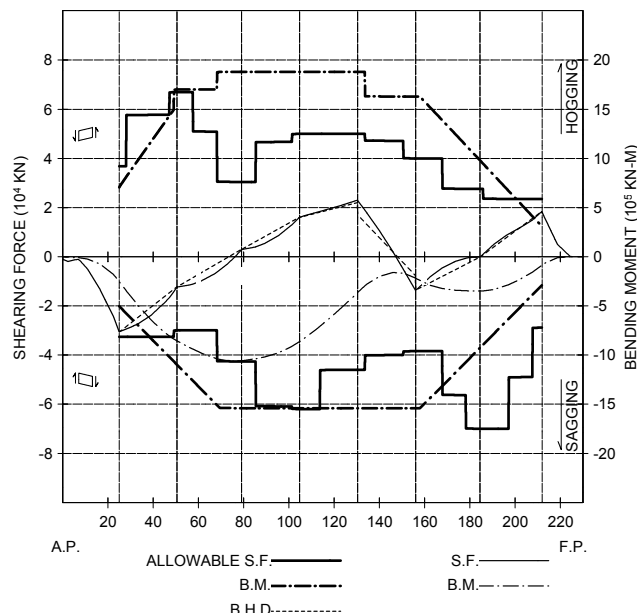
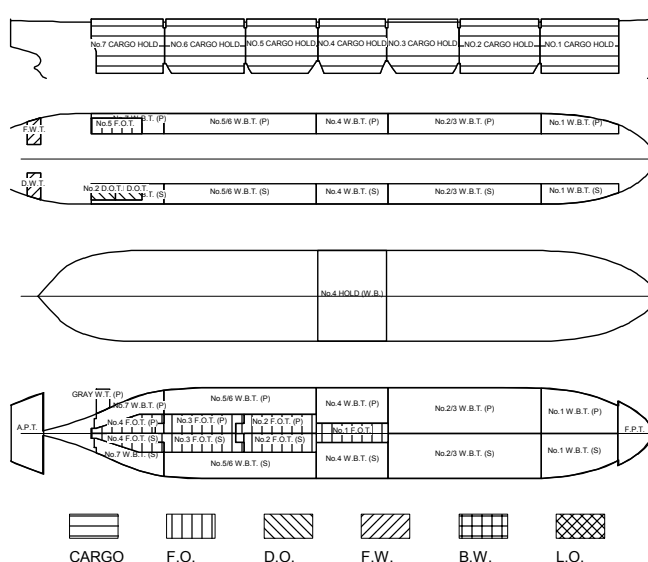
ALLOWABLE GRAIN HEELING MOMENT (MT-M) ----- 58937

CONDITION NAME : A1.GRAIN LOAD CONDITION (TRIMMED) SF=42 DEP.(FULL BUNKER)

LONGITUDINAL STRENGTH			ACTUAL / ALLOW.	
Max. Bending Moment	(Fr. No. : 238.97)	KN-M	25	0.0%
Min. Bending Moment	(Fr. No. : 83.00)	KN-M	-1064137	-69.0%
Max. Shearing Force *)	(Fr. No. : 140.00)	KN	22129	44.3%
Min. Shearing Force *)	(Fr. No. : 29.00)	KN	-30717	-94.2%

*) : VALUE AFTER BHD CORRECTION.

POSITION FRAME NO.	FROM A.P. (M)	SHEARING FORCE (SF) (KN)	BHD CORR. (SF) (KN)	BENDING MOMENT (BM) (KN-M)
240.15	225.49	-0		-91
240.15	225.49	-1		-104
239.11	224.50	-41		-34
227.29	213.27	15631		-65983
226.00	212.05	18546	18546	-86885
221.47	207.85	15044		-156922
215.37	202.05	11836		-234552
210.42	197.35	9368		-284461
203.55	190.82	5231		-332758
198.47	186.00	1168		-348607
197.00	184.60		-217	-349290
191.74	179.60	-404		-348118
190.37	178.30	-609		-347469
179.92	168.38	-4344		-325975
179.53	168.00	-4555		-324291
168.11	157.15	-12845		-233676
167.00	156.10	-13869	-13691	-219659
161.39	150.77	-5208		-169094
156.29	145.93	2227		-162038
144.47	134.70	17778		-276479
143.47	133.75	18988		-293946
140.00	130.45	23064	22129	-363379
132.66	123.47	21049		-517163
127.47	118.55	19698		-617474
122.60	113.11	18215		-718284
120.84	112.15	16351		-835105
113.00	104.60	16200	16200	-863335
109.47	101.45	13105		-912908
109.03	101.03	12745		-918404
97.21	89.80	5620		-1017196
92.68	85.50	4100		-1037856
86.00	79.15	3063	3063	-1059853
85.39	78.57	2419		-1061426
83.00	76.30	-4		-1064137
74.63	68.35	-6286		-1037597
73.58	67.35	-6913		-1030995
63.47	57.75	-11132		-941828
61.76	56.13	-11539		-923396
56.00	50.65	-12325	-12325	-857675
54.53	49.25	-14230		-839068
53.00	47.80	-16049		-817097
52.47	47.30	-16591		-808936
49.95	44.90	-18930		-766223
48.00	43.05	-20447		-729762
38.13	33.68	-27225		-502486
38.00	33.55	-27285		-499079
35.00	30.70	-28513		-419503
32.42	28.25	-29392		-348544
29.26	25.25	-30603		-258700
29.00	25.00	-30717	-30717	-251035
26.17	22.45	-24228		-181193
13.69	11.22	-5266		-24253
10.00	7.90	-1846		-12797
9.00	7.11	-1139		-11622
3.00	2.37	-1959		-4899
0.00	0.00	-976		-1541
-4.42	-3.49	-3		-0
-4.43	-3.50	-1		-0



ACTUAL / ALLOWABLE [At Sea]

Fr. No.	29	56	86	113	140	167	197	226
S.F. (%)	-94.2	-41.1	10.1	32.4	44.3	-35.7	-0.3	78.9
B.M. (%)	-49.9	-78.0	-68.7	-56.0	-23.6	-14.2	-37.7	-30.0

IMO GRAIN STABILITY

CONDITION NAME : A1.GRAIN LOAD CONDITION (TRIMMED) SF=42 DEP.(FULL BUNKER)

(1) STABILITY CURVE

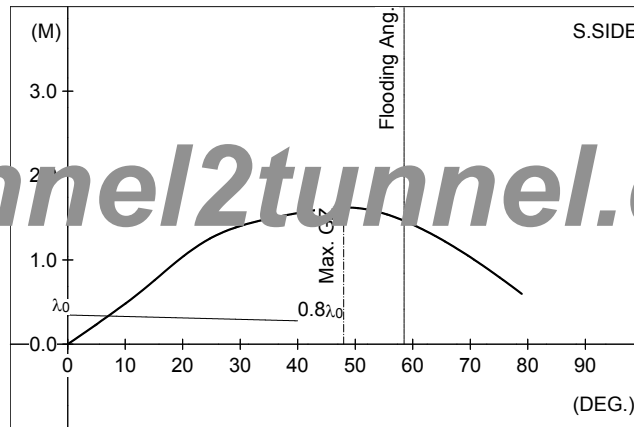
$$GZ = GZa - (VCGo - VCGa)SIN\theta$$

GZa : GZ FROM CROSS CURVE

VCGa (VCG Assumed in Cross Curve) = 0.00 M

VCGo - VCGa = 10.95 M

θ (deg)	0	5	10	12	20	25	30	40	50	60	70	80
SIN θ	0.000	0.087	0.174	0.208	0.342	0.423	0.500	0.643	0.766	0.866	0.940	0.985
GZa	0.000	1.191	2.383	2.861	4.783	5.892	6.878	8.594	10.007	10.903	11.323	11.327
(VCGo - VCGa)SIN θ	0.000	0.954	1.902	2.277	3.746	4.628	5.476	7.040	8.389	9.484	10.291	10.785
GZ	0.000	0.236	0.482	0.584	1.037	1.264	1.402	1.555	1.618	1.419	1.032	0.542



(2) APPLIED RULE INTERNATIONAL GRAIN CODE (IMO RES. MSC.23(59))

CRITERIA	UNIT	REQUIRED		ATTAINED	JUDGE
GoM	M	0.30	≤	2.69	GOOD
Heeling Angle Due to Grain Shift	DEG	12.00	≥	7.04	GOOD
Residual Dynamic Stability	M-RAD	0.075	≤	0.454	GOOD
θ_m : Deck Edge Immersion Angle	DEG	-		17.70	
θ_f : Flooding Angle	DEG	-		58.50	
λ_0 = Heeling Moment / Displacement	M	-		0.35	

(3) APPLIED RULE 2008 IS Code Part A Chapter 2.2

CRITERIA	UNIT	REQUIRED		ATTAINED	JUDGE
Area (0° - 30°)	M-RAD	0.055	≤	0.391	GOOD
Area (30° - 40° or θ_f)	M-RAD	0.030	≤	0.259	GOOD
Area (0° - 40° or θ_f)	M-RAD	0.090	≤	0.650	GOOD
Max. GZ	M	0.20	≤	1.62	GOOD
θ at Max. GZ	DEG	25.00	≤	48.31	GOOD
GoM	M	0.15	≤	2.69	GOOD
GZ at 30°	M	-		1.40	

(4) APPLIED RULE 2008 IS Code Part A Chapter 2.3

CRITERIA	UNIT	REQUIRED		ATTAINED	JUDGE
Inclining Angle by Wind	DEG	14.16	>	0.32	GOOD
Area "B" / Area "A"	-	1.00	≤	5.09	GOOD