ANNEX

STABILITY INFORMATION BOOKLET

Foreword

This document indicates the details which should be provided in the ship's "Stability Information Booklet" so as to ensure compliance with the Merchant Shipping (Load Line) Regulations 199B-see Regulations 32 and 33 and Schedule 6 of Merchant Shipping Notice MSN 1752(M).

In an endeavor to **"standardise"** the presentation of stabi**l**ty information submitted for examination and so expedite its assimilation and approval, the Maritime and Coastguard Agency (MCA) encourages all shipbuilders to adopt this layout (which has been developed following an analysis of the many varied presentations currently submitted) when preparing the **"Stability Information Booklet"** for their new constructions.

Included in this booklet are also details of the Flooding and Damaged Stability requirements for certain types of ships assigned reduced freeboards;-see Regulations 29 and 30 and Schedule 2 paragraph 1 and Schedule 4 Part I paragraph 5.

INDEX

Simplified Stability Information

Damaged Stability

20. Flooding and Damaged Stability; requirements for Type 'A' and Type 'B' ships I

21. Flooding and Damaged Stability; requirements in the flooded condition

22. Flooding and Damaged Stability; information to be presented from flooding calculations

23. Flooding and Damaged Stability; typical sketches required

GENERAL PARTICULARS

Ships Name signal Letters

Official Number

Port of Registry

Owners Name and Address

Builders Name, Address and Ship Number

Date Keel Laid

Moulded Dimensions (in metres)

Summer Load Draught (in metres)

Block Coefficient

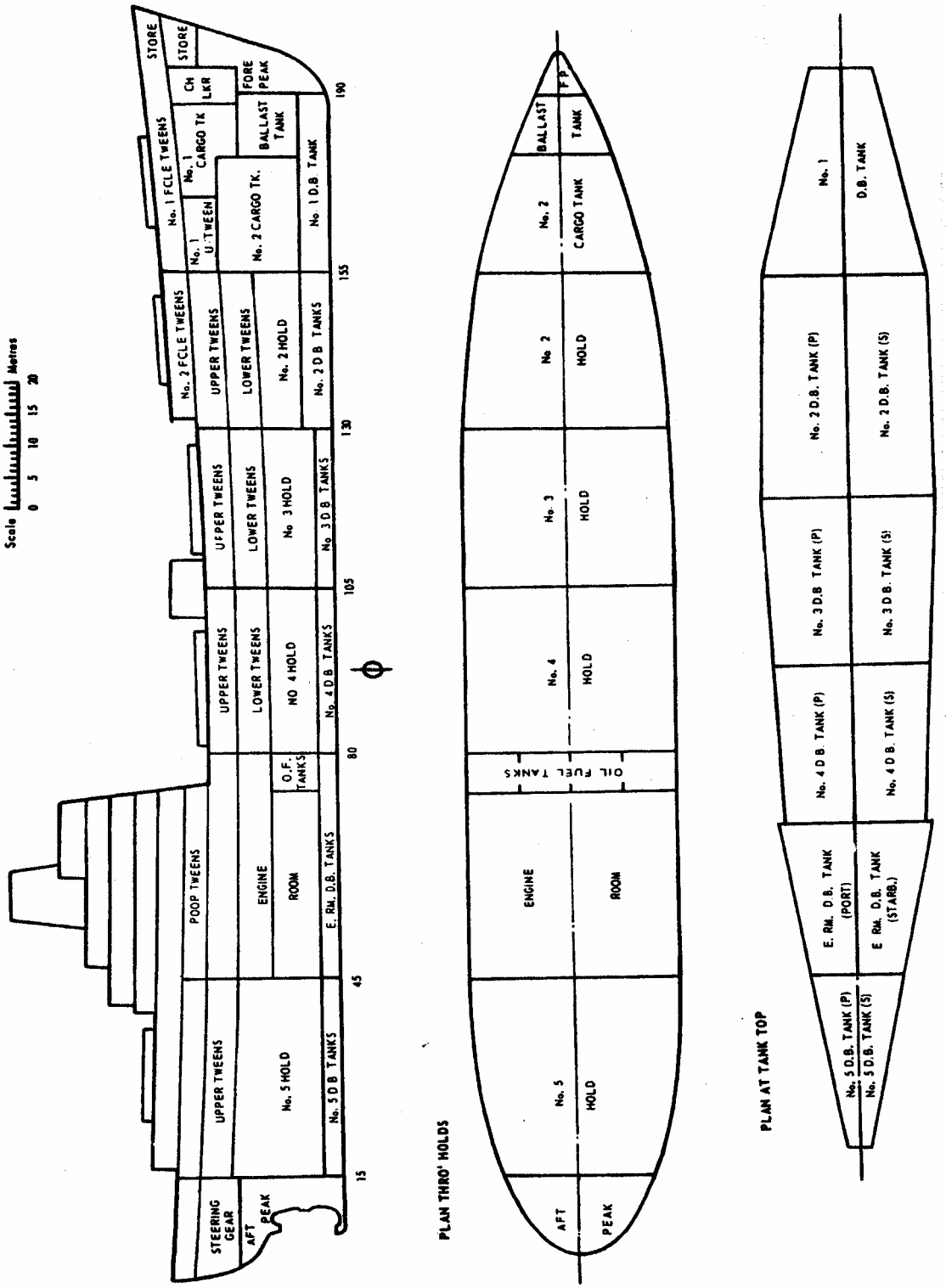
Displacement (in tonnes)

Deadweight (in tonnes)

Gross Tonnage

Net Tonnage .

PLAN SHOWING CARGO SPACES, STOREROOMS AND TANKS



General Precautions against Capsizing I

1. Compliance with the stability criteria indicated overleaf does not ensure immunity against capsizing regardless of the circumstances or absolve the master from his responstbilities. 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.

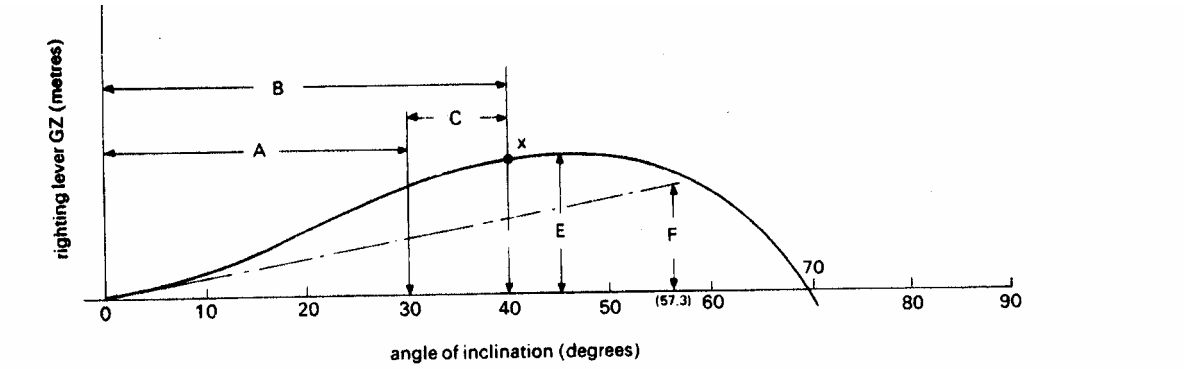
2. Care should be taken to ensure that the cargo allocated to the ship is capable of being stowed so that compliance with the criteria can be achieved. If necessary the amount should be limited to the extent that ballast weight may be required.

3. Before a voyage commences care should be taken to ensure that the cargo 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.

SPECIAL NOTES REGARDING THE STABILITY AND LOADING OF THE SHIP

1. As this ship is required to comply with Schedule 2, Part 1 para. 2 of MSN 1752(M) by the Merchant Shipping (Load Line) Regulations 1998, it is most important to ensure that in any sailing condition the stability complies at least with the following minimum criteria:-

Statical stability curve



A- area under curve up to 30 degrees to be not less than 0.055 metre-radians.

B- area under curve up to x degrees to be not less than 0.09 metre-radians.

C- area between 30 degrees and x degrees to be not less than 0.03 metre radians.

x- 40 degrees or any lesser angle at which the lower edges of any openings in the hull, superstructure or deckhouses which lead below deck and cannot be closed weathertight, would be immersed. .

E- maximum GZ to occur at angle not less than 30 degrees and to be at least 0.20 metres in height.

F- initial GM to be not less than 0.15 metres. In ships with timber deck cargo 0.05 metres will be permitted. The volume of timber deck cargo may be included in the derivation of the cross curves.

2. In order that the required minimum Bow Height is always maintained the forward draught should not exceed

Other Items that should be mentioned as appropriate

3. Sequence of ballasting to ensure adequate stability throughout the voyage.

4. Warning about effects of strong winds upon ships carrying containers or deck cargoes, especially if trading in the Great Lakes.

5. Dangers of icing if engaged in Arctic Waters

6 Any special features regarding the stowage or behaviour of cargo to be carried.

METRIC CONVERSIONS

Metric Equivalents

The use of S I (Systeme Internationale) units is strongly recommended.

MULTIPLY BY	TO CONVERT FROM	TO OBTAIN	-
0.03937	MILLIMETRES	INCHES	25.400
0.3937	CENTIMETRES	INCHES	2.5400
3.2808	METRES	FEET	0.3048
2.2046	KILOGRAMMES	POUNDS	0.45359
0.0009842	KILOGRAMMES	TONS(2240 lbs.)	1016.047
0.9842	TONNES(1000 KG)	TONS (2240 lbs.)	1.016
2.4998	TONNES PER CENTIMETRE (OF IMMERSION)	TONNES PER INCH (IMMERSION)	0.4000
8.2014	MOMENT TO CHANGE TRIM ONE CENTIMETRE (TONNES METRE UNITS)	MOMENT.TO CHANGE TRIM ONE INCH (FOOT TON UNITS)	0.122
187.9767	METRE RADIANS	FEET DEGREES	0.0053
-	**TO OBTAIN**	**TO CONVERT FROM**	**MULTIPLY BY ABOVE**

Relation between Weight and Volume

10 m.m. cubed = 1 cubic centimetre
1 cubic centimetre of freshwater (S.G. 1.0) = 1 gramme
1000 cubic centimetre of freshwater (S.G. 1.0) = 1 Kilogram (1000 grammes)
1 cubic metre of freshwater (S.G. 1.0) = 1 Tonne (1000 Kilos)
1 cubic metre of saltwater (S.G. 1.025) = 1.025 Tonnes
1 tonne of saltwater (S.G. 1.025) = 0.975 Cubic Metres

1 cubic metre = 35.316 cubic feet
1 cubic foot = 0.0283 cubic metres

HYDROSTATIC PARTICULARS (in Salt Water) (S.G 1.025)

A.B. = Above Keel
A.P. = Aft. Perpendicular

To extend at least between Light and Deepest Load Lines

DRAUGHT (Bottom of Keel) (Metres)	DISPLACEMENT Tonnes (i.e. 1000 kilograms)	T.P.C (Tonnes per Cm. Immersion)	M.C.T.C. (Moment to Change Trim One Cm.)	L.C.B. FWD. OF A.P. (Metres)	L.C.F. FWD. OF A.P (Metres)	V.C.B. A.B. (Metres)	K.M. (T) TRANSVERSE METACENTRE A.B. (Metres)	K.M. (L) LONGL. METACENTRE A.B. (Metres)
1.000								
.200								
.400								
.600								
.800								
2.000								
.200								
etc.								

NOTE: The hydrostatic particulars given above have been developed with the vessel floating on waterlines which are *level or inclined to the keel
*(Delete whichever is not applicable)

CAPACITIES AND CENTRES OF GRAVITY OF CARGO SPACES, STOREROOMS AND CREW AND EFFECTS

(A.B. = Above Base)
(A.P. = Aft. Perpendicular)

1. DRY CARGO

COMPARTMENT	LOCATION (Frame numbers)	CAPACITIES		CENTRES OF GRAVITY (Metres)	
		BALE Cubic Metres	GRAIN Cubic Metres	VERT ⌊ A.B.	LONG ⌊ FROM A.P.
TOTAL					

2. REFRIGERATED CARGO

COMPARTMENT	LOCATION (Frame Numbers)	BALE CAPACITY (Cubic Metres)	CENTRES OF GRAVITY (Metres)	
			VERT ⌊ A.B.	LONG ⌊ FROM A.P.

3. STOREROOMS

COMPARTMENT	LOCATION (Frame Numbers)	BALE CAPACITY (Cubic Metres)	CENTRES OF GRAVITY (Metres)	
			VERT ⌊ A.B.	LONG ⌊ FROM A.P.

4. CREW, STORES AND EFFECTS

ITEM	DEPARTURE			ARRIVAL		
	TONNES	CENTRES OF GRAVITY		TONNES	CENTRES OF GRAVITY	
		VERT ⌊ A.B.	LONG ⌊ FROM A.P.		VERT ⌊ A.B.	LONG ⌊ FROM A.P.
Stores						
Crew and Effects						
TOTAL						

CAPACITIES, CENTRES OF GRAVITY AND FREE-SURFACE MOMENTS OF OIL AND WATER TANKS (Sheet 1)

1. CARGO TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G. 1.0	VERT ⌞ A.B. 98%	LONG ⌞ FROM A.P.	AT S.G. 1.0 (Tonnes Metres)
TOTAL							

2. OIL FUEL TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G. 1.0	VERT ⌞ A.B. 98%	LONG ⌞ FROM A.P.	AT S.G. 1.0 (Tonnes Metres)
TOTAL							

NOTE:

1. To obtain weight of the liquid contents of any compartment multiply "Tonnes at S.G. 1.0" by the actual Specific Gravity of the liquid.
2. See page ref Notes on use of Free-surface Moments.

CAPACITIES, CENTRES OF GRAVITY AND FREE-SURFACE MOMENTS OF OIL AND WATER TANKS (Sheet 2)

3. ENGINE ROOM AND LUB.-OIL TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G. 1.0	VERT ↓ A.B. 98%	LONG ↓ FROM A.P.	AT S.G. 1.0 (Tonnes Metres)
TOTAL							

4. FRESH, FEED AND BALLAST WATER TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G. 1.0	VERT ↓ A.B. 98%	LONG ↓ FROM A.P.	AT S.G. 1.0 (Tonnes Metres)
TOTAL (FRESH WATER)							
TOTAL (WATER BALLAST)							

NOTE:

1. To obtain weight of the liquid contents of any compartment multiply "Tonnes at S.G 1.0" by the actual Specific Gravity of the liquid.
2. See page ref Notes on use of Free-surface Moments.

NOTES ON USE OF FREE SURFACE MOMENTS I

(Given in end column of tables on pages 11 and 12)

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 effects". This adverse effect on the stability is referred to as a "loss in G.M." or as a "virtual rise in V.C.G." and is calculated as follows:

$$\text{Loss in G.M due to Free Surface Effects (in metres)} = \frac{\text{Free Surface Moment (tonnes metres)} \times \text{Specific Gravity liquid in Tank}}{\text{Displacement of vessel in Tonnes}}$$

N.B. The "free surface effects" of a proportion of all oil-fuel, fresh water, feed- water and service
tanks should be taken into account in both the Arrival and Departure Conditions.

CONTAINER SHIPS

(Capacities and Centres of Gravity)

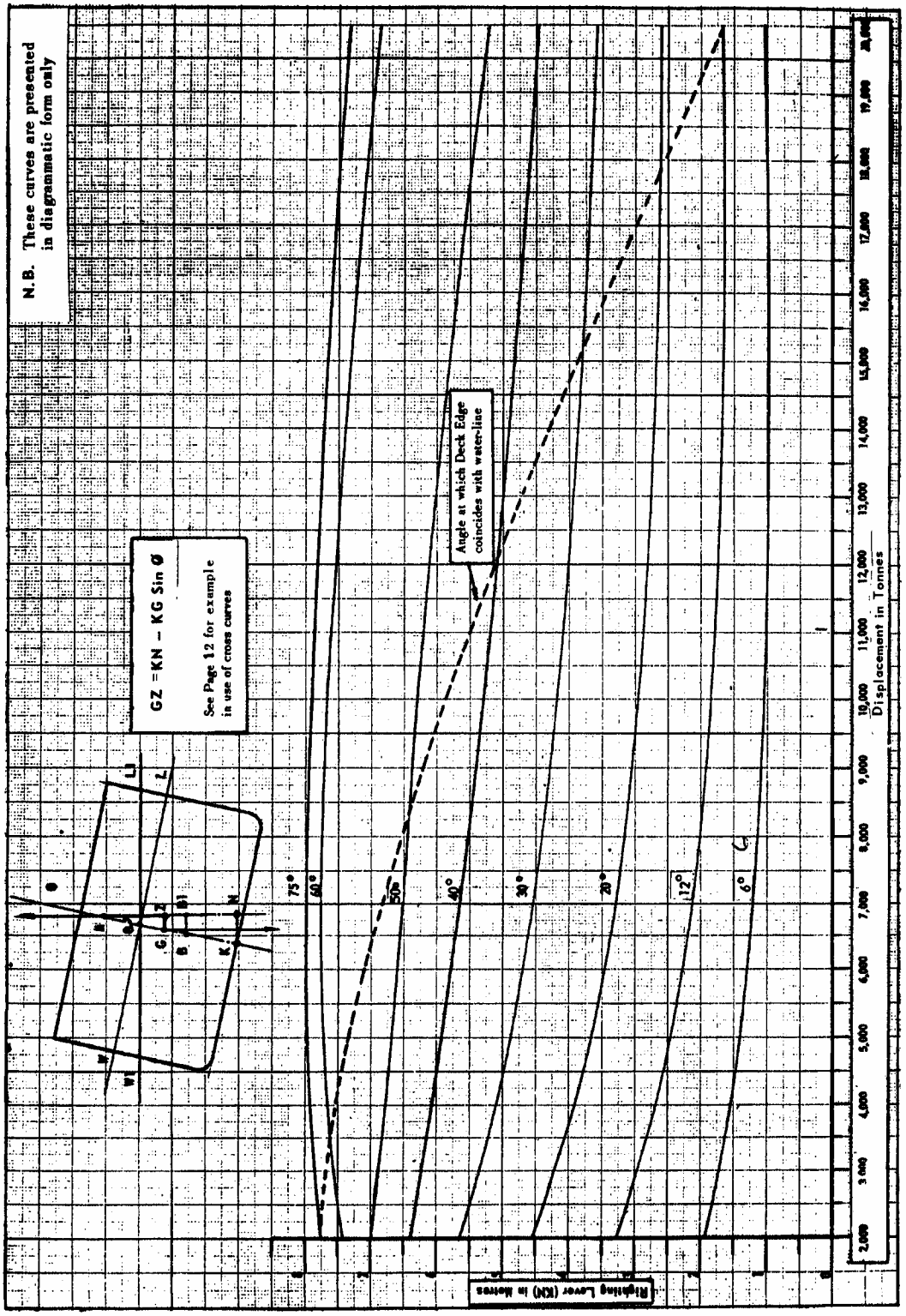
When a ship is designed for the carriage of containers or pallets the following I information should be provided to enable the sailing condition to be calculated:

(i) A 'Container Stowage Plan' showing the disposition and identification arrangement of every container. The size and maximum laden and unladen weight of the various types of container should be indicated.

(ii) A 'Tabular Statement' giving the vertical and longitudinal geometric centres of each container in its stowed position.

CROSS CURVES OF STABILITY (KN CURVES)

It should be clearly stated which erections, trunks and deck cargoes (if any) have been included in the derivation of these curves; see Schedule 6(9).



When a ship is to be engaged in the carriage of grain cargoes then it will be necessary to include K N curves for inclinations of 12° and 40°

EXAMPLE SHOWING USE OF CROSS CURVES (KN)

The purpose of the Cross Curves is to enable Statical Stability Curves to be drawn for the ship in any sailing condition, e.g.:

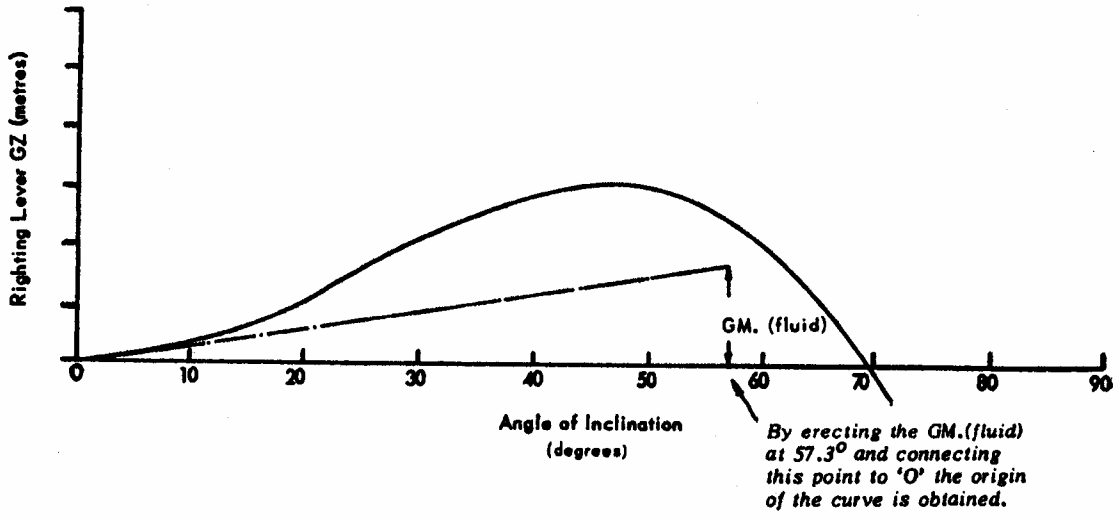
Assume the displacement of the ship to be .....tonnes, and the vertical centre of gravity .....metres above base (bottom of keel); as in Condition No. .....

Then the Righting Lever GZ = KN − KG Sin θ; see diagram on page

where KN = Cross Curve ordinate
and KG = Centre of Gravity above Keel (corrected for free surface effects)
and θ = Angle of inclination

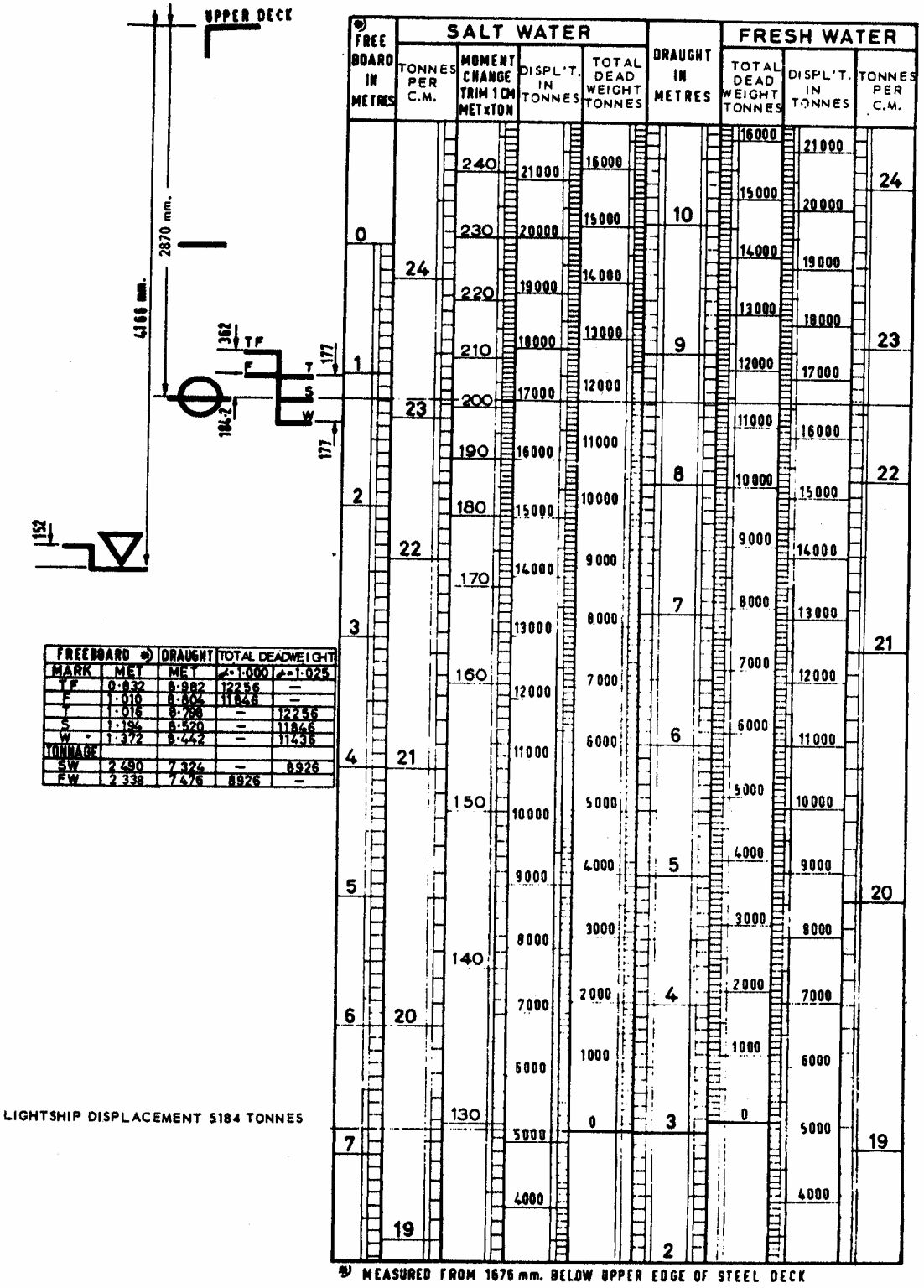
KN at Δ =	θ°	Sin θ	KG Sin θ	GZ = (KN − KG Sin θ)
	5	.0872		
	10	.1736		
	20	.3420		
	30	.5000		
	45	.7071		
	60	.8660		
	75	.9659		

Then by using the GZ values in the last column a Statical Stability Curve can be drawn for the ship at the assumed displacement:



DEADWEIGHT SCALE

ALL FIGURES INDICATED IN THE D.W. SCALE ARE BASED ON METRIC UNITS



FREEBOARD		DRAUGHT	TOTAL DEADWEIGHT	
MARK	MET	MET	⚓ 1·000	⚓ 1·025
TF	0·832	9·982	12256	—
F	1·010	9·804	11846	—
T	1·016	9·798	—	12256
S	1·194	9·620	—	11846
W	1·372	9·442	—	11436
TONNAGE				
SW	2 490	7 324	—	8926
FW	2 338	7476	8926	—

LIGHTSHIP DISPLACEMENT 5184 TONNES

LIST OF CONDITIONS REQUIRED

The following intact conditions are required for every ship

1. LIGHTSHIP CONDITION

This should indicate the items considered as a permanent part of the Lightship. Where permanent ballast is included 2 conditions should be indicated i.e. With Ballast and Without Ballast.

2. BALLAST CONDITION-Departure

This should indicate a suitable sea-going ballast condition

2A. BALLAST CONDITION-Arrival

3. HOMOGENEOUS LOADING CONDITION-Departure

For this condition all cargo spaces are to be filled with homogeneous cargo such that the ship is loaded down to the Summer load line. This condition will not be required on ships where it is clearly appropriate. The stowage rate should be clearly indicated.

3A. HOMOGENEOUS LOADING CONDITION-Departure and Arrival

The arrival condition should indicate that the oil-fuel, fresh water and other consumable stores have been reduced to approximately 10% of their original quantities.

4. SERVICE LOADED CONDITIONS-Departure and Arrival

There should be included in the Booklet at least one typical service condition with the ship loaded to the summer load line, and where appropriate the timber summer load line.

5. INFORMATION AS TO LOADING AND BALLASTING OF SHIPS

In addition to the conditions listed above it will be necessary to provide in the Booklet guidance for the Master of any ship to which Regulation 33 applies (i.e. ships of more than 150 metres in length specially designed for the carriage of liquid or ore in bulk) to enable him to load the ship in a manner which will avoid the creation of unacceptable stresses in the structure. The maximum permissible stresses should also be indicated.

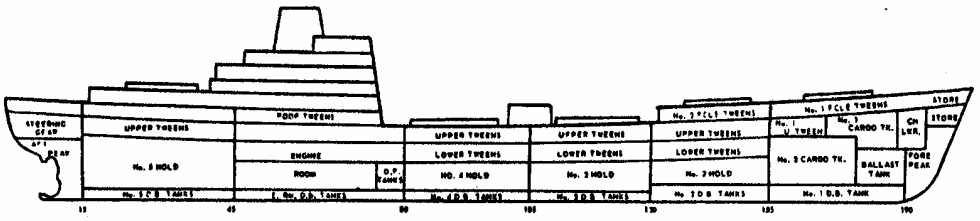
This information is subject to the approval of the Assigning Authority issuing the Load Line Certificate.

A copy of the Inclining Test Report will also be required.

TYPICAL CONDITION SHEET

Loading Code

Dry Cargo	
Refrig. Cargo	
Cargo Oil	
Fuel Oil	
Fresh Water	
Water Ballast	



CONDITION No.	Description of Condition							
Items of Deadweight	Weight	V.C.G.	Vertl. Moment	L.C.G.	Longl. Moment	Free Surface	SAILING STATE	
							DRAFT AT L.C.F.	
							DRAFT AFT.	
							DRAFT FWD.	
							MEAN DRAFT	
							TRIM. BY	
							K.M.	
							K.G.	
							G.M. (Solid)	
							FREE Surface Corrn.	
							G.M. (Fluid)	
DEADWEIGHT								
LIGHTSHIP								
DISPLACEMENT								

(Tanks with Free Surface Effects)

Trim = Displt. x distance between L.C.G. and L.C.B.
M.C.T. 1cm.

= _____

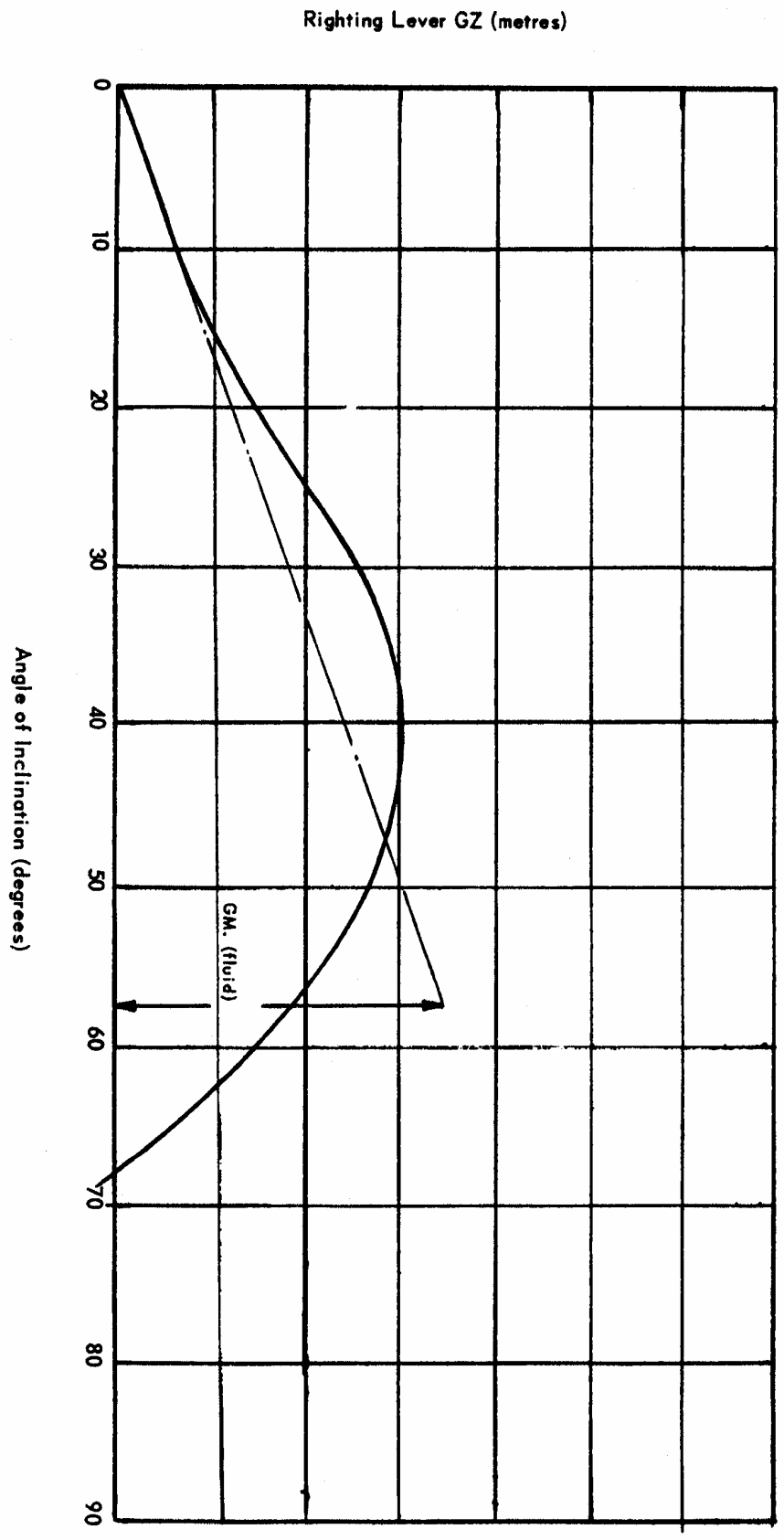
= _____ by stern

Free Surface Correction = Total Free Surface Mom. / Displacement

= _____

= _____

STATICAL STABILITY CURVE FOR CONDITION OPPOSITE



Area under curve up to 30°	=	metre radians
Area under curve up to 40°	=	metre radians
Max GZ =	at	degrees

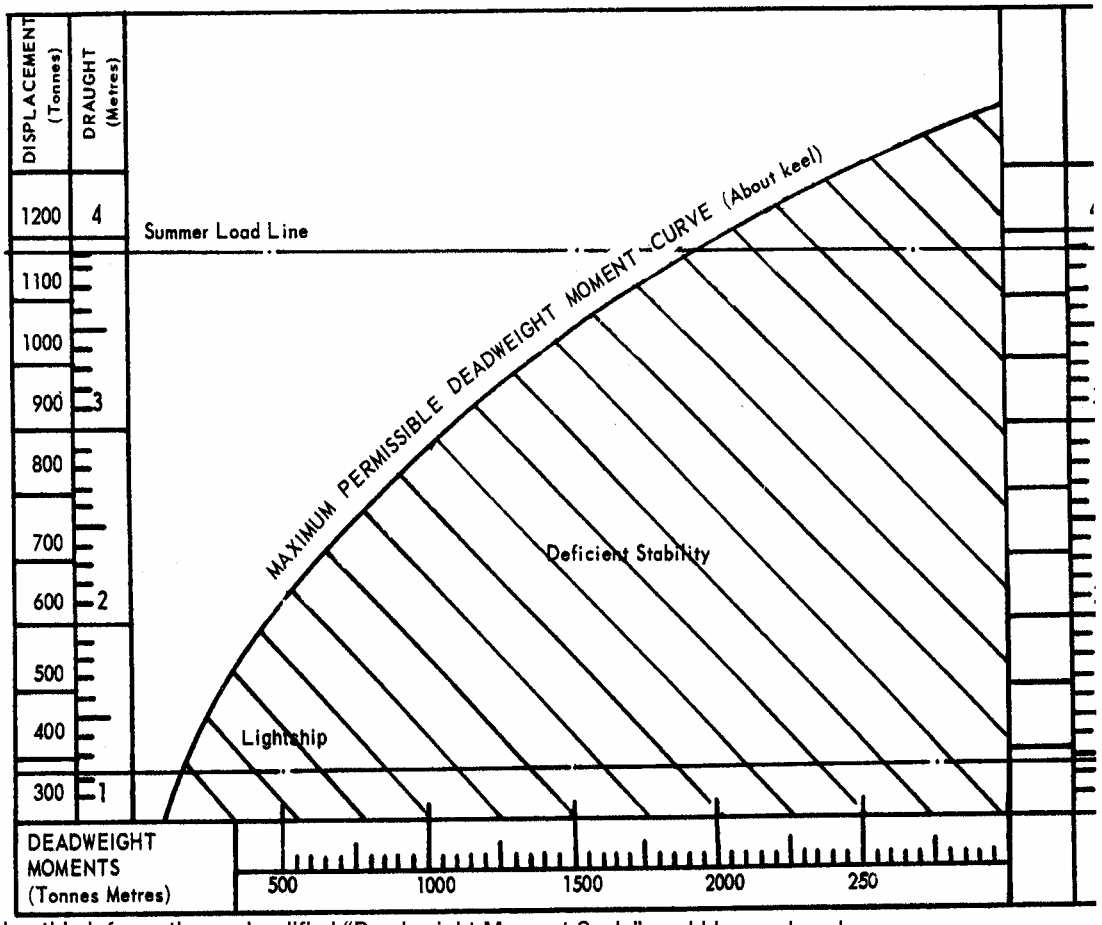
* (Or lesser angle at which water could enter hull)

SIMPLIFIED STABILITY INFORMATION

A recommended method of presenting stability information in a simplified manner is shown on the next two pages. Either maximum permissable deadweight moments about keel or maximum permissable KG values may be presented; the use of deadweight moments is illustrated. If required, advice on the method of preparing such information can be obtained from any Marine Survey Office.

SIMPLIFIED STABILITY INFORMATION

Deadweight Moment Curve



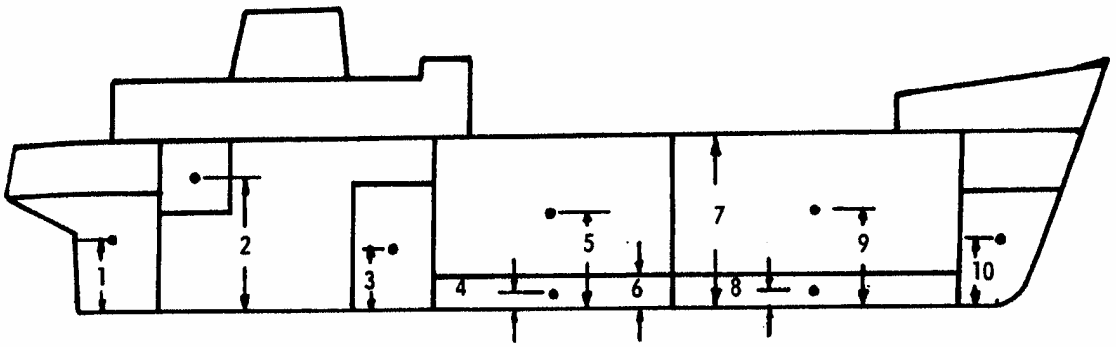
Using this information a simplified "Deadweight Moment Scale" could be produced e.g.

Deadweight Moment Scale

MAX. PERMISSIBLE DEADWEIGHT MOMENT (Tonnes Metres)	2050	2025	2000	1975	1950	1925												
DISPLACEMENT (Tonnes)	1200	1192.5	1185	1177.5	1170	1162.5												
DRAUGHT (Metres)	4.000	3.975	.950	.925	.900	.875	etc.											

SIMPLIFIED STABILITY INFORMATION

Typical Loading Sheet



Heights 'h' 1 = ; 2 = ; 3 = ; 4 = ; 5 = ;

6 = ; 7 = ; 8 = ; 9 = ; 10 = .

Items of Deadweight	Weight 'w'	Height above keel to centre 'h'	Deadweight Moment w × h
Cargo in Hold			
Cargo on Deck			
Oil Fuel			
Water Ballast in F. Peak			
etc.			
TOTAL DEADWEIGHT		TOTAL DEADWEIGHT MOMENT	
LIGHTSHIP			
DISPLACEMENT*			

N.B.* At this Displacement the "Total Deadweight Moment" must not exceed the value of ....., as shown by the Deadweight Moment Scale.

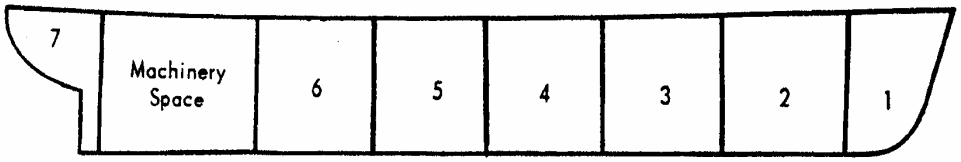
FLOODING AND DAMAGED STABILITY REQUIREMENTS FOR VESSELS HAVING LESS THAN "TABLE B" FREEBOARD

Flooding and damage stability requirements

General

All ships which are assigned less than Table B basic freeboards should, if over 100 metres in length (or 150 metres where Table A applies), be capable of withstanding the flooding of one or more of their main watertight compartments when loaded to the summer load waterline-see Regulation 29 and Schedule 2 paragraph 1, and Schedule 4 paragraph 5(3), (5), (6) and (7) of MSN *1752(M).*

Type A Ships

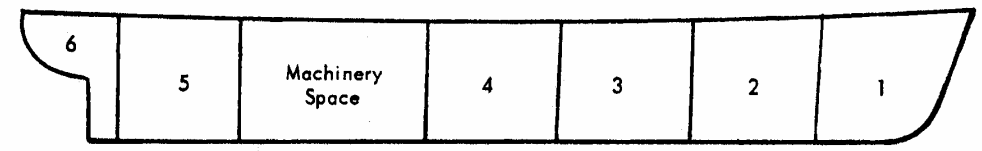


Ships over 150 metres but not exceeding 225 *metres in length*
Such ships must be capable of withstanding the flooding of anyone compartment, other than the machinery space, designed to be empty* in the summer load condition. The permeability of the compartment is to be taken as 95 per cent.

Ships over 225 *metres in length*
Such ships must be capable of withstanding the flooding of anyone compartment, designed to be empty* in the summer load condition or the machinery space. The permeabilities of the machinery space and other compartments are to be taken as 85 per cent and 95 per cent respectively.

* or as shown to be empty in the Stability Information Booklet

Type B ships



Tabular freeboard less than 8 but not less than 8-60

Ships over 100 metres but not exceeding 225 *metres in length.*
Such ship must be capable of withstanding the flooding of anyone compartment (including the machinery space) when loaded to the summer load waterline. The permeabilities of the machinery space and other compartments , are to be taken as 85 per cent and 95 per cent respectively.

Tabular Freeboard less **than B-60 but not** less **than B-100 .**

Ships over 100 metres but not exceeding 225 *metres in length* - .Such ships must be capable of withstanding the flooding of any two adjacent for and aft compartments, neither of which is the machinery space, when loaded to the summer load waterline. The permeability of each compartment is to be taken as 95 per cent.

Ships over 225 *metres in length*
Such ships must be capable of withstanding the flooding of the machinery space alone or any two other adjacent fore and aft compartments. The permeabilities of the machinery space and other compartments are to be taken as 85 per cent and 95 per cent respectively.

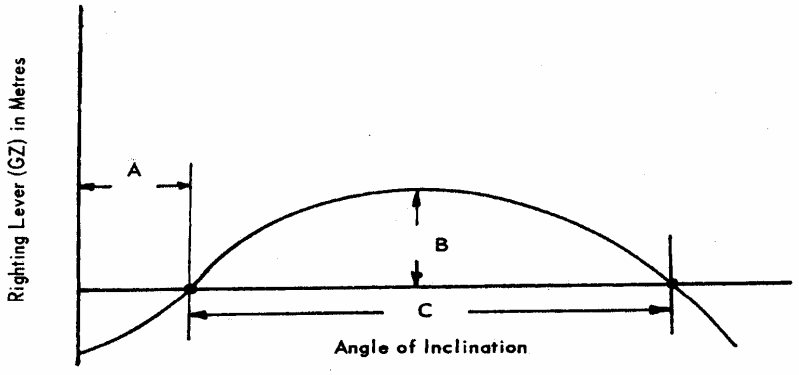
Requirements in the flooded condition
After flooding the ship must be capable of remaining afloat in the following condition of equilibrium:

(a) the final waterline after flooding should be below the top of any ventilator coaming, the lower edge of any air pipe opening, the upper edge of the sill of any access opening fitted with a weather-tight door and the lower edge of any other opening through which progressive flooding could take place.

(b) The angle of heel due to unsymmetrical flooding should not normally exceed 15 degrees but if no part of the deck is immersed an angle of 1 7 degrees may be accepted.

(c) In the case of symmetrical flooding the metacentric height (GM) calculated using the constant displacement method should have a positive value of at least 50 mm in the upright condition after flooding.

(d) The residual stability should be not less than that indicated by the statical stability curve shown.



A—The final angle of heel should not exceed 15° or 17° if (b) applies.
B—The maximum height of righting lever (GZ) should not be less than 0.1 metres.
C—The range of positive stability should be not less than 20°.

Information to be presented from flooding calculations

In cases where flooding calculations are required as a condition of assignment of freeboard, ie under Schedule 2 paragraph (1) or Schedule 4 paragraph 5(3), (5) and (6) of MSN 1752(M), the MCA will require the following information to be included in the Stability Information Booklet in order to demonstrate compliance:

(a) a statement indicating the condition of the ship prior to flooding. This should include the displacement and the centre of gravity of the ship in the light condition. These values must be examined carefully to see that they relate to the results obtained from either the inclining test or detailed weight calculation.

(b) A small scale plan showing the compartments assumed to have been flooded (see Figure ").

(c) A statement indicating the method of calculation that has been employed to obtain the final results

(d) A statement and small scale sketches giving the condition of the ship after flooding indicating:

(i) the draughts of the final trim line (see Figure 2).

(ii) The final angle of heel, if any, or if the ship remains upright after flooding the value of the metacentric height (GM) (see Figure 3).

(iii) The proximity of the final trim line to the nearest opening through which progressive flooding could take place (see Figure 3).

(e) A curve of residual stability for the final condition of flooding.

(f) A cautionary note on any condition of loading that could be rearranged without affecting the freeboard where such a rearrangement, eg filling of central compartments instead of wing compartments, would place the ship in a more onerous condition should collision damage be sustained.

Typical sketches & data to illustrate flooding calculations

Details of damaged compartment

Location of compartment	Weight of flood water	V.C.G.	Vertical moment	L.C.G.	Longitudinal moment	T.C.G.	Transverse moment

Figure 1

Plan view

ii

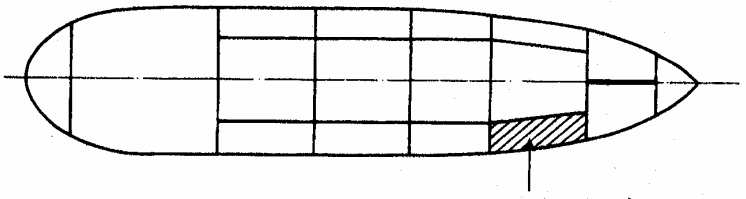


Figure 2

Profile showing final trim waterline

iii

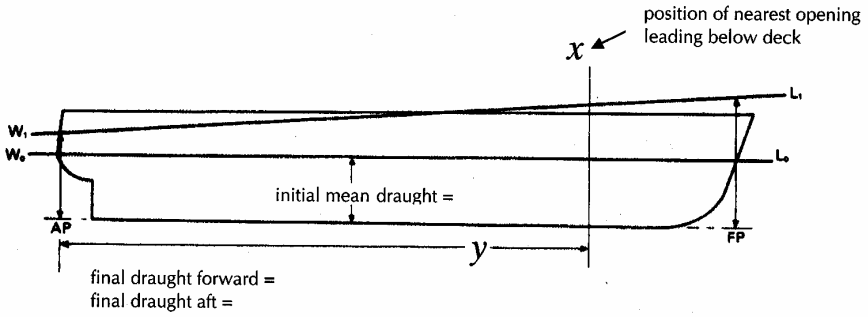
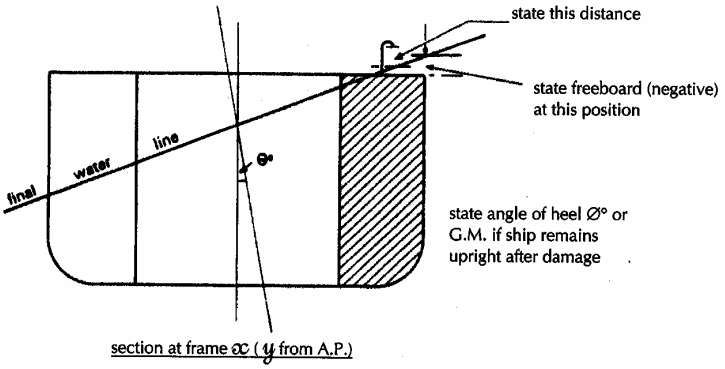


Figure 3

Section to show proximity of final waterline to nearest opening leading below deck

iv



v The 'Curve of Residential Stability' should be given on the adjacent sheet