Canadian
Coast Guard

TP 7301E

STABILITY, SUBDIVISION, AND LOAD LINE STANDARDS

First Issued
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Ship Safety Branch

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INTRODUCTION

The standards outlined in this booklet have been developed by the Board of Steamship Inspection, Department of Transport, and indicate conditions of approval and criteria used by the approval authority in assessing submissions required by regulations written under the Canada Shipping Act.

The standards and accompanying notes have been compiled for the guidance of the Steamship Inspection field and headquarter's staff, as well as for industry in general.

The criteria outlined in the various standards denote minimum requirements with no maximum limits having been set. The standards are intended to supplement the regulations in matters of detail to ensure uniform minimum across the country and to give a base from which shipowners, shipbuilders, and designers may work.

For convenience this booklet has been divided into three parts, namely(I) Stability, (II) Subdivision and (III) Load Lines, and each Standard within each Part is numbered.

As additions and amendments are issued, they will be marked with the appropriate Part and Standard number for insertion in this booklet.

STABILITY, SUBDIVISION AND LOAD LINE STANDARDS
AMENDMENT RECORD

DATE OF AMENDMENT	AMENDMENT NUMBER	STANDARD AMENDED	DATE INSERTED
Nov. 1975	1	STAB. 9 Pages 1-5	
Nov. 1975	2	LOAD 1 Page 3	
Jan. 1976	3	STAB. 9 Pages 2-5	
Jan. 1976	4	STAB. 2 Pages 1-2	
Jun. 1976	5	General Notes Pages 1-3 STAB: 4 Pages 1-2	
Oct. 1976	6	STAB. 6 Page 1	
Jan. 1977	7	LOAD 3 Pages 1-5	
Mar. 1977	8	LOAD 3 Page 1	
Mar. 1977	9	LOAD 3 Appendix ‘A’	
Apr. 1977	10	LOAD 3 Appendix ‘A”	
May 1977	11	STAB. 9 Page 1	
May 1977	12	STAB. 5 Pages 1-7	
Aug. 1977	13	STAB. 2 Page 2 STAB. 9 Page 4	
Mar. 1978	14	STAB. 2A Pages 1-3 STAB. 2A Appendix ‘A’ Pages 1-9	

Feb. 1980	15	LOAD 3 Page 5 LOAD 3 Appendix Page 7	
		LOAD 4 Pages 1-12 LOAD 5 One page LOAD 6 Pages 1-24	
Apr. 1985	16	STAB. 7	
Jan. 1986	17	STAB. 5	
July 1986	18	ALL	
Oct. 1986	19	STAB. 1 Page 1	
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Sept 1989	21	STAB 1 STAB 3(F) STAB 5	

PART I

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STANDARD: STAB 1

GENERAL INFORMATION REGARDING THE PREPARATION AND SUBMISSION OF STABILITY BOOKLETS

BASIC DATA

1(i) The Hull Construction Regulations and Fishing Vessel Inspection Regulations require that the following basic data be submitted together with the Stability Booklet:

(a) Hydrostatic Curves
(b) Cross Curves of Stability
(c) Capacity Plan
(d) Tank Sounding Tables, including free surface effects
(e) Draft Mark Locations

(ii) Although not a regulatory requirement, a copy of the Lines Plan should be submitted in addition to the above data.

(iii) Hydrostatic and stability curves should normally be prepared on a designed trim basis. However, where the operating trim has an appreciable effect on righting arms, such change in trim should be taken into account.

(iv) The calculations may take into account the volume to the upper surface of the deck sheathing, if fitted. In the case of wood ships the dimensions should be taken to the outside of the hull and deck planking.

(v) See Appendix 'B' to this Standard for Recommended Datum Lines for. Hydrostatic Properties and Centres of Gravity.

(vi) Cross curves of stability may take the following into account and a note to this effect must be shown;

(a) Enclosed weathertight superstructures complying with Regulation 3(10) (b) of the 1966 Load Line Convention, and enclosed weathertight deckhouses of similar construction,
(b) Weathertight trunks, and
(c) Hatchways having regard to the effectiveness of their closures.

If no erections are included, the cross curves of stability should contain a statement to this effect.

(vii) Four copies of all information are to be provided in each submission.

Amendment No. 21
September 1989

INCLINING EXPERIMENT

2(i) On completion or near completion of a ship the owner shall, where required by the regulations;

(a) arrange for an inclining experiment as described in STAB 2 to be conducted on the ship in the presence of and to the satisfaction of a marine surveyor;
(b) submit to the approval authority in respect of the ship the basic stability data described in 1(i) and 1(ii); and
(c) submit to the approval authority in respect of the ship the results of the inclining experiment referred to in paragraph (a) and the developed stability data computed as outlined in the various standards. The results of the inclining experiment shall be taken into account when computing the developed stability data.

(ii) The Board will consider an application for waiving an inclining experiment for a sister ship on receipt of the following:

(a) A request in writing from the owner together with a recommendation from the Regional Manager responsible.
(b) A statement in writing from the shipbuilder and/or owner that the vessels in question are similar in all respects regarding stability.
(c) Data for the inclined sister ship, giving details of the inclining experiment carried out by a CW marine surveyor (or other acceptable authority in the case of a ship foreign-built for registry in Canada) and the conditions developed therefrom.
(d) Copies of the lightship check report (including LCG) together with confirmation by the attending surveyor that the results are consistent with that of its inclined sister ship - use S.I.35 form.

On acceptance of the Lightship check, the loading conditions are to be developed accordingly and submitted in the usual manner.

(iii) The Board may allow the inclining experiment to be dispensed with in exceptional circumstances if it can be shown to the approval authority's satisfaction that owing to the form, construction and arrangement of the ship, stability calculations can safely be made without the inclining experiment being conducted.

(iv) Vessels transferred to Canadian registry are considered "new" ships and are to have inclining experiments conducted in accordance with the applicable regulations. Under special circumstances, the Board will consider waiving of an inclining experiment for vessels recently inclined employing similar procedures to those that apply to Canadian vessels. Applications for such a waiver shall include:

(a) Documented verification that the experiment was carried out under the supervision of a governmental or classification authority acceptable to the Board,
(b) A request in writing from the owner together with a recommendation from the Regional Manager responsible,
(c) A statement in writing from the owner confirming that no changes which would affect stability characteristics have been made to the vessel since the last inclining, and
(d) Copies of a lightship check report, including LCG, which establishes consistency with the submitted inclining.

STABILITY BOOKLET

3(i) In an endeavour to expedite the approval process and to simplify use of stability information, the Board of Steamship Inspection encourages the adoption of a standard presentation for Stability Booklets. Naval architects, shipowners and shipbuilders are therefore requested to adopt the format given in Appendix W to this standard and to follow the guidance notes contained herein.

(ii) Reference should also be made, when developing stability information, to the other STAB standards contained in this book. Such standards outline the minimum stability of a particular type of vessel as well as other guidance data, such as inclining experiment procedures.

(iii) The system of measurement used in the presentation of stability data must agree with that used for the ship's draft marks but, wherever possible, the S.I. system of measurement should be adopted. In any case, a single system of measurement should be used consistently throughout.

(iv) It is the responsibility of the Owner to ensure that the stability conditions presented in the Stability Booklet submitted for approval accurately reflect the vessel's loading conditions and modes of operation.

An approved copy of the Stability Booklet, accompanied by the basic data documents listed in subsection 1(i), is to be carried on board the vessel at all times for the guidance of the Master.
(v) The free surface of liquid in tanks shall be taken into account when computing a righting lever curve or a metacentric height for the purposes of the developed stability data referred to in the foregoing paragraph.

(vi) In cases where a ship would flood through an opening, the stability curve is to be cut short at the corresponding angle of flooding and the ship is to be considered as having entirely lost her stability at that angle. In every case, the angle of downflooding should be identified.

(vii) Every righting lever curve shall show the angle of heel at which the edge of the main deck submerges.

(viii) In all cases the cargo should be assumed to be homogeneous unless this is inconsistent with practice.

(ix) In all cases when deck cargo is to be carried, a realistic stowage weight is to be assumed and stated, including the centroids of the cargo.

(x) Passengers and luggage should be considered to be in the highest deck spaces normally at their disposal.

(xi) The Load Line Regulations (Sea) and Load Line Regulations (Inland) require vessels which are assigned load lines to have a minimum bow height. Reference to the required minimum bow height should be made and the corresponding maximum forward draft noted in the Stability Booklet.

(xii) The effect on stability with regard to water absorption must be accounted for in all conditions where timber cargo is carried on deck. In the arrival condition it should be assumed that water absorption increases the weight of deck timber cargo by ten percent.

(xiii) Sequence of ballasting must be indicated in the Stability Booklet where required to ensure adequate stability throughout the voyage.

(xiv) The weight and centres of gravity of any permanent ballast should be shown as a separate item in the Lightship Condition. Subsequent conditions should list the lightship with permanent ballast included. A sketch indicating the position and description of the material and its securing arrangements should be incorporated into the Stability Booklet.

All stability data which is based on a lightship having a negative GM to be submitted to H.Q. for approval.

Modification No. 20
October 1, 1987

(xv) Where tugs and similar vessels are fitted with buoyancy material, the volume and location of the approved material should be noted in the Stability Booklet.

(xvi) Stability Booklets for ships engaged in the carriage of bulk cargoes should carry appropriate warning notations on cargo shifting hazards peculiar to such cargoes and outline corrective measures to be taken in the event that cargo shifts occur.

(xvii) As the Board of Steamship Inspection has no control over the basic data used to develop the Stability Booklet conditions submitted by the owner, his shipbuilder or his naval architect, nor of any other condition of loading employed by the master while operating his vessel, the following qualifying note is to be appended to all stability approvals:

“Subject to the owner, his shipbuilder or naval architect being responsible for the accuracy of the design operating conditions presented herein and of the basic data from which such conditions were developed. It shall be the responsibility of the owner and master to ensure that a proper measure of stability is maintained for all conditions of loading and ballasting”.

GENERAL NOTES

4(i) Where an existing ship is modified in such a manner as to affect its stability characteristics:

(a) in the case of a ship for which the required stability information is available, that stability information shall be modified and submitted to the approval authority; and
(b) in the case of a ship for which the stability information required is not available, that stability information shall be provided to the extent considered necessary by the approval authority.

(ii) Where the approval authority is of the opinion that modifications made to a ship adversely affect its stability, the owner of that ship shall submit such stability data as the approval authority may request.

(iii) Certain types of vessels such as passenger vessels, Arctic class ships, tankers, ships carrying dangerous cargoes etc. may also be required to submit subdivision and/or damaged stability calculations in addition to intact stability requirements. Further detailed information regarding subdivision and damaged stability requirements is contained in applicable Regulations.
(iv) Owners of vessels required to comply with subdivision or damage stability criteria should be encouraged to submit ‘ at the design stage or early in construction, preliminary subdivision, damaged stability, or flooding calculations to avoid possible structural alterations to the vessel or undue delay when the vessel is ready to enter service.

(v) The stowage of deck cargo should be so arranged that the stress exerted by the cargo does not exceed the maximum permissible stress on the deck areas or hatches upon which it is stowed.

APPENDIX A

STABILITY BOOKLET

GUIDANCE NOTES

Notes presented in this appendix in italics are for the guidance of those preparing the Stability Booklet and need not appear in its completed form.

STABILITY BOOKLET GUIDANCE NOTES
CONTENTS

GENERAL PARTICULARS

Ship’s Name

Type of Vessel

Official Number

Port of Registry

Number of Passengers (if applicable)

Length between perpendiculars (metres)

Breadth Moulded (metres)

Depth Moulded (metres)

Subdivision Draft (if applicable)

Summer Freeboard (millimetres)

Summer Load Draft (metres)

Displacement at Summer Load Line (tonnes)

Lightship (tonnes)

Gross Tonnage

Net Tonnage

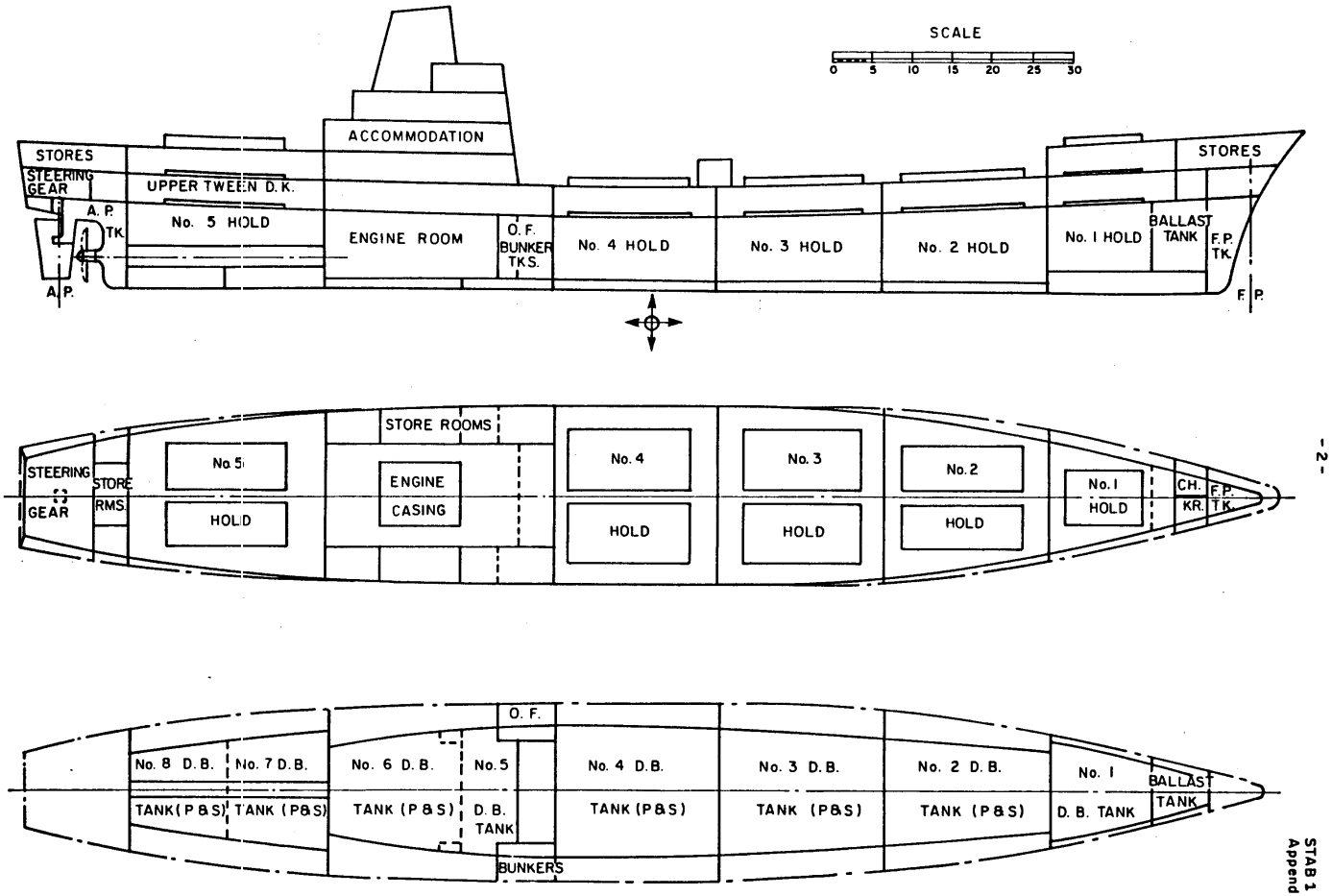
Class of Voyages

Date Keel Laid

Builder’s Name

Owner’s Name

Some of the above particulars may not be available at the time of submission of the booklet for approval and may be added as they become available.



ARRANGEMENT OF TANKS, STOREROOMS & CARGO SPACES

NOTES REGARDING STABILITY AND LOADING OF THE SHIP

1 The Stability Booklet should contain notes similar to the following, prominently displayed, and any other notes as appropriate:

(a) Compliance with the stability criteria indicated 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.

(b) 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.

(c) Before a voyage commences care should be taken to ensure that the cargo and 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.

2 The stability conditions developed for the ship should be representative of the operations envisaged and the Stability Booklet should contain sufficient information to enable the master to assess new conditions as necessary.

3 Every condition in the Stability Booklet should list the calculated results, along with the minimum Coast Guard required criteria as described in the relevant STAB standard.

CAPACITIES, CENTRES OF GRAVITY AND FREE- SURFACE MOMENTS.

1. CARGO-OIL TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT AT S.G.I.O (Tonnes Metres)
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G.I.O	VERTL. A.B. 98%	L0NGL .FROM A.P.	
							.
TOTAL							

2. OIL - FUEL TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT AT S.G.I.O (Tonnes Metres)
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G.I.O	VERTL. A.B. 98%	L0NGL .FROM A.P.	
							.
TOTAL							

NOTE:
To obtain weight of the liquid contents of any compartment multiply "Tonnes at S.G.I.O" by the actual Specific Gravity of the liquid.

CAPACITIES, CENTRES OF GRAVITY AND FREE -SURFACE MOMENTS

3. ENGINE - ROOM AND LUB-OIL TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT AT S.G.I.O (Tonnes Metres)
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G.I.O	VERTL .A.B. 98%	L0NGL .FROM A.P.	
							.
TOTAL							

4. FRESH, FEED AND BALLAST WATER TANKS

COMPARTMENT	LOCATION (Frame Numbers)	CAPACITIES			CENTRES OF GRAVITY (Metres)		FREE SURFACE MOMENT AT S.G.I.O (Tonnes Metres)
		100% FULL	98% FULL				
		CUBIC METRES	CUBIC METRES	TONNES AT S.G.I.O	VERTL .A.B. 98%	L0NGL .FROM A.P.	
							.
TOTAL (FRESH WATER)							
TOTAL (WATER BALLAST)							

NOTE:
To obtain weight of the liquid contents of any compartment multiply "Tonnes at S.G.I.O" by the actual Specific Gravity of the liquid.

EFFECT OF FREE SURFACE ON STABILITY

The effect of free surface in compartments containing fluids or fluid cargoes must be taken into account for all conditions of loading.

The maximum free surface moment in units of tonnes metres should be calculated for all tanks, based on the following table of specific weights:

FLUID	*SPECIFIC WEIGHT IN TONNES PER CUBIC METRE*
Salt Water	*1.025*
Fresh Water	*1.000*
Fuel 011	*0.90 - 0.97*
Diesel 011	*0.82 - 0.92*
Lubricating 011	*0.85 - 0.95*
Gasoline	*0.70 - 0.79*

EXAMPLE: Displacement of Vessel = 6,740 tonnes.

TANK	*INERTIA(m^4)*	*SPECIFIC WEIGHT*	*FREE SURFACE MOMENT (Tonnes M)*
Ballast Tank	*1,000*	*1.025*	*1,025*
Fresh Water Tank	*850*	*1.000*	*850*
Fuel 011 Tank	*1,500*	*0.95*	*1,425*
Lubricating 011 Tank	*600*	*0.90*	*540*
TOTAL F. S. MOMENT			*3,840*

$$\textbf{LOSS IN GM} = \frac{\textbf{Total free surface moment (tonnes metres)}}{\textbf{Displacement of Vessel (tonnes)}}$$

$$= 3840 / 6740$$

$$= 0.570 \text{ m}$$

Other methods of determining the effect of free surface of liquids may be acceptable and should be accompanied by detailed calculations.

EXAMPLE SHOWING USE OF CROSS CURVES (RN)

GZ calculations must be submitted for all sea going conditions. It is recommended that the following format be submitted for each condition included in the booklet:

Righting Lever GZ = KN - KG Sin Æ

where KN = Cross Curve ordinate

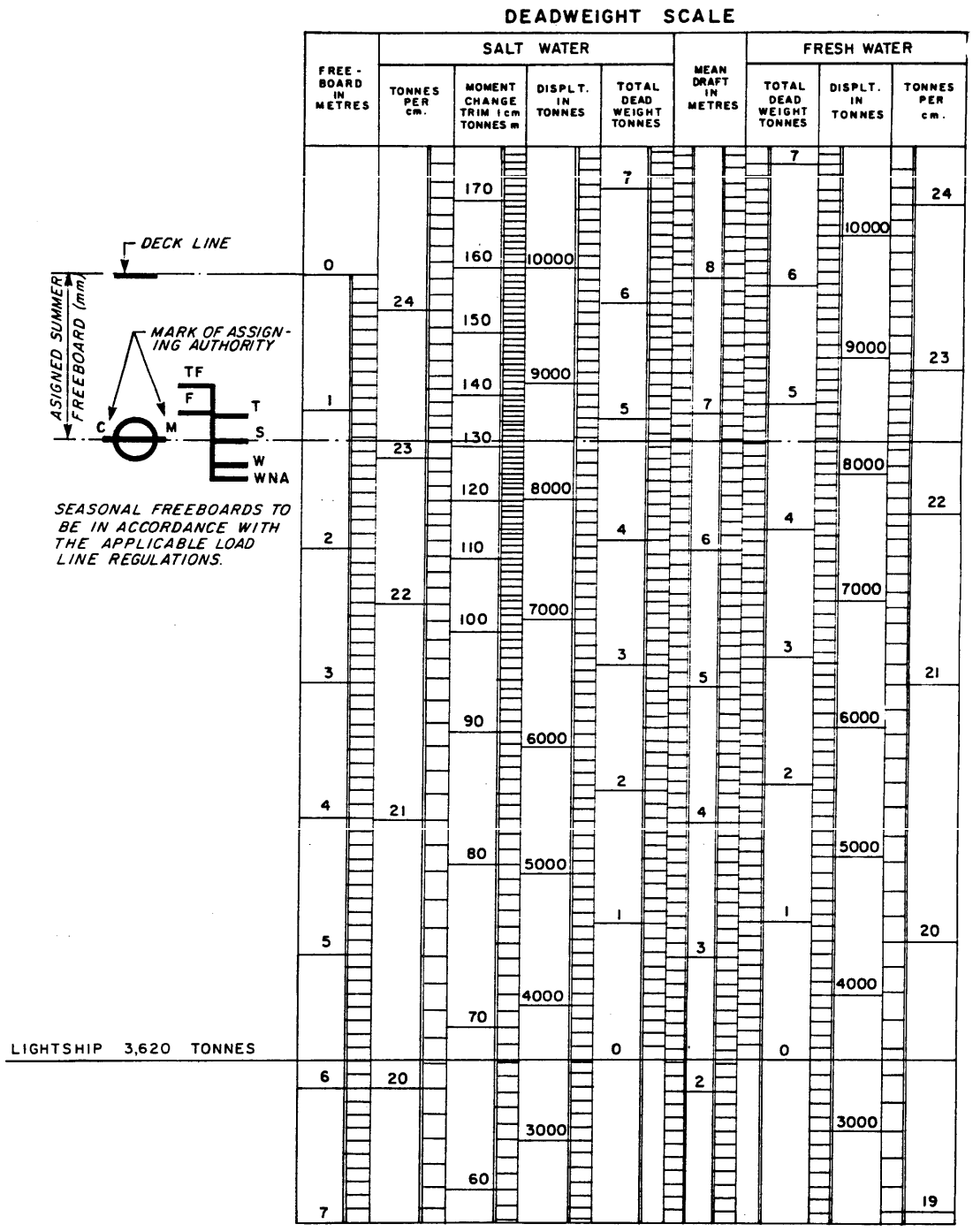
KG = Centre of Gravity above base (corrected for free surface effects)

and Æ = Angle of Inclination

Condition No.
Corresponding Displacement = tonnes

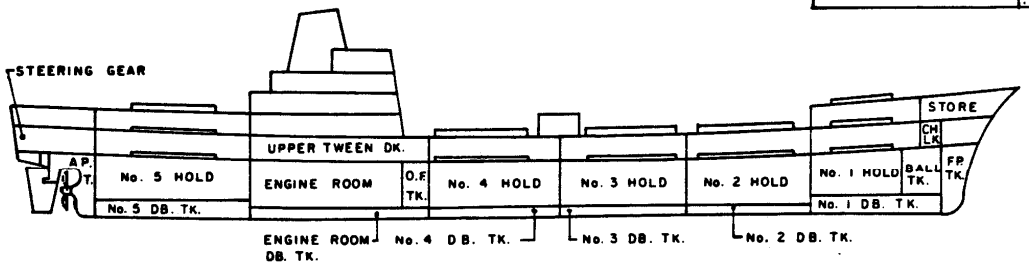
KN	Æ°	Sin Æ	KG Sin Æ	GZ = (KN-KG Sin Æ)
	5	.0872		
	10	.1736		
	20	.3420		
	30	.5000		
	40	.6428		
	60	.8660		
	80	.9848		

The Statical Stability curve may be drawn for each condition by using the GZ values calculated in the last column.


DEADWEIGHT SCALE
SALT WATER
FRESH WATER
FREE-BOARD IN METRES
TONNES PER cm.
MOMENT CHANGE TRIM 1 cm TONNES m
DISPLT. IN TONNES
TOTAL DEAD WEIGHT TONNES
MEAN DRAFT IN METRES
TOTAL DEAD WEIGHT TONNES
DISPLT. IN TONNES
TONNES PER cm.
DECK LINE
ASIGNED SUMMER FREEBOARD (mm)
MARK OF ASSIGN-ING AUTHORITY
TF
F
T
C
M
S
W
WNA
SEASONAL FREEBOARDS TO BE IN ACCORDANCE WITH THE APPLICABLE LOAD LINE REGULATIONS.
LIGHTSHIP 3,620 TONNES

TYPICAL CONDITION SHEET

COLOUR CODE
CARGO
FUEL OIL
LUB OIL
DIESEL OIL
WATER BALLAST
FRESH WATER



CONDITION Nº		DESCRIPTION OF CONDITION							
DEADWEIGHT ITEMS	WEIGHT (Tonnes)	K.G. (metres)	VERT. MOMENT	L.C.G AB* (metres)	LONGL MOMENT	F.S. MOMENT (Tonnes m)	HYDROSTATIC DATA	S.W.	
								F.W.	
							DRAFT AT L.C.F.		
DEADWEIGHT ITEMS							DRAFT AT A.P.		
TO BE LISTED							DRAFT AT F.P.		
SEPARATELY							MEAN DRAFT		
							TRIM BY		
							KM_T		
							KG		
							GM (Solid)		
							FREE SURFACE CORRN		
							GM FLUID		
							HYDROSTATIC PROPERTIES		
							KM_T		
							L.C.B.		
							L.C.F.		
							M.C.T. 1cm		
DEADWEIGHT									
LIGHTSHIP									
DISPLACEMENT									

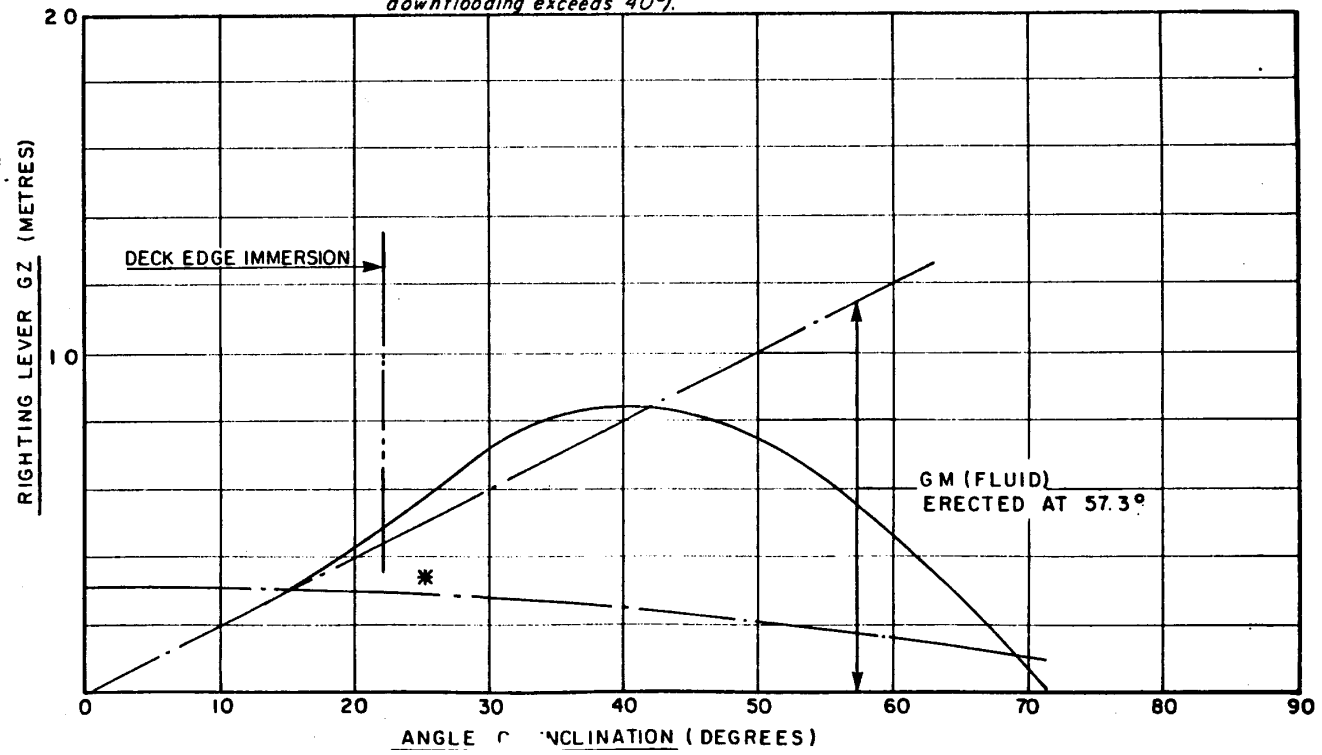
1) Aft (-ive) or Fwd (+ive) of Amidships or may be given from A. P. if preferred.
2) Corrected for Specific Weight (see page 6)
3) Check appropriate condition.

TYPICAL STATICAL STABILITY CURVE

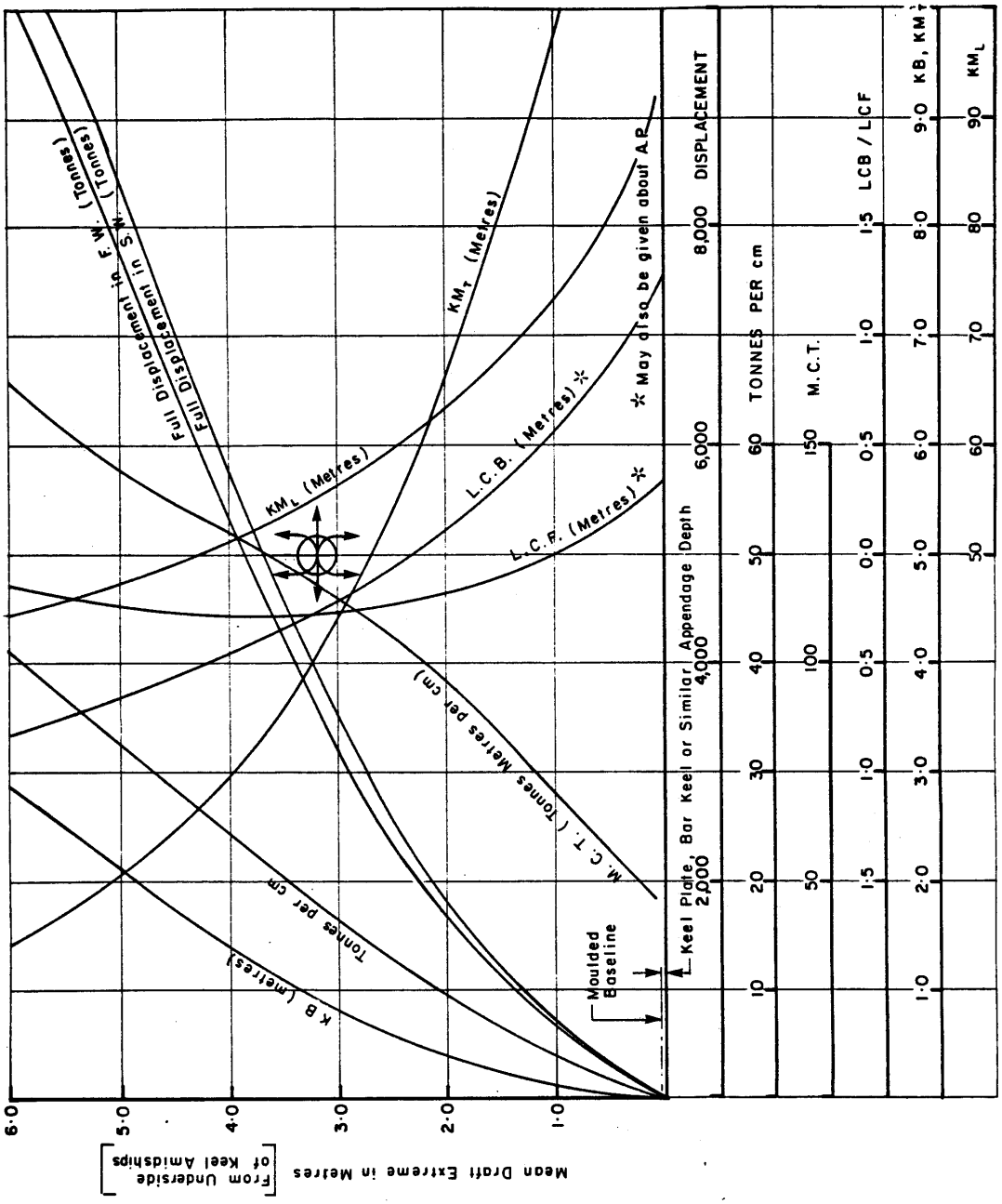
AREA UNDER CURVE UP TO 30° =	METRE RADIANS
✓ AREA UNDER CURVE UP TO 40° =	METRE RADIANS
✓ AREA BETWEEN 30° AND 40° =	METRE RADIANS
MAXIMUM GZ = METRES AT	DEGREES.
GZ AT 30° = METRES.	

✓ *or angle of downflooding whichever is less*
(angle of downflooding to be shown if less than 40°; otherwise, state angle of downflooding exceeds 40°).

✱ Curve of heeling arms to be superimposed on statical stability curve where applicable to special vessels (eg. passenger-wind - crane load heeling etc.) Heeling arms may be assumed to vary as the cosine function of the angle of heel.



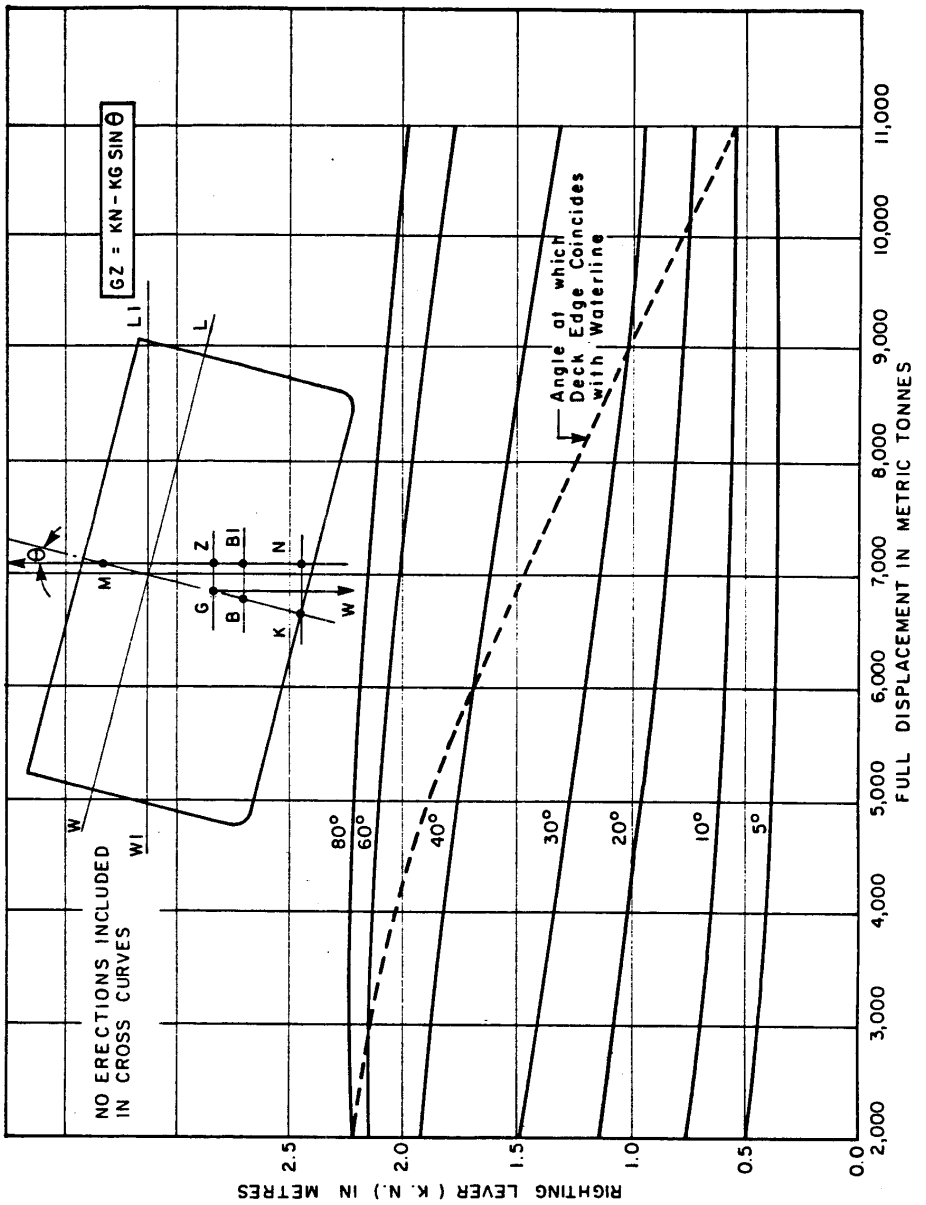
HYDROSTATIC CURVES



NOTES:

1. *Curves should normally be prepared on a level keel basis or, in the case of raked keels, on waterlines parallel to the recommended baseline.*
2. *The curves must cover a range from lightship to the deepest operating draft, however, for vessels which are required to submit damaged stability, the range is to extend to the bulkhead deck.*

CROSS CURVES OF STABILITY



NOTES:

1. *The curves may take into account effective superstructures, deckhouses, trunks, hatchways etc. However, it should be clearly stated which erections have been considered in the derivation of the curves.*

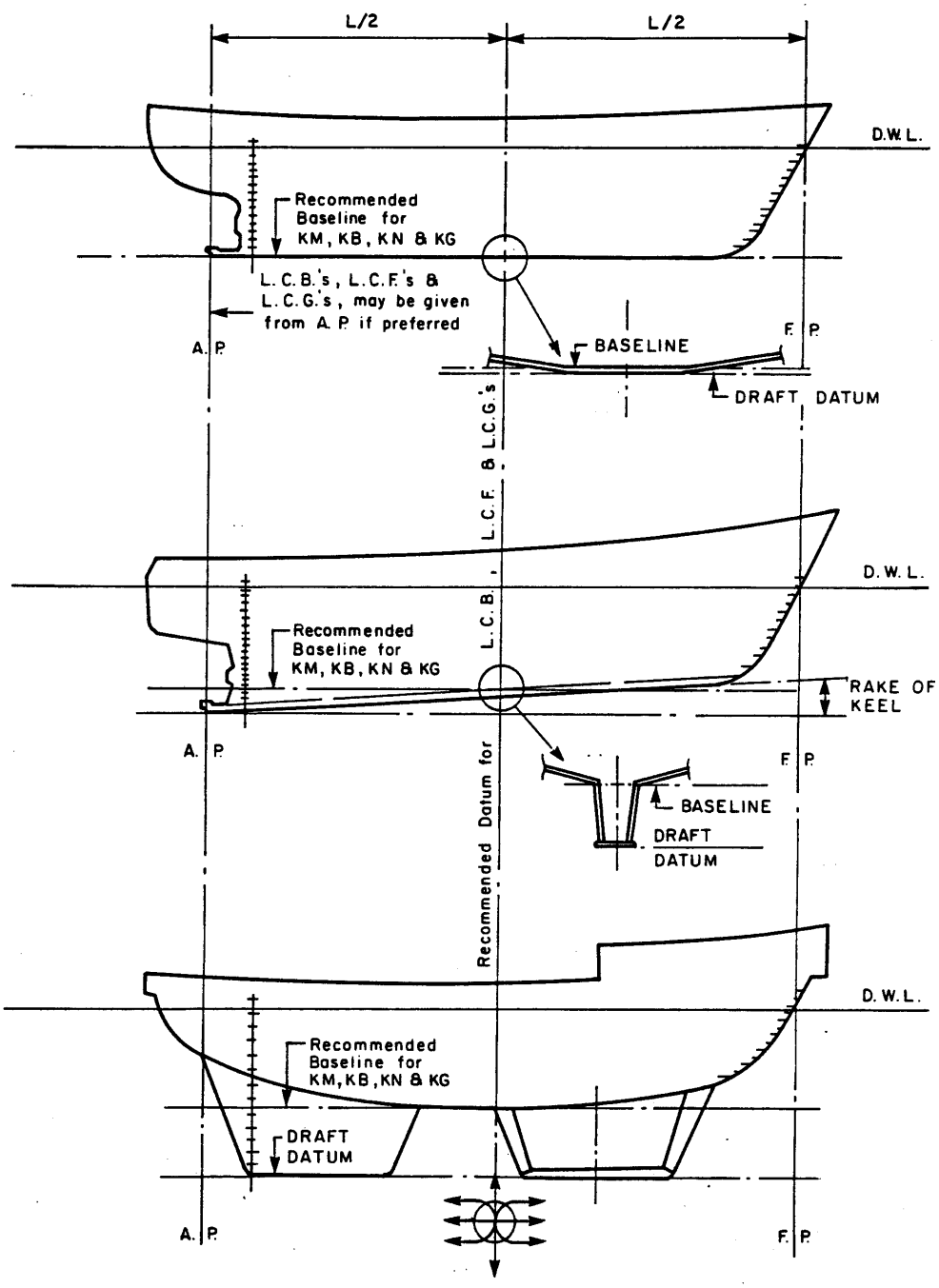
2. *The curves should normally be prepared on a zero trim basis. Where the operating trim has an appreciable effect on the righting arms, such change in trim should be taken into account.*

3. *Where a ship carrying a timber deck cargo is assigned a timber freeboard, the timber deck cargo may be included in the cross curves of stability and the criteria of Section 5 of STAB 6 applied, provided that a permeability of 25 % is assumed for the volume occupied by the deck cargo.*

APPENDIX ‘B’

RECOMMENDED DATUM LINES FOR HYDROSTATIC PROPERTIES AND CENTRES OF GRAVITY

RECOMMENDED DATUM LINES FOR HYDROSTATIC PROPERTIES AND CENTRES OF GRAVITY



1. Mean hydrostatic drafts to be measured from the underside of keel at amidships.
2. Draft mark locations to be provided.

STANDARD: STAB 2

INCLINING EXPERIMENTS

CONTENTS

INTRODUCTION

Stability calculations depend upon an accurate determination of the centre of gravity of the ship and, unless the Inclining Experiment from which this determination is made is itself carried out with the greatest possible .accuracy, no really reliable calculation can be made.

Thus, the first determination of the centre of gravity, is basic, in that any alterations, additions of weight to, or removals of weight from, the ship during her life, are made relying upon figures obtained from the Inclining Experiment.

With the foregoing in mind, the preparations and procedures outlined in Appendix 'A' have been prepared to provide guidelines for the conduct of inclining experiments.

APPENDIX ‘A’

INCLINING EXPERIMENT

PREPARATIONS AND PROCEDURES

INCLINING EXPERIMENT - PREPARATIONS AND PROCEDURES

WEATHER CONDITIONS & MOORING ARRANGEMENTS .

1(i) The vessel should be moored in a sheltered area with bow or stern to the wind. The depth of water under the hull should be sufficient to allow the vessel to move freely. The breast ropes should be slackened right down and the remaining hawsers slackened each time a reading is taken. During the test the gangway should be removed.

(ii) If possible the test should not be conducted in wind conditions heavier than a light breeze. Excessive accumulations of rain, snow or ice should be removed before the test. Surveyors should ensure that the effect of wind and current does not adversely affect the test results.

CONDITION OF VESSEL, TRIM AND LIST

2(i) The vessel should be in as nearly a finished condition as possible and in a good state of readiness with shipyard gear and equipment, tool boxes, scaffolding, scrap and debris removed from the vessel. Weights capable of moving should be lashed in place.

(ii) During the test only the minimum number of people should be on board.

(iii) Bilges, decks and flats must be free of liquids.

(iv) Boilers, wet machinery and piping should be at operating level.

(v) Where possible all tanks should be empty. Tanks containing liquids should either be pressed full or at a level where the free surface effect can accurately be calculated. However, it is emphasized that empty tanks are preferred for an accurate test. It is advisable to remove manhole covers to verify that tanks are empty rather than relying on soundings. The viscosity of the liquid should be considered and the liquid heated if necessary to allow free movement. Care should be taken in pressing up tanks to ensure that there is no entrapped air.

(vi) In all cases the effect of free surface on the test results should be considered before proceeding with the test. Excessive free surface could .well lead to doubtful results and, in such cases, the surveyor should consider postponing the test.

(vii) All valves should be closed to prevent cross flooding or intercompartmental flooding.

(viii) The vessel should be as close to the design trim as possible and should not differ from this by more than 0.01 LBP. Unless the vessel is at the designed trim, soundings of tanks will not give true readings and the inclining stability calculation will require to be calculated for the trimmed waterline.

(ix) The vessel should be upright or within 1/2° from upright.

PENDULUMS

3(i) Two pendulums should be used, one at each end of the vessel. The length of each pendulum should be as long as possible and they should be located in an area protected from the wind. Pendulum weights should be suspended into a liquid such as oil to dampen excessive movement.

DRAUGHTS AND FREEBOARD

4(i) Draughts and/or freeboards should be read immediately before or immediately after the test. All persons required to be on board for the test should be in location during these readings. If the water is not perfectly calm a gauge glass may be used to ensure accuracy.

(ii) Draughts should be read forward and aft and draughts or freeboards lifted amidships to determine hog or sag. At the same time the density of the water should be recorded at various locations along the vessel.

TEST WEIGHTS

5(i) The weights used should be sufficient to give a total inclination of 1 1/2° to 3° on each side. It may be necessary to have a larger inclination in small vessels in order to get sufficient deflection of the pendulum. However, care should be taken to ensure:

(a) that the angle of heel does not exceed the angle at which GZ no longer equals GM sin ∅.
(b) that the deflection of the pendulum for each shift is sufficiently large to give meaningful readings, and
(c) that changes in the waterplane area during the shifts are kept as small as possible. In this regard vessels with appreciable flare at the waterline should be carefully considered and the angle of inclination should not exceed 1°. The test weights should be divided into four lots and arranged as close to amidships as possible. The accuracy of the test weights should be determined.

WEIGHT MOVEMENTS

6(i) Eight (8) movements of the weights should normally be carried out. If the readings are not consistent for the initial four readings, the cause must be corrected and the number of movements repeated. At the time of the recording of the readings, the men on board should be allocated to their positions and not allowed to move.

RESPONSIBILITIES

7(i) The responsibility for preparing the vessel for the test and conducting the test rests with the owner, shipbuilder or naval architect. The marine surveyor will assist only as necessary to obtain valid test results and will;

(a) check and record the adequacy of the vessel's preparation by conducting a general inspection of the vessel prior to the inclining experiment,
(b) witness and record the soundings of tanks containing liquids and inspect all empty tanks prior to the test,
(c) verify the accuracy of the test data accumulated,
(d) verify weight and location of permanent ballast, if any, and
(e) submit a completed SI 35, "Report of an Inclining Experiment".

The organization conducting the test shall:

(f) accumulate a complete record of all test information,
(g) furnish the marine surveyor with accurate weight and centre of gravity information on weights to add, to deduct and to relocate to bring the vessel to lightship condition. This data should provide a clear accounting of the condition of the vessel as inclined and should be acceptable to the Surveyor,
(h) provide details as to weight and location of all permanent ballast on board the vessel, and
(i) prepare an inclining experiment report and submit the stability data as required by the regulations..

WAIVING OF AN INCLINING EXPERIMENT

8(i) Under certain circumstances the Approval Authority will consider an application from the owner for waiving an inclining experiment. See STAB 1, section 2.

APPENDIX ‘B’

DETERMINATION OF SHIP’S METACENTRIC HEIGHT (GM)

BY MEANS OF THE ROLLING PERIOD TEST

DETERMINATION OF SHIP'S METACENTRIC HEIGHT (GM) BY MEANS OF THE ROLLING PERIOD TEST

INTRODUCTION

1(i) Subject to subsection (iv), this method of approximating a ship's initial metacentric height (GM) may be used for vessels up to 24 metres in registered length, where it is not practicable to carry out an inclining experiment, or as a supplement to an inclining experiment.

(ii) If the following instructions are properly carried out, this method allows a reasonably quick estimation of the metacentric height, which is a measure of the ship's stability.

(iii) The method depends upon the relationship between the metacentric height and the rolling period in terms of the extreme breadth of the vessel.

(iv) It should be noted that a roll test is not acceptable as a basis for determining a ship's stability characteristics, where:

(a) an inclining experiment is required by Regulations;
(b) the vessel is of hard chine construction (i.e. of knuckled hull form) or is fitted with bilge keels, or
(c) reasonable doubt exists as to the adequacy of the intact stability characteristics of the ship, over its complete range of operating conditions.

TEST PROCEDURE

2(i) The rolling period required is the time for one complete oscillation of the vessel. To ensure the most accurate results in obtaining this value the following precautions should be observed:

(a) The test should be conducted with the vessel in harbour, in smooth water with the minimum interference from wind and tide.
(b) Starting with the vessel at the extreme end of a roll to one side (say port) and the vessel about to move towards the upright, one complete oscillation will have been made when the vessel has moved right across to the other extreme side (i.e. starboard) and returned to the original starting point and is about to commence the next roll.

(c) By means of a stop watch, the time should be taken for about five (5) of these complete oscillations; the counting of these oscillations should begin when the vessel is at the extreme end of a roll. After allowing the roll to completely fade away, this operation should be repeated at least twice more. If possible, in every case the same number of complete oscillations should be timed to establish that the readings are consistent, i.e. repeating themselves within reasonable limits. Knowing the total time for the total number of oscillations made, the time for one complete oscillation can be calculated.

(d) The vessel can be made to roll by rhythmically lifting up and putting down a weight as far off middle-line as possible; by pulling on the mast with a rope; by people running athwartships in unison; or by any other means. However, and this is most important, as soon as this forced rolling has commenced the means by which it has been induced must be stopped and the vessel allowed to roll freely and naturally. If rolling has been induced by lowering or raising a weight it is preferable that the weight is moved by a dockside crane. If the ship's own derrick is used, the weight should be placed on the deck, at the middle-line, as soon as the rolling is established.

(e) The timing and counting of the oscillations should only begin when it is judged that the vessel is rolling freely and naturally, and only as much as is necessary to accurately count these oscillations.

(f) The mooring should be slack and the vessel "breasted off" to avoid making any contact during its rolling. To check this, and also to get some idea of the number of complete oscillations that can be reasonably counted and timed, a preliminary rolling test should be made before starting to record actual times.

(g) Care should be taken to ensure that there is a reasonable clearance of water under the keel and at the sides of the vessel.

(h) Weights of reasonable size which are liable to swing (e.g. a lifeboat), or liable to move (e.g. drum), should be secured against such movement. The free surface effects of slack tanks should be kept as small as is practicable during the test.

DETERMINATION OF THE INITIAL STABILITY

3(i) Having calculated the period for one complete oscillation, say T seconds, the metacentric height GM_o can be calculated from the following formula:

$$GM_0 = \left(\frac{f.B}{T_r}\right)^2$$

Where:

f = factor for the rolling period
B = breadth of the ship in metric units,
T_r = time for a full rolling period in seconds (i.e. for one oscillation 'to and fro' port-starboard-port, or vice versa).

ROLL FACTORS

4(i) The factor 'f' is of the greatest importance and data from a number of tests have been used in determining the following typical values:

(A) For unloaded fishing boats (but with fuel, stores, and equipment). f = 0.761

(B) For vessels of normal size (excluding tankers):

(a) empty ship or ship carrying ballast f = 0.88

(b) ship fully loaded and with liquids in tanks comprising the following percentage of the total load on board (i.e. cargo, liquids, stores, etc.)

1. 20 percent of total load f = 0.78
2. 10 percent of total load f = 0.75
3. 5 percent of total load f = 0.73

The stated values are mean values. Generally, f - values are within ±0.05 of those given above.

LIMITATIONS TO THE USE OF THIS METHOD

5(i) It must be noted that the greater the distance of masses from the rolling axis, the greater the rolling coefficient will be.

Therefore, it can be expected that:

- the rolling coefficient for an unloaded ship, i.e. for a hollow body, will be higher than that for a loaded ship;
- the rolling coefficient for a ship carrying a great amount of bunkers and ballast - both groups are usually located in the double bottom, i.e. far away from the rolling axis - will be higher than that of the same ship having an empty double bottom.

(ii) The above recommended rolling coefficients were determined by tests with vessels in port and with their consumable liquids at normal working levels; thus, the influences exerted by the vicinity of the quay, the limited depth of water and the free surface of liquids in service tanks are covered.

(iii) Experiments have shown that the results of the rolling test method get increasingly less reliable the nearer they approach GM-values of 0.20 metres and below.

(iv) For the following reasons, it is not generally recommended that results be obtained from rolling oscillations taken in a seaway:

(a) Exact coefficients for tests in open waters are not available.
(b) The rolling periods observed may not be free oscillations but forced oscillations due to seaway.
(c) Frequently, oscillations are either irregular or only regular for too short an interval of time to allow accurate measurements to be observed.
(d) Specialized recording equipment is necessary.

(v) However, sometimes it may be desirable to use the vessel's period of roll as a means of approximately judging the stability at sea. If this is done, care should be taken to discard readings which depart appreciably from the majority of other observations. For oscillations corresponding to the sea period and differing from the natural period at which the vessel seems to move should be disregarded. In order to obtain satisfactory results, it may be necessary to discard a considerable number of observations.

(vi) In view of the foregoing circumstances, it needs to be recognized that the determination of the stability by means of the rolling test in disturbed waters should only be regarded as a very approximate estimation.

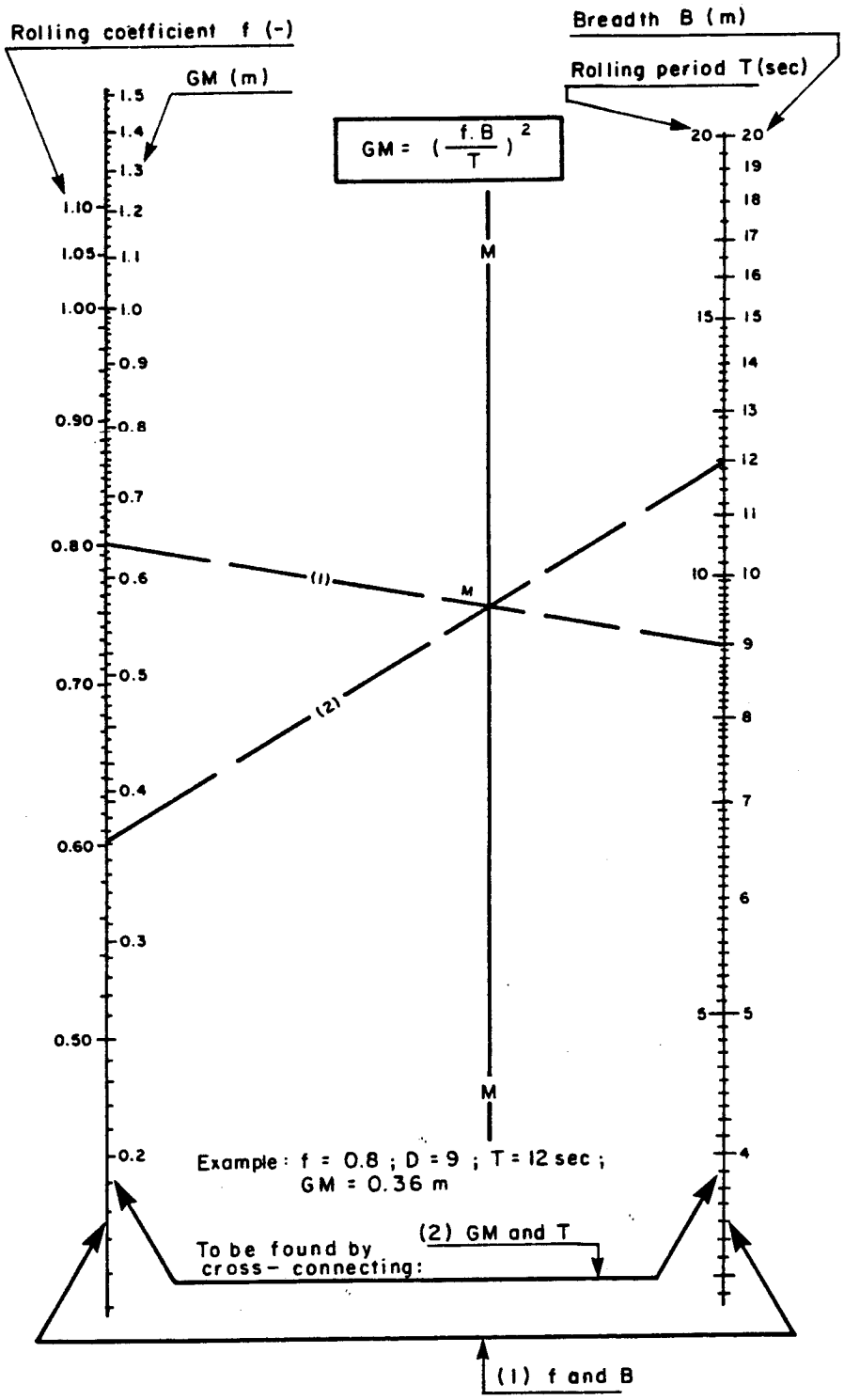
GRAPHICAL METHOD

6(i) The initial stability may also be more easily determined graphically by using the sample nomogram on page 5.

(a) The values for B and f are marked in the relevant scales and connected by a straight line (1) . This straight line intersects the vertical line (mm) in the point (M).

(b) A second straight line (2) which connects this point (M) and the point on the, T r scale corresponding with the determined rolling period, intersects the GM scale of the requested value.

METRIC UNIT



STANDARD: STAB 3

INTERIM STANDARD OF STABILITY FOR SHIPS BUILT OR CONVERTED FOR TOWING

1 As an interim measure while research is continuing, the following minimum intact stability criteria are to be used in the approval of stability data for the above vessels.

VESSELS BUILT OR CONVERTED FOR TOWING:

2(I) The area under the righting lever (GZ) curve should not be less than 0.055 metre-radians up to 30 degrees angle of heel and not less than 0.09 metre-radians up to 40 degrees or the angle of downflooding if this angle is less than 40 degrees.

Additionally, the area under the righting lever (GZ) curve between the angles of heel of 30 degrees and 40 degrees or between 30 degrees and the angle of downflooding, if this angle is less than 40 degrees, should not be less than 0.03 metre-radians.

(ii) The righting lever (GZ) should be at least 0.20 metres at an angle of heel equal to or greater than 30 degrees.

(iii) The maximum righting lever should occur at an angle of heel preferably exceeding 30 degrees but not less than 25 degrees.

(iv) The initial metacentric height (GM) should not be less than 0.55 metres.

3 With regard to the-Lightship condition specified in the Hull Construction Regulations, this condition is not considered to be an operating condition. Therefore, the above criteria are not applicable and the standard to be attained in this condition is a positive GM. (The Lightship condition is defined as the condition of a vessel ready for sea with no stores, consumables, fluid ballast, or crew on board).

STANDARD: STAB 4

STABILITY STANDARDS FOR FISHING VESSELS:

(a) subject to compliance with the Large Fishing Vessel Inspection Regulations, or
(b) required to submit stability data by the Small Fishing Vessel Inspection Regulations.

OPERATING CONDITIONS WITH NO ACCUMULATED ICE

1 The following minimum intact stability criteria are to be used in the approval of stability data for the above vessels:

(i) The area under the righting lever (GZ) curve should not be less than 0.055 metre-radians up to ϕ = 30° angle of heel, and not less than 0.09 metre-radians up to ϕ = 40°, or the angle or downflooding ϕ_f if this angle is less than 40° Additionally, the area under the righting lever (GZ) curve between the angles of heel of 30° and 40° or between 30° and ϕ_f if this angle is less than 40° should not be less than 0.03 metre-radians.

(ii) The righting lever GZ should be at least 0.20 metres at an angle of heel equal to or greater than 30°.

(iii) The maximum righting arm should occur at an angle of heel preferably exceeding 30° but not less than 25°.

(iv) The initial metacentric height(GM) should not be less than 0.35 metres.

WORST OPERATING CONDITION WITH ACCUMULATED ICE

2 Using the ice accumulation weights and vertical centres of gravity requires by the appropriate fishing vessel inspection regulations:

(i) The area under the righting lever (GZ) curve should not be less than 0.04 metre-radians up to 30 degrees angle of heel and not less than 0.058 metre-radians up to 40 degrees or the angle of downflooding if this angle is ,.less than 40 degrees.

Additionally, the area under the righting lever (GZ) curve between the angles of heel of 30 degrees And 40 degrees or between 30 degrees and the angle of downflooding, if this angle is less than 40 degrees, should not be less than 0.016 metre-radians.

(ii) The righting lever (GZ) should be at least 0.15 metres at an angle of heel equal to or greater than 20 degrees.

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(iii) The maximum righting lever (GZ) should occur at an angle of heel not less than 20 degrees.
(iv) The initial metacentric height (GM) should not be less than 0.23 metres.

3 Hydrostatic and stability curves should normally be prepared on a designed trim basis. However., where the operating trim or the form and arrangement of the ship are such that change in trim has an appreciable effect on righting arms, such change of trim is to be taken into account.

4 The calculations may take into account the volume to the upper surface of the deck sheathing, if fitted. In the case of wood ships the dimensions should be taken to the outside of hull and deck planking.
5 Cross Curves of Stability may take the following into account and a note to this effect must be shown:

(a) Enclosed weathertight superstructures and enclosed weathertight deckhouses of similar construction,
(b) Weathertight trunks, and
(c) Hatchways having regard to the effectiveness of the closures.

6 Definitions for paragraph 5 are as follows:

SUPERSTRUCTURE means a decked structure on the bulkhead deck extending from side to side of the ship, or with the side plating not being inboard of the shell plating more than 4 per cent of the maximum moulded breadth of the vessel measured at mid-ships. A raised quarter deck is regarded as a superstructure.

WEATHERTIGHT means that in any sea conditions water will not penetrate into the ship.

7 In cases where a ship would flood through an opening, the stability curve is to be cut short at the corresponding angle of flooding and the ship is to be considered as having entirely lost her stability at that angle.

8 In the calculations for loading conditions an allowance is to be made for the weight of the wet fishing nets and tackle.

9 In all cases the cargo should be assumed to be homogenous unless this is inconsistent with practice.

10 The following conditions are not considered as operating conditions. Therefore the above criteria are not applicable and the standard to be obtained in these conditions is a positive.GM:

(a) Lightship
(b) Port after discharge of cargo with 10% of fuel, fresh water and stores remaining and accumulated ice on top-sides and rigging.

(The lightship condition is defined as the condition of a vessel ready for sea with no stores, consumables, fluid ballast or crew on board).

APPENDIX ‘A’

DENSITIES AND STOWAGE RATES OF SOME FISHERY PRODUCTS

DENSITIES AND STOWAGE RATES OF SOME FISHERY PRODUCTS

1(i) The following stowage rates may be used when approximate figures are required for stability calculations.
(ii) Other than the figures for redfish, the basic data is extracted from the British White Fish Authority Pamphlet Torry Advisory Note No. 17.

DENSITIES AND STOWAGE RATES

Items	Density	Stowage Rate
2 Fresh Fish	kg/m^3	m^3/tonne
Chilled fresh fish muscle	1054	-
Whole fresh herring in bulk	932	1.11
Whole fresh mackerel in bulk	801	1.29
Whole fresh sprats in bulk	852	1.21
Whole fresh redfish in bulk	617	-
Whole fresh capelin in bulk	1001	1.04
Whole fresh cold in bulk gutted (variable - depends on size of fish)	921	1.12
Whole gutted fresh cod in bulk	793 mixture	1.29 mixture
with ice (2/3 fish to 1/3 ice by weight)	529 fish	1.96 fish
Whole gutted fresh cod in bulk in ice (ratio as above) but including allowance for fishroom structure	513 fish	2.01 fish
Whole fresh red fish in bulk in ice (2/3 fish to 1/3 flake ice)	570 mixture	-
Whole gutted fresh cod stowed in single layers on ice on shelves 23 cm apart (including allowance for structure)	224 fish	4.60 fish
Whole gutted fresh cod boxed in ice (2/3 fish to 1/3 ice by weight, and including allowance for space occupied by boxes in block stowage).	368 fish	2.76 fish
Fresh fish fillets in bulk	961	1.06
Fresh fillets, boxed with ice (enough ice for normal inland journey, and including allowance for box)	481	2.16
Fresh fish livers, roes or milts in bulk	1001	1.04

3 Frozen fish		
Frozen whole gutted cod in large blocks - weight of fish within dimensions of the block	641 loose in block	-
	881 compact in block	-
	769 average	-
Frozen fish		
Frozen whole gutted cod in large blocks, including allowance for supporting structure. access, etc.	497	2.07 fish
Frozen fillets in large blocks	881-961	1.06-1.15
Frozen fillets in large blocks, including allowance for packaging, structure., access, etc.	641-801	1.29-1.61
Frozen fillets in consumer pack in master carton, with allowance for pallets, access, etc.	400	2.59
Frozen fish sticks in retail packs	400-481	2.16-2.59
Frozen whole gutted cod, stowed as single fish	400-481	2.16-2.59
Frozen whole gutted ..halibut:		
in wooden boxes	481-561	1.87-2.16
stowed loose	609.	1.07
Frozen whole salmon:		
stowed loose	529-561	1.87-1.96
in wooden boxes	-	2.59-2.73
Frozen shelled shrimp in blocks	721-881	1.15-1.44
Frozen fillets or steaks in catering packs in master carton	801-961	1.06-1.29
Frozen shelled shrimp in blocks, including allowance for packing structure, etc.	591-721	1.44-1.73
Frozen breaded shrimp in consumer packs in master carton	400-481	2.16-2.59
4 Other Fish Products		
Fish liver oil	929	1.12
Fish meal, loose ground	625	1.67
Fish meal unground	481	2.16
Crawfish, canned in cartons	-	approx 2.88
Salmon salted in barrels	-	1.29-1.44
Salt fish:		
in bags, 99 kg gross wt.	-	3.60
in wooden boxes, 84 kg gross wt.	-	1.44
in casks, 327 kg gross wt.	-	1.29
in kegs, 41 kg gross wt.	-	1.58

5 Ice		
Solid ice at O⌗C	917	-
Crushed block ice	641	1.61
Flake ice	481	2.16
Tube ice	545	1.90

STANDARD: STAB 5

STANDARD FOR THE INTACT STABILITY OF PASSENGER VESSELS CARRYING MORE THAN 12 PASSENGERS

1 The provisions of this standard are not applicable to:

(i) Hydrofoils, air cushion vehicles, and high speed planing craft; and

(ii) Ships built or converted before 1 June 1977, except where otherwise required by the Board.

DEFINITION

2 "Margin Line" - means an assumed line located 76.2 mm below and parallel to the upper surface of the bulkhead deck at side or, in the case of a vessel of open construction where the side shell is intact up to the gunwale, 305 mm below and parallel to the gunwale.

3 The owner of a vessel to which this standard applies, shall:

(i) arrange for an inclining experiment to be carried out in accordance with the requirements of STAB 2.
(ii) provide stability data in accordance with the requirements of this standard and those of STAB 1, with the proviso that the cross curves required by STAB 1 are to include a curve at a 10^{o} angle of inclination; and
(iii) provide a general arrangement drawing showing passenger seating arrangements and a ship profile view.

4 The owner shall submit for approval, stability data for each of the following conditions:

(li Lightship Condition - ship completely outfitted for sea but with no passengers, crew cargo or stores and with all fuel, fresh water and water ballast tanks empty.
(ii) Light Operating Condition - lightship condition, plus crew, full fuel, water and stores.
(iii) Departure Condition - lightship condition, plus crew, full fuel, water and stores, cargo, full passenger complement, normally distributed.
(iv) Arrival Condition - lightship condition, plus crew, 10% fuel, water and stores, full cargo and passenger complement, normally distributed.

(v) Worst Designed Operating Condition - any condition likely to be encountered in service in which the distribution and quantity of consumables, cargo, and passengers produce lower values of GZ and/or GM than conditions (ii), (iii) and (iv) above.

5 In addition to the conditions required in section 4. an emergency passenger heeling condition, as described in Section 6, shall be provided in all cases where the value of GZ at 100, in the Arrival Operating Condition, is equal to or less than $\frac{BN}{40\Delta}$ BN metres where:

B = moulded breadth of vessel in metres.
N = total number of passengers carried.
Δ = displacement of vessels in tonnes.

6 Where an investigation of the effects of passenger crowding is indicated by the provisions of Section 5, the following shall apply:

(i) The passenger complement shall be restricted, in addition to any other criteria applicable, by the angle of heel due to passengers crowding to one side of the vessel. The certificate shall be endorsed to indicate the maximum number of passengers allowed on each deck and the Master shall be made aware that these numbers are not to be exceeded.

If the stability calculations reveal that, du ‘e to a disregard by passengers of deck capacity limiting notices, it would be possible to produce a passenger distribution which would create a dangerous situation, the Board may prescribe special measures, such as additional crew members or restricted areas, to control passenger distribution.

(ii) The maximum number of passengers on any deck shall be determ ined as follows:

Whether seats are provided or not, an allowance of two persons for each square metre of available deck area may be applied. The available deck area is considered to be the area of deck assigned to passengers including seating areas but excluding concessions stands, washrooms, stairwells, casings etc., and a minimum of 15% of the net area for passageways.

(iii) If required by Section 5, an Emergency Heeling Condition as described in this Section to be provided.

Superimposed upon the GZ curve for the Arrival Condition shall be shown a curve of passenger heeling arm, determined as follows:

(a) The assigned number of passengers on each deck shall be taken into account for the purpose of calculating the passenger heeling moment.

(b) On each deck, on the “down” side of the centerline, the passengers will be standing adjacent to their seats. The remainder of that deck’s total complement will move as far as possible to the “down” side to fill all available space on the basis of 4 persons per square metre. Should this area on the “down” side of the centerline not accommodate the required number, then credit in the heeling moment shall be allowed for the persons on the “up” side of the centerline. However, in such circumstances, an additional heeling condition will be required reflecting a partial passenger load such that the number of passengers on the deck or decks in question are crowded on the “down” side of the centerline only.

(c) The passenger heeling arm $= \mathbf{COS}\ \varnothing \times \frac{\textbf{total heeling moment}}{\Delta}$ for any angle of heel

7 In the development of the stability conditions required by Sections 4 and 6, the following standards will apply:

(i) In all conditions., except the Lightship Condition, calculations shall take into account the free surface effect of fluids in all slack tanks.

(ii) The weight of passengers shall be taken as follows:

(a) for vessels not carrying berthed passengers - 63.5 kg per person.
(b) for vessels carrying berthed passengers - 74.8 kg per person.

(iii) The height to the centre of gravity of passengers shall be assumed to be 1 metre above the deck level.

GENERAL CRITERIA FOR NORMAL OPERATING CONDITIONS

8(i) The following minimum criteria shall be used to assess the stability of the vessel in the conditions required by sub-sections 4(ii) to 4(v).

(a) The area under the righting lever (GZ) curve shall not be less than .055 metre radians up to 30⌖ angle of heel, and not less than 0.09 metre radians up to 40⌖ angle of heel or the angle of downflooding if it be less than 40⌖.
(b) Additionally, the area under the righting lever (GZ) curve between the angles of 30⌖ and 40⌖, or between the angle of 30⌖ and the angle of downflooding if that angle be less than 40⌖.shall not be less than 0.03 metre radians.

(ii) The righting lever (GZ) shall have a value of at least 0.20 metres at an angle of heel equal to or greater than 30⌖, except where otherwise provided in subsection (v).

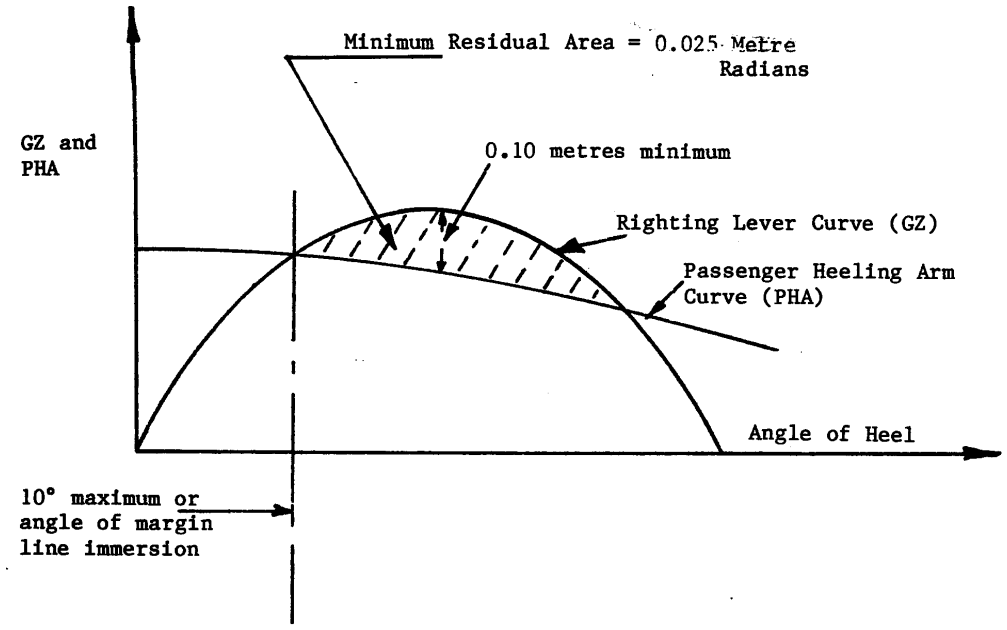
(iii) The maximum value of the righting lever shall occur at an angle of heel preferably exceeding 30° but, except where otherwise provided in subsection (v), not less than 25°.
(iv) The initial fluid metacentric height (GM), shall not be less than 0.15 metres in the worst designed operating condition.
(v) For ferries and vessels of barge type hull form, on restricted service, where a limited range of stability may not permit compliance with subsections (ii) and (iii), the Board may accept a righting lever curve having its maximum GZ value at less than 25° and having a value at 30° of less than 0.20 metres provided that:

(a) the range of the righting lever (GZ) curve is not less than 40°.
(b) the area under the righting lever (GZ) curve within its range, or to the angle of downflooding if this be less, is not less than 0.18 metre radians.

Upon application to the Board. the criteria of this subsection may be modified for applicable vessels limited to voyages on sheltered waters.

GENERAL CRITERIA FOR ASSESSMENT OF EMERGENCY PASSENGER HEELING CONDITIONS

9(I) In addition to the criteria for normal operating conditions given in Section 8, the following criteria shall be used to assess the Emergency Passenger Heeling Condition required by Section 5.
(ii) Upon the righting lever (GZ) curve of the arrival condition, with an assigned distribution of passengers, shall be superimposed a curve of the passenger heeling arm, as determined from Section 6. The angle of static heel, determined from the intersection of the righting lever (GZ) curve and the heeling arm curve, shall neither exceed 100 nor immerse the margin line.
(iii) The residual area, between the curves of righting levers and passenger heeling arms shall be not less than 0.025 metre radians and the remaining righting lever must attain a value of at least 0.1 metres.
(iv) The criteria of this section are illustrated on the next page.



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APPENDIX ‘A’

SEATING ARRANGEMENTS FOR HIGH DENSITY PASSENGER VESSELS

SEATING ARRANGEMENTS FOR HIGH DENSITY PASSENGER VESSELS

Seats are to provide a minimum width per person of 450 mm and, where seats are arranged in rows, the horizontal clearance at seat level between the seat front of one row and the seat back of the next row shall not be less than 300 mm. Aisles between rows of seats or between a row of seating and adjacent structure shall, subject to the approval of the marine surveyor, have a minimum width of 750 mm.

APPENDIX ‘B’

ALTERNATIVE STANDARD FOR THE INTACT STABILITY OF SMALL PASSENGER VESSELS OF MULTIPLE-PONTOON CONFIGURATION AND RESTRICTED PASSENGER MOVEMENT

ALTERNATIVE STANDARD FOR THE INTACT STABILITY OF . SHALL PASSENGER VESSELS OF MULTIPLE-PONTOON CONFIGURATION AND RESTRICTED PASSENGER MOVEMENT

APPLICATION

1 The following criteria may be used as an alternative to those of STAB 5 to evaluate the intact stability and related characteristics of small passenger vessels:

(a) to which the Safety Convention does not apply,
(b) which are of multiple-pontoon configuration,
(c) which carry wore than 12, but not more than 30 unberthed ..passengers on a single, open or partly-screened deck in fixed high-density seating, except that , upon request and with the Regional Manager's favourable recommendations, the Board may consider accepting up to 49 passengers in individual cases,
(d) which do not exceed 18.3 metres in length or 40 gross tons, and
(e) which undertake short voyages, seasonally, in fine weather and .in sheltered waters within limits, specified in the Inspection Certificate not exceeding those appropriate to a Minor Waters Voyage, Class II.

2 This standard does not apply to:

(a) hydrofoils, air cushion vehicles, and high-speed planing craft, or
(b) ferries.

PREREQUISITES

3 For vessels to which this standard is to be applied, calculations are to be submitted to show that in the full load condition:

(a) the reserve buoyancy is not less than 100%, and
(b) the trim is not more than 50% of the mean hydrostatic draft.

4 Where practicable, means should be provided for verifying the watertight integrity of the pontoons and for periodic inspection of the internal structure. Also, the pontoons should be:

(a) filled with a suitable closed-cell buoyant material, or
(b) subdivided into watertight compartments in such a manner as to ensure that adequate reserves of buoyancy and of transverse and longitudinal stability remain after flooding of any one compartment.

5 The design of the platform and its supporting structure should ensure than no pockets or horizontal surfaces are formed in which water can accumulate.

MINIMUM INTACT STABILITY

6 The intact stability characteristics of the vessel will be considered to be acceptable if the following relationship is shown, by calculation, experiment or a combination of both, to be satisfied in the full load condition:

$$\frac{GoM}{B} \geq \frac{(p / n)(N / \Delta)}{\tan \varnothing_L}$$

where:
GoM = initial metacentric height (metres) at displacement 🖒 as determined by calculation or experiment.
B = breadth (metres) at load waterline.
p = passenger heel factor as defined in Section 8.
n = number of passengers per tonne, taken as 14 for the purpose of this standard.
N = maximum number of passengers.
🖒 = full load displacement (tonnes).
$\varnothing_L$ = limiting heel angle as defined in Section 11.

PASSENGER HEEL FACTOR

7 Passenger freedom of movement is governed by the seating and access arrangements and is represented by a passenger heel factor, p.

8 The heel factor is defined as the transverse shift of the passenger centre of gravity, expressed as a fraction of the breadth B, caused by a general movement of passengers as follows:

(a) With all seats initially occupied, passengers on one side of the centre line stand and move as far as possible to the other side to fill all available space at the rate of 4 persons per square metre. If the area available on the "down" side is not sufficient to accommodate the required number ,then the heeling moment calculation should take account of the number accommodated on the "up" side.
(b) Passengers initially seated on the "down" side do not move, but are assumed to be standing adjacent to their seats.
(c) For the purpose of the calculation, passengers should be assumed to weigh the equivalent of 14 per tonne. Their centre of gravity should be taken to be 1 metre above deck.

(d) The passenger heel factor should be calculated from: $\mathbf{p = \frac{Passenger\ Heeling\ Moment}{B \times Passenger\ Weight}}$ or taken as 0.15 whichever is greater. B is as previously defined.LIMITING HEEL ANGLE

9 Because of the variety of pontoon shapes and configurations which are possible, freeboard is defined in angular rather than linear terms as illustrated in Figure 1.

10 The angular freeboard, ϕ_F, is determined as the angle of heel at which the righting lever, GZ, reaches its maximum value, normally the angle at which the pontoon on the "down" side is just completely immersed.

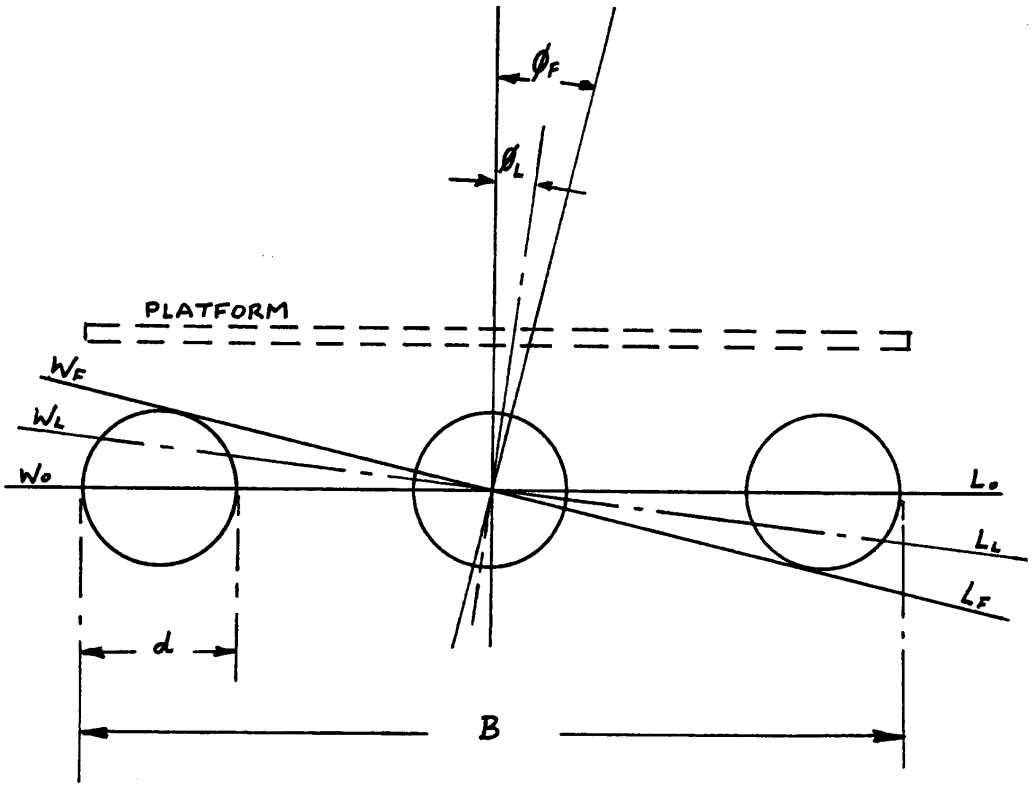
11 The limiting heel angle, ϕ_L, is taken as half the value of ϕ_F or as 10°, whichever is less.

HEEL & TRIM TEST

12 An experiment shall be conducted simulating the movement of passengers plus 10% overload both in the longitudinal and transverse directions. This experiment will demonstrate the reserve of freeboard in the worst anticipated heeling and trimming conditions to the complete satisfaction of a marine surveyor.

Figure 1

Freeboard & Limited Heel Angle



Angular Freeboard, $\varnothing_F = \sin^{-1}\frac{1}{(B/d - 1)}$

Limiting Heel Angle, $\varnothing_L = \frac{\varnothing_F}{2}$ **or** 10^0**, whichever is less**

STANDARD: STAB 6

STANDARD FOR INTACT STABILITY OF NON-PASSENGER SHIPS AND PASSENGER SHIPS CARRYING NOT MORE THAN 12 PASSENGERS

1 The provisions of this standard do not apply to the following:

(i) Ships built or converted for towing, and
(ii) Fishing vessels.

2 The following intact stability criteria should be complied with for non-passenger ships and for passenger ships carrying not more than 12 passengers.

(i) The area under the righting lever (GZ) curve should not be less than 0.055 metre-radians up to 30 degrees angle of heel, and not less than 0.09 metre-radians up to 40 degrees or the angle of downflooding if this angle is less than 40 degrees. Additionally, the area under the righting lever (GZ) curve between the angle of heel of 30 degrees and 40 degrees, or between 30 degrees and the angle of downflooding if this angle is less than 40 degrees, should be not less than 0.03 metre-radians.

(ii) The righting lever GZ should be at least 0.20 metres at an angle of heel equal to or greater than 30 degrees.

(iii) The maximum righting lever (GZ) should occur at an angle of heel preferably exceeding 30 degrees but not less than 25 degrees.

(iv) The initial metacentric height (GM) should not be less than 0.15 metres.

3 The criteria mentioned in Section 2 give minimum values but no maximum values. However, it is advisable to avoid excessive values as these might lead to acceleration forces which could be prejudicial to the ship, it's complement, or it's equipment.

4 Regard is to be paid to the possible adverse effects on stability when certain bulk cargoes are carried. In this connection attention should be paid to the "Code of Safe Practice for Solid Bulk Cargoes", TP 5761.

5. Ships carrying grain in bulk are to comply with the criteria in .Section 2 in addition to the stability requirements contained in the "Grain Cargo Regulations".

6 For ships loaded with timber deck cargoes and provided that;

(i) The cargo extends longitudinally between superstructures or, where there is no limiting superstructure at the after end, it extends at least to the after end of the aftermost hatchway;
(ii) The cargo extends transversely for the full beam of the ship after due allowance for the rounded gunwhale and/or securing the supporting uprights, not exceeding 4 per cent of the breadth of the ship; and
(iii) The cargo remains securely fixed at large angles of heel.

The following stability criteria should be complied with:

(a) the area under the righting lever (GZ) curve should not be less than 0.08 metre-radians up to 40 degrees or the angle of downflooding if this angle is less than 40 degrees.
(b) the maximum value of the righting lever (GZ) should be at least 0.25 metres..
(c) at all times during a voyage the metacentric height (GM) should be positive after correction for the free surface effects of liquids in tanks and, where appropriate, the absorption of water by the deck cargo and/or ice accretion on the exposed surfaces.
Additionally, in the departure condition the metacentric height (GM) should be not less than 0.10 metres.
(d) The conditions of loading should take account of:

1. in the arrival condition it should be assumed that the weight of the deck cargo has increased by 10 per cent due to water absorption, and
2. where it is anticipated that some formation of ice will take place an allowance should be made in the arrival condition for additional weight.

STANDARD: STAB 7

STABILITY CRITERIA FOR OFFSHORE SUPPLY VESSELS

CONTENTS

GENERAL

APPLICATION

1(i) Every new offshore supply vessel of 24 metres and over but not more than 100 metres in length is to comply with the provisions of this Standard.

(ii) An existing vessel which is modified to such an extent that, in the opinion of the Board, its stability has been adversely affected shall comply with the provisions of this Standard as far as is reasonable and practicable.

(iii) Where a ship other than an offshore supply vessel as referred in (I) is employed on similar services, the extent of compliance with the provisions of this Standard will be determined on the basis of hull forms, ship design and type of operation.

(iv) Provisions for offshore supply vessels carrying more than 12 industrial personnel are not included in this Standard.

(v) Offshore supply vessels used for specialized services such as diving, research, surveys, “stand-by purposes” etc., are to be considered by the Board on an individual basis taking into account the design and size of the ship, the number of personnel carried and the operational characteristics.

DEFINITIONS

2(i) “New ship” means a ship the keel of which is laid or construction of the hull of which is commenced, or a ship transferred from foreign registry to Canadian registry on or after September 1, 1985.

(ii) “Offshore supply vessel” means a vessel:

- (a) which is primarily engaged in the transport of stores, materials and equipment for offshore installations; and
- (b) which is designed with accommodation and bridge erections in the forward part of the vessel and an exposed cargo deck in the after part of the handling of cargo at sea.

.(iii) “Offshore Installation” means a marine structure located at an offshore site.

OPERATIONAL PRECAUTIONS AGAINST CAPSIZING

3 In addition to the guidance data contained in Stability Standard STAB 1, the following notes to the master are to be included in the Stability Booklet as appropriate:

(i) Compliance with the stability criteria does not ensure immunity against capsizing regardless of the circumstances or absolve the master from his responsibilities. The master 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.

(ii) Care should be taken to ensure that the cargo allocated to the vessel is capable of being stowed in such a way that compliance with the stability criteria can be achieved and if necessary the amount of cargo should be limited so as to allow any required ballast water to be taken.

(iii) 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.

(iv) The arrangement of cargo stowed on deck should be such as to avoid any obstruction of the freeing ports or the areas necessary for the drainage of pipe stowage positions to the freeing ports. Freeing ports are not to be fitted with covers.

(v) The number of tanks containing slack liquids should be kept to a minimum.

(vi) Having regard to anticipated weather conditions, the adjustment in port loading is to be carried out at the discretion of the master to compensate for the likelihood of ice accretion/water on deck in accordance with Subsection 2(5) - Environmental Factors.

(vii) When the danger of ice formation arises immediate steps should be taken to remove the ice from large surfaces of the vessel, beginning with the upper structures. All the means for combating ice formation should be ready for use.

(viii) Hatches, doors, etc., which give access to the cargo deck should be kept closed during navigation, except when necessarily opened for the working of the vessel, 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.

(ix) Shipowners bear the responsibility to ensure that adequate, accurate and up-to-date stability information for the master's use is provided.

INTACT STABILITY

CALCULATION OF STABILITY CURVES

1(i) Because of the unique design characteristics of offshore supply vessels the conventional method of investigation of stability using Cross Curves which assume level trim and no change in trim during heeling over-estimates the results. Therefore, the Cross Curves of stability are to be prepared:

(a) taking into account the change of trim due to heel, i.e., on the basis of free trim during heeling;
(b) for a range of heeling angles at close intervals to enable the accurate calculation of the maximum righting lever; and
(c) for the design level. keel trim and for additional trimmed conditions where the operational range of trim is in the order of 0.01L or more.

(ii) Hydrostatic curves need only be prepared at design level keel trim unless the operational trim would have an adverse effect on stability.

(iii) The stability data are to clearly identify any of the following superstructures, deckhouses, etc., which may be taken into account in the calculations:

(a) enclosed superstructures complying with Schedule I, Section 3(9)(b) of the Load Line Regulations (Sea);
(b) the second tier of similarly enclosed superstuctures; and
(c) deckhouses on the freeboard deck, provided that they comply with the conditions for enclosed superstructures as referred to in (a).

(iv) Where deckhouses comply with the above conditions, except that no additional exit is provided to a deck above, such deckhouses should not be taken into account; however, any deck openings inside such deckhouses should be considered as closed even where no means of closure is provided.

(v) Deckhouses, the doors of which do not comply with the requirements of Schedule I, Section 12 of the Load Line Regulations (Sea) should not be taken into account; however, any deck openings inside the deckhouse are regarded as closed when their means of closure comply with the requirements of Schedule I, Sections 15, 17, or 18 of that Regulation.

(vi) Deckhouses on decks above the freeboard deck should not be taken into account but openings within them may be regarded as closed.

(vii) The stability data submitted are to clearly indicate the allowances for appendages such as shell thickness, bossings, the exclusion of thruster tunnels, diving pools, etc., considered in the calculations.

(viii) It is recommended that tabular data for stability curves be also included for reference.

DOWNFLOODING POINTS

2(i) A diagram, to be included in the Stability Booklet, is to indicate the downflooding points. That is, the position of openings which cannot be closed weathertight at sea, such as funnel exhaust and vents and other openings leading below deck or to enclosed superstructures.

(ii) The angle of immersion of these openings under free trim should be in excess of 30 degrees and such that the minimum criteria are met before immersion takes place.

(iii) Small openings such as those for passing wires or chains, tackle anchors and also holes of scuppers, discharge and sanitary pipes should not be considered as open if they submerge at an angle of inclination more than 30°; but if they submerge at an angle of 30° or less; these openings should be assumed open if significant progressive flooding could occur.

STABILITY CRITERIA

3(I) The following are the stability criteria:

(a) the area under the righting lever (GZ) curve should not be less than 0.055 metre-radians up to ϕ = 30° angle of heel and not less than 0.09 metre-radians up to ϕ_f* if this angle is less than 40°. Additionally, the area under the righting lever (GZ) curve between the angles of heel of 30° and 40° or between 30° and ϕ_f, if this angle is less than 40°, should not be less than 0.03 metre-radians;
(b) the righting lever GZ should be at least 0.20 m at an angle of heel equal to or greater than 30°;
(c) the maximum righting arm should occur at an angle of heel preferably exceeding 30° but not less than 25°; and
(d) the initial metacentric height GM_o should not be less than 0.15 m.

(ii) The following equivalent criteria are acceptable where a vessel's characteristics render compliance with (a) impracticable:

(a) the area under the righting lever (GZ) curve should not be less than 0.070 metre-radians up to an angle of 15⌖ when the maximum righting lever (GZ) occurs at 15⌖ and 0.055 metre-radians up to angle of 30⌖ when the maximum righting lever (GZ) occurs at 30⌖ or above. 'Where the maximum righting lever (GZ) occurs at angles of between 15° and 30°, the corresponding area under the righting lever curve should be:
0.055 + 0.001 (30° - $\varnothing_{max}$**) metre-radians;

(b) the area under the righting lever (GZ) curve between the angles of heel of 30° and 40°, or between 30 and $\varnothing_f$ if this angle is less than 40°, should not be less than 0.03 metre-radians;

* $\varnothing_f$ is the angle of heel in degrees at which openings in the hull, superstructure or deckhouse which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open. (See Subsection 2(c).)

** $\varnothing_{max}$ is the angle of heel in degrees at which the righting lever curve reaches its maximum.

(c) the righting lever (GZ) should be at least 0.20 m at an angle of heel equal to or greater than 30°;

(d) the maximum righting lever (GZ) should occur at an angle of heel equal to not less than 15°; and

(e) the initial transverse metacentric height (GMO) should not be less than 0.15 m. .

(iii) The minimum freeboard at the stern in all operating conditions shall not be less than 0.01L or the assigned slimmer freeboard, whichever is less.

(iv) The stability criteria mentioned above are minimum values; no maximum values are recommended but it is advisable to avoid excessive values, since these might lead to acceleration forces which could be prejudicial to the vessel, its complement, its equipment and the safe carriage of the cargo.

(v) The applicable stability criteria used is to be included in the Stability Booklet for reference.

LOADING CONDITIONS

4(i) For the purpose of assessing in general whether the stability criteria are met, stability data are to be submitted for the main loading conditions intended by the owner in respect of the vessel's operations. As a minimum, in addition to the lightship condition, the following loading conditions are to be submitted:

(a) vessel in fully loaded departure condition with cargo distributed below deck and with cargo specified by position and weight on deck, with 100% stores and fuel, corresponding to the worst service condition in which all the relevant stability criteria are met;
(b) vessel in fully loaded arrival condition with cargo as specified in (a), but with 10% stores and fuel;
(c) vessel in ballast departure condition, without cargo but with 100% stores and fuel;
(d) vessel in ballast arrival condition without cargo and with 10% stores and fuel remaining; and
(e) vessel in the worst anticipated operating condition or conditions.

(ii) The assumptions for calculating the loading conditions are to be as follows:

(a) if the vessel is fitted with cargo tanks, the fully loaded conditions of (i)(a) and (i)(b) are to be modified, assuming first the cargo tanks full and then the cargo tanks empty;
(b) if in any loading condition water ballast is necessary, additional diagrams should be calculated, taking into account the water ballast, the quantity and disposition of which should
be stated in the stability information; and
(c) in all cases when deck cargo is carried a realistic stowage weight should be assumed and stated in the stability information, including the height of the cargo and its centre of gravity.

(iii) A diagram showing the maximum permissible deck load (tonnes/m^2) along the cargo deck is to be included in the Stability Booklet.

ENVIRONMENTAL FACTORS

5(i) Because of the adverse effect on stability, due allowances are to be made in the loading conditions for the anticipated additional weight as a result of water entrapped in and around pipe deck cargo; and considering the season of the year and the navigational zone where the vessel may operate, the additional weight from ice accretion is to be similarly treated.

(ii) In addition to the minimum loading conditions, the worst operating conditions are to be evaluated as follows:

(a) included in the Stability Booklet:

1. Case No. 1
Operating conditions representing the vessel loaded such that where pipe deck cargo water entrapment is encountered, seasonal load line marks will not be submerged.

2. Case No. 2
Operating conditions representing the vessel loaded such that where ice accretion is encountered, seasonal load line marks will not be submerged.

(b) not included in Stability Booklet but submitted for review:

1. Case No. 3
Non-operating conditions representing the vessel fully loaded to the seasonal load line mark and the additional weight (overload) from pipe deck cargo water entrapment.

2. Case No. 4
Non-operating conditions representing the vessel fully loaded to the seasonal load line mark and the additional weight (overload) from ice accretion.

(iii) The criteria and assumptions taking into account the environmental factors are to be as follows:

(a) Pipe entrapped water

Where pipes are carried on deck, a quantity of trapped water equal to a certain percentage of the net volume of the pipe deck cargo should be assumed in and around the pipes:

1. the net volume should be taken as the internal volume of the pipes, plus the volume between the pipes;
2. this percentage of the net volume should be 30 if the freeboard amidships is equal to or less than 0.015L and 10 percent if the freeboard amidships is equal to or greater than 0.03L;
3. for intermediate values of freeboard amidships the percentage may be obtained by linear interpolation; and
4. for the purpose of calculation of the percentage of net volume, the summer freeboard amidships should be used.
5. Plugged pipes are not to be accepted as a means of reducing the amount of entrapped water.

6. No free surface allowance need be made for water entrapped in pipe deck cargo.
7. A sample calculation should be provided to confirm the amount of entrapped water shown in the loading condition. Where pipe deck cargoes of various types and diameters may be carried, information should be provided in the form of calculations, curves or tables to indicate the quantity of entrapped water to be assumed in each case.
8. Relevant conditions should be clearly marked ‘pipe deck cargo

(b) Ice Accretion

For vessels operating in areas where severe ice accretion may be expected - the areas North of latitude 43°N bounded in the West by the North American Coast and the East by the rhumb line running from latitude 43°N longitude 48°W to latitude 63°N longitude 28°W and hence along longitude 28°W - the following ice accretion loads are to be used in the stability calculations:

1. 54 kg/M^2 of total deck area, including the superstructure and deckhouse tops that are exposed to the weather;
2. 37 kg/M^2 of area exposed to the weather in the case of the superstructure and deckhouse fronts, and the deckhouse sides and bulwarks including the area of the deckhouse sides and bulwarks on both sides of the vessel except that only the inboard surfaces shall be included in computing the bulwark areas;
3. 78 kg/M^2 of area, taking into consideration overall block dimensions, in the case of the guardrails and stanchions, hatch coamings, companionways and ship fittings exposed to the weather; and
4. 48 kg/M^2 in the case of rigging, masts, derricks and similar high objects measured to a height of 6.1 m above the main weatherdeck.
3. Relevant conditions should be clearly marked ‘ice accretion’.

For vessels operating in the “north” - all sea areas North of the North American continent, West of the area defined above - a reduced ice accretion load may be considered by the Board where the owner demonstrates that lesser loads are encountered.

STABILIZING TANKS AND TRANSFER OF LIQUIDS

6(i) Limitations on the use of stabilizing tanks (when fitted) are to be observed:

(a) loading conditions where the stabilizing tank is in use should be included;
(b) guidance should be given concerning the operation of the stabilizing tank including appropriate liquid levels and any restrictions on its use in certain sea conditions;
(c) the free surface of the liquid in the tank should be taken into account unless the particular condition is marked 'Stabilizing tank empty' (or 'pressed up');
(d) the free surface used should be that corresponding to the inertia of the maximum water plane of the tank with the ship upright; and
(e) the operating position of the dump valves or other means of emptying the tank(s) should be clearly indicated.

(ii) Where, due to burning of fuel oil, it is essential to add water ballast during a voyage to maintain an adequate standard of stability, attention should be drawn to this in the appropriate condition.

(iii) The liquid ballast used in an oil tank must be discharged in accordance with the Oil Pollution Prevention Regulations or the Arctic Shipping Pollution Prevention Regulations.

FREE SURFACE EFFECTS

7(i) For all loading conditions, the initial metacentric height and the statical stability curves are to be corrected for the effect of liquids in tanks.

(ii) When liquid cargo is to be discharged or a tank is to be ballasted at sea, as soon as pumping commences a full free surface will exist on those tanks being pumped and the effect of this on the stability is to be taken into account.

(iii) Tanks which are taken into consideration when determining the effect of liquids on the stability at all angles of inclination should include single tanks or combinations of tanks for each kind of liquid (including those for water ballast) which according to the service conditions can simultaneously have free surfaces.

SIMPLIFIED STABILITY INFORMATION

8(i) To enable the master to assess the stability of the vessel and verify whether the stability is sufficient in all loading conditions differing from loading conditions specified elsewhere, information in the form of tables or diagrams is to be provided as follows:

(a) the data may take the form of a diagram or tables giving maximum KG, minimum GM or maximum deadweight moment values relative to draught or displacement, according to the owner's general practice. In company fleets it is recommended that a single method be utilized throughout;
(b) the scale of draughts or displacements in the diagram or tables should be extended to take account of the addition of entrapped water to the full load displacement where pipe deck cargoes may be carried or of the effect of ice accretion;
(c) particular effort should be made to facilitate the use of this information by clear and straight-forward presentation; and
(d) a sample calculation showing the use of the deadweight moment diagram or equivalent should be provided, including the treatment of free surface. Derivation of the effective deadweight moment or equivalent should also be shown on each condition sheet.

VESSELS ENGAGED IN TOWING

1(i) Where a vessel is also engaged in towing operations, the additional stability requirements specified in Part VIII, Section 104 of the Hull Construction Regulations are to be complied with.

(ii) The stability criteria in Standard STAB 3 or as stated in this Standard may be used, provided the initial metacentric height GM_O for any particular towing condition is not less than 0.55 m.

(iii) A vessel engaged in towing operations should not carry deck cargo, except that a limited amount, properly secured, which would neither endanger the safe working of the crew on deck nor impede the proper functioning of the towing equipment, may be accepted.

(iv) While towing is underway the vessel must carry only the crew normally assigned for such operations.

STANDARD: STAB 8

INTERIM STANDARD FOR THE INTACT STABILITY OF UNMANNED CARGO BARGES

1 The provisions of this standard are applicable to unmanned cargo barges that:

(i) are required by standard LOAD 2 to be assigned load lines; and

(ii) are constructed after 1 September 1977.

2 This standard does not apply to Crane, Derrick or Hopper Barges.

3 Except where otherwise exempted by the Board, the owner of a new barge shall:

(i) arrange to have an inclining experiment carried out in the presence of and to the satisfaction of a marine surveyor;

(ii) submit to the Board the developed stability data for the operating conditions of the barge, including the light, loaded and worst operating conditions; and

(iii) include in the stability submission the basic data required by Section 1 of standard STAB 1.

4 Except where otherwise provided in Section 5 of this standard, the intact transverse stability of the barge shall be based upon a minimum area under the GZ curve up to the angle of maximum GZ, or to the angle of downflooding if this be less, of not less than 0.08 metre-radians.

5 Where the vertical centre of gravity of the cargo is below the deck at side, the required transverse stability may be determined in terms of the metacentric height in metres. The initial metacentric height (GM) at any draft must not be less than that given by the following formula:

$$\mathbf{GM} = \frac{\mathbf{kB}}{\mathbf{f_e}}$$

where

k = .15

B = Beam in metres

fe = Effective freeboard ($f + f_a$) in metres, where

f freeboard to the deck at side in metres;
f_a = additional freeboard allowance for barges having a structural watertight trunk.

$$f_a = 1.25 \frac{hl}{L} \frac{(2b - 1)}{B} \text{ or } h, \text{ whichever is less}$$

l = length of trunk in metres
L = overall length of barge in metres
b = breadth of trunk in metres
h = trunk height at side in metres

6 The intact longitudinal stability of the barge is to be determined in terms of the minimum longitudinal metacentric height (GM_1) within the range of operating drafts and is not to be less than that given by the following formula:

$$GM_1 = \frac{.02\,L^2}{d} \text{ metres}$$

where
L = overall length of barge in metres
d = draft in metres.

PART II

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PART III

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STANDARD: LOAD 1

INTERNATIONAL LOAD LINE CONVENTION, 1930, ACCEPTANCE OF EQUIVALENT ARRANGEMENT

1(i) Rule XVIII of Annex I to the Load Line Convention, 1930, provides that cargo, coaling and other hatchways in the freeboard deck within superstructures which are fitted with Class 2 closing appliances shall have coamings at least 9 inches in height and closing arrangements as effective as those required for exposed cargo hatchways whose coamings are 18 inches high.

(ii) Under Article 18 of Chapter IV of the Convention the Board will accept hatchways having no coamings and fitted with flush metal hatch covers in the freeboard deck within open shelter 'tween deck spaces as the equivalent of the arrangements required by Rule 24 of the General Load Line Rules, subject to the following conditions:

(a) The tonnage hatchway in the shelter deck shall be fitted with efficient temporary closing appliances.

(b) A tonnage well shall be provided below the tonnage hatchway having on each side a 5" diameter scupper leading overboard fitted with a screw-down, non-return valve geared to the shelter deck. The tonnage openings in the 'tween deck bulkheads between the well and the flush hatchways shall be provided with steel plate covers with hook bolts or with wood shifting boards.

(c) Openings in the sides of the shelter 'tween deck spaces shall be fitted with watertight doors or covers which, with their securing appliances, shall be of sufficient strength. Scuppers led through the sides of the shelter 'tween deck spaces shall each be fitted with a screw-down, non-return valve geared to the shelter deck.

(d) The hatch covers and jointing strips shall be carefully constructed and fitted so that they are substantially watertight.

(e) Drains fitted in connection with the flush hatchway arrangements may be led to the bilges outside of the main machinery space provided that screw-down valves geared to the shelter deck are fitted in the pipes.

(f) This arrangement will be accepted only on open shelter deck ships in which tonnage exception of the 'tween deck is claimed because of a tonnage opening in the shelter deck; it will not be accepted on ships in which tonnage exemption of the 'tween deck is claimed because of tonnage openings fitted in the shell plating.

2(i) Rule VIII of Annex I to the Load Line Convention, 1930, provides that the construction and fitting of cargo and other hatchways in exposed positions on freeboard and superstructure decks are to be at least equivalent to the standards laid down in Rules IX to XVI.

(ii) Under Article 18 of Chapter IV of the Convention the Board will accept an equivalent arrangement whereby the tonnage opening on the shelter deck can be closed watertight, where open shelter deck ships are converted for use as closed shelter deck ships, by means of the following:

(a) a strong steel plate permanently attached in a watertight manner by welding, riveting or other equivalent means to a substantially constructed coaming; or,

(b) a strong steel plate secured by rigging screws or hook bolts of iron or steel not less than 3/4" diameter and not more than 24" apart, or by other equivalent means and made watertight by rubber or other suitable packing and provided:

1. that the securing arrangements can readily be inspected and, if necessary, hardened up at sea;
2. that the coaming to the tonnage opening in the shelter deck is substantially constructed and is at least 12 inches high; and
3. that the projection of the cover beyond the coaming is kept to the minimum necessary for the housing of the packing.

3(i) Rule XI of Annex I to the Load Line Convention, 1930, provides that where wood hatchway covers are fitted, the hatchway beams and fore-and-afters are to be of the scantlings and spacing given in Table I where coamings 24 inches high are required, and as given in Table 2 where coamings 18 inches high are required. Angle bar mountings on the upper edge are to extend continuously for the full length of each beam. Wood fore-and-afters are to be steel shod at all bearing surfaces.

(ii) Rule 20 of the General Load Line Rules implements this requirement of the Convention. Under Article 18 of Chapter IV of the Convention the Board will accept, as equivalent of the requirements of Rule 20 of the General Load Line Rules, hatchway beams of aluminium alloy of scantlings and spacing provided as follows:

Modulus of Section -

Calculated as for mild steel beams in Schedules D and E in Rule 20 x f

Moment of inertia of Section-

Calculated as for mild steel beams in Schedules D and E in Rule $\mathbf{20 \times \frac{13{,}000}{E_A}}$

f Strength factor of the aluminium alloy

$$\frac{\mathbf{29}}{\mathbf{U \text{ or } 2P, \text{ whichever is the smaller}}}$$

U Ultimate stress of the aluminium alloy

p 0.1% Proof stress of the aluminium alloy

E_A Modulus of elasticity of the aluminium alloy in tons per square inch.

4(i) While Rule X of Annex I to the Load Line Convention, 1930, and Rule 19 of the General Load Line Rules provide that covers to exposed hatchways are to be efficient and specify the thickness of wood covers, they do not provide for standards of strength for metal hatch covers.

(ii) Consideration has been given to the formulation of standards of strength for steel and aluminium alloy hatch covers, which for all practical purposes are equal to the standards for steel hatch beams laid down in Rule XI of Annex I to the Load Line Convention, 1930, and Rule 20 of the General Load Line Rules.

(iii) The Board is, therefore, prepared to accept steel and aluminium alloy hatch covers, whose scantlings are based on the formulae laid down in the Tables in Appendix A to this standard.

APPENDIX 'A'

1. HATCH COVERS CONSTRUCTED OF PLATING AND ATTACHED STIFFENERS - MINIMUM REQUIREMENTS.

2. HATCH COVERS IN ASSOCIATION WITH SHIFTING BEAMS - MINIMUM REQUIREMENTS.

1. HATCH COVERS CONSTRUCTED OF PLATING AND ATTACHED STIFFENERS - MINIMUM REQUIREMENTS

(1) Steel Covers

	For hatchways required to have 24 inch coamings	For hatchways required to have 18 inch coamings
Modulus of section of stiffener plus attached plating (in ^{3})	$0.04 \times L^2 \times S$	$0.03 \times L^2 \times S$
Moment of inertia of stiffener plus attached plating (in ^{4})	$.008 \times L^3 \times S$	$.006 \times L^3 \times S$
Thickness of plating (in)	$.26 + \frac{s-24}{150}$. Minimum thickness .26	$.24 + \frac{s-24}{200}$ Minimum thickness .24

(2) Aluminium Alloy Covers

Modulus of section of stiffener plus attached plating (in ^{3})	$0.04 \times L^2 2x S \times f$	$0.03 \times L^2 \times S \times f$
Moment of inertia of stiffener plus attached plating (in ^{4})	$104 \times \frac{L^3 \times S}{E_A}$	$78 \times \frac{L^3 \times S}{E_A}$
Thickness of plating (in)	$(.26 + \frac{s-24)}{150)} \times \sqrt{f}$	$(.24 + \frac{s-24)}{200)} \times \sqrt{f}$

NOTES:

(1)

L = Span of stiffeners in feet

S = Spacing of stiffeners in feet

s = Spacing in stiffeners in inches, for use in calculating the thickness of the plating

f = Strength factor of the aluminium alloy

$$= \frac{29}{\text{U or 2P, whichever is smaller}}$$

U = Ultimate stress of the aluminium alloy

P = 0.1% Proof stress of the aluminium alloy

E_A = Modulus of Elasticity of the aluminium alloy in tons per sq. in.

(2) If the stiffeners are tapered then the modulus at the middle should be suitably increased or the taper commenced at a suitable distance from the middle.

(3) In the case of riveted construction the modulus and moment of inertia of the section shown above are those required after correction for rivet holes.

2. HATCH COVERS IN ASSOCIATION WITH SHIFTING BEAMS MINIMUM REQUIREMENTS

(1) Steel Covers

	For hatchways required to have 24 inch coamings	For hatchways required to have 18 inch coamings
Modulus of section (in ^{3})	$0.04 \times L^2 \times B$	$0.03 \times L^2 \times B$
Moment of inertia of section (in ^{4})	$.008 \times L^3 \times B$	$.006 \times L^3 \times B$

(2) Aluminium Alloy Covers

Modulus of section (in ^{3})	$0.04 \times L^2 \times B \times f$	$0.03 \times L^2 \times B \times f$
Moment of inertia of section (in ^{4})	$104 \times \frac{L^3 \times B}{E_A}$	$78 \times \frac{L^3 \times B}{E_A}$

NOTES:
(1)
L = Length of cover in feet
B = Breadth of cover in feet
f = Strength factor of the aluminium alloy

$$\frac{29}{\text{U or 2P, whichever is smaller}}$$

U = Ultimate stress of the aluminium alloy
P = 0.1% Proof stress of the aluminium alloy
E_A = Modulus of Elasticity of the aluminium alloy in tons per sq. in.

(2) When the freeboard to be Assigned is less than the ordinary steamer freeboard, then the above standards of strength shall be increased by 15 per cent.

STANDARD: LOAD 2

LOAD LINE REQUIREMENTS FOR UNMANNED BARGES

1(i) The following are guidance notes on which unmanned barges require or do not require load lines.

(ii) "New unmanned barge" means any unmanned barge required to be surveyed under, or any "existing unmanned barge" whose Owner chooses to have the survey done under, the Load Line Regulations (Sea) or (Inland).

2 New unmanned barges, on Ocean Service; 79 feet in length and over:

(i) domestic voyages (Canada to Canada):

(a) oil cargo - load line is required.
(b) non-oil cargo - load line is not required.

(ii) international voyages (Canada to any other country):

(a) oil cargo - load line is required. See Note A.
(b) on-oil cargo - load line is required. See Note A.

3 New unmanned barges, on Inland Service; 79 feet in length and over:

(i) domestic voyages (Canada to Canada):

(a) oil cargo - load line is required.
(b) non-oil cargo - load line is not required.

(ii) international voyages (Canada to any other country):

(a) oil cargo - load line is required.
(b) non-oil cargo - load line is required.

4 Existing unmanned barges, on Ocean Service; 150 gross tons and over:

(i) domestic voyages (Canada to Canada):

(a) oil cargo - load line is not required.
(b) non-oil cargo - load line is not required.

(ii) international voyages (Canada to any other country):

(a) oil cargo - load line is required. See Note A.
(b) non-oil cargo - load line is required. See Note A.

5 Existing unmanned barges, on Inland Service; 150 gross tons and over:

(i) domestic voyages (Canada to Canada):

(a) oil cargo - load line is not required.
(b) non-oil cargo - load line is not required.

(ii) international voyages (Canada to U.S.A.):

(a) oil cargo - load line is not required. See Notes B, C.
(b) non-oil cargo - load line is not required. See Notes B, C.

Note A - except for voyages wholly within the treaty zone.
Note B - Canada Shipping Act 415(5).
Note C - U.S.A. authorities require a load line for clearance from their ports for any vessel with any cargo required under U.S. law to have a load line. Canadian markings will satisfy American Authorities.

STANDARD: LOAD 3

PROCEDURES TO BE FOLLOWED BY CLASSIFICATION SOCIETIES THAT HAVE BEEN AUTHORIZED TO ASSIGN LOAD LINES AND TO SURVEY CANADIAN REGISTERED SHIPS

1 AUTHORIZED CLASSIFICATION SOCIETIES

(i) This document outlines the procedures to be followed by the following classification societies, which are authorized to survey Canadian registered ships and assign load lines in compliance with the Load Line Regulations (Sea); Load Line Regulations (Inland); General Load Line Rules and the Load Line Rules for Lakes and Rivers:

Authorized Classification Societies

American Bureau of Shipping
Bureau Veritas
Det norske Veritas
Germanischer Lloyd
Lloyd's Register of-Shipping
Nippon Kaiji Kyokai
Registro Italiano Navale

(ii) Initial and periodical surveys required by the Load Line Regulations way be carried out by Surveyors of the authorized classification society assigning the freeboard, subject to the following condition:

Surveys within Canada are to be carried out either by an exclusive surveyor or by an independent surveyor of equivalent qualification and competence who has been appointed to conduct such surveys on the classification society's behalf, provided that where the society's current Register of Shipping or its Classification Rules do not list the names of such independent surveyors, these are forwarded to the Canadian Administration so that endorsements on Load Line Certificates may be readily identified.

2 FORM OF LOAD LINE CERTIFICATES AND PROCEDURES TO BE FOLLOWED:

(i) The type and form of load line certificates, issued to Canadian ships under the provision of the Canada Shipping Act, are described in the applicable load line regulations. Generally, certificates issued by an authorized classification society on behalf of-the Canadian Administration are to comply with the following references:

Applicable Regulations	Type of Voyage	Reference
Load Line Regulations (Sea)	International	LL2
Load Line Regulations (Sea)	Local	LL3
General Load Lines Rules	International	LL2
General Load Lines Rules	Local	LL3
Load Line Regulations (Inland)	Inland Waters	LL3A
Load Line Rules for Lakes and Rivers	Inland Waters	LL3A

The issuing authority and its distinguishing mark are to be substituted for those of the Canadian Administration in all load line certificates issued by authorized classification societies.

(ii) Certificates are to be printed in both the English and French languages but need only be completed in the language requested by the master or owner.

(iii) The 1930 and the 1966 Load Line Conventions are implemented by the provisions of the 'General Load Line Rules' and the 'Load Line Regulations (Sea)' respectively.

(iv) A Canadian load line vessel to which the Load Line Regulations (Sea) applies, is one which:

(a) makes more than an occasional international voyage and has its keel laid or construction of the hull commenced, on or after April 14, 1970;
(b) does not make international voyages, or makes only an occasional international voyage and had its keel laid or construction of the hull commenced on or after April 1, 1973; or
(c) was built prior to the dates given in sub-paragraphs (a) or (b) and whose Owner has elected to comply with the Load Line Regulations (Sea) in lieu of the General Load Line Rules.

(v) A Canadian load line vessel which is not an inland waters vessel and to which paragraph 2(iv) does not apply, is to comply with the General Load Line Rules.

(vi) A Canadian load line vessel to which the Load Line Regulations (Inland) applies is one which:

(a) makes inland waters voyages and had its keel laid or construction of the hull commenced on or after April 14, 1973;
or
(b) is an inland waters vessel built prior to April 14, 1973 and whose Owner has elected to comply with the Load Line Regulations (Inland) in lieu of the Load Line Rules for Lakes and Rivers.

(vii) A Canadian inland waters load line vessel, to which paragraph 2(vi) does not apply, is to comply with the Load Line Rules for Lakes and Rivers.

(viii) At the time of their issue, load line certificates must be signed by a senior official of the authorized classification society concerned. Annual endorsements to the certificate may be made by either an exclusive surveyor of the classification society or by an independent surveyor of the classification society or by an independent surveyor appointed by the society to carry out load line surveys on its behalf.

(ix) In cases where load lines are being assigned to a passenger vessel, which may carry more than 12 passengers, the following endorsement is to be added to the Load Line Certificate:

> "When more than 12 passengers are carried, the freeboard of the ship shall he governed by the Subdivision Load Line shown on the Inspection Certificate, provided that in no case shall the ship be loaded so as to submerge the Load Line mark appropriate to the season and locality as shown on the certificate."

(x) Where the deepest subdivision load line assigned by the Canadian administration is located below the lowest load line on the grid mark, an "all seasons' mark may be substituted for the grid, if the owner of the ship so elects. In that case, the ship is to be marked with a deck line, the disc (or diamond), the subdivision load line or lines, and the fresh water (or salt water) allowance line. The centre of the disc is to be located at the upper edge of the deepest subdivision load line and the fresh water (or salt water) allowance line marked relative to the centre of the disc (or diamond). Fresh or Salt water allowance are to be' computed from the normal load line draft.

(xi) Where an 'all seasons' mark is issued, the notation on the load line certificate, quoted in paragraph 2(ix), may finish at the words .....shown on the Inspection Certificate".'

(xii) One copy of each of the following completed documents is to be forwarded to the Canadian Administration for record purposes, following the initial survey and at every renewal survey thereafter:

(a) Load Line Certificate;
(b) Report of the Load Line Survey indicating compliance with all conditions of assignment; and
(c) Copy of freeboard calculation.

For renewal surveys, item (c) need not be submitted if there has been no change in item (b).

(xiii) It is to be noted that load lines are not generally assigned to barges and other non self-propelled vessels, making voyages solely within Canadian waters, unless such vessels carry passengers and crew. An exception to this is when oil is being carried as cargo and the assignment is being made in compliance with either the Load Line Regulations (Sea) or the Load-Line Regulations (Inland), in which case non self-propelled vessels require load lines.

(xiv) Exemption from load line assignment is also provided for Canadian registered ships making international voyages within the west coast treaty waters defined in the application section of the General Load Line Rules and the Load Line Regulations (Sea) and also for vessels operating on Minor Waters Voyages Class II or on Home Trade Voyages Class IV.

3. LOAD LINE STRENGTH STANDARDS, LOADING MANUALS, SUBDIVISION, INTACT AND DAMAGED STABILITY

(i) The structural strength standards required for vessels which are to be assigned freeboards under the Load Line Regulations (Sea) are to be in accordance-with the published rules of the authorized classification society concerned.

(ii) The structural strength standards required for vessels which are to be assigned freeboards under the Load Line Regulations (Inland) are to be in accordance with the “Great Lakes Load Line 1968 Strength Standard”.

(iii) The structural strength for existing vessels assigned freeboards under the General Load Line Rules or the Load Line Rules for Lakes and Rivers are to comply with the provisions contained therein.

(iv) The following conditions will apply to all vessels for which free-boards are being assigned by an authorized classification society:

(a) Confirmation of compliance with the appropriate strength standards is to be indicated in the Report of Load Line Survey, submitted to the Canadian Administration by the authorized classification society.

(b) Where an authorized classification society considers its reason-able in certain cases to allow a reduction, exemption or special condition to be applied-to any provision of the appropriate regulations or strength standards, full particulars must first be submitted for the approval of the Canadian administration and the submission must include the recommendation of the authorized classification society.

(c) Any proposed change in the service or design of a vessel is to be submitted for the approval of the Canadian administration and the submission must include the recommendation of the authorized classification society concerned.

(v) Where a loading manual is required by the regulations, the form of the manual is to be submitted to the Canadian Administration for approval. A completed manual, approved by the authorized classification society concerned, is to be placed on board the vessel and a copy is to be forwarded to the Canadian Administration for record purposes.

(vi) The Canadian Administration will retain the approval function of all subdivision, intact and damaged stability information which is required by the regulations to be carried on board Canadian vessels for the information of the Master.

(vii) Only those comments having direct relevance to the conditions under which a load line certificate is issued are permitted as endorsements there-on. Comments, dealing with the appropriate certification of officers or any special conditions of the classification society, are not to appear on the Load Line Certificate.

4 SCALE OF FEES

(i) The fees to be charged for the issue and renewal of Load Line Certificates and for associated annual and periodical surveys are not to exceed those given in Part VI of the Board of Steamship Inspection Scale of Fees.

STANDARD: LOAD 4

ASSIGNMENT OF LOAD LINES TO DREDGERS, SANDSUCKERS AND OPEN HOPPER BARGES

1(i) The General Load Line Rules, Load Line Rules for Lakes and Rivers, Load Line Regulations (Inland) and the Load Line Regulations (Sea) permit individual consideration by the Board of the freeboard assigned to the above ships.

(ii) The Board is prepared to assign freeboards to such ships in accordance with the following guidelines.

2 VESSELS WITHOUT HOPPER DOORS OR APPROVED MEANS OF SPEEDILY JETTISONING THE CARGO

(I) Operating with Hold Spaces Open

When these ships required to be assigned freeboards in accordance with the Regulations they may qualify for exemption from the provision to fit hatch covers to their holds provided it can be shown to the satisfaction of the Board that, when operating at that freeboard, they cannot be overloaded and the stability and safety are not impaired when the hold is filled with water, cargo, or a mixture of water and cargo. (Cargo means either dredgings recovered for commercial use or spoil recovered in the maintenance of harbours and rivers). See items (A), (B), (C), and (D) below.

(A) Loading Arrangements

(i) As operational and weather conditions at sea may preclude the accurate checking of draught marks, it is essential to ensure that whenever cargo is being carried the maximum draught permitted cannot be exceeded.

(ii) The maximum volume of cargo that can be carried should be determined using the anticipated maximum cargo density. If these calculations show that the volume of cargo to be carried is such that the cargo space (hold and coaming) is not completely filled when the ship is at the assigned freeboard, it will be necessary to introduce spillways or to provide other suitable means to prevent possible overloading.

(B) Loading Trials

(i) A loading trial at sea will be required to prove the efficiency of .the arrangements provided to prevent overloading. The surveyor should witness and report upon such trials. He should be satisfied that the distribution and area of spillways provided are sufficient to prevent an excessive build-up of cargo in the hold and that they are also capable of freeing any accumulation of water due to heavy seas breaking over the hatchway. To ascertain that the vessel is not overloaded during the trial it may be necessary to inspect the draught marks from a boat positioned alongside the ship, especially in ships which are not fitted with accurate draught indicators.

(ii) For this trial a cargo of the maximum density it is intended to carry should be loaded. The loading should continue to the point when solid material begins to overflow through the spillways prior to the commencement of draining the cargo. At no stage during the trial should the draught associated with the freeboard be exceeded.

(C) Investigation of Stability

(i) The following “spill-out” method should normally be adopted to investigate the stability and safety of these ships. The method takes account of the spillage of saturated cargo and water overboard as the ship heels and can be developed either by direct means or by computer. Where, however, an owner can demonstrate that this method is not wholly appropriate to a particular case, the Board will be prepared to consider an alternative method of investigating the stability of the ship.

(ii) In addition to the hydrostatic curves and cross (KN) curves of stability, curves should be prepared for the ship at various angles of heel representing:

(a) the effective volume of the cargo hold to the top of the hatch; (see Appendix ‘A’)
(b) the cargo heeling lever (y); (see Appendix ‘A’).

(iii) In developing these curves the cargo surface should normally be assumed to remain horizontal (i.e. parallel to the sea level) and to be touching the top of the hatch coaming. Where, however, it can be shown that the distribution and area of the spillways on either side of the ship are capable of rapidly releasing the cargo with the ship at any angle of heel, consideration may be given to lowering this final level of the cargo surface to a point coincident with the lower edge of the spillway openings. The cross curves are derived from calculations which assume that since the top of the hold is open the buoyancy above the level of the horizontal cargo surface beyond the line of the hatch coaming does not exist (see Appendix ‘A’). An allowance may be given for all erections which have weathertight means of closure and comply with the applicable Load Line Regulations.

(iv) With this information, curves of righting levers (GZ) for various loaded conditions can be prepared. The initial stability of the ship in the ,upright condition should be calculated in the normal manner with the metacentric height (GM) corrected for the effect of all free surface including that in the main cargo hold where account should be taken of the actual density of the contents therein; normally a specific gravity the mean of that for saltwater and the cargo will be acceptable. A typical example of this is given in Appendix 'B'.

(D) Stability Information Required

(i) The stability of the ship is to be fully investigated, and the following minimum number of conditions should be calculated and presented in the Stability Booklet:

(a) Lightship.
(b) The Arrival and Departure Conditions for the ship loaded with:

1. water ballast;
2. cargo of the anticipated maximum density;
3. cargo of the anticipated minimum density.

(c) Worst Stability Condition. It should be noted that due to the large volume of water and the resultant free surface effect which exists in the intermediate stages of loading a suction type dredger, a more onerous condition may then exist than when the ship is fully loaded. Therefore, a condition indicating the stability of the ship in the intermediate stages of loading (i.e. when the hold contains only a percentage of the intended load of dredgings plus the relative quantity of water) may be the worst stability condition.
(d) Emergency Flooded Conditions i.e. an investigation of the effects of water breaking over the hatchway into the hold.

(E) The Load Line Certificate issued to these ships shall include a note specifying the specific gravity of the spoil used in the determination of the position of the spillways.

(II) <u>Operating with Hold Spaces Closed</u>

(i) For ships designed to operate with their hold spaces closed with either hatch covers or by permanent means the investigation of the stability by the "spill-out" method is inappropriate. In such cases the normal free surface correction should be applied for. the cargo in the hold (suitably amended for density) when calculating the stability for various conditions of loading.

(ii) The Board is prepared however to consider dispensing with the free surface correction for the cargo in the hold provided either the ship owner of their consultants can show to the satisfaction of the Board that during the collection of the dredgings the water content is removed expeditiously. In this case the ship's stability should be investigated by assuming the cargo of dredgings to shift as the ship rolls. The intact stability could then be considered adequate if, after taking account of any cargo shift, the following results are obtained:

(a) the angle of heel does not exceed 65 percent of the angle at which the deck edge is immersed in still water; and
(b) the residual dynamic stability measured up to 30 degrees beyond the angle of heel is not less than 0.10 metre-radians.

(iii) The cargo shift moments should be calculated assuming the surface shift angle to be 200. The ship will be required to comply in all other respects with the requirements of Paragraphs (I)(A), (B) and (D) of Section 2.

3 VESSELS WITH HOPPER DOORS OR APPROVED MEANS OF SPEEDILY JETTISONING THE CARGO

(I) Operating with Hold Spaces Open

When these ships require to be assigned freeboards in accordance with the Regulations they may qualify for exemption from the provision to fit hatch covers to their holds provided it can be shown to the satisfaction of the Board that, when operating at that freeboard, they cannot be overloaded and the stability and safety are not impaired when the hold is filled with water, cargo, or a mixture of water and cargo. (Cargo means either dredgings recovered for commercial use or spoil recovered in the maintenance of harbours and rivers). See items (A), (B), (C) and (D) below.

(A) Loading Arrangements

(i) As operational weather conditions at sea may preclude the accurate checking of draught marks, it is essential to ensure that whenever cargo is being carried the maximum draught permitted cannot be exceeded.

(ii) The maximum volume of cargo that can be carried should be determined using the anticipated maximum cargo density. If these calculations show that the volume of cargo to be carried is such that the cargo space (hold and coaming) is not completely filled when the ship is at the assigned freeboard, it will be necessary to introduce spillways or to provide other suitable means to prevent possible overloading.

(B) Investigation of Stability.

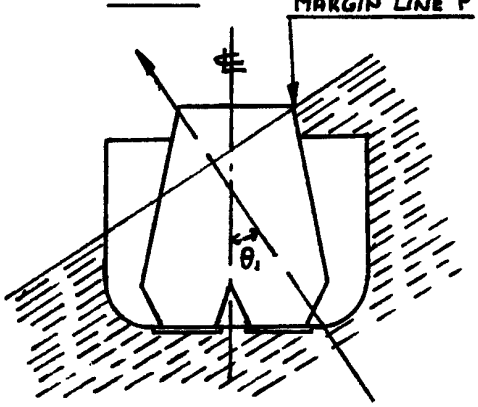
(i) The following “spill-out” method should normally be adopted to investigate the stability and safety of these ships. The method takes account of the spillage of saturated cargo and water overboard as the ship heels and may be developed either by direct means or by computer. Where, however, an owner can demonstrate that this method is not wholly appropriate to a particular case the Board will be prepared to consider an alternative .method of investigating the stability of the ship.

Stage 1
The basic ship should be considered to consist of two different hull forms; i.e.:

Hull Form 'A'
The volume of the whole ship below the top of the hatchway coaming (see Figure 1).

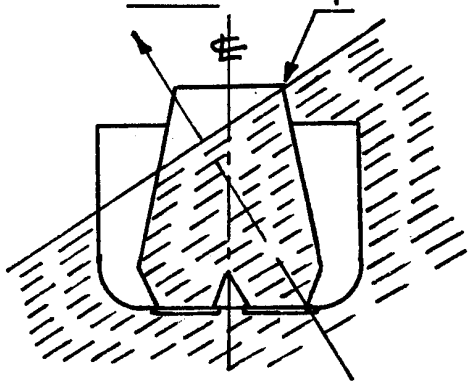
Hull Form 'B'
The volume of the ship as Hull Form W but excluding the volume of the cargo hold (See Figure 2).

FIG. 1



HULL FORM 'A'

FIG. 2



HULL FORM 'B'

A set of hydrostatics and cross (KN) curves of stability are prepared for each hull form.

Stage 2
Curves should be prepared for the ship at various angles of heel representing:

(a) the effective volume of the cargo hold to the top of the hatch (See Appendix 'A'), and
(b) the cargo heeling lever (y), (See Appendix 'A').

Stage 3
To calculate the lightship and water ballast conditions required by (C)(i)(a) and (C)(i)(b)l. of Section 3, the hydrostatic curves and cross curves for hull form 'B' are used and the calculations are made in the normal manner.

.Stage 4
To calculate the loaded conditions required by (C)(i)(b)2., (C)(i)(b)3. and (C)(i)(c) of Section 3 the hydrostatics curves for hull form 'A' are used. it is assumed that the cargo will compact at the bottom of the hold, scaling the hopper doors and resulting in an "intact" ship.

The initial stability in the upright condition should be calculated in the normal manner with the metacentric height (GM) corrected for the effect of all free surfaces, including that in the main cargo hold, where account should be taken of the density of the contents; normally a specific gravity the mean of that for saltwater and the cargo will be acceptable. A typical example of the initial stability calculation is given in Appendix 'B'.

In both the initial stability calculation and in the calculation of the GZ curves the effect of water already in the cargo hold should be taken into consideration. This water will be displaced by the cargo and will flow over the top of the hatch coaming until the hold is filled with cargo. Where it can be shown that the distribution and area of the spillways on either side of the ship are capable of rapidly releasing the water and cargo with the ship at any angle of heel,, consideration may be given to lowering the final level of the water surface to a point coincident with the lower edge of the spillways openings. An allowance may be made for all erections which have weathertight means of closure and comply with the applicable Load Line Regulations.
Using the formula:

$$GZ = KN - \left(\frac{W_o \bullet KG_o \bullet \sin\theta + w \bullet y}{W_o + w} \right)$$

the curve of righting levers (GZ) for a particular loaded condition can be developed. (w is the weight of cargo in the hold.) If in any loaded condition there is water on top of the cargo in the hold an allowance will have to be made in the calculation of w and y for the difference in density between the water and the cargo. A typical example of the GZ calculation is given in Appendix 'B'.

(C) Stability Information Required

(i) The stability of the ship is to be fully investigated, and the following minimum number of conditions should be calculated and presented in the Stability Booklet:

(a) Light ship. (If the ship is fitted with bottom doors water should be in the hold space):
(b) The Arrival and Departure Conditions for the ship loaded with:

1. water ballast;
2. cargo of the anticipated maximum density;
3. cargo of the anticipated minimum density.

(c) Worst Stability Condition. It should be noted that due to the large volume of water and the resultant free surface effect which exists in the intermediate stages of loading a suction type dredger a more onerous condition may then exist than when the ship is fully loaded. Therefore., a condition indicating the stability of the ship in the intermediate stages of loading (i.e. when the hold contains only a percentage of the intended load of dredgings plus the relative quantity of water) may be the worst stability condition.

(d) In a ship fitted with double bottom doors or other similar means of jettisoning cargo, a condition to indicate the heeling effect should the doors on one side fail to open when the ship is in its worst condition as regards stability.

(D) Survey of Hopper Type Ships

The surveyor should ensure that in hopper type ships the bottom doors or other arrangements for the jettisoning of the cargo are fitted with controls which are readily accessible for use in an emergency and these items should be regularly surveyed and seen to operate efficiently.

(E) The Load Line Certificate issued to these ships shall include a note specifying a the specific gravity of the spoil used in the determination of the position of the spillways.

(II) Operating with Hold Spaces Closed

For ships designed to operate with their hold spaces closed with either hatch covers or by permanent means, the investigation of the stability by the “spill-out” method is inappropriate. In such cases the normal free surface correction should be applied for the cargo in the hold (suitably amended for density) when calculating the stability for various conditions of loading.

The Board is prepared however, to consider dispensing with the free surface correction for the cargo in the hold provided either the ship owners or their consultants can show to the satisfaction of the Board that during the collection of the dredgings the water content is removed expeditiously. In this case the ship’s stability should be investigated by assuming the .cargo of dredgings to shift as the ship rolls. The intact stability could then be considered adequate if, after taking into account of any cargo shift, the following results are obtained:

(a) the angle of heel does not exceed 65 percent of the angle at which the deck edge is immersed in still water; and
(b) the residual dynamic stability measured up to 30 degrees beyond the angle of heel is not less than 0.10 metre-radians.

The cargo shift moments should be calculated assuming the surface shift angle to be 200. The ship will be required to comply in all other respects with the requirements of paragraphs (I) (A) (C) and (D) of Section 3.

4 REDUCED FREEBOARD TO HOPPER TYPE SHIPS

(I) The Board is prepared to consider applications for the assignment of a reduced freeboard to these types of ships subject to the following conditions:

(a) The strength of the ship is to be adequate for the increased draft.
(b) The ship is to be a “hopper` type (i.e.) fitted with bottom doors in the shell or having other similar means capable of quickly jettisoning the cargo under all seagoing conditions and in an emergency. Details of the arrangements are to be submitted to the Board for approval.
(c) The specific operational limits are to be approved by the Board. In this regard the surveyor concerned is to make a recommendation concerning the suitability of the ship taking into consideration the proposed operational area and the weather conditions likely to be encountered.
(d) The stability of the ship is to be adequate at the deeper draft and calculations are to be submitted to the Board for approval.

(ii) The minimum freeboard to be assigned is not to be less than 5/8 of the summer freeboard calculated in accordance with the applicable load line rules or regulations. In all cases the assigned freeboard shall be not less than 150 mm.

(iii) The marking on the ship for the reduced freeboard should be painted red on a white background and should consist of the circle or diamond and the intersecting horizontal line only. If the red marking is additional to the normal load line marks, it should be placed with the centre of the circle 762 mm abaft the normal load line mark.

5 MINIMUM INTACT STABILITY CRITERIA

(i) Dredgers, sandsuckers, and open hopper barges are to comply with the following minimum intact stability criteria in all operating conditions, including the stability conditions required by:

Sub-paragraphs (I)(D)(i)(b) and (I)(D)(i)(c) of Section 2,
Sub-section (II) of Section 2,
Sub-paragraphs (1)(C)(b) and (I)(C)(c) of Section 3,
Sub-section (II) of Section 3, and
Sub-paragraph (i)(d) of Section 4.

(a) The area under the righting lever (GZ) curve should not be less than 0.055 metre-radians up to 30 degrees angle of heel and not less than 0.09 metre-radians up to 40 degrees or the angle of downflooding if this angle is less than 40 degrees. Additionally, the area under the righting lever (GZ) curve between the angle of heel of 30 degrees and 40 degrees or between 30 degrees and the angle of downflooding, if this angle is less than 40 degrees, should be not less than 0.03 metre-radians.

(b) The righting lever (GZ) should be at least 0.20 metres at an angle of heel equal to or greater than 30 degrees.

(c) The maximum righting lever (GZ) should occur at an angle of heel preferably exceeding 30 degrees but not less than 25 degrees.

(d) The initial metacentric height (GM) should not be less than 0.15 metres.

6 APPLICATION

(i) All new ships, ships to which a major modification was made, and all existing ships with hatch covers, applying for an exemption from the provision to fit hatch covers, shall comply with the requirements of Sub-section (1) of Section 2 or Sub-section (I) of Section 3, as the case may be, of this standard.

(ii) All ships of the “hopper type”, applying for the assignment of reduced freeboards shall comply with the requirements of Section 4.

APPENDIX ‘A”

1 EFFECTIVE VOLUME OF CARGO HOLD

2 CARGO HEELING LEVER

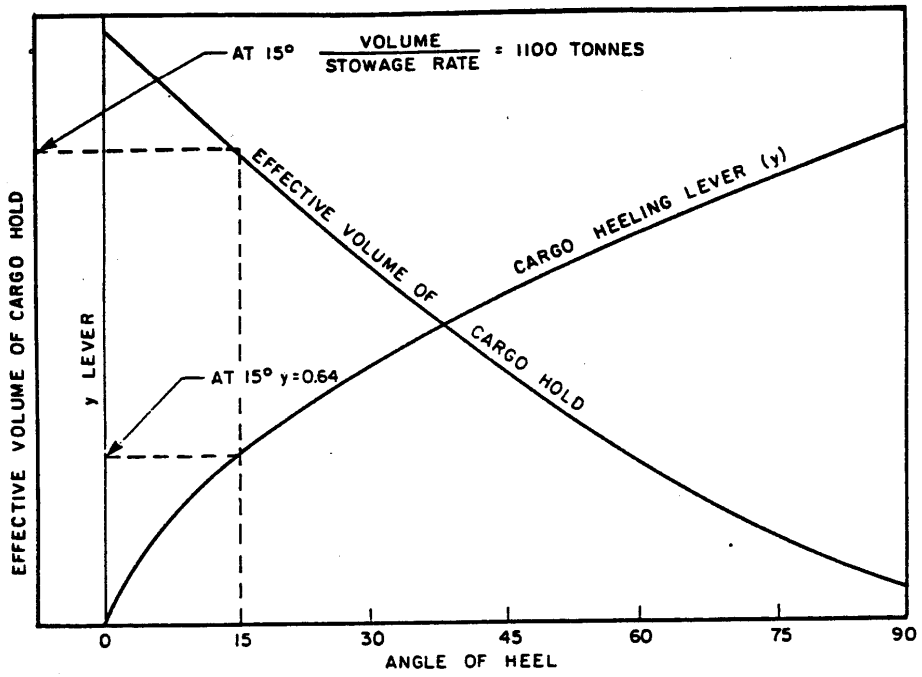
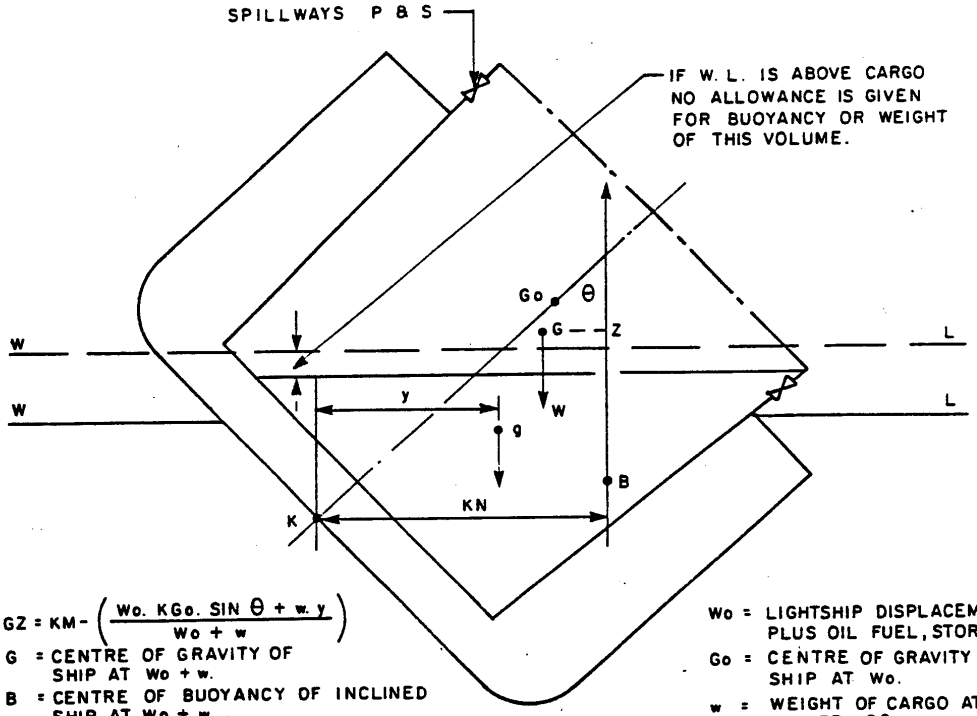


FIG. 1



$GZ = KM - \left(\frac{Wo.\ KGo.\ SIN\ \theta + w.y}{Wo + w} \right)$

G = CENTRE OF GRAVITY OF SHIP AT Wo + w.

B = CENTRE OF BUOYANCY OF INCLINED SHIP AT Wo + w.

Wo = LIGHTSHIP DISPLACEMENT PLUS OIL FUEL, STORES, ETC.

Go = CENTRE OF GRAVITY OF SHIP AT Wo.

w = WEIGHT OF CARGO AT ANGLE OF HEEL θ°.

g = CENTRE OF GRAVITY OF CARGO AT ANGLE OF HEEL θ°.

FIG. 2

APPENDIX ‘B’

TYPICAL CALCULATION OF STATICAL STABILITY IN LOADED CONDITION

TYPICAL CALCULATION OF STATICAL STABILITY IN LOADED CONDITION

1. Initial stability (ship upright)

Item	WEIGHT (tonnes)	VCG (metres)	Vertical Moment	Free Surface Correction (metres)	
Lightship	500	3.35	1675	0.027	Plus normal
Oil fuel	10	1.52	15	0.027	trim
Diesel oil	2	4.57	9	0.015	particulars
Lubricating oil	1	4.87	5	0.009	
Fresh water	4	2.74	10	0.012	
Stores etc	2	0.30	1		
Lightship, fuel stores etc. (W_0)	519	3.30	1715	0.063	
Cargo (w)	1200	2.59	3108	0.610	
Load displacement (W_0 + w)	1719	2.81	4823	673	

KM = 4.13
GM (solid) = 1.32
Free Surface = 0.673
GM (fluid) = 0.647 metres

2. Righting lever when ∅= 15°

Item	WEIGHT	LEVER	Horizontal Moment
Lightship, fuel stores, etc. (W_0)	519	0.87 (3.363 Sin 15°)	451
Cargo (w)	1100	0.64 (y from Figure 1) Appendix 'A'	704
Loaded ship (W_0) + w)	1619	0.713	1155

Then GZ at 15° =.1.000 (KN from curves) - 0.713
= 0.287 metres

3. Righting lever when ∅ 30°

Item	WEIGHT	LEVER	Horizontal Moment
Lightship, fuel stores, etc (W_0) Cargo (w)	519 906	1.681 (3.63 Sin 30°) 1.210 (y from Figure 1) Appendix 'A'	872 1096
Loaded ship (W_0+ w)	1425	1.381	1968

Then GZ at 30° = 1.880 (KN from curves) 1.381
= 0.499 metres

In the above calculations the value of KG for the Lightship, fuel, stores, etc., (W_0) is increased by the free surface correction for liquids in oil and water tanks,
i.e. 3.30 + 0.063 = 3.363 metres.

LOAD 5

RESERVED

STANDARD: LOAD 6

INTERPRETATIONS OF THE INTERNATIONAL CONVENTION ON LOAD LINES, 1966
APPLICABLE TO LOAD LINE REGULATIONS (SEA)

PREAMBLE

The International Association of Classification Societies (IACS), to December 1978, have established 45 interpretations of various Articles and Regulations respecting the Implementation of the International Convention on Load Lines 1966.

The Board of Steamship Inspection concur with the majority of these interpretations and it is the purpose of this document to emphasize those areas where the IACS Interpretations and those of the Board are in variance with respect to their application to Canadian Regulations, particularly Load Line Regulations (Sea).

Interpretation Numbers are identical to those of the IACS Interpretations in order to facilitate direct comparison.

Canadian Administration comments or overriding interpretations are highlighted by rectangular boundary lines.

Regulation references pertain to Schedule I, Load Line Regulations (Sea) unless otherwise noted.

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Interpretation LL 42	Access Openings on Barges	Reg. 27(11)
Interpretation LL 43	Minimum Bow Height	Reg. 39
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Interpretation LL 1
Application (Section 3(2)(b))

Even where the increase in draught is only of the order of 25 mm to 50 mm there should be no relaxation from the condition that existing ships comply with all the requirements.

Interpretation LL 2
Depth for Freeboard (Regulation 3(6), Schedule 1)

The correction for thickness of sheathing on the exposed freeboard deck, $\frac{T\ (L - S)}{L}$ is applicable only when deck is completely sheathed between superstructures. In other cases the correction should be $\frac{T\ x\ 1}{L}$ where l = length of sheathed area which extends from side to side. Only wood sheathing should be considered.

Interpretation LL 3
Superstructure (Regulation 3(9)(b), Schedule I)

A bridge or poop shall not be regarded as enclosed unless access is provided for the crew starting from any point on the uppermost complete exposed deck or higher to reach machinery and other working spaces inside these superstructures by alternative means which are available at all times when bulkhead openings are closed.

Interpretation LL 4
Details of Marking (Regulation 8,, Schedule I)

“Permanently marked” is considered to include welding of the marks on the sides of the ship provided the usual precautions as to material, electrodes etc. ate observed.

Interpretation LL 5
Doors (Regulation 12, Schedule I)

a) Doors should generally open outwards ‘to provide additional security against the impact of the sea. Doors which open inwards are to be especially approved.

b) Portable sills should be avoided. However, in order to facilitate the loading/unloading of heavy spare parts or similar, portable sills may be fitted on the following conditions:

1) They must be installed before the ship leaves port.

2) Sills are to be gasketted and fastened by closely spaced through bolts.
3) Whenever the sills are replaced after removal, the weather-tightness of the sills and the related doors must be verified by hose testing. The dates of removal, replacing and hose testing shall be recorded in the ship's log book.

Interpretation LL 6
Hatchways closed by weathertight covers of steel or other equivalent material fitted with gaskets and clamping devices (Regulations 16 and 27(7)(c), Schedule I)

Regulation 16:

Where hatchways are fitted with coamings of standard height, no extra strengthening (beyond what is required in the Load Line Convention) shall be required for covers loaded with cargo, even if dense cargo, provided the load does not exceed 1.75 tons/m2 (in position 1).

Regulation 27(7)(c):

No extra strengthening is recommended for hatchway covers on vessels which are assigned freeboards less than those based on table B, except for flush hatchway covers which are fitted on the freeboard deck forward of the quarter length, in which case the section modulus and the moment of inertia shall be increased 15% over that required by Regulation 16.

Interpretation LL 7
Machinery Space Openings (Regulation 17(1), Schedule I.)

Where casings are not protected by other structures double doors should be required for ships assigned freeboards less than those based on table B. An inner sill of 230 mm in conjunction with the outer sill of 600 mm is recommended.

Interpretation LL 8
'Miscellaneous Openings in Freeboard and Superstructure Decks (Regulation 18(2) and 18(3), Schedule I)

Regulation 18(2):

Only those doorways in deck houses leading to or giving access to companionways leading below, need to be fitted with doors in accordance with Regulation 12.

Alternatively, if stairways within a deck house are enclosed within properly constructed companionways fitted with doors complying with Regulation 12, then the external doors need not be weathertight.

Where an opening in a superstructure deck or in the top of a deck house on freeboard deck which gives access to space below the freeboard deck or to a space within an enclosed superstructure and is protected by a deck house, then it is considered that only those side scuttles fitted in spaces which give direct access to an open stairway need be fitted with deadlights in accordance with Regulation 23. A cabin is considered to provide adequate protection against the minimal amount of water which will enter through a broken side scuttle glass fitted on the second tier.

Regulation 18(3):

In the application of Regulation 18 it is understood that:

a) where access is provided from the deck above as an alternative to access from the freeboard deck in accordance with Regulation 3(1)(b) then the height of sills into a bridge or poop should be 380 mm. The same consideration should apply to deck houses on the freeboard deck.
b) where access is not provided from above, the height of the sills to doorways in a poop bridge or deck house on the freeboard deck should be 600 mm.
c) where the closing appliances of access openings in superstructures and deck houses are not in accordance with Regulation 12, interior deck openings are to be considered exposed, i.e. situated in the open deck.

Interpretation LL 9

Interpretation rejected.

Interpretation LL 10
Air Pipes (Regulation 20, Schedule I)

For ships assigned timber freeboards the air pipes should be provided with automatic closing appliances.

Interpretation LL 11
Scuppers, Inlets and Discharges (Regulation 22(1), Schedule I)

It is considered that an acceptable equivalent to one automatic non return valve with a positive means of closing from a position above the freeboard deck would be one automatic non return valve and one sluice valve controlled from above the freeboard deck. Where two automatic non 7 return valves are required, the inboard valve must always be accessible under service conditions, i.e. the inboard valve should be above the level of the tropical load water line. If this is not practicable, then, provided a locally controlled sluice valve is interposed between the two automatic non return valves, the inboard valve need not be fitted above the LWL.

Where sanitary discharges and scuppers lead overboard through the shell in way of manned machinery spaces, the fitting to shell of a locally operated positive closing valve together with a non return valve inboard, is considered to provide protection equivalent to the requirements of Regulation 22(1).

It is considered that the requirements of Regulation 22(1) for non return valves are applicable only to those discharges which remain open during the normal operation of a vessel. For discharges which must necessarily be closed at sea such as gravity drains from topside ballast tanks, a single screw down valve operated from the deck is considered to provide efficient protection.

interpretation LL 12
Side Scuttles (Regulation 23, Section I)

For those vessels where the freeboard is reduced on account of subdivision characteristics, side scuttles fitted outside the space considered flooded and which are below the final waterline shall be of the non opening type.

Interpretation LL 13
Freeing Ports (Regulation 24(1) and 24(5), Schedule I)

Regulation 24(l):

On a flush deck ship with a substantial deck house amidships it is considered that the deck house provides sufficient break to form two wells and that each could be given the required freeing port area based upon the length of the "well". It would not then be allowed to base the area upon 0.7L.

In defining a substantial deck house it is suggested that the breadth of the deck house should be at least 80% of the beam of the vessel, and that the passageways along the side of the ship should not exceed 1.5 m (4.9 ft.) in width.

Where a screen bulkhead is fitted completely across the vessel, at the forward end of amidship deck house, this would effectively divide the exposed deck into wells and no limitation on the breadth of the deck house is considered necessary in this case.

It is considered that wells on raised quarter decks should be treated as previously, i.e. as being on freeboard decks.

Regulation 24(5):

With zero or little sheer on the exposed freeboard deck or an exposed superstructure deck it is considered that the freeing port area should be spread along the length of the well.

Interpretation LL 14
Protection of the Crew (Regulation 25(2), Schedule I)

A guard rail shall also be required for first tier deck houses and for superstructures' ends.

This is recognized as an International minimum standard. However, a higher degree of protection of crew is required by Canadian Regulations (Hull Construction Regulations, Part V, Section 68).

Interpretation LL 15
Length of Superstructure (Regulation 34(1) and 34(2), Schedule I)

Regulation 34(l):

Where a superstructure bulkhead is recessed, the effective length of the superstructure shall be reduced by an amount equivalent in area to the area of the recess related to the breadth of the ship at the mid-length of the recess.

Where the recess is unsymmetrical about the centre line, the largest portion of the recess shall be considered as applying to both sides of the ship.

It is considered that such a recess need not be decked over.

Regulation 34(2):

Where there is an extension to a superstructure, which extension has a breadth on each side of the centre line at least 30% of the breadth of the ship, then the effective length of the superstructure may be increased by considering an equivalent superstructure bulkhead in the form of a parabola. This parabola should extend from the extension at the centre line and pass through the junction of the actual superstructure bulkhead with the sides of the extension and extend to the sides of the ship. This parabola should be completely contained within the boundary of the superstructure and its extensions.

Interpretation LL 16
Sheer (Regulation 38, Schedule I)

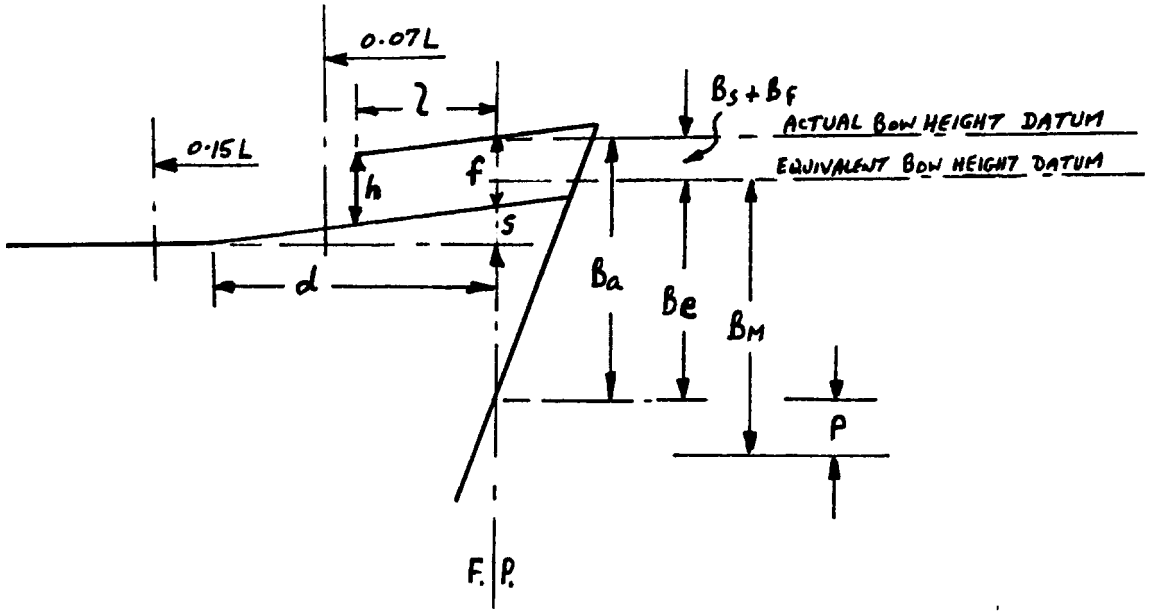
Where the height of a superstructure is less than standard, paragraph 12 may be applied except that the superstructure deck shall not be less than the minimum height of the superstructure above the virtual sheer curve at any point.

For this purpose “y” shall be taken as the difference between the actual and minimum height of the superstructure at the end of sheer.

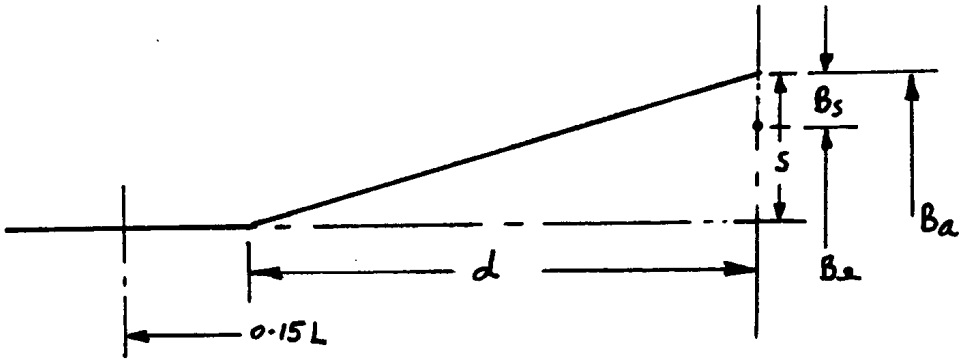
Interpretation LL 17
Minimum Bow Height (Regulation 39(1) and 39(2), Schedule I)

Method of determining Bow Height Penalty for vessels with forecastle and/or sheer which do not meet the requirements of Regulation 39(1) and 39(2).
Nomenclature:

Ba	Actual bow height - The vertical distance at the forward perpendicular between the waterline corresponding to the assigned summer freeboard and the designed trim and the top of the exposed deck at side.
Bm	Minimum bow height calculated using appropriate formula in paragraph (1) of this Regulation.
d	Extent of sheer measured from FP.
S	Actual sheet measured at FP.
Bs	Bow height correction for sheer when d < 0.15L
	Mean covered length of forecastle.
f	Height of forecastle at FP.
h	Least height of forecastle.
Bf	Bow height correction for forecastle when < 0.15L or d < 0.07L.
Be	Equivalent Bow height. Ba - (Bs + Bf)
p	Bow Height Penalty. Bm - Be.



a) Where no forecastle is fitted and the sheer forward extends less than 0.15L from fore perpendicular (FP).

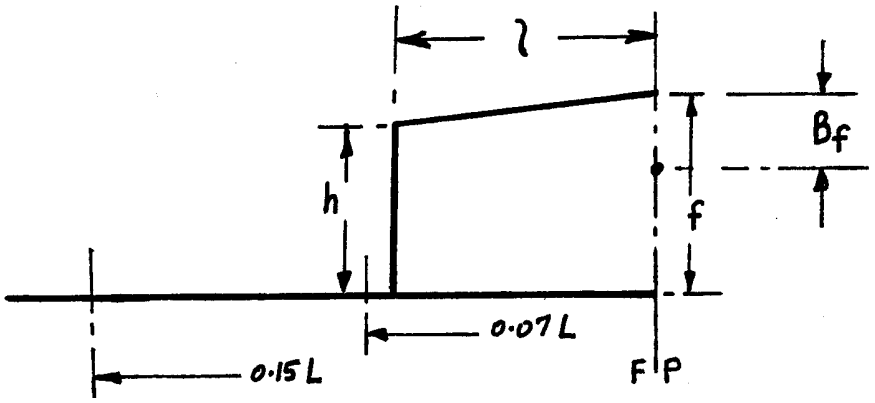


i) Bow height correction for sheer,

$$Bs = S\left[1 - \frac{d^2}{(0.15L)^2}\right]$$

(ii) Bow height correction for f'c'le, Bf = 0

b) Where there is no sheer on the forward part of the freeboard deck and the



forecastle is less than 0.07L from FP.

i) Bow height correction for forecastle,

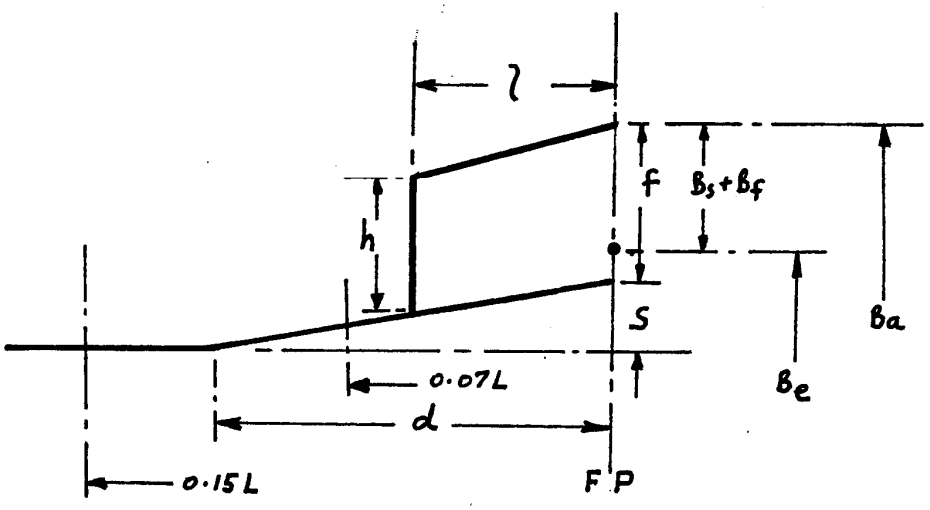
$$Bf = f - {}^{2}\left[\frac{f - h}{(0.15L)^2} + \frac{h}{x^2}\right].$$

where X = 0.07L

ii) Bow height correction for sheer, Bs = 0

* Note: x is set to when 0.15 L ≥ ≥ 0.07L

c) Where the sheer forward extends less than 0.15L and the length of forecastle is less than 0.07L from FP.



i) $$Bs = S\left[1 - \frac{d^2}{(0.15L)^2}\right]$$

ii) $$Bf = f^{-2}\left[\frac{f - h}{(0.15L)^2} + \frac{h}{x^2}\right]$$

where X 0.07L

In determining the Bow Height Penalty, where the minimum bow height (Bm) is greater than the equivalent bow height (Actual bow height corrected for sheer and forecastle) and Bow Height Penalty is given
by:
P = Bm - Be
where Be = Ba (Bs + Bf)

Interpretation LL 18

Freeboard Tables (Regulation 28, Schedule I)

1) Type 'A' ships

a) Freeboards for Type 'A' ships with lengths between 365 m and 400 m shall be determined by the following formula:

$f = 221 + 16.10L - 0.02L^2$
where f is the freeboard in mm
L is the length as defined in Regulation 3(1).

b) Freeboards for Type 'A' ships with lengths of 400 m and above shall be the constant value, 3460 mm.

2), Type 'B' ships

a) Freeboard for Type 'B' ships with lengths between 365 m and 400 m shall be determined by the following formula:

$f = -587 + 23L - 0.0188L^2$
where f is the freeboard in mm
L is the length as defined in Regulation 3(1).

b) Freeboards for Type 'B' ships with lengths of 400 m and above shall be the constant value, 5605 mm.

Interpretation LL 19
Form of Certificates (Part II, Section 38)

It is recommended that the model form of certificates given in Annex III of the Load Line Convention should be strictly adhered to and any deviations from this pattern should be avoided.

Certificate registration being a legal requirement necessitates display of the registry number on each certificate, consequently strict adherence cannot be achieved.

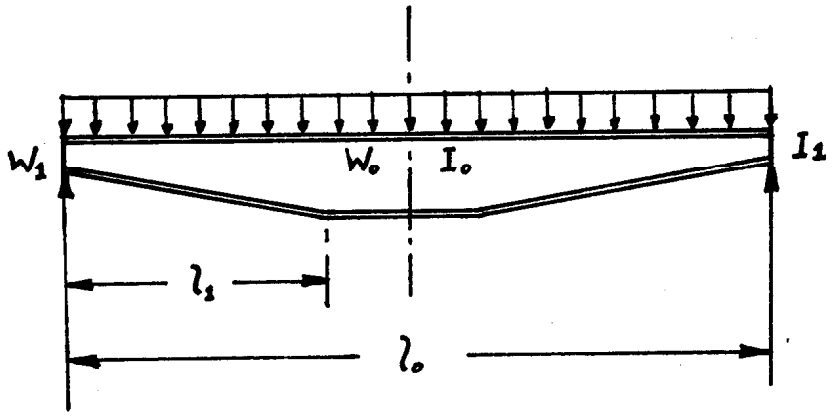
Interpretation LL 20

Hatch beams and cover stiffeners of variable cross section (Regulations 15(4) to 15(7) and 16, Schedule I)

To avoid stresses and deflections exceeding those given in the above Regulations along construction elements of variable cross section, the required section modulus calculated as for construction elements of constant cross section is to be increased by a factor K expressed by: $K = 1 + \frac{3.2\alpha - \gamma - 0.8}{7\gamma + 0.4}$

where $\alpha = t_1/to$, $\gamma = W_1/W$The value of factor K obtained by the formula is not to be less than unity.

,l., to.,W_1,W_0 and are indicated on the sketch below:



The moment of inertia is likewise to be increased by the factor C expressed by:
√

$$C = 1 + 8a^3 \bullet \frac{1 - b}{0.2 + 3\sqrt{b}}$$

where-a = $_1/_0$, $\delta\wp = I_1/I_0$

The value of factor C obtained by the formula is not to be less than unity. I_1 and I_0 are indicted on the sketch on page 13.

The use of the above formulae is limited to the determination of the strength of hatch beams and covers in which abrupt changes in the section of the face material do not occur along the length of the beam or cover.

Interpretation LL 21
Cargo ports or similar openings below the uppermost load line (Regulation 21(2), Schedule I)

It is recommended that cargo ports or similar openings may be accepted submerged provided the safety of the ship is in no way impaired. It is considered that the fitting of a second door of equivalent strength and watertightness is one acceptable arrangement. In that case a leakage detection device should be provided in the compartment between the two doors. Further, drainage of this compartment to the bilges controlled by an easily accessible screw down valve, should be arranged. The outer door should preferably open outwards.

Interpretations LL 22
Position of the inboard end of discharges when timber freeboard is assigned (Regulation 22(1), Schedule I)

It is considered that the position of the inboard end of discharges should be related to the timber summer load waterline when timber freeboard is assigned.

Interpretation LL 23
Freeing arrangement (Regulations 26(5), 27(7) and 36(1)(e), Schedule I)

Regulation 27(7): Freeing arrangements on ships having reduced B freeboard assigned and fitted with bulwarks on the freeboard deck.

For Type ‘B’ ships with freeboards reduced by not more than 60% of the difference between B and A tables there shall be freeing port area in the lower part of the bulwarks equal to at least 25% of the total area of the bulwarks.

The upper edge of the sheer strake shall be kept as low as possible.

Regulations 26(5) and 36(1)(e): Freeing arrangements for type ‘’ ships and Type ‘B’ ships with trunks.

It is considered that a freeing port area, in the lower part of the bulwarks, of 33% of the total area of the bulwarks provides the “other effective freeing arrangements” mentioned in Regulation 26(5), and may be considered equivalent to the 50% open rails in way of trunks required by Regulation 36(1)(e).

Interpretation LL 24
Negative depth correction (Regulation 31(3), Schedule I)

When the height of a superstructure, raised quarter deck or trunk is less than the corresponding standard height, it is recommended that the calculated reduction be corrected in the ratio of the height of the actual superstructure, raised quarter deck or trunk to the applicable standard height as defined in Regulation 33.

Interpretation LL 25
Effective length of raised quarter deck (Regulation 35(4), Schedule I)

It is recommended that the maximum effective length of 0.6L of a raised quarter deck which is stipulated by Regulation 35(4), is to be measured from the after perpendicular even where a poop is fitted in conjunction with the raised quarter deck.

Interpretation LL 26
Continuous hatchways as trunk (Regulation 36, Schedule I)

It is recommended that continuous hatchways may be treated as a trunk in the freeboard computation provided Regulation 36 is complied with in all respects.

The trunk deck stringer referred to in Regulation 36(1)(b) may be fitted outboard of the trunk side bulkhead in association with the following:

1) The stringer so formed is to provide a clear walkway of at least 450 mm in width on each side of the ship.
2) The stringer is to be of solid plate efficiently supported and stiffened.
3) The stringer is to be as high above the freeboard deck as practical and not more than 600 mm below the top of the hatchway coamings.

4) Hatch cover securing appliances are to be accessible from the stringer or walkway.
5) The breadth of the trunk is to be measured between the trunk side bulkheads.
6) Regulation 36 is to be complied with in all other respects.

Interpretation LL 27
Less than standard hatch coamings on trunks of less than standard height (Regulation 36(4), Schedule I)

In the case where the trunk height is less than standard and the trunk hatch coamings are also of less than standard height, or omitted entirely, doubt may arise whether the trunk hatchways are located in position 1 or position 2 and, consequently, about the reduction to be made in the actual trunk height. It is considered that in these cases the reduction from the actual height of trunk on account of insufficient hatch coaming height shall be taken as the difference between 600 mm and the actual height of coaming, or 600 mm if no hatch coamings are fitted. Reduction in the actual height of trunk shall not be required in cases where only small hatches with less than standard height are fitted in the trunk deck for which dispensation from the requirement of standard coaming height may be given.

Interpretation LL 28
Deduction for Superstructures and Trunks (Regulation 37, Schedule I)

For the purpose of applying the table, Percentage of Deduction for Type 'B' ships, in Regulation 37(2) it is considered that any detached superstructure within length L may be treated as a detached bridge.
However, in applying Regulation 37(3)(a) when considering a detached bridge whose after bulkhead is located within 0.05L from the after perpendicular, the length in relationship to 0.2L would be the effective length/s of detached bridge/s less the length of the
detached bridge within 0.05L from the after perpendicular.

Any excess in the height of such a superstructure, which does not extend to the after perpendicular, cannot be regarded as contributing to the sheer allowance contemplated in Regulation 38(12).

Interpretation LL 29
Sheer credit for superimposed superstructure (Regulation 38(5.) and 38(12), Schedule I)

In applying Regulation 38(5) (sheer on complete superstructure ship), where there is an enclosed poop or forecastle superimposed on a complete superstructure, sheer credit shall be allowed for such poop or forecastle according to the method of Regulation 38(12), except that "y" is to be the actual height of the poop or forecastle at the end ordinate.

Interpretation LL 30
Sheer allowance for excess height of superstructure (Regulation 38(7) and 38(12), Schedule I)

As Regulation 38(7) and (12) does not refer to a raised quarter deck it is recommended that credit under this paragraph be given for this type of superstructure only when the height of the raised quarter deck is greater than the standard height of "other superstructures" as defined in Regulation 33, and only for the amount by which the actual height of the raised quarter deck exceeds that standard height.

Interpretation LL 31
Deduction for excess sheer (Regulation 38(15), Schedule I)

Since no stipulation is made as to the height of the superstucture referred to in Regulation 38(15), it is recommended that the height of this superstructure shall be related to its standard height. When the height of the superstructure or raised quarter deck is less than standard, the reduction shall be in the ratio of the actual to the standard height thereof.

Interpretation LL 32
Special requirements for vehicle ferries, Ro-Ro ships and other ships of similar type

Stern, bow and side doors of large dimensions, when manual devices would not be readily accessible, are to be normally secured by means of power systems. Alternative means of securing are also to be provided for emergency use in case of failure of the power systems.

Paragraph b) is not considered to be relevant to Load Line assignment.

Interpretation LL 33
Timber freeboards for ships having reduced Type 'B' freeboards assigned

By reason that vessels having reduced 'B' freeboards are based upon floodability they cannot be assigned deeper load lines.

Interpretation LL 34
Freeboard for Lighters and Barges (Regulation 27(11), Schedule I)

In applying Regulation 27(11) to deck cargo barges it is recommended that only Type 'B' freeboard can be assigned, even if the barges possess the same integrity of exposed decks and equivalent safety against flooding as normal tank barges.

This view is taken as a result of the consideration that Type 'A' freeboard can only be assigned to liquid cargo barges.

It is further concluded that deck cargo can only be carried on barges to which Type 'B' freeboard is assigned.

Interpretation LL 35
Stowage of timber deck cargo on ships having timber freeboards assigned (Regulations 44 and 45, Schedule I)

It is recommended that for the purpose of applying Regulation 45 the timber deck cargo shall extend as far outboard as possible, due allowance being given for obstructions such as guard rail, stanchions, uprights etc.

Interpretation LL 36/Rev. 1
(Revision to Interpretation LL 36)

Minimum Wall Thickness of Pipes (Regulations 19, 20 and 22, Schedule I)

For pipes covered by the above Regulations the following minimum wall thicknesses are recommended:

a) 1. For scupper and discharge pipes, where substantial thickness is not required.
2. For venting pipes other than specified under c)

External diameter of pipes equal to or less than 155 mm - thickness not less than 4.5 mm
External diameter of pipes equal to or more than 230 mm - thickness not less than 6.0 mm

Intermediate sizes are to be determined by linear interpolation.

b) For scupper and discharge pipes where substantial thickness is required.
External diameter of pipes equal to or less than 80 mm - thickness not less than 7.0 mm
External diameter of pipes 180 mm - thickness not less than 10.0 mm
External diameter of pipes equal to or more than 220 mm - thickness not less than 12.5 mm
Intermediate sizes are to be determined by linear interpolation.

c) For venting pipes in position 1 and 2 leading to spaces below the freeboard deck or to spaces within closed superstructures.
External diameter of pipes equal to or less than 80 mm thickness not less than 6.0 mm
External diameter of pipes equal to or more than 165 mm thickness not less than 8.5 mm
Intermediate sizes are to be determined by linear interpolation.

The above wall thicknesses of steel pipes are not totally compatible with North American 'Standards. Consequently where substantial thickness is not required, ref a) above standard piping ASA Schedule 40 shall apply.

Where substantial thickness is required, ref b) above, extra strong piping ASA Schedule 80 shall apply.

In the case of venting pipes, ref c) above, where vents are located in protected area such as at after bulkheads of superstructures or deckhouses, standard piping, ASA Schedule 40 shall apply. In exposed positions, piping shall be extra heavy, ASA Schedule 80.

Interpretation LL 37
Superstructures with sloping end bulkheads (Regulations 34.. 35 and 38(12), schedule I)

When taking account of superstructures which have sloping end bulkheads in the calculations of freeboards, such superstructures shall be dealt with in the following manner:

1. ad Regulation 34

(i) When the height of superstructure, clear of the slope, is equal to or smaller than the standard height, length (s) is to be obtained as shown on sketch I.

(ii) When the height is greater than the standard, length (S) is to be obtained as shown on sketch II.

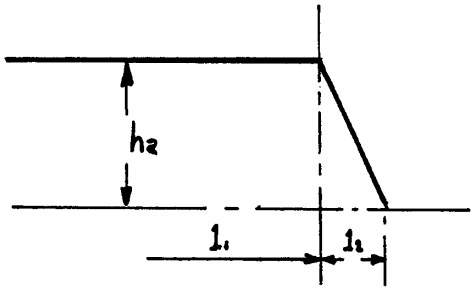
2. ad Regulation 35

When the height of superstructure, clear of the slope is less than the standard height, its effective length (E) shall be its length (S) as obtained per paragraph 1(i), reduced in the ratio of the actual height to the standard height.

3. ad Regulation 38(12)

When a poop or a forecastle has sloping end bulkheads, and sheer credit may be allowed on account of excess height, the formula given in Regulation 38(12) shall be used. the values for (y) and L' being as shown on sketch III.

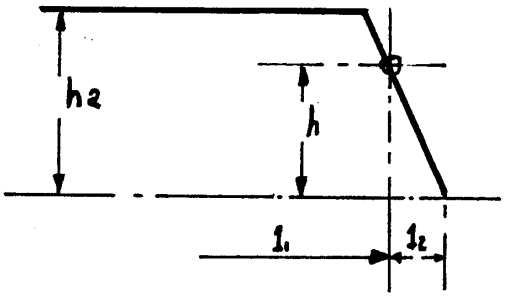
I. HEIGHT OF SUPERSTRUCTURE EQUAL TO OR SMALLER THAN THE STANDARD HEIGHT (h)



$$(S) = 1_1 + \frac{1_2}{2}$$

$$(E) = (S) \bullet \frac{h_a}{h}$$

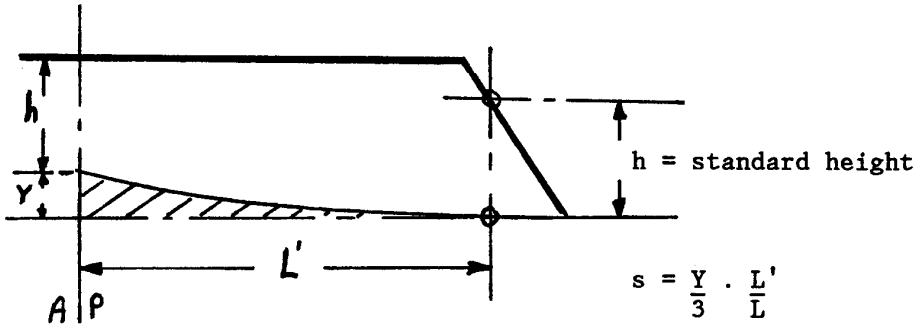
II. HEIGHT OF SUPERSTRUCTURE GREATER THAN THE STANDARD HEIGHT (h)



$$(S) = 1_1 + \frac{1_2}{2}$$

$$(E) = (S)$$

III. SHEER CREDIT s FOR EXCESS HEIGHT



Interpretation LL 38
Bow Height (Regulation 39, Schedule I)

When calculating bow height, if the length of a forecastle is less than 0.15L but greater than 0.07L, the height of the forecastle excluding sheer is included and reduced allowance for forecastle sheer is applicable.

(See Interpretation LL. 17)

Interpretation LL 39
Structure of a Lower Freeboard Deck (Regulation 3(8), Schedule I)

When a lower deck is designated as the freeboard deck, it shall be continuous in fore and aft direction as well as athwartship.

Interpretation LL 40
Security of Hatch Covers (Regulation 15(13), Schedule I)

Acceptable equivalent means to steel bars shall consist of devices and materials which will provide strength equivalent to, and elasticity not greater than that of steel.

Efficient steel wire rope lashings properly set up with tightening screws can be regarded as satisfactory equivalent means.

Care is to be taken that tarpaulins are adequately protected from the possibility of damage arising from the use of securing devices which do not provide a flat bearing surface.

Interpretation LL 41
Trunks (Regulations 29, 31, 35, 36, 37 and 38, Schedule I)

1. Where the length of a trunk, corrected for breadth and height as may be appropriate, can be included in the effective length used for calculating the correction for superstructures in accordance with Reg. 37, it shall not be taken into account for calculating the total length (S) for the purpose of sheer correction according to Reg. 38(13).
2. The effective length of superstructures (E) which is used for calculating the freeboard correction according to Reg. 29 shall be determined excluding the length of trunks.
3. The inclusion of a trunk is the calculation of freeboard need not prohibit the fitting of openings in the bulkheads of adjacent superstructures such as poops, bridges or forecastles.
4. The sides and ends of a trunk need not be intact providing that openings are efficiently closed having equivalent structural integrity

and tightness as an enclosed superstructure, all other aspects respecting trunks being complied with.

Interpretation LL 42
Access Openings on Barges (Regulation 27(11), Schedule I)

a) Since Reg. 27(11) does not contain any indication as to what size the term “small access openings” refers, it is recommended that such openings should not be greater than 1.5 M^2 in case the freeboard reduction of 25% is granted.

b) Access plates are considered as being equivalent to an intact deck for unmanned barges, thereby allowing for a 25% reduction in freeboard, provided they are secured by closely spaced bolts, their joining parts are properly gasketted and their arrangements, for all practical purposes, have equivalent structural integrity and tightness as an intact deck.

Interpretation LL 43
Minimum Bow Height (Regulation 39, Schedule I)

On ships to which timber freeboards are assigned Regulation 39 should relate to the summer load water line and not to the timber summer load waterline.

Interpretation LL 44
Freeing Ports (Regulation 24(3), Schedule I)

The IACS proposal does not take into account the longitudinal disposition of free flow gaps in discontinuous trunks and hatchways therefore its general application is not recommended.

Interpretation LL 45
Presentation of Stability Information (Reg. 10(2), Schedule I)

Standards for the presentation of Stability information have been established by the Canadian Coast Guard. Authority to approve stability information is confided to the Board of Steamship Inspection.