Australian Government

Australian Maritime Safety Authority

MARINE ORDERS

Part 12

Construction—
Subdivision & stability, machinery and electrical installations

Issue 2
(Amendment)

Order No. 5 of 2004

Pursuant to subsection 425(1AA) of the *Navigation Act 1912*, I hereby make this Order amending Marine Orders Part 12, Issue 2 by omitting pages (i), 1 to 4, 7 to 9 and 93 to 95 and substituting the attached pages (i), 1, 2, 3, 4, 7 and 8, to come into operation on 1 July 2004.

Clive Davidson
Chief Executive Officer
8 June 2004

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Previous issues

Part 12, Issue 1, Order No 10 of 1983
Part 13, Issue 1, Order No 17 of 1983
—Amended by Order No 7 of 1986
—Amended by Order No 2 of 1990
—Amended by Order No 9 of 1992
Part 20, Issue 1, Order No 18 of 1983
—Amended by Order No 4 of 1989
—Amended by Order No 3 of 1990
—Amended by Order No 1 of 1994
Part 12, Issue 2, Order No 16 of 1998
—Amended by Order No 15 of 2001

1 Purpose & power

1.1 Purpose

This Part of Marine Orders gives effect to Chapter II-1 of SOLAS and prescribes standards to be met concerning structure, subdivision, stability, machinery and electrical installations for SOLAS ships and non-SOLAS ships. It also gives effect to the IMO guidelines for the design and construction of offshore supply vessels.

1.2 Power

1.2.1 Paragraph 190B(1)(a) of the Navigation Act provides for regulations to specify requirements with which the construction, hull, equipment and machinery of ships shall comply. Section 191 of that Act provides for regulations to make provision for or in relation to giving effect to SOLAS, while section 192B provides for regulations to make provision for or in relation to the carrying on a ship of information with respect to the stability of the ship. Paragraph 283D(1)(a) of the Act provides that the regulations may make provision for or in relation to giving effect to resolutions of the International Maritime Organization with respect to off-shore industry vessels.

1.2.2 Subsection 425(1AA) of the Navigation Act provides that AMSA may make orders with respect to any matter for or in relation to which provision may be made by regulation.

2 Definitions of words and phrases used in this Part

AMSA means the Australian Maritime Safety Authority established by the *Australian Maritime Safety Authority Act 1990*;

angle of down-flooding (θ_f) is the smallest angle of heel at which down-flooding will occur, if all weather tight closing appliances are properly secured;

Chief Marine Surveyor means the person occupying the position of Manager, Ship Inspections, in AMSA or, in respect of any particular purpose under this Part, a suitably qualified person authorised by the Manager, Ship Inspections, for that purpose;

General Manager means the person occupying the position of General Manager, Maritime Operations, in AMSA;

IMO means the International Maritime Organization;

IS Code means the *Code on Intact Stability for All Types of Ships Covered by IMO Instruments*, published by IMO as Resolution A.749(18) and amended by Resolution MSC.75(69);

length, unless specified otherwise, refers to the Length Between Perpendiculars (LBP);

midships means a transverse plane through the ship equidistant between the forward and aft perpendiculars;

Navigation Act means the *Navigation Act 1912*;

offshore supply vessel has the same meaning as in the Guidelines;

penal provision means a penal provision for the purposes of Regulation 4 of the Navigation (Orders) Regulations.[1]

potential angle of flooding (θ_p) is the smallest angle of heel at which down-flooding will occur if weathertight closing appliances, through which down-flooding can occur if they are not secured, are left open;

SOLAS means the Safety Convention as defined in the Navigation Act[2];

SOLAS ship means:

(a) a ship to which SOLAS applies as set out in Regulations 1 and 3 of Chapter I of SOLAS; or

(b) an Australian registered ship to which SOLAS would apply if that ship were to undertake an international voyage as defined in the Navigation Act;

survey authority means a survey authority approved for the purposes of the Navigation Act[3];

surveyor means a person appointed to be a surveyor under s.190 of the Navigation Act;

the Guidelines means the *Guidelines for the Design and Construction of Offshore Supply Vessels*, published by IMO as Resolution A.469(XII).

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1 Subregulation 4(1) of the Navigation (Orders) Regulations provides that a person who fails to comply with a provision of an order made under subsection 425(1AA) of the Navigation Act that is expressed to be a penal provision is guilty of an offence and is punishable by:
(a) if the offender is an individual—a fine not exceeding 20 penalty units; or
(b) if the offender is a body corporate—a fine not exceeding 50 penalty units.
By virtue of section 4AA of the *Crimes Act 1914*, a penalty unit is currently $110.

2 The current text of Chapter II-1 of SOLAS is to be found in the SOLAS Consolidated Edition 2001, as amended by IMO Resolutions MSC.69(69) and MSC.99(73) and, with effect from 1 July 2004, by Resolution MSC.134(76).

3 The following survey authorities are approved: American Bureau of Shipping; Bureau Veritas; Det Norske Veritas; Germanischer Lloyd; Lloyd's Register of Shipping; and Nippon Kaiji Kyokai.

USL Code means the Uniform Shipping Laws Code referred to in section 427 of the Navigation Act.

3 Interpretation

3.1 In this Part, a reference to the date on which a ship was constructed means the date on which not less than 50 tonnes or one per cent of the proposed total mass of the structural material of the ship, whichever is the less, has been assembled.

3.2 A reference in Chapter II-1 of SOLAS to **the Administration** is to be read, in relation to an Australian registered ship, as a reference to the Chief Marine Surveyor, and a power, function or discretion by **the Administration** is exercisable by the Chief Marine Surveyor.[4]

3.3 In this Part:

(a) headings and subheadings are part of the Part;

(b) each Appendix is part of the Part;

(c) a footnote, or a note included in the text and printed as italics, is not part of the Part, but may provide additional information or guidance in applying the Part.

4 Application

4.1 This Part applies to and in relation to:

(a) a ship registered in Australia; and

(b) a ship registered in a country other than Australia, that is in the territorial sea of Australia or in waters on the landward side of the territorial sea.

4.2 This Part does not apply to a ship that is a Safety Convention ship registered in a country other than Australia, except to the extent that the ship fails to comply with Chapter II-1 of SOLAS.

[4] Chapter II-1 of SOLAS refers to a number of Resolutions, Circulars etc of relevance in giving effect to the Regulations. These are obtainable from AMSA.

5 Exemptions & equivalents[5]

5.1 Exemptions

The Chief Marine Surveyor, if satisfied that compliance with a provision of this Part would be unnecessary or unreasonable having regard to a ship, its equipment and its intended voyage, may exempt that ship from compliance with such provision to the extent specified and subject to such conditions as that officer thinks fit.

5.2 Equivalents

Where a provision of this Part requires a particular fitting, material, appliance or apparatus, or type thereof to be fitted or carried in a ship or a particular provision to be made in a ship, the Chief Marine Surveyor may allow any other fitting, material, appliance or apparatus, or type thereof, to be fitted or carried, or any other provision to be made, if that officer is satisfied that the other fitting, material, appliance or apparatus, or type thereof, or provision, is at least as effective as that required by that provision of this Part.

5.3 Exemptions and equivalents not to contravene SOLAS

The Chief Marine Surveyor must not give an exemption under 5.1 or allow an equivalent under 5.2 if it would contravene SOLAS.

6 Review of decisions

6.1 Internal review

6.1.1 If the Chief Marine Surveyor makes a decision under this Part, a person affected by the decision may apply to the General Manager for review of that decision.

6.1.2 An application for internal review under 6.1.1 must be made in writing to the General Manager and must be accompanied by such information as the General Manager requires to enable that officer to make a proper decision.

6.1.3 The General Manager may:

- affirm the original decision by the Chief Marine Surveyor; or

[5] Applications for modifications or exemptions should be made to the Chief Marine Surveyor and should be accompanied by relevant information. The Chief Marine Surveyor may seek additional information to assist in reaching a decision.

- make any decision that could be made by the Chief Marine Surveyor in accordance with this Part.

6.2 Review by the AAT

6.2.1 Application may be made to the Administrative Appeals Tribunal for review of a decision by the General Manager under 6.1.3.

6.2.2 The General Manager must give his or her decision in writing within 28 days of receiving the application for internal review. The notice must include a statement to the effect that, if the person is dissatisfied with the decision, application may, subject to the *Administrative Appeals Tribunal Act 1975*, be made to the Administrative Appeals Tribunal for review of the decision. The notice must also include a statement to the effect that the person may request a statement under section 28 of that Act.

6.2.3 Failure to comply with 6.2.2 in relation to a decision does not affect the validity of that decision.

7 Requirements

7.1 SOLAS ships

7.1.1 Subject to 7.1.2 and 7.3, a SOLAS ship must meet the relevant standards for structure, subdivision, stability, machinery and electrical installations contained in Chapter II-1 of SOLAS.[6]

7.1.2 If a ship is surveyed and certificated under:

- the MODU Code, in accordance with Marine Orders, Part 47; or
- the High Speed Craft Code, in accordance with Marine Orders, Part 49,

it is to meet the standards specified in the relevant code rather than those in Chapter II-1 of SOLAS.

7.2 Non-SOLAS ships

A ship that is not a SOLAS ship must comply with the relevant construction and stability standards set out in the USL Code.

[6] Some Regulations, or parts of Regulations, of Chapter II-1 of SOLAS apply only to certain kinds of ships or to ships constructed after a certain dates. Those dates are set out clearly in the SOLAS Consolidated Edition 2001.

7.3 Off-shore supply vessels

If a ship is to operate as an off-shore supply vessel:

- it is to meet the requirements specified in Part 2 (Intact Stability) and Part 3 (Subdivision and Damage Stability) of the Guidelines where such requirements differ from those in Chapter II-1 of SOLAS or Section 8 of the USL Code, as applicable to the vessel;[7]
- an opening in a watertight bulkhead one or both sides of which may be subjected to flooding under the assumptions of 3.2 of the Guidelines must be fitted with a sliding watertight door;[8] and
- its engine room(s) must be separated from a steering space, or any space that may be rendered open to the sea by damage to propellers, propeller shafting, rudders or steering gear, by one or more watertight bulkheads.

8 Intact stability information

8.1 The owner of a ship must ensure that, at all times, there is carried on a ship information relating to the ship's intact stability characteristics under different conditions of service.

This is a penal provision.

8.2 The information referred to in 8.1 must be:

- substantially in accordance with Appendix 2;[9] and
- approved:

- in the case of a ship registered in Australia—by the Chief Marine Surveyor or a survey authority;[10] or

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[7] Parts 4, 5 and 6 of the Guidelines deal with matters implemented by other parts of Marine Orders or the USL Code. Relevant provisions of those Marine Orders or USL Code will also need to be complied with.

[8] A sliding watertight door should be of such design, material and construction as will maintain the integrity of the watertight bulkhead in which it is fitted. The door should be capable of being remotely closed from above the bulkhead deck outside a machinery space and also operable locally from each side of the bulkhead. Indicators should be provided at the control position showing whether the doors are open or closed, and an audible alarm is to be provided at the door closure. In assessing the design, material, construction and means of operation, the relevant requirements of Regulation II-1/25-9 of SOLAS will be considered.

[9] Information in respect of an off-shore supply vessel should be in accordance with the Guidelines and include appropriate guidance for the Master to ensure operational compliance.

[10] The Chief Marine Surveyor or survey authority will not approve information unless any inclining experiment or light ship measurement has been carried out substantially in accordance with the procedures set out in Appendix 3.

- in the case of any other ship—by the marine administration of the country in which the ship is registered.

9 Additional requirements

9.1 An Australian registered SOLAS ship must, in addition to complying with the relevant requirements of Chapter II-1 of SOLAS, comply with Appendix 4 of this Part.[11]

9.2 The Chief Marine Surveyor may, if satisfied in respect of an Australian registered ship or class of ships that the standards specified in SOLAS, the USL Code or Appendix 4 do not provide for an adequate level of safety, require the ship or class of ships to comply with such additional requirements that that officer determines.[12]

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[11] Requirements dealing with materials containing asbestos are also to be found in the Occupational Health and Safety (Maritime Industry)(National Standards) Regulations 2003.

[12] The Chief Marine Surveyor has determined that ro-ro passenger ships must comply with the annex to Resolution 14, *Stability Requirements pertaining to the Agreement* (the "Stockholm Agreement"), of the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974, adopted on 29 November 1995, including the revised model test method and associated guidance notes adopted by IMO Resolution MSC.141(76).

Appendix 1

Appendix 1 is not used

[Continued on Page 15]

Appendix 2

Stability information required for approval

Contents

1 General

1.1 Purpose

This Appendix sets out the detailed information required to be included in a ship's stability book. The purpose of the stability book is to provide a ship's personnel and the shore-based personnel concerned with its loading, ballasting and discharging, with all the information necessary to perform the appropriate loading calculations so that the vessel can be loaded, proceed to sea, be handled correctly from the stability aspect during the voyage, and arrive safely at its destination.

1.2 Standard abbreviations and symbols

The following abbreviations and symbols are used in this Appendix and are to be standard in any Stability Book prepared or amended, and in any inclining experiment or light ship measurement carried out, after 1 January 1999.

AP Aft perpendicular;

BG Longitudinal separation of the centres of buoyancy and gravity;

BM Height of the initial transverse metacentre above the centre of buoyancy B;

FP Forward perpendicular;

FSC Free surface correction. This is equal to the free surface moment of the tank or sum of the free surface moments of the tanks, divided by the displacement at the time, or the lowest displacement to be reached during the voyage;

G The position of the centre of gravity of the ship. It is always to be taken to include the effects of free surface in tanks. When it is necessary to refer to the centre of gravity excluding the effect of free surface, it is referred to as G_0;

G_0 The position of the centre of gravity when no tank is slack;

GM The initial transverse metacentric height when one (or more) tank is slack—known as the metacentric height;

GM_0 The initial transverse metacentric height when no tank is slack;

GZ The transverse righting lever, being the shortest distance from G to the vertical through B, the centre of buoyancy;

KB The height of the vertical centre of buoyancy above the baseline;

KG Height of the centre of gravity, corrected for free surface, above the baseline;

KM Height of the initial transverse metacentre above the baseline;

KN The righting lever when the centre of gravity of the vessel is assumed to be at the baseline; the horizontal distance between the intersection of the centreline of the ship and the baseline, and the vertical through the centre of buoyancy;

L_{BP} Length of the ship between perpendiculars;

LCA Longitudinal centre of area;

LCB Longitudinal centre of buoyancy;

LCF Longitudinal centre of flotation;

LCG Longitudinal centre of gravity;

M Initial transverse metacentre;

M_L Longitudinal metacentre;

MCT1cm Moment to change trim 1 centimetre over the length between perpendiculars;

TCB Transverse centre of buoyancy;

TCG Transverse centre of gravity;

TPC Tonnes per centimetre immersion;

USK Underside of keel;

WL Waterline

∞ Midships—the mid-length between perpendiculars

Δ Displacement

∇ Volume of displacement

θ The angle of heel of the ship;

θ_f The 'actual' angle of down-flooding;

θ_p The 'potential' angle of flooding; and

θ_{max} The angle of heel at which the righting lever is a maximum.

1.3 Information to be furnished

The information must be:

(a) complete and accurate so that all necessary information is available for working out any loading condition for the vessel and for ensuring that the resulting stability meets all the minimal requirements of the International Maritime Organization or other appropriate criteria;

(b) in a standard form so that personnel moving from ship to ship, or the shore-based personnel concerned with loading different ships, will find the stability data of each ship laid out in a similar way; and

(c) plainly expressed and fully explained in order that all concerned with stability calculations can use the information confidently and accurately.

Note: *Ships that are required to have a Loading Manual may combine the Stability Book with the Loading Manual. The Chief Marine Surveyor will, however, only approve the combined manual from the trim and stability aspects. Information not related to trim and stability, or to loading and longitudinal strength, should be excluded from the book or books.*

2 Format of the stability book

2.1 A stability book may be in more than one volume, and should have:

(a) a durable cover and secure binding;

(b) a contents list, enabling information to be quickly found;

(c) each page numbered consecutively;

(d) general information relating to stability;

(e) specific information relating to the ship, including a statement of the intended trade of the ship for which the stability book was prepared and the stability criteria to be complied with by the ship and, in particular, information relating to peculiarities of the ship which warrant special consideration;

(f) instructions on how to carry out both a simplified stability assessment, where applicable, and a detailed stability assessment;

(g) a sample stability calculation, both using the simplified method, if applicable, and the detailed method;

(h) the following information placed at the back of the book:

(i) tank layout diagrams;

(ii) tank summary tables;

(iii) tank calibration curves or tables;

(iv) cargo space diagrams;

(v) cargo space calibration curves or tables;

(vi) store space volumes and centres of gravity;

(vii) crew and effects, weights and centres of gravity;

(viii) hydrostatic curves or tables; and

(ix) KN curves or tables; and

(x) inclining experiment or lightship measurement report.

(i) the date of its preparation and latest amendment shown on the front cover, together with the name of the person or organization preparing the book; and

(j) a list of standard abbreviations and symbols in accordance with 1.2.

Note: *Where the lightship measurement report is included in the Stability Book, there must also be included the inclining experiment report for the sister ship on which the light ship measurement is based.*

3 Particulars of ship

3.1 Data to be included

The following particulars of a ship must be listed in the stability book immediately following the contents list:

(a) name, IMO number, builder's yard number, date keel laid and official number;

(b) length between perpendiculars, moulded breadth and moulded depth;

(c) assigned summer freeboard and by whom assigned;

(d) draft at the longitudinal centre of flotation at level trim corresponding to the assigned summer freeboard, and the displacement or deadweight at that draft;

(e) minimum bow height as calculated in the load line computation and the corresponding maximum forward draft, and the minimum stern height as calculated in accordance with 6.4 and the corresponding maximum after draft;

(f) position of the baseline;

(g) the datums for the forward and aft draft marks;

(h) the sill or coaming of the opening on or above the freeboard deck that first reaches water level as the ship heels, through which progressive down-flooding can occur;

(i) the weights and centres of gravity of any solid ballast fitted or stowed in the ship; and

(j) where a tank-type roll stabilizer is fitted, a copy of the stabilizer operating manual.

3.2 Draft Marks Datums

3.2.1 For ships without a rake of keel, the datum is the line of the underside of the keel (USK).

3.2.2 For ships with a rake of keel, the datum for the forward draft marks is a line parallel to the designed load waterline passing through the cut-up point forward, and the datum for the aft draft marks is the lowest point of the keel, skeg, rudder or propeller.

3.3 Baseline

For all ships, the baseline is the line parallel to the designed load waterline passing through the datum for the aft draft marks.

4 Frame spacing, draft mark and load line diagrams

4.1 Profile sketch

A profile sketch of the ship must be provided. The diagram must include the following particulars:

(a) frame spacing for the full length of the ship;

(b) the position of the midships and the forward and aft perpendiculars relative to the nearest frames;

(c) the baseline;

(d) for ships with a rake of keel, all dimensions required to relate the line of the underside of the keel to the baseline;

(e) the positions of the forward and aft draft marks relative to the forward and aft perpendiculars respectively;

(f) where vessels are designed with a rake of keel, the position of the forward draft mark datum line must be shown and dimensioned; and

(g) the fore and aft location of the loadline mark.

4.2 Midships

The midships referred to in 4.1*(b)* is at the mid-length between the perpendiculars and the resulting half-lengths must be dimensioned.

4.3 Aft draft marks

Where the aft draft marks referred to in 4.1*(e)* are 'stepped', each set of marks must be dimensioned from the aft perpendicular, and the range of drafts indicated by each set of marks must be listed

4.4 Forward draft marks

Where the forward draft marks follow the line of a raked stem, the sketch required by 4.1 must be followed by a table giving the distances of each forward draft mark from the forward perpendicular.

4.5 Draft mark datum

In the case of a ship with a rake of keel, the table required by 4.1 must include the distance of each original draft mark datum above the baseline.

4.6 Loadline diagram

A diagram must be provided showing the assigned loadlines, and loadline mark, together with details of the distances from nearby salient points of the ship, including the midships point, so as to provide ready means of checking the marks and establishing their datum points.

5 Immersion angle diagram

5.1 Provision of immersion angle diagram

A immersion angle diagram must be provided following the diagrams and information required by 4.

5.2 Information to be included in immersion angle diagram

5.2.1 The immersion angle diagram must be an outline of the section of the ship at midships showing the following information:

(a) the moulded depth;

(b) the thickness of the deck stringer plate at side;

(c) the thickness of the plate keel or the depth of the bar keel;

(d) for ships designed with a rake of keel, the distance of the underside of the keel above the baseline at midships;

(e) the waterline corresponding to the assigned freeboard, the dimensions of assigned freeboard, total depth and load draft;

Note: *Where the depth of a ship above baseline varies between midships and the longitudinal position of the load line disc, details of the variation should be shown with this diagram.*

(f) the line drawn to the deck edge from the intersection of the waterline referred to in 5.2.1*(e)* with the centreline and the dimensions required for the calculation of the deck edge immersion angle;

(g) the dimensions of the position of the outboard edge of the lowest sill through which down-flooding can occur, measured horizontally from the centreline and vertically above the base plane;

(h) the angle of down-flooding calculated from the dimensions required by 5.2.1*(g)*;

(i) the dimensions of the position of the outboard edge of the sill of the lowest opening fitted with a weathertight closing appliance, through which down-flooding can occur if the closing appliance is not secured, horizontally from the centreline and vertically above the base plane; and

(j) the potential angle of flooding calculated from the dimensions required by 5.2.1*(i)*.

5.2.2 The angle of flooding, and potential angle of flooding, are to be tabulated or graphed for the summer freeboard even keel condition, and also for a range of trims which the ship could reasonably attain in practice. Where a ship is fitted with bow or stern doors, the trim at which the potential angle of flooding is zero is also to be tabulated or graphed against draft.

6 Loading information

6.1 Information to be included in stability book

6.1.1 The information specified in the Model Stability Book must be included in the stability book of a ship, where relevant to that ship, under the heading '**INFORMATION FOR THE MASTER AND PERSONS RESPONSIBLE FOR LOADING THE SHIP**', commencing on the page immediately following the immersion angle diagram and information.

Note: *An electronic copy of the Model Stability Book is available from AMSA.*

6.1.2 The following instructions are expressed in general terms, because they must cover all ships but the information included in the stability book of a ship must specifically refer to that ship: for example, under 'angle of flooding', the openings concerned must be positively identified and under 'stability criteria' the criteria listed must be those to which the particular ship is subject.

6.2 Stability Criteria—all ships

6.2.1 The IMO Stability Criteria specified in 6.2.2 are to be complied with by all ships unless provided otherwise.

6.2.2 In all conditions of loading, the following criteria are to be met:

(a) the area under the righting lever curve is to be not less than 3.15 metre-degrees between the 0 and 30 degree angles of heel;

(b) the area under the righting lever curve is to be not less than 5.16 metre-degrees between the 0 and 40 degree angles of heel, or 0 degrees and the angle of flooding, if this is less than 40 degrees;

(c) the area under the righting lever curve is to be not less than 1.72 metre-degrees between the 30 and 40 degree angles of heel, or 30 degrees and the angle of flooding, if this is less than 40 degrees;

(d) the righting lever ordinate is to be at least 0.20 metres at an angle of heel equal to or greater than 30 degrees;

(e) the maximum righting lever ordinate is to occur at an angel of heel preferably exceeding 30 degrees, but not less than 25 degrees; and

(f) the initial metacentric height, corrected for free surface, must be not less than 0.15 metres for cargo ships, passenger ships and tugs, and 0.35 metres for fishing vessels.

6.2.3 The IMO Stability Criteria are varied as follows:

(a) additionally, passenger ships must comply with the IMO "Severe wind and rolling criterion" specified in 3.2 of the IS Code;

(b) additionally, passenger ships must have stability such that neither the angle of heel due to crowding of passengers to one side, nor the angle of heel due to turning, exceeds 10°;

(c) ships carrying bulk grain must comply with the stability criteria specified in A7, A8 or A9 of the International Code for the Safe Carriage of Grain in Bulk, as appropriate;

(d) sailing vessels must comply with the criteria specified in 8.C.12 of the USL Code;

(e) mobile offshore drilling units must comply with the stability criteria specified in 4.6 of the IS Code;

(f) pontoons must comply with the stability criteria specified in 4.7 of the IS Code;

(g) Dynamically Supported Craft must comply with the stability criteria specified in 4.8 of the IS Code and High Speed Craft must comply with the stability criteria specified in the International Code of Safety for High Speed Craft;

(h) the Chief Marine Surveyor may require fishing vessels of 45 metres in length and over, and high side cargo ships, such as car carriers, to comply with the IMO "Severe wind and rolling criterion" specified in 3.2 of the IS Code;

(i) Off shore supply vessels may comply with the following requirements, if they cannot comply with those of 6.2.1:

(i) the maximum righting lever must be at least 0.20 metres and must occur at an angle of heel not less than 15°;

(ii) the GM must be not less than 0.15 metres;

(iii) where the maximum righting lever occurs at 15° the area under the righting lever curve must be not less than 4.01 metre-degrees;

(iv) where the maximum righting lever occurs at angles between 15° and 30° the area under the righting lever curve must be not less than $3.15 + 0.0573(30 - \theta_{max})$ metre-degrees;

(v) where the maximum righting lever occurs at 30° or more the area under the righting lever curve must be not less than 3.15 metre-degrees;

(vi) the area under the righting lever curve between 30° and 40°, or between 30° and θ_f if θ_f is less than 40°, must be not less than 1.72 metre-degrees;

(j) The Chief Marine Surveyor may permit special purpose ships of less than 100 metres in length, which have a similar form to off shore supply vessels, to comply with the criteria for off shore supply vessels as specified above;

(k) the Chief Marine Surveyor may permit landing barge type ships to comply with the criteria for offshore supply vessels, except that where the maximum righting lever occurs at 15° the area under the righting lever curve must be not less than 6.28 metre-degrees, and where the maximum righting lever occurs at 20° the area under the righting lever curve must be not less than 4.30 metre-degrees. Where the maximum righting lever occurs between 15 and 20, or 20 and 30 degrees, the area under the righting lever curve must be not less than the area found by interpolating between the areas required at 15, 20 or 30 degrees, as appropriate.

(l) the Chief Marine Surveyor may permit a ship carrying a timber deck cargo to comply with the requirements of 4.1 of the IS Code in place of those of 6.2.1;

(m) The Chief Marine Surveyor may permit container ships of length greater than 100 metres to comply with the stability criteria specified in 4.9 of the IS Code.

6.3 Openings

6.3.1 All openings on or above the freeboard deck must be investigated to determine which of them will cause down-flooding.

6.3.2 Where the openings on or above the freeboard deck, through which down-flooding can occur, have weathertight closing appliances which can be kept closed and secured at all times while the ship is under way, it must be determined which openings will immerse at an angle of heel of 40 degrees or less in any loading condition. Each such opening must have a notice posted adjacent to it, to the following effect:

'THIS [DOOR] [HATCH] IS TO BE KEPT CLOSED AND SECURED AT ALL TIMES WHEN THE SHIP IS UNDER WAY, EXCEPT THAT IN LIGHT OR MODERATE WEATHER, THIS [DOOR] [HATCH] MAY BE USED FOR ACCESS ESSENTIAL TO THE WORKING OF THE SHIP PROVIDED IT IS THEN IMMEDIATELY CLOSED AND SECURED.'

The angle of immersion of the first such sill to reach water level as the ship heels must be plotted on the transverse righting lever curve and marked as the angle of potential flooding.

6.3.3 Where an opening on or above the freeboard deck, through which down-flooding can occur, has either a weathertight closing appliance which cannot be kept closed and secured when the vessel is under way, (for example an engine room air supply trunk), or has no weathertight closing appliance, the angle of immersion of the lower sill of that opening having the least angle of immersion must be determined. This is the 'actual' angle of flooding.

6.3.4 If the angle of flooding referred to in 6.3.3 is less than the apparent range of the righting lever curve of any loading condition, this angle of flooding will be deemed to be the range of the righting lever curve and the righting lever curve to terminate at this angle.

> ***Note:*** *The method of calculation of the angle of flooding and the potential angle of flooding is shown in the Model Stability Book. This method assumes that the ship heels about the intersection of the centreline and the water level. More accurate methods are acceptable.*

6.4 Minimum freeboard at stern

6.4.1 The stern door of a stern door vessel is subject to heavy loading from wave action. To keep this within acceptable limits, the minimum freeboard at the stern door must not be less than $0.006L_{BP}$ in all seagoing conditions.

6.4.2 The after deck of an offshore supply or similar vessel is subject to frequent flooding, which has an adverse effect on her stability. To keep this within acceptable limits, the minimum freeboard at the stern must be not less than $0.005L_{BP}$ in all seagoing conditions.

6.4.3 The Chief Marine Surveyor may require a minimum stern freeboard for any other vessel if that officer considers it necessary in the interests of safety.

6.5 Stability book to be kept on ship

A copy of the stability book approved and endorsed by the Chief Marine Surveyor must be kept on board the ship to which it relates.

7 Information and calculations to be presented

7.1 Inclining experiment report

7.1.1 A complete inclining experiment report for a ship must be presented for approval of the Stability Book. A copy is to be located at the back of the book.

7.1.2 If the Chief Marine Surveyor has permitted an inclining experiment to be not performed on a ship, her stability book must include the lightship measurement report for the subject ship, the inclining experiment report for the sister ship on which her stability data is based and a table showing the measured displacement and longitudinal centres of gravity of the subject ship and the sister ship.

7.2 Loading conditions to be presented

7.2.1 All loading conditions must include free surface effects for all tanks expected to be slack, or become slack, during the voyage.

> ***Note 1:*** *Some tanks, even if pressed up at the time of departure, will become slack due to usage after a short time under way.*
>
> ***Note 2:*** *Where any tank is not situated on the ship's centreline, allowance is to be made for free surface effects for tanks used to compensate for heeling moments induced by consumption of fuel or water.*

Note 3: *Where more than one type of fuel is used on a ship, such as light fuel oil for auxiliary generators, and heavy fuel oil for main engines, arrival and departure conditions must take account of at least one tank of each being slack.*

7.2.2 Arrival conditions are to include quantities of fuel, fresh water and consumable stores corresponding to 10 per cent of the quantities at departure.

7.2.3 The maximum free surface moment must be provided for each tank, and used for all calculations involving slack tanks. However, where the surface area of the liquid in a tank markedly varies with quantity, and the tank is not likely to be used during a voyage (as is the case of a ballast tank with double bottom and wing tank sections) a maximum free surface moment must be provided for each range of soundings or ullages.

7.2.4 Where a cargo space is fitted with a fixed pressure water-spraying system, information is to be provided about the effects on the ship's stability arising from:

(a) the mass of water accumulated on each deck; and

(b) its free surface,

assuming that the fixed pressure water-spraying system operates for one hour without water being discharged overboard by scuppers or pumping, or pumping or drainage of water to holding tanks.

7.2.5 The loading conditions presented for **a cargo ship** must include conditions typical of the service in which the vessel is to engage. The conditions presented must include at least the following:

(a) lightship condition;

(b) ballast:

(i) departure condition; and

(ii) arrival condition

(c) homogeneous load:

(i) departure condition, carrying a homogeneous load which fills all enclosed cargo spaces and which, with full fuel, fresh water and stores, brings the ship to a draft corresponding to the assigned summer freeboard;

Note 1: *In the case of a ship carrying containers the homogeneous load must comprise the maximum number of containers that the ship is designed to carry, all containers being of such equal weight that, with full fuel, fresh water and stores, the ship is on a draft corresponding to the assigned summer freeboard.*

Note 2: *A homogeneous cargo condition is not required to be presented for offshore supply vessels.*

(ii) arrival condition, having a load in accordance with *(i)*; and

(iii) if the stability of the ship corresponding to conditions *(i)* or *(ii)* does not meet the criteria defined in 6.2, or a more rigorous condition required by the type of ship or her service, a modified homogeneous condition or conditions such that the stability of the ship, with liquid ballast added, meets the criteria in 6.2. In such a case:

(A) attention must be drawn to the need for liquid ballast in that loading condition in the stability book; and

(B) each of the homogeneous load conditions in which the ship does not meet the stability criteria must be included in its stability book, clearly marked with the notation:

"**THIS CONDITION MUST NOT BE USED: IT DOES NOT MEET THE SPECIFIED STABILITY CRITERIA AND IS FOR REFERENCE ONLY**";

(d) loaded with cargoes typical of the intended service:

(i) departure condition; and

(ii) arrival condition: and

Note 1: *Where the ship is to carry bulk cargoes that do not completely fill the hold, the KG of the cargo must be corrected for the 'piling' effect of the cargo.*

Note 2: *Where the ship is loaded with cargoes typical of the intended service, at least one condition must be presented where the ship is laden to her summer freeboard.*

(e) loaded to include, where applicable, the maximum deck cargo likely to be carried on:

(i) departure condition; and

(ii) arrival condition.

Note: *Where a ship has peculiarities that could affect her docking, a reference should be made in the Stability Book to the effect that such peculiarities should be shown in the Docking Plan.*

7.2.6 The loading conditions presented for **a passenger ship** must include conditions typical of the service in which the ship is to engage. The conditions presented must include at least the following:

(a) lightship;

(b) ballast condition without passengers and baggage:

(i) departure; and

(ii) arrival;

(c) loaded with the maximum number of passengers for which the vessel is certified, with their baggage, and carrying cargo as defined in 7.2.5*(c)*. A weight of 75 kilograms per passenger should be assumed. The height of the centre of gravity of the passengers should be assumed to be one metre above deck level for passengers standing upright, and 0.3 metres above the top of the seat for seated passengers. In determining the passenger and baggage distribution, it must be assumed that all the spaces set aside for their use are occupied:

(i) departure condition; and

(ii) arrival condition;

(d) a loading condition appropriate for each subdivision loadline for which the ship is certified, with the maximum number of passengers permissible in that subdivision condition. The condition is to be given for both departure and arrival conditions, with the same assumptions as in *(c)* above; and

(e) a loading condition with full passengers, but no cargo, in departure and arrival conditions.

7.2.7 The loading conditions presented for **a tug** must include conditions typical of the service in which the tug is to engage. The conditions presented must include at least the following:

(a) lightship;

(b) service conditions having fuel, fresh water and consumable stores corresponding to:

(i) full quantity;

(ii) 50 per cent of full quantity;

(iii) 10 per cent of full quantity;

(c) loaded to summer freeboard. Where tugs are unable to attain their maximum summer draft by filling all tanks and store spaces, the condition presented must correspond to the maximum service draft. However, where a tug is designed to carry additional towage, salvage or other equipment and stores on deck, the conditions presented must include one with all such equipment and stores as is permitted, together with sufficient fuel, water and stores as will load her to her summer freeboard; and

(d) the heeling level curves resulting from the worst combination of towline forces, together with a sample calculation showing that the stability meets the minimum criteria specified in 6.

7.2.8 The loading conditions presented for **an offshore supply vessel** must include conditions typical of the service in which the vessel is to engage. The conditions presented must include at least the following:

(a) lightship;

(b) loaded:

(i) departure;

(ii) arrival; and

(c) departure and arrival condition loadings corresponding to as many of the following as are relevant to the service or the intended service, of the vessel:

(i) maximum pipe cargo;

(ii) maximum liquid cargo;

(iii) anchor handling; and

(iv) towing.

Where the loadings specified in 7.2.8*(c)(iii)* and *(iv*) are relevant to the service of an offshore supply vessel the corresponding heeling lever curves must be shown, together with a sample calculation showing that the stability meets the minimum criteria specified in 6.

7.2.9 The loading conditions presented for **a fishing vessel** must include conditions typical of the service in which the vessel is to engage. The conditions presented must include at least the following:

(a) lightship;

(b) departure for fishing grounds:

(i) with full fuel, fresh water, stores, ice and bait. Brine tanks normally full at departure must be included; and

(ii) where near grounds are to be fished, quantities of fuel, fresh water, stores, ice, bait and brine acceptable to Chief Marine Surveyor;

(c) fishing condition. Where vessels fish with heavy gear suspended from booms or an A-frame, the fishing condition presented must be that which corresponds to the most critical stability. The point of application of the load from the fishing gear plus full catch is the boom head or A-frame, and the load must be applied at this position when calculating KG for the fishing condition:

(d) snagged net condition. For the fishing condition as is *(c)*, a vertical load must be applied to the boom head, equivalent to the breaking strength of the weakest component of the fishing gear. This load at the boom head must be used to calculate the KG for this condition. The resulting heeling effect must be applied to the righting lever curve as a heeling lever curve;

(e) stalled trawl winch condition. For the fishing condition as is *(c)*, the full pull of the stalled trawl winch must be applied as a vertical load to the boom head. This pull must be added to the displacement, and the resulting heeling effect must be applied to the righting lever curve as a heeling lever curve;

(f) departure from the fishing grounds with the appropriate quantities of fuel, fresh water and stores remaining, together with:

(i) full catch; and

(ii) 20 per cent of full catch;

(g) departure and arrival from the fishing grounds with full catch and 90% fuel, water and stores; and

(h) arrival together with:

(i) full catch; and

(ii) 20 per cent of full catch.

7.2.10 The loading conditions presented for **a dredger or a ship with bottom opening doors** must include conditions typical of the service in which the ship is to engage. The conditions presented must include at least the following:

(a) lightship;

(b) for delivery or transfer voyages, both with hopper doors open and closed, with appropriate ballasting:

(i) departure condition;

(ii) arrival condition; and

(c) where the operations of the ship are such that the voyages are under the jurisdiction of the Navigation Act, or where the ship is declared to be one to which the Act applies, typical conditions loaded with spoil of densities appropriate to the service. These conditions must be for each spoil density, taking account of:

(i) full quantities of fuel, fresh water and stores; and

(ii) 10 per cent of full quantities of fuel, fresh water and stores.

Note: *The righting lever curves should be calculated on the basis of the spoil remaining solid, or the spoil overflowing and being replaced by sea water when the hatch coaming is immersed, whichever is more detrimental to stability.*

7.2.11 The loading conditions presented for **a ship undertaking a delivery or transfer voyage** must include conditions typical of the service in which the ship is to engage. The conditions presented must include at least the following:

(a) lightship; and

(b) departure and arrival conditions for the voyage, with appropriate ballasting.

7.2.12 The Stability Book must include guidance to the Master on:

(a) avoiding dangerous situations in following and quartering seas, based on IMO MSC Circular 707; and

(b) in the case of a tanker, maintaining stability during loading and unloading, based on IMO MSC Circular 706.

Note: *Where a port authority requires the main engines of a tanker to be ready for operation during load and unloading, the stability of the tanker is to be maintained in the sea-going condition.*

7.2.13 The Stability Book of a ship that is intended to proceed into areas where icing is a possibility must include guidance to the Master on the effect on stability of icing, in accordance with Chapter 5 of the IS Code. At least one arrival or departure conditions must be provided showing the effects of ice accretion in accordance with 5.3.1 of the IS Code, and at a level twice that specified in 5.3.1 of the IS Code. Such condition is to be that where the area under the righting lever curve is least. In

addition, if such condition is not that where the range of stability is least, the effects must also be shown on the arrival or departure condition with the smallest range of stability.

7.3 Worked example

One loading condition, preferably a full load service condition, but not a homogeneous condition, must be worked out in detail for the guidance of the ship's personnel and other users of the stability data. It is to be presented in the manner of the '*Standard layout for the calculation of a loading condition*', as defined in 11, and must follow the loading conditions in the stability book as defined in 7.2.

8 Loading condition calculations

8.1 Required layout

The calculations for every loading condition in a ship's stability book must:

(a) be set out in accordance with Table 3; and

(b) use the following reference planes:

(i) for vertical measurements—the baseline; and

(ii) for longitudinal measurements—the aft perpendicular.

Note: *The Chief Marine Surveyor may permit the use of midships as the reference point but, irrespective of the location of the reference point, the same position must be used for all hydrostatic curves and loading calculations and conditions.*

8.2 Rounding of measurements and calculations

8.2.1 Measurements and calculations for ships must be rounded as follows:

(a) linear measurements are to be rounded to the nearest 0.01 metre;

(b) masses are to be rounded to the nearest 0.1 tonne;

(c) for ships over 2,000 tonnes and up to and including 20,000 tonnes full load displacement, moments may be rounded to the nearest tonne-metre; and

(d) for ships over 20,000 tonnes full load displacement, moments may be rounded to the nearest 5 tonne-metres.

8.2.2 If the above rounding standards are considered inappropriate for any ship for which stability data is to be prepared, assumptions and supporting calculations

justifying a different rounding standard are to be submitted to the Chief Marine Surveyor before preparation of the stability data. Such a proposal, when accepted in writing by the Chief Marine Surveyor, becomes the rounding standard for the stability data of that particular ship.

8.3 KG, Free Surface and Metacentric Height (GM)

8.3.1 The KG used for all determinations of stability must include the effects of free surface moments for all tanks that are liable to be slack in the particular condition considered. That is, the KG, in metres, is equal to the KG as determined from the mass of the ship and all items aboard her, plus the free surface correction, being the increase due to all tanks which are, or are considered to be, slack.

8.3.2 The metacentric height of a ship is calculated by subtracting the KG, as determined above, from the KM, the height in metres of the initial transverse metacentre of the ship above the baseline. The KM is obtained from the hydrostatic tables of the ship.

8.4 Variable free surface correction

The free surface moment may be calculated using any method acceptable to the Chief Marine Surveyor.

8.5 Righting lever curve (GZ curve)

8.5.1 The GZ curve must be plotted for each loading condition of a ship. It must be drawn over its full positive range, or up to the angle of flooding.

8.5.2 The scales chosen for a righting lever curve must be in accordance with 8.6. The same scales must be used for all GZ curves in the stability book.

8.5.3 The following must be shown on each GZ curve:

(a) GM.θ line (θ measured in radians);

(b) the immersion angle of the deck edge;

(c) the potential angle of flooding θp; and

(d) the actual angle of flooding θf.

8.5.4 Where appropriate, the following must be plotted on the GZ curves:

(a) for tugs and all other ships engaged in towing, the tow rope heeling lever curve;

(b) for passenger ships, container ships, and all other ships with large windage areas, and ships carrying sail, the wind pressure heeling lever curve;

(c) for fishing vessels in the fishing condition with full catch, the snagged fishing gear or the stalled trawl winch heeling lever curve, whichever is the more severe; and

(d) for salvage ships and service ships making lifts at sea, a stalled winch heeling lever curve for the most unfavourable possible lifting condition.

8.5.5 A table for comparing the values obtained from the GZ curve with those required by the criteria must be provided.

8.5.6 Where areas under the GZ curve for stated heel angle ranges are required to be calculated, the result must be rounded to the nearest 0.01 metre-degree.

8.5.7 Other information required by the criteria must be lifted off the GZ curve.

8.6 Scales for righting lever curves

When curves are used for plotting GZ, KN, hydrostatic, tank calibration, sill and deck edge immersion data, all curves must be to standard engineering scales.

9 Simplified presentation of stability

9.1 Purpose

9.1.1 Simplified stability data is much simpler in concept than full stability data. Masters and others responsible for loading a vessel have less difficulty in using such data when compared to undertaking a full stability analysis. This is particularly so where damage stability compliance is required.

9.1.2 Simplified stability data involves the development of limiting KG or maximum allowable deadweight moment curves or tables for various displacements or drafts and trims of a vessel. For a specific loading condition, the Master or other person responsible for loading a vessel calculates the KG and longitudinal centre of gravity (or deadweight moment) of the vessel including the full effects of free surface. To meet the minimum stability criteria, the calculated figure must be less than the limiting KG or deadweight moment specified in the simplified stability data for the vessel. This obviates the need to undertake a full analysis, for that particular loading condition, using the applicable stability criteria.

9.1.3 Alternatively, simplified stability data may use the 'Limiting GM' in place of 'Limiting KG', and 9.2 to 9.5 should be interpreted accordingly.

9.2 Application

9.2.1 In the case of a vessel of 24 metres in length and above the simplified presentation is to be provided on board in addition to the presentation of data specified elsewhere in this appendix.

9.2.2 In the case of vessels of 6 metres in length and above, but less than 24 metres, the simplified presentation is to be provided on board. The Chief Marine Surveyor may permit the information specified in 13 *(hydrostatic information to be provided)* & 14 *(cross curves of stability),* together with the method of calculating the righting lever curves as shown in the Model Stability Book, to be omitted from the ship's Stability Book, provided that sufficient information is included to guide the Master in calculating the ship's stability.

9.3 Format of Simplified Stability Data

9.3.1 The data must include:

(a) the maximum vertical centre of gravity corrected for free surface moments (KG), or maximum allowable deadweight moment, based on the applicable stability criteria for the type of vessel and nature of operation, graphed or tabulated against displacement or draft, for level trim and for other trims covering the full operational trim range of the vessel. The operationally unacceptable area should be clearly marked 'UNSAFE';

> ***Note:*** *If the simplified stability data is graphed, a large scale should be used to avoid errors in plotting and interpretation.*

(b) a table of draft versus displacement;

(c) a sample calculation showing use of the simplified stability data, including treatment of free surface effect; and

(d) information for the various section of the limiting loading curves, showing which is the limiting criterion for that section of the curve.

9.3.2 Where a ship is, in service, normally subjected to transverse heeling moments, such as tugs, sailing vessels, high sided vessels, passenger ships and fishing vessels, the simplified presentation must take the relevant heeling moments into account.

9.3.3 The presentation must state that exact compliance with the criteria gives no margin to allow for changes during the voyage.

9.4 Method of calculation

9.4.1 The information on limiting stability characteristics must be based on all the applicable stability criteria including damage stability criteria, where applicable.

> ***Note:*** *Limiting KG values which include the impact of damage stability requirements may appear to be conservative compared with the comprehensive intact stability assessment.*

9.4.2 The cross curves of stability on which the limiting KG data is derived must be based on the free trimming method of calculation.

9.4.3 The effect of free surface in tanks is to be taken into account.

9.5 Submission of simplified presentation of stability

9.5.1 The simplified presentation must be submitted to AMSA for approval.

9.5.2 For all vessels of 6 metres or more length, the submission must be accompanied by full information as to the stability characteristics and form of the vessel to enable the authority to approve the accuracy and acceptability of the simplified presentation and to determine if a full stability presentation is required.

9.5.3 Such information must include a lines and general arrangement plan, hydrostatic curves, cross curves of stability, capacity information, free surface corrections and an inclining experiment report and must demonstrate compliance with the applicable stability criteria.

9.5.4 The submission is to indicate, for each area above the line of limiting stability, which criterion is not met.

10 Submission of stability data for approval

10.1 Submission of completed data

10.1.1 Two copies of the completed stability data must be submitted to AMSA Head Office as soon as practicable after the inclining experiment has been performed.

Note: *The inclining experiment report and a lines plan may be submitted for examination as soon as it is available. Loading conditions in the stability book may then be calculated on the basis of agreed lightship particulars.*

10.2 Information to be furnished

The submission of stability data must be accompanied by:

(a) the latest general arrangement plan available; and

(b) a lines plan.

10.3 Ships undertaking inter-State or overseas delivery or transfer voyages

10.3.1 Where a ship, which has not been surveyed in accordance with Part IV of the Navigation Act, is to undertake a delivery or transfer voyage without the carriage of cargo or passengers or is being towed, the stability data is to be to the satisfaction of the Chief Marine Surveyor or a survey authority.

10.3.2 The stability data of ships undertaking delivery or transfer voyages other than ships referred to in 10.3.1 must be submitted to the Chief Marine Surveyor.

Note: *Approval will be facilitated if the initial submission is fully documented, is complete and complies with this Appendix.*

10.4 Amendments

If amendment is necessary, a further submission will be required. All submissions and re-submissions must be dated.

10.5 Graphs and curves

In all graphs and curves, the grid is to be distinct, so that the values can be read off without the use of scale rules.

11 Standard layout for the calculation of a loading condition

11.1 Format of calculation

A table such as Table 1 is a convenient format for a standard layout for the calculation of a loading condition, and is to be used unless the Chief Marine Surveyor allows the use of an alternative table.

Note 1: *The loading calculation layout which follows is for a ship designed without a rake of keel. Where the loading condition applies to a ship with a rake of keel, certain sections of the calculations will need to be modified accordingly.*

Note 2: *One or more blank loading condition calculation sheets are included adjacent to the worked example in the stability book for the use of ship's officers.*

Note 3: *It is strongly recommended that owners provide a stability calculation computer program approved by the ship's classification society. Computers should be capable of calculations giving answers consistent with the standard loading conditions, and the worked example. The program should be capable of working direct from the ship's lines plan, or otherwise, to give accurate results for any likely trim or angle of heel. Printers should be capable of providing scale drawings sufficiently accurate to enable areas under the righting levers to be compared with those obtained by program calculations.*

12 Tank, cargo space and store space information to be provided

12.1 Tank information

12.1.1 The identification of each tank in a ship must correspond with the operating valve name plates and to the tank piping plan on the ship and must be used throughout the stability data.

12.1.2 A summary table of the particulars of each tank in a ship must be provided which lists the following information:

(a) the tank name and/or number, and the position with reference to frame numbers;

(b) the contents for which the calibration has been prepared;

(c) the capacity when full or 98% full, as appropriate;

(d) the vertical distance of the centre of gravity of the contents above the baseline when the tank is full;

(e) the longitudinal and transverse distance of the centre of gravity of the contents from the after perpendicular and the centre line, respectively: and

(f) the maximum free surface moment.

12.1.3 A plan and elevation showing the physical positions of all the tanks in the ship must be provided.

Table 1

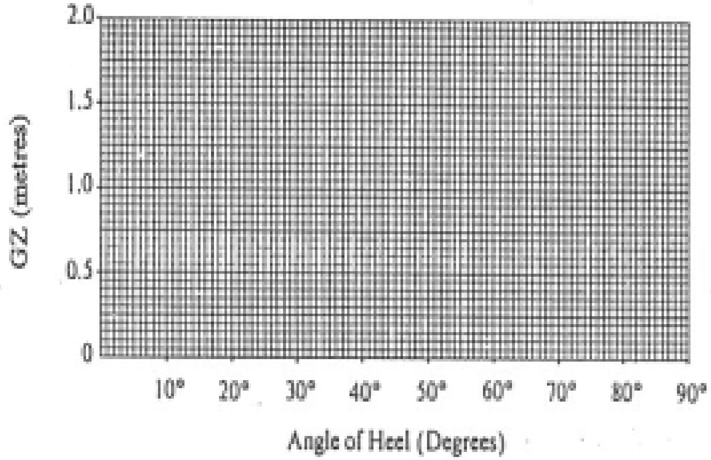
NAME OF SHIP						
CONDITION No.	Description					
ITEM	*Mass (tonnes)*	*KG (metres)*	*Vertical Moment about Baseline (tonne-metres)*	*LCG from AP*	*Moments Forward +ve*	*Free surface moment (tonne-metres)*
Sum of Deadweight, Vertical Moments and Longitudinal Moments						
Light ship details						
Totals	A		B		C	D

Trim		*Draft*	*(metres)*
Length Between Perpendiculars (metres)		Draft LCF above Baseline	
LCB from After Perpendicular (metres)		Forward Draft Mark Datum above Baseline	
MCT (tonne-metres/cm)		Draft at Forward Marks	
LCF from After Perpendicular (metres)		Draft at Aft Marks	
Trim by Bow/Stern (metres)			

Loaded Vertical Centre of Gravity = B/A =	
Free Surface Correction = D/A =	
KG = B/A + D/A =	
KM =	
GM = KM - KG =	
Net Longitudinal Moment = C/A =	

Righting Levers	GZ = KN - KG.sinθ								
Angle θ	10°	20°	30°	40°	50°	60°	70°	80°	90°
Sin θ	0.1737	0.3420	0.5000	0.6428	0.7660	0.8660	0.9397	0.9848	1.0000
KN (metres)									
KG.sin θ									
GZ (metres)									

GZ Curve



Stability Criteria

Criterion	*IMO Minimum*	*Actual*
Area 0° to 30°	3.15 metre-degrees	
Area 0° to 40° or 0° to θ_f	5.16 metre-degrees	
Area 30° to 40° or 30° to θ_f	1.72 metre-degrees	
Max. GZ at 30° or greater	0.20 metres	
Angle of max. GZ	25° or more	
GM	0.15 metres	

12.1.4 Tank calibration curves or tables must be provided for all tanks exceeding in capacity:

(a) 2 tonnes for ships of 100 tonnes full load displacement or less;

(b) 5 tonnes for ships from 100 to less than 1,000 tonnes full load displacement;

(c) 10 tonnes for ships from 1,000 to less than 20,000 tonnes full load displacement; and

(d) 20 tonnes for ships 20,000 tonnes full load displacement or more.

12.1.5 The calibration curves or tables for each tank must be preceded by:

(a) tank identification and frame reference;

(b) a dimensioned longitudinal section of the tank showing the frame references of the end bulkheads and the position of the sounding pipe, or other sounding or ullage measuring device, referred to the same end bulkhead as that used as reference for the longitudinal centre of area curve of the tank;

(c) the maximum free surface moment for the tank; and

(d) where it is desired to use the method described in 3.3 of the IS Code, all necessary data (including table 3.3.3 of the IS Code) required to apply that method.

Note: *This method is not permitted for ships of less than 60 metres in length or for fishing vessels.*

12.1.6 Curves or tabular values against sounding or ullage readings, with the ship at designed level trim, must be provided and show at least the following:

(a) capacity by volume. Where a tank is primarily intended for use with a liquid of known SG, the corresponding mass of liquid may also be given;

(b) vertical height of the centre of gravity of the contents above the baseline;

(c) longitudinal distance of the centre of gravity of the contents from the after perpendicular;

(d) calibrated corrections to soundings or ullages for list and trim;

(e) the transverse distance of the centre of gravity of the contents from the centre line of the ship.

Note 1: *Free surface moment curves or tables should not be included, as the maximum free surface moment must be used in all loading conditions in which the tank is slack. However, where the surface area of the liquid in a tank markedly varies with quantity, and the tank is not likely to be used during a voyage (as in the case of a ballast tank with both double bottom and wing tank sections) a maximum free surface moment should be provided for each range of soundings or ullages.*

Note 2: *Small engine room tanks which remain substantially full at all times may be listed together, and the characteristics of their total added into items whose total weight remains constant in all loading conditions.*

12.1.7 Where it is proposed to carry water ballast or other fluids in a dry cargo hold, complete information in accordance with 12.1.6 , together with the maximum free surface moments for the liquid to be carried.

12.2 Dry cargo spaces and storeroom information

12.2.1 A summary table of every dry cargo space and storeroom must be provided and must include the following:

(a) the name of the space and the frame reference;

(b) the grain, bale, or store capacities of the space;

(c) the vertical distance of the centre of gravity of the space above the baseline; and

(d) the longitudinal and transverse distance of the centre of gravity of the space from midships.

12.2.2 Where it is proposed to carry bulk cargoes which will not fill the holds, calibration curves or tables for intermediate cargo space depth values must be provided. The volumes and the positions of the centres of gravity must be provided against soundings or ullage readings.

12.2.3 The KG of bulk cargoes which do not fill the holds must be corrected for the 'piling' effect of the cargo.

12.3 Container information

12.3.1 Where containers are to be carried, the centre of gravity of each container must be taken as the centroid of its internal volume.

12.3.2 Tables must be provided which list the vertical, longitudinal and transverse positions of the centre of gravity of every container on board. The position of each container must be designated by letters and/or numbers so that it may be immediately identified in the tables. Where the container stowage is divided into sections, sufficient diagrams must be included, together with frame references, to enable each section to be identified.

12.4 Specialized cargo information

Where specialized cargo is to be carried, all information required in the preparation of the loading conditions must be provided in tables and/or curves, and illustrated with all the diagrams necessary to interpret the information.

13 Hydrostatic information to be provided

13.1 Hydrostatic information

Hydrostatic information must be provided as curves or in tables.

13.2 Required hydrostatic information

The following information must be provided for a range of drafts, at level trim, from the draft at the margin line or one metre above the summer loadline, whichever is the less, to the lightship draft:

(a) total displacement in salt water and in fresh water;

(b) displacement change per unit immersion, in salt and fresh water;

(c) height of the initial transverse metacentre above the baseline;

(d) moment to change trim one unit;

(e) longitudinal centre of buoyancy from the after perpendicular; and

(f) longitudinal centre of flotation from the after perpendicular.

Note: *Displacement change per unit immersion should normally be given in tonnes/cm. Moment to change trim should normally be given in MCT1cm. Vertical centre of buoyancy above the baseline may be included with this information. Distances of LCB and LCF from midships may also be provided.*

Where any of the above data varies with the trim of the ship, additional tables should be provided for a range of trims from 1% of L by the head to 4% of L by the stern.

Alternatively, tables or curves may be provided to enable ready correction of the level trim figures.

13.3 Draft scale

The draft scale must normally be "Draft to the Baseline at the LCF". Alternatively, the scale may be "Draft to the Baseline at Midships" provided that curves or tables are provided to enable ready correction to draft at the LCF. The baseline must be clearly defined and illustrated on a dimensioned sketch included with the hydrostatic information.

13.4 Ease of use of scales

The scales used must be marked on the axes, and must be such that values may be read off the curves easily and accurately over the full working range of the drafts.

13.5 Scale grid

The scale grid must be legible so that values can be read off the curves with reasonable accuracy without applying a scale rule to the curves.

> ***Note:*** *It is preferred that hydrostatic information be provided as tables rather than as curves.*

13.6 Hydrostatic tables

Where hydrostatic tables are provided, they must give the values of the hydrostatic particulars listed in 13.2, at draft intervals of not greater than:

(a) 5 centimetres for ships up 20 000 tonnes full load displacement; and

(b) 10 centimetres for ships over 20 000 tonnes full load displacement.

> ***Note:*** *Where computer printouts are used for the tables they should be calibrated at 1 or 2 cm intervals. Alternatively, calibrations should be at draft intervals of 10 cm, and should show the mean differences for 1 cm change between each calibrated draft.*

13.7 Bottom opening doors

The hydrostatic tables must be calculated for hopper doors both closed and open to the sea.

Note: *The hydrostatic tables may be calculated on the basis of the spoil remaining solid or the spoil overflowing and being replaced by sea water when the hatch coaming is immersed.*

14 Cross curves of stability

14.1 KN presentation

The only cross curve presentation that will be accepted is the KN presentation.

14.2 KN values

KN values must be presented at intervals of 10° angle of heel (free trimming method). Values of KN must be provided at sufficient angles of heel to allow the range of the GZ curves to be determined for all loading conditions. Where the positive range of the GZ curve exceeds 90°, the provision of KN values up to 90° angle of heel will be deemed sufficient.

14.3 Range of KN values

The KN values must be provided to cover the full working range of the ship's displacement from lightship to immersion of the margin line or one metre above summer load waterline, whichever is the less. Values must also be provided to cover the same range of trims for which hydrostatic tables are required to be provided.

14.4 Provision of sketch

A sketch which shows the superstructures, deckhouses and other intact spaces included in the computation of the KN values must be provided with the KN information.

14.5 Hatch trunks and deck houses

Hatch trunks and deck houses which meet weathertight integrity requirements may be included in the KN computations.

14.6 Midship section sketch

A midship section sketch of the ship must be included with the KN information.

14.7 KN information

The KN information must be provided as curves or in tables, plotted against the ship's total displacement.

> ***Note:*** *It is preferred that KN information be provided as tables rather than as curves.*

14.8 KN curves

Where the KN curves are printed, the scale grid must be legible so that the values can be read off without using a scale rule.

14.9 KN tables

Where KN tables are provided, they must give the KN values at displacement intervals of, at most:

(a) 5 tonnes for ships less than 100 tonnes full load displacement;

(b) 10 tonnes for ships from 100 to less than 500 tonnes full load displacement;

(c) 20 tonnes for ships from 500 to less than 1 000 tonnes full load displacement;

(d) 50 tonnes for ships from 1 000 to less than 5 000 tonnes full load displacement;

(e) 100 tonnes for ships from 5 000 to less than 10 000 tonnes full load displacement;

(f) 200 tonnes for ships from 10 000 to less than 20 000 tonnes full load displacement; and

(g) 500 tonnes for ships greater than 20 000 tonnes full load displacement.

14.10 Requirements for calculations of KN information—ships with bottom opening and hopper doors

The KN data must be calculated for hopper doors both closed and open to the sea.

> ***Note:*** *The righting lever data may be calculated on the basis of the spoil remaining solid or the spoil overflowing and being replaced by sea water when the hatch coaming is immersed.*

* * * * * *

Appendix 3

Inclining experiments & lightship measurements

Contents

1 Introduction

1.1 This Appendix specifies the requirements for carrying out inclining experiments and lightship measurements and for the reporting of results for ships that require their stability data to be approved by the Chief Marine Surveyor.

1.2 The object of the inclining experiment is to obtain a ship's lightship displacement and the vertical (VCG), longitudinal (LCG) and transverse (TCG) positions of the centre of gravity. These lightship characteristics are the basis of every loading condition calculated for the ship.

1.3 The object of the lightship measurement is to obtain a ship's lightship displacement and the longitudinal (LCG) and transverse (TCG) positions of the centre of gravity.

1.4 Where the stability data is to be approved by the Chief Marine Surveyor, the inclining experiment or lightship measurement must be witnessed by a surveyor.

2 General

2.1 All readings taken during an inclining experiment or lightship measurement must be measured and recorded in units consistent with the ship's hydrostatic information. All readings and measurements required to complete the calculations must be taken and recorded in the report.

2.2 Where the required standard of accuracy of the inclining experiment or lightship measurement is not achieved, the Chief Marine Surveyor may accept the report on the basis that a lesser value of GM than that measured (or than that of the sister ship, in the case of a lightship measurement) is used to calculate the stability of the ship in each of the conditions in the stability book.

2.3 Any decrease in GM referred to in 2.2 will be determined by the Chief Marine Surveyor on the basis of the accuracy achieved in the inclining experiment or lightship measurement.

2.4 Where the required standard of accuracy is not achieved and the Chief Marine Surveyor does not consider that the application of 2.2 is appropriate, the report will not be accepted. The inclining experiment must be repeated, or an inclining experiment carried out if the lightship measurement is unacceptable.

> ***Note:*** *The calculation of GM at inclining depends on the waterplane of the ship remaining substantially constant as the ship is heeled. Many ships are now being built where this is not so. This is particularly true of ships having chines; if the chines of such a ship cannot be kept immersed throughout the experiment, the waterplane varies dramatically as the ship is heeled. A heeled waterplane calculation will be required under these circumstances.*

2.5 Standard abbreviations and symbols

The abbreviations and symbols used in this Appendix and that are to be standard in any inclining experiment or lightship measurement undertaken after 1 January 1999 are set out in 1.2 of Appendix 2.

3 Dispensation from performing an inclining experiment

3.1 Dispensation from undergoing an inclining experiment may be granted to a ship that is built to the same lines plan and is in all respects similar in construction and outfit to an existing ship which has stability data approved by the Chief Marine Surveyor.

3.2 Application for a dispensation referred to in 3.1 must be made in writing before the ship is completed and must contain a detailed statement of all variations between the subject ship and the similar ship.

3.3 Where a dispensation is granted, a lightship measurement must be carried out on the ship in the presence of a surveyor.

4 Preliminary planning for the inclining experiment

4.1 The date of the inclining experiment must be set for a time when the ship will be complete or close to completion.

4.2 The draft marks must be verified for accuracy by a surveyor or by a survey authority.

4.3 The basic information required for the inclining experiment calculations must be available on the day of the inclining experiment and must include:

(a) hydrostatic curves or a hydrostatic table;

(b) a plan showing the location of the draft marks;

(c) a lines plan;

(d) tank calibration and free surface information;

(e) an up-to-date general arrangement plan; and

(f) if the ship is to be heeled by the movement of liquids, full details of the liquid transfer arrangements and measuring systems as accepted by the Chief Marine Surveyor.

4.4 During the inclining experiment, the ship must be heeled to between 2 and 3 degrees either side of the upright. An estimate of the GM value of the ship at inclining must be made and the weight transfer moment required to produce a 2 degree angle of heel on either side of the upright must be calculated.

4.5 Solid weights may be used to heel the ship where:

(a) suitable weights are available to produce the required weight transfer moment;

(b) crane capacity is available to position the weights; and

(c) the deck has sufficient strength to bear the weights.

4.6 Where solid weights are used to heel the ship, they must be arranged as 4 weights or groups of weights: 2 on the port side and 2 on the starboard side. The total of the weights on the port side must be similar to the total of the weights on the starboard side. No single weight or group of weights on one side of the vessel must have more than twice the mass of the other weight or group of weights on that side.

4.7 Where the heeling moment required to achieve the necessary minimum heeling angle involves the movement of solid weights that are too large to handle, the heeling may be accomplished by the transfer of liquid. Details of arrangements for the transfer of liquids and the recording system to be used should be submitted to the Chief Marine Surveyor for acceptance at least 2 weeks prior to the experiment. When this method is used, strict attention must be paid to the conditions in 4.8 to 4.13.

4.8 The tanks must be fully calibrated over the full range of soundings to be used during the experiment. The weight, transverse, vertical and longitudinal positions of the centre of gravity and the free surface moments of the contents are to be accurately established taking account of the trim and heel of the ship at inclining.

Note: *Rectangular tanks are preferred.*

4.9 The density of the liquid used for the heeling of the ship is to be determined using a hydrometer as specified in 4.15.

4.10 The method used for transferring liquid from one tank to the other must be simple and direct, allowing for the transfer to be accomplished in a reasonable time with minimum leakage. Prior to undertaking the inclining experiment, the transfer system is to be purged to ensure that the system is working satisfactorily.

4.11 A calibrated sight board must be set up in each tank to measure the liquid level.

Note: *The work of calculation is reduced and the accuracy increased where the sight boards are placed at the intersection of the longitudinal and transverse centres of the liquid surfaces. In a rectangular tank, the preferred position of the sight board would thus be at the vertical axis of the tank.*

4.12 Safe access and adequate lighting of the sight boards must be provided to permit accurate liquid level readings to be taken.

4.13 Where it is impossible or impracticable to measure accurately the liquid level in a tank using sight boards, the Chief Marine Surveyor may, on written application, accept the use of sounding tubes for measurement of liquid level.

4.14 A heel angle of less than 2 degrees but not less than one degree may be accepted by the Chief Marine Surveyor.

> ***Note 1:*** *Application for acceptance of the nominated maximum heel angle must be submitted to the Chief Marine Surveyor who will advise the applicant in writing of the result of his request.*
>
> ***Note 2:*** *Large ships with high specific GM values require very large heeling moments.*

4.15 The hydrometer used in the experiment must be the subject of a current certificate of calibration of a standard acceptable to the Chief Marine Surveyor and must have been calibrated not more than:

(a) two years before the date of the experiment in the case of a hydrometer made of metal; and

(b) five years before the date of the experiment in the case of a hydrometer made of glass.

4.16 The ship must be berthed for the experiment in a protected position where it will be afloat throughout the experiment, and not affected by wind, tide and currents. A boat, suitable for use when reading the draft marks, must be available during the inclining experiment.

4.17 The liquids on board must not exceed the amounts required to provide necessary services and essential ballasting. Except by prior approval of the Chief Marine Surveyor in writing, the total weight of liquids on board must not exceed 25 per cent of the lightship displacement.

4.18 The liquids on board must be confined to the minimum number of tanks. If any spaces contain small quantities of liquid, the experiment must not proceed until these spaces have been cleared.

4.19 Measurements from which the angle of heel of the ship may be calculated must be taken at 2 locations on the ship. These locations must be protected from the effect

of wind and weather and must not be closer than 10 per cent of the length of the vessel to the forward perpendicular or aft perpendiculars.

4.20 Measurements may be made by pendulums or other measuring devices.

4.21 Arrangements must be made to keep a permanent record of the measurements from which the heel angle is calculated.

4.22 Where pendulums are used the length of one pendulum must be not less than 1.2 times the length of the other pendulum. Unless authorized in writing by Chief Marine Surveyor prior to the experiment, the effective length of the shorter pendulum must be not less than 0.6 times the moulded depth of the vessel.

4.23 The movement of each pendulum must be damped by immersing the pendulum bob in a trough of liquid.

4.24 A device, other than a pendulum, must not be used unless it has been accepted by the Chief Marine Surveyor in writing. Where a device, other than a pendulum, is to be used, full details of the device, its mode of operation, the means of recording the measurements and evidence as to its accuracy must be submitted to the Chief Marine Surveyor at least 2 weeks prior to the experiment.

Note: *'U' tubes may underestimate the heel of a vessel.*

5 Preparations on the day of the inclining experiment

5.1 Where solid weights are to be used, the 4 weights or groups of weights, as described in 4.6, must be placed on board in their required positions. Weight identifications must be checked against the identification shown on the weighbridge certificates, and their positions on the ship noted.

5.2 Where liquid transfer is to be used to heel the ship, the accepted liquid transfer and recording systems must be set up.

5.3 The organization of the inclining experiment must be such that the person in charge has control over the workforce carrying out the inclining experiment.

5.4 The surveyor must determine if the weather, wind, dock water and tidal conditions are acceptable or not at the beginning the inclining experiment. If the weather conditions become unacceptable during the experiment, it must be discontinued.

Note: *Unacceptable weather conditions include excessive wind or waves, rain and adverse tidal conditions.*

5.5 The following precautions must be observed immediately before beginning the inclining experiment:

(a) all persons not engaged in the inclining experiment must be ashore and the gangway has been taken off or accommodation ladder raised;

(b) the person in charge of the experiment must notify the deck and engineer officers on duty that the inclining experiment is to begin and that no fluid handling of any kind (other than that required for the experiment, if liquid transfer is to be used) may take place throughout the experiment;

(c) the person in charge of the experiment must confirm with the deck and engineer officers on duty that:

(i) all engine room bilges are dry;

(ii) all control valves for heeling and trimming tanks and cross-flooding connections have been securely closed; and

(iii) all pumps not required for essential services have been shut down;

(d) moveable weights, loose gear, shipyard plant and staging, must, where practical, be ashore and those items which must remain on board must be secured against movement;

(e) the ship must be plumbed upright (initial heel angles are within 0.5 degrees of upright);

(f) all persons on board for the performance of the experiment must understand their duties and the set positions they must take up while heel measurements are being taken. Their weights and positions must be recorded for inclusion with the 'dry items off' in Table 1;

(g) the ship must be afloat with all moorings slackened off. The ship must be easily kept clear of the berth while drafts are read and the pendulum readings are being taken;

(h) a sketch of the deck must be prepared that shows the initial positions of the inclining weights and their positions after the movements. The weight movement distances are to be measured and recorded, as the experiment proceeds;

(i) the pendulums or other measuring devices must be free to swing throughout the heeling of the ship. The effective lengths of pendulums are to be measured and recorded;

(j) every part of the ship is to be inspected to sight the items that are to 'come off' the ship to obtain the lightship. The weight of each item is to be estimated, and the position of its centre of gravity established with the help of a general arrangement plan. This information is to be recorded in a table similar to Table 1; and;

(k) 'Items to be shifted' to their correct lightship positions are to be checked, and their particulars entered in a table similar to Table 2.

6 The inclining experiment

6.1 Information to be recorded

6.1.1 All fresh water, fuel, lubricating oil, water ballast and cargo tanks, and bilges and drain tanks must be sounded, and the readings recorded in a table similar to Table 5.

6.1.2 From the boat, the draft readings forward, aft and at midships, on both sides of the ship, must be measured. In the case of a ship 70 metres or more in length without midship draft marks, freeboard measurements at midships must be taken on both sides of the ship.

6.1.3 At the same time as the drafts are measured, a sample of the dock water must be taken forward, aft and amidships on each side of the ship.

6.1.4 The water samples must be taken at a depth equal to one-half of the draft of the ship in each case, except that in estuarial waters where water may be of varying density at different levels, an average density at each position must be calculated from samples taken at surface, mid draft and keel levels. The density must be determined as the arithmetical mean of the densities measured forward, aft and amidships.

6.1.5 Liquid ‘items off' must be recorded in a table similar to Table 3.

6.1.6 The soundings (or ullages) read for each tank must be corrected for trim using the tank calibration curves (or tables) provided. The weight of the liquid content of each tank and of the vertical and longitudinal positions of its centre of gravity must be determined from the corrected soundings (or ullages).

6.1.7 All items to be put on board to complete the lightship must be recorded in a table similar to Table 6 together with their respective weights and the vertical and longitudinal positions of their centres of gravity.

6.1.8 Where solid ballast is used, the weight and centres of gravity of each item of ballast must be recorded.

6.2 Heeling the ship

6.2.1 The heeling of the ship by the movement of the inclining weights or the transfer of liquids must be a continuous process and must be interrupted only for taking and checking measurements. The time interval between the weight movements or liquid transfer and the measurement must be kept as constant as is practical. The experiment must be conducted in accordance with the procedures set out in 6.2.2 to 6.2.1l .

> ***Note:*** *The procedure described in 6.2.2 to 6.2.11 is that applicable to the conduct of an inclining experiment using pendulums to measure heel angle. Where the use of other measuring devices is accepted the procedure should be amended as appropriate.*

6.2.2 All members of the inclining party must take up their positions for pendulum readings and then;

(a) the reading of both pendulums must be recorded;

(b) the first weight movement must be made;

(c) the distance that the weight has been moved must be measured and recorded;

(d) where:

(i) the ship's gear is being used, the crane or derrick must be restowed and, in the case of a derrick, the topping lift must be slackened; or

(ii) shore gear is being used, the lifting hook must be uncoupled.

6.2.3 The members of the inclining party must be recalled to their previous positions, all moorings must be checked to ensure that they are slack and, with the ship clear of the berth, the following tasks must he carried out:

(a) when the pendulums are steady, their readings and the time of reading must be recorded;

(b) each pendulum deflection *(x)* resulting from the weight movement must be ascertained;

(c) for each pendulum, the following value is to be entered into Table 4:

$$\frac{wd}{x} = \frac{\text{weight (w) } x \text{ distance (d)}}{\text{pendulum deflexion (x)}}$$

6.2.4 The procedure in 6.2.2 and 6.2.3 must be repeated for the remaining weight movements.

Note: *An example of an appropriate sequence of weight movements is:*

Number 1 weight	*port to starboard;*
Number 2 weight	*port to starboard;*
Numbers 1 and 2 weights	*starboard to port;*
Number 3 weight	*starboard to port;*
Number 4 weight	*starboard to port; and*
Numbers 3 and 4 weights	*port to starboard.*

6.2.5 Each successive value of $\frac{wd}{x}$ must be compared with the running average of the values calculated for the completed weight movements

6.2.6 If any value of $\frac{wd}{x}$ is not within 5 per cent of the running average value, the following must be checked and rectified if possible and appropriate:

(a) that the ship is still clear of the berth and that the moorings are still slack;

(b) the pendulum readings, making sure that the pendulums are free to swing;

(c) the value of the weight last moved and the distance through which it was moved;

(d) that nothing aboard the ship has moved due to heeling;

(e) that the ship is not aground.

6.2.7 After the completion of the weight movements referred to in 6.2.4 have been completed, the average of the values of $\frac{wd}{x}$ must be compared to the individual values.

6.2.8 Where an individual value of $\frac{wd}{x}$ varies from the average value by more than 5 per cent of the average value, the corresponding weight movement must be repeated until a satisfactory set of values has been obtained.

6.2.9 Where it is found, after checking, that:

(a) the pendulum readings of the ship in the upright position are considerably erratic;

(b) the pendulum deflexions are greater than might have been expected;

(c) there is an inconsistency in the values of the pendulum deflexions for equal weight movements in opposite directions; or

(d) the ship appears to have an unexplained initial list that cannot be corrected,

the ship could have a negative GM value and therefore might be initially unstable. The inclining experiment must be immediately discontinued and the Chief Marine Surveyor advised.

6.2.10 The readings obtained during the inclining experiment, whether a solid weight movement or liquid transfer method is used, must be recorded in a table similar to Table 4.

6.2.11 Where liquid transfer is used, the readings obtained during the inclining experiment must be recorded in a table similar to Table 3.

7 Calculation of displacement, LCB and KM at inclining

7.1 For a ship of conventional form at bow and stern the hydrostatic curves may be used to determine the hydrostatic elements (ie, displacement, LCB and KM) at inclining where:

(a) the hull of the ship being inclined is of conventional form at the bow and the stern; and

(b) the trim between perpendiculars does not exceed:

(i) $\frac{\text{Length}}{50}$ for ships of Length up to 30 metres;

(ii) $\frac{\text{Length}}{75}$ for ships of Length above 30 metres up to 60 metres; or

(iii) $\frac{\text{Length}}{100}$ for ships of Length exceeding 60 metres.

7.2 Where a ship has a fine bow and a full flat stern, the hydrostatic curves may be used to determine the hydrostatic elements at inclining only if the trim between perpendiculars does not exceed:

(a) 0.3 metres for ships of Length up to 45 metres; or

(b) $\frac{\text{Length}}{150}$ for ships of Length over 45 metres.

> ***Note:*** *The trim for all ships is the trim of the baseline, including those with a designed rake of keel.*

7.3 Where the trim exceeds the values listed in 7.1 and 7.2, the 'as inclined' waterplane on the lines plan must be used to calculate the displacement, LCB, VCB and BM at inclining. The full calculations, together with a copy of the lines plan and table of offsets, must be submitted with the inclining experiment report.

> ***Note:*** *The direct calculation of hydrostatic particulars at the 'as inclined' waterplane is recommended, even in cases where trim does not exceed the limiting value specified in 7.1 or 7.2.*

7.4 The displacement calculated at inclining must be corrected for the density of the water in which the ship is floating at the time of the inclining experiment.

7.5 The displacement, LCB, VCB and BM calculated at inclining must be corrected for hog or sag.

7.6 Where the 'as inclined' waterplane is required to be used on the lines plan, it must be the hogged or sagged waterplane as the case may be. The hogged or sagged waterplane must be taken as parabolic in form through the forward, aft and midship drafts.

7.7 Where the hydrostatic information is determined from the hydrostatic curves the draft to be used must be the draft at midships. The correction to this draft for hog or sag must be:

(a) +75% of the sag in metres; or

(b) -75% of the hog in metres.

7.8 Where doubt exists as to which of the 2 categories of allowable trim applies to a particular ship at inclining, a lines plan of the ship must be submitted to the Chief Marine Surveyor who will decide on the category to which a particular ship belongs.

8 Calculations of the VCG at inclining

8.1 For each pendulum,

$$GM = \frac{wd}{x} x \frac{\ell}{\Delta}$$

where $\frac{wd}{x}$ is the average value of $\frac{wd}{x}$ calculated in accordance with 6.2.7;

ℓ is the effective pendulum length, and

Δ is the displacement at inclining (corrected for density and hog or sag), in tonnes.

GM for the ship at inclining is the arithmetic mean of the GM values calculated for each of the 2 pendulums.

> ***Note:*** *In the above formula* 'w' *and* 'Δ' *have the same units and* 'd', 'ℓ', 'x' *and* GM *have the same units.*

8.2 Correction for free surface effects

8.2.1 Where tanks contain liquids, but are not pressed up, corrections for free surface effects must be applied. The correction must only be applied in respect of tanks where the exact details of the free surface are known, or where a correction can be calculated.

8.2.2 Free surface effects may only be applied for measured amounts of liquids in calibrated tanks.

8.2.3 The free surface moment of the actual liquid surface at inclining must be calculated and used in determining the free surface correction.

8.2.4 The correction for free surface to be applied to GM is FSC, which is equal to the sum of the free surface moments for all slack tanks, divided by the displacement at inclining.

8.3 Calculation of GM_0 at inclining

$$GM_0 = GM + FSC$$

8.4 Calculation of VCG above baseline at inclining

$$VCG = KM - GM_0$$

where KM is the height of the initial transverse metacentre above the baseline at inclining.

9 Calculation of the LCG at inclining

9.1 Where level trim hydrostatic curves are used to evaluate the hydrostatic elements at inclining, the position of the trimmed LCB must be determined from the trim of the baseline between perpendiculars, the LCB at level trim and the MCT1cm.

9.2 Where an inclined waterplane or trimmed hydrostatics curves are used, the position of the LCB is to be obtained from the curves or computer program.

9.3 At inclining the centre of gravity of the ship is vertically above the centre of buoyancy. To calculate the distance of the LCG from midships, a correction depending on the trim of the ship must be applied to the distance of the LCB from midships to take account of the height of the VCG above the VCB.

10 Calculation of lightship particulars

10.1 The lightship condition is deemed to be that of the ship complete and ready for sea with all spares and equipment on board, all fluid systems primed and all permanent solid ballast fixed in position. All fuel oil, lubricating oil (other than 'in use' lubricating oil in sumps and drain tanks), fresh water, water ballast and cargo tanks and all cargo spaces must be empty and no passengers, crew and effects nor consumable stores must be included.

> ***Note:*** *If the owner requires an 'Owner's Lightship' condition different from this, it is to be shown separately, in detail, and clearly labelled 'Owner's Lightship Condition'.*

10.2 A summary table similar to Table 7 must be prepared. In this table, the totals of the 'items on', 'solid items off', 'liquid items off' and 'items to be shifted' are to be applied to the 'as inclined' particulars of the ship to obtain the lightship characteristics.

11 Inclining experiment report—information to be included

An inclining experiment report containing the following information must be prepared:

(a) date, time and place of the experiment;

(b) the wind, weather and tidal conditions;

(c) the ship's heading and mooring conditions;

(d) the dock water density calculated in accordance with 6.2.3 ;

(e) the names and designations of those carrying out the inclining experiment and the total number of persons on board;

(f) the following particulars of the ship:

(i) length between perpendiculars (LBP) nominated for use throughout the stability data;

(ii) maximum moulded breadth at midships LBP;

(iii) moulded depth at midships LBP (from upperside of bottom plating at centreline to underside of the deck stringer plate at side for steel ships);

(iv) thickness of the keel plate at midships LBP;

(v) thickness of the deck stringer plate at side at midships LBP.

(vi) if appropriate, the designed rake of keel used in the calculations. Details are to be shown on a sketch;

(vii) a table listing the longitudinal positions of each forward draft mark relative to the forward perpendicular. For ships with a designed rake of keel, the corresponding height of the draft datum above the baseline;

(viii) longitudinal position of the aft draft marks relative to the aft perpendicular;

(ix) longitudinal position of midships LBP relative to the nearest frame;

(x) longitudinal position of the midship draft marks relative to midships LBP; and

(xi) frame spacing. Where the frame spacing is not uniform throughout the ship's length, the details must be shown on a dimensioned sketch;

Note: *Where the report forms part of the trim and stability book for a ship and the information specified in 11(f) is contained elsewhere in that book, such information need not be repeated in the report.*

(g) every reading and measurement taken during the inclining experiment;

(h) the complete calculations based on these readings and measurements for the derivation of the lightship displacement and the vertical and longitudinal positions of the centre of gravity. The calculations including sketches as necessary must include a statement of the maximum angles of heel achieved when inclining the ship and a statement of the percentage of the lightship displacement represented by the liquids on board at inclining; and

(i) an up-to-date general arrangement plan, the hydrostatic information, a lines plan and the tank calibration and free surface information.

12 Accuracy of inclining experiment and calculations

12.1.1 The standards of accuracy must be sufficient to enable rounding in accordance with 8.2.1 of Appendix 2.

12.1.2 If the above accuracy standards are considered inappropriate for any ship for which stability data is to be prepared, assumptions and supporting calculations justifying a different standard are to be submitted to the Chief Marine Surveyor before commencement of the experiment or measurement. Such a proposal, when accepted in writing by the Chief Marine Surveyor, becomes the accuracy standard for the stability data of that particular ship.

***Note** 1: The lightship particulars calculated from the inclining experiment are the basis of every loading condition in the stability book. The accuracy of these lightship particulars is dependent on the care taken in conducting the experiment and in calculating the results.*

***Note 2:** In determining the lightship displacement, VCG, TGC and LCG of a ship the accuracy achieved is influenced by such factors as:*
(a) the accuracy of the hydrostatic calculations which are based on Simpson's or other rules for integration;
(b) the accuracy of the checking of the inclining weights on the weighbridge and of the measuring of the distances moved by their centres of gravity during weight

movements;
(c) the accuracy of the reading of the drafts. This is governed by the accuracy with which the draft marks have been 'cut in' and by the dock water conditions when the readings are being taken; and
(d) the accuracy of the measurement of the pendulum effective lengths and measurement of the pendulum movements.

Note 3: *The lightship measurement is the means of obtaining the lightship displacement and the longitudinal position of the centre of gravity of the ship. The assumption is made that, if the lightship displacements and the longitudinal positions of the centres of gravity of 2 ships are closely similar, the vertical positions of the centres of gravity of the 2 ships are closely similar also.*

12.2 Diagrams included in the inclining experiment report must be complete in themselves for their intended purposes and should not require reference to other pages of the report for interpretation.

13 Performing lightship measurement

13.1 The procedures used and the care and accuracy required in the lightship measurement are the same as those for the inclining experiment. The following are not required in connection with a lightship measurement:

(a) the placing on board of inclining weights;

(b) the movement of the inclining weights across the deck to heel the ship; and

(c) the measurement of the resulting heel.

13.2.1 The following provisions are relevant to a lightship measurement:
1, 2 (except 2.3), 3, 4 (except 4.3*(f)*), 4.4 to 4.7, 4.9 to 4.14, 4.17 to 4.24), 5 (except 5.1), 5.2, 5.5*(f)*, *(h)*, and *(i)*, 6.1, 7, 9, 10, 11 and 12.

13.2.2 In particular:

(a) the draft marks must have been verified by an AMSA surveyor or by a survey authority; and

(b) readings and measurements taken must be recorded in the units in which they were measured.

13.3 A report is to be prepared containing all information detailed in 11, including the calculations referred to in 11*(h)* other than those dependent on the angle of heel at inclining.

13.4 A table must be prepared comparing the values of the measured ship's lightship displacement and longitudinal position of the centre of gravity with those of the similar ship.

13.5 If the difference between the lightship particulars of the measured ship and the similar ship, as determined by an inclining experiment, corrected for known small differences between the 2 ships, is:

(a) no greater than 0.5 per cent of the LBP in the case of the LCG; and

(b) no greater than 1.0 per cent in the case of the lightship displacement,

and the ships are otherwise closely similar, the measured ship will be treated as a sister to the similar ship.

13.6.1 A dispensation from carrying out an inclining experiment granted under Regulation 22 of Chapter II-1 of SOLAS or under 3 of this Appendix may be granted by the Chief Marine Surveyor if a lightship measurement has been carried out on the subject ship and if the subject ship is similar in all respects to the sister ship whose stability data has been approved by the Chief Marine Surveyor.

13.6.2 Where the difference between the LCG of the ship and the similar ship is between 0.5 per cent and 1.0 per cent of the LBP and/or the difference between the lightship displacement of the ship and the similar ship is between 1 per cent and 2 per cent, the Chief Marine Surveyor may adjudge the measured ship to be a sister of the similar ship and may require the application of 2.2.

13.6.3 If the results of the lightship measurement do not meet the criteria, the measured ship must be inclined.

13.7 If the lightship comparison meets the criteria in 13.5 the lightship characteristics of the ship with approved stability data corrected for known small differences between the ships may be taken, unless otherwise determined by the Chief Marine Surveyor, as the lightship characteristics of the measured ship.

13.8 The stability book for the measured ship must include the approved inclining experiment report of the sister ship, the lightship measurement report for the subject ship and the comparison table of the lightship displacements and the longitudinal positions of the centres of gravity of the two ships.

13.9 Where an existing ship is to be reinclined, the Chief Marine Surveyor may permit a light ship measurement to be carried out in accordance with 13. If the difference between the light ship measurement and the results of the ship's previous

inclining experiment is greater than the parameters in 13.5, the Chief Marine Surveyor will require an inclining experiment to be carried out.

Table 1 Dry items off

Item	*Weight*	*VCG above baseline*	*Vertical moment about baseline*	*LCG*	*Longitudinal moments*

Table 2—Items to be shifted

Item to be shifted	*Weight of item*	*VCG at inclining above baseline*	*Final position VCG above baseline*	*Change of vertical moment*	*LCG at inclining*	*Final position of LCG*	*Change of longitudinal moment*
Total							

Note 1: Change of Vertical Moment = Weight x (Final Position VCG - VCG at inclining).

Note 2: Change of Longitudinal Moment = Weight x (Final Position LCG - LCG at inclining).

Table 3 Liquid transfer method - weight movements & resulting heeling moments

Time of Reading	Shift Number	Direction of Liquid Transfer	Port Tank						Starboard tank						Total Heeling Moment (wd)
			Liquid level Reading	Corrected Liquid level Reading	Liquid Weight in Tank	Liquid TCG off Centreline	Liquid Heeling Moment	Change in Heeling Moment	Liquid level Reading	Corrected Liquid level Reading	Liquid Weight in Tank	Liquid TCG off Centreline	Liquid Heeling Moment	Change in Heeling Moment	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Initial Readings														
	1														
	2														
	3														
	4														
	5														
	6														
	7														
	8														

Notes:

Columns 5 and 11 Liquid Level Readings Corrected for Trim and Heel
Columns 9, 15 = Difference between current Liquid Heeling Moment and previous Liquid Heeling Moment for thisTank
Column 16 = Column 9 + Column 15
Enter Column 16 into the Resulting Heeling Moments Column in Table 4

Table 4 Table of Weight Movement and Readings of Pendulums or Alternative Devices

Forward Pendulum or Alternative Device

Time of Reading	*Weight Movement No*	*Direction of Weight Movement*	*Weight (w)*	*Distance Weight Moved (d)*	*Resulting Heeling Moment (wd)*	*Pendulum or Other Device Reading*	*Deflexion (x)*	*(wd)/x*	*Running Average of (wd)/x (A1)*	*% Difference of this Reading from (A1)*	*% Difference of this Reading from (A2)*
	Initial										
	1										
	2										
	3										
	4										
	5										
	6										

Length of Pendulum or Alt. Device =

Maximum heel angle = To Port

To Starboard

Average (A2) =

Total =

Aft Pendulum or Alternative Device

Time of Reading	*Weight Movement No*	*Direction of Weight Movement*	*Weight (w)*	*Distance Weight Moved (d)*	*Resulting Heeling Moment (wd)*	*Pendulum or Other Device Reading*	*Deflexion (x)*	*(wd)/x*	*Running Average of (wd)/x (A1)*	*% Difference of this Reading from (A1)*	*% Difference of this Reading from (A2)*
	Initial										
	1										
	2										
	3										
	4										
	5										
	6										

Length of Pendulum or Alt. Device =

Maximum heel angle = To Port

To Starboard

Average (A2) =

Total =

Table 5 Contents of tanks

Tank	*Position*	*Contents*	*Sounding or ullage reading*	*Reading corrected for trim/heel*	*Corres-ponding weight*	*VCG above baseline*	*Vertical moment about baseline*	*LCG*	*Longitudinal moment*	*Actual free surface moment*

(Sounding or ullage readings are to be corrected for trim and/or heel, as appropriate)

Table 6—Items on/off

Item	*Weight*	*VCG above baseline*	*Vertical moment about baseline*	*LCG*	*Longitudinal moment*

Table 7 Calculation of lightship characteristics

Item	*Weight*	*VCG above baseline*	*Vertical moment about baseline*	*LCG*	*Longitudinal moment*
As inclined					
Dry items off					
Liquid items off					
Items on					
Item shifted					
Lightship					

Note: Tables should be modified, using transverse in place of longitudinal, in calculating the location of the transverse centre of gravity

* * * * * *

Appendix 4

Additional or different requirements

1 Watertight doors

(relates to II-1/18.1 of SOLAS)

The design, materials and construction of a watertight door and its frame on passenger and cargo ships must comply with or be shown to be equivalent to the following:

(a) the door and its frame is to be made of suitable material to withstand the likely hydraulic, impact or other stresses involved;

(b) a sliding door or its frame is to be fitted with rubbing faces of brass or a similar material, such rubbing faces being fitted in recesses where the width of the rubbing face is less than 25 mm;

(c) the mechanical components of the operating gear of a sliding door are to be made of a suitable, non-corrodible material;

(d) the jointing material between a bulkhead and the frame of a door is to be of a type that will not deteriorate or be damaged when subjected to heat;

(e) the frame is to be so constructed that dirt cannot lodge in it;

(f) the bottom edge of a vertically-sliding door is to be tapered or bevelled;

(g) a power-operated vertically-sliding door is not to drop if the power is interrupted when the door is raised;

(h) a horizontally-sliding door is to be so installed as to resist uncontrolled movement when the ship rolls;

(i) any restraining device fitted to a door to comply with *(h)* is not to interfere with the closing of the door when it is required to be closed.

2 Bilge pumping arrangements

(relates to II-1/21 of SOLAS)

2.1 General

The requirements in Regulation 21 of Chapter II-1 of SOLAS for passenger ships are to be applied to cargo ships as far as practicable.

2.2 Power bilge pumps to be self priming

Power pumps that are required for bilge pumping must be of the self-priming type or be provided with an efficient priming device, unless a central priming system is provided that is satisfactory to the Chief Marine Surveyor or survey authority, as appropriate. However, cooling water pumps having emergency bilge suctions need not be of the self-priming type.

2.3 Bilge branch suctions and strum boxes

2.3.1 The diameter of the bilge branch suction pipes is to be calculated according to the following formula:

$$d_b = 25 + 2.15\sqrt{C(B+D)}$$

where: d_b is the internal diameter of the bilge branch suction in millimetres;

B is the breadth of the ship in metres;

C is the length of the compartment in metres; and

D is the moulded depth of the ship to bulkhead deck in metres provided that, in a ship having an enclosed cargo space on the bulkhead deck which is internally drained and which extends for the full length of the ship, D shall be measured to the next deck above the bulkhead deck. Where the enclosed cargo spaces cover a lesser length, D shall be taken as the moulded depth to the bulkhead deck plus lh/L where l and h are the aggregate length and height respectively of the enclosed cargo spaces in metres.

However, the actual internal diameter of any bilge branch pipe may be rounded off to the nearest standard size acceptable to the Chief Marine Surveyor or survey authority, as appropriate, but in no case may the diameter of any suction be less than 32 mm.

2.3.2 A bilge suction in the machinery space or tunnel of a ship, other than an emergency suction, must be led from a filter box capable of being readily cleaned situated in an accessible position and, wherever practicable, above the level of the working floor. This filter box must be provided with a straight tail pipe to the bilges and a cover that may be readily opened and closed. Strum boxes are not to be fitted to the lower end of such tail pipe or emergency suction.

2.3.3 A bilge suction end in a hold space or other compartment outside the machinery spaces or tunnel must be enclosed in a strum box. The strum box must be provided with perforations of approximately 10 mm in diameter, the combined area of

which is not to be less than twice the area of the end of the bilge suction pipe. The strum box must be so constructed that it can be cleared without breaking any joint of the bilge suction pipe.

2.3.4 The open end of an emergency bilge suction or its strainer, if any, must be accessible for clearing.

3 Sounding arrangements

3.1 A tank forming part of the structure of a ship, and any watertight compartment (other than one that is part of a machinery space) of a ship, must be provided with means for sounding the depth of liquid that may be present in the tank or compartment. Such means must, if necessary, be protected against damage.

3.2 If the means for sounding tanks uses sounding pipes, then:

(a) a thick steel doubling plate for the sounding rod to strike upon must be securely fixed below each sounding pipe;

(b) each sounding pipe for the bilge of an insulated hold must be at least 60 mm in diameter and must itself be insulated; and

(c) each sounding pipe must extend to an accessible position above the top of the tank and above the bulkhead deck, except that where a bilge, cofferdam or double bottom tank is in a machinery space its sounding pipe need not extend above the bulkhead deck if the upper end of the pipe:

(i) is in an accessible position above an access platform in that space; and

(ii) is not situated adjacent to boilers or electrical equipment nor where an accidental spray from the cock, when opened, could impact on a surface the temperature of which is likely to be above the ignition temperature of the oil fuel used in the ship; and

(iii) is fitted with a cock with a permanently secured handle so loaded that, on being released, it automatically closes the cock.

Note: Provision must be made for sounding all tanks and the bilges of those compartments that are not readily accessible at all times.

4 Stability information

Regulation 22 of Chapter II-1 of SOLAS applies to all Australian registered cargo ships, regardless of length.

5 Machinery installations

5.1 Cooling systems

(relates to II-1/27 of SOLAS)

Exhaust pipes of an internal combustion engine must be efficiently cooled or lagged.

5.2 Operation of safety devices

(relates to II-1/31 of SOLAS)

Safety devices are to be installed that will prevent the operation of machinery unless all ancillary devices essential for the safe operation of such machinery are working. Failure of main or emergency power supplies to control systems or safety devices must not prevent the safety devices operating as designed.

5.3 Compressed air starting and pipes

(relates to II-1/34 of SOLAS)

5.3.1 A ship with engines designed to be started by compressed air must be provided with at least 2 starting air compressors, fit for the service for which they are intended.

5.3.2 If a compressed air pipe or fitting may receive compressed air from any source at a higher pressure than that for which it is designed, a suitable reducing valve, relief valve and pressure gauge must be fitted.

5.3.3 Where the main propulsion internal combustion engines are arranged for air starting, the total air receiver capacity is to be sufficient to provide, without replenishment, not less than 12 consecutive starts of each main engine if of the reversible type and not less than 6 consecutive starts if of the non-reversible type. If the ship is fitted with a controllable pitch propeller, a lesser number of starts may be permitted by the Chief Marine Surveyor or survey authority, as appropriate. At least 2 starting air receivers must be fitted, capable of being isolated from each other. The air receivers should be of approximately equal capacity.

6 Electrical installations: Emergency sources of power

(relates to II-1/42 & 43 of SOLAS)

6.1 Emergency sources of power are not to be used for the normal day-to-day supply of electrical power. However, they may be used, in addition to the requirements of SOLAS, to assist with bringing the ship's machinery into operation from the dead ship condition, and as a back up during periods of maintenance of the main sources of power.

6.2 In addition to the emergency power availability required by Regulation 43 of Chapter II-1 of SOLAS, the emergency power source must be capable of:

(a) operating the machinery space fixed pressure water spraying fire-extinguishing system pump, if any, for a period of 18 hours; and

(b) providing such other services, and for such periods, as the Chief Marine Surveyor considers necessary for the safety of all on board in an emergency.

7 Alarm systems

(relates to II-1/51 of SOLAS)

7.1 Introduction

7.1.1 This part of Appendix 4 sets out requirements for alarm systems. The requirements of Regulation 51 of Chapter II-1 of SOLAS are applicable to all ships whether they have unmanned machinery spaces or not.

7.1.2 Proposals for unattended machinery spaces on a passenger ship must be submitted to the Chief Marine Surveyor for consideration.

7.2 Fire precautions

7.2.1 Internal combustion engines of 2250 kW or over having cylinders of more than 300 mm bore must be provided with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices to the satisfaction of the Chief Marine Surveyor or survey authority, as appropriate.

7.2.2 The oil fuel and lubricating oil systems must comply with the following:

(a) where necessary, oil fuel and lubricating oil pipelines must be screened or otherwise suitably protected to avoid as far as practicable oil spray or oil leakages on to hot surfaces or into machinery air intakes and the number of joints in such piping systems must be kept to a minimum and, where practicable, leakages from high pressure oil fuel pipes must be collected and arrangements provided for an alarm to be given;

(b) where daily service oil fuel tanks are filled automatically, or by remote control, means must be provided to prevent overflow spillages. Other equipment that treats flammable liquids automatically, such as oil fuel purifiers, must, wherever practicable, be installed in a special space reserved for purifiers and their heaters, and must have arrangements to prevent overflow spillages; and

(c) where daily service oil fuel tanks or settling tanks are fitted with heating arrangements a high temperature alarm must be provided if the flashpoint of the oil fuel can be exceeded.

7.3 Alarm systems

An alarm system complying with Regulation 51 of Chapter II-1 of SOLAS, together with a shutdown system as necessary, must be provided for all important pressures, temperatures and fluid levels and other essential criteria as set out in Tables 1 to 7.

Table 1

Main Propulsion Internal Combustion Machinery & Associated Gearing

Machinery system requiring alarm	*Measured item*	*Item fault condition*	*Shut down required*
Lubricating Oil	Inlet Pressure	Low	No
Lubricating Oil	Inlet Pressure	Low Low*	Yes
Lubricating Oil	Inlet Temperature	High	No
Lubricating Oil	Cylinder Lubricator Flow from each lubricator unit	Low	No
Cooling	Piston Inlet Pressure	Low	No
Cooling	Piston Outlet Temperature	High	No
Cooling	Piston Outlet Flow	Low	No
Cooling	Cylinder Inlet Pressure	Low	No
Cooling	Cylinder Outlet Temperature	High	No
Cooling	Fuel Valve Pressure	Low	No
Oil Fuel	Booster Pump Pressure	Low	No
Oil Fuel	Temperature or Viscosity	High	No
Oil Fuel	Temperature or Viscosity	Low	No
Scavenge Air	Temperature	High	No**
Exhaust Gas	Individual Cylinder Temperature	High	No
Starting Air	Pressure	Low	No
Crankcase	Oil Mist Concentration	High	No
Engine	Rotational Speed	High	Yes

***** This level should be set at some point above the level at which low lubricating oil pressure would result in damage to the engine. An example might be where lubricating oil pressure is sufficient for most bearings, but is insufficient to protect the thrust bearing.

** Slow down may be required

Table 2

Steam Turbine Machinery and Associated Gearing

Machinery system requiring alarm	*Measured item*	*Item fault condition*	*Shut down required?*
Lubricating Oil	Pressure	Low	No
Lubricating Oil	Pressure	Low Low*	Yes
Lubricating Oil	Temperature	High	No
Turbine & Gearing Bearings	Temperature	High	No
Astern Turbine Casing	Temperature	High	No
Gland Steam	Pressure	High	No
Sea Water	Pressure or flow	Low	No
Turbine Rotor	Vibration	Excessive	Yes
Turbine Rotor	Axial Movement	Excessive	Yes**
Lubricating Oil Gravity Tank	Oil Level	Low	No
Main Condenser	Vacuum	Low	No
Main Condenser	Condensate Level	High	No
Turbine Rotor	Rotational Speed	High	Yes

***** This level should be set at some point above the level at which low lubricating oil pressure would result in damage to the engine. An example might be where lubricating oil pressure is sufficient for most bearings, but is insufficient to protect the thrust bearing.

** An alarm giving warning before shut down occurs may be fitted.

Table 3

Main and Auxiliary Boilers

Machinery system requiring alarm	*Measured item*	*Item fault condition*	*Shut down required*
Feed Water	Working Level	Low	Yes *(See Note)*
Feed Water	Working Level	High	No
Steam	Drum Pressure	High	No
Steam	Drum Pressure	Low	No
Superheated Steam	Temperature	High	No
De-Superheated Steam	Temperature	High	No
Feed Water	Forced Circulation Flow	Low	Yes

Feed Water	Salinity	High	No
Combustion Air	Pressure	Low	Yes
Oil Fuel	Pressure	Low	No
Oil Fuel	Temperature or Viscosity	Low	No
Oil Fuel	Temperature or Viscosity	High	No
Oil Fuel Atomising Steam	Pressure	Low	No
Oil Fuel Each Burner	Flame	Extinguished	Yes
Uptake where economiser and gas air heater are internal with boiler	Temperature	High	No

Note: (a) Two water level sensors must be provided, each to operate independently, and automatically shut off the fuel for combustion and operate alarms.

(b) Sensors may be set to give alarm before shut off of the fuel for combustion occurs.

Table 4

Electrical Generating Plant

Machinery system requiring alarm	*Measured item*	*Item fault condition*	*Shut down required*
Electrical Generator	Voltage	High	No
Electrical Generator	Voltage	Low	No
Electrical Generator	Frequency	Low	No
Electrical Generator D.C.	Current Load	High	No
Electrical Generator A.C.	Power Load	High	No

Table 5

Tanks

Tanks	*Measured item*	*Item fault condition*
A Tank Arranged for Automatic Filling	Level	High
Stern Tube Lubricating Oil Header Tank	Level	Low
Daily Service Oil Fuel	Level	High
Daily Service Oil Fuel	Level	Low
Sludge	Level	High
Boiler Feed Water	Level	Low
Main Engine Expansion Tank	Level	Low
Daily Service Oil Fuel Fitted with Heating Arrangements	Temperature	High
Oil-Fuel Settling Tank Fitted with Heating Arrangements	Temperature	High
High Pressure Fuel Oil Pipe Leakage Collection Tank	Level	High

Table 6

Miscellaneous Machinery

Machinery system requiring alarm	*Measured item*	*Item fault condition*
Steering Gear Header Tank	Oil level	Low
Pneumatic Control (See Note)	Pressure	Low
Hydraulic Control (See Note)	Pressure	Low
Electrical Control (See Note)	Power	Low
Oil Purifiers	Oil Inlet Temperature	High
Oil Purifiers	Water Seal	Loss
Steering Gear	Power	Loss
Controllable Pitch Propeller	Servo Oil Pressure	Loss
Controllable Pitch Propeller	Servo Oil Temperature	High
Alarms	Electric power	Loss
Machinery Monitoring System	Various	System failure

Note: This refers only to those items that are necessary for:
(a) the safe operation of the main propulsion machinery and its auxiliaries; and
(b) the safe operation of the ship.

Table 7

Gas Turbine Machinery

Machinery system requiring alarm	*Measured item*	*Item fault condition*	*Shut down required*
Turbine Rotor	Rotational Speed	High	Yes
Lubricating Oil	Pressure	Low	Yes
Turbine Rotor	Vibration	High	Yes
Combustion	Flame	Loss	Yes
Exhaust Gas	Temperature	High	Yes

7.4 Alternative arrangements

Where the hull, machinery, anchors and cables of a cargo ship comply with the requirements of a survey authority and the machinery spaces are fitted out and certified in accordance with that survey authority's requirements for a ship to operate with its machinery spaces unmanned, it will be deemed to comply with this Part.

7.5 Additional equipment

Where an item of instrumentation, control, alarm or detection equipment that is fitted in a ship, additional to the provisions of this Appendix or the requirements of one of the specified survey authorities, is not subject to the survey of a survey authority and malfunction of that item could adversely affect the safety of the ship, it is subject to annual survey by an AMSA surveyor. If the performance of the item proves to be unsatisfactory, the Chief Marine Surveyor may require that it be removed from the ship.

7.6 Instruction books

There must be carried on board for the use of the engineers operating and maintaining the equipment adequate instruction books in English containing information on:

(a) operation of machinery, control systems, monitoring systems and alarms systems;

(b) maintenance of systems;

(c) testing of systems;

(d) identification and rectification of faults; and

(e) emergency operation equipment and systems,

in respect of such equipment and systems installed in the ship.

8 Lifts

8.1 Introduction

This part of Appendix 4 sets out the requirements additional to AS 1735 (lifts, escalators and moving walks) that apply to lifts installed in ships for the use of passengers or crew. It does not apply to lifts used primarily for the conveyance of cargo and stores.

8.2 Definitions

Except for the definitions below, terms have the same meaning as in AS 1735. Where reference is made in AS 1735 to the Statutory Authority, this means AMSA.

approved means approved by the Chief Marine Surveyor;

'A' class division, door or enclosure means a fire division that complies with the requirements of Marine Orders, Part 15, for such a division, door or enclosure;

low flame spread surface means a surface that complies with the requirements of Marine Orders, Part 15;

passenger means a person other than:

(a) a member of the crew of the ship; or

(b) another person employed or engaged in any capacity on board the ship on the business of that ship.

8.3 General

8.3.1 Lifts must comply with AS 1735, modified where necessary in accordance with these requirements, except that in the case of ships built overseas a National standard acceptable to the Chief Marine Surveyor may be substituted for AS 1735.

8.3.2 Any departure from these requirements must be submitted to the Chief Marine Surveyor for consideration.

8.3.3 In lifts installed in hazardous locations, such as pump rooms in oil or gas tankers, the designer must take into account the hazardous environment. Special precautions must be taken to prevent static discharge or sparking due to electrical equipment, or metals in either impact or rubbing contact.

8.4 Submission of plans and data

8.4.1 A sufficient number of copies of drawings and data must be submitted to permit:

(a) the retention of one copy by AMSA; and

(b) the return of the number of copies required by the designer.

8.4.2 The information must be sufficient to establish that the lift installation complies with this Appendix. Such information is to include:

(a) a specification of the lift installation;

(b) the location of the lift trunk in the ship, the position of lift trunk entrances, means of escape and location of the lift machinery room; and

(c) arrangements and details of safety devices.

8.5 Design

8.5.1 Lifts must be designed to operate safely in both directions of travel with a load 25% in excess of the rated load.

8.5.2 Due regard must be given to the arrangement and position of the lift installation within the ship, particular attention being given to:

(a) integration with and means of attachment to the ship's structure;

(b) effects of static and dynamic forces arising from the motion of the ship at sea; and

(c) effects of vibration on the lift structure and machinery.

8.5.3 The lift installation must be capable of safe operation when the ship is listed 10° either side of the upright position whilst simultaneously trimmed 5° forward or aft. It must be capable of withstanding a rolling motion of the ship up to 30° on either side of the vertical combined with a simultaneous pitching motion of up to 10° with the car stopped at any position in its travel.

8.5.4 The lift trunk and machinery room must be located within the structure of the ship so as to give protection to machinery, electrical equipment and other parts liable to corrosion or deterioration in a marine environment.

8.5.5 Passenger and machinery spaces are not to be served by the same lift.

8.5.6 The lift car must be provided with a suitable grab rail.

8.5.7 The method of operating the lift must be obvious and not require any instruction notice.

8.6 Structural fire protection

8.6.1 The lift car frame must be constructed of steel. The cladding, lining and flooring shall be of approved materials that have low flame spread surfaces.

8.6.2 Lift landing doors must be of an approved type and, having regard to the nature of the space adjacent to the door, must meet the requirements for 'A' class doors except that, when lift landing doors are protected by 'A' class enclosures around a landing entrance, the lift landing doors need not be of 'A' class standard or be of an approved type.

8.6.3 A glass viewing window may be permitted in lift landing doors where:

(a) the door with the viewing window has been approved as an 'A' class lift landing door; or

(b) an unrated lift landing door is protected by an 'A' class enclosure.

8.6.4 That part of a lift trunk located wholly within the machinery space need not be insulated. However, the trunk must be at least A0 standard in respect of prevention of passage of smoke and flame to upper levels of the ship.

8.6.5 Lift trunks and closure of openings in lift trunks must in addition comply with Marine Orders, Part 15.

8.7 Means of escape

8.7.1 A steel ladder of adequate strength must be provided in the trunk so situated that a person can escape from the lift when the car is stopped at any position in its travel. An emergency exit must be provided above the upper limit of travel of the lift car, and may be supplemented by additional emergency exits at other locations in the trunk. The emergency exits must be easy to open from within the trunk and readily accessible from the ladder.

8.7.2 In a passenger ship where a lift is used exclusively by crew members and in a cargo ship, the trap door in the lift car must be operable from inside the car by means of a special key contained in a break glass box. Where necessary, steps or equivalent means must be provided within the lift car to gain access to the trap door.

8.8 Ventilation

8.8.1 Where necessary, lift trunks must be adequately ventilated to prevent the accumulation of stagnant air in any part of the trunk.

8.8.2 Lift cars must be provided with screened ventilation openings giving positive circulation of air in the car and, if necessary, be supplemented by power ventilation.

8.9 Electrical

8.9.1 Power supplies for personnel lifts, for lifting machinery, lighting in lifts and machinery rooms, alarms, communications and signalling devices must be from both main and emergency sources on all ships, irrespective of date of build.

8.9.2 Power supplies for lift alarms, communication and signalling devices may also be provided from an independent accumulator battery.

8.9.3 The power supply must be so arranged that in the event of a failure of the mains supply, each lift can be moved by the emergency supply to a deck where the doors can be safely opened.

8.9.4 When the trap door in the lift car is opened, the hoist power supply must be shut off. It must not be possible to restore hoist power supply until the trap door is shut and locked by means of a key from within the car.

8.10 Alarms and communications

A lift car must be provided with a telephone for communication with a station in an area normally occupied whilst the ship is in service. In a passenger ship where a lift is used exclusively by crew members and in a cargo ship, an alarm push button giving audible and visual warning at a station normally occupied whilst the ship is in service may be provided in place of a telephone.

8.11 Notices

8.11.1 A notice must be provided at each landing door carrying a warning that the lift is not to be used when the general alarm has sounded, in case of fire, or when the ship is rolling more than 10° from the vertical.

8.11.2 A notice must be mounted in a prominent position in the lift car stating the maximum number of persons and the maximum mass permitted and the date of test of the lift.

8.11.3 In a passenger ship where a lift is used exclusively by crew members and in a cargo ship, a notice describing the emergency means of escape must be provided inside the lift car, on the roof of the car adjacent to the trap door and at the emergency exit.

8.12 Tests and certificates

8.12.1 Tests required by AS 1735 and this Appendix must be carried out before putting the lift into service and must be witnessed by an AMSA surveyor. In the case of a ship built overseas, tests may instead be witnessed by an employee of an organisation nominated by the Chief Marine Surveyor. A certificate must be issued by the firm responsible for the tests, listing the tests carried out and their result. The certificate must also state that the installation complies with AS 1735 and these requirements.

8.12.2 A certificate covering tests of wire ropes must be supplied.

8.13 Maintenance manual

A suitable handbook containing all relevant particulars necessary for servicing and maintaining the lift installation must be provided.

9 Machinery space cranes and other lifting gear

9.1 Introduction

This part of Appendix 4 sets out the requirements for the certification, testing, examination and marking of machinery space cranes and other lifting gear.

9.2 Definitions

In Provision 9:

lifting gear means an article for use in lifting operations within a machinery space that is not riveted, welded or otherwise permanently attached to the machinery space crane, and includes wire rope slings, shackles, chain blocks and eye bolts;

machinery space crane means a crane permanently installed within a machinery space;

qualified person in relation to a function means a member of the ship's crew who is appropriately certificated such as to be competent to perform that function;

responsible person means a person who, in relation to machinery space cranes and other lifting gear, is responsible to:

(a) the manufacturer of that equipment; or

(b) a classification society in pursuance of a scheme of classification or certification of such equipment; or

(c) a competent testing establishment.

thorough examination means a detailed visual examination and such other measures as are considered necessary by the person carrying out the examination to determine the condition of an article or integrated assembly of articles being examined and may include ultrasonic, dye penetrant and magnetic particle testing, hammer testing, drilling, opening up and dismantling.

9.3 Machinery space cranes

9.3.1 A machinery space crane must not be used unless:

(a) it has been tested, thoroughly examined, certificated and marked in accordance with the relevant provisions of this Appendix;

(b) the current record of examination in the appropriate register indicates that the crane is fit for use; and

(c) a qualified person has determined it to be fit for such use.

9.3.2 A crane must be tested and thoroughly examined by a responsible person in accordance with 9.3.5 before being put to use for the first time and subsequently tested and thoroughly examined at intervals not greater than 5 years. A test and thorough examination may be postponed, for a

period of not more than 6 months, where the postponement will enable the test and examination to be carried out concurrently with a class survey of the ship by its classification society, provided that a responsible person certifies in writing that, in that person's opinion, the crane may be safely operated during the period of the postponement.

9.3.3 Where the design of the crane is such that compliance with 9.3.2 is, in the opinion of the responsible person, impractical or would require unnecessary dismantling, the test and thorough examination may be dispensed with provided:

(a) the manufacturer's equipment specification, schedule of examination and maintenance manual are available to the responsible person; and

(b) such examination and maintenance procedures in accordance with the maintenance manual as have been carried out are recorded in the appropriate register of the ship by the qualified person.

9.3.4 A crane must be thoroughly examined by a qualified person in accordance with 9.3.5 at intervals not greater than 12 months. Following examination, the qualified person must record the examination and condition of the crane in an appropriate register, such as the register of materials handling equipment of the ship.

9.3.5 Testing

9.3.5.1 Proof Load

When a crane is tested, the proof load must not be less than 1.25 x the safe working load (SWL) of the crane.

9.3.5.2 Thorough examination

Following the testing of a crane, the crane and all accessory gear must be examined for damage or permanent deformity.

9.3.5.3 Certification

A Certificate of Test and Examination in accordance with Form MO32/1 (see Marine Orders, Part 32) is to be issued on satisfactory completion of testing referred to in 9.3.2.

9.3.5.4 Marking

A machinery space crane must be clearly marked with its safe working load (SWL).

9.4 Machinery space lifting gear

9.4.1 Machinery space lifting gear must not be used unless:

(a) it has been tested, examined, certificated and marked by a responsible person in accordance with the relevant provisions of this Appendix before first putting into use; and

(b) a qualified person has determined it to be fit for such use on each occasion thereafter.

9.4.2 Wire rope slings are to be tested, examined, certificated and marked in accordance with AS 1666 (Wire Rope Slings).

9.4.3 Shackles are to be tested, examined, certificated and marked in accordance with AS 2741 (Shackles).

9.4.4 Chain blocks are to be tested, examined, certificated and marked in accordance with AS 1418.2 (Cranes (including Hoists and Winches) Part 2—Serial Hoists and Winches).

9.4.5 Eyebolts are to be tested, examined, certificated and marked in accordance with AS 2317 (Collared Eye Bolts).

10 Spare parts and tools

A ship must be provided with an adequate quantity of replacements for those parts of the ship's electrical and mechanical equipment and installations that, having regard to the intended service of the ship, are essential for the safety of the ship and of the persons on board and that will enable running repairs to be carried out while the ship is at sea. Tools and materials necessary for carrying out repairs must also be provided.

11 Gas welding and cutting equipment

11.1 Introduction

This part of Appendix 4 details the requirements for gas welding and cutting equipment installed on board and carried by a ship for the purposes of maintenance and repair.

11.2 Definitions

fuel gas means acetylene gas or any liquefied petroleum gas;

fuel gas cylinder or oxygen cylinder includes a cylinder that is fully charged, partially charged, or expended; and

portable unit means gas welding and cutting equipment containing not more than one cylinder of fuel gas and one of oxygen.

11.3 General requirements

11.3.1 A fuel gas cylinder and an oxygen cylinder must comply with Australian Standard 2030 'SAA Gas Cylinder Code', or an equivalent standard accepted by the Chief Marine Surveyor.

11.3.2 A fuel gas cylinder and an oxygen cylinder must not be recharged whilst on board a ship.

11.3.3 A tool necessary for opening or closing a cylinder head valve must be available in a readily accessible and conspicuous position near the cylinder.

11.4 Cylinder storage

11.4.1 A fuel gas cylinder and an oxygen cylinder must be adequately secured and stored in a position not immediately above a machinery space that is:

(a) a sheltered position on the open deck; or

(b) a storage room situated on or above the uppermost continuous deck.

11.4.2 A fuel gas cylinder and an oxygen cylinder, whether in use or in store, must be kept in an upright position (that is, longitudinal axis vertical). A cylinder securing device must be capable of quick and easy release, and cylinder stowage arrangements must be such that, in the event of fire, each cylinder may be quickly removed.

11.4.3 Fuel gas cylinders stored on the open deck must be at least 3 metres from oxygen cylinders stored on the open deck except that a single fuel gas cylinder and a single oxygen cylinder may be stored together. Separate rooms must be provided for fuel gas cylinders and oxygen cylinders, except that a single fuel gas cylinder and a single oxygen cylinder may be carried in the same storage room.

11.4.4 A fuel gas cylinder or an oxygen cylinder stored on the open deck must be located away from an accommodation space and, where practicable, the distance of separation is to be at least 3 metres.

11.4.5 A fuel gas cylinder stored on the open deck must not be directly over a hold or compartment containing:

(a) a flammable solid or a substance liable to spontaneous combustion, designated Class 4.2 by the International Maritime Dangerous Goods Code;

(b) a flammable liquid, having a flash point of less than 23°C designated Class 3 by the International Maritime Dangerous Goods Code; or

(c) coal.

11.4.6 A fuel gas cylinder or an oxygen cylinder, when in the stored position must not be exposed to the direct rays of the sun or to another source of heat that will cause overheating of the cylinder or its contents.

11.5 Storage room

11.5.1 A storage room for gas bottles must:

(a) be constructed of steel and be gas tight to any adjacent enclosed space;

(b) have safe and ready access that must be from the open deck only; and

(c) not have a boundary common with an accommodation space.

11.5.2 Unless the room is fitted with an expanded metal mesh door, a mechanical or natural ventilation system must be provided for a storage room as a safeguard against the accumulation of fuel gas or oxygen and the system shall be separate from any other ventilation system.

11.5.3 The installation of electric wiring and electrical fittings in a storage room, or in contact with exhaust from a storage room, must be kept to a minimum. The wiring and fittings must be of the intrinsically safe or explosion proof type.

11.5.4 Storage rooms must not be used for storage of material other than gas bottles.

11.6 Pipes and fittings

11.6.1 Where in a ship a fixed system is fitted to convey fuel gas or oxygen, a pipe or fitting used in or connected to the system must:

(a) be constructed of steel; or other suitable material, except that a material containing more than 70% copper must not be used in association with acetylene unless for a blow pipe tip; and

(b) be capable of withstanding the maximum working stresses to which the pipe or fitting may be subject with a factor of safety that is adequate having regard to:

(i) the material of which the pipe or fitting is constructed; and

(ii) the working conditions under which the pipe or fitting is intended to be used.

11.6.2 Pipes and fittings must be properly supported, protected against damage and installed with adequate allowance for expansion.

11.6.3 Where a fuel gas cylinder or an oxygen cylinder is connected to a fixed system, it must be by a flexible hose or pipe.

11.6.4 The working pressure in a piping system must not exceed:

(a) 100 kPa for fuel gas; and

(b) 700 kPa for oxygen,

except that a short length of pipe between a cylinder and a pressure regulator may be subject to a pressure equal to that within the cylinder.

11.6.5 Where a pipe for conveying fuel gas, a pipe for conveying oxygen or any fitting connected to such pipes may receive fuel gas or oxygen from a source at a higher pressure than it can withstand with an adequate factor of safety, those pipes and fittings must be fitted with:

(a) a reducing valve;

(b) a relief valve located on the low pressure side of the reducing valve; and

(c) a pressure gauge located on the low pressure side of the reducing valve.

Where a relief valve is fitted, it must be arranged so that it discharges within the store room or to a safe position on the open deck.

11.6.6 A pipe for conveying fuel gas and a pipe for conveying oxygen must:

(a) not pass through accommodation spaces, including galleys and associated domestic store rooms;

(b) be readily visible;

(c) be marked at appropriate intervals to indicate their contents; and

(d) be readily accessible.

11.6.7 Where a fixed system may be supplied by more than one cylinder, it must be possible to isolate any cylinder by a stop valve and this stop valve is to be in addition to the shut off valve on the cylinder head.

11.6.8 The outlet from a pipe conveying fuel gas and from a pipe conveying oxygen must be fitted with:

(a) a stop valve; and

(b) a device to prevent return flow of gas or back burning.

11.6.9 An outlet from a pipe conveying fuel gas and an outlet from a pipe conveying oxygen must be confined to an area suitable for welding or cutting.

11.6.10 The number of joints in any system used for conveying fuel gas or for conveying oxygen must be kept to the practical minimum.

11.7 Notices

A warning notice in clear and permanent lettering must be displayed in a conspicuous position:

(a) at any space where a fuel gas cylinder or an oxygen cylinder is stored, and the wording of the notice must be:

Danger 'Name of Stored Gas'
No Smoking
No Naked Flames
Close All Valves When Gas Is Not In Use;

(b) at a space where an acetylene cylinder is stored, and the wording of the notice must be, in addition to the above:

In Case Of Fire, Acetylene Cylinders
That Have Been Hot May Explode Even
After They Have Cooled And Therefore
Should Be Jettisoned

(c) in a welding or cutting area, and the wording of the notice must be:

Close All Valves When Gas Is Not In Use.

11.8 Installation and initial testing

11.8.1 A gas welding and cutting installation must be installed and tested to the satisfaction of an AMSA surveyor.

11.8.2 Before being put into service for the first time, the assembly of pipes and fittings making up a fixed system must satisfactorily withstand a pressure test equal to twice the maximum working pressure of the system without leakage or failure.

11.8.3 After installation in a ship and prior to use, a fixed system for conveying fuel gas and oxygen must be cleaned, de-greased internally and purged with inert gas.

Note: *In deciding whether to provide a fixed system or a portable unit, account must be taken of the design parameter that a portable unit unused for a continuous period of 4 hours must be returned to the position set aside for its safe storage.*

11.9 Installation and maintenance

11.9.1 All the equipment and fittings required by this Appendix must be installed, serviced and maintained so that they remain safe to operate and do not endanger the safety of the ship and the persons on board.

11.9.2 A storage room must be kept free from contamination by grease and oil.

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