

PART A

CHAPTER 1

APPROVAL OF STABILITY INFORMATION

1.1 Introduction

1.1.1 *Legal Basis*

1.1.1 The requirement for stability approval by the Secretary of State is contained in various SIs and associated M notices, depending on ship type and size. The main requirements are as follows:

- Merchant Shipping (Load Line) Regulations 1998, Reg 32(5)* for cargo ships;
- Merchant Shipping (Passenger Ship Construction: Construction of Ships of Classes I, II and II(A)) Regulations 1998, Reg 38; and
- Merchant Shipping (Passenger Ship Construction: Construction of Ships of Classes III to VI(A)) Regulations 1998, Reg 31.
- The Merchant Shipping (Passenger Ships on Domestic Voyages) Regulations 2000.
- The Merchant Shipping (Ro-Ro Passenger Ships) (Stability) Regulations 2004
- The Merchant Shipping (Passenger Ship)(Safety Code for UK Categorised Waters) Regulations 2010
- The Merchant Shipping (Vessels in Commercial Use for Sport or Pleasure) Regulations 1998.
- The Merchant Shipping (Vessels in Commercial Use for Sport or Pleasure) Regulations 1998
- The Merchant Shipping (Small Workboats and Pilot Boats) Regulations 1998,
- The Fishing Vessels (Safety of 15-24 Metre Vessels) Regulations 2002
- The Fishing Vessels (Safety Provisions) Rules 1975.

* Note that specific ship types have been delegated to Assigning Authorities:

- an oil tanker over 100 metres in length;
- a bulk carrier, or an ore carrier, over 150 metres in length;
- a single deck bulk carrier over 100 metres in length but not exceeding 150 metres in length;
- a single deck dry cargo ship over 100 metres in length;
- a purpose built container ship over 125 metres in length;
- a column stabilised mobile offshore drilling unit; or
- a column stabilised mobile offshore support unit.

If in doubt, contact Stability Unit for advice.

1.1.1.2 For Code vessels the stability approval is carried out by the Certifying Authority which may be MCA, however approval is of “form and content” only. This is explained in section 1.7.

1.1.2 Responsibilities

1.1.2.1 The following table sets out the responsibilities for differing types and extent of approval:

Allocation of Responsibilities for Stability Work

	Lightweight Survey and report	Heel Test and report	Buoyancy or deflation tests	Inclining and report	Confirmation of subdivision arrangements onboard	Minor modifications to an approved stability book	Modifications to a stability book not affecting basic data	Modifications to a stability book involving changes to basic data	Flag in of vessel to UK or newbuilding (not delegated stability)	Flag in of vessel to UK or newbuilding (delegated stability)	Approval of Stability book for form and content	Approval of stability book requiring independent check
Stability Unit								✓	✓			✓
UK recognised RO / CA										✓ ⁴	✓ ⁴	
MO Prin Ship Surveyor	✓	✓	✓	✓	✓	✓	✓				✓	
MO MS1 Ship Surveyor	✓	✓	✓	✓	✓	✓	✓ ¹				✓ ¹	
Any MO MS1	✓ ³	✓ ³	✓	✓ ³	✓ ²	✓ ³						
MO MS2/ FVS	✓ ³	✓ ³		✓ ³		✓ ³						
Chapter	annex 1	annex 2		annex 3	annex4	1.2	1.3	1.4	1.5	1.6	1.7	1.4

TABLE 1

NOTES

1. Book to be signed by a Principal Surveyor (see below)
2. Inexperienced non ship surveyors should seek advice from SU or Principal Ship Surveyor on requirements.
3. Complex cases should be referred to a ship surveyor.
4. RO or CA is responsible for formal approval of stability book.
5. All large yacht approvals are usually carried out by Ensign.

1.1.1.2 Definitions for stability work:

- (a) Minor Modifications to an Approved Stability Book – These are changes to the vessel, reported to MCA, which will not affect the basic assumptions made about the hullform and watertight integrity, but when taken into account present a more accurate picture of the condition of a vessel. There may be other limitations on overall changes that can be accepted, before re-measurement of stability is required.
- (b) Basic Data – This is the hydrostatics, cross curves, limiting intact and damage KG / GM data and watertight subdivision and weathertight integrity arrangements of the vessel.
- (c) Delegated Stability – Where stability approval is carried out by the Certifying Authority not Secretary of State.
- (d) Form and Content – Stability approval in MCA normally involves creating an independent computer hull model and comparing the results with those presented for approval. In the case of form and content, no independent model is produced and approval is given solely for the layout and data presented in the book indicating compliance with the requirements.
- (e) Independent Check – the use of the computer hull model referred to above.

1.1.3 *Starting Stability Work*

1.1.3.1 Any request for stability work judged different from the distribution of the responsibilities given in TABLE 1 to decide who should carry out the work. If in any doubt then surveyors should contact Survey Operations Branch for clarification.

1.1.3.2 All stability measurement and approval is fee earning. Appropriate fees should be obtained in advance using MSF5100. In the case of work to be done by the Stability Unit, the Marine Office is responsible for obtaining sufficient fees for SU to carry out their work and advising them of the job number so that funds can be journal transferred to the SU.

1.1.3.3 If a Marine Office does not possess the appropriate skills to complete the stability work locally, then AOM/SIC should seek assistance, via their line management, from other offices. In some cases approval work (and not measurement) normally done by an MO may be sent to the SU, with their agreement.

1.2 **Minor Modifications to an Approved Stability Book**

1.2.1 An example of such minor modifications are addition of a new or replacement item of equipment, such as a boat or winch. Minor modifications

would not be accepted for “unknown” items such as a general increase in lightship weight, or a change which affects the assumptions made in the stability book such as a new or modified weathertight deckhouse. Structural changes, such as a new open shelter, should be accompanied by supporting information such as detailed weight and centre calculations. Equipment changes should be accompanied by weighed weights (for example from a manufacturer or a load cell) and centres. This ensures the effects of the changes can be determined accurately and confidently.

1.2.2 Where an owner/operator proposes minor modifications to the approved stability information to reflect minor changes in arrangements, and the arrangement of the booklet is such that this may readily be achieved, the following process may be adopted provided that the basic stability data remains unaltered.

1.2.3 The owner/operator should be requested to forward minimum two copies of the proposed amended pages to the local Marine Office. The pages should be examined for accuracy and to ensure that no required data is lost if pages are also to be removed.

1.2.4 For a small number of revised pages, each should be stamped and dated with the approval date using a standard MCA stamp. The file copy of the MSF 2227 ‘Record of Stability Approvals’ form should be copied and completed to reflect the new status of the booklet.

1.2.5 Approved replacement pages and Record of Stability Approval forms should be returned to the owner/operator with a request to confirm when modifications to the ship copy have been completed. Copies of all documents should be placed on file. The book need not be re-signed.

1.2.6 In cases where it is considered impracticable to amend an existing approved stability booklet, due to the binding for example, new stability information booklets should be submitted and then treated as 1.3.

Records to be kept on File

File Theme: 31/04 – Fishing Vessels, 18/01 - Passenger Ships, 18/02 - Cargo Ships, 46/01 – Code Boats
Minute indicating the work done
Documents relating to discussions with owner/ consultant
MSF2227 – Record of Stability Approvals
Copy of final approved book and any amendment pages
Supporting data and calculations of the changes

1.2.7 Changes to the vessel should be based on known weighed weights and centres. The surveyor may request to witness the changes in cases of doubt. In the case of Fishing Vessels, the cumulative effect of a number of

approved modifications may not result in a revised lightship which exceeds the 2% 1% limits on displacement and LCG.

1.3 Modifications to Stability Book not Affecting Basic Data

1.3.1 In circumstances where an owner has submitted revised stability information for a vessel where stability data (hydrostatics, KN's or critical KG/GM's) are unchanged from the previous approved copy, then due reference should be made to the appropriate Stability Unit checklists when determining if sufficient information is provided. This work should be carried out by a Naval Architect.

1.3.2 Provided all relevant information is provided the booklet should be considered suitable for approval, noting that any additional information not directly related to the calculation of stability should be removed or placed in a separate annex at the back of the book and that, unless otherwise stated in the checklist specific to the ship type, information for vessels over 24m should also meet general checklist MSF 2223. A record should be made making reference to the checklists completed.

1.3.3 Examination of the revised stability information should include confirmation that stability data (hydrostatics, KN's or critical KG/ GM's) are the same as those in the previous approved copy of the stability information and insertion of an MSF 2227 'Record of Stability Approvals' into front of MCA copy only.

1.3.4 Stability information should be prepared for endorsement by the surveyor up to a maximum of four copies including the MCA file copy. All pages should be numbered. The front page (or suitable inside page) should additionally be stamped with unsigned stability approval stamp in red (completed to refer to the appropriate regulation(s) with which the stability information complies, no of pages and file number etc.) and with the stamp drawing the masters attention to special notes on stability (completed to refer to those pages directly referring to stability assessment). The MSF 2227 should be completed and stamped by the surveyor.

1.3.5 Stability information should be forwarded to a Principal Marine Surveyor for endorsement, on the appropriate file, with all records completed. The Principal Surveyor should be a Ship Surveyor where the examining surveyor is not of that discipline and be satisfied that the book indicates compliance with the regulations and that the surveyor has performed all the required checks before signing the books. A declaration should be provided on file by the examining surveyor on MSF 2202 together with a completed checklist for the relevant type of vessel. The Principal Surveyor should also endorse the minute on file. It should be noted that the endorsement of the stability approval stamp is confirmation that MCA process has been completed correctly and that the book is

ready for issue. The endorsing surveyor should not be the same as the examining surveyor in order to provide the independent quality check. Confirmation of the technical content of the book, and the basis of that confirmation, is given in the declaration by the examining surveyor.

1.3.6 Where stability information contains grain stability data, then the booklet should additionally be stamped with the Document of Authorisation to Load Grain in red, and an official Letter of Authorisation to Load Grain should also be issued.

1.3.7 An example of such a letter is available from the Stability Unit micro site on the MNet.

1.3.8 Following any stability information approval, the assigning authority for load line, if applicable, should be informed of the approval with details of the assigned draught and freeboard and a copy placed on the file. An example of such a letter is available from the Stability Unit micro site on the MNet.

Records to be kept on File

File Theme: 31/04 – Fishing Vessels, 18/01 - Passenger Ships, 18/02 - Cargo Ships, 46/01 – Code Boats
Minute indicating the work done and the reason for it.
Documents relating to discussions with owner/ consultant/ Assigning Authority
MSF2227 – Record of Stability Approvals
MSF2202 – Stability Declaration
Relevant checklist for ship type
Copy of final approved book and any amendment pages (previous approved stability book to be retained on file but marked “superceded”)
Supporting data and calculations of the changes

1.4 Modifications or Initial Approval of a Stability Book Requiring Independent Check

1.4.1 Modifications requiring independent checks will normally be carried out by the Stability Unit (SU). The Marine Office lead surveyor needs to request the appropriate information from the owner/ consultant and forward this to the SU. It is vital that all requested information is provided to enable to independent check to be carried out.

1.4.2 The Stability Questionnaire form, MSF 2200, and the drawings listed on it will provide the Stability Unit with the necessary information to start work on the approval.

1.4.3 The MO lead surveyor should forward the form to the shipbuilder or consultant for completion and return at a very early stage. This is to allow time for the analysis to be carried out. In the case of a newbuild this should be at the

design stage, as any changes will be much more costly once the ship is under construction.

1.4.4 The MO lead surveyor should complete the General Particulars and Marine Office Declaration sections of an MSF 2202 “Stability Declaration”. If the Classification Society has verified items, e.g. the draught marks, on behalf of MCA, written confirmation should be obtained and placed on the CM stability file.

1.4.5 The inclining test report will be examined for acceptance by the Stability Unit on the basis of the MO lead surveyor having confirmed on the MSF 2202 that the report reflects the ship condition and test readings etc. at the time.

1.4.6 Having made adequate provision for fees, the MO lead surveyor should forward the relevant stability CM file/s to the Stability Unit with a short minute indicating any relevant information or peculiarities for that specific case.

Records to be kept on File

File Theme: 31/04 – Fishing Vessels, 18/01 - Passenger Ships, 18/02 - Cargo Ships, 46/01 – Code Boats
Minute to SU indicating any background to the work and requesting approval.
Documents relating to discussions with owner/ consultant/ Assigning Authority
MSF2200 – Stability Questionnaire
Copy of submitted information
Drawings listed on MSF2200
MSF 2202 Stability Declaration relating to inclining test

If further information is submitted to the surveyor, this may be forwarded to the SU for attachment to the file.

1.4.7 The Head of the Stability Unit will allocate the case within the unit.

1.4.8 The lead surveyor should liaise with the SU to keep up to date with the progress of approval.

1.4.9 It is normal practice that the SU will communicate any issues relating to the approval directly to the consultant / shipyard, keeping the lead surveyor copied in on progress..

1.5 Flag In/ Newbuild of Vessel With Delegated Stability

1.5.1 The authorisations for Recognised Organisations to carry out stability approval as outlined at 1.1.1 are subject to the formal written agreements being in place between the MCA and each Classification Society or Certifying Authority involved.

1.5.2 In cases where stability approval has been authorised, owners or shipbuilders should be advised to approach the Classification Society or Certifying Authority as appropriate.

1.5.3 In the case of ships joining the UK flag, where stability approval is delegated to Class Society, the Marine Office surveyor should verify that the ship has stability information on board which has been approved by a UK recognised Class Society and is in English. It is the responsibility of the Class Society to make sure that the contents of the book are accurate and contain the information required.

1.6 Flag in/ Newbuild of Vessel Without Delegated Stability

1.6.1 Procedure for Stability Assessment at Time of Flag In

1.6.1.1 Unless unusual circumstances prevail, flag-in's to the UK should be undertaken with sufficient notice to permit implementation of the following procedure for stability assessment. It is anticipated that 2 weeks lead time will be enough to guarantee completion of this process from time of initial receipt of required documentation in the Stability Unit to provisional approval.

1.6.1.2 Under this procedure it is the intention that stability information for all flag-in cases shall be initially assessed and approved by the Stability Unit prior to the flag-in being completed, provided they meet an adequate standard.

1.6.1.3 Where assessment indicates the existing stability information meets minimum requirements and has previously been subject to an acceptable independent verification (i.e. a full independent computer check of hydrostatics, critical KGs and loading conditions), full approval shall normally be given. Provisional approval shall be given if the existing information is only considered sufficient to be accepted temporarily, subject to verification of lightship data or other minor modifications.

1.6.1.4 In those cases where initial assessment by the Stability Unit indicates material deficiencies in the submitted information, with respect to the stability standard for which certification has been issued by the losing flag, the flag-in process shall be suspended until these issues are resolved.

1.6.1.5 On receipt of the notification of the intention to flag a vessel into the UK, the lead surveyor should secure submission of the following information at the earliest possible juncture and submit these on CM stability file to the Stability Unit with covering minute and SU job number confirming that sufficient fees are available to cover at least twelve hours initial assessment and processing.

1.6.1.6 The following information is required for vessels required to comply with intact stability only:

- (i). Minimum 3 copies existing approved stability information. (If original booklet is not in English, one copy of the original and minimum 3 translated copies to be provided as soon as practicable thereafter, noting that only English translation is eligible for approval).
- (ii). General arrangement
- (iii). Capacity plan
- (iv). Lines and body plans
- (v). Copy of load line certificate
- (vi). Copy of most recent inclining report where not included in the above. (If original report is not in English, one copy of the original with English translation to be provided as soon as practicable thereafter).
- (vii). Copies of recent typical loading conditions calculated on board. These are required to determine the margins of stability currently achieved by the vessel.
- (viii). Declaration from the operators of the vessel confirming that there are no material changes to the vessel which would render the approved stability information inaccurate.

1.6.1.7 The following information is required, in addition to the above for vessels also required to comply with damage stability and/ or subdivision:

(Including calculations demonstrating compliance with Marpol, reduced load line freeboard, IGC, IBC, HSC or other codes, probabilistic damage, side damage and floodable lengths as applicable to the case in hand.)

- (i). Full copy of damage stability assessment upon which critical loading data (KG or GM limit curves) are based. (If original assessment is not in English, one copy of the original with English translation to be provided as soon as practicable thereafter).
- (ii). Copy of floodable length data/ curves where applicable and available.
- (iii). Copy of sufficient detailed structural drawings to permit independent MCA definition of all internal compartmentation.

1.6.2 Initial Assessment by Stability Unit

1.6.2.1 On receipt of the background data, the Head of the Stability Unit shall assign the case for appraisal, which should be completed within the timescale at 1.6.1.1 . The appraisal shall comprise the following steps:

1.6.2.2 Vessels required to comply with intact stability only -

- (i). Stability information shall be assessed against the requirements of the appropriate stability approval checklist and any deficiencies noted for inclusion in the report of assessment. It may be noted that previously approved information may be accepted with omissions from the full

checklist provided these omissions are not severe enough to prevent an accurate assessment of stability from being made.

- (ii). Confirmation shall be obtained from previous approval authority where possible to determine the level of checks upon which this approval was given. In particular, whether an independent computer check has been conducted.
- (iii). Correct stability criteria to be applied.
- (iv). Approved loading conditions in the stability information shall be considered for accuracy with particular attention to treatment of free surface correction and the overall margin of stability over the statutory minimum.
- (v). Recent loading conditions shall also be examined with particular attention to treatment of free surface correction and the overall margin of stability over the statutory minimum.
- (vi). Most recent inclining report to be examined for accuracy and lightship history examined to determine if these form a reliable basis for stability assessment (passenger ships should have had lightweight check or inclining within previous 5 years). This is of particular importance where margins of stability are seen to be low and, in such cases, an assessment should be made to determine if conditions remain compliant if lightship growth exceeds standard limits (2% lightship weight, 1% on lightship LCG). See additional guidance at Annex 3.

1.6.2.3 Additional steps for vessels also required to comply with damage stability/ subdivision:

- (i). Correct application of stability criteria to be applied. Particular attention to be paid to existing passenger ships constructed prior to 29 April 1990, for which UK 'Stab 80' standard of residual stability following side damage is appropriate. Refer to Stability Unit.
- (ii). Correct application of compartment permeability's to be applied.
- (iii). Vessels to be correctly treated for long compartments inside longitudinal bulkheads typically positioned just inside B/5 line, having regard to floodable length and survivability following damage beyond the longitudinal bulkhead.
- (iv). Asymmetry and cross-flooding in way of watertight longitudinal divisions to have been adequately considered within damage evaluation.
- (v). Lesser cases of damage and down-flooding arrangements to have been adequately considered within damage evaluation.
- (vi). For probabilistic damage cases in particular, confirmation of correct application of the regulations with regard to derivation of inputs such as H_{max} , L_s , X_1 and X_2 values and 'b' values, derivation of calculation draughts, treatment of stepped bulkheads, derivation of critical KG values from input GM data, correct definition of damage cases, correct consideration of lesser cases of damage and consistency of results for determination of 's' against damages considered.

1.6.3 *Report of Stability Appraisal*

1.6.3.1 Having given due consideration to the above, the surveyor shall make a report of stability appraisal to the Head of the Stability Unit detailing all discrepancies noted in the appraisal and recommending one of the following courses of action :

- (i). Full approval and stamping of the existing submitted information.
- (ii). Provisional approval and endorsement of the existing submitted information pending specified modifications to the text.
- (iii). Provisional approval and endorsement of the existing submitted information pending full independent MCA computer check. This shall normally be required for the vessel types listed at 1.8.5.
- (iv). Suspension of flag-in pending lightweight check/ re-inclining and revision of existing stability information to suit revised values.
- (v). Rejection of submitted stability information for specified material defects and suspension of flag-in pending full resubmission and full independent MCA computer check.

1.6.3.2 The report should include details of any verification that an independent check of the submitted stability information has been completed for the losing flag state, and whether this was completed by the flag state or by a classification society recognised by MCA for this purpose.

1.6.3.3 Where further action is proposed to complete formal approval, an estimate of fees to complete this work should be included.

1.6.4 *Notification of findings*

1.6.4.1 Following consideration of the report of stability appraisal the Head of the Stability Unit shall approve the submitted stability information booklets where appropriate and return these to the MO lead surveyor. In those cases where full approval is given, booklets will be returned on the file and the SU job closed out.

1.6.4.2 In those cases where additional work shall be required before full approval can be given, such as provisional approval or rejection of existing stability information due to material defects, the MO lead surveyor shall be informed by loose minute (copied onto CM file) of the Stability Unit's findings and what outstanding works are required.

1.6.4.3 Where provisional approval is given the booklets shall be attached to the minute and in all cases the MO lead surveyor will be advised of the estimated fees required to complete the full approval process. These additional fees shall be raised through the local MO directly against the SU job number.

1.7 Approval of Stability Book for Form and Content

1.7.1 The approval of stability information for code vessels is “form and content” only. The following checks should be used for assessment:

- (i). Carry out check of inclining test results, using submitted hydrostatics, and verify lightship displacement, VCG and LCG.
- (ii). Carry out broad manual check of hydrostatics. Do values for displacement, LCB, LCF, VCB appear reasonable for vessel shape and stated dimensions.
- (iii). Check that the extent of buoyant superstructures included in computation of KN values is acceptable.
- (iv). Check worst service condition for make up of deadweight, distribution and free surfaces. Carry out check of worst service condition using submitted hydrostatics and KN values. All should compare well with submission.
- (v). Check limiting KG or GM values, if applicable, at full load displacement by calculating sailing condition at maximum allowable KG or minimum allowable GM to confirm the results are exactly on the limit with respect to whichever criterion is the limiting one. Where the limiting curve is dictated by damage stability criteria, perform the above check to ensure that intact criteria are met and have surplus in hand.
- (vi). For sailing vessels, confirm correct method of assessment has been used.
- (vii). If damage stability is required, the volumes and centres of each relevant compartment should appear reasonable for the vessel shape and dimensions. It should be verified that the correct criteria have been applied and that the results meet the required standard.
- (viii). Confirm stability information book contains all data required by MSF 2204 - Code Vessels stability approval checklist above, that all stability criteria are met and that there are no obvious errors. A copy of the completed checklist should be placed on the CM stability file.

1.7.2 The following process should be used for approval:

- (i). Any significant discrepancy after the above checks may warrant full hull computer check. In the first instance however, discrepancies should be taken up with the consultant.

- (ii). If necessary, the shipbuilder/consultant should be advised of any errors or omissions and requested to resubmit the stability information taking those into account.
- (iii). The stability declaration MSF2202 should be completed and placed on file along with a minute explaining the work carried out and requesting approval. MSF 2227 should be completed and added to the file copy of the Stability Book.
- (iv). The stability books should be prepared for endorsement in the same way as indicated in section 1.3.4, adding the words “Form and Content Only” to the approval stamp.
- (v) Stability information should be forwarded to a Principal Marine Surveyor for endorsement, on the appropriate file, with all records completed. The Principal Surveyor should be a Ship Surveyor where the examining surveyor is not of that discipline and be satisfied that the book indicates compliance with the regulations and that the surveyor has performed all the required checks before signing the books. A declaration should be provided on file by the examining surveyor on MSF 2202 together with a completed checklist for the relevant type of vessel. The Principal Surveyor should also endorse the minute on file. It should be noted that the endorsement of the stability approval stamp is confirmation that MCA process has been completed correctly and that the book is ready for issue. The endorsing surveyor should not be the same as the examining surveyor in order to provide the independent quality check. Confirmation of the technical form of the book is given in the declaration by the examining surveyor.
- (vi) The Lead Surveyor should then keep one file copy of the Stability Book and forward the remaining books to the owner/consultant with a covering letter that explains their responsibilities for the accuracy of the hull data.

Records to be kept on File

File Theme: 46/01 – Code Boats
Minute indicating the work done and the reason for it.
Documents relating to discussions with owner/ consultant/ Assigning Authority
MSF2227 – Record of Stability Approvals
MSF2202 – Stability Declaration
Relevant checklist for ship type
Copy of final approved book and any amendment pages (previous approved stability book to be retained on file but marked “superceded”)
Supporting data and calculations of the changes

1.8 Special Instructions

1.8.1 *Stability Unit Approval of Intact Stability (not requiring subsequent damage stability verification)*

The following process should be followed by the SU lead surveyor:

- (i). Ensure that the correct intact stability criteria have been used.
- (ii). The hull model should be defined on computer.
- (iii). It will not normally be necessary to define internal compartments/ tanks but this may be done if considered necessary by the surveyor in a particular case. Normally verification of volume/ free surface can be by simple allowance for shape and BD 3/12 etc. for free surface.
- (iv). Carry out computer check of hydrostatics at relevant draught range and trims and check against submitted values. In general, comparison within 3% of submitted figures may be accepted – See note below.
- (v). Carry out computer check of inclining test results and verify lightship displacement, VCG and LCG.
- (vi). Ensure that the extent of buoyant structure used in calculating KN values is acceptable. Carry out computer check of KN values at relevant draught range and trims and check against submitted values. In general, comparison within 3% of submitted figures may be accepted – See note below.
- (vii). Ensure that the submitted loading conditions are as required by regulation for the vessel type and that deadweight items are realistic in terms of weight and distribution. [Where loading conditions are produced using a spreadsheet program it is not necessary to conduct a full arithmetic check for summation provided basic checks are made to ensure correct operation.]
- (viii). Carry out computer check of submitted loading conditions and ensure GZ curve and obtained stability values are in line with submitted values.
- (ix). Carry out computer check of limiting KG or GM values at relevant draught range and trims and ensure submitted values are acceptable.
- (x). Confirm stability information book contains all data required by relevant stability approval checklist/s MSF 2203 to MSF 2224 for appropriate ship type and that such data is technically correct. A copy of each completed checklist should be placed on the CM stability file.

- (xi). If necessary, the shipbuilder/ consultant should be advised of any errors or omissions and requested to resubmit the stability information taking those into account.
- (xii). If all is in order the Stability Unit section of the MSF 2202 “Stability Declaration” should be completed and placed on the relevant CM file.
- (xiii). The file should then be forwarded to the Head of the Stability Unit with a short minute recommending formal approval. The Head of the Stability Unit will review the case and if satisfied that all is in order will endorse the stability information to indicate approval and arrange for the Assigning Authority to be advised.
- (xiv). The file will then be returned to the MO lead surveyor for distribution of the approved stability books.
- (xv). The MO lead surveyor should request written confirmation from the owners or consultants that the approved book has been placed on board and place a copy of the receipt on the CM file.

Note - Surveyors must always exercise their professional judgement when comparing MCA data with the original submission, taking account of available margins of stability. The tolerances given are for guidance only and assessment will be at the discretion of MCA.

1.8.2 Stability Unit Approval of Cases where both Intact Stability and Damage Stability Apply

The process at 1.8.1 should be followed but all compartments and tanks involved in subdivision or damage stability considerations should be defined on computer and compared with submitted values. In addition, the following process should be followed:

- (i). Ensure correct damage stability criteria have been used.
- (ii). Carry out computer check of subdivision or equivalent damage stability.
- (iii). Carry out computer check of damage stability and ensure resulting limiting KG or GM values are acceptable.
- (iv). Carry out computer check of probabilistic damage stability if applicable to ensure acceptability of submission.
- (v). Carry out computer check of Stockholm water on deck, if applicable.

1.8.3 *Standards to be applied in consideration of stability information for flag ins.*

1.8.3.1 Inclining tests - cargo ships

For cargo ships the basic requirement is that a further inclining is not required on transfer to the UK flag provided the following conditions are met:

- (i). The report of the previous inclining test is available and was witnessed by an IACS member classification society, or flag Administration; and
- (ii). after examination, the MO lead surveyor considers the inclining test report is sufficiently detailed, is valid for the ship in its present condition having regard to the age and type of ship, and the test was properly conducted; and
- (iii). a responsible representative of the owner provides written confirmation that he is satisfied that the result of the last test is still valid for the ship in its present condition.
- (iv). The ship flagging-in is a sister ship and first of class inclining details are provided by the owner. Where the owner is unable to provide this he will be required to demonstrate with justification and to the satisfaction of the MCA on what basis the stability book has previously been approved.

When an inclining test is requested, draught marks need not be rechecked unless there is cause to doubt their accuracy.

On ships where the estimated stability margins may be low, especially on low deadweight/ displacement ratio ships, or on other ships if there are reservations as to the inclining test validity, a lightweight check should be carried out. If the lightship particulars do not agree closely with documented values, i.e. Weight within $\pm 2\%$, and LCG position within $\pm 1\%$ of LBP, then a new inclining test should be conducted as soon as possible.

1.8.3.2 Inclining tests - passenger ships

Additional considerations for passenger ships are that the ship should have been inclined within the previous five years. The report of this inclining should have been witnessed by an IACS member Classification Society or contracting flag State and approved by the flag State.

The surveyor should examine the report to ensure that it is sufficiently detailed and that the test was properly conducted. If the inclining experiment was carried out more than five years ago, it can be accepted, provided subsequent lightweight surveys have been carried out at intervals of no more than five years, endorsed by the flag State or an IACS member Classification Society and the results are within the limits of the original inclining data, given below :

- (i). Lightship displacement within $\pm 2\%$ and
- (ii). Lightship LCG position within $\pm 1\%$ of the length between perpendiculars.

1.8.4 *Survivability (damage stability and subdivision standard)*

1.8.4.1 It should be confirmed that the correct survivability standards have been applied to any ship. For passenger ships in particular it should be noted that vessels for which probabilistic damage is not applied, these should meet both subdivision requirements (floodable length) and side damage.

1.8.4.2 It should always be confirmed that the damage stability criteria used are applicable to the ship and whether they should be applied to one compartment or two compartment damages (or more). It should also be noted that some ships have a dual role requiring both one and two compartment subdivision standards.

1.8.4.3 Owners transferring ships to the UK register which do not comply with the required survivability standards will need to put forward proposals for compliance.

1.8.4.4 Having regard to applicable residual stability standards after side damage, the following is provided from the regulations.

A) *Non Ro-Ro passenger ships (Class I, II and II(A) damage stability standards)*

- (i). Ships built before 29 April 1990 should comply with STAB 80 (i.e. Section 2 of Schedule 3 of MSN 1698(M)); for details see "*Passenger Ship Construction – Classes I, II & II(A) Instructions for the Guidance of Surveyors*" section 5.6.
- (ii). Ships built on or after 29 April 1990 should comply with SOLAS 90 (i.e. Section 3 of Schedule 3 of MSN 1698(M)); for details see "*Passenger Ship Construction – Classes I, II & II(A) Instructions for the Guidance of Surveyors*" section 5.7.

B) *Ro-Ro passenger ships (UK Classes I, II and II(A) damage stability standards)*

The Stockholm Agreement applying SOLAS 90 standard plus consideration of water on deck applies to all UK Class I, II and II(A) ro-ro passenger ships operating regular scheduled voyages in certain areas i.e. UK Coast, North-western Atlantic, Irish Sea, North Sea, the English Channel and the Baltic Sea. Such ships should be in possession of documentary evidence to indicate compliance. The document should also state the maximum significant wave height the ship may operate in which should be checked against the required value for the intended area of operation in accordance with the Stockholm Agreement (ref. MSN 1790(M)). (NOTE: This is the sea area for the predicted wave height and not the actual wave height which may be encountered in service).

C) *Ro-Ro passenger ships (EU Classes A, B and C damage stability standards)*

- (i). The Stockholm Agreement applying SOLAS 90 standard plus consideration of water on deck is applied to all EU Class A and B ro-ro passenger vessels and to EU class C Ro-Ro passenger vessels constructed after 1st October 2004 operating in EU waters, by Directive 2003/25/EC. These provisions come into force for UK ships within EU waters, and foreign ships whilst in UK waters from 16 November 2004
- (ii). Such ships should be in possession of documentary evidence to indicate compliance by the time they reach 30 years after their keel date, but in any case no later than 1st October 2015, or otherwise be phased out. The document should also state the maximum significant wave height the ship may operate in which should be checked against the required value for the intended area of operation in accordance with the Stockholm Agreement (ref. MSN 1790(M)). (NOTE: This is the sea area for the predicted wave height and not the actual wave height which may be encountered in service).

Note : For EU Class A vessels operating on an equivalent UK Class II(A) service, the provisions of part B above should be applied as if it was a UK Class II(A) vessel.

D) *Ro-Ro passenger ships damage stability standards – UK Ships Operating Outside Northern European Areas*

Ro-Ro ships not operating within the above areas are not required to comply with the Stockholm Agreement. If built on or after 29 April 1990 they

should be to SOLAS 90 standard. If of Classes I, II or II(A) built before that date they should meet STAB 80 standard and have a document showing their A/A_{max} value. They are to phase in to SOLAS 90 in accordance with the timetable given in the Passenger Ship Construction: Ships of Classes I, II and II(A) Regulations 1998, Regulation 44(2).

1.8.4.5 All passenger Ships with long spaces inboard of longitudinal divisions situated below the bulkhead deck (e.g. long lower holds) are to comply with survivability standards in accordance with Part 2.5 of the “Passenger Ship Construction – Classes I, II and II(A) – Instructions for the Guidance of Surveyors”.

1.8.5 Vessels for which full MCA computer check is normally required:

- Passenger vessels
- INF carriers
- HSC
- Fishing vessels

1.8.6 Where MCA are the approving authority for Classed vessels, the relevant Classification Society should be informed when the book is approved (see 1.3.8). Prior to approval Class should be informed of progress, in particular when the surveyor is content for a short term certificate to be issued (this normally for six months and follows provisional approval).

1.9 Provisional approval

1.9.1 In all cases, stability information should be submitted to the MCA for approval, prior to a vessel entering service or re-entering service following modifications affecting stability.

1.9.2 In cases where sufficient time is not available between the submission of stability information and the vessel entering service, for the completion of examination and approval of the stability information, the MCA may grant provisional approval of stability information to allow the vessel to operate in the short term.

1.9.3 Prior to agreeing to provisional approval, the examining surveyor should be satisfied that the stability information indicates compliance with the relevant statutory requirements and that sufficient guidance and information is provided to enable the Master to determine the stability of the vessel in any anticipated condition of loading.

- 1.9.4 Where a vessel is provided with provisionally approved stability information, any certificate issued to the vessel shall have a maximum duration **to the next anniversary date plus three months.**
- 1.9.5 For newbuild vessels and vessels listed in section 1.8.5, provisional approval should only be granted where the following conditions are met
- 1.9.5.1. Accurate stability information is provided
 - 1.9.5.2. The vessel has been subject to an inclining test or lightship check
 - 1.9.5.3. The vessel's basic data have been subject to an independent computer check and the results of this are shown to be satisfactory (see sections 1.4, 1.6, 1.7, 1.8.1 and 1.8.2)

1.10 References

The following are available on the internal MCA Master List of Documents:

- MSF 2200 – Stability Questionnaire
- MSF 2202 – Stability Declaration
- MSF 2203 – Stability Approval Check List - Fishing Vessels 15m LOA to less than 24m Registered Length
- MSF 2204 - Stability Approval Check List - Code Vessels
- MSF 2205 - Stability Approval Check List - High Speed Craft
- MSF 2206 - Stability Approval Check List - Large Subdivided Non Ro-Ro Passenger Ships (UK Classes I, II and II(A))
- MSF 2207 - Stability Approval Check List - Large Subdivided Ro-Ro Passenger Ships (UK Classes I, II and II(A))
- MSF 2208 - Stability Approval Check List - Small Subdivided non Ro-Ro Passenger Ships (UK Classes III to VIA and EC A to D)
- MSF 2209 - Stability Approval Check List - Small Subdivided Ro-Ro Passenger Ships (UK Classes III to VIA and EC A to D)
- MSF 2210 - Stability Approval Check List - Standby Vessels
- MSF 2211 – Stability Approval Check List - Tugs
- MSF 2212 - Stability Approval Check List - Chemical Tankers
- MSF 2213 - Stability Approval Check List - Ships Carrying Deck Cargoes
- MSF 2214 – Stability Approval Check List - Dredgers
- MSF 2215 - Stability Approval Check List - Ships Carrying Grain Cargo
- MSF 2216 - Stability Approval Check List - General Cargo Ships
- MSF 2217 - Stability Approval Check List - Gas Carriers
- MSF 2218 - Stability Approval Check List - Mobile Offshore Drilling Units and Ships
- MSF 2219 - Stability Approval Check List - Oil Tankers
- MSF 2220 - Stability Approval Check List - Offshore Supply Vessels

- MSF 2221 – Stability Approval Check List - Pontoons
- MSF 2222 - Stability Approval Check List - Special Purpose Ships
- MSF 2223 - Stability Approval Check List - All Load Line Ships
- MSF 2224 - Stability Approval Check List - Fishing Vessels Over 24m Registered Length
- MSF 2227 - Record of Stability Approval

Annex 1

LIGHTWEIGHT SURVEY PROCESS

A1.1 Purpose

A lightweight survey is carried out to confirm that the vessel remains unchanged within certain limits since the last stability measurement.

A1.2 Preparation

1.2.1 The lightweight check should be carried out by the builder's/owner's representatives with a MCA surveyor in attendance.

1.2.2 Where applicable, the surveyor should confirm with the builders/ operator that the ship is similar in all respects to the first sister ship or remains unchanged since the last inclining (taking account of approved weight changes) for which a satisfactory inclining test or lightweight check report is available.

1.2.3 The same care should be exercised in preparing and carrying out the lightweight check, as applies to the inclining test. The relevant parts of these Annex 3 apply.

A1.3 Conducting the Survey

1.3.1 The survey should be conducted in the same way as the first part of the inclining test. See Annex 3.

1.3.2 Note that whilst calm weather and waters are needed to take accurate draft readings, there is less restriction on conditions for the remainder of the test as no heeling is required.

A1.4 Following the Survey

1.4.1 After the lightweight check has been completed the builders should furnish the surveyor with a report which includes details of the condition of the ship, calculation of lightship displacement and longitudinal centre of gravity.

1.4.2 On completion of a lightweight check, reports should be checked and approved by the attending surveyor. The surveyor should examine the report and be satisfied that it represents the state of the vessel during the survey.

1.4.3 Formal confirmation should be provided to the owner/operator/builder of the results of the check and a copy placed on the file. An example of such a confirmation letter will be made available from the Stability Unit micro site on the MNet.

Records to be kept on File

File Theme: 31/04 – Fishing Vessels, 18/01 - Passenger Ships, 18/02 - Cargo Ship Newbuilds, 46/01 – Code Boat Newbuilds
Minute indicating any background to the work and requesting approval.
Documents relating to discussions with owner/ consultant/ builder
Copy of submitted lightship report
MSF 2202 Stability Declaration (for new vessels)
MSF 2227 Stability Approval Record
Letter to owner/ operator/ builder confirming approval of the report

A1.5 Special Instructions

1.5.1 If the lightship particulars obtained from the lightweight check do not agree closely with the test results for the first ship or previous inclining taking account of approved weight changes, the subject should be inclined e.g.:-

- (i) weight within $\pm 2\%$
- (ii) LCG position within $\pm 1\%$

If the surveyor is in any doubt, then the case should be referred to a Principal Surveyor (Ship) before informing the owner/ operator/ builder.

1.5.2 Where the lightship comparison is satisfactory, the revised lightship and LCG should be used together with the approved VCG from the approved inclining test for calculations onboard the ship. The stability book should be endorsed with the revised particulars. Small modifications capable of accurate assessment may be taken account of by calculation. A copy of the lightweight check report should be kept in the file record.

1.5.3 In the case of sister ships the lightship weight and LCG from the test should be used along with the approved VCG from the first sister. The stability book should reflect the fact that sister ship information has been used and a copy of the original inclining report enclosed within the book.

Annex 2

HEEL TEST PROCESS

A2.1 Test Purpose

The test is intended to measure the resistance of the vessel to heeling. This is an indirect measurement of stability that has the advantage of being simple and not requiring full stability information.

A2.2 Preparation

2.2.1 The owner should be contacted to prepare the vessel for the survey and obtain the weights and battons required. The heeling test should be conducted with fuel and water tanks 95% full. If this is not possible, extra weights should be added at approximately the same longitudinal centre of gravity to simulate the additional fuel or water required. Any loose equipment not normally onboard should be removed.

2.2.2 The owner should confirm that weights amounting to WB/12 will be available to move and any other weights needed to bring the vessel to the loaded condition. The location of weights should be agreed to replicate the location of passengers. The batons or other measuring equipment should also be provided by the owner.

2.2.3 Any form of weights may be used where the mass is known or can be checked using a suitable weighing device. Care should be taken when using sandbags or similar where moisture ingress may have a significant effect on their weight. The use of people for performing heeling tests is not permitted due to safety and accuracy considerations.

2.2.4 The surveyor should have the stability information or previous test report available to check the condition of the previous test.

2.2.5 The first part of MSF2015 should be completed and sent to the owner so that they are aware of the weights needed. It will save a lot of time on the day of the test if the locations of weights are agreed with the owner before hand and added to MSF2015.

A2.3 Conducting the Test

2.3.1 The condition of the vessel should be verified by examining all spaces and tank levels. The results should be added to MSF2015. Any ballast present on the vessel should be recorded for reference at future stability verifications. Photographs of the vessel should be taken to aid recording of the condition of the vessel during the test.

2.3.2 The vessel should initially be presented in a “light condition”, this excludes any weights onboard which represent passengers. This will enable light freeboards to be taken.

2.3.4 The light freeboards should be recorded on MSF2015. It is vital to note carefully where and how freeboards are measured, for future reference.

2.3.5 The weights representing passengers should then be loaded onboard in the agreed locations. The weight will be split between fixed weight and those to be used to provide the heel.

2.3.6 The total heeling moment of WB/12 should be imposed in 3 shifts of approximately WB/36, with the angle of heel being recorded at each stage. This staged heeling allows for subsequent analysis in borderline cases, helps avoid experimental errors and reduces the risk of excessive heel angles being achieved on newly considered vessels. The process should be performed for shifts both to port and to starboard.

2.3.7 The angle of heel may be measured using battens pre-marked by the owner with freeboard corresponding to 5° and 7° of heel; a pendulum, calibrated inclinometer, water tube or by freeboard measurements. The angles of heel should be measured by two separate methods where practicable to provide a means of verification. For example, this could be two pendulums (forward and aft), a pendulum and freeboard measurements or pendulum and inclinometer. When a pendulum is used to measure the heel angle the pendulum should ideally be of sufficient length to produce a deflection of 35 mm for each weight shift. The angle of heel should be recorded in the spaces provided on the pro-forma. Care should be taken to ensure the vessel is floating freely and avoid the influence of wash from passing vessels, wind heeling and mooring line tension on heel angle measurements.

2.3.8 The freeboards and other measurements should be written onto MSF2015.

2.3.9 Take photographs of the test for future reference.

2.3.10 The MSF2015 should then be completed and signed by owner and surveyor. The owner should be requested to formally submit a copy of the MSF2015 to the surveyor for approval.

A2.4 Following the Test

2.4.1 The surveyor should check the calculations on the MSF2015. Once satisfied, an approved copy of the report should be sent to the owner. The file should be updated to reflect the approval. Note for non-subdivided ships the records may be kept on the 33/01 General Survey file.

Records to be kept on File

File Theme: 33/01 - Passenger Ships
Minute indicating the work done and the reason for it.
Documents relating to discussions with owner/ consultant
MSF2015 – Completed Heel test Proforma

Should the vessel fail to meet the heel test requirements, the case should be referred to a Principal Marine Surveyor (Ship) for advice before responding to the owner.

A2.4 Special Instructions:

2.4.1 Assumed Disposition of Passenger Loading:

For the purposes of the heeling test, passengers should be assumed to congregate on the highest decks first in order to simulate a worst case loading condition. For open deck areas passenger numbers are allocated on a basis of 0.3 m² per passenger for the clear deck area. Clear deck area excludes any permanent fixtures that reduce the deck area available to standing passengers. Where permanently fitted seating is present, the area taken up by the seating is subtracted from the clear deck area, and the number of seats added to the passenger allocation for that deck. If the seating is in the form of benches, the number of passengers is to be calculated by dividing the length of the bench in mm by 460 and rounding to the nearest integer passenger value.

2.4.2 Restricting Deck Areas:

Where upper deck areas could exceed the passenger distribution assumed in the heeling test calculations (e.g. when entertainment is provided to a standing audience) control measures should be put in place to ensure that this does not occur.

2.4.3 Assumed Centre of Gravity of Passengers:

The vertical centre of gravity of standing passengers should be assumed to be 760 mm above the deck. For seated passengers the vertical centre of gravity is taken as 300 mm above the seat base.

2.4.4 Responsibilities:

2.4.4.1 The owner is responsible for the stability of the vessel and ensuring the stability information for the vessel is both accurate and current. It is the owner's responsibility to retain all of the stability information relating to the vessel. All heeling test and lightship check reports should be kept with the vessel's documentation, preferably with a copy onboard if the vessel has an enclosed wheelhouse.

2.4.4.2 The owner is responsible for preparing the vessel for the heeling test. This should include ensuring that all tanks are filled to the correct level, the vessel is in a suitable sheltered location for performing the test, suitable weights with which to conduct the test are supplied, along with the equipment and personnel required to safely position and shift these weights.

2.4.4.3 The Master of the vessel is responsible for ensuring that the vessel is not overloaded and is operated in a safe manner exercising prudence and good seamanship. Masters should be aware that compliance with stability criteria does not ensure immunity from capsize or absolve the Master from his responsibilities.

2.4.5 Passenger Heeling Moment:

The two thirds – one third passenger distribution defined within MSN 1699 equates to the standard passenger heeling moment of $WB/12$. W is the weight of passengers (at 75 kg each) and B is the extreme breadth to the outside of the hull plating (excluding any fendering or rubbing strakes). This heeling moment may be applied using any weight and shift distance combination, provided it produces the required heeling moment (heeling moment = weight x distance moved).

2.4.6 Freeboard measurements:

2.4.6.1 Loaded freeboard measurements should be taken at the heeling test. Freeboard measurements should be taken at positions forward, aft and amidships; with the location of the measurement points being recorded for future reference. Freeboard measurements should generally be taken to the deck edge at side; any exception to this should be noted to avoid any misinterpretation. The minimum freeboard and its location should also be recorded. The requirements for minimum freeboard are stipulated in MSN1699(M). For vessels of waterline length 6 m or less, a minimum freeboard of 380 mm is required. Vessels with a waterline length of 18.3 m or more require a minimum freeboard of 760 mm. For intermediate lengths the minimum freeboard should be calculated by linear interpolation.

2.4.6.2 The mean loaded freeboard measured at the amidships point is the assigned loaded freeboard of the vessel. Freeboard marks consisting of horizontal lines 25 millimetres in height and 300 millimetres in length should be marked on both sides of the vessel at amidships. The assigned freeboard should be the distance between the top edge of the mark and the deck edge at side (or noted alternative reference point). The marks shall be painted in white or yellow if the background is dark or in black if the background is light and, if the sides of the ship are of metal, they shall be cut in, centre punched or indicated by welded beads. If the sides of the ship are of wood, the marks shall be cut into the planking to a depth of not less than 3 millimetres. If the sides are of other

materials to which the foregoing methods of marking cannot effectively be applied, the marks shall be permanently affixed to the sides of the ship by bonding or some other effective method. The surveyor should attend the vessel to verify that the marks are in the correct position. The freeboard should be marked at the next out water survey after 1st October 2007.

2.4.6.3 Vessels operating on category A and B waters may take the minimum freeboard to the lowest point of downflooding rather than to the deck edge, providing that the upstands or superstructure raising the point of downflooding above the level of the deck are of a similar standard of watertight structural efficiency to the vessel's topsides. Vessels operating on category A and B waters, heeling less than 7° but not meeting the minimum freeboard requirement may be accepted on a basis that the residual freeboard of the vessel in the heeled condition is not less than the residual freeboard that the vessel would have had, had the prescribed freeboard criteria been complied with and the vessel heeled to the full 7°.

2.4.6.4 Narrowboats operating on category A waters may be allowed to take the minimum freeboard requirement of 380 mm regardless of the length of the vessel provided the minimum residual freeboard in the heeled condition is at least 252mm.

2.4.6.5 At the heeling test freeboard measurements should also be taken in the 'light' condition with no passenger weight on board. This may be done before or after the heeling test is conducted. The tank states should be as per the heeling test condition (95% full or compensated using weights). Freeboard measurements should be taken forward, aft and amidships; with the location of the measurement points being recorded for future reference. Details of any bar stock, changes in normal furniture and equipment, and number of personnel onboard should also be noted.

2.4.7 Subsequent Stability Verifications:

2.4.7.1 The stability of the vessel is required to be reconsidered every 5 years either by repeating the heel test or undertaking a lightship survey, provided the lightship survey undertaken at the previous heel test was well documented and the freeboard measurements recorded. The owner must also prepare and sign a declaration to verify no changes have been made to the vessel in the intervening period.

2.4.7.2 The vessel should be placed in the same "light" condition as recorded. The upright freeboards should be re-recorded and compared with the previous values. Should the result be the same then the vessel is deemed to be unchanged and the stability is accepted for a further five years. Due to measurement errors freeboards are considered unchanged if within 3 cm of the original figures at the bow and stern and 2 cm at the amidships measuring point.

However, if the change in freeboard exceeds these margins indicating an increase in the lightship displacement then the heeling test must be repeated.

Annex 3

IIINCLINING TEST PROCESS

A3.1 Introduction

3.1.1 These notes are intended to provide practical guidance in order to minimise inaccuracies and ensure that the information derived from the inclining test provides a satisfactory basis, acceptable to the MCA or delegated Authority, for the determination of the ship's stability.

3.1.2 It is appreciated that the following recommended procedures for inclining tests cannot always be achieved and equally efficient alternative procedures may have to be adopted to suit particular circumstances.

3.1.3 For small ships where it is considered impracticable to adopt procedures as given in these notes the MCA may be prepared to accept alternative procedures.

3.1.4 Advice on the procedure when an inclining test may be dispensed with in certain circumstances is contained in paragraph 4 below.

A3.2 Preparation for the Test

3.2.1 *Notification to the MCA or delegated Authority*

3.2.1.1 It is most important that the surveyor should inspect the ship shortly before the test in order to be satisfied that the ship will be in an acceptable condition. If this is not so the surveyor may require that the test be deferred.

3.2.1.2 An opportunity should be taken to discuss and confirm arrangements for the test with the builder/owner with particular regard to the following:-

- (i) inclining weight data;
- (ii) type, amount and position on board;
- (iii) method of handling weights;
- (iv) anticipated maximum angle of heel to each side from upright;
- (v) pendulums; approximate location and length;
- (vi) stabilograph or similar instrument; calibration and position; and
- (vi) condition of tanks and approximate trim; consideration being given to practical measures to minimise the free surface effects of liquids, excessive trim or initial heel.

3.2.1.3 Draught marks;

- (i) draught marks should have been checked on the building berth or in dry dock by a surveyor from the MCA or delegated Authority as appropriate;

- (ii) keel sight readings indicating the baseline from which the draught marks have been measured should be available for reference. Details of any local corrections for keel projections etc. should be provided before draught mark readings are taken;
- (iii) The draught and trim of the vessel during the test should be such that the forward mid, and aft draught marks are easily read and accessible, preferably away from areas of significant flare, overhangs or projections.
- (iii) a plastic damping tube with engraved scale may be of assistance in reading the marks if the water surface is likely to be disturbed;
- (iv) draught datum marks may require to be established should the draught marks be inaccessible e.g. when there is a flat overhang at the stern;
- (v) a recently calibrated hydrometer with suitable density bucket is available; and
- (vi) a suitable small boat is to be available.

3.2.1.4 Degree of completion;

- (i) items to be added;
- (ii) items to be deducted;
- (iii) items to be relocated; and
- (iv) removal of debris and overall cleanliness.

3.2.1.5 Location and timing;

- (i) the test should be carried out where possible in a wet dock basin to provide stable conditions and minimise disturbance from passing craft;
- (ii) where the test may be affected by a tidal stream or current it may require to be timed to coincide with a slack water period; and
- (iii) there should be no risk of grounding during the test.

3.2.1.6 Specialised ship types;

Ro-Ro ferries with hoistable or hinged decks; the centre of gravity of the ship will require to be determined for two lightship conditions, such decks will require to be adequately secured to prevent movement during the test.

3.2.2 Data required

3.2.2.1 Trimmed hydrostatic data should be available over an adequate range of draughts.

3.2.2.2 Tank layout plan. The drawing should show the locations of the sounding pipes, air pipes and access manholes.

3.2.2.3 Tank calibrations and capacities.

3.2.2.4 Length of sounding pipes from striker to deck plate. This can provide a useful indication in the event of a sounding pipe being blocked.

3.2.2.5. Copies of up to date calibration certificates should be available for inspection for the, inclining weights, hydrometer and any weighing scales / load cells used on the day of the inclining test.

3.2.3 General condition of the ship

3.2.3.1 The ship should be complete or virtually so. An accurate list of items to be added, deducted, or relocated after the test should be prepared by the builder/owner and their weights and positions as recorded agreed by the surveyor. Such items, however, should be reduced in number to the absolute minimum.

3.2.3.2 In conjunction with the person conducting the test, the surveyor should thoroughly inspect the ship to ensure that all items on the list above are accurately assessed and check that any omissions are taken into account.

3.2.3.3 The ship should be generally clean. Shipyard equipment, staging and debris should be removed as far as practicable.

3.2.3.4 Suspended weights including boats, anchors, derricks, vehicle ramps and decks etc. should be secured in their seagoing positions.

3.2.3.5 Tank top, open floored spaces and bilges in the machinery space and elsewhere should be clean and dry. Loose water and oil should be removed.

3.2.3.6 In general, machinery, piping systems, boilers and associated equipment should be at operating levels.

3.2.3.7 Keys to all locked compartments should be available.

3.2.3.8 In the inclined condition, it should be ensured that the ship has adequate positive stability.

3.2.4 *Tanks*

3.2.4.1 General

(i) The number of tanks containing liquids during the test should be kept to a minimum. As a guide the total weight of liquids should not exceed 25% of the lightweight. This may be exceeded where it is desirable to reduce the trim of the vessel.

(ii) The disposition of all liquids required to be on board should be agreed by the surveyor, prior to the test.

(iii) Where it is agreed that particular tanks may contain liquid, these must either be pressed full or the level must be such that the free surface effect can be accurately determined. Slack tanks where permitted should comply with the slack tank instructions given in paragraph 2.4.2 below. The number of slack tanks is to be restricted to one pair for either oil or fresh water.

(iv) All tanks not permitted to contain liquids during the test should be dry. (See also paragraph 2.4.2 (ii) below).

(v) Cross connections between port and starboard tanks containing liquids should be checked to ensure that the control valves are closed.

3.2.4.2 Slack tanks

(i) The free surface allowance for slack tanks should be subject to agreement of the surveyor. When these are not agreed and they are slack a free surface correction should not be allowed for in determining the lightship KG.

(ii) Slack tanks should be limited to tanks with essentially rectangular form. Double bottom tanks should generally not be slack during the experiment.

(iii) As a guide where tanks are permitted to contain liquids in accordance with paragraph 2.4.1 (iii), above, deep tanks should be 20% to 80% full and double bottom tanks 40% to 60% full to ensure that a significant change in the dimensions of the free surface does not occur during inclining. The effect of trim should be taken into account when considering the configuration of the liquid surface.

(iv) Tanks containing liquids of high viscosity should not be permitted to be slack since the free surface effect is impossible to determine. However if such liquids can be heated to reduce viscosity then a free surface correction can be accepted at the surveyor's discretion.

3.2.4.3 Pressed-up tanks

Such tanks are assumed to be completely full with no air pockets or voids. In practice it is difficult to obtain a completely filled tank even assuming normal venting and air hole provision and a free surface of unknown extent may occur in an apparently filled tank. For this reason tanks required to be pressed should be filled in advance of the test until the tank is completely full. Each tank should subsequently be topped up, the final topping up being carried out slowly and the tank ullage checked at intervals.

3.2.4.4 Empty tanks

(i) Where tanks are required to be empty, it is not sufficient to pump tanks until stripping should be performed with portable pumps where this is necessary. Narrow tanks such as peaks having sharp deadrise and negligible free surface may be exceptions to this.

(ii) Proper safety precautions should be adopted before entering the tanks - See Marine Information Note MIN 29(M) regarding the Merchant Shipping (Entry into Dangerous Spaces) Regulations 1988 and Codes of Practice.

3.2.4.5 Identification of liquids

Liquids retained in tanks should be identified and their specific gravity's determined.

3.2.5 *Trim*

3.2.5.1 Trim by the head or excessive trim by the stern should be avoided.

3.2.5.2 If tanks are to be pressed up, some trim by the stern will aid in venting and elimination of air pockets. A small trim will also facilitate emptying tanks required to be empty. Where a number of tanks are permitted to be full, aftermost tanks should be pressed up first.

3.2.5.3 Any marked change in the shape of the waterplane when the ship is heeled during inclining such as may occur with a chine form or where the ship has 'flat' sections aft, should be avoided e.g. by modifying the trim so that the chine is immersed both when upright and heeled.

3.2.5.4 Hydrostatic particulars for the ship as inclined should be calculated for the actual trimmed waterline. A correction should be made for hog or sag as applicable.

3.2.6 *List*

3.2.6.1 As far as practicable the ship should be upright with the inclining weights in the initial position.

3.2.6.2 A small initial list is acceptable but ideally this should not exceed one-half degree. Weights to correct any list should be used where necessary.

3.2.7 *Mooring arrangements*

The ship should be moored so that it is floating freely during heeling in an adequate depth of water. The mooring ropes should be arranged so as not to restrict heeling. Ideally the ship should be moored bow and stern only by as few lines as possible led parallel to the fore and aft axis.

3.2.8 *Weather*

3.2.8.1 It is desirable that the weather should be fine with little or no wind and with calm water conditions.

3.2.8.2 The effect of wind, current, wavelets, or difficult mooring conditions may adversely affect results due to:

- (i) inability to measure draught and freeboards accurately;
- (ii) excessive or irregular oscillations of the pendulums; and
- (iii) variations in superimposed heeling moments.

3.2.8.3 In poor or deteriorating weather conditions, the surveyor will require to assess the situation and indicate whether he considers it necessary to discontinue the test.

A3.3 Conduct of the Test

3.3.1 *Supervision*

3.3.1.1 Routine preparation, organisation and direction of the test is the builder's/owner's responsibility.

3.3.1.2 The builder's/owner's representative in charge should:

- (i) make sure that the ship is completely prepared for the test in compliance with 2 above;
- (ii) have authority over all personnel participating in the test; and
- (iii) maintain close liaison with the surveyor;

3.3.1.3 The surveyor will personally verify:

- (i) the adequacy of the ship's preparation and condition;
- (ii) that the mooring arrangements are satisfactory having regard to the weather conditions; and
- (iii) the accuracy of the test data accumulated and confirm its proper recording in the test report.

3.3.2 *General*

3.3.2.1 The minimum number of personnel should be on board during the test and their same position maintained during the recording of the pendulum readings.

3.3.2.2 Shore gangways should be lifted during the test to minimise restriction of ship's movement and maintain control on the number of personnel on board during the test. Power lines, hoses etc. connected to the shore should be kept to a minimum and those that are essential kept slack at all times.

3.3.2.3 Any appreciable quantities of snow or ice must be removed from the ship before test.

3.3.2.4 If the inclining test is carried out at low water, checks should be made to ensure that the ship is not aground.

3.3.3 *Test weights*

3.3.3.1 The total weight used should be sufficient to produce an inclination of about 2° to each side. Larger inclinations of up to 3° may be necessary to provide measurable deflections of the pendulum on smaller ships. This will depend upon the hull form and whether the waterplane shape changes during heeling. See also paragraph 2.5.3. The inclination should not exceed 4° from the upright zero position.

3.3.3.2 Generally, it will be most convenient to use 4 weights or sets of weights. These should be as near equal as practicable and be positioned symmetrically 2 each port and starboard.

3.3.3.3 The weights should be compact and of such configuration that the vertical centre of gravity may be accurately determined. Personnel are not an acceptable alternative to weights.

3.3.3.4 Each weight should be marked with an identification number and its weight. The surveyor should confirm that the test weights have been verified by means of weighbridge or equivalent immediately prior to the test. Weight test certificates should be inspected and the surveyor should be satisfied that the certificate remains applicable.

3.3.3.5 The weights should be positioned as far outboard as possible on the upper deck. The positions of the weights should be marked and arrangements made to ensure that they can be placed back in their exact original positions as the test progresses.

3.3.3.6 The transverse movement of the weights should be arranged so that there is no longitudinal change in the positions of each weight which would affect the ship's trim.

3.3.3.7 The lifting arrangements should be such that the weights can be transferred rapidly once the test is started to minimise delay and reduce the likelihood of encountering changing tide, current or weather conditions.

3.3.3.8 The use of water transfer between wing tanks in lieu of solid weights is acceptable under carefully controlled conditions.

3.3.4 *Pendulums*

3.3.4.1 At least two pendulums should be used except as noted in paragraph 3.4.5 below. These should be located in separate positions in areas protected from the wind.

3.3.4.2 The pendulums should be as long as practicable. They should comprise good quality wire such as piano wire.

3.3.4.3 The deflections of the pendulum giving the reading for each individual shift of inclining weight should be sufficient to provide accurate results. A deflection for each shift of not less than 35mm would be expected.

3.3.4.4 The pendulum weights should be immersed in a trough of liquid to dampen the pendulum oscillations. Care should be taken that the trough is of adequate size to give ample margin beyond the maximum anticipated deflection and that the pendulum weight does not touch the bottom of the trough. The trough should be secured against accidental movement. Improved damping can be achieved by filling with oil rather than water.

3.3.4.5 In lieu of one of the pendulums referred top in paragraph 3.4.1 above:-

(i) a Stabilograph may be used. The surveyor should ensure that the Stabilograph has been regularly tested and require reports of such tests to be provided; or

(ii) a U tube water level may be used. The ends of the level should be positioned as far outboard as possible. Arrangements should be made for a record of all readings (from both ends of the tube) to be obtained. Clear plastic tube should be used and care should be taken to exclude all air bubbles and avoid topping up after commencement of test.

3.3.5 *Draught and freeboards*

3.3.5.1 Using the boat provided, draughts should be measured with the gangway raised, and with the ship in the same condition as during the test.

3.3.5.2 Draughts should be measured port and starboard at the forward and aft draught marks and freeboard or datum mark measurements obtained port and starboard amidships to determine hog and sag. In cases where the ship's form makes the draught marks inaccessible or difficult to read, adjacent check measurements of freeboard to a suitable datum should be taken.

3.3.5.3 The longitudinal positions at which the draught measurements are taken should be recorded so that the necessary corrections can be applied in the inclining report.

3.3.5.4 For small vessels, not required to be fitted with draught marks:

(i) Freeboard may be utilised in lieu of draught measurements after establishing the sheer profile relative to the keel. In addition to measurements at bow and stern, measurements should be obtained at convenient locations near the fore and aft quarter lengths and amidships. The relative measurements fore and aft and port and starboard should be taken simultaneously.

(ii) When recording measurements, particular care should be taken that all persons who will be on board during the test, are disposed in the positions allocated.

3.3.5.5 The specific gravity of the water in which the ship is floating should be checked using a hydrometer at the same time as the draughts are measured. Where necessary, readings at various depths should be obtained to ensure accurate assessment of the mean specific gravity. The hydrometer should be checked in fresh water before use.

3.3.6 *Communications and control*

3.3.6.1 One person at a central control station should have complete control over all personnel involved in the test.

3.3.6.2 There should be efficient two-way communications between

- (i) the person in control and the weight handlers;
- (ii) each pendulum or deflection recording station; and
- (iii) the mooring attendants.

3.3.7 *Weight movements*

3.3.7.1 Following the initial zero reading, the standard test should preferably involve at least 8 weight movements, and in no case less than 6 weight movements. Thus, where W is the total weight on each side of the ship:

SHIFT	MOVEMENT
1	W/2 tonnes P to S
2	W/2 tonnes P to S
3	W/2 tonnes S to P
4	W/2 tonnes S to P (zero checked)
5	W/2 tonnes S to P
6	W/2 tonnes S to P
7	W/2 tonnes P to S
8	W/2 tonnes P to S (zero checked)

3.3.7.2 At each weight shift, the pendulum readings should be marked on a wood batten, the deflection being measured from the previous shift mark.

3.3.7.3 As the test proceeds the standard of the results may conveniently be verified by plotting the moment of transverse weight movements against the tangent of deflection or equivalents. The weight movements proposed should give a good spread of points but additional shifts should be carried out if necessary to minimise any error resulting from an appreciable "stagger". All readings without omission should be shown in the test report. This recorded plot is to be included in the final inclining experiment report.

3.3.7.4 Weight movements should be made directly athwartships so as to avoid a change in the ship's trim, and should be maintained in the same horizontal plane above the keel.

3.3.7.5 Checks should be made during the test to see that all personnel are in their agreed locations and that all mooring lines which should be slack, are in fact slack.

3.3.8 *Test results*

3.3.8.1 The builder/owner should provide the surveyor with a detailed inclining test report which should include:

- (i) a complete record of all test information, including the trace from the Stabilograph if used and including moment shift plotted against inclinations recorded;
- (ii) a statement providing a clear account of the condition of the ship as inclined. This should include all weights, with their centres of gravity, required to be added, deducted or relocated for derivation of the lightship condition; and
- (iii) calculations using the test data to determine the characteristics of the ship in the inclined and lightship condition.

3.3.8.2 The surveyor should examine the test report for accuracy and completeness and immediately advise the builder/owner concerning any comments or disagreement with the report.

3.3.8.3 When the surveyor has confirmed satisfaction with the results of the inclining test and the accuracy of the report, the report should be used as a basis for the production of the stability information booklet (marked 'provisional') to be placed on board prior to the ship's departure on the maiden voyage.

3.3.8.4 On completion of an inclining test, reports should be checked and approved locally by Marine Office surveyors with relevant expertise subject to formal confirmation being given to the owner/operator of the results of the test and a copy placed on the file. An example of such a confirmation letter will be made available from the Stability Unit micro site on the MNet. A copy of the inclining report should be included in the approved stability information booklet and a copy kept on file.

Records to be kept on File

File Theme: 31/04 – Fishing Vessels, 18/01 - Passenger Ships, 18/02 - Cargo Ships, 46/01 – Code Boats
Minute indicating the work done and the reason for it.
Documents relating to discussions with owner/ consultant
Approved inclining report

Annex 4

CONFIRMATION OF SUBDIVISION REQUIREMENTS

A4.1 Purpose

4.1.1 The purpose of confirming subdivision arrangements is to ensure that the assumptions made during the analysis of subdivision at the design stage is correct as the ship is constructed.

4.1.2 Any significant deviation from the design could adversely affect the outcome of both probabilistic and deterministic calculations. In particular if bulkheads or decks are in different places then compartment volumes will be different.

4.1.3 Sometime smaller differences might have a significant effect. For example an open ended pipe in the damage zone could lead to progressive flooding of an adjacent compartment or tank. Thus changing the worst damage case and the shape of the critical KG curves.

4.1.4 In smaller cargo ships the arrangements are relatively simple and therefore checking is straight-forward. More complex vessels such as Ro Ros and large passenger ships have more complicated arrangements and they require greater time to ensure the ship is build as designed. Not all parts of this guidance will be relevant to all ship types.

A4.2 Prior to Attending the Vessel

The attending surveyor should be conversant with the subdivision arrangements of the vessel and assumptions made during analysis of subdivision. In particular the surveyor should have access to:

- (i). The compartment plan – showing locations of all watertight bulkheads and partial bulkheads to prevent progressive flooding.
- (ii). Piping Schematics and plans – indicating the route of piping systems.
- (iii). Ventilation plan - indicating the penetration of bulkheads and decks and external openings.
- (iv). Active and passive subdivision arrangements – such as cross flooding ducts, convention valves and downflooding ducts.
- (v). The locations of watertight, weathertight and splashtight doors and hatches.

The surveyor should identify critical aspects for verification onboard the ship, such as ventilation openings assumed as downflooding points. Where applicable

the vessels damage control plan and damage control booklet should be referenced.

A4.3 Conducting Checks

Checks should be undertaken as follows:

- (i). Bulkhead positions should be checked against frame spacing on a sample basis.
- (ii). The location of each watertight door should appear to be correct according to the plans provided.
- (iii). Tank divisions should be checked on a sample basis that boundaries are in line frame spacing shown on plans.
- (iv). Location of partial bulkheads should be verified.
- (v). Any cross/ down flooding ducts should be checked clear.
- (vi). Critical ventilation or air pipe openings should be verified. The surveyor should take a general view of adjacent areas to make sure there are no other openings that might be critical which may or may not be shown on the plans.
- (vii). Watertight bulkheads should be checked for correct penetrations of cables, ducting and pipes.
- (viii). Any convention or cross flooding valves fitted should be function tested.

A4.4 Recording Checks

Once checks have been completed, this should be reported in a minute on the relevant file and a copy sent to the Stability Unit for reference.

Records to be kept on File

File Theme: 13/02 - Passenger Ships, 18/02 - Cargo Ships
Minute indicating that the subdivision has been checked and verified.
Documents relating to discussions with owner/ consultant
Drawings relating to subdivision checks

Annex 5 – Form of Stability Approval

A5.1 Books being prepared for approval should be stamped and/or sealed as described below:

A5.2 Books should be stamped with:

- An approval stamp (see below)
- A notice to masters (see below)



The stamp is rectangular with a red border. At the top left is the Royal Coat of Arms. To its right, the text 'Maritime & Coastguard Agency' is printed in red. Below this, the text 'STABILITY INFORMATION APPROVED as complying with the requirements of the:' is printed in red. This is followed by two horizontal dashed lines. Below these lines, the text 'Signed:.....' is printed in red, with 'Authorised Officer' printed in smaller red text to its right. Below this, the text 'Date:.....' is printed in red. Below that, the text 'No. of pages:..... No. of plans:.....' is printed in red. Below this, the text 'No addition or amendment is to be made to this Document without prior approval of the MCA.' is printed in red. At the bottom, the text 'File No. CM.....' is printed in red.



The stamp is rectangular with a red border. At the top left is the Royal Coat of Arms. To its right, the text 'Maritime & Coastguard Agency' is printed in red. Below this, the text 'PRIOR TO USING THE DETAILED INFORMATION CONTAINED IN THIS BOOKLET ATTENTION SHOULD BE PAID TO THE SPECIAL NOTES GIVEN IN PAGES:.....' is printed in red.

Where appropriate a book should be stamped with a form and content only approval in the form below:



Individual pages should be numbered and either be stamped with an office stamp, permanently bound or sealed so that pages cannot be added and any loss of pages can be recognised.

Author	Á Doherty	Branch	Survey Ops
Approved By	S Roberts	Branch	Survey Ops
Authorised By	P Coley	Branch	Technical Performance