

GUIDE FOR

VESSELS INTENDED TO CARRY COMPRESSED NATURAL GASES IN BULK APRIL 2005

NOTICE NO. 2 – July 2007

The following Rule Changes were approved by the ABS Rules Committee on 7 June 2007 and become **EFFECTIVE AS OF 1 JULY 2007**.

(See <http://www.eagle.org/rules/downloads.html> for the consolidated version of the Guide for Vessels Intended to Carry Compressed Natural Gases in Bulk 2005 with all Notices and Corrigenda incorporated.)

Notes - The date in the parentheses means the date that the Rule becomes effective for new construction based on the contract date for construction, unless otherwise noted. (See 1-4/2.2.)

CHAPTER 3 SHIP SURVIVAL CAPABILITY AND LOCATION OF CARGO TANKS

SECTION 1 FREEBOARD AND INTACT STABILITY

(Delete last sentence and Note in Subsection 3-1/6, to read as follows.)

6 Onboard Computers for Stability Calculations (1 July 2007)

The use of onboard computers for stability calculations is not a requirement of class. However, if stability software is installed onboard vessels contracted on or after 1 July 2005, it should cover all stability requirements applicable to the vessel and is to be approved by the Bureau for compliance with the requirements of Appendix 3-A1, “Onboard Computers for Stability Calculations”.

CHAPTER 3 SHIP SURVIVAL CAPABILITY AND LOCATION OF CARGO TANKS

APPENDIX 1 ONBOARD COMPUTERS FOR STABILITY CALCULATIONS

(1 July 2007)

(Revise Appendix 3-A1, specifically 3-A1/Table 1 and 3-A1/6.1, as follows.)

1 General

1.1 Scope

The scope of stability calculation software is to be in accordance with the stability information as approved by the flag Administration or the Bureau on behalf of the flag Administration. The software is at least to include all information and perform all calculations or checks as necessary to ensure compliance with the applicable stability requirements.

Approved stability software is not a substitute for the approved stability information, and is used as a supplement to the approved stability information to facilitate stability calculations.

1.2 Design

The input/output information is to be easily comparable with approved stability information so as to avoid confusion and possible misinterpretation by the operator relative to the approved stability information.

An operation manual is to be provided for the onboard computer stability software.

The language in which the stability information is displayed and printed out as well as the operation manual is written is to be the same as used in the vessel's approved stability information. The primary language is to be English.

The onboard computer for stability calculations is vessel specific equipment and the results of the calculations are only applicable to the vessel for which it has been approved.

In case of modifications implying changes in the main data or internal arrangement of the vessel, the specific approval of any original stability calculation software is no longer valid. The software is to be modified accordingly and reapproved.

2 Calculation Systems

This Appendix covers either system, a passive system that requires manual data entry or an active system, which replaces the manual with the automatic entry with sensors reading and entering the contents of tanks, etc., provided the active system is in the off-line operation mode. However, an integrated system, which controls or initiates actions based on the sensor-supplied inputs is not within the scope of this Appendix.

3 Types of Stability Software

Three types of calculations performed by stability software are acceptable depending upon a vessel's stability requirements:

- Type 1 Software calculating intact stability only (for vessels not required to meet a damage stability criterion)
- Type 2 Software calculating intact stability and checking damage stability on basis of a limit curve or previously approved loading conditions
- Type 3 Software calculating intact stability and damage stability by direct application of preprogrammed damage cases for each loading condition

4 Functional Requirements

4.1 Calculation Program

The calculation program is to present relevant parameters of each loading condition in order to assist the Master in his judgment on whether the vessel is loaded within the approval limits. The following parameters are to be presented for a given loading condition:

- Deadweight data
- Lightship data
- Trim
- Draft at the draft marks and perpendiculars
- Summary of loading condition displacement, VCG, LCG and, if applicable, TCG
- Downflooding angle and corresponding downflooding opening
- Compliance with stability criteria: Listing of all calculated stability criteria, the limit values, the obtained values and the conclusions (criteria fulfilled or not fulfilled)

4.2 Direct Damage Stability Calculations

If direct damage stability calculations are performed, the relevant damage cases according to the applicable rules are to be pre-defined for automatic check of a given loading condition.

4.3 Warning

A clear warning is to be given on screen and in hard copy printout if any of the loading limitations are not complied with.

4.4 Data Printout

The data are to be presented on screen and in hard copy printout in a clear unambiguous manner.

4.5 Date and Time

The date and time of a saved calculation are to be part of the screen display and hard copy printout.

4.6 Information of Program

Each hard copy printout is to include identification of the calculation program with version number.

4.7 Units

Units of measurement are to be clearly identified and used consistently within a loading calculation.

5 Acceptable Tolerances

Depending on the type and scope of programs, the acceptable tolerances are to be determined differently, according to 3-A1/5.1 or 3-A1/5.2. In general, deviation from these tolerances is not to be accepted unless a satisfactory explanation for the difference is submitted for review and the same is satisfactorily confirmed by the Bureau that there would be no adverse effect on the safety of the vessel.

Examples of pre-programmed input data include the following:

- Hydrostatic data: Displacement, LCB, LCF, VCB, KMt and MCT vs. draft
- Stability data: KN or MS values at appropriate heel/trim angles vs. displacement, stability limits.
- Compartment data: Volume, LCG, VCG, TCG and FSM heeling moments vs. level of the compartment's contents.

Examples of output data include the following:

- Hydrostatic data: Displacement, LCB, LCF, VCB, KMt and MCT versus draft, as well as actual drafts, trim.
- Stability data: FSC (free surface correction), GZ-values, KG, GM, KG/GM limits, derived stability criteria (e.g., areas under the GZ curve), weather criteria.
- Compartment data: Calculated Volume, LCG, VCG, TCG and FSM heeling moments vs. level of the compartment's contents

The computational accuracy of the calculation program results is to be within the acceptable tolerances specified in 3-A3/5.1 or 3-A3/5.2, of the results using an independent program or the approved stability information with identical input.

5.1 Calculation Program of the Approved Stability Information

Programs which use only pre-programmed data from the approved stability information as the basis for stability calculations are to have zero tolerances for the printouts of input data.

Output data tolerances are to be close to zero. However, small differences associated with calculation rounding or abridged input data are acceptable. Additionally differences associated with the use of hydrostatic and stability data for trims that differ from those in the approved stability information are acceptable subject to review by the Bureau.

5.2 Independent Program for Assessment of Stability

Programs which use hull form models as their basis for stability calculations are to have tolerances for the printouts of basic calculated data established against either data from the approved stability information or data obtained using the approval authority's model. Acceptable tolerances shall be in accordance with 3-A1/Table 1.

TABLE 1
Acceptable Tolerances

<i>Hull Form Dependent</i>	<i>Acceptable Tolerance ⁽¹⁾</i>
Displacement	2%
Longitudinal center of buoyancy, from AP	1%/50 cm max
Vertical center of buoyancy	1%/5 cm max
Transverse center of buoyancy	0.5% of B/5 cm max
Longitudinal center of flotation, from AP	1%/50 cm max
Moment to trim 1 cm	2%
Transverse metacentric height	1%/5 cm max
Longitudinal metacentric height	1%/50cm max
Cross curves of stability	5 cm
<i>Compartment Dependent</i>	
	<i>Acceptable Tolerance ⁽¹⁾</i>
Volume or deadweight	2%
Longitudinal center of gravity, from AP	1%/50 cm max
Vertical centre of gravity	1%/5 cm max
Transverse center of gravity	0.5% of B/5 cm max
Free surface moment	2%
Shifting moment	5%
Level of contents	2%
<i>Trim and Stability</i>	
	<i>Acceptable Tolerance ⁽¹⁾</i>
Drafts (forward, aft, mean)	1%/5 cm max
GMt	1%/5 cm max
GZ values	1%/5 cm max
FS correction	2%
Downflooding angle	2°
Equilibrium angles	1°
Distance to unprotected openings or margin line from WL, if applicable	±5%/5 cm
Areas under righting arm curve	5% or 0.0012 mrad

Notes:

- 1 Deviation in % = [(base value – applicant’s value)/base value] × 100.
- 2 Where the “base value” may be from the approved stability information or the results of master computer using an independent program.

6 Approval Procedure

6.1 Conditions of Approval of the Onboard Software for Stability Calculations

The onboard software used for stability calculations is subject to approval, which is to include:

- Verification of type approval, if any,
- Verification that the data used is consistent with the current condition of the vessel (see 3-A1/6.3),
- Verification and approval of the test conditions, and
- Verification that the software is appropriate for the type of vessel and stability calculations required.

The satisfactory operation of the software with the onboard computer(s) for stability calculations is to be verified by testing upon installation (see 3-A1/8). A copy of the approved test conditions and the operation manual for the computer/software are to be available onboard.

6.2 General Approval (optional)

Upon receipt of application for general approval of the calculation program, the Bureau may provide the applicant with test data consisting of two or more design data sets, each of which is to include a vessel's hull form data, compartmentation data, lightship characteristics and deadweight data, in sufficient detail to accurately define the vessel and its loading condition.

Acceptable hull form and compartmentation data may be in the form of surface coordinates for modeling the hull form and compartment boundaries (e.g., a table of offsets) or in the form of pre-calculated tabular data (e.g., hydrostatic tables, capacity tables) depending upon the form of data used by the software being submitted for approval. Alternatively, the general approval may be given based on at least two test vessels agreed upon between the applicant and the Bureau.

In general, the software is to be tested for two types of vessels for which approval is requested, with at least one design data set for each of the two types. Where approval is requested for only one type of vessel, a minimum of two data sets for different hull forms of that type of vessel are required to be tested.

For calculation software which is based on the input of hull form data, design data sets are to be provided for three types of vessels for which the software is to be approved, or a minimum of three data sets for different hull forms if approval is requested for only one type of vessel. Representative vessel types are those which, due to their different hull forms, typical arrangements and nature of cargo, require different design data.

The test data sets are to be used by the applicant to run the calculation program for the test vessels. The results obtained, together with the hydrostatic data and cross-curve data developed by the program, if appropriate are to be submitted to the Bureau for the assessment of the program's computational accuracy. The Bureau is to perform parallel calculations using the same data sets and a comparison of these results will be made against the applicant's submitted program's results.

6.3 Specific Approval

The Bureau is to verify the accuracy of the computational results and actual vessel data used by the calculation program for the particular vessel on which the program will be installed.

Upon receipt of application for data verification, the Bureau and the applicant are to agree on a minimum of four loading conditions, taken from the vessel's approved stability information, which are to be used as the test conditions.

Within the test conditions each compartment is to be loaded at least once. The test conditions normally are to cover the range of load drafts from the deepest envisaged loaded condition to the light ballast condition and are to include at least one departure and one arrival condition.

The Bureau is to verify that the following data, submitted by the applicant, is consistent with arrangements and most recently approved lightship characteristics of the vessel according to current plans and documentation on file with the Bureau, subject to possible further verification onboard:

- Identification of the calculation program including version number.
- Main dimensions, hydrostatic particulars and, if applicable, the vessel profile.
- The position of the forward and after perpendiculars, and if appropriate, the calculation method to derive the forward and after drafts at the actual position of the vessel's draft marks.
- Vessel lightweight and center of gravity derived from the most recently approved inclining experiment or light weight check.

- Lines plan, offset tables or other suitable presentation of hull form data if necessary for the Bureau to model the vessel.
- Compartment definitions, including frame spacing, and centers of volume, together with capacity tables (sounding/ullage tables), free surface corrections, if appropriate
- Cargo and Consumables distribution for each loading condition.

Verification by the Bureau does not absolve the applicant and shipowner of responsibility for ensuring that the information programmed into the onboard computer software is consistent with the current condition of the vessel.

7 Operation Manual

A simple and straightforward operation manual is to be provided, containing descriptions and instructions, as appropriate, for at least the following:

- Installation
- Function keys
- Menu displays
- Input and output data
- Required minimum hardware to operate the software
- Use of the test loading conditions
- Computer-guided dialogue steps
- List of warnings

8 Installation Testing

To ensure correct working of the computer after the final or updated software has been installed, it is the responsibility of the vessel's master to have test calculations carried out according to the following pattern in the presence of the Surveyor:

- From the approved test conditions at least one load case (other than lightship) is to be calculated.
Note: Actual loading condition results are not suitable for checking the correct working of the computer.
- Normally, the test conditions are permanently stored in the computer.

Steps to be performed:

- Retrieve the test load case and start a calculation run; compare the stability results with those in the documentation.
- Change several items of deadweight (tank weights and the cargo weight) sufficiently to change the draft or displacement by at least 10%. The results are to be reviewed to ensure that they differ in a logical way from those of the approved test condition.
- Revise the above modified load condition to restore the initial test condition and compare the results. The relevant input and output data of the approved test condition are to be replicated.
- Alternatively, one or more test conditions shall be selected and the test calculation performed by entering all deadweight data for each selected test condition into the program as if it were a proposed loading. The results shall be verified as identical to the results in the approved copy of the test conditions.

9 Periodical Testing

It is the responsibility of the vessel's master to check the accuracy of the onboard computer for stability calculations at each Annual Survey by applying at least one approved test condition.

If the Surveyor is not present for the computer check, a copy of the test condition results obtained by the computer check is to be retained onboard as documentation of satisfactory testing for the Surveyor's verification.

At each Special Periodical Survey, this checking for all approved test loading conditions is to be done in presence of the surveyor.

The testing procedure is to be carried out in accordance with 3-A1/8.

10 Other Requirements

The following features are to be provided to the software:

- Protection against unintentional or unauthorized modification of programs and data is to be provided.
- The program is to monitor operations and activate an alarm when the program is incorrectly or abnormally used.
- The program and any data stored in the system are to be protected from corruption by loss of power.
- Error messages with regard to limitations such as filling a compartment beyond capacity, or exceeding the assigned load line, etc. are to be included.