RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part U Intact Stability

2018 AMENDMENT NO.1

Rule No.100 29 June 2018

Resolved by Technical Committee on 31 January 2018

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

Rule No.100 29 June 2018
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part U INTACT STABILITY

Chapter 2 STABILITY REQUIREMENTS

2.3 Stability Requirements in Wind and Waves

2.3.1 Stability Curves and Wind-heeling Moment Lever Curves*

Sub-paragraph -1(2) has been amended as follows.

1 Stability curves and wind-heeling moment lever curves of ships are to comply with the following requirements in **Fig. U2.2**.

(1) Heeling angle caused by steady wind is to be less than 16° or an angle corresponding to 80% of immersing angle of deck edge, whichever is less.

(2) Area "*b*" is not to be less than area "*a*".
where

l_{w1} : Heeling moment lever caused by steady wind (*m*) given by the following formula:

$$\frac{0.0514AZ}{W'}$$

A : Projected lateral area of hull and cargoes on deck above waterline (m^2).

Z : Vertical distance between the centre of "*A*" and the centre of underwater projected lateral area of hull (*m*). In general, the centre of underwater projected lateral area may be approximated to locate at half the draught.

W' : Displacement (*t*).

l_{w2} : Heeling moment lever caused by gust (*m*) given by the following formula:

$1.5l_{w1}$

a : Area encircled by stability curve, l_{w2} and θ_r ($m \cdot rad$).

b : Area encircled by stability curve, l_{w2} and θ_2 ($m \cdot rad$).

θ_r : Angle of rolling stop motion (*degree*). In general, it may be given by the formula $(\theta_0 - \theta_1)$.

θ_c : Heeling angle at the second intersection between heeling moment lever and stability curve (*degree*).

θ_2 : Heeling angle (*degree*) to be taken of whichever is the least, downflooding angle, θ_c or 50°.

θ_0 : Angle of heel under action of steady wind (*degree*).

θ_1 : Angle of roll to windward due to wave action (*degree*) given by the following formula:

$109 x_1 x_2 k \sqrt{rs}$

x_1 : Values obtained from **Table U2.1** according to the value of B/d' In case the value of B/d' becomes intermediate, values are to be determined by interpolation.

B : Moulded breadth of the ship (m).

d' : Mean moulded draught of the ship (m).

x_2 : Values obtained from **Table U2.2** according to C_b . In case C_b becomes intermediate, values are to be determined by interpolation.

C_b : Block coefficient given by the following formula:

$$\frac{W'}{1.025 L' B d'}$$

L' : Length of the ship at waterline (m).

k : Values determined as follows;

For round-bilged ships having neither bilge keels nor bar keels: 1.0

For ships with sharp bilges: 0.7

For ships with bilge keel and/or bar keels: Values obtained from **Table U2.3** according to the value of $100A_k / L'B$. In case $100A_k / L'B$ becomes intermediate, values are to be determined by interpolation.

A_k : Total area of bilge keels, projected lateral area of bar keels or sum of those areas (m^2).

r : Values obtained from the following formula. ~~However, the value of r need not be taken over 1.0.~~

$$0.73 + 0.6 \frac{OG}{d'}$$

OG : Distance between the centre of gravity and the waterline (m), and is taken as positive when the centre of gravity is above waterline.

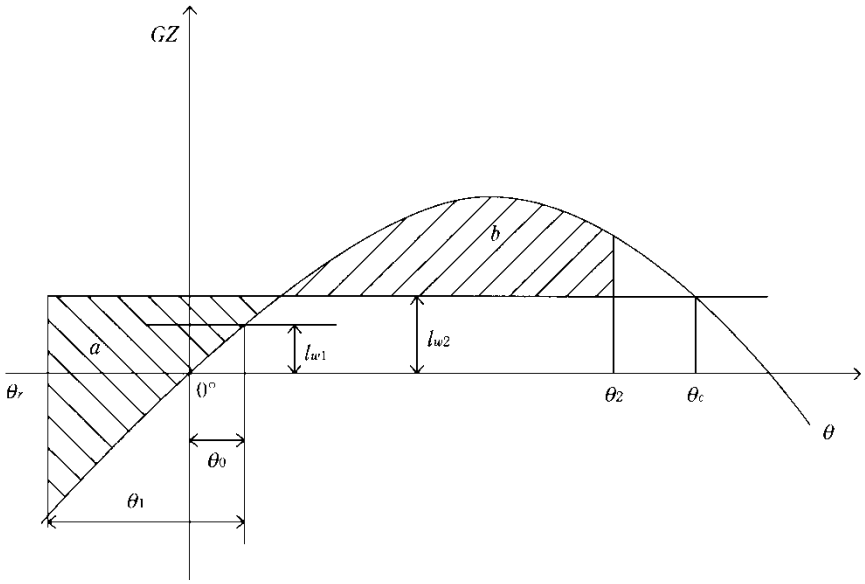
s : Values obtained from **Table U 2.4** according to the value of T. In case T becomes intermediate, values are to be determined by interpolation.

T : Rolling period (seconds) obtained from the following formula. However, value of T based on information considered sufficient may be used instead.

$$\frac{2B}{\sqrt{G_0 M}} \left(0.373 + 0.023 \frac{B}{d'} - 0.043 \frac{L'}{100} \right)$$

$G_0 M$: As specified in **2.2.1**

Fig. U2.2 Stability and Wind-heeling Moment Lever Curve
(Stability Requirements in Wind and Waves)



EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 29 December 2018.

2. Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction is before the effective date.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part U Intact Stability

2018 AMENDMENT NO.1

Notice No.52 29 June 2018
Resolved by Technical Committee on 31 January 2018

Notice No.52 29 June 2018
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

Part U INTACT STABILITY

Annex U1.2.2 GUIDANCE FOR STABILITY COMPUTER

1.2 Software for Stability Calculation

Paragraph 1.2.1 has been amended as follows.

1.2.1 Types of Software

Software for stability calculation is categorized as following **(1)** to **(3)**, corresponding to the stability requirements applied to the ship.

(1) Type 1: Software calculating intact stability for each loading condition

(2) Type 2: Software calculating intact stability as specified in **(1)** and checking damage stability by showing a limit G_0M curve or ~~previously approved loading conditions~~checking all the stability requirements (intact and damage stability) on the basis of a limit curve.

(3) Type 3: Software calculating intact stability and damage stability by direct application of pre-programmed damage cases according to the applicable rules for each loading condition. Damage stability is to be based on a hull form model, that is, directly calculated from a full three-dimensional geometric model.

Paragraph 1.2.2 has been amended as follows.

1.2.2 Functional Requirements for Software

1 The calculation program of the software for stability calculation is to present relevant parameters ~~as specified in **1.3.9-3** of **Annex U1.2.1** "**GUIDANCE FOR STABILITY INFORMATION FOR MASTER**",~~ of each loading condition~~,~~ in order to assist the Master in his judgement on whether the ship is loaded within the approval limit. The following parameters are to be presented for a given condition.

(1) Deadweight data

(2) Lightship data

(3) Trim

(4) Draft at the draft marks and perpendiculars

(5) Summary of loading condition displacement, *VCG*, *LCG* and, if applicable, *TCG*

(6) Downflooding angle and corresponding downflooding opening (not applicable for type 2 software which uses limit curve for checking all stability requirements. However, if intact stability criteria are given in addition to the limit curve, downflooding angle and the corresponding downflooding opening are to be indicated.)

(7) Compliance with stability criteria: Listing of all calculated stability criteria, the limit values, the obtained values and the conclusions (criteria fulfilled or not fulfilled) (not applicable for type 2 software which uses limit curve for checking all the stability requirements. However, if intact stability criteria are given in addition to the limit curve, the limit values, the obtained

values and the conclusion are to be indicated.)

(8) Other parameters deemed necessary by the Society

2 A clear warning is to be given on screen and in hard copy printout if any of the loading limitations are not complied with. Loading limitations are to include, but may not be limited to the following.

(1) Trim, draught, liquid densities, tank filling levels, initial heel

(2) Use of limit KG_0 / G_0M curves in conjunction with above for type 2

(3) Restrictions to the stowage height for timber where timber load lines are assigned

~~2~~3 For ~~the software of~~ type 3 software, the relevant damage cases according to the applicable rules are to be pre-defined for automatic check of a given loading condition and, the system is to be pre-loaded with a detailed computer model of the complete hull, including appendages, all compartments, tanks and the relevant parts of the superstructure considered in the damage stability calculation, wind profile, down-flooding and up-flooding openings, cross-flooding arrangements and internal compartment.

4 For type 1 and type 2 software, in case a full three dimensional model is used for stability calculations, the requirements of the computer model are to be as per **-3** above to the extent as applicable and according to the type of stability software.

~~3~~5 Regarding the output on screen and in hard copy printout, the data with units of measurement are to be presented in clear unambiguous manner with units of measurement ~~and a clear warning is to be given if any of the loading limitations are not complied with~~. The data and time of a saved calculation and identification of the calculation program including version number are also to be presented.

1.2.3 Computational Accuracy of Program

1 For the computational accuracy of the stability calculation program, tolerances of the calculation results from the approved stability information booklet are, in general, to be zero.

2 Notwithstanding the provisions of **-1**, for programs which use hull form models as their basis for stability calculations, the tolerances of the calculation results from the approved stability information booklet may be within the acceptable tolerances as shown in **Table 1**.

3 The computational accuracy of the program for the particular ship is to be verified so that the calculation results are within the acceptable tolerances specified in **-1** or **-2** as applicable. Such calculation is to be made by using actual ship data for at least four loading conditions which are selected from the ship's approved stability information booklet (except the light ship condition) in accordance with the following **(1)** to **(3)**. Notwithstanding the above, for programs approved for not-particular ships in accordance with **1.2.4**, such verification may be done for one loading condition. Where deemed as necessary by the Society, submission of detail data for the verification may be required.

(1) Loading conditions for the verification (hereinafter, referred to as test loading conditions) are to be full of variety as possible and include a cargo loaded condition with the deepest draught and a ballast condition with the lightest draught. For ships carrying liquid cargoes in bulk, at least one of the conditions is to include partially filled tanks. For ships carrying grain in bulk, one of the grain loading conditions is to include a partially filled grain compartment.

(2) Within the test loading conditions each main compartment (cargo spaces, ballast tanks, etc.) is to be loaded at once.

(3) The test loading conditions are to include at least one departure and one arrival condition.

Table 1 has been amended as follows.

Table 1 Acceptable Tolerances

Hull form dependent	
Displacement	+/− 2%
Longitudinal centre of buoyancy, from *AP*	+/− 1% / 50 *cm* ~~max~~
Vertical centre of buoyancy	+/− 1% / 5 *cm* ~~max~~
Transverse centre of buoyancy	+/− 0.005*B* / 5 *cm* ~~max~~
Longitudinal centre 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% / 50 *cm* ~~max~~
Cross curves of stability	+/− 5 *cm*~~0 mm~~
Compartment dependent	
Volume or deadweight	+/− 2%
Longitudinal centre of gravity, from *AP*	+/− 1% / 50 *cm* ~~max~~
Vertical centre of gravity	+/− 1% / 5 *cm* ~~max~~
Transverse centre of gravity	+/− 0.005*B* / 5 *cm* ~~max~~
Free surface moment	+/− 2%
Shifting moment	+/− 5%
Level of contents	+/− 2%
Trim and stability	
Draughts (forward, aft, mean)	+/− 1% / 5 *cm* ~~max~~
GM, G_0M (transverse metacentric height from centre of gravity)	+/− 1% / 5 *cm* ~~max~~
GZ values (righting arm)	+/− 5% / 5 *cm* ~~max~~
~~Free surface correction~~	~~2%~~
Downflooding angle	+/− 2 *degrees*
Equilibrium angles	+/− 1 *degree*
Distance ~~to unprotected openings or margin line~~ from *WL* to unprotected and weathertight openings, or other relevant point, if applicable	+/−5% / 5 *cm*~~0 mm max~~
Areas under righting arm curve	+/− 5% / 0.0012 *m-rad* ~~max~~

Notes:

1 Deviation in % means a ratio of the difference between the calculation results and values of the approved stability information booklet, to the values of the booklet.

2 When applying the tolerances in **Table 1** having two values, the allowable tolerance is the greater of the two values.

3 Where differences in calculation methodology exist between the programs used in the comparison, this may be a basis for accepting deviations greater than that specified in **Table 1** provided a software examination is carried out in sufficient detail to clearly document that such differences are technically justifiable.

4 Deviation from these tolerances is not to be accepted unless the Society considers that there is a satisfactory explanation for the difference and that it is clearly evident from the Society's stability calculations that the deviation does not impact compliance with the required stability criteria for the ship under consideration.

1.2.4 Approval of Software

Sub-paragraph (2) has been amended as follows.

The Society may approve software as a stability calculation program which does not depend on data of a particular ship. In this case, the Society examines such software in accordance with the procedures specified in the following **(1)** to **(4)** and then, may issue a certificate of approval after success in the examination.

(1) Verify the compliance with the functional requirements as specified in **1.2.2**.

(2) Verify the compliance with the requirements of the computation accuracy in **1.2.3**, by using at least three data sets of different types of ship which are containing of four loading conditions selected in accordance with **1.2.3-3(1)** to **(3)**. In such case, the tolerances are to be evaluated from calculation results by the stability calculation program which is provided by the Society. For the purpose of the verification, the type of ship is, in general, categorized into the following four types.
   (a) Tankers, ships carrying dangerous chemicals in bulk, ships carrying liquefied gases in bulk and ships having loading conditions as similar to such type of ship
   (b) Bulk carriers and ships having loading conditions as similar to such type of ship
   (c) Container carriers and ships having loading conditions as similar to such type of ship
   (d) Other cargo ships <u>and passenger ships</u>

(3) Notwithstanding the above **(2)**, for software which applicable type of ship is limited, the verification may be made by using at least three data sets of ships having different hull forms of applicable type of ship.

(4) For the approval of software, any applicant is to submit the following documents in addition to the software.
   (a) Application for approval (including applicable type of ship, where it is limited)
   (b) General information of the software (including information regarding its version)
   (c) Operation manual
   (d) Necessary data regarding displacement, compartmentation, weight, centre of gravity, loaded cargoes and loading conditions of the ships used for the verification of the computational accuracy (lines, hydrostatic curves, tank capacity plan, etc.)

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 July 2018.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.