# Uniform Shipping Laws Code 2008

**Section 8B: Simplified Presentation of Stability**

**(CTH, NSW, NT, QLD, SA, TAS, VIC & WA)**

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### B.1 Submission of Simplified Stability Data

In small ships, simplified stability information to be posted in the wheelhouse may be prepared and submitted to the Authority for approval. In such cases, the simplified data should be accompanied in the submission by full information as to the stability characteristics and form of the vessel to enable the Authority to check the accuracy and acceptability of the simplified data. Such information shall include general arrangement plans, hydrostatic curves, cross curves of stability, capacity information and free surface corrections.

### B.2 Form of Simplified Stability Data

This simplified stability information may take the form of either:

(a) instructions as to limitations on loading, tank capacities, use of cargo gear, closure of openings etc. together with a statement as to the responsibility of the Master in maintaining the vessel in a satisfactory state of stability at all times; or

(b) diagrams showing limiting deadweight moments at various draughts, together with the assumptions as to the state of the vessel's tanks on which the diagrams are based. (Particularly useful in the case of vessels carrying deck cargoes); or

(c) a diagram showing a limiting GM value plotted against draught or displacement. (Some notations concerning assumptions as to free surface and/or appropriate correction may be necessary).

# Uniform Shipping Laws Code
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**Section 8C: Stability Criteria**

**(CTH, NSW, NT, QLD, SA, TAS, VIC & WA)**

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## C.1 Class 1 Vessels

### C.1.1 General Provisions

C.1.1.1 For the purposes of this clause unless otherwise stated:

(a) the standard mass of a passenger shall be taken as 65 kg for operations within sheltered water areas and 75 kg for all other operational areas;

(b) the standard distribution of passengers when crowded shall be taken as 4 passengers per square metre;

(c) each passenger in the crowded distribution shall be considered to cover an area 625 mm x 400 mm;

(d) the vertical centre of gravity of a standing passenger shall be taken as 1 metre above the deck;

(e) the vertical centre of gravity of a seated passenger shall be taken as 300 mm above the seat; and

(f) the angle of flooding $\Theta_f$ is the least angle of heel at which openings in the hull, superstructures or deckhouses which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

C.1.1.2 In assessing the angle of heel caused by the crowding of passengers (except as provided in C.1.3.4.1 (a)), the passengers shall be considered to be distributed to produce the most unfavourable combination of passenger heeling moment and/or initial metacentric height which may be obtained in practice, using the standard characteristics given in C.1.1.1.

C.1.1.3 The angle of heel due to wind pressure shall be derived using a wind heeling moment determined from the equation:

$$M = 1.02 \times 10^{-4} Pah \text{ tonne metres}$$

where P = wind pressure in Pascals

A = area of hull subject to wind influence being the projected lateral area of the vessel above the waterline in metres$^2$;

h = lever arm being the vertical distance in metres from the centre of area A to the centre of the projected lateral underwater area.

C.1.1.4 The formula to be used in calculating the heel due to the effect of the rudder when turning shall be:

$$\text{heeling moment} = \frac{5.3xV^2\Delta d}{1000L} \text{ tonne metres}$$

where V = service speed in knots
L = waterline length of vessel
$\Delta$ = displacement in tonnes
d = vertical distance between the vertical centre of gravity of the vessel and the centre of the projected lateral underwater area in metres.

This formula applies only to vessels where $\frac{V}{\sqrt{L}}$ is less than 4.

C.1.1.5 A passenger vessel of 35 metres and over in measured length in addition to meeting the intact stability requirements of this Sub-section shall also meet the requirements of paragraphs C.11.1 (a) to (d) inclusive of Sub-section C of the Construction Section.

C.1.2 Categories of Service

C.1.2.1 Category P—Vessels of any length which engage in 'Unlimited' and 'Australian Coastal and Middle Water' operations.

C.1.2.2 Category Q—Vessels of:

(i) 20 metres in measured length or over; or

(ii) less than 20 metres in measured length carrying 50 persons or more in addition to the Master and crew;

engaged in 'Offshore' and 'Restricted Offshore' operations.

C.1.2.3 Category R—Vessels of any length carrying 50 persons or more in addition to the Master and crew and multi-deck vessels where the passenger mass/displacement ratio exceeds 0.04, engaged in 'Sheltered Water' operations only.

C.1.2.4 Category S—Vessels of less than 20 metres in measured length carrying less than 50 persons in addition to the Master and crew and engaged in 'Offshore' and 'Restricted Offshore' operations.

C.1.2.5 Category T—Vessels of any length carrying less than 50 persons in addition to the Master and crew and engaged in 'Sheltered Water' operations only.

C.1.3 Criteria to be Applied to these Categories

C.1.3.1 Categories P and Q. The stability is considered satisfactory if:

C.1.3.1.1 The area under the righting lever curve, i.e. the GZ curve, is not less than 3.15 metre-degrees up to 30° angle of heel and not less than 5.16 metre-degrees up to 40° angle of heel or the angle of flooding $\theta_f$ if this angle is less than 40°. Additionally the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40° or between 30° and $\theta_f$ if $\theta_f$ is less than 40° shall be not less than 1.72 metre-degrees.

C.1.3.1.2 The righting lever GZ shall have a value not less than 0.2 metres at an angle of heel equal to or greater than 30°.

C.1.3.1.3 The maximum righting lever GZ shall occur at an angle of heel preferably exceeding 30° but in any case not less than 25°.

C.1.3.1.4 The initial metacentric height GM shall be not less than 0.15 metres.

C.1.3.1.5 The angle of heel shall not exceed 10° when any one of the following capsizing influences is applied or 15° when the worst two capsizing influences are applied together:

(a) the moment caused by passenger crowding using the maximum passenger heeling lever;

(b) the wind moment derived from a wind pressure of 600 Pa; and

(c) the moment derived from the effect of the rudder on the vessel when turning.

C.1.3.2 Category R. The stability is considered satisfactory if:

C.1.3.2.1 The angle of heel does not exceed 10° when all persons are crowded on one side of the vessel resulting in the maximum heeling lever.

C.1.3.2.2 The righting lever GZ, at the intersection of the curve of righting levers and the heeling lever curve due to the combined effects of passenger heel and the more severe of either wind or rudder heel, does not exceed $0.6\ GZ_{max}$

C.1.3.2.3 The area under the curve of righting levers above the passenger heeling lever curve taken up to the angle of flooding $\theta_f$ or the second intercept with the righting lever curve (whichever is less), shall be not less than one quarter of the total area under the curve of righting levers up to the angle of flooding $\theta_f$ or the second intercept whichever is less.

C.1.3.2.4 The wind moment derived from a wind pressure of 300 Pa in smooth water areas and 360 Pa in partially smooth water areas shall not produce a heel angle of more than 10°.

C.1.3.2.5 The moment derived from the effect of the rudder on the vessel when turning shall not produce a heel angle of more than 10°.

C.1.3.2.6 The combined moment due to passenger loading and the more severe of the heeling levers due to either wind or rudder shall not produce an angle of heel in excess of 15°.

C.1.3.3 Category S. The stability is considered satisfactory if:

C.1.3.3.1 The vessel in the intact condition is shown to have a net metacentric height GM, at any operating draft, not less than any of the following taken singly. The most severe requirement shall govern at any draft. Allowance shall be made for normally slack tanks.

C.1.3.3.2 $GM = \dfrac{0.046\ Ah}{\Delta \tan \theta} + 0.15$ metres

where A = projected lateral area of the vessel above the waterline in metres$^2$

h = vertical distance in metres from the centre of area A to the centre of the projected lateral underwater area

$\Delta$ = displacement in tonnes

$\theta$ = angle of heel to one half the freeboard to the deck edge, or the angle of bilge emersion or 14° whichever is less. (Vessels having a discontinuous weather deck or abnormal sheer may have a modified value applied for the angle to the one half freeboard).

C.1.3.3.3 $GM = \dfrac{Nb}{23.5\Delta \tan \theta} + 0.15$ metres

where N = number of passengers

b = distance in metres from the vessel's centre line to the geometrical centre of the deck area occupied by passengers in accordance with C.1.1.2.

$\Delta$ = displacement in tonnes

$\theta$ = as described in C.1.3.3.2.

C.1.3.3.4 $GM = \dfrac{0.0053\ V^2 d}{L \sin \theta} + 0.15$ metres

where V = service speed in knots

L = waterline length of vessel

d = vertical distance between the vertical centre of gravity of the vessel, and the centre of the projected lateral underwater area in metres

$\theta$ = as described in C.1.3.3.2.

This formula applies only to vessels where $\dfrac{V}{\sqrt{L}}$ is less than 4.

C.1.3.4 Category T. The stability is considered satisfactory if:

C.1.3.4.1 The vessel when subjected to the greater of the following heeling moments, does not heel more than 14° provided that the loss of freeboard does not exceed the values set out in C.1.3.4.4.

(a) $M_p = W \times \frac{B_p}{6}$

where $M_p$= passenger heeling moment in tonnes metres

W = total mass of passengers in tonnes

$B_p$= maximum breadth of space in vessel which is accessible to passengers in metres.

(b) $M_w = P\,Ah$

where $M_w$= wind heeling moment in tonnes metres

h= vertical distance in metres from the centre of area A to the centre of the projected lateral underwater area

A= projected lateral area of the vessel above the load waterline in metres$^2$

P= 0.0306 for smooth water areas

= 0.0367 for partially smooth water areas

C.1.3.4.2 The mass of the passengers and other load, if any, shall be simulated by equivalent masses distributed so as to provide normal trim and the most unfavourable vertical centre of gravity (VCG) likely to occur in service.

C.1.3.4.3 On vessels having non-return closures in cockpit scuppers or on weather deck drains, such closures shall be restrained in the open position during the course of the test.

C.1.3.4.4 When subjected to the required heeling moment, the loss of freeboard due to heel measured in way of the point of least freeboard (or at a point 0.75 L from the bow if the point of least freeboard is aft of 0.75 L from the bow) shall not exceed the following:

(a) On flushed deck vessels the freeboard shall be measured to the top of the weather deck at side. The loss of freeboard shall not be more than one half of this freeboard.

(b) On well deck vessels the freeboard shall be measured to the top of the weather deck at side. The loss of freeboard shall not be more than half of this freeboard. In vessels with scuppers rather than freeing ports, immersion to the full freeboard may be permitted provided it does not exceed one quarter of the height from the load waterline to the top of the gunwale.

(c) On cockpit boats the freeboard shall be measured to the top of the gunwale. The maximum reduction in freeboard shall be calculated by:

$$\text{loss of freeboard} = \frac{f(2L-C)}{4L}$$

where f= freeboard when upright in metres

L= measured length of vessel in metres

C= length of cockpit in metres.

(d) On open boats the freeboard shall be measured to the top of the gunwale and the maximum allowable reduction of freeboard shall be one quarter of this freeboard.

(e) Vessels carrying vehicular loads, in addition to complying with the other provisions of this Sub-section shall be tested to determine that maximum trim or heel during loading or unloading will not be excessive.

C.1.4 Special Cases relating to Categories S and T

C.1.4.1 The owner of any vessel which does not meet the criteria specified in C.1.3.3.2, C.1.3.3.3, C.1.3.3.4 and C.1.3.4.1 may, in lieu of complying with those requirements, present a complete stability submission showing conformity with C.1.3.2.

C.1.5 Damage Stability

C.1.5.1 Criteria for damage stability for passenger vessels 35 metres and over in measured length are laid down in clause C.10 and Appendix 2 of Sub-section C of the Construction Section.

C.1.5.2 Criteria for damage stability for passenger vessels less than 35 metres in measured length are laid down in sub-clause C.64.2 and Appendix 3 of Sub-section C of the Construction Sction.

**C.2 Class 2A, 2B and 2C Vessels 24 Metres and Over in Load Line Length**

Unless criteria are otherwise specified in this Sub-section all vessels of class 2A, 2B and 2C, 24 metres and over in load line length shall have stability in all probable loading conditions which meets at least the following criteria:

(a) The area under the righting lever curve, i.e. the GZ curve, is not to be less than 3.15 metre-degrees up to 30° angle of heel and not less than 5.16 metre-degrees up to 40° angle of heel or the angle of flooding $\theta_f$** if this angle is less than 40°. Additionally the area under the righting lever curve between the angles of heel of 30° and 40° or between 30° and $\theta_f$ if this angle is less than 40°, shall be not less than 1.72 metre-degrees.

(b) The righting lever (GZ) is not to be less than 0.20 metres at an angle of heel equal to or greater than 30°;

(c) The maximum righting lever (GZ) is to occur at an angle of heel preferably exceeding 30° but in any case not less than 25°; and

(d) The initial transverse metacentric height is not to be less than 0.15 metres.

**C.3 Class 2A, 2B and 2C Vessels 16 Metres and Over in Measured Length but Less than 24 Metres in Load Line Length and Class 2D and 2E Vessels 16 Metres and Over in Measured Length**

C.3.1 Unless criteria are otherwise specified in this Sub-section all vessels of Classes 2A, 2B and 2C 20 metres in measured length and over but less than 24 metres in load line length and Class 2D and 2E vessels 16 metres and over in measured length shall have stability in all probable loading conditions which meets at least the criteria laid down in clause C.2.

C.3.2 Unless criteria are otherwise specified in this Sub-section, all vessels 16 metres in measured length and over but less than 20 metres in measured length, where:

(a) $\frac{f}{B}$ is between 0.1 and 0.2; and

(b) $\frac{B}{D}$ is between 1.75 and 2.15,

may in lieu of the stability data based on the criteria prescribed in clause C.2 ensure that the GM in all probable loaded conditions is greater than that calculated by the following formula:

$$GM\ (Min) = 0.60 + 0.05B - 0.25f \text{ (metres)}$$

where
- GM (Min) = required metacentric height (metres)
- B = moulded breadth (metres)
- D = moulded depth of vessel measured amidships (metres)
- f = smallest freeboard measured vertically from the top of the upper deck at side to the actual waterline (metres)

***Note:*

$\theta_f$ is the angle of heel at which openings in the hull, superstructures or deckhouses which cannot be closed weathertight commence to immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

To determine whether the vessel complies with the sub-clause, the vessel, unless the Authority permits otherwise, shall be subjected to an inclining or rolling period test carried out in the presence of a Surveyor. Where the rolling period test is used the GM shall be calculated from the following formula:

$$GM = \left( \frac{F_r B}{T_r} \right)^2 \text{ metres}$$

where B = moulded breadth (metres)
$T_r$ = time for one complete oscillation (i.e. for one complete roll port-starboard-port or vice versa) (seconds)
GM = metacentric height (metres)
$F_r$ = rolling period factor determined from the following table:

| *Conditions of vessels* | *Rolling period factor* |
|---|---|
| (a) Empty vessel | 0.88 |
| (b) Vessel carrying ballast | 0.88 |
| (c) Vessel fully loaded and with liquids in tanks comprising the following percentage of the total load on board (i.e. cargo, liquids, stores, etc.) | |
| 1. 20 per cent of total load | 0.78 |
| 2. 10 per cent of total load | 0.75 |
| 3. 5 per cent of total load | 0.73 |
| (Order of accuracy of factors ± 0.05) | |

The value of the metacentric height determined from the inclining or rolling period tests shall be equal to or in excess of that required.

C.3.3 Barges and lighters and similar vessels operating within partially smooth waters shall have a minimum GM allowing for any free surface corrections, which is the greater value of the following:

(a) $GM = \frac{0.036\ Ah}{\Delta \tan \theta} + 0.15$ metres

where A = projected lateral area in metres$^2$ above the waterline considered
h = vertical distance in metres from the centre of area 'A' and the centre of the underwater lateral area
$\Delta$ = displacement in tonnes
$\theta$ = angle of heel to one half of the freeboard being immersed for particular loading being considered or five (5) degrees, whichever is less.

(b) $GM = \frac{0.0053\ V^2 d}{L \sin \theta} + 0.15$ metres

where V = service speed in knots
L = waterline length of vessel
d = vertical distance between VCG and the centre of the underwater lateral area in metres
$\theta$ = as above.

This formula applies only to vessels where $\frac{V}{\sqrt{L}}$ is less than 4.

(c) If a derrick, deck crane or cranes are fitted on board, the vessel must have sufficient GM to ensure that it does not heel any more than the angle equivalent to one half the freeboard, in the condition being considered, or five (5) degrees whichever is less, when the cranes have their working loads extended their maximum outreach over the side.

(d) GM = 1 metre

C.3.4 Barges, lighters and similar vessels operating within smooth water limits shall have a minimum GM allowing for any free surface corrections, which is the greater of the following:

(a) $GM = \frac{0.0274\ Ah}{\Delta \tan \theta} + 0.15$ metres

where A = projected lateral area in metres$^2$ above the waterline considered
h = vertical distance in metres from the centre of 'A' to the centre of the underwater lateral area in metres
$\Delta$ = displacement in tonnes
$\theta$ = angle of heel equivalent to one half the freeboard being immersed for the particular loading being considered or five (5) degrees, whichever is less.

(b) $GM = \frac{0.0053\ V^2 d}{L \sin \theta} + 0.15$ metres

where V = service speed in knots
L = waterline length of vessel
d = vertical distance between VCG and the centre of the underwater lateral area in metres
$\theta$ = as above.

This formula applies only to vessels where $\frac{V}{\sqrt{L}}$ is less than 4.

(c) If a deck crane or cranes are fitted on board, the vessel must have sufficient GM to ensure that it does not heel any more than the angle equivalent to one half the freeboard, in the condition being considered, or five (5) degrees, whichever is less, when the cranes have their working loads extended their maximum outreach over the side.

(d) GM=1 metre.

**C.4 Class 2 Vessels Less Than 16 Metres Measured Length**

C.4.1 The stability of a Class 2 vessel less than 16 metres in measured length may be considered satisfactory if the metacentric height (GM) in the worst anticipated condition of loading is not less than 0.75 m, and the angle of deck edge immersion at the point of lowest freeboard is not less than 14°.

C.4.2 For the purposes of sub-clause C.4.1 above, the vessel may be subjected to a Rolling Period Test, and the GM obtained from the following formula:

$$GM = \left( \frac{F_r B}{T_r} \right)^2 \text{ metres}$$

where GM = metacentric height (metres)
B = moulded breadth of vessel (metres)
$T_r$ = time for one complete oscillation (i.e. for one complete roll port-starboard-port or vice versa) (seconds)
$F_r$ = factor for rolling period and may be determined from the values given in C.3.2.

C.4.3 To determine the time for a complete oscillation (t) the following precautions should be observed:

(a) The test should be conducted with the vessel in harbour, in smooth water and with the minimum interference from wind and tide.