RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part O Work-Ships

2019 AMENDMENT NO.1

Rule No.103 27 December 2019

Resolved by Technical Committee on 22 July 2019

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

Rule No.103 27 December 2019
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 O WORK-SHIPS

Amendment 1-1

Chapter 11 WIND TURBINE INSTALLATION SHIPS

11.5 Hull Equipment

11.5.1 General

Sub-paragraph -2 has been amended as follows.

2 Hull equipment of self-elevating ships is to be according to this **11.5** in addition to the requirements in **9.1** to ~~**9.6**~~**9.5** of **Part P**.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 27 December 2019.

Amendment 1-2

Chapter 1 GENERAL

1.3 Definitions

1.3.2 Work-ship*

Sub-paragraph (3) has been amended as follows.

A "Work-ship" is a ship primary engaged in a designated operation such as dredging, lifting of heavy loads, fire fighting, offshore supply, towing, etc. at sea. Work-ships are defined according to their purpose as follows:

((1) and (2) are omitted.)

(3) Vessels engaged in towing operations

(a) Tugs

A "tug" is a ship primary engaged in towing ships when such ships leave or come into a port and leave or come alongside the shore, or towing non self-propelled units, floating units, etc.

(b) Ocean tugs

An "ocean tug" is a ship engaged in towing non self-propelled units, floating units, etc. in the ocean.

(c) Escort tugs

An "escort tug" is a ship engaged in towing operations as steering, braking and otherwise controlling of the assisted ship during ordinary or emergency maneuvering.

((4) to (11) are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 January 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to ships the keels of which were laid or which were at *a similar stage of construction* before the effective date.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1%* of the estimated mass of all structural material, whichever is the less.

* For high speed craft, "1%" is to be read as "3%".

Amendment 1-3

Chapter 4 VESSELS ENGAGED IN TOWING OPERATIONS

4.4 Hull Equipment

Paragraph 4.4.2 has been amended as follows.

4.4.2 Towing Equipment*

1 The towing hooks, towing bits or towing bollards fitted onto ocean tugs is to be located as low as practicable, and close to, but abaft of, the centre of gravity of the ship in the expected towing condition.

2 Equipment, such as winches, for towing operations is to be provided with suitable safety devices so that towing wires are able to be released or cut in times of emergency except in cases where the emergency release systems required in accordance with the following **-3** are fitted.

3 In the case of tugs engaged in towing operations within close quarters, ports or terminals, towing winches other than those on board ships used solely for long distance ocean towage, anchor handling or similar offshore activities are to be fitted with an emergency release system complying with the requirements of **Annex 4.4.2-3**.

Annex 4.4.2-3 has been added as follows.

Annex 4.4.2-3 TOWING WINCH EMERGENCY RELEASE SYSTEMS

1.1 General

1.1.1 General

This annex defines minimum safety standards for winch emergency release systems provided on towing winches that are used on towing ships within close quarters, ports or terminals (hereinafter referred to as "tugs" in this annex).

1.1.2 Application

The requirements of this annex apply to towing winches of the ships referred to in **1.1.1** but do not apply to towing winches on board ships used solely for long distance ocean towage, anchor handling or similar offshore activities.

1.2 Terminology

1.2.1 Definitions

For the purpose of this annex, the following definitions are to apply.

(1) "Emergency release system" refers to the mechanism and associated control arrangements that are used to release the load on the towline in a controlled manner under both normal and dead-ship conditions.

(2) "Maximum design load" is the maximum load that can be held by the winch as defined by the manufacturer (the manufacturer's rating).

(3) "Girting" means the capsize of a tug when in the act of towage as a result of the towline force acting transversely to the tug (in beam direction) as a consequence of an unexpected event (could be loss of propulsion/steering or otherwise), whereby the resulting couple generated by offset and opposing transverse forces (towline force is opposed by thrust or hull resistance force) causes the tug to heel and, ultimately, to capsize. This may also be referred to as "girthing", "girding" or "tripping". See **Fig. 1.2.1-1** which shows the forces acting during towage operations.

(4) "Fleet angle" is the angle between the applied load (towline force) and the towline as it is wound onto the winch drum. See **Fig. 1.2.1-2**.

Fig. 1.2.1-1 Forces During Towing

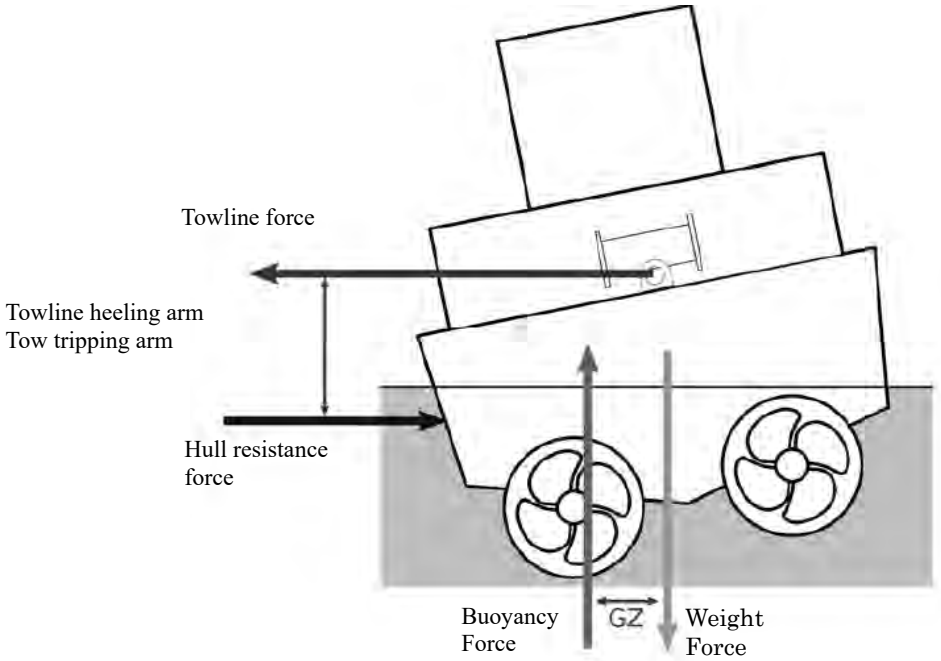
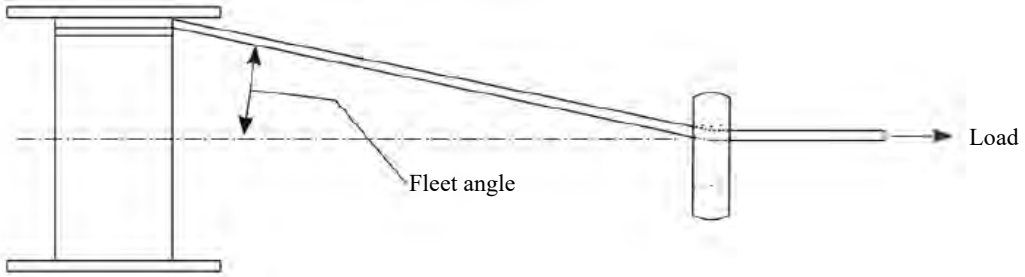


Fig. 1.2.1-2 Towline "Fleet Angle"



1.3 General Requirements

1.3.1 Attaching of Towlines

The in-board end of the towline is to be attached to the winch drum with a weak link or similar arrangement that is designed to release the towline at low load.

1.3.2 Emergency Release Systems

All towing winches are to be fitted with an emergency release system.

1.4 Emergency Release System Requirements

1.4.1 Performance requirements

1 The emergency release system is to operate across the full range of towline load, fleet angle and ship heel angle under all normal and reasonably foreseeable abnormal conditions (these may include, but are not limited to, the following: ship electrical failure, variable towline load (for example, due to heavy weather), etc.).

2 The emergency release system is to be capable of operating with towline loads up to at least 100 % of the maximum design load.

3 The emergency release system is to function as quickly as is reasonably practicable and within a maximum of three seconds after activation.

4 The emergency release system is to allow the winch drum to rotate and the towline to pay out in a controlled manner such that, when the emergency release system is activated, there is sufficient resistance to rotation to avoid uncontrolled unwinding of the towline from the drum. Spinning (free, uncontrolled rotation) of the winch drum is to be avoided, as this could cause the towline to get stuck and disable the release function of the winch.

5 Once the emergency release is activated, the towline load required to rotate the winch drum is to be no greater than **(1)** or **(2)**:

(1) The lesser of five *tonnes* or 5% of the maximum design load when two layers of towline are on the drum, or

(2) 15% of the maximum design load where it is demonstrated that this resistance to rotation does not exceed 25% of the force that will result in listing sufficient for the immersion of the lowest unprotected opening.

6 An alternative source of energy is to be provided such that normal operation of the emergency release system can be sustained under dead-ship conditions.

7 The alternative source of energy required by **-6** above is to be sufficient to achieve the most onerous of the following conditions (as applicable):

(1) Sufficient for at least three attempts to release the towline (i.e. three activations of the emergency release system). Where the system provides energy for more than one winch it is to be sufficient for three activations of the most demanding winch connected to it.

(2) Where the winch design is such that the drum release mechanism requires continuous application of power (e.g. where the brake is applied by spring tension and released using hydraulic or pneumatic power) sufficient power is to be provided to operate the emergency release system (e.g. hold the brake open and allow release of the towline) in a dead-ship situation for a minimum of 5 *minutes*. This may be reduced to the time required for the full length of the towline to feed off the winch drum at the load specified in **-5** above if this is less than 5 *minutes*.

1.4.2 Operational Requirements

1 Emergency release operation is to be possible from the bridge and from the winch control station on deck. The winch control station on deck is to be in a safe location.

2 The emergency release control is to be located in close proximity to the emergency stop button for winch operation and both are to be clearly identifiable, clearly visible, easily accessible and positioned to allow safe operability.

3 The emergency release function is to take priority over any emergency stop function. Activation of the winch emergency stop from any location is not to inhibit operation of the emergency release system from any location.

4 Emergency release system control buttons are to require positive action to cancel, the positive action may be made at a different control position from the one where the emergency release was activated. It is to always be possible to cancel the emergency release from the bridge regardless of the activation location and without manual intervention on the working deck.

5 Controls for emergency use are to be protected against accidental use.

6 Indications are to be provided on the bridge for all power supply and/or pressure levels related to the normal operation of the emergency release system. Alarms are to activate automatically if any level falls outside of the limits within which the emergency release system is fully operational.

7 Wherever practicable, control of the emergency release system is to be provided by a hard-wired system, fully independent of programmable electronic systems.

8 Computer based systems that operate or may affect the control of emergency release systems are to meet the requirements for Category III systems in accordance with **18.1.1-3, Part D**.

9 Components critical for the safe operation of the emergency release system are to be identified by the manufacturer.

10 The method for annual survey of the winch is to be documented.

11 Where necessary for conducting the annual survey of the winch, adequately sized strong points are to be provided on deck.

1.5 Test Requirements

1.5.1 General

1 All testing defined within Section 4 is to be witnessed by the Surveyor.

2 For each emergency release system or type thereof, the performance requirements of **1.4.1** are to be verified either at the manufacturer's works or as part of the commissioning of the towing winch when it is installed on board. Where verification solely through testing is impracticable (e.g. due to health and safety), testing may be combined with inspection, analysis or demonstration in agreement with the Society.

3 The performance capabilities and operating instructions of the emergency release system are to be documented and made available on board the ship on which the winch has been installed.

1.5.2 Installation Trials

1 The full functionality of the emergency release system is to be tested as part of the shipboard commissioning trials to the satisfaction of the surveyor. Testing may be conducted either during a bollard pull test or by applying the towline load against a strong point on the deck of the tug that is certified to the appropriate load.

2 Where the performance of the winch in accordance with **1.4.1** has previously been verified, the load applied for the installation trials is to be at least the lesser of 30% of the maximum design load or 80% of the ship's bollard pull.

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 January 2020.

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.

* "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.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part O Work-Ships

2019 AMENDMENT NO.1

Notice No.70 27 December 2019

Resolved by Technical Committee on 22 July 2019

Notice No.70 27 December 2019
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 O WORK-SHIPS

Amendment 1-1

O1 GENERAL

O1.2 General

O1.2.4 Class Notations

Sub-paragraph (3) has been amended as follows.

With respect to ships complying with relevant requirements given in this Part, notations corresponding to the purpose of those ships defined in **1.3.2**, **Part O of the Rules** are affixed to the Classification Characters as follows:

(1) Dredgers: *Dredger* (abbreviated to *D*)
(2) Crane ships
  (a) Ship-type ships: *Crane Vessel* (abbreviated to *CV*)
  (b) Barge-type ships: *Floating Crane* (abbreviated to *FC*)
(3) Vessels engaged in towing operations
  (a) Tugs: *Tug*
  (b) Ocean Tugs: *Towing Vessel* (abbreviated to *TV*)
  (c) Escort Tugs: *Escort Vessel* (abbreviated to *EV*)

((4) to (11) are omitted.)

O4 VESSELS ENGAGED IN TOWING OPERATION

O4.2 Stability

Paragraph O4.2.1 has been amended as follows.

O4.2.1 General

Ships engaged in towing operations are to comply with the following requirements or the requirements given in **Annex O4.2.1"GUIDANCE FOR INTACT STABILITY FOR SHIPS ENGAGED IN TOWING OPERATIONS"**, in addition to the requirements of **2.2.1**, **Part U of the Rules**.

(1) The initial transverse metacentric height (G_0M) is not to be less than 0.15 *m*.

(2) The stability curves are to comply with the following **(a)** or **(b)**:

(a) The residual area between a righting lever curve and a heeling lever curve developed from the bollard pull force is not to be less than 0.09 *m-rad*. The area is to be determined between the first interception of the two curves and the second interception or the angle of down flooding whichever is less. (The area as specified by "*A*" in **Fig. O4.2.1**)

(b) The area under a righting lever curve ("*A*" + "*B*" in **Fig. O4.2.1**) is not to be less than 1.4 *times* the area under a heeling lever curve developed from the bollard pull force ("*B*" + "*C*" in **Fig. O4.2.1**). The areas are to be determined between 0 *degree* and the 2nd interception or the angle of down flooding whichever is less.

In the application of the above requirements, the heeling lever (l_h) curve developed from the bollard pull force is to be derived by using the following formula. For ships intended for towing astern, such lever is to be that for towing ahead or that for towing astern, whichever is larger.

$$l_h = \frac{\kappa \cdot T \cdot h \cdot \cos\theta}{9.81 \cdot \Delta} \quad (m)$$

where

κ : Coefficient relating to type of propulsion, is to be taken equal to 0.7 for ships with azimuth thruster(s) and 0.5 for other ships.

T : Maximum bollard pull (*kN*). In principle, maximum bollard pull is to be derived from the actual test at the maximum continuous output of the engine(s). However, a nominal bollard pull specified by constructor of the considered ship may be accepted, provided that such value is not less than value given by **Table O4.2.1** as a standard, unless records of bollard pull tests in similar ships or sufficient information provided by the constructor.

h : Vertical distance (*m*) between the towing hook and the centre of the propeller.

Δ : Displacement (*ton*)

(3) Maximum bollard pull used in the application of **(2)** above is to be clearly stated in the ship's stability information and drawings relating to ship's towing arrangements. Such maximum bollard pull is also to be indicated at an appropriate position on each of the ship's towing arrangements.

(4) In principle, ships are to be provided with an appropriate device being capable of releasing the towing cable in an instant. Notwithstanding the above, ships only engaged in coasting service or equivalent, such device may be dispensed with, provided that appropriate safety procedures for emergency are to be stated in the ship's stability information.

Fig. O4.2.1 Heeling Lever Curve Developed from the Bollard Pull Force

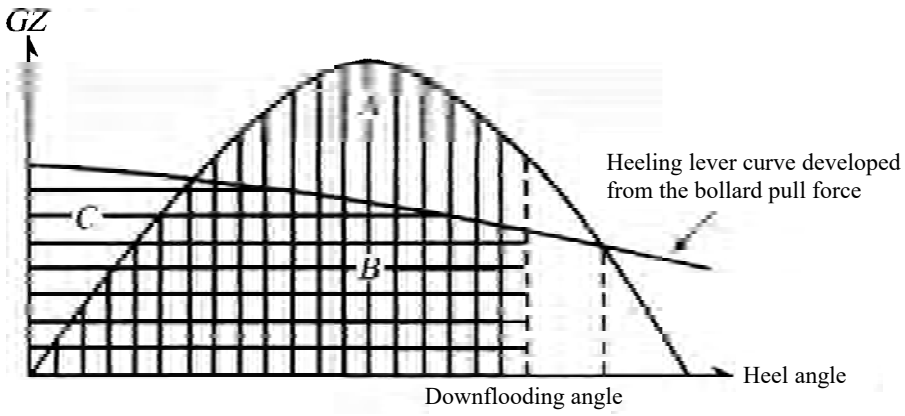


Table O4.2.1 Maximum Bollard Pull (*kN*)

	Towing ahead	Towing astern	
		For azimuth thruster(s)	For others
For propeller(s) not fitted with nozzles	0.16 *H*	0.14 *H*	0.08 *H*
For propeller(s) fitted with nozzles	0.19 *H*	0.17 *H*	0.10 *H*

H : Maximum continuous output of engine(s) (*kW*)

Note:

For ships other than conventional ships having propulsion(s) in the aft end, a special consideration is to be given for each ship.

O8 ANCHOR HANDLING VESSELS

O8.2 Stability

Paragraph O8.2.1 has been amended as follows.

O8.2.1 General

~~Ships are to comply with the following requirements corresponding to their designated operations in addition to the requirements given in **2.2.1, Part U of the Rules**. However, in cases where other stability requirements deemed appropriate by the Society are in effect, this requirement may be dispensed with.~~

~~Stability curves are to comply with the following:~~

~~The residual area between a righting lever curve and a heeling lever curve due to designated operations is not to be less than 0.09*m-rad*. The area is to be determined between the first intercept of the two curves and the second intercept or the angle of down flooding, whichever is less.~~

Ships are to comply with the requirements given in **Annex O8.2.1 "GUIDANCE FOR INTACT STABILITY FOR SHIPS ENGAGED IN ANCHOR HANDLING OPERATIONS"** in addition to the requirements given in **2.2.1, Part U of the Rules**. However, in cases where other stability requirements deemed appropriate by the Society are in effect, this requirement may be dispensed with.

Annex O4.2.1 has been added as follows.

Annex O4.2.1 GUIDANCE FOR INTACT STABILITY FOR SHIPS ENGAGED IN TOWING OPERATIONS

1.1 General

1.1.1 General

This guidance applies to ships engaged in port, coastal or ocean towing operations.

1.1.2 Definition

"Towing point" is the location where the towline force is applied to the ship. The towing point may be a towing hook, staple (rope guide for towing), fairlead or equivalent fitting serving that purpose.

1.2 Heeling Lever for Towing Operations

1.2.1 Calculation for the Self-tripping Heeling Lever

The self-tripping heeling lever is calculated according to the following **1** and **2**.

1 A transverse heeling moment is generated by the maximum transverse thrust exerted by the ship's propulsion and steering systems and the corresponding opposing towline pull.

2 The heeling lever, in *m*, as a function of the heeling angle θ, is to be calculated according to the following formula:

$$HL_\theta = \frac{B_P C_T (h\cos\theta - r\sin\theta)}{g\Delta}$$

B_P: bollard pull, in *kN*, which is the documented maximum continuous pull obtained from a static bollard pull test performed in accordance with **Appendix O1**. However, a nominal bollard pull specified by constructor of the considered ship may be accepted, provided that such value is not less than value given in **Table 1** as a standard, unless records of bollard pull tests in similar ships or sufficient information is provided by the constructor.

C_T: the value is to be according to the following formula.

for ships with conventional, non-azimuth propulsion units

$$C_T = 0.5$$

for ships with azimuth propulsion units installed at a single point along the length

$$C_T = \frac{0.90}{1 + l / L_f}$$

However, C_T is not to be less than 0.7 for ships with azimuth stern drive towing over the stern or tractor tugs towing over the bow, and not less than 0.5 for ships with azimuth stern drive towing over the bow or tractor tugs towing over the stern. For tugs with other propulsion and/or towing arrangements, the value of C_T is to be established on a case by case basis to the satisfaction of the Society.

Δ: displacement, in *t*

l: longitudinal distance, in *m*, between the towing point and the vertical centreline of

the propulsion unit(s) relevant to the towing situation considered.

h : vertical distance, in *m*, between the towing point and the horizontal centreline of the propulsion unit(s) as relevant for the towing situation considered.

g : gravitational acceleration, in m/s^2, to be taken as 9.81

r : the transverse distance, in *m*, between the centreline and the towing point, to be taken as 0 when the towing point is at the centreline.

L_f : length for freeboard as defined in **2.1.3, Part A**.

Table 1 Bollard Pull (*kN*)

	Towing ahead	Towing astern	
		For azimuth thruster(s)	For others
For propeller(s) not fitted with nozzles	0.16*H*	0.14*H*	0.08*H*
For propeller(s) fitted with nozzles	0.19*H*	0.17*H*	0.10*H*

H : Maximum continuous output of engine(s) (*kW*)

Note:

For ships other than conventional ships having propulsion(s) in the aft end, a special consideration is to be given for each ship.

1.2.2 Calculation for the Tow-tripping Heeling Lever

The tow-tripping heeling lever is calculated according to the following formula.

$$HL_\theta = \frac{C_1 C_2 \gamma V^2 A_P (h\cos\theta - r\sin\theta + C_3 d)}{2g\Delta}$$

C_1 : lateral traction coefficient according to the following formula.

$$C_1 = 2.8\left(\frac{L_s}{L_{pp}} - 0.1\right)$$

$0.10 \le C_1 \le 1.00$

C_2 : correction of C_1 for angle of heel according to the following formula.

$$C_2 = \frac{\theta}{3\theta_D} - 0.1$$

$C_2 \ge 1.00$

θ_D : angle of deck edge according to the following formula.

$$\theta_D = \arctan\left(\frac{2f}{B}\right)$$

C_3 : distance from the centre of A_P to the waterline as fraction of the draught related to the heeling angle according to the following formula.

$$C_3 = \left(\frac{\theta}{\theta_D}\right) \times 0.26 + 0.30$$

$0.50 \le C_3 \le 0.83$

γ : specific gravity of water, in t/m^3

V : lateral velocity, in *m/s*, to be taken as 2.57 (5 *knots*)

A_P : lateral projected area, in m^2, of the underwater hull.

r : the transverse distance, in *m*, between the centreline and the towing point, to be taken as 0 when the towing point is at the centreline.

L_S : the longitudinal distance, in *m*, from the aft perpendicular to the towing point.
L_{PP} : length between perpendiculars, in *m*
θ : angle of heel, in *degrees*
f : freeboard amidship, in *m*
B : moulded breadth, in *m*
h : vertical distance, in *m*, from the waterline to the towing point.
d : actual mean draught, in *m*

1.3 Heeling Lever for Escort Tugs

1.3.1 General

1 For the evaluation of the stability particulars during escort operations, the ship is considered to be in an equilibrium position determined by the combined action of the hydrodynamic forces acting on hull and appendages, the thrust force and the towline force as shown in **Fig. 1**.

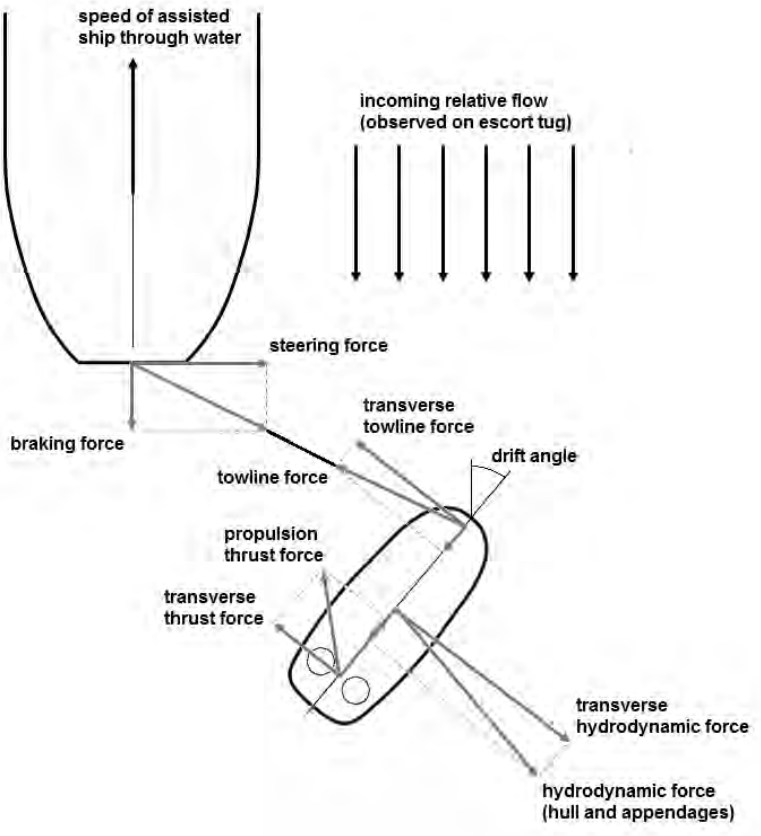
2 For each equilibrium position, the corresponding steering force, braking force, heel angle and heeling lever are to be obtained from the results of full scale trials, model tests, or numerical simulations in accordance with a methodology acceptable to the Society.

3 For each relevant loading condition, the evaluation of the equilibrium positions is to be performed over the applicable escort speed range, whereby the speed of the assisted ship through the water is to be considered. The typical escort speed range is 6 to 10 *knots* in such cases.

4 For each relevant combination of loading condition and escort speed, the maximum heeling lever is to be used for the evaluation of the stability particulars.

5 For the purpose of stability calculations, the heeling lever is to be taken as constant.

Fig. 1 Escort tug equilibrium position



1.4 Stability Criteria

1.4.1 General

1 In addition to the stability criteria specified in **2.2 and 2.3 Part U**, the following stability criteria are to be complied with.

2 For ships engaged in port, coastal or ocean towing operations, the area A contained between the righting lever curve and the heeling lever curve calculated in accordance with **1.2.1**, as measured from the heel angle, θ_e, to the angle of the second intersection, θ_c, or the angle of down-flooding, θ_f, whichever is less, is to be greater than the area B contained between the heeling lever curve and the righting lever curve, as measured from the heel angle is 0 to the heel angle, θ_e.

where

θ_e : Angle of first intersection between the heeling lever and righting lever curves.

θ_f : Angle of down-flooding. Openings required to be fitted with weathertight closing devices but which are required to be kept open for operational reasons are to be considered as down-flooding points in stability calculations.

θ_c : Angle of second intersection between the heeling lever and righting lever curves.

3 For ships engaged in port, coastal or ocean towing operations, the first intersection between the righting lever curve and the heeling lever curve calculated in accordance with **1.2.2** is to occur at an angle of heel less than the angle of down-flooding, θ_f.

4 For ships engaged in port, coastal or ocean escort operations, the maximum heeling lever determined in accordance with **1.3** complies with the following **(1)** to **(3)** and **Fig. 2**.

(1) Area A ≥ 1.25 × Area B

(2) Area C ≥ 1.40 × Area D

(3) $\theta_e \leq 15$ *degrees*

Area A : Righting lever curve area measured from the heel angle θ_e to a heel angle of 20 *degrees.*

Area B : Heeling lever curve area measured from the heeling angle θ_e to a heel angle of 20 *degrees.*

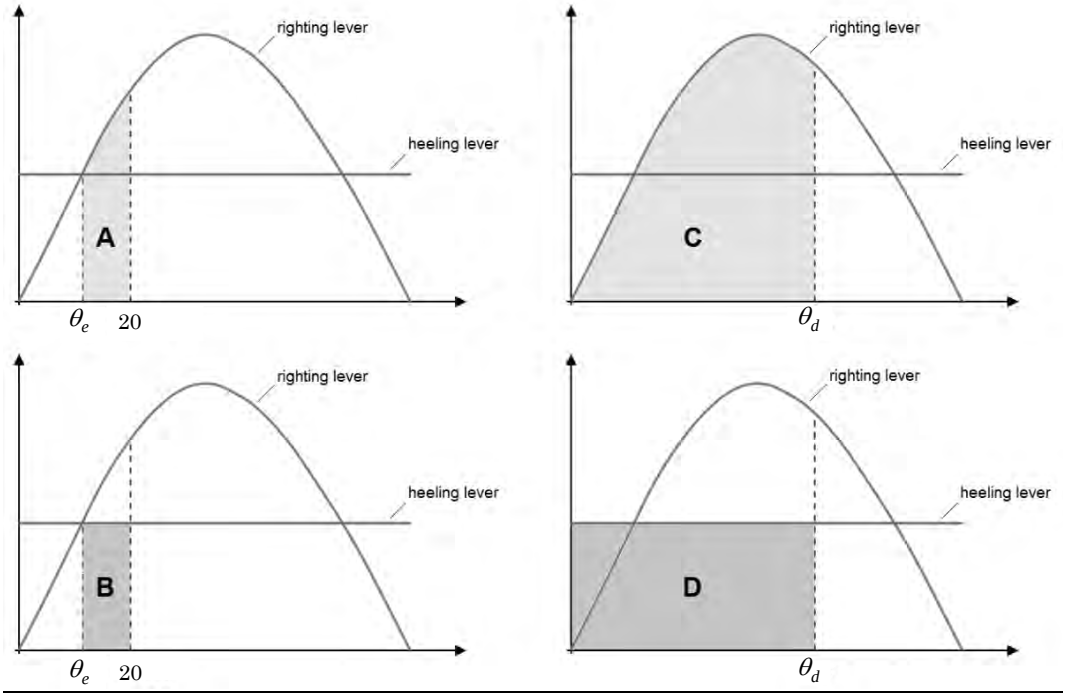
Area C : Righting lever curve area measured from the heel angle of 0 *degrees* to θ_d.

Area D : Heeling lever curve area measured from the heel angle of 0 *degrees* to θ_d.

θ_e : Equilibrium heel angle, corresponding to the first intersection between heeling lever curve and the righting lever curve.

θ_d : The heel angle corresponding to the second intersection between heeling lever curve and the righting lever curve or the angle of down-flooding or 40 *degrees*, whichever is less.

Fig. 2



1.5 Constructional Precautions Against Capsizing

1.5.1 General

1 Access to the machinery space, excluding emergency access and removal hatches, are to be arranged within the forecastle if possible. Any access to the machinery space from the exposed cargo deck is to be provided with two weathertight closures, if practicable. Access to spaces below the exposed cargo deck is to preferably be from a position within or above the superstructure deck.

2 The disposition of the freeing ports are to be carefully considered to ensure the most effective drainage of water trapped on the working deck and in recesses at the after end of the forecastle. In ships operating in areas where icing is likely to occur, no shutters are to be fitted in the freeing ports.

3 A ship engaged in towing operations is to be provided with means for quick release of the towline. Ships provided with towing winch systems also are to be provided with means of quick release.

1.6 Stability Information

1.6.1 Standard Loading Condition

1 The following loading conditions are to be included in addition to the standard loading conditions.

(1) Maximum operational draught at which towing or escorting operations are carried out, considering full stores and fuel.

(2) Minimum operational draught at which towing or escorting operations are carried out, considering 10% stores and fuel.

(3) Intermediate condition with 50% stores and fuel.

2 Allowance is to be made for the anticipated weight of cargo on and below deck, chains in lockers, anticipated types of wires or ropes on storage reels and wires on the winches when calculating loading conditions.

1.6.2 Additional Information

1 The stability information booklet for ships applying this guidance is to contain the following **(1)** to **(8)** as additional information.

(1) Maximum bollard pull

(2) Details on the towing arrangement, including the location(s) and type(s) of towing point(s), such as towing hooks, staples (rope guides for towing), fairleads or any other point serving that purpose.

(3) Identification of critical down-flooding openings.

(4) Recommendations on the use of roll reduction systems.

(5) Clear guidance on the quantity and size, in cases where any wires, etc. is included as part of the lightship weight.

(6) Maximum and minimum draughts for towing and escort operations.

(7) Instructions on the use of quick-release devices.

(8) For ships engaged in escort operations, the following additional operating information.

(a) A table with permissible limits of heel angles in accordance with **1.3.1-4** as functions of loading condition and escort speed.

(b) Instructions on the available means to limit heel angles within permissible limits.

Annex O8.2.1 has been added as follows.

Annex O8.2.1 GUIDANCE FOR INTACT STABILITY FOR SHIPS ENGAGED IN ANCHOR HANDLING OPERATIONS

1.1 General

1.1.1 General

This guidance applies to the ships engaged in anchor handling operations.

1.1.2 Definition

"Wire" means a dedicated line (wire rope, synthetic rope or chain cable) used for the handling of anchors by means of an anchor handling winch.

1.2 Heeling Lever

1.2.1 Calculation for the Heeling Lever

A heeling lever, HL_θ, generated by the action of a heeling moment caused by the vertical and horizontal components of the tension applied to the wire is to be calculated according to the following formula.

$$HL_\theta = \left(\frac{M_{AH}}{\Delta_2} \right) \cos\theta$$

$$M_{AH} = F_p (h \sin\alpha \cos\beta + y \sin\beta)$$

Δ_2 : Displacement of a loading condition in *t*, including action of the vertical loads added *Fv*, at the centreline in the stern of ship. Where *Fv* is to be calculated as follows.

$$F_v = F_p \sin\beta$$

α : The horizontal angle in *degrees* between the centreline and the vector at which the wire tension is applied to the ship in the upright position, positive outboard.

β : The vertical angle in *degrees* between the waterplane and the vector at which the wire tension is applied to the ship, positive downwards. This is to be taken at the maximum heeling moment angle according to the following formula.

$$\beta = \tan^{-1}\left(\frac{y}{h \sin\alpha} \right)$$

but not less than $\beta = \cos^{-1}\left(\frac{1.5 B_P}{F_p \cos\alpha} \right)$

B_P : The Bollard pull in *kN*, that is the documented maximum continuous pull obtained from a static pull test on sea trial according to *Appendix O1* or an equivalent value is to be at the discretion of the Society.

F_p : Permissible tension in *kN*, the wire tension which can be applied to the ship as loaded while working through a specified tow pin set, at each α, for which all stability criteria can be met. F_p is to in no circumstance be taken as greater than F_d.

F_d : Design maximum wire tension in *kN*, the maximum winch wire pull or maximum

static winch brake holding force, whichever is greater.

h : The vertical distance in *m* from the centre of the propulsive force acting upon the ship to the following **(1)** or **(2)**.

(1) The uppermost part at the towing pin.

(2) A point on a line defined between the highest point of the winch pay-out and the top of the stern or any physical restriction of the transverse wire movement.

y : The transverse distance in *m* from the centreline to the outboard point at which the wire tension is applied to the ship according to the following formula but not greater than *B*/2.

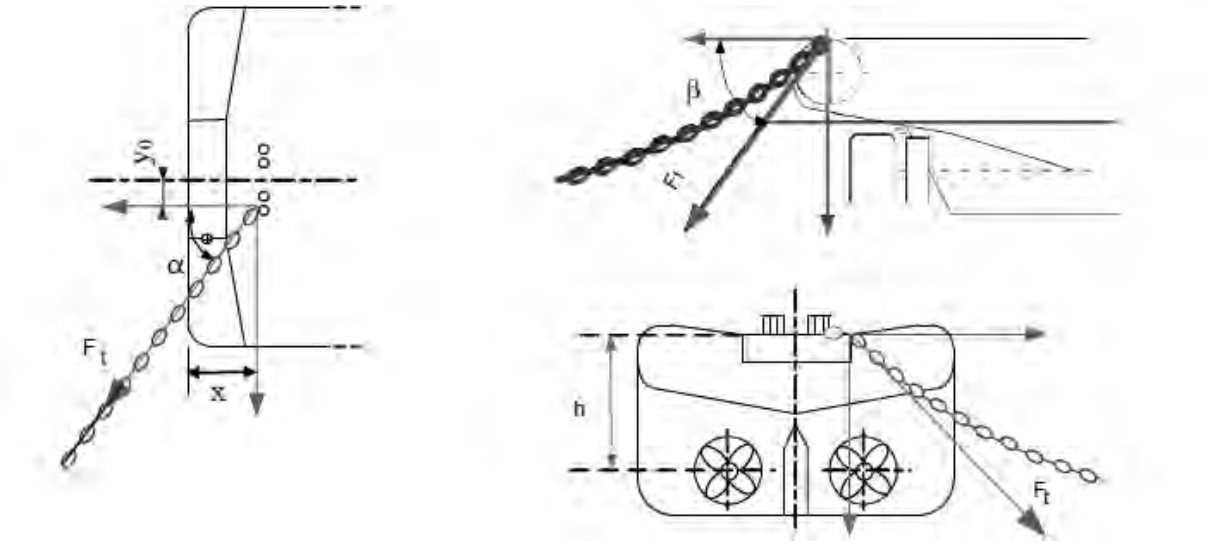
$$y = y_0 + x \tan \alpha$$

B : The moulded breadth in *m*

y_0 : The transverse distance in *m* between the ship centreline to the inner part of the towing pin or any physical restriction of the transverse wire movement.

x : The longitudinal distance in *m* between the stern and the towing pin or any physical restriction of the transverse wire movement.

Fig. 1 Example of α, β, x, y and h



Note;

F_t : The vector of the applied wire tension.

1.2.2 Permissible Tension

1 The permissible tension as function of α, defined in **1.2.1**, is not to be greater than the tension given by **-2**.

2 The permissible tension as function of α can be calculated by direct stability calculations, provided that the following **(1)** to **(4)** are met.

(1) The heeling lever is to be taken as defined in **1.2.1** for each α.

(2) The stability criteria in **1.3** are to be met.

(3) α is not to be taken less than 5 *degrees*, except as permitted by **-3**.

(4) Intervals of α are not to be more than 5 *degrees*; however, larger intervals may be accepted, provided that the permissible tension is limited to the higher α by forming working sectors.

3 For the case of a planned operation to retrieve a stuck anchor in which the ship is on station above the anchor and the ship has low or no speed, α may be taken as less than 5 *degrees*.

1.3 Stability Criteria

1.3.1 General

1 For the loading conditions intended for anchor handling but before commencing operations, the stability criteria given in **2.2 and 2.3, part U of the Rules** are to be applied. During operations, under the action of the heeling moment, the criteria following **-2** to **-4** are to be applied.

2 The residual area between the righting lever curve and the heeling lever curve calculated in accordance with **1.2.1** is not to be less than 0.070 *m-rad*. The area is determined from the first intersection of the two curves to the angle of the second intersection or the angle of down-flooding, whichever is less.

3 The maximum residual righting lever *GZ* between the righting lever curve and the heeling lever curve calculated in accordance with **1.2.1** is to be at least 0.2 *m*.

4 The static angle at the first intersection between the righting lever curve and the heeling lever curve calculated in accordance with **1.2.1** is not to be greater than the following **(1)** to **(3)** whichever is less.

(1) The angle at which the righting lever equals 50 % of the maximum righting lever.

(2) The deck edge immersion angle.

(3) 15 *degrees*

5 A minimum freeboard at the stern on the centreline of at least 0.005 *L* is to be maintained in all operating conditions, with a displacement as defined in **1.2.1**. In the case of the anchor retrieval operations covered by **1.2.2-3**, a lower minimum freeboard may be accepted provided that due consideration has been given to this in the operation plan.

1.4 Constructional Precautions Against Capsizing

1.4.1 General

1 A stability instrument may be used for determining the permissible tension and then checking compliance with relevant stability criteria. The following two types of stability instruments may be used on board

(1) Software checking either the intended or actual tension on the basis of the permissible tension curves.

(2) Software performing direct stability calculations to check compliance with the relevant criteria, for a given loading condition (before application of the tension force), a given tension and a given wire position (defined by angles α and β).

2 Access to the machinery space, excluding emergency access and removal hatches, is to be arranged within the forecastle if possible. Any access to the machinery space from the exposed cargo deck is to be provided with two weathertight closures. Access to spaces below the exposed cargo deck is to preferably be from a position within or above the superstructure deck.

3 The disposition of the freeing ports is to be carefully considered to ensure the most effective drainage of water trapped in working deck and in recesses at the after end of the forecastle. In ships operating in areas where icing is likely to occur, no shutters are to be fitted in the freeing ports.

4 Winch systems are to be provided with means of emergency release.

5 For ships engaged in anchor handling operations, the following recommendations for the anchor handling arrangements are to be considered.

(1) Stop pins or other design features meant to impede the movement of wire further outboard are to be installed.

(2) The working deck is to be marked with contrasting colours or other identifiers such as guide pins, stop pins or similar easily identifiable points that identify operational zones for the line to aid operator observation.

1.5 Stability Information

1.5.1 Standard Loading Condition

1 The following loading conditions are to be included in addition to the standard loading conditions.

(1) Service loading condition at the maximum draught at which anchor handling operations may occur with the heeling levers in accordance with **1.2.1** for the line tension the ship is capable of with a minimum of 67 % stores and fuel, in which all the relevant stability criteria as specified in **1.3** are met.

(2) Service loading condition at the minimum draught at which anchor handling operations may occur with the heeling levers in accordance with **1.2.1** for the line tension the ship is capable of with 10 % stores and fuel, in which all the relevant stability criteria as specified in **1.3** are met.

2 Allowance is to be made for the anticipated weight of cargo on and below deck, chains in lockers, anticipated types of wires or ropes on storage reels and wires on the winches when calculating loading conditions.

3 The compliance with the relevant stability criteria is to be made for each set of towing pins and its associated permissible line tensions, including any physical element or arrangement that can restrict the line movement.

4 When applying the design tension F_d for the tow pin set nearest to centreline, the stability criteria specified in **1.3** is to be met at the condition specified in **-1** as a minimum for the lowest α equal to 5 *degrees*.

1.5.2 Additional Information

The stability information booklet for ships applying this guidance is to contain the following **(1)** to **(5)** as additional information.

(1) Maximum bollard pull, winch pull capacity and brake holding force.

(2) Details on the anchor handling arrangement such as the location of the fastening point of the wire, type and arrangement of towing pins, stern rollers, all points or elements where the tension is applied to the ship.

(3) Identification of critical down-flooding openings

(4) Guidance on the permissible tensions for each mode of operation and for each set of towing pins, including any physical element or arrangement that can restrict wire movement, as a function of all relevant stability criteria.

(5) Recommendations on the use of roll reduction systems.

Appendix O1 has been added as follows.

Appendix O1 BOLLARD PULL TESTING PROCEDURE

(APPENDIX A to MSC/Circ.884 "GUIDELINES FOR SAFE OCEAN TOWING")

1 A proposed test programme should be submitted prior to the testing.

2 During testing of continuous bollard pull (*BP*) the main engine(s) should be run at the manufacturer's recommended maximum torque according to maximum continuous rating. Verification of the actual output should be requested during the test.

3 During testing of overload pull, the main engine(s) should be run at the manufacturer's recommended maximum rating that can be maintained for minimum 30 *minutes*.

The overload test may be omitted.

4 The propeller(s) fitted when performing the test should be the propeller(s) used when the vessel is in normal operation.

5 All auxiliary equipment such as pumps, generators and other equipment which are driven from the main engine(s) or propeller shaft(s) in normal operation of the vessel should be connected during the test.

6 The length of the towline should not be less than 300 *metres*, measured between the stern of the vessel and the test bollard. A minimum length of twice the vessel length might be accepted.

7 The water depth at the test location should not be less than 20 *metres* within a radius of 100 *metres* of the vessel. If the water depth of 20 *metres* cannot be obtained at the test location, then a minimum water depth which is equal to twice the maximum draft of the vessel may be accepted. It should be noted that reduced water depth may adversely affect the test results.

8 The test should be carried out with the vessel's displacement corresponding to full ballast and half fuel capacity.

9 The vessel should be trimmed at even keel or at a trim by stern not exceeding 2% of the vessel's length.

10 The vessel should be able to maintain a fixed course for not less than 10 *minutes* while pulling as specified in items 2 or 3 above. Certified continuous bollard pull is the average reading of the 10 *minutes* period.

11 The test should be performed with a wind speed not exceeding 5 *m/sec*.

12 The current at the test location should not exceed 0.5 *m/sec*. in any direction.

13 The load cell used for the test should be approved by a competent body and be accurate within +/- 2% within the range of loads to be measured and for the environmental conditions experienced during the test.

14 An instrument giving a continuous read-out and also a recording instrument recording the bollard pull graphically as a function of time should both be connected to the load cell. The instruments should if possible be placed and monitored ashore.

15 The load cell should be fitted between the eye of the towline and the bollard.

16 The figure certified as the vessel's continuous bollard pull shall be the towing force recorded as being maintained without any tendency to decline for a duration of not less than 10 *minutes*.

17 Certification of bollard pull figures recorded when running the engine(s) at overload, reduced *RPM* or with a reduced number of main engines or propellers operating can be given and noted on the certificate.

18 A communication system shall be established between the vessel and the person(s) monitoring the load cell and the recording instrument ashore, by means of *VHF* or telephone connection, for the

duration of the test.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 1 January 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships the keels of which were laid or which were at *a similar stage of construction* before the effective date.
(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1%* of the estimated mass of all structural material, whichever is the less.
* For high speed craft, "1%" is to be read as "3%".

Amendment 1-2

O7 OFFSHORE SUPPLY VESSELS

O7.2 Stability

O7.2.1 General

Sub-paragraph -2 has been amended as follows.

2 "Those ships specifically approved by the Society" refers to the offshore supply vessels complying with the requirements of *IMO Resolution MSC.*235(82), as amended.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 January 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships other than ships that fall under the following:

(1) for which the contract for construction is placed on or after the effective date; or

(2) in the absence of a contract for construction, the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2020; or

(3) the delivery of which is on or after 1 January 2024.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.