Guidelines for Construction and Classification

Part 1 Seagoing Ship

Volume 12

GUIDELINES FOR SAFE OCEAN TOWING

2021

Biro Klasifikasi Indonesia

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Biro Klasifikasi Indonesia

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The following Guidelines come into force on 1st July 2021.

Foreword

These Guidelines for Safe Ocean Towing (Pt.1, Vol.12) 2021 edition replace Guidelines for Ocean Towage (Pt.1, Vol.2) 2001 Edition and Guidance for the Construction and Testing of Towing Gears (Pt1, Vol.E) 2000 Edition. The major changes have been made regarding the content and reference of this Guidelines.

This Guidelines accommodate provision as basis for which to assess in each particular case the safety of ocean towage operations which consist of 3 Section namely:

Section 1 - General

Section 2 - Towing Gear

Section 3 - Towage Operation

The reference sources of the rules are mainly derived from IMO Resolutions, IACS Requirements and inputs from BKI Branch Offices and Technical Division BKI Head Office.

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Any quires or comments concerning these Rules are welcomed through communication (either phone call or email) with BKI Head Office.

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Section 1 General

A. General 1–1

A. General

1. Purpose

The objectives of these Guidelines are to ensure safety at sea, prevention of human injury or loss of life, avoidance of damage to the environment, in particular to the marine environment, and to property through providing minimum recommendations for the organization, planning and execution of ocean towages and the design of associated equipment.

2. Application

2.1 These Guidelines are applicable to international ocean towing operations. However, these guidelines may also be used for any other ocean towing operation.

2.2 These Guidelines do only apply to commercial towage operations, which are not in the nature of salvage. However, amongst towing vessels available to undertake such towing, priority should be given to those which are fitted to the nearest extent in line with Section 3.

2.3 The status of these Guidelines is advisory

2.4 On principle towage operations are formally covered by the necessary and available international and national certificates and by the class of the tug and its tow.

2.5 These Guidelines do not covered to the conveyance of floating "offshore installations (marine structures)".

3. Definition

Bollard Pull (BP)	:	Documented continuous bollard pull.
Breaking Load (BL)	:	Documented minimum breaking load.
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 black out conditions.
Fleet angle	:	The angle between the applied load (towline force) and the towline as it is wound onto the winch drum, see Fig. 1.1

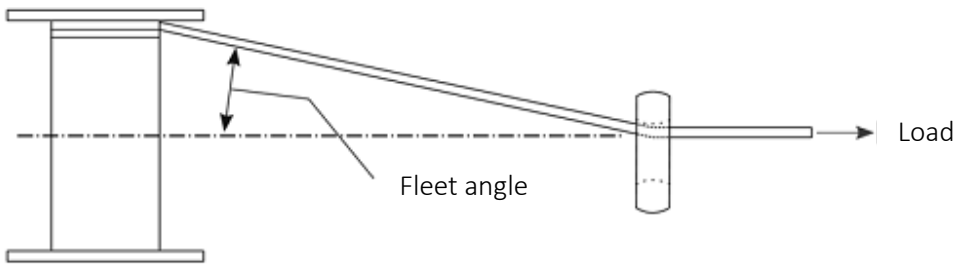

Fig. 1.1 Towline 'fleet angle'

Local towing	:	Towing operations where the distance between designated ports of refuge or safe anchoring along the route is less than 24 hours, taken into account weather conditions.
Maximum design load	:	Maximum load that can be held by the winch as defined by the manufacturer (the manufacturer's rating).
Ocean towing	:	Towing operations where the distance between designated ports of refuge or safe anchoring along the route is more than 24 hours, taken into account weather conditions.
Tow	:	The towing vessel, including towing vessel equipment and the towed object including its towing equipment, cargo and cargo securing
Towage	:	The complete towing operation
Towing equipment	:	All towing equipment on the towing vessel and the towed object used to effect the towage
Towing master	:	The manager responsible for the towage. A Tug master may be designated as Towing master
Tug master	:	The master of a towing vessel
1 and 10-year return periods	:	The most unfavourable combination of extreme environmental conditions, comprising wind, wave and current, that can be expected statistically every 1 and 10 years respectively.

Section 2 Towing Gear

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A. General

1. Range of Application

For vessels which are subject to supervision under BKI (character of class "TUG") or if BKI have especially been entrusted with testing of towing gears, BKI carry out the calculations for and testing of those gears in accordance with the present Regulations.

2. Examination of Drawing

Drawings of all parts under stress of the towing gear (towing hook, slip arrangement, towing winch, foundations, etc.) have to be submitted electronic format for approval to BKI Head Office.

Details on the materials to be used have to be stated in the drawings.

B. Calculation and Dimensioning of the Towing Gears

1. Original Data

For vessels which are subject to supervision under BKI (character of class "TUG") or if BKI have especially been entrusted with testing of towing gears, BKI carry out the calculations for and testing of those gears in accordance with the present Regulations.

1.1. For dimensioning of the towing gears, the test load "PL" has to be taken as a basis which has to be in a prescribed ratio to the maximum tow rope pull ''T".

Dimensioning of the towing winch has to be based on both, the tow rope pull T and the holding power of the winch.

1.2 Ratio of tow rope pull T to test load PL

Table 2.1 Ratio of tow rope pull T to test load PL

	T	PL
Up to	500 kN	2 x T
over	500 – 1500 kN	T + 500 kN
over	1500 kN	1,33 x T

1.3 Magnitude of tow rope pull T

If the tow rope pull T is not known, it can be estimated on the basis of the propulsive output, according to the following formula :

Tug with Kort Nozzle: T up to 245 N/kW (18 kg/HP)

Tug without Kort Nozzle: T up to 160 N/kW (12 kg/HP)

1.4 Direction of tow rope pull T

1.4.1 The towing hook, the towing hook seating, the foundations in the hull and the slip arrangement will be dimensioned with a test load PL up to 500 kN under consideration of tow rope direction from abeam position over astern to abeam and a tow rope inclination of 60° towards above against the horizontal line.

1.4.2 The towing hook, the towing hook seating, the foundations in the hull and the slip arrangement are dimensioned with a test load PL of more than 500 kN under consideration of the tow rope direction from abeam over astern to abeam and a tow rope inclination of 45° towards above against the horizontal line.

1.4.3 For all towing hooks (independently of the magnitude of test load PL), the slip arrangement has to be tested with a tow rope inclination of 60° towards above against the horizontal line, under the tow rope pull T.

1.4.3 For testing of towing gear with towing winches, the direction of the tow rope has to be indicated on the drawing.

2. Admissible Stress

The admissible stress in the towing gear with the load assumptions as per A.1, has to be ascertained in accordance with the details in Guidelines For Loading Gear on Seagoing Ships and Offshore Installations (Pt.4, Vol.3) Sec. 5, the compensating factor $\Phi = 1$ and load condition B have to be assumed.

With the tow rope pull T, the tow rope should at least have 2,5 times the safety against the minimum breaking load of the rope.

C. Construction of Towing Gears

1. Towing Hook and Slip Device

1.1 The towing hook is to be arranged as deep as possible. The towing hook has to be designed such as to permit adjusting in each tow rope direction as per B.1.4.

1.2 The towing hook has to be fitted with an adequate arrangement guaranteeing slipping of the hook in case of emergency, from the bridge as well as in the vicinity of the hook itself. These release stations have to be arranged in a way that free visibility of the towing hook is guaranteed.

1.3 Slip devices can be equipped with mechanical, hydraulic and pneumatic transmission appliances. A safety device has to guarantee that unintentional slipping is avoided.

1.4 A mechanical slip device has to be designed such that the required release force does not exceed 150 N at the towing hook and 250 N on the bridge if the hook is subjected to test load PL. For tests under tow rope pull T this values are to be reduced in relation T/PL.

1.5 In case of a mechanical slip device, the releasing rope has to be guided over rope sheaves. If necessary, slipping should be possible by downward drawing, using the whole body weight. A corresponding rope guide has to be provided.

1.6 For a pneumatic slip device, a complete mechanical slip device has to be additionally provided always (among other reasons, because of possible icing).

1.7 An adequately heavy hatchet or axe accessible from all sides which is closely located to the towing hook is used for emergency slipping by cutting the tow rope in case of failure of the slip device.

2. Tricing Winches

Control platforms for the tricing winches must not be located in the dangerous zone of the tow rope. Apart from the control stations on deck, another control station should be available on the bridge.

The tricing winch has to be satisfactorily dimensioned in accordance with the size of the tug. For operation of the tricing winch, perfect transmission of orders has to be safeguarded.

3. Towing Winches

The towing winch has to be arranged such as to guarantee safe guiding of the tow ropes in all directions in accordance with B.1.4.

The winch drum has to be equipped with a satisfactorily dimensioned brake. It should be possible to quickly release the brake from the control stand on the bridge as well as from any other control stand. Free visibility of the winch drum should be possible from any control stand where no fairlead exists.

The operating lever for the winch has to return to zero automatically if it is freed (dead man setting). It should be possible to secure the lever at zero.

The operating levers have to be secured against unintentional release of the brake.

The regulating device for the braking, lifting and lowering forces should be fitted on the control panel of the winch.

All towing winches have also to be fitted with a mechanical hand brake. Fastening of the towing hawser on the winch drum has to be such that it breaks if the towing hawser has to be released.

The winch drum diameter has to be at least 14 times the diameter of the towing hawser.

D. Testing of the Towing Gears

1. Testing at the Manufacturers

1.1 Towing hook with mechanical slip device.

These towing hooks, movable towing arms, and other devices have to be subjected to a test load PL with the aid of an approved testing facility. In connection with this, the slip device has to be tested likewise; the required tripping force has to be measured; this force must not exceed 150 N according to C.1.4.

1.2 Towing hook with hydraulic slip device.[1)]

These towing hooks have to be subjected to a test load PL against the standing piston. The hydraulic slip device need not be subjected to a test load PL. Functioning of the tripping device is to be proved with the towing hawse loosely resting on the hook.

1.3 Towing hook with pneumatic slip device.

These towing hooks have to undergo testing according to 1.1. See also C.1.6.

1.4 Towing winch.

1.4.1 The towing winch undergoes survey and functioning test at the manufacturers.

1.4.2 A load test at the manufacturers is not required. The manufacturer is responsible for fulfilment of the requirements. Testing as per 2. may be carried out.

1.5 Certificate and stamping of the towing hook.

For each testing carried out in accordance with 1.1, 1.2, or 1.3, a certificate is issued which has to be handed on board with the towing hook.

2. Initial Testing of Towing Hooks on Board (Bollard Pull Trial)

2.1 The installed towing gear should be tested on the tug under operational conditions. See also B.1.4.3.

2.2 For obtaining comparable values for sister vessels when carrying out inspections at different places and on different dates, the following details should be given:

- compass course
- wind direction and force
- current direction and intensity
- length of towing hawse from hook or winch to fixed point (approx. 100 m)
- output and rpm of engine plant.

2.3 The functional tests of the slip device have to be carried out on board for all types of hooks; for the mechanical slip devices, the tripping forces have to be measured. Observance of the values under C.1. has to be proved.

2.4 After each initial testing on board (bollard pull trial), entries are to be made into issued as per 1.5.

[1)] The prescriptions under the Rules for Hull (Pt.1, Vol.II) Sec.27, C.3 have to be applied analogously.

3. Repeat Tests of Towing Hooks

3.1 Functional safety of towing hook and slip device has to be checked by the ship's master at least once a month.

3.2 Towing hooks with mechanical and/ or pneumatic slip device have to be dismounted every two years and have to be tested in compliance with 1.1 on an approved testing equipment. After fitting of the hook on the tug, the slip device has to be subjected to a functional test, by tripping the hook without load.

3.3 For avoiding dismounting of these towing hooks, the test load PL can also be produced by fastening in front of the first tug towed to the bollard, the hook of which is intended to be tested, another tug of almost equal power. Slipping has to be effected whilst both tugs are pulling with full engine power and, thus, are additionally generating a shear effect through moving of rudder. If the hook of the aft tug has been tested, the tugs change their positions, so that towing hook and slip device of the second tug can be tested likewise.

3.4 Towing hooks with hydraulic slip arrangement are subjected to a functional test on board every two years. They are ready for operation with the tow rope loosely resting on the hook.

3.5 The repeat test will be confirmed by the surveyor.

4. Repeat Tests of Towing Winches

Repeat tests are not required for towing winches. The towing winches, however, have to be subjected to an external survey for wear and tear, within the scope of class renewal surveys.

E. Material

1. The towing hooks can either be made of forged steel (C 15; C 22), of structural steel (R St 37.2; R St 42.2) or of cast steel (GS-45.3 DIN 1681) or equivalent. The cast steel pieces have to be tested by BKI in compliance with its Rules for Materials (Pt.1, Vol. V). The material certificate has to be presented to the surveyor upon testing according to 1.

2. The materials of the winches are to be selected according to their purpose.

F. Welding

For welding on towing gears, the Rules for Welding (Pt.1, Vol. VI) have to be applied.

G. Towing winch emergency release systems

1. Scope

1.1 This sub section 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, including those ships normally not intended for towing operation in transverse direction.

1.2 This Sub section is not intended to cover towing winches on board ships used solely for long distance ocean towage, anchor handling or similar offshore activities.

2. Purpose

2.1 The purpose of this sub section is to provide requirements to prevent 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. See Fig. 2.1 which shows the forces acting during towage operations.

Note:

1. This sub section is to be uniformly implemented for vessels contracted for construction on or after 1 July 2021.

2. The "contracted for construction" date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder.

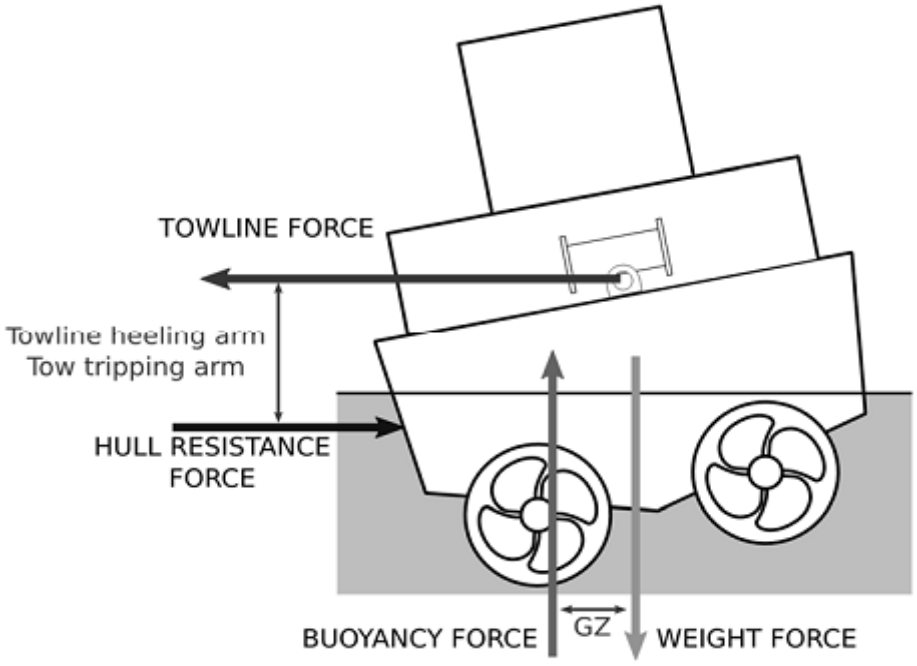

Fig. 2.1 Forces during towing

3. General requirements

3.1 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.

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

4. Emergency release system requirements

4.1 Performance requirements

4.1.1 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: vessel electrical failure, variable towline load (for example due to heavy weather), etc.)

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

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

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

4.1.4 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.

4.1.5 Once the emergency release is activated, the towline load required to rotate the winch drum is to be no greater than:

- the lesser of five tonnes or 5 % of the maximum design load when two layers of towline are on the drum, or
- 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.

4.1.6 Emergency release of the towline is to be possible in the event of a blackout. For this purpose, where additional sources of energy are required, such sources are to comply with 4.1.7.

4.1.7 The sources of energy required by 4.1.6 are 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 the event of a blackout for a minimum of five 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 4.1.5 if this is less than 5 minutes.

4.2 Operational requirements

4.2.1 Emergency release operation must 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. A position in close proximity to the winch is not regarded as “safe location”, unless it is documented that the position is at least protected against towline break or winch failure.

4.2.2 The emergency release control is to be located emergency stop button for winch operation, if provided, and shall be clearly identifiable, clearly visible, easily accessible and positioned to allow safe operability.

4.2.3 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.

4.2.4 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 must always be possible to cancel the emergency release from the bridge regardless of the activation location and without manual intervention on the working deck.

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

4.2.6 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.

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

4.2.8 Computer based systems that operate or may affect the control of emergency release systems are to meet the requirements for Category III systems see Rules for Electrical Installations (Pt.1, Vol.IV) Sec.10.B.3

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

5. Test requirements

5.1 General

5.1.1 All testing defined within 4. to 5. is to be witnessed by a BKI surveyor.

5.1.2 For each emergency release system or type thereof, the performance requirements 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 BKI.

5.1.3 The performance capabilities as well as instructions for operation of the emergency release system are to be documented by the manufacturer and made available on board the ship on which the winch has been installed.

5.1.4 Instructions for surveys of the emergency release system are to be documented by the manufacturer, agreed by BKI and made available on board the ship on which the winch has been installed.

5.1.5 Where necessary for conducting the annual and special surveys of the winch, adequately sized strong points are to be provided on deck.

5.2 Installation trials

5.2.1 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.

5.2.2 Where the performance of the winch in accordance with 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 vessel bollard pull.

Section 3 Towage Operation

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A. Scope

1. These Section provide a basis on which to assess in each particular case the safety of ocean towage operations in accordance with the documentation, already available or to be submitted, and the relevant surveys.

2. These Section are intended to provide those concerned in towage operations (owners of vessels to be towed, tug masters and owners, shippers, insurers and competent authorities) with information relevant to conditions and feasibility.

3. These Section apply to the towage of seagoing ships or other floating craft, with and without cargo, and also, where appropriate, to the conveyance under their own power of seagoing ships whose class is suspended or expired or whose class, in so far as it relates to the range of service, does not cover the proposed voyage.

B. Conditions for towage

1. Application assessment

1.1. Application for assessment of towing/ conveying operations is to be made to BKI

1.2. The extent of the assessment/ survey will be agreed between the applicant and BKI in each case. Where necessary, the ship-owner, the ship's command, the insurers and the authorities shall also be consulted.

The publication of these Guidelines shall not imply any obligation on BKI to carry out in every case an examination to the full extent provided for in these Guidelines.

1.3. Assessment of the towage/ conveyance of vessels which, in respect of their type, design, equipment, cargo etc., are suitable for permanent seagoing service, is normally based on C.

1.4. Special investigations and conditions become necessary in relation to the towing of vessels which are not suitable for permanent seagoing service, e.g. floating docks and inland ships, and of seagoing vessels with special cargoes especially sensitive to conditions at sea such as crane structures, exceptional heavy cargo etc. in D "Controlled transport" is also to be applied, wherever relevant, to towing operations of this kind.

2. Details and Documents

2.1. General

The following details and documents are to be submitted to BKI in electronic format for examination.

2.1.1 Port of departure, expected start of voyage, route, port of destination, expected end of voyage.

2.1.2 Towed vessel :

1) Name,
2) distinctive number or letters,
3) port of registry, draught in tow,
4) proof of adequate stability (not required where reference to available stability documents shows that stability is sufficient without special proof),
5) certificate :

– Certificate of Registry,
– Tonnage Certificate,
– Class Certificates,
– Load Line Certificate,
– Safety Construction Certificate,
– Safety Equipment Certificate,
– Safety Radiotelegraphy/ Radiotelephony Certificate.

2.1.3 For a tow with other Classification Society the following additional details are to be supplied:

– Type of vessel (general arrangement plan),
– Dimensions,
– Class,
– Anchor equipment,
– Bilge arrangement.

2.1.4. Towing arrangement on the tow:

– Towing brackets (strong points),
– Chains,
– Triangular plate,
– Recovery devices,
– Emergency towing gear.

2.1.5. Tug :

– Name,
– Distinctive number or letters and port of registry, if already known.

2.2. Controlled transport

The following are to be supplied in addition to the details and documents listed in 2.1 :

2.2.1 Detailed information about proposed route, excepted speed, bunkering ports and possible ports of refuge. Meteorological advertise of the wind, sea conditions and swell to be expected during the proposed voyage supplied by the institute also advising respectively on the route during towage/ conveyance.

2.2.2. Tow :

Proof of sufficient intact stability.

(In special cases, proof of unsinkability may be demanded).

Construction drawings and strength calculations for the tow and/or the cargo together with lashings.

2.2.3. Tug :

- Name,
- Distinctive number or letters,
- Port of registry,
- Bollard pull.

Also, for tugs with other Classification Society:

- Type of vessel (general arrangement plan),
- Dimensions,
- Class,
- Stability calculations for departure and arrival,
- Bollard pull/ engine power,
- Propeller/ Kort nozzle,
- Fuel consumption/ fuel reserves,
- Towing winch/ holding load/ quick release,
- Towing lines/ breaking strength.

3. Tug

3.1 The tug shall be suitable for the proposed towing operation in respect of its type, size, design, power, towing force and equipment.

3.2 The towing force is to be ascertained with due allowance for the tow, the route, the duration of the voyage and the weather and sea state proper to the time of the year. A general reference value may be taken as the power by which a tug is able to keep the tow in position with a head wind of V_w = 20 m/s = Bft 8-9 and a head current of V_c= 1 m/s.[1)].

4. Survey

4.1. After examination of the documents by BKI Head Office and after the satisfactory survey carried out by a BKI Surveyor, a Certificate of Conveyance will be issued.

4.2. Prior to the towage/ conveyance of vessels whose class has expired, a survey equivalent to an Annual Class Survey is to be performed. This survey shall normally be carried out in dry dock if the last bottom survey has taken place more than 2,5 years previously.

4.3. Prior to the towage/conveyance of non-classified vessels, a survey equivalent to a survey for admission to class is to be carried out. The appropriate drawings and documents for the ship's hull and the machinery/ electrical installation are to be submitted.

[1] This reference value is not to be interpreted to mean that a tug and tow drifting astern under the effect of higher winds and wave drifting forces in the open sea is exposed to danger. Controlled drifting in the open sea is generally to be regarded as acceptable. In tug service it is normal practice for a towing train to drift under appropriate current and weather conditions.

5. Ship's command

5.1. The issue of the Certificate of Conveyance is subjected to the proviso that the towage operation will be performed by good seamanship and according to established seafaring practice. This includes compliance with the conditions stipulated in the Certificate.

5.2. If, in a special situation arising during the voyage, the master is no longer able to comply with the stipulated conditions, he shall, after expert assessment of the situation, take such measures as are appropriate to the special circumstances.

5.3. In the vicinity of coasts or shallow waters, the course and the respective leg of the voyage are to be selected in such a way that the tug and tow can be either brought with adequate speed into safe waters (open sea or port of refuge) or kept clear of the coast or shallows under any foreseeable conditions of current or weather.

5.4. During the towing operation, the tow is to be repeatedly inspected, provided that weather conditions enable persons to be transferred. The first inspection is to take place when, after the start of the voyage, the tow, the cargo and the lashings have been subjected to the first loads due to motions in the seaway or listing caused by the wind.

5.5. BKI is to be notified of departure, arrival and any abnormal occurrences during the voyage. In special cases, the Society is to be kept regularly informed of position, towing speed, wind forces (Bft) and seaway (wave height and period).

5.6. The master of the tug remains solely responsible for the tug, the towing gear, the tow and the conduct of the towing operation as well as for the choice of route and any departures from the route which may prove necessary.

C. Installations and equipment of the towed/ conveyed vessel

1. Closing appliances

1.1. Hatches, ventilators, air pipes, outside doors, windows and other openings through which water might intrude into the interior of the vessel are to be closed weathertight.

Side scuttles in the shell plating are to be securely closed by fitting fixed covers.

Wherever practicable, the closing devices of sanitary discharges are to be secured in the closed position.

In addition, all sea and discharge valves of systems which are not required to operate during conveyance are to be closed.

1.2. The closing appliances of vessels not subject to International Load Line Convention shall, as far as possible, conform to the conditions of assignment for the load line.

1.3. The following systems shall comply with the Rules for Machinery Installations (Pt.1, Vol.III)

- Air and overflow pipes,
- Combustion air supply to auxiliary engines,
- Design and arrangement of exhaust lines,
- Engine room ventilation,
- Sounding pipes, of tanks, empty cells, cofferdams and the bilges of spaces.

Which are not always accessible. Where these do not conform to Rules for Machinery Installations (Pt.1, Vol.III) they are to be closed permanently.

2. Lights, shapes, sound signal appliances

2.1. The design and positioning of lights, shapes and sound signal appliances shall meet the requirements of the International Regulations for Preventing Collisions at Sea.

A towed vessel shall carry:

- Side lights,
- A stern light,
- A diamond shape where it can best be seen, when the length of the tow exceeds 200 m.

2.2. The towed vessel, if manned, shall sound the signals prescribed in Reg. 35 (Collisions Regulations) in restricted visibility.

2.3. An adequate power supply is to be provided.

3. Anchoring Equipment

3.1. At least one anchoring equipment shall be available ready for use. Anchors and chains should comply with Rules for Hull (Pt.1, Vol.II) Sec. 18, C and D.

3.2. Where wire ropes are fitted in lieu of anchor chain cables, the length of the wire ropes should be equal at least 1,5 times the length of the required chain cable length.

The wire rope's breaking strength should not be less than the breaking strength of the required chain cable of grade K1.

4. Strongpoints for towing gear

4.1. At least two suitable strong points (towing brackets) as well as suitable fairleads through which the chains can be led shall be available on the tow.

Suitable bitts or the anchor installation of the tow can also be used as strong points.

4.2. The strong points shall be able to withstand at least 1,2 times the tensile breaking strength of the towing line/ chain.

5. Securing the rudder and propeller

5.1. The rudder is to be locked in the midships position. This can be effected by means of the steering gear or other mechanical device.

5.2. The propeller shaft shall, as a rule, be immobilized by appropriate means to prevent the shut-down propulsion machinery from being transmitted.

6. Bilge arrangements

6.1. All spaces, tanks and empty cells which affect the buoyancy of the vessel shall, as a rule, be provided with bilge arrangements.

6.2. At least one bilge pump is to be permanently installed on vessels with auxiliary machinery.

6.3. At least one transportable, power-operated bilge pump is to be carried on vessels without auxiliary machinery.

7. Fire protection and firefighting equipment

The type and extent of the fire protection and firefighting equipment are to be agreed with BKI with due regard to the vessel, the cargo and the crew.

8. Equipment for crews on manned tows

Regarding accommodation, life-saving appliances and telephone communication between the tug and the tow are to comply with national regulations.

Where not specified, at least the following facilities should be available on the tow together with an adequate power supply:

8.1. Living quarters

Living quarters including day room, sleeping accommodation, galley and toilet facilities sufficient for all on board.

8.2. Lifesaving appliances

A liferaft capable of accommodating all persons on board and a ladder on each side of the tow,

- 4 lifebuoys, including two provided with self-igniting light and two fitted with a buoyant lifeline,
- 1 life-jacket for each person,
- 1 immersion suit for each person,[2)]
- 6 parachute signals,
- 6 hand flares,
- 1 daylight signalling lamp.

8.3. Radio communication installation

Radio communication installation station providing permanent telephone communication between tow and tug on a ship-to-ship channel and on channel 16.

8.4. Access to vessel to be towed

Means of access is to be provided on both sides of the towed vessel to allow it to be boarded from the tug, a utility boat or the water.

This means of access may take the form of steel ladders, rungs or rope ladders. Means must also be provided for fastening the latter to the ship's side.

9. Fuel reserves

Adequate fuel reserves are to be provided compatible with the ratings of consumers which may be needed during the towing operation.

10. Stability- freeboard- trim

Adequate intact stability is stipulated. In case of doubt, proof is to be supplied of adequate stability. (See also B.2.1.2.)

[2] For tropical countries not applicable/not necessary.

Where specialty justified by circumstances, proof of unsinkability may be required.

When towing pontoon-shaped vessels, the towing speed must be such as to allow the maintenance of sufficient freeboard at the forward end of the pontoon in the direction of motion so as to avoid the danger of dipping and capsizing as a result of excessive towing speed. In order to reduce this danger, trimmed vessels should be towed so that the emergent end faces forwards. This arrangement can also have a beneficial effect on the course-holding behaviour of the vessel.

D. Controlled Transport

1. Definition/ Certification

1.1 When transporting goods especially sensitive to conditions at sea (see B.2.1.4) it is necessary that the planning and execution of the operation should meet the special requirements set out below. This applies especially to cases of unusual configuration and/or loading or where the dimensions of the towed vessel or transport vessel are not suitable (without restriction) for the route to be followed. In these circumstances a special investigation is needed into motion behaviour and into the dynamic loads generated by a seaway.

1.2. Fulfilment of the conditions applicable to "Controlled transport" is certified by BKI by the issue of an appropriate Certificate, which may be backed up by an expert appraisal.

2. Conditions applicable to controlled transport

2.1. Route planning

2.1.1. The routing of ocean towing operations normally comprises the following elements:

Ports of departure and destination, Ports of refuge, bunkering ports, Shallows and restricted waters etc. (see B.2.2.1).

2.1.2. The persistent or seasonably variable environmental conditions encountered along the route, or over parts thereof, are normally to be described statistically with the relevant probability of occurrence. This applies to the following in particulars :

- Wind forces and directions,
- Characteristic wave heights hi (with their probability of occurrence $\mathrm{P}\,[\mathrm{hi}]$),
- Characteristic wave periods tj, (with their probability of occurrence $\mathrm{P}\,[\mathrm{tj}]$).
- Current velocities and directions,
- Drift ice according to type and density etc.

(For this purpose, the characteristic wave heights and the characteristic wave periods may be equated with those observed visually).

2.1.3. Wherever possible, the combined probability of occurrence of characteristic wave height and characteristic period ($\mathrm{P}[\mathrm{hi}, \mathrm{tj}]$) should also be ascertained. For much used routes, atlases are available which show these probabilities in terms of relative frequencies of occurrence. In special cases, hydrographic institutes, sea weather bureaus and similar institutions should be consulted.

2.1.4. The mean sea steaming time(s) $\mathrm{T_{sm}}$ required for the journey, or the parts thereof, are to be calculated (see 2.3.4).

2.2. Motions and loads

2.2.1. The resistance of the towed vessel is to be shown in relation to various speeds and allowing for differing environmental conditions, including especially different seaways with the corresponding wind and current conditions. The calculation of the resistance mutt also allow for. The drifting force of the waves exerted on the tow. A seaway is generally defined by a paired value (h_i, t_j) using an associated standard spectrum, see BKI Rules for the Classification and Construction of Offshore Technology.

2.2.2 The thrust of the tug is to be shown in relation to towing speed and allowing for differing environmental conditions (see 2.2.1).

2.2.3 On the basis of the results obtained by applying 2.2.1 and 2.2.2, the mean towing speed Vs for the route, or parts thereof, is to be determined in relation to various environmental conditions. This is based on the condition: thrust equals resistance.

2.2.4 Under extreme environmental conditions, controlled drifting astern can be accepted provided that the steerability of the tug is not seriously impaired. In this context, extreme environmental conditions are defined by the following reference values:

- Wind speed over 20 m/s,
- Characteristic wave height greater than 7,5 m,
- Current velocity greater than 1 m/s see 2.3.2.

In shallow waters (see 2.1.1), ocean towage is subject to limitations in respect of seaway (see 2.3.5).

2.2.5 When the environmental conditions are not extreme, the towing speed Vs shall be at least equal to 0.

2.2.6 With a heavy seaway the towing speed Vs should be limited to a maximum of 2 kN. A heavy seaway in this context is defined by the following reference value :

- Observed wave length equal to 0,7 – 1,1 times the length of the towed vessel (wave length in metres equal to 1,5 times the square of the wave period in seconds),or
- Observed wave height greater than 0,07 times the observed wave length.

2.2.7 The seaway-related motions of the towed vessel provide the basis for calculating the corresponding magnitude of the forces acting in the cargo lashings. The recommended standard procedure for determining the motions and forces is the "spectral analysis", which involves linear motions and load analysis in regular waves and its evaluation by reference to standard seaway spectra (for detailed Information see BKI Rules for the Classification and Construction of Offshore Technology). By this method it is possible to calculate design values for safe lashings, the design value being defined as that value which is exceeded just once within a given safe period of time T_s (for T_s see 2.3.2).

2.2.8 Using the standard procedure referred to in 2.2.7 it is generally sufficient to allow for seaways running in the following two main directions:

Towing condition : oncoming seaway.

Drifting condition : seaway from the side.

2.2.9 Approximate load calculations based on motions at natural frequencies (see 3.) are generally suitable only for preliminary dimensioning and can be verified in accordance with the preceding in 2.2.7 and 2.2.8.

2.3. Essential boundary conditions

2.3.1 The essential boundary condition for the application of the standard procedure described in 2.2.7 and 2.2.8 is the safe period of time T_s (for details see 2.3.2 - 2.3.4 below). In addition, maximum environmental parameters may, subject to certain requirements, be defined as essential boundary conditions (for details see 2.3.5).

2.3.2 If the mean sea steaming times T_{sm} for the journey, or parts thereof, are greater than the period for which the weather can be reliably forecast, an ocean towing operation may nonetheless be commenced provided that the design values of the lashings in accordance with 2.2.8 and 2.2.9, as applicable, are determined by applying a safe period of time T_s calculated as follows :

$$T_s = t_m \,.\, 10^y \,;\, y = 1.1 \,.\log\,(T_{sm}/\, t_m)$$

For the parameters t, and T_{sm} see 2.3.3 and 2.3.4 below.

2.3.3 The mean wave period lm is to be substituted by the weighted mean value of all the characteristic wave periods for the route, or parts thereof, as defined in 2.1.2.

$$t_m = \sum_{j=1}^{J} P\,[t_j].\, t_j$$

The symbol J signifies the number of observation intervals of t_j used for the statistical analysis.

2.3.4 The mean steaming time is calculated from the lengths of the route, or parts thereof, and the mean speed V_{sm} attained over that distance, i.e. :

$$T_{sm} = S \,/\, V_{sm}$$

The mean speed V_{sm} is determined by reference to the mean wave period tm and the mean wave height

$$t_m = \sum_{i=1}^{I} P\,[h_i].\, h_i$$

In accordance with 2.2.1 - 2.2.3 for a mean seaway defined by the paired value (h_m, t_m). The symbol I signifies the number of observation intervals of hi used for the statistical analysis.

2.3.5 If the mean sea steaming times T_{sm} for the route, or parts thereof, are shorter than the period of time for which the weather conditions can be reliably forecast, the motions and forces can be calculated by reference to a specified maximum value for the characteristic wave height and to other environmental parameters and can then be used as a basis for determining the dimensions of the lashings. In this case it is necessary to ensure that the entire ocean towing operation is independently monitored. Care must be taken to ensure in particular that the weather forecast is from a qualified source, so that the maximum value of the characteristic wave height is not. Exceeded during the planned duration of the voyage. When planning the route, due allowance is to be made for waiting times at ports.

3. Mechanical strength, securing of cargo

3.1 Instructions for use

3.1.1 The following Regulations concern the mechanical strength and constructional design of the structural members of the towed vessel as well as the ancillary equipment (dunnage blocks, lashings etc.) to be provided for securing or supporting the cargo.

3.1.2 The remarks apply in analogous manner to the components and equipment of ships with their own propulsion plant which are used to transport heavy deck cargoes.

3.1.3 Components not specially mentioned below are to be dimensioned in accordance with the principles set out in the Rules for Hull (Pt.1, Vol.II) Sec. 21.H.

3.2 Design strength

3.2.1 The structure of the towed vessel is to be investigated with regard to the global strength, e.g. longitudinal and transverse strength, with due consideration for the load distribution due to the deck cargo. Where very large and rigid items are transported, allowance is to be made for the reciprocal effects due to the relative rigidity/elasticity of the ship's hull and the cargo.

3.2.2 The local supporting or load-transmitting members under the deck are to be checked with regard to the stresses associated with the specified bearing points and mass distribution of the deck cargo and the assumed motions (accelerations) of the vessel. They are also to be checked for stability, e.g. with regard to local web failure or the tripping of beams. The permissible stresses and the execution of any reinforcements which may be necessary (supports, girders, slings etc.) are governed by Rules for Hull (Pt.1, Vol.II) Sec. 4.C.

3.2.3 The anchorage points and guides for the towing line are to be checked for conformity with the arrangement adopted for the particular towing operation. The general instructions contained in Rules for Hull (Pt.1, Vol.II) Sec. 18. F are applicable. The dimensional design and the verification of the stresses induced shall assume a force greater by 20 % than the breaking strength of the towline.

Wherever their use is unavoidable, deviation guides shall be designed to minimize friction and prevent any bending over edges. Towropes shall not be used at guide points (see 3 and 4.).

3.3 Devices for securing cargo

3.3.1 Supporting structures, blocks

1. Devices and appliances on deck used for load distribution, support and/or transporting parts of the cargo are to be dimensioned in accordance with the static and dynamic loads referred to in 3.2 and 3.4 or in respectively. Where such components are welded to the hull of the ship or pontoon, Rules for Hull (Pt.1, Vol.II) Sec. 4.C are to be applied.

2. With regard to their loading, continuous beams or rails permanently fastened to the deck of the vessel are to be regarded as part of the ship's hull (e.g. they are to be included when determining the longitudinal strength, see 3.2.1.

3. As far as possible, pillars, rails, dunnage blocks etc. are to be located over strength members in the ship's hull which are suitable for withstanding the bearing loads (see 3.2) and are to be adequately supported to resist the horizontal forces caused chiefly by inclinations of the ship and by the rolling and heaving motions of the towed vessel. Blocks (generally timber on steel) are to be secured to prevent horizontal displacement (slipping).

4. When determining the most unfavourable loading conditions, consideration shall in each case be given, to possible displacements and elastic deformation of parts of the cargo.

3.3.2 Lashing components

1. The components of lashings and restraining devices such as rods, ropes, straps etc. which are mainly subjected to tensile stresses are to be dimensioned in accordance with the static and dynamic loads determined in accordance with 4.3 or 4.2 Where there is danger of the deck becoming awash, the forces due to the wash of the sea and to buoyancy shall also be taken into account.

2. The materials used for lashing components must conform to Rules for Material (Pt.1, Vol.V) and must be covered at least by a Works Acceptance Test Certificate to DIN 10204. In cases where such action is justified, BKI reserves the right to demand Test Certificates to DIN 10204.

3. The use of chains as lashings is not recommended. Where ropes are used, deflections are to be avoided (danger of pinching and abrasion, see 3.2.3).

4. Special attention is to be paid to the design of the terminal fastenings. In cases where such action is justified, the strength and/or method of manufacture may have to be verified by testing.

5. Sub-section 3.2.2 and 3.3.1.3 apply in analogous manner to the fastening points on the deck, of the vessel. Welded eyes, lashing rings and the like are to be designed and fitted in accordance with Rules for Stowage and Lashing of Containers (Pt.4, Vol. I).

6. Sub-section 3.3.1.4 applies in analogous manner to lashing components. In general, attention shall also be paid to the elasticity of the lashing component. Itself and, where provided, to preloading (see 3.3.2.7). Unsymmetrical arrangements, should be avoided.

7. Where the calculated deformations and/ or movements occurring at the ends of lashing components (3.3.1.4/ 3.3.2.6) suggest the possible occurrence of comprehensive forces, elements such as rods or bars, which resist buckling, are to be used. Any slackening of lashing components designed only for tensile loads. Must be avoided. The preloading needed to achieve this must be applied in a controlled manner.

8. The permissible stresses/ loads acting in lashing components are shown in the following Table:

Table 3.1 Permissible stresses/ loads acting in lashing components

<table>
<tr><td rowspan="2">Nature of lashing component</td><td colspan="2">Method of calculating accelerations and restraining forces</td></tr>
<tr><td>Approximate in accordance with 4.3.4</td><td>Computerized calculation of dynamic behaviour in accordance with 4.2.</td></tr>
<tr><td rowspan="5">Steel components and their welds</td><td colspan="2">$\sigma_{perm} = \frac{1}{v.k}.R_{eh}$
(τ_{perm})</td></tr>
<tr><td>tension / compression / flexion : $v = 1,5$</td><td>1,35</td></tr>
<tr><td>shear : $v = 2,6$</td><td>2,30</td></tr>
<tr><td>equivalent stress : $v = 1,4$</td><td>1,25</td></tr>
<tr><td colspan="2">buckling : $P_{perm} = \frac{1}{v_B}.P_{kr}$</td></tr>
<tr><td>$V_B = 2,8$</td><td>2,50</td></tr>
</table>

Table 3.1. Permissible stresses/ loads acting in lashing components *(continued)*

	Method of calculating accelerations and restraining forces	
Wire ropes	$P_{perm} = \frac{1}{v}.P_{rupture}$	
	V = 2,7	2,40
R_{eh} = upper yield points as shown on Material Certificate k = $\frac{295}{R_{eh}+60}$ P_{kr} = critical buckling force		

3.3.3 Loads acting on parts of cargo

1. The cargo components fastened to the deck, both regarding the total structure and the local strength at the anchorage points of the restraining devices, must be adequately dimensioned to withstand the forces occurring during the voyage. It is generally for the manufacturer to prove the strength of the transported items of cargo in relation to the means used to secure them.

2. Sensitive and projecting portions of the cargo such as the jibs of cranes shall, wherever possible, be dismounted or lowered and secured separately.

3.4. Approximate calculation of loads acting on supports and lashing components

3.4.1. As an approximation, the following procedure can be used to calculate the forces acting on the supports and lashings of deck cargo. Other values or factors more suitable in special cases are to be agreed with BKI.

3.4.2. Forces acting athwart ships

The force acting athwart ships (parallel to the deck) is obtained by adding together the inertia forces of the cargo and the wind pressure (see Fig. 3.1) :

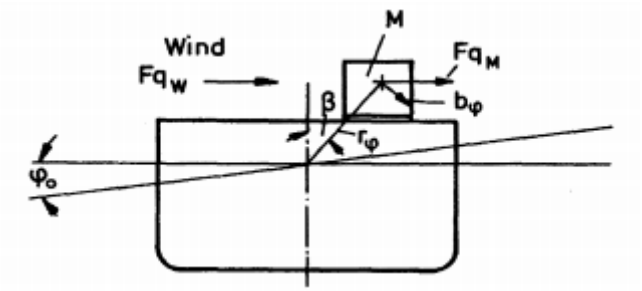

Fig. 3.1 Forces acting athwart ships

$F_q = F_{qm} + F_{qw}$ (plus the wash of the sea, where applicable, see 3.3.2.1)

The portion attributable to the cargo, acting at the centre of mass of cargo item M can be determined approximately by applying the expression :

$$F_{qm} = M.[k_\varphi.\, b_\varphi.\cos\beta + \sin\varphi_0(g + k_\omega.\, b_\omega.\sin\delta + k_z.\, b_z)]$$

where :

M = mass of cargo item concerned

β = see Fig. 3.1

δ = see Fig. 3.2

g = gravitational acceleration (9,81 m/s^2)

$$b_\varphi = r_\varphi . \frac{\varphi_0 \pi}{180} . \left[\frac{2\pi}{T_\varphi}\right]^2 \text{ (rolling acceleration)}$$

Where :

r_φ = distance of centre of mass of cargo item from point of rotation, assumed to be at waterline (m).

φ_0 = maximum amplitude of roll (angle in degrees)

T_φ = period of roll (s)

For φ_0 and T_φ the most unfavourable combination of values liable to occur during transport is to be taken. If no more accurate values available, φ_0 and T_φ can be approximately determined as follows :

$$T_\varphi = c . \frac{B}{\sqrt{M_B G}}$$

where :

B = breadth of the vessel (m).

$M_B G$ = metacentric height (m)

For given loading condition

Table 3.2. Loading condition

	φ_0	c
Ships	$35 - \frac{L}{13}$	0,8
Pontoons	15 ° or max. wave slope *)	1,1
L = length of vessel (m). *) The greater of the two values is to be used		

k_φ, k_ω, k_z ; as a rough approximation, the k factors take account of the phase position. Two conditions are considered, for which the following values of k may be assumed :

Table 3.3. Values of k

	k_φ	k_ω	k_z
Mainly rolling motion	1	0,6	0,8
Mainly pitching and heave motion	0,6	1	1

$b_\omega b_z$; pitching and heave acceleration (see 3.4.3 and 3.4.4)

Wind pressure, Fq_w : if no reliable information is available concerning the likely wind velocities, Fq_w shall be calculated on the assumption of a wind speed of 50 m/s.

3.4.3. Forces in the longitudinal direction

The force F_1 acting in the longitudinal (for-and-aft) direction of the vessel may also be important for the supports/ lashings of the cargo.

An approximate value F_1 is given by the expression :

$$F_1 = F_{1M} + F_{1W} = M\,[k_\psi \,.\, b_\psi \,.\, \cos\delta + \sin\psi_o\,(g + k_\varphi\, b_\varphi \sin\beta + k_z b_z)] + F_{1W}$$

(plus the wash of the sea, where applicable; the 2nd part in the square brackets can normally be disregarded).

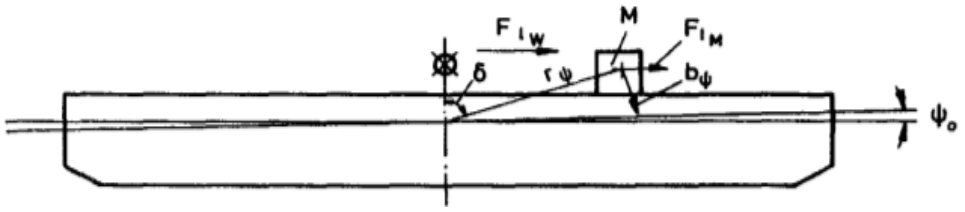

Fig. 3.2 Forces Longitudinal direction

$$b_\psi = r_\psi \,.\, \frac{\psi_o.\pi}{180} \,.\, \left(\frac{2\pi}{T_\psi}\right) \text{ (pitching acceleration)}$$

where :

ψo = maximum pitching angle [°]

T_ψ = pitching period [s] = $2\pi \,.\, \sqrt{\frac{\theta L}{D.M_L F}}$ (or applying a suitable approximation formula).

θL = mass moment of inertia (in relation to transverse axis) including hydrodynamic mass [kNms^2].

D = displacement [kN].

MLF = metacentric radius (lengthwise) [m].

(Pontoon: $D \,.\, M_L F = \gamma \,.\, I_L = \gamma \,.\, \frac{L^3\, B}{180}$)

For ψ_o and T_ψ the most unfavaourable combination of values liable to occur during transport is to be taken. If no more accurate values are available, it may be assumed for ψ_o that:

ψ_o = 5^0 or = maximum wave slope where relatively short vessels (pontoons) are towed in a Seaway with widely spaced crests. δ , r_ψ : see Fig. 3.2.

3.4.4. Forces perpendicular to the deck

Beside the weight of the cargo, consideration is also to be given to components of the pitching and heave motion of the vessel and to the tilting action of the transverse forces (Fq). The former can be summarized as follows (see Fig. 3.1-3.3):

$$F_{VM} = M\,[k_\varphi \,.\, b_\varphi \,.\, \sin\beta + \cos\varphi_o\,(g + k_\psi \,.\, b_\psi \,.\, \sin\delta + k_z \,.\, b_z)]$$

b_φ, b_ψ, k factors etc.: as defined in 3.4.2 and 3.4.3.

$$b_z = z_o \,.\, \left(\frac{2\pi}{T_z}\right)^2 \text{ (heave acceleration)}$$

where z_o = maximum assumed heave amplitude

Ships: $z_o = L/80$

Pontoons: $z_o = L/100$

L = length of vessel [m]

unless more accurate values of z_o, or values producing a greater acceleration, are available.

$$T_z \cong 2\pi \cdot \sqrt{\frac{2V}{A_{WL} \cdot g}} = 8{,}9 \cdot \sqrt{\frac{V}{A_{WL} \cdot g}}$$

V = displacement [m^3]

A_{WL} = waterline area [m^2]

The bearing forces A are to be determined for the two loading conditions “mainly rolling motion” and “mainly pitching and heave motion”.

In the transverse direction, for example, the following expression applies :

$$\Sigma A_q = Fv_M \cdot \frac{a_q}{e_q} + Fq_M \cdot \frac{h_M}{e_q} + Fq_W \cdot \frac{h_W}{e_q}$$ (See Fig. 3.3).

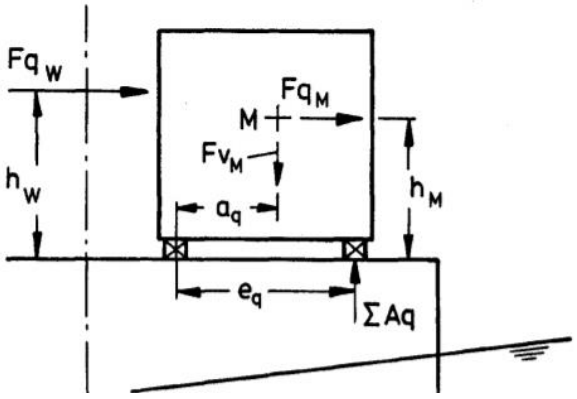

Fig. 3.3 Transverse Direction

The bearing forces generated by the forces in the longitudinal direction, A_L, are determined in similar manner. The most unfavourable bearing load in any given case is obtained by adding together the bearing forces derived from the transverse and longitudinal forces, Fq and Fl, plus Fv, relevant to the particular loading condition. Forces due to the wind and, where applicable, the wash of the sea are to be allowed for in one direction only.

(e.g.: Loading condition: “Mainly rolling motion”; cross wind; 4 bearing points assumed :

$$A_{max} = Fv_M \cdot \frac{a_q}{e_q} \cdot \frac{a_1}{e_1} + \frac{1}{2} Fq_M \cdot \frac{h_M}{e_q} + \frac{1}{2} Fq_W \cdot \frac{h_W}{e_q} + \frac{1}{2} Fl_M \cdot \frac{h_M}{e_1}$$

Fv_M, Fq_M, Fl_M, determined by applying k_φ = 1, k_ψ = 0,6 and k_z = 0,8).

Because of the measures which may be necessary to prevent lift-off, the lowest possible values, A_{min}, are also to be investigated.

E. Tug

1. Suitability for Tug

1.1. The criteria mentioned in para B.3 are to be applied.

1.2. The necessary towing force is determined in accordance with para D.2.2.

1.3. For assessing the suitability of a tug the bollard pull I is a basic, though not the sole, criterion.

For the determination of bollard pull, see 2.

1.4. All the prescribed certificates must be present and valid, e.g.:

- Certificate of Registry,
- Tonnage Certificate,
- Class Certificates (for hull and machinery),
- Load Line Certificate,
- Safety Construction Certificate,
- Safety Equipment Certificate,
- Safety Radiotelegraphy/ Radiotelephony Certificate,
- Additional national Certificates.

1.5. BKI reserves the right to call for the following documents:

- Stability information,
- General arrangement plan,
- Drawing of towing winches,
- Sketch showing arrangement of towing gear with detailed information.

2. Recommendation for the Performance of Bollard Pull Tests

1. To obtain comparable results when testing bollard pull, the details given in the "Protocol concerning the Determination of Bollard Pull" should be adhered to.

2. The measuring instrument must be calibrated and equipped to display and record the bollard pull. Wherever possible, it should also be capable of being coupled to record the engine output and speed. The calibration certificate is to be presented. If the measuring instrument is not equipped to record the bollard pull, the test is to be conducted by discretion of Surveyor.

3. The length of the towrope from hook or winch to the strong point shall be at least 100 m. During the test the towrope shall be as near horizontal as possible.

4. There shall be sufficient open water, at least one ship's length in extent, on each side of the vessel together with a depth of water equal to twice the draught of the tug, subject to a minimum of 10 m.

5. Wherever possible, the bollard pull test is to be conducted in calm air and slack water or at a low wind velocity (of $V_w \leq 5$ m/s) and a low current velocity (of $V_c \leq 0{,}5$ m/s).

6. In order to exclude dynamic effects, bollard pulls are to be recorded/read only when the tug is pulling dead ahead, i.e. without any sheering movements.

7. All auxiliary equipment such as pumps and generators which is driven by the main engine or the propeller shaft is to be operated during the test.

8. The bollard pull with the main engine running at its continuous power shall be maintained for at least 10 minutes.

9. The maximum bollard pull with the main engine running at an overload power of 10 % shall be maintained for at least one minute.

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