
**Ships and marine technology — Major
components of emergency towing
arrangements**

*Navires et technologie maritime — Principaux éléments des
dispositifs de remorquage d'urgence*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Ships and marine technology — Major components of emergency towing arrangements

1 Scope

This document specifies the technical requirements, test methods, inspection rules and markings for major components of emergency towing arrangements (ETA) provided for tankers, gas carriers (LPG, LNG, etc.) and chemical vessels no less than 20 000 deadweight tonnes (DWT).

It is only applicable to emergency towing arrangements as defined in 3.1.

NOTE For any other applications, such as for mooring at a single point mooring (SPM) facility, the appropriate standards need to be referred to.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3808, *Road vehicles — Unscreened high-voltage ignition cables — General specifications, test methods and requirements*

ISO 4306-1, *Cranes — Vocabulary — Part 1: General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4306-1, ISO 3808 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

emergency towing arrangement

ETA

system equipped on tankers, gas carriers and chemical vessels, used to tow the vessel in an emergency such as mechanical failure or lack of power

Note 1 to entry: The International Maritime Organization (IMO) requires that tankers, gas carriers and chemical vessels of not less than 20 000 DWT and constructed since Jan 1, 1996, be provided with emergency towing arrangements installed on both the bow and the stern.

3.2

safe working load

SWL

maximum permissible load determined after the equipment has been tested according to the relevant regulations

3.3 ultimate strength

certified minimum breaking load of a wire rope, chafing chain, shackle, etc.

Note 1 to entry: In the case of equipment such as chain stoppers, fairleads, etc., it can be defined as the load that will cause a general failure of the structure or its attachment to the deck.

3.4 classification society

institution that establishes and maintains technical standards for the construction and operation of ships and offshore facilities

4 Technical requirements

4.1 Major components of ETA

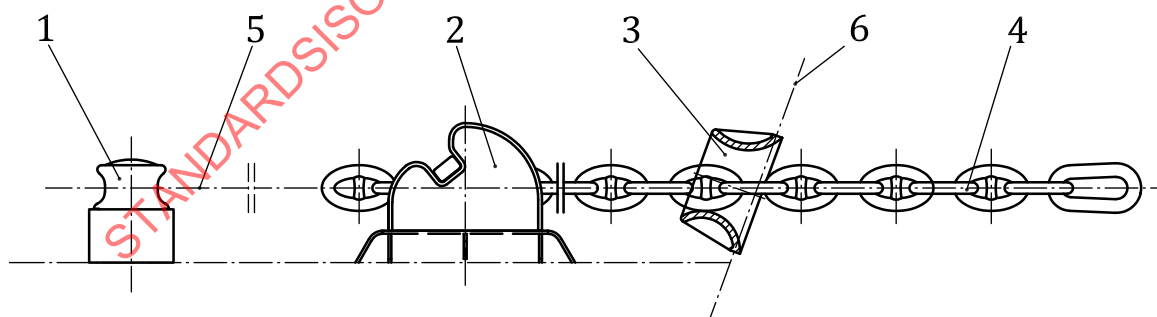
The major components of ETA are listed in [Table 1](#) with their installation requirements.

Table 1 — ETA major components and installation requirements

Component	Bow ETA (not preconfigured)	Stern ETA (preconfigured)	Strength requirements (see 4.3.1)
Pick-up gear	Optional	Required	—
Towing rope	Optional	Required	Required
Chafing chain	Required	Determined according to the design	Required
Fairlead	Required	Required	Required
Strong point	Required	Required	Required
Pedestal rollers	Required	Determined according to the design	—

4.2 Design arrangement of ETA

4.2.1 A typical arrangement of bow ETA is shown in [Figure 1](#).



Key

- | | | |
|--------------------|-----------------|---------------------------|
| 1 pedestal rollers | 3 fairlead | 5 centreline of the chain |
| 2 chain stopper | 4 chafing chain | 6 bulwark |

NOTE The centreline of the chain is parallel to the deck.

Figure 1 — Typical arrangement of bow ETA

4.2.2 A typical arrangement of stern ETA is shown in Figure 2.

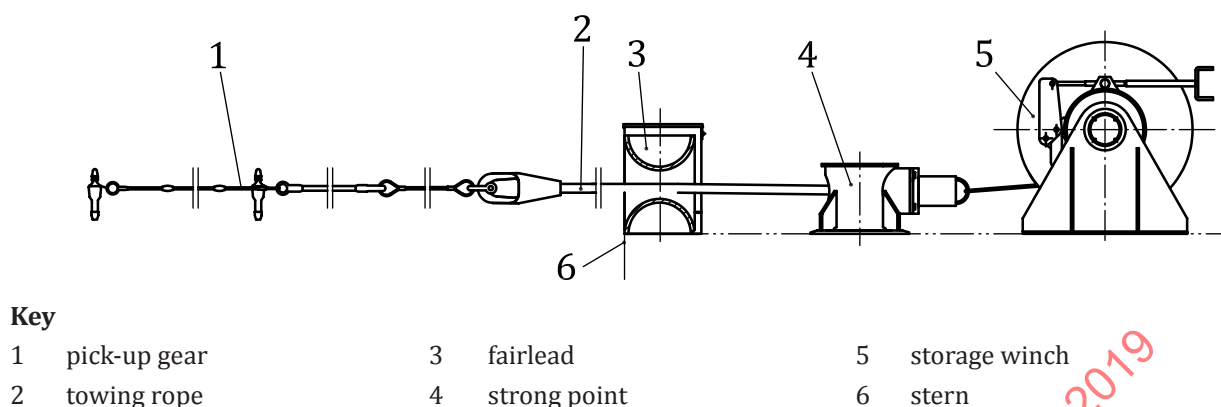


Figure 2 — Typical arrangement of stern ETA

4.3 Design and manufacturing requirements for major components

4.3.1 Minimum strength requirement for ETA components

The minimum strength requirement for ETA components under stress during the towing operation is given in Table 2.

Table 2 — Minimum strength requirement

Ship size	Working strength	Ultimate strength
	kN	kN
20 000 tonnes ≤ DWT < 50 000 tonnes	1 000	2 000
50 000 tonnes ≤ DWT	2 000	4 000

The strength should be sufficient for all relevant angles of the towline, i.e. up to 90° from the ship's centreline to the port and starboard and 30° vertical downwards.

4.3.2 Strength requirement for other parts

Other parts shall have sufficient strength to withstand the load to which they may be subjected in towing operations.

4.3.3 Bow ETA

4.3.3.1 Fairlead

- The fairlead shall be of a closed type, with the opening dimensions of at least 600 mm in width and 450 mm in height.
- The fairlead should be capable of supporting the stress at the angles described in 4.3.1.
- See Annex A for the general configuration of a bow fairlead.
- Materials shall be weldable cast steel, e.g. 200-400 W in accordance with ISO 14737.
- The fairlead shall be free from defects that affect its intended use, such as cracks, sand holes and pores.
- The SWL of the installed fairlead shall be marked at a conspicuous location on the fairlead.

4.3.3.2 Chafing chain

- a) The chafing chain shall be of a welded stud type and made of materials of Grade III or better chain steel. (See [Annex B](#) for the typical chemical composition and mechanical properties of steel bars for a ship anchor chain). The minimum diameters of chafing chains are given in [Table 3](#).

Table 3 — Minimum diameters of chafing chains

SWL kN	Minimum diameter ϕ of chafing chains mm
1 000	52
2 000	76

- b) The length of chafing chain shall not be less than 8 m and the length outboard of the fairlead shall be at least 3 m.
- c) One end of the chafing chain shall be connected to the chain stopper, and the other end shall be fitted with a standard pear-shaped studless link of a size suitable for the attachment to a standard bow shackle.
- d) See [Annex C](#) for the general configuration of a chafing chain.
- e) The manufacturing quality shall meet the relevant technical standards, e.g. ISO 1704.

4.3.3.3 Chain stopper

- a) Based upon the defined SWL, the specification of minimum chain stoppers is given in [Table 4](#).

Table 4 — Specification of minimum chain stoppers

SWL kN	Specification of minimum chain stoppers
1 000	Chafing chain diameter 52 mm
2 000	Chafing chain diameter 76 mm

- b) See [Annex D](#) for the general configuration of a chain stopper.
- c) In the closed position, the chain stopper design shall be such that it prevents chafing chains from being thrown-out due to their sudden release.
- d) Materials may be weldable cast steel, forged steel or rolled steel that conforms to the manufacturer's standards. The weldments must conform to the requirements of qualified welding procedures (WPS), etc.
- e) The chain stopper product shall be free from defects that affect its intended use, such as cracks, sand holes and pores.
- f) If the chain stopper is welded to its foundation, the weld strength shall be capable to resist design loads of at least 1,3× specified ultimate strength of the chain stopper or the weakest component of the emergency towing arrangement if that be lower.
- g) If the chain stopper is bolted to its foundation, effective thrust blocks shall be provided to reduce the shear.
- h) The chain stopper's SWL shall be marked at a conspicuous location on the chain stopper.
- i) When the ship is provided with a chain stopper for a single point mooring arrangement (SPM), that chain stopper may also be used for the ETA.

- j) In lieu of a conventional chain stopper, a Smit-Type bracket together with an appropriate arrangement is considered acceptable.

4.3.3.4 Pedestal roller

- a) The minimum roller diameter specification for pedestal rollers is given in [Table 5](#).

Table 5 — Specification of pedestal rollers

Applicable tanker DWT	Minimum roller diameter, ϕ
	mm
$20\,000 \leq \text{DWT} < 50\,000$ tonnes	300
$50\,000 \text{ tonnes} \leq \text{DWT}$	350

- b) Materials may be weldable cast steel, forged steel or rolled steel that conforms to the manufacturer's standards. The weldments must conform to the requirements of WPS, etc.

4.3.4 Stern ETA

4.3.4.1 Pick-up gear

The general configuration of a pick-up gear is given in [Figure 3](#).

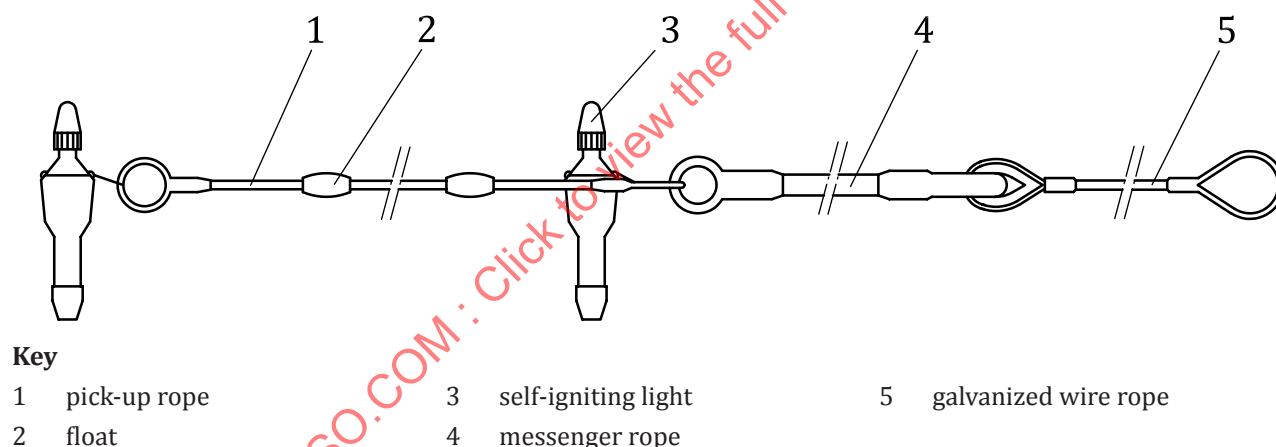


Figure 3 — Pick-up gear

4.3.4.2 Towing rope

- a) The length shall be at least twice the ship's freeboard when in its lightest ballasted condition, plus 50 m.
- b) The towing rope shall be provided with a rigid eye ring suitable for the connection to a standard shackle. The rigid eye ring shall not be attached by a manual tuck. A poured socket or other types of mechanical attachment shall be used.
- c) See [Annex E](#) for the general configuration of a towing rope.
- d) The towing rope and pick-up gear may be connected by a shackle or studless chain.

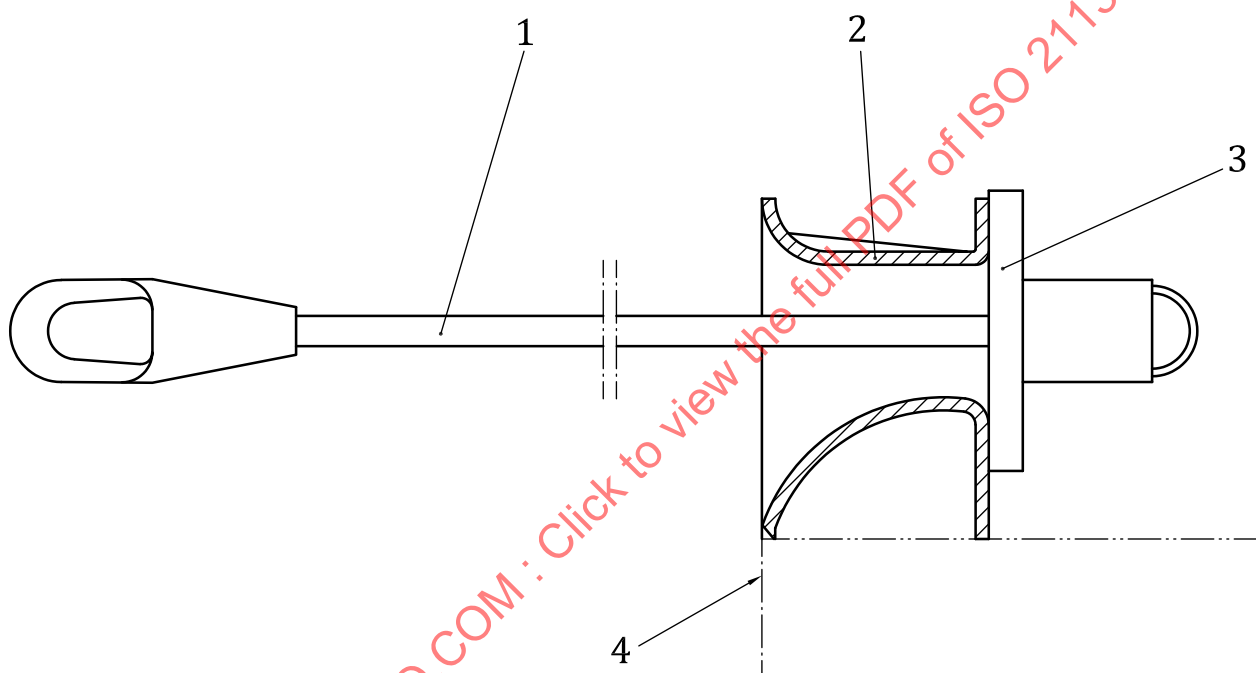
4.3.4.3 Fairlead

- a) The fairlead shall be of a closed type, with an opening large enough to allow the passage of the towing rope.

- b) The fairlead should be capable of supporting the stress at the angles described in 4.3.1.
- c) The ratio of the curvature of the fairlead surface in contact to the towing rope diameter under stress during towing operations shall be not less than 7:1.
- d) Materials shall be weldable cast steel, e.g. 200-400 W in accordance with ISO 14737.
- e) The product shall be free from defects that affect its intended use, such as cracks, sand holes and pores.
- f) The SWL shall be marked at a conspicuous location on the fairlead.

4.3.4.4 Strong point

- a) The strong point may be integrated into a design of the fairlead, the general configuration of a strong point is given in Annex F and its working state is given in Figure 4.



Key

- | | |
|-------------------------|----------------|
| 1 towing rope | 3 stopper ring |
| 2 fairlead/strong point | 4 stern |

Figure 4 — Working state of a fairlead/strong point

- b) The strong point shall have the equivalent strength as that of the device, such as brake, bracket, etc.
- c) If the material is weldable cast steel, e.g. 200-400 W in accordance with ISO 14737, the product shall be free from defects that affect its intended use, such as cracks, sand holes and pores.
- d) If the material is rolled steel, the welds shall be smooth and flat, and shall be free from defects, such as cracks, pores, undercut and lack of fusion/penetration. The weldments must conform to the requirements of WPS, etc.
- e) The SWL shall be marked at a conspicuous location on the strong point.

4.3.4.5 Storage container of the pick-up gear

- a) The design shall be such that the pick-up gear can be easily cast into the sea.

- b) Materials shall be ordinary rolled steel, stainless steel or other materials (such as glass reinforced plastic) that conform to the manufacturer's standards.
- c) If the storage container is provided with the hinges, their material shall be suitable for the exposed marine environment or stainless steel.

4.3.4.6 Storage winch

- a) The storage winch shall be used for the storage of the towing rope.
- b) The winch design shall be such that it can control the release speed of the towing rope.
- c) Materials shall be ordinary rolled steel or other materials that conform to the manufacturer's standards.
- d) The welds shall be smooth and flat, and shall be free from defects, such as cracks, pores, undercut and lack of fusion/penetration.

5 Test method

5.1 Bow ETA

5.1.1 Prototype strength test for the bow ETA

- a) Magnetic particle inspection shall be carried out on the fairlead, chain stopper and chafing chain prior to the test so as to ensure they are free from defects.
- b) Using the SWL requirements of [4.2.1](#) and [4.3.1](#), the fairlead, chain stopper and chafing chain shall be tensioned to twice the SWL.
- c) Tension force shall be gradually applied to the components and the maximum tension held for 1 min.
- d) After the test, the prototype shall be examined for any failures, including unacceptable deformations.
- e) The prototype of an ETA arrangement that was strength-tested shall not be installed on board.

5.1.2 Fairlead

- a) A physical and chemical inspection shall be carried out for the material test rods, and the inspection results shall conform to the corresponding material standards.
- b) A magnetic particle inspection shall be carried out during the manufacturing process but after surface polishing; the product shall be free from defects that affect its intended use, such as cracks, sand holes and pores.

5.1.3 Chain stopper

- a) If the material is cast steel, a physical and chemical inspection shall be carried out for the material test rods, and the inspection results shall conform to the corresponding material standards.
- b) A magnetic particle inspection shall be carried out after surface polishing; the product shall be free from defects that affect its use, such as cracks, sand holes and pores.
- c) For components made of forgings, a physical and chemical inspection shall be carried out for the material test rods, and the inspection results shall conform to the corresponding material standards. An ultrasonic detection shall be made according to Grade II forging requirements, and the component shall be free from cracks, folding or other defects that affect its use.

- d) The welds on the weldments shall be smooth and flat. An ultrasonic detection shall be made for main welds, which shall be free from defects that affect their use, such as cracks, pores, lack of fusion and weld flashes.
- e) Using a balance weight of 25 kg mass, verify that the operating force of the chain stopper is not more than 245 N, according to the lever balance calculations.

5.1.4 Chafing chain

The chafing chain shall be manufactured according to standard manufacturing criteria such that a certificate of quality can be awarded by the relevant classification society.

5.1.5 Pedestal roller

- a) Verify that the pedestal roller is suitably free to move and functions satisfactorily.
- b) Any exposed welds shall be smooth and flat, and shall be free from defects that affect the use, such as cracks, pores, lack of fusion and weld flashes.

5.2 Stern ETA

5.2.1 Strength test for the stern ETA

- a) Magnetic particle inspection shall be carried out on the fairlead/strong point and both sides of the ring eyes prior to the test so as to ensure they are free from defects.
- b) Using the SWL requirements of [4.2.2](#) and [4.3.1](#), the fairlead/strong point and towing rope shall be tensioned to twice the SWL.
- c) Tension force shall be gradually applied to the components and the maximum tension held for 1 min.
- d) After the test, the prototype shall be examined for any failures, including unacceptable deformations.
- e) The prototype of an ETA arrangement that was strength-tested shall not be installed on board.

5.2.2 Fairlead

- a) A physical and chemical inspection shall be carried out for the material test rods, and the inspection results shall conform to the corresponding material standards.
- b) A magnetic particle inspection shall be carried out during the manufacturing process but after surface polishing, and the product shall be free from defects that affect its intended use, such as cracks, sand holes and pores.

5.2.3 Towing rope

- a) The rope shall be manufactured by a professional manufacturer, and the certificate of the product quality shall be awarded by the relevant classification society. The pouring technology shall be exactly followed in the connection of the socket fixed by zinc covering and the wire rope, and the certificate shall be provided. If mechanical bonding is used, the relevant certificate shall be also provided.
- b) Non-destructive evaluation shall be made on its rigid eye ring (such as the socket).

5.2.4 Stopper ring

A physical and chemical inspection shall be carried out for the material test rods, and the inspection results shall conform to the corresponding material standards. An ultrasonic detection shall be made; the product shall be free from cracks, folding or other defects that affect its use.

5.2.5 Strong point

- a) If the material is cast steel, a physical and chemical inspection shall be carried out for the material test rods, and the inspection results shall conform to the corresponding material standards.
- b) A magnetic particle inspection shall be carried out after surface polishing, and the product shall be free from defects that affect its use, such as cracks, sand holes and pores.
- c) The exposed welds on the weldments shall be smooth and flat. An ultrasonic detection shall be made for main welds, which shall be free from defects that affect the use, such as cracks, sand holes, pores and weld flashes.

5.2.6 Storage container for the pick-up gear

- a) If the product is made of welded steel plate, the welds shall be smooth and flat, and shall be free from defects that affect the use, such as cracks, pores, undercut and lack of fusion/penetration.
- b) If the material is glass reinforced plastic, the surface shall be smooth and flat, and shall be of an uniform colour.

5.2.7 Storage winch

- a) Verify that all components operate reliably, e.g. the hand brake and storage drum can work smoothly to appropriately move the towing rope.
- b) Exposed welds shall be smooth and flat, and shall be free from defects that affect the use, such as cracks, pores, undercut and lack of fusion/penetration.

5.3 Function test

- a) The bow ETA design shall be suitable to be arranged within 1 h, when in harbour conditions.
- b) The stern ETA, when pre-configured, shall be suitable to be arranged within 15 min, when in harbour conditions.

Annex A (informative)

Type and dimensions of a fairlead

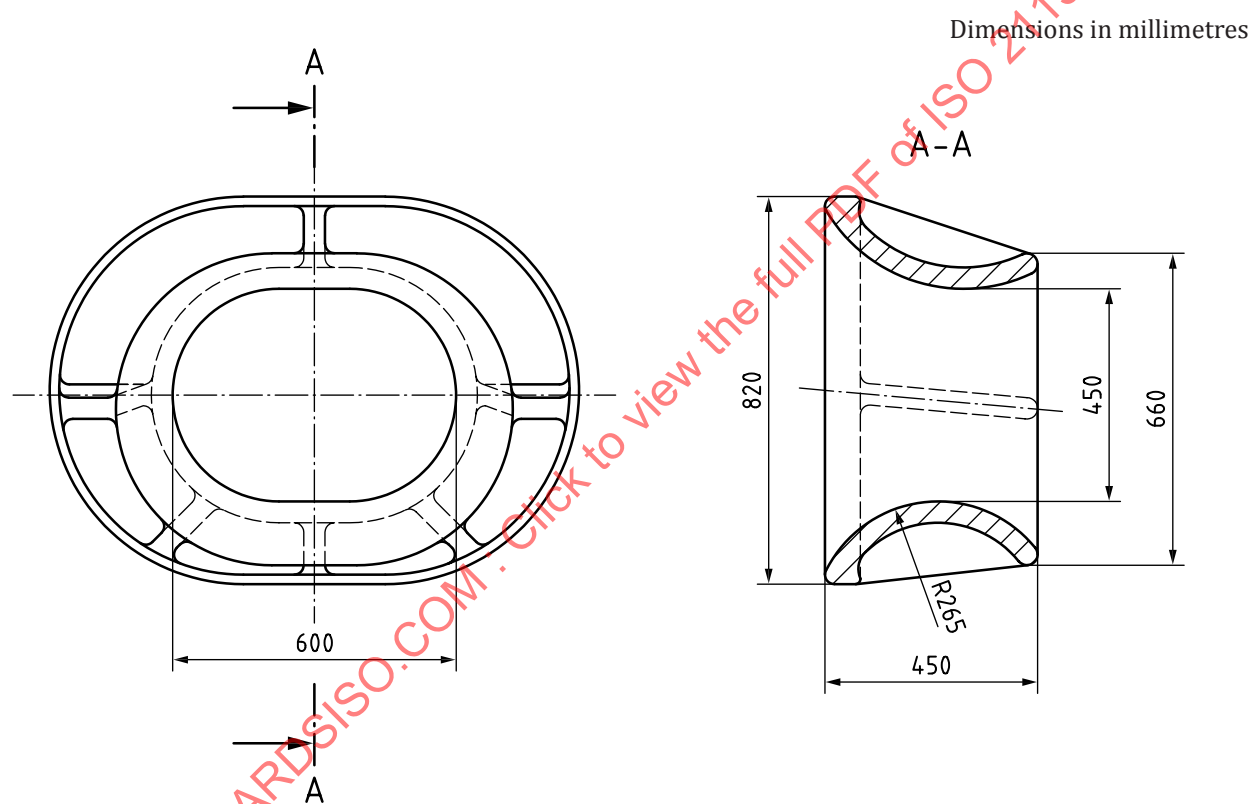


Figure A.1 — An SWL 2 000 kN fairlead

Annex B

(informative)

Chemical composition and mechanical properties of steel bars for ship anchor chains

Table B.1 — Chemical composition

Mass ratio %								
C	Si	Mn	P	S	Al	V	Nb	Ti
0,27~0,33	0,15~0,55	1,30~1,90	≤0,035	≤0,030	≥0,015	≤0,010	≤0,05	≤0,02

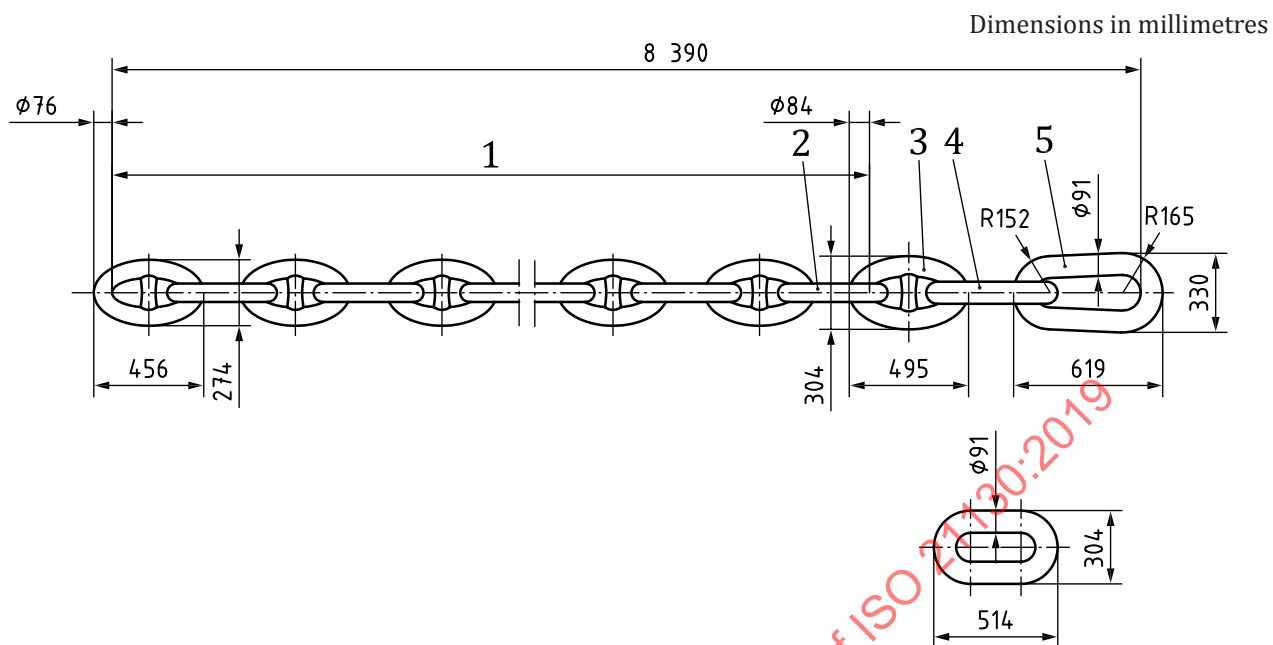
Table B.2 — Mechanical properties

Tensile test				Impact test		Test condition
Yield strength	Tensile strength	Percentage elongation after fracture	Reduction of area	Temperature	Impact absorbed energy	
σ_s N/mm ²	σ_b N/mm ²	δ %	ψ %	°C	J	
≥410	≥690	≥17	≥40	0	≥60	heat treated

Types and dimensions of chafing chains



- Figure C.1 — A ϕ 52 mm chafing chain**

**Key**

- 1 24 normal link chains
- 2 normal link chain
- 3 enlarged link chain
- 4 end link chain
- 5 pear-shaped link chain

Figure C.2 — A ϕ 76 mm chafing chain

Annex D (informative)

Types and dimensions of chain stoppers

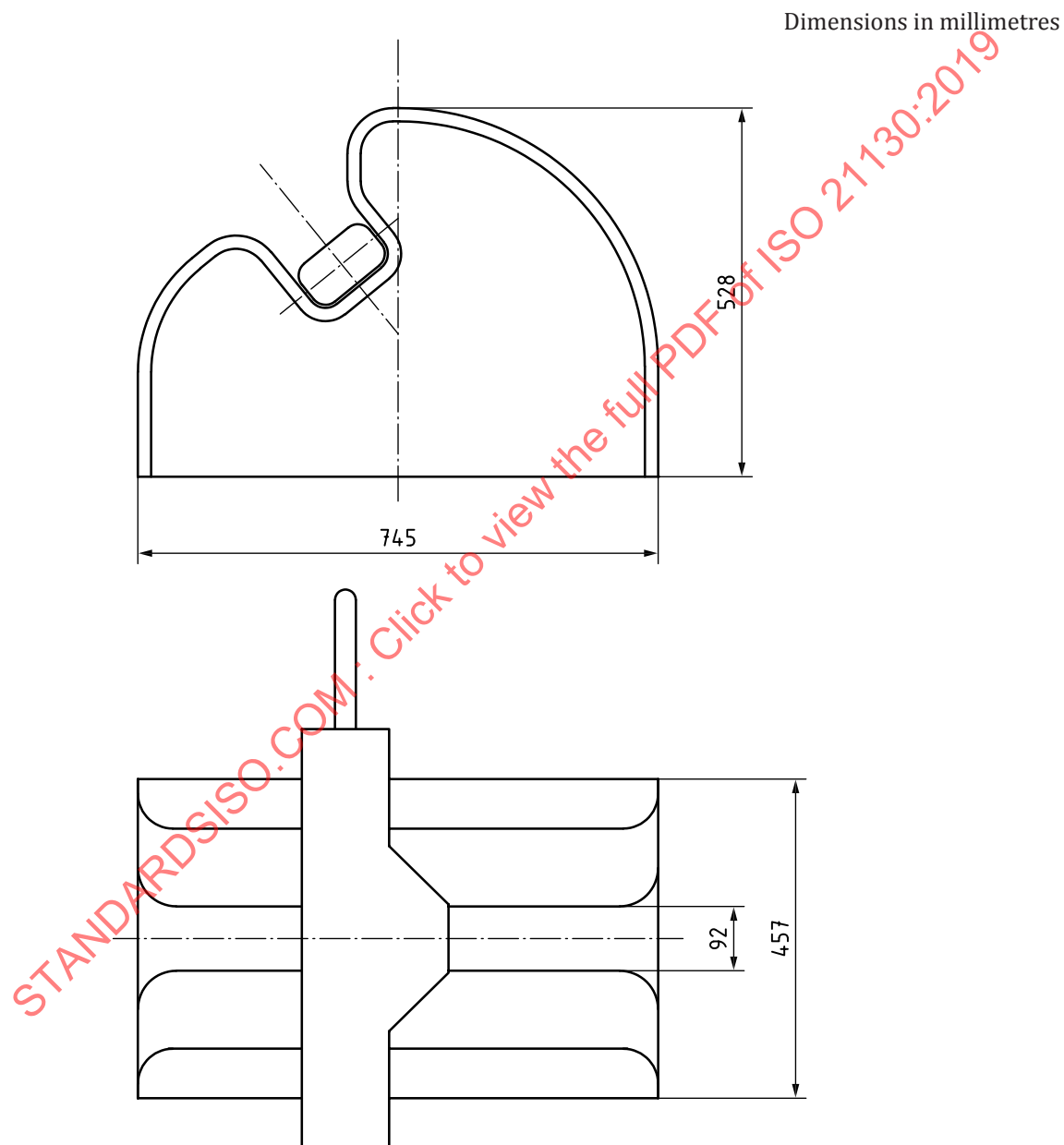


Figure D.1 — An SWL 1 000 kN bar-type chain stopper

Dimensions in millimetres

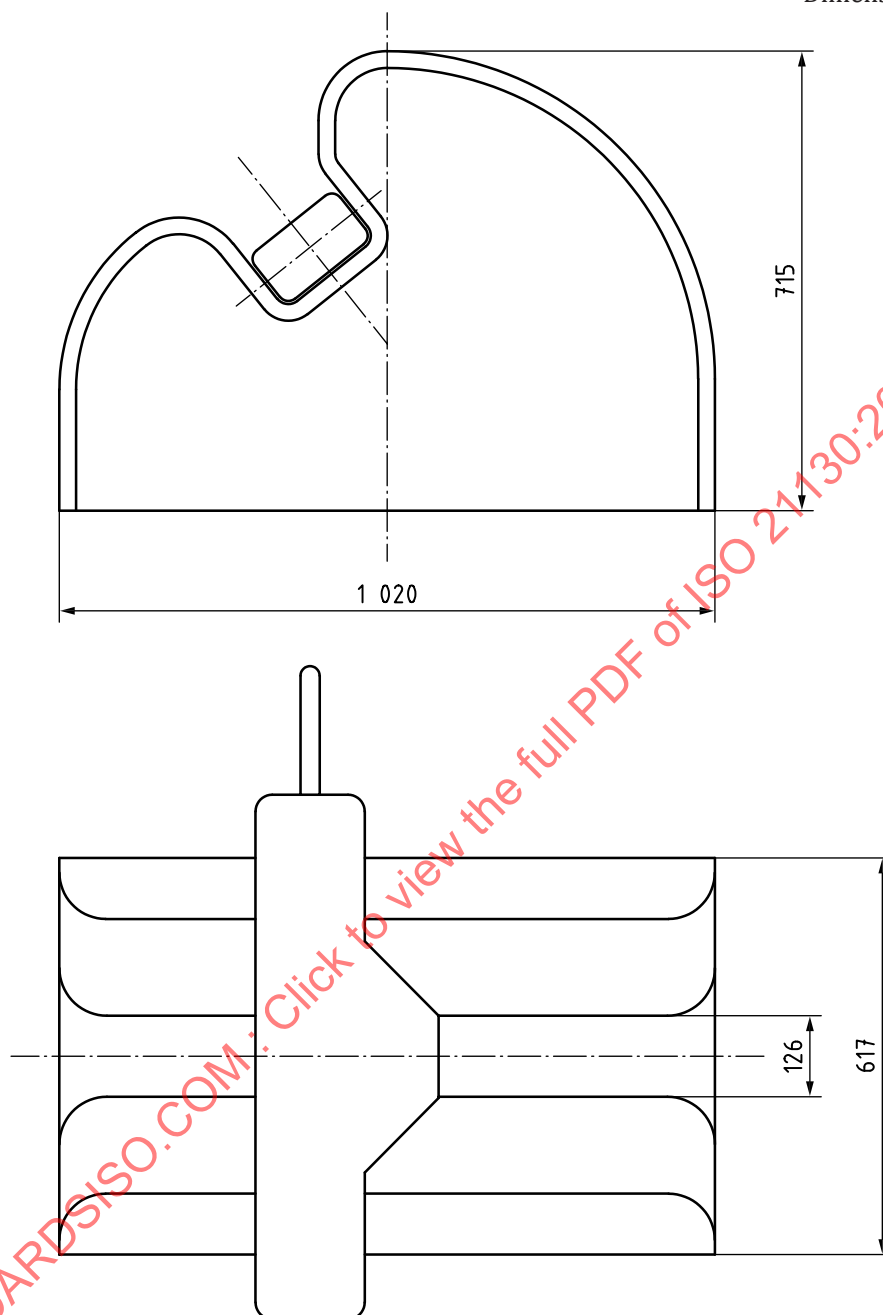


Figure D.2 — An SWL 2 000 kN bar-type chain stopper