
**Ships and marine technology —
Offshore mooring chains**

Navires et technologie maritime — Chaînes d'amarrage en haute mer

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

Ships and marine technology — Offshore mooring chains

1 Scope

This document specifies the requirements for grades, materials, shapes, proportions, dimensions and tolerances of offshore mooring chains.

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 4967, *Steel — Determination of content of non-metallic inclusions — Micrographic method using standard diagrams*

ASTM A255, *Standard test methods for determining hardenability of steel*

ASTM E112, *Standard test methods for determining average grain size*

ASTM E381, *Standard method of macroetch testing steel bars, billets, blooms, and forgings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19901-7:2013 and the following apply.

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

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

3.1

mooring chain

component used for positioning and mooring of offshore structures composed of *chain links* (3.2) and *accessories* (3.3)

3.2

chain link

closed, link shaped components of *mooring chain* (3.1), including common stud link, common studless link, enlarged link and end link

3.3

accessory

detachable connectors used for joining different chain components, including *joining shackle* (3.8) and *end shackle* (3.9)

3.4

common stud link

common mooring *chain link* (3.2) with stud

3.5

common studless link

common mooring *chain link* (3.2) without stud

3.6

enlarged link

strengthened link that connects a common link and the *end link* (3.7)

3.7

end link

link that joins *mooring chains* (3.1) and shackles

3.8

joining shackle

accessories used for joining *chain links* (3.2) or other accessories, including “D” type LTM joining shackle, “D” type LTM end joining shackle, Kenter type joining shackle and “H” type LTM joining shackle

3.9

end shackle

accessories used for attaching the *mooring chain* (3.1) to mooring equipment

Note 1 to entry: It usually refers to LTM end shackle.

3.10

LTM shackle

long term moored “D” type joining shackle, “D” type end joining shackle and end shackle with the bolt fastened by nut

3.11

nominal diameter

diameter of the common link

4 Grade

4.1 The mooring chain is classified by tensile strength into five grades: R3, R3S, R4, R4S and R5.

4.2 The mechanical properties of mooring chain for each grade are given in [Table 1](#).

4.3 The proof load and breaking load of mooring chains for each grade are given in [Table 2](#).

5 Materials

5.1 The steel used for manufacturing of mooring chains is classified into five grades: R3, R3S, R4, R4S and R5.

5.2 Mechanical properties for materials of each grade shall meet the requirements of base materials specified in [Table 1](#).

5.3 The steel shall be manufactured by an electric progress or one of the basic oxygen processes or any other process involving secondary refining. The austenite grain size shall be 6 or finer in accordance with ASTM E112.

5.4 Steel grades R4S and R5 shall be vacuum degassed.

5.5 For steel grades R4S and R5, the following test results shall be supplied by steel mills to the mooring chain or accessory manufacturer:

- a) Each heat shall be examined for non-metallic inclusions according to ISO 4967 or equivalent standards.

- b) A sample from each heat shall be macro etched according to ASTM E381 or equivalent standards to ensure there is no injurious segregation or porosity.
- c) Jominy hardenability data according to ASTM A255 or equivalent standards shall be supplied with each heat.

5.6 Steel grades R4, R4S and R5 shall contain a minimum of 0,20 % molybdenum.

6 Shape, dimensions and tolerances

6.1 The shapes of common studless link, common stud link, enlarged studless link, enlarged stud link and end link are indicated in [Figures 1 to 5](#) and their dimensions are specified in [Tables 3 to 7](#).

6.2 The shapes of kenter shackle, “H” type LTM joining shackle (sample), “D” type LTM end joining shackle (sample), “D” type LTM joining shackle, LTM end shackle are indicated in [Figures 6 to 10](#) and their dimensions are specified in [Tables 8 to 12](#).

6.3 Tolerances of common links, enlarged links and end links

The diameter shall be measured at crown, and the average value based on two perpendicular measurements must have no negative tolerance and the plus tolerance shall not exceed 5 % of nominal diameter. The minus tolerance for the diameter measured at crown shall meet the following requirements:

- for nominal diameter from 50 mm to 84 mm: -2 mm;
- for nominal diameter from 85 mm to 122 mm: -3 mm;
- for nominal diameter from 123 mm to 152 mm: -4 mm;
- for nominal diameter from 153 mm to 184 mm: -6 mm;
- for nominal diameter from 185 mm to 210 mm: -7,5 mm;
- for nominal diameter over 210 mm: -8,5 mm.

The cross sectional area of the crown shall not be less than the theoretical cross section of the nominal diameter.

The plus tolerance at weld shall not exceed 15 % of nominal chain diameter.

6.4 Length of five links

The five-link length of links shall be $5 \times p + 2 d = 22 d$ measured from outside. The allowable manufacturing tolerance on a length of five links is $^{+2,5}_{0} \%$.

6.5 All other dimensions

The tolerances of the diameter: $^{+5}_{0} \%$.

The tolerances other than diameter: $\pm 2,5 \%$.