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Round steel short link chains for lifting purposes — Medium tolerance sling chains — Grade 4, stainless steel

Chaînes de levage en acier de section ronde à maillons courts — Chaînes de élingue de tolérance moyenne — Classe de qualité 4, acier inoxydable

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 111, *Round steel link chains, chain slings, components and accessories,* Subcommittee SC 1, *Chains and chain slings*.

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.

This second edition cancels and replaces the first edition (ISO 1835:1980), which has been technically revised. The main changes compared to the previous edition are as follows:

— change of material requirements towards stainless steel;

— modernization of the document structure and layout, following the structure already implemented in the latest publications of ISO/TC 111/SC 1;

— consideration of current nominal diameters of chain and requirements;

— environmental aspects have been considered.

Round steel short link chains for lifting purposes — Medium tolerance sling chains — Grade 4, stainless steel

1 Scope

This document specifies the requirements for medium tolerance sling chains of grade 4 from stainless steel for use preferably in chain slings of grade 4 from stainless steel or for other lifting purposes.

The range of nominal diameter, d_n, covered by this document is from 4 mm to 22 mm.

These sling chains are round steel short link chains with a nominal pitch, $p_n = 3 \times d_n$, electrically welded, solution-annealed and tested. They are for use in the temperature range –100 °C to +400 °C. They comply with the general conditions of acceptance of ISO 1834.

NOTE 1 Because sling chains are solution-annealed in the finished condition, they can be used without restrictions with regard to the corrosion resistance of the steels according to 5.2. Higher grades of stainless steel chains are achieved by cold drawing of the wire prior to the chain manufacturing. Therefore, solution annealing is not possible without reduction of strength. The weld seam, in particular, represents a critical area with regard to the corrosion resistance.

NOTE 2 Resistance butt welding and flash welding are listed in ISO 4063.

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 1834, *Short link chain for lifting purposes — General conditions of acceptance*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO 13385-1, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1: Callipers; Design and metrological characteristics*

ISO 16143-2, *Stainless steels for general purposes — Part 2: Corrosion-resistant semi-finished products, bars, rods and sections*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1834 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/

4 Dimensions, masses and designation

4.1 Dimensions and masses

The bases for calculation of the values for the dimensions listed in Table 1 are given in Annex A.

The bases for calculation of the values for the mass per metre listed in Table B.1 are given in Annex B.

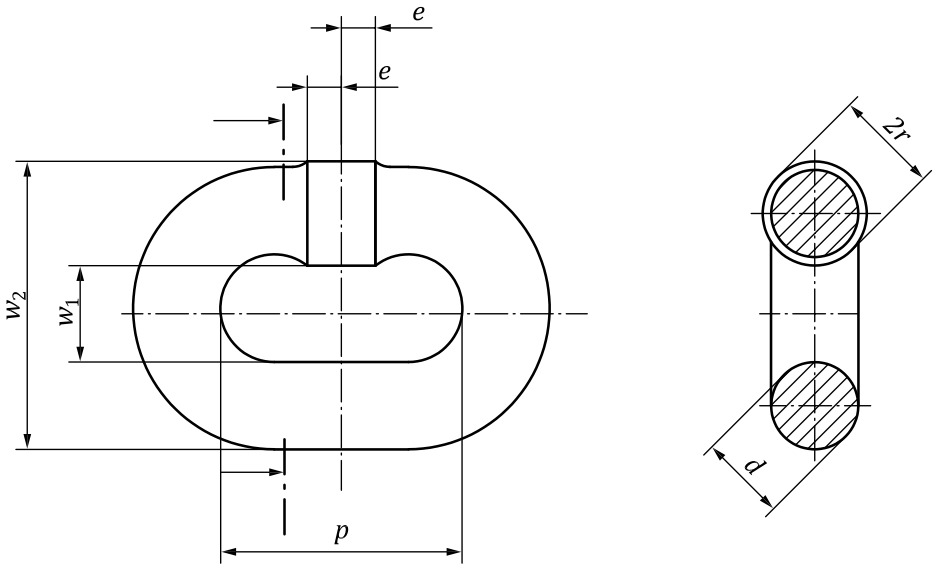
The nominal diameter, d_n, of the sling chain corresponds to the nominal diameter of the steel wire as presented in ISO 16124, or bar as presented in ISO 1035-1, from which the sling chain is made.

Preferred nominal diameters are given in Table 1, column 1. Other nominal diameters may be used, provided the corresponding dimensions and tolerances are calculated in accordance with Annex A.

Table 1 — Dimensions

Dimensions in millimetres

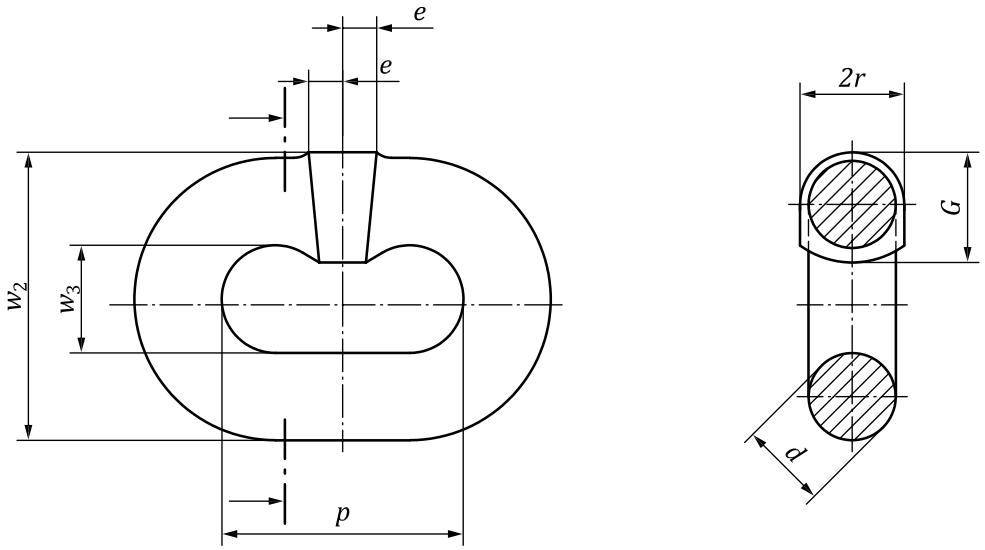
1	2	3	4	5	6	7	8	9
Diameter d		**Pitch** p		**Width**			**Weld dimension**	
				Internal	**External**	**Internal**		
Nominal d_n	**Tolerance**	**Nominal** p_n	**Tolerance**	**Type 1** w_1 **min.**	**Types 1 and 2** w_2 **max.**	**Type 2** w_3 **min.**	**Types 1 and 2** $2r$ **max.**	**Type 2** G **max.**
4	±0,2	12	±0,4	5,2	14,8	5,0	4,4	5,0
6	±0,2	18	±0,5	7,8	22,2	7,5	6,6	7,5
8	±0,3	24	±0,7	10,4	29,6	10,0	8,8	10,0
10	±0,4	30	±0,9	13,0	37,0	12,5	11,0	12,5
13	±0,5	39	±1,2	16,9	48,1	16,3	14,3	16,3
16	±0,6	48	±1,4	20,8	59,2	20,0	17,6	20,0
18	±0,7	54	±1,6	23,4	66,6	22,5	19,8	22,5
20	±0,8	60	±1,8	26,0	74,0	25,0	22,0	25,0
22	±0,9	66	±2,0	28,6	81,4	27,5	24,2	27,5



Key

p	pitch
d	diameter (measured opposite to the weld)
r	radius at the weld
e	length affected by welding
w_1	internal width at the weld
w_2	external width over the weld

Figure 1 — Chain link — Type 1



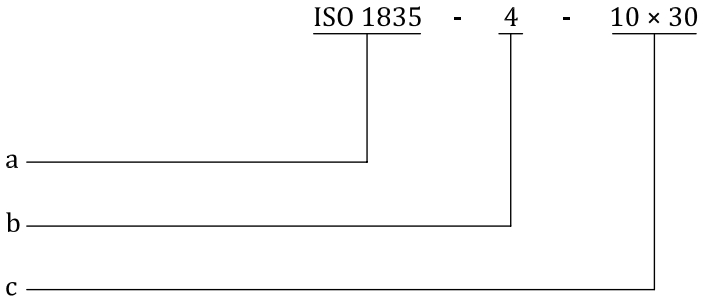
Key

p pitch
d diameter (measured opposite to the weld)
r radius at the weld
G dimension at the weld
e length affected by welding
w_2 external width over the weld
w_3 internal width away from the weld

Figure 2 — Chain link — Type 2

4.2 Designation

Figure 3 shows the general format for a designation to be used.



Key

a ISO number block.
b Grade of sling chain.
c Size of sling chain.

Figure 3 — Designation

5 Requirements

5.1 General

The sling chain shall comply with the requirements of ISO 1834 as well as those of this document.

5.2 Material

The steel used shall be austenitic stainless steels with molybdenum and shall be resistant against intergranular corrosion, for example the steel with the ISO name X6CrNiMoTi17-12-2 and the ISO number 4571-316-35-I according to ISO 15510.

After solution annealing intergranular corrosion is unlikely at a service temperature of +400 °C and with an extra low carbon content of the steel. To avoid this corrosive attack under severe service conditions and with higher carbon contents of the steel, a stabilization with titanium is recommended.

NOTE 1 The resistance against pitting corrosion can be increased by alloying with molybdenum.

NOTE 2 According to ISO 15510 (see Table A.1), the above-mentioned stainless steel is also well known under the number S31635, where 35 means titanium added. Internationally equivalent numbers of the steel are X6CrNiMoTi17-12-2; 1.4571; AISI/SAE 316Ti and UNS S31635.

5.3 Heat treatment

All sling chains shall be solution annealed within a temperature range of 1 020 °C to 1 120 °C according to ISO 16143-2 and cooled rapidly by water before being subjected to the manufacturing proof force (MPF).

5.4 Surface condition

For an enhanced corrosion resistance, the sling chains shall be pickled after heat treatment to get a constant smooth surface.

NOTE An improved corrosion resistance and smooth surface condition require the passivation of the surface by pickling after heat treating.

5.5 Dimensions

5.5.1 Diameter

The dimensions and tolerances for the diameter, *d*, shall be as given in Table 1, columns 1 and 2 calculated in accordance with Annex A.

5.5.2 Pitch

The dimensions and tolerances for the pitch, *p*, shall be as given in Table 1, columns 3 and 4 calculated in accordance with Annex A.

5.5.3 Width

The dimensions for the width, w_1, w_2 and w_3 shall be as given in Table 1, columns 5, 6 and 7 calculated in accordance with Annex A.

5.5.4 Weld dimensions

The dimensions for the weld, $2r$ and G, shall be as given in Table 1, columns 8 and 9 calculated in accordance with Annex A.

5.5.5 Length dimensionally affected by welding

The length dimensionally affected by welding, *e*, (see Figures 1 and 2) shall not extend by more than 0,6 × d_n to either side of the centre of the chain link.

5.6 Working load limit (WLL)

Table 2 gives values for the working load limit (WLL), calculated on the basis given in Annex A. For other nominal diameters, the values for the working load limit shall be calculated in accordance with Annex A.

Table 2 — Working load limit (WLL)

1	2
Nominal diameter d_n mm	**Working load limit** WLL t
4	0,25
6	0,56
8	1,00
10	1,60
13	2,65
16	4,00
18	5,00
20	6,30
22	7,50

5.7 Mechanical properties

5.7.1 General

Sling chains according to this document shall comply with the mechanical requirements as given in Table 3.

Table 3 — Mechanical requirements

1	2	3	4
Nominal diameter d_n mm	**Manufacturing proof force (MPF)** F_{MP} kN **min.**	**Breaking force (BF)** F_B kN **min.**	**Bend deflection** f mm **min.**
4	5,0	10,0	3,2
6	11,2	22,4	4,8
8	20,0	40,0	6,4
10	31,5	63,0	8
13	53,0	106	10
16	80,0	160	13
18	100	200	14
20	125	250	16
22	150	300	18

5.7.2 Manufacturing proof force (MPF)

All sling chains shall be subjected to the manufacturing proof force (MPF), at least equal to the value specified in Table 3, column 2, calculated on the bases given in Annex A.

5.7.3 Breaking force (BF)

Samples of sling chains shall withstand the minimum value for the breaking force (BF) specified in Table 3, column 3, calculated on the bases given in Annex A.

5.7.4 Bend deflection, *f*

Samples of single chain links shall withstand the minimum value for the deflection, *f*, specified in Table 3, column 4, calculated on the bases given in Table 4 and shall be free from visible defects.

5.7.5 Total ultimate elongation, *A*

On completion of the tensile test, the minimum total ultimate elongation, *A*, shall be in accordance with the value given in Table 4.

Table 4 — Mechanical properties

Line	Mechanical property	Requirement
1	Specified nominal stress at breaking force (BF)	$\sigma_{BF} = 400\ N/mm^2$
2	Specified nominal stress at manufacturing proof force (MPF)	$\sigma_{MPF} = 200\ N/mm^2$
3	Percentage ratio of specified nominal stress at manufacturing proof force (MPF) to the specified nominal stress at breaking force (BF)	$\frac{\sigma_{MPF}}{\sigma_{BF}} = 50\ \%$
4	Specified minimum total ultimate elongation	$A_{min} = 30\ \%$
5	Specified nominal bend deflection	$f = 0{,}8 \times d_n$
6	Specified nominal stress at working load limit (WLL)	$\sigma_{WLL} = 100\ N/mm^2$

6 Tests

6.1 General

The tests shall be performed on the finished sling chain.

Apart from the dimension test (according to 6.4), they are conducted as destructive tests (according to 6.5 and 6.6) on samples taken lot by lot.

6.2 Size of lot

One lot comprises a manufacturing unit of 200 m. Any started manufacturing unit is deemed to be one lot.

6.3 Sampling

Samples shall be selected in accordance with ISO 1834.

6.4 Dimension test

The dimensions of the chain links as specified in Table 1 shall be checked using a calliper according to ISO 13385-1.