INTERNATIONAL STANDARD

ISO 8539

Second edition
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Forged steel lifting components for use with Grade 8 chain

Accessoires de levage en acier forgé pour utilisation avec des chaînes de Classe 8

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 8539 was prepared by Technical Committee ISO/TC 111, *Round steel link chains, chain slings, components and accessories*, Subcommittee SC 3, *Components and accessories*.

This second edition cancels and replaces the first edition (ISO 8539:1986), of which it is a technical revision.

Introduction

The components covered by this International Standard are normally supplied to be part of a sling, but they may also be used for other applications. In such instances, it is important that the components design be checked to ensure its fitness for the intended use.

Forged steel lifting components for use with Grade 8 chain

1 Scope

This International Standard specifies general requirements for forged steel components of Grade 8 up to 63 t working load limit (WLL), mainly for use in

— chain slings in conformance with ISO 4778 and ISO 7593,

— steel wire rope slings in conformance with ISO 7531, and

— textile slings

intended for lifting objects, materials or goods.

This International Standard is not applicable to hand forged components and welded links, nor is it applicable to other welded components.

2 Normative references

The following referenced documents are indispensable for the application 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 643, *Steels — Micrographic determination of the apparent grain size*

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

EN 10025-2:2004, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10228-1, *Non-destructive testing of steel forgings — Part 1: Magnetic partical inspection*

EN 10228-2, *Non-destructive testing of steel forgings — Part 2: Penetrant testing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
working load limit
WLL
maximum mass that a component is authorized to sustain in general lifting service

3.2
manufacturing proof force
MPF
force applied to the component during the manufacturing proof test

3.3
breaking force
BF
maximum force reached during the static tensile test of the component, at which the component fails to retain the load

3.4
traceability code
series of letters and/or numbers marked on a component that enables its manufacturing history, including the identity of the cast of steel used, to be traced

3.5
competent person
designated person, suitably trained, qualified by knowledge and practical experience, and with the necessary instruction to enable the required test and examination to be carried out

NOTE ISO 9001:2008, 6.2.2 gives guidance on training

3.6
lot
specified number of components from which samples are selected for testing purposes, and which have been manufactured from the same cast of steel and subjected to the same heat treatment process

4 Safety requirements

4.1 General

4.1.1 Articulation

The dimensions of the forged steel components shall be such as to ensure articulation so that the force imposed is transmitted in the intended direction.

4.1.2 Relative movement

Parts of mechanical joining devices, such as pins and their securing elements, shall be so designed and manufactured that, after assembly, no unintended displacement can occur.

The effects of wear, corrosion of securing elements or rough usage should be considered.

4.2 Materials

4.2.1 General

Within the limitations given in 4.2.2 to 4.2.4 the manufacturer shall select the type of steel to be used so that the finished component, when suitably heat-treated, conforms to the mechanical properties specified in this International Standard.

4.2.2 Type of steel

The steel shall be produced by an electric process or by an oxygen blown process.

4.2.3 Deoxidation

The steel shall be fully killed as defined in EN 10025-2:2004, 6.2.2, shall be stabilized against strain-age embrittlement, and shall have an austenitic grain size of 5 or finer when tested in accordance with ISO 643.

To ensure the forged steel components are stabilized against strain-age embrittlement during services, the steel shall contain at least 0,025 % aluminium.

4.2.4 Chemical composition

The steel shall contain alloying elements in sufficient quantities so that the finished component, when heat-treated in accordance with 4.3, not only conforms to the mechanical properties specified in this International Standard, but also possesses low temperature ductility adequate for working satisfactorily in the temperature range −40 °C to +400 °C.

The steel shall contain at least two of the three alloying elements, in the minimum percentages specified in Table 1.

Table 1 — Chemical composition of alloying elements

Element	**Minimum mass content** (in percent by mass) **as determined by cast analysis**
Nickel	0,40
Chromium	0,40
Molybdenum	0,15

The steel shall contain no more sulfur and phosphorus than the limits given in Table 2.

Table 2 — Sulfur and phosphorus content

Element	**Maximum mass content** (in percent by mass) **as determined by**	
	Cast analysis	**Check analysis**
Sulfur	0,025	0,030
Phosphorus	0,025	0,030

4.3 Heat treatment

Each component shall be hardened from a temperature above the relevant AC3 point and tempered before being subjected to the manufacturing proof force (MPF). The tempering temperature shall be a minimum of 400 °C.

The tempering conditions shall be at least as effective as a temperature of 400 °C maintained for a period of 1 h.

A method of verification is as follows. After the components have been reheated to and maintained for 1 h at 400 °C and then cooled to room temperature, they should conform in the finished condition to Columns 3 and 4 of Table 3.

Surface hardening shall not be permitted for load-bearing parts of the component.

4.4 Manufacturing methods and workmanship

4.4.1 Manufacture

Each forged part of a component shall be forged hot in one piece. Excess metal from the forging operation shall be removed cleanly, leaving the surface free of sharp edges. After heat treatment, furnace scale shall be removed.

Edges of machined surfaces shall be rounded to eliminate cutting edges and to ensure attainment of mechanical properties of the component.

Welding shall not be used during the manufacture of components unless

a) none of the parts to be welded are load bearing,

b) the area affected by the weld is not to be subjected to load under normal operating conditions or under any foreseeable misuse of the component, or

c) the welding is completed before heat treatment.

Care should be taken during welding to ensure that the mechanical properties of any load-bearing parts of the finished component are not affected.

All welds shall be smoothly finished.

4.4.2 Surface finish

The finished condition of components shall include any surface finish.

NOTE Components are supplied in various surface finishes, e.g. descaled, electroplated or painted.

4.5 Mechanical properties

4.5.1 Manufacturing proof force

Components, including load-bearing pins, if used, shall be able to withstand the manufacturing proof force (MPF) specified in Table 3. Following removal of the force, the dimensions shall be within the tolerances specified on the component manufacturer's drawings.

4.5.2 Breaking force

Components, including load-bearing pins, if used, shall have a breaking force (BF) at least equal to that specified in Table 3.

On completion of the static tensile test, components shall show evidence of deformation.

4.5.3 Fatigue resistance

Components, including load-bearing pins, if used, with a working load limit up to 32 t, shall withstand, without breaking, at least 20 000 cycles of application of the force range specified in 5.2.5.

Table 3 — Code number, working load limits and mechanical properties

1	2	3	4
Code number [a]	**Working load limit** WLL t	**Manufacturing proof force** [b] MPF kN	**Breaking force** [b] BF kN (min)
3	0,25	6,1	9,8
4	0,5	12,3	19,6
5	0,8	19,6	31,4
6	1,12	27,5	43,9
7	1,5	36,8	58,8
8	2	49	78,5
9	2,5	61,3	98,1
10	3,15	77,2	124
11	3,75	91,9	147
13	5,3	130	208
14	6	147	235
16	8	196	314
18	10	245	392
19	11,2	275	439
20	12,5	306	490
22	15	368	588
23	16	392	628
25	20	490	785
26	21,2	520	832
28	25	613	981
32	31,5	772	1 240
36	40	981	1 570
40	50	1 230	1 960
45	63	1 540	2 470

[a] The code is the same as the nominal diameter of chain.

[b] The mechanical properties specified in Table 3 are calculated on the basis specified in Annex A. It is common practice for manufacturers to round MPF and BF up to higher values that may appear in their published catalogues.