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Components for slings - Safety - Part 6: Links - Grade 4

Einzelteile für Anschlagmittel - Sicherheit - Teil 6: Einzelglieder - Güteklasse 4

Accessoires pour élingues - Sécurité - Partie 6: Mailles - Classe 4

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Components for slings - Safety - Part 6: Links - Grade 4

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Foreword

This document (EN 1677-6:2001+A1:2008) has been prepared by Technical Committee CEN/TC 168 “Chains, ropes, webbing, slings and accessories - Safety”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document supersedes EN 1677-6:2001.

This document includes Amendment 1, approved by CEN on 2008-09-09.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

⟨A1⟩ For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. ⟨A1⟩

The other Parts of EN 1677 for components for slings are:

Part 1: Forged steel components - Grade 8
Part 2: Forged steel lifting hooks with latch - Grade 8
Part 3: Forged steel self-locking hooks - Grade 8
Part 4: Links - Grade 8
Part 5: Forged steel lifting hooks with latch - Grade 4

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This European Standard has been prepared to be a harmonized standard providing one means of complying with the essential safety requirements of the Machinery Directive and associated EFTA regulations.

The links covered by this Part of EN 1677 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 link design is checked to ensure its fitness for the intended use.

The extent to which hazards are covered is indicated in the scope. In addition, lifting equipment shall conform as appropriate to EN 292 for hazards that are not covered by this standard.

1 Scope

This part of EN 1677 specifies requirements for welded steel master links, intermediate master links, master link assemblies and lower terminal links of grade 4 up to 67 t WLL, mainly for use in:

— chain slings according to EN 818-5

— steel wire rope slings according to prEN 13414-1:1998

— textile slings according to EN 1492-1, EN 1492-2.

intended for lifting objects, materials or goods.

The hazards covered by this Part of EN 1677 are identified in clause 4.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 292-1, Safety of machinery - Basic concepts - General principles for design - Part 1: Basic terminology, methodology

EN 292-2:1991/A1:1995, Safety of machinery - Basic concepts - General principles for design - Part 2: Technical principles and specifications (Amendment 1: 1995)

EN 818-5:1999, Short link chain for lifting purposes – Safety - Part 5: Chain slings - Grade 4

EN 818-6, Short link chain for lifting purposes – Safety - Part 6: Chain slings - Specification for information for use and maintenance to be provided by the manufacturer

EN 1050:1996, Safety of machinery - Principles for risk assessment

EN 1492-1, Textile slings – Safety - Part 1: Flat woven webbing slings made of man-made fibres.

EN 1492-2, Textile slings – Safety - Part 2: Round slings made of man-made fibres

EN 10002-2:1991, Metallic materials - Tensile test - Part 2: Verification of the force measuring system of the tensile testing machine

EN 10025:1990+A1:1993, Hot rolled products of non-alloy structural steels — Technical delivery conditions

prEN 13414-1:1998, Steel wire ropes for slings – Safety - Part 1: Wire rope slings

EN 45012, General requirements for bodies operating assessment and certification/registration of quality systems (ISO/IEC Guide 62:1996)

EN ISO 9002:1994, Quality systems - Model for quality assurance in production, installation and servicing

ISO 643:1983, Steels - Micrographic determination of the ferritic or austenitic grain size

3 Terms and definitions

For the purposes of this Part of EN 1677, the following terms and definitions apply.

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

NOTE This term has the same meaning as the term maximum working load used in the amendment to EN 292-2:1991/A1:1995.

3.2
manufacturing proof force (MPF)

force applied to the link during the manufacturing proof test

3.3
breaking force (BF)
maximum force reached during the static tensile test of the link at which the link fails to retain the load

3.4
sling
assembly consisting of chain, wire rope or textile joined to upper and lower terminals suitable for attaching loads to the hook of a crane or other lifting machine

3.5
master link
link forming the upper terminal of a sling by means of which the sling is attached to the hook of a crane or other lifting machine

3.6
intermediate master link
link used to connect one or two legs of a sling to a master link

3.7
master link assembly
assembly consisting of a master link together with two intermediate master links

3.8
lower terminal
link, hook or other device fitted at the end of a leg of a sling, remote from the master link or upper terminal

3.9
traceability code
series of letters and/or numbers marked on a link that enable its manufacturing history, including the identity of the cast of steel used, to be traced

3.10
lot
specified number of links from which samples are selected for testing purposes, and that have been manufactured from the same cast of steel and subjected to the same heat treatment process

3.11
total ultimate elongation
total extension at the point of fracture of the link expressed as a percentage of the internal length of the test sample

3.12
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 4.18 of EN ISO 9002:1994 gives guidance on training

4 Hazards

Accidental release of a load, or release of a load due to failure of a link puts at risk, either directly or indirectly, the safety or health of those persons within the danger zone.

In order to provide the necessary strength and durability of links, this Part of EN 1677 gives requirements for the design, manufacture and testing to ensure that specified levels of performance are met.

Fatigue failure has not been identified as a hazard when grade 4 links having the specified levels of performance given in this standard are used for general lifting purposes.

Since failure can be caused by the incorrect choice of grade and specification of link, this standard also gives requirements for marking and the manufacturer's certificate.

Errors in fitting can also lead to failure and this Part of EN 1677 contains dimensional requirements to allow correct fit.

Risk of injury due to sharp edges, sharp angles or rough surfaces when handling is also covered by this standard.

Those aspects of safe use associated with good practice are given in EN 818-6.

Table 1 contains those hazards that require action to reduce risk identified by risk assessment as being specific and significant for links of grade 4.

Table 1 — Hazards and associated requirements

Hazards identified in annex A of EN 1050: 1996		Relevant clause of annex A of EN 292-2: 1991/A1: 1995	Relevant clause/subclause of this Part of EN1677
1e	Mechanical hazard due to inadequacy of strength	1.3.2 4.1.2.3 4.1.2.5 4.2.4 1.7.3 1.7.4	5 5 5 5 7 9
1.3	Cutting hazard	1.3.4	5.4
1.8	Friction or abrasion hazard	1.3.4	5.4
15	Errors of fitting hazard	1.5.4	5.2 9

5 Safety requirements

5.1 Design

Links shall be parallel-sided links produced by welding.

5.2 Dimensions

The internal dimensions of links covered by this Part of EN 1677 shall be such as to ensure effective articulation so that the load is transmitted axially.

The cross-section of links shall be so as to conform to 5.5.

NOTE This requirement permits a varying shape and area of cross-section.

The internal length of master links shall be $58\sqrt{WLL}$ minimum (in millimetres) and the internal width $31{,}5\sqrt{WLL}$ minimum (in millimetres) where the WLL is given in tonnes.

5.3 Materials and heat treatment

5.3.1 Quality of material

5.3.1.1 General

Within the limitations given in 5.3.1.2 to 5.3.1.4, the manufacturer shall select the type of steel to be used so that the finished links, when suitably heat-treated conform to the mechanical properties specified in this Part of EN 1677.

5.3.1.2 Type of steel

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

5.3.1.3 Deoxidation

The steel shall be fully killed as defined in EN 10025:1990+A1:1993, stabilized against strain age embrittlement, and have an austenitic grain size of 5 or finer when tested in accordance with ISO 643 : 1983

5.3.1.4 Chemical composition

To ensure that links are stabilized against strain age embrittlement during service, the steel shall contain at least 0,025 % aluminium.

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

Table 2 — Sulfur and phosphorous content

Element	Maximum mass content as determined by	
	Cast analysis %	Check analysis %
Sulfur	0,025	0,030
Phosphorous	0,025	0,030

The silicon content of the steel shall be as specified in Table 3.

NOTE The purpose of this requirement is to limit the detrimental effect on the hook as part of a chain sling when used for lifting in galvanizing baths.

Table 3 — Silicon content

Element	Mass content as determined by	
	Cast analysis %	Check analysis %
Silicon	0,12 to 0,30	0,15 to 0,35

5.3.2 Heat treatment

Each link shall either be hardened from a temperature above the AC_3 point and tempered, or normalized from a temperature above the AC_3 point, before being subjected to the manufacturing proof force. The tempering temperature shall be a minimum of 475 °C.

The tempering conditions shall be at least as effective as a temperature of 475 °C maintained for a period of 1 h.

NOTE A method of verification is as follows. After the links have been reheated to and maintained for 1 h at 475 °C and then cooled to room temperature, they should conform in the finished condition to 5.5.2 and 5.5.3.

5.4 Manufacturing methods and workmanship

5.4.1 Manufacture

Each link shall be manufactured from steel of weldable quality.

Welds shall be produced using the resistance butt or flash butt processes and shall be positioned in the centre of the side of the link (see Figure 1).

The steel in the length affected by welding shall not be displaced at any point so as to undercut the contours of the link. The weld shall be smoothly finished all round.

The length affected by welding shall not extend by more than 0,6 of the material diameter to either side of the centre of the weld.

If the link has a flattened section, this shall be on the side of the link opposite to the weld.

5.4.2 Surface finish

The finished condition of links shall include any surface finish.

NOTE Links are supplied in various surface finishes, e.g. natural black (i.e. furnace scaled), de-scaled, electroplated or painted.

5.5 Mechanical properties

5.5.1 General

The mechanical properties of links shall be as specified in 5.5.2 to 5.5.4.

NOTE Selected working load limits are given in Table 4. Other working load limits are permissible.

NOTE The working load limits for links are generally as given in Table 2 of EN 818-5:1999 for multi-leg slings.