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Terminations for steel wire ropes - Safety - Part 7: Symmetric wedge socket

Endverbindungen für Drahtseile aus Stahldraht - Sicherheit - Teil 7: Symmetrische Seilschlösser

Terminaisons pour câbles en acier - Sécurité - Partie 7: Boîte à coin symétrique

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ICS:

53.020.30	Pribor za dvigalno opremo	Accessories for lifting equipment
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EUROPEAN STANDARD
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Terminations for steel wire ropes - Safety - Part 7: Symmetric wedge socket

Terminaisons pour câbles en acier - Sécurité - Partie 7:
Boîte à coin symétrique

Endverbindungen für Drahtseile aus Stahldraht - Sicherheit
- Teil 7: Symmetrische Seilschlösser

This European Standard was approved by CEN on 10 May 2006 and includes Amendment 1 approved by CEN on 18 September 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 13411-7:2006+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of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document supersedes EN 13411-7:2006.

This document includes Amendment 1, approved by CEN on 2008-09-18.

The start and finish of text introduced or altered by amendment is indicated in the text by tags $\boxed{A_1}$ $\boxed{A_1}$.

This document 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).

$\boxed{A_1}$ For relationship with EU Directive(s), see informative Annexes ZA, ZB and ZC, which are integral parts of this document. $\boxed{A_1}$

EN 13411 consists of the following parts:

Part 1: Thimbles for steel wire rope slings

Part 2: Splicing of eyes for steel wire rope slings

Part 3: Ferrules and ferrule-securing

Part 4: Metal and resin socketing

Part 5: U-bolt wire rope grips

Part 6: Asymmetric wedge socket

Part 7: Symmetric wedge socket

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.

EN 13411-7:2006+A1:2008 (E)**Introduction**

This European Standard is a type C standard as stated in EN 12100.

This European Standard has been prepared to provide a means of conforming with the essential safety requirements of the Machinery Directive and the Lift Directive and associated EFTA regulations.

The wedge socket concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this standard part of the standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards for symmetric wedge sockets that have been designed and produced according to the provisions of this type C standard.

Purchasers ordering to this standards are advised to specify in their purchasing contract that the supplier operates a quality assurance system applicable to the relevant part of this standard (e.g. EN ISO 9001) to ensure themselves that products claiming to comply consistently achieve the required level of quality.

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1 Scope

This European Standard specifies the minimum requirements for symmetrical wedge socket terminations for stranded steel wire ropes conforming to EN 12385-5 for lifts.

This European Standard covers those symmetric wedge sockets intended for use at temperatures between -20 °C and 100 °C.

This European Standard only covers those symmetric wedge sockets that have welded socket bodies.

An example of the construction and sizes of a symmetric wedge socket is given in informative Annex A.

The informative Annex B gives the recommendations for the safe use and inspection of symmetric wedge socket according to Annex A.

This European Standard deals with all significant hazards, hazardous situations and events relevant to symmetric wedge sockets for terminations for steel wire ropes, when used as intended and under conditions of misuse which are reasonable foreseeable by the manufacturer.

The hazards covered by this European Standard are identified in Clause 4.

This European Standard applies to symmetric wedge sockets, which are manufactured after the date of its publication.

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.

- <https://standards.iteh.ai/catalog/standards/sist/722aa609-e663-409b-9267-128812881288>
- EN 1050:1996, *Safety of machinery — Principles for risk assessment*
- EN 1289:1998, *Non-destructive testing of welds — Penetrant testing of welds — Acceptance levels*
- EN 1290:1998, *Non-destructive examination of welds — Magnetic particle examination of welds*
- EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*
- EN 12385-2:2002, *Steel wire ropes — Safety — Part 2: Definitions, designation and classification*
- EN 12385-5:2002, *Steel wire ropes — Safety — Part 5: Stranded ropes for lifts*
- EN ISO 4063, *Welding and allied processes - Nomenclature of processes and reference numbers (ISO 4063:1998)*
- EN ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2003)*
- EN ISO 7500-1:2004, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2004)*
- EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*
- EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

EN 13411-7:2006+A1:2008 (E)**3 Terms and definitions**

For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003, EN ISO 12100-2:2003, EN 12385-2:2002 and the following apply.

3.1
symmetric wedge socket
assembly consisting of a socket body, wedge, and pin and securing means for the pin; when assembled the centre line of the pin is marginally offset (by one half rope diameter, see Figure B.1) to the longitudinal axis of the live portion of the rope

3.2
socket body
principal component of a wedge socket termination having an internal tapered form suitable for receiving a wedge (see 3.3) and the rope with which the wedge is associated, see Figure A.1

3.3
wedge
flat tapered component with peripheral groove, suitable for fitting into a tapered socket body to accommodate a rope of matching nominal diameter, see Figure A.1

3.4
pin
removable component intended to facilitate connection of the socket body to its anchorage point

3.5
lot
number of symmetric wedge sockets from which samples are selected for testing purposes which are of the same type and dimension, each of their constituent components manufactured during the same production run from material of the same cast and subjected to the same heat treatment process

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4 List of significant hazards

This European Standard contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this European Standard, identified by risk assessment as significant for this type of steel wire rope termination that require action to eliminate or reduce the risk.

In particular, the hazard caused by accidental release of a load, or release of a load due to failure of a symmetric wedge socket, puts at risk, either directly or indirectly, the safety or health of those persons within the hazard zone.

Errors in the fitting of accessories can also lead to premature failure and this European Standard contains dimensional and geometrical requirements to allow correct fit.

Table 1 contains those hazards that require action to reduce risk identified by risk assessment as being specific and significant for symmetric wedge sockets.

Table 1 — Hazards and associated requirements

Hazards identified in Annex A of EN 1050:1996		Relevant clause of this Part of EN 13411
1.1.5	Mechanical hazard due to inadequacy of strength	5 6 7
1.3	Cutting or shearing hazard	7
15	Errors of fitting	7

5 Safety requirements and/or measures

5.1 Geometry of wedge and socket body

Symmetric wedge socket terminations for ropes shall conform to the following geometrical criteria (see Figure A.1):

- the wedge groove angle (α) shall be the same as the socket angle in the body (β);
- the wedge shall be symmetric;
- the internal side surfaces of the socket body and the wedge in contact with the rope shall be straight;
- the grooves of the body and the wedge shall have no surface irregularities, such as, protrusions or joints which could influence the intimate contact with the rope;
- the clamping length between the socket body and the wedge shall be at least 7,3 times the nominal rope diameter d ;
- the radius r_3 of the wedge at the bottom of the groove at the large end shall be at least 1 times the nominal diameter d of the rope.

5.2 Security of the pin

The pin shall be provided with a means for securing it in position when in operation.

5.3 Welded socket body

The welding and allied process shall conform to one of those specified in EN ISO 4063. The person who supervises the production process shall be trained in the chosen welding process.

The quality of the welding joint shall be in accordance with assessment group B of EN ISO 5817:2003. There shall be no melted on weld chips.

The ligament distance in the root of the welding joint shall be 1 mm for material thickness up to 6 mm and 1,5 mm for material thickness more than 6 mm up to and including 12 mm. The penetration of the root of the welding shall be avoided. There shall be no increase of the welding joint in the area of contact with the rope. The welding joint shall have a bonding area of at least 70 % at the joint edge.

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Any offset of the edges of the body halves shall be limited to 0,5 mm for material thickness up to 6 mm and 0,8 mm for material thickness more than 6 mm up to and including 12 mm.

5.4 Mechanical properties**5.4.1 General**

The required mechanical properties take into account, that symmetric wedge sockets in combination with stranded ropes for lifts to EN 12385-5 have to be used with a minimum coefficient of use of 5 for lifting goods and 10 for lifting of persons.

5.4.2 Termination efficiency

When tested in accordance with 6.2.2 the efficiency of the assembled termination shall be at least 80 % of the minimum breaking force of the rope without any movement between the rope and the termination and any deformation of the wedge and the socket.

5.4.3 Fatigue behaviour of the socket body and pin

When tested in accordance with 6.2.3 the socket body, wedge and pin shall not exhibit any indications of cracks after 75 000 load cycles.

The socket and wedge shall also exhibit no sign of local permanent deformation.

5.4.4 Low temperature properties

The material of the socket body and pin, when tested in accordance to 6.2.4 shall possess a minimum low temperature ductility at $-20\text{ }^{\circ}\text{C}$ as follows:

Minimum average Charpy impact value at 27 J, with no individual value less than 18 J.

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6 Verification of safety requirements**6.1 Qualifications of personnel**

All testing and examination shall be carried out by a competent person.

6.2 Type testing**6.2.1 General**

Two type tests shall be carried out for each requirement, in accordance with 6.2.2 to 6.2.3 on assembled terminations of each design, material and method of manufacture, using the highest minimum breaking force of rope as defined in EN 12385-5 for which the socket is designed.

If the dimensional criteria, the material or the method of manufacture are subsequently varied outside the usual manufacturing tolerances, the type tests shall be repeated.

The testing machine shall conform to the requirements of EN ISO 7500-1.

6.2.2 Tensile efficiency test

Subject the assembled termination to an initial load of 60 % of the minimum breaking force of the rope, then increase the loading at a rate of not more than 0,5 % of the breaking force per second in the tensile testing machine. The test shall be continued until either rope breaks or slips out of the socket.

If terminations are tested in pairs, the distance between the inner faces of the socket bodies shall be at least 30d.

6.2.3 Fatigue test

The test shall be carried out on an in-line tensile fatigue machine. The termination shall not be allowed to rotate and the test shall consist of the application of the cycle force from 15 % to 30 % of the minimum breaking force of the rope along the rope axis for 75 000 cycles.

The frequency of the force shall not exceed 5 Hz.

The component parts shall be subject to dye penetrant in accordance with EN 1289 or magnetic particle inspection in accordance with EN 1290, both before and after the fatigue test to enable any crack propagation as a result of fatigue to be readily identified.

NOTE More than one rope may be required to enable the socket body to achieve 75 000 cycles.

6.2.4 Acceptance criteria for type testing

If the assemblies pass all of the above tests, the symmetric wedge socket of the size submitted for type testing shall be deemed to conform to this European Standard.

Should one sample fail these tests, and on examination it is found due to a material defect in the socket body or pin, the manufacturing process shall be re-examined and amended to eliminate such defects, after which a further two assemblies of the same size, design and material content shall be tested. If these pass the above tests, the symmetric wedge socket of the size submitted for type testing shall be deemed to conform to this European Standard.

If one or both fail the re-test, the symmetric wedge socket of the size submitted for type testing shall be deemed not to conform to this European Standard.

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6.2.5 Charpy impact test

Charpy V-notch impact test shall be carried out in accordance with EN 10045-1 on material of socket bodies and pins of all sizes. Three samples shall be tested at a temperature of -20°C .

If one of the three sample of the Charpy impact test fails the individual value test or the three samples fail the average value test two further samples shall be taken and both shall pass the individual value test and the average of the five samples shall pass the average test in order for the respective component of size submitted for type testing to be deemed to conform to this European Standard.

If two or three samples fail the individual value test, the respective component of the size submitted for type testing shall be deemed not to conform to this European Standard.

6.3 Manufacturing tests and examination

6.3.1 Manufacturers tests

Socket body and pin shall be subjected to the manufacturing proof force equal to a load of 40 % of the highest minimum breaking force of rope for which the socket is designed. This shall be sustained without deviating from the dimensions of the manufacturer's drawings, and without visible defect after removal of the load.