SLOVENSKI STANDARD
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Terminations for steel wire ropes - Safety - Part 9: Solid thimbles

Endverbindungen für Drahtseile aus Stahldraht - Sicherheit - Teil 9: Vollkauschen

Terminaisons pour câbles en acier - Sécurité - Partie 9: Cosses pleines

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53.020.30	Pribor za dvigalno opremo	Accessories for lifting equipment
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Terminations for steel wire ropes - Safety - Part 9: Solid thimbles

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Endverbindungen für Drahtseile aus Stahldraht - Sicherheit - Teil 9: Vollkauschen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 168.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 13411-9:2019) has been prepared by Technical Committee CEN/TC 168 “Chains, ropes, webbing, slings and accessories”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document (prEN 13411-9:2016) has been prepared by Technical Committee CEN/TC 168 “Chains, ropes, webbing, slings and accessories”, the secretariat of which is held by BSI.

This document is a working document.

EN 13411, under the general title *Terminations for steel wire ropes — Safety*, consists of the following parts:

— *Part 1: Thimbles for steel wire rope slings*

— *Part 2: Splicing of eyes for 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*

— *Part 8: Swage terminals and swaging*

— *Part 9: Solid thimbles*

1 Scope

This document specifies the minimum requirements for solid thimbles made of steel or cast iron for terminations of stranded steel wire ropes.

This document is applicable to ferrule-secured terminations with solid thimbles in combination with ferrules according to EN 13411-3, that have an efficiency factor K_T of at least 0,9, and to spliced terminations with solid thimbles according to EN 13411-2, that have an efficiency factor K_T of at least 0,8, which are used as accessories for steel wire ropes, such as slings or wire rope assemblies, having a lifting, lowering or load-bearing effect in hoisting equipment.

Examples of designs of solid thimbles are given in informative Annex B and C.

Round thimbles are not subject to this document.

This document is applicable to ferrule-secured terminations that are manufactured after the date of publication of this document.

Hazards that are dealt with in this document are listed in Clause 4.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1562, *Founding — Malleable cast irons*

EN 1563, *Founding — Spheroidal graphite cast irons*

EN 10025 (all parts), *Hot rolled products of structural steels*

EN 10293, *Steel castings — Steel castings for general engineering uses*

EN 10340, *Steel castings for structural uses*

EN 12385-2, *Steel wire ropes — Safety — Part 2: Definitions, designation and classification*

EN 13411-3, *Terminations for steel wire ropes — Safety — Part 3: Ferrules and ferrule-securing*

EN 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*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12385-2 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
nominal thimble size
size of the nominal rope diameter (*d*) for which the thimble was primarily designed

4 List of hazards

This clause contains hazards and hazardous situations, as far as they are dealt with in this document, identified by risk assessment as significant for solid thimbles and which require action to eliminate or reduce the risk.

Accidental release of a load due to failure of the solid thimble directly or indirectly endangers the life or health of those persons within the danger zone.

In order to exhibit the required strength and endurance, this document specifies requirements for the design, manufacture and testing of solid thimbles, to ensure that the required level of performance is obtained.

Assembly faults can also lead to premature failure. This document contains requirements regarding the dimensions enabling the correct assembly.

The following hazardous events according to EN ISO 12100:2010, B.4, that are recognized as being typical for solid thimbles for general purposes, are covered by this document:

Contact with rough surfaces, sharp edges and corners as well as protruding parts, the origin of which relates to the shape and/or superficial finishing.

Break-up during operation, the origin of which relates to the mechanical strength, which can result in hazard to hand and/or falling parts.

5 Safety requirements and/or protective measures

5.1 Material

The material used to manufacture the thimbles shall be steel according to EN 10025, cast steel according to EN 10293 or EN 10340, respectively, malleable cast iron according to EN 1562 or spheroidal graphite cast iron according to EN 1563.

NOTE If hot-dip galvanized zinc coatings are applied, they are expected to be applied according to EN ISO 1461.

5.2 Design

Solid thimbles shall be free of cracks, surface defects and sharp edges, which may compromise the stability of the solid thimble or damage the rope.

5.3 Type testing

5.3.1 General

A type test consisting of a tensile test according to 5.3.3 and a fatigue test according to 5.3.4 shall verify that the design, material and manufacturing process of the solid thimble with the dimensions specified in this document can resist the maximum loads that are expected under normal operating conditions.

Each modification, e.g. of the material, the manufacturing process or dimensions, that is likely to compromise the safety of the solid thimble, requires type testing of the modified solid thimble according to 6.2.

For type testing, maximum permissible diameter of each bore diameter and the minimum thickness between the root of the grove and the bore for which the thimble is designed, shall be used.

It is recommended that the bolt diameter should not be less than 90 % of the bore diameter.

5.3.2 Sampling

Where the solid thimble design follows a mathematical progression throughout a given size range, rope diameter within that range for which the system is designated shall be selected for testing.

Where the solid thimble design does not follow a mathematical progression through a size range, each rope diameter within that range for which the system is designed shall be selected for testing.

For each rope diameter selected in accordance with the above, the rope grade and minimum breaking force of rope shall be the highest for which the system is designed. At least two (2) solid thimbles shall be tested.

In each case, a ferrule according to EN 13411-3 shall establish the ferrule-secured termination.

NOTE If the test length has a solid thimble mounted on both ends, it can be assumed that the number of type tests is two.

5.3.3 Tensile test

When tested in accordance with 6.2.1, the ferrule-secured termination (consisting of a solid thimble and a ferrule) shall withstand a test force of at least 90 % of the minimum breaking force of the rope.

NOTE A terminal efficiency of 90 % is equivalent to a termination efficiency factor K_T of 0,9, which is taken as a basis when using ferrules according to EN 13411-3.

After the test, the solid thimble shall remain in one piece (not broken) and without visible cracks.

5.3.4 Fatigue test

When tested in accordance with 6.2.2 for 75 000 cycles, the solid thimble shall not show any visible cracks or the thimble shall not be broken. Any local deformation at the bore hole for the pin shall be assessed by a competent person for acceptance.

6 Verification of the safety requirements

6.1 Qualification of personnel

All tests and examinations shall be performed by a competent person.

6.2 Type testing

6.2.1 Tensile test

The solid thimble is loaded with an initial force of 80 % of the minimum breaking force and then this force is increased with a load rate of up to 0,5 % of the breaking force per second.

The minimum value of the free test length, excluding the entire terminations (including the ferrule), shall comply with Table 1.

The testing machine shall comply with the requirements of EN ISO 7500-1.

Table 1 — Test lengths

Nominal rope diameter d mm	**Minimum test length** Stranded rope mm
≤ 6	300
> 6 ≤ 20	600
> 20 ≤ 60	30 × d
> 60	3 m

6.2.2 Fatigue test

The test shall be performed on a single-axle fatigue-test machine. The rope terminations shall not be able to rotate and the test shall be performed by applying 75 000 cycles of a cyclic load of 15 % to 30 % of the minimum breaking force of the rope along the rope axis.

The cycle test frequency shall not exceed 5 Hz at an ambient temperature of 10 °C to 40 °C.

6.3 Material

The supplier's documentation shall be consulted for the verification of the material.

6.4 Design

The solid thimbles shall be examined by visual inspection for surface defects, which can injure the user, degrade the rope or impair the functioning.

7 Reusability

Solid thimbles of ropes that are removed may be reused if they show no visible cracks or other types of damage that could compromise the stability of the solid thimble. These other types of damage and any local deformation at the bore hole for the pin shall be assessed by a competent person for acceptance.

8 User information

8.1 Marking

The nominal size of the solid thimble is designated by the rope diameter(s), for which the solid thimble is designed.

Solid thimbles shall be permanently marked by the manufacturer with the following information:

a) manufacturer's logo;

b) nominal size or rope diameter for which the solid thimble is designed;

c) part numbers and/or letters, that facilitate an allocation to the test certificate according to 8.2;

d) traceability code for a manufacturing batch;

e) minimum breaking force, for which the solid thimble is designed.

NOTE The marking according to 8.1 c) is intended to describe the type and/or shape of the thimble and is not conform to a batch number.

8.2 Test certificate

If the solid thimble is not part of a rope assembly, the manufacturer or the supplier shall provide a certificate on request that contains the following information:

a) verification of the compliance with this document;

b) manufacturer's name and address or, if applicable, of the representative;

c) nominal thimble size (rope diameter);

d) reference of the certificate to the thimble (number according to 8.1 c));

e) minimum breaking force, for which the solid thimble is designed;

f) material of the thimble;

g) instructions for use, where applicable;

h) information of the suitability with Flemish Eyes.

Annex A
(normative)

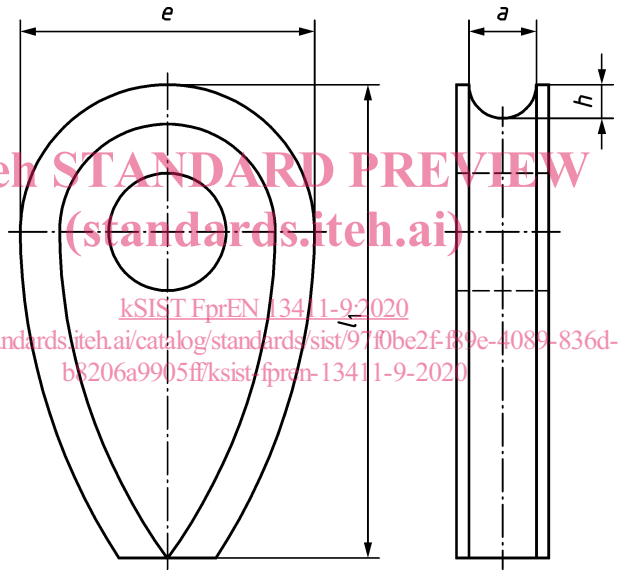
Dimensions

Experience has demonstrated that ropes terminated in accordance with this document using solid thimbles falling within the basic dimensions listed below will meet the tensile efficiency requirements of this document.

The basic dimensions of all thimble sizes should comply with Figure A.1.

NOTE 1 The compliance with the basic dimensions listed below will not replace the need for type testing according to this document.

For ferrule-secured terminations with Flemish eyes according to EN 13411-3 it shall be observed that the size of the solid thimble is such that the Flemish rope eye is at least four times the rope lay length.



Key

$2{,}7 \times d \leq e \leq 4{,}5 \times d$

$1{,}9 \times e \leq l_1 \leq 2{,}5 \times e$

$a \geq 1{,}05 \times d$ for ferrule-secured terminations

$h \geq 0{,}40 \times d$

d = nominal rope diameter

NOTE e is is expected to be $3 \times d$ or bigger for rotation resistant ropes

Figure A.1 — Basic dimensions of the solid thimble