



# SLOVENSKI STANDARD

## SIST EN 13411-9:2021

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### Zaključki jeklenih žičnih vrvi - Varnost - 9. del: Trdna vrvna srca

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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#### **ICS:**

53.020.30	Pribor za dvigalno opremo	Accessories for lifting equipment
77.140.99	Drugi železni in jekleni izdelki	Other iron and steel products

**SIST EN 13411-9:2021**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 13411-9**

April 2021

ICS 21.060.70; 53.020.30

English Version

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

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

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

This European Standard was approved by CEN on 20 December 2020.

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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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## European foreword

This document (EN 13411-9:2021) has been prepared by Technical Committee CEN/TC 168 “Chains, ropes, webbing, slings and accessories”, 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of an identical text or by endorsement, at the latest by October 2021, and conflicting national standards shall be withdrawn at the latest by October 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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*

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

**EN 13411-9:2021 (E)****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 (see EN 13411-3), that have an efficiency factor  $K_T$  of at least 0,9, and to spliced terminations with solid thimbles (see 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 which meet the requirements of this standard are given in informative Annexes B and C.

Round thimbles (thimble with rotational symmetry around the bore) 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 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.

EN 1562:2019, *Founding - Malleable cast irons*

EN 1563:2018, *Founding - Spheroidal graphite cast irons*

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

EN 10293:2015, *Steel castings - Steel castings for general engineering uses*

EN 10340:2007, *Steel castings for structural uses*

EN 12385-2:2002+A1:2008, *Steel wire ropes - Safety - Part 2: Definitions, designation and classification*

EN 13411-3:2004+A.1:2008, *Terminations for steel wire ropes - Safety - Part 3: Ferrules and ferrule-securing*

EN ISO 1461:2009, *Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461:2009)*

EN ISO 7500-1:2018, *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 7500-1:2018)*

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 <https://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.

Hot-dip galvanized zinc coatings shall 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.

**EN 13411-9:2021 (E)****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 Annex A 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 groove and the bore for which the thimble is designed, shall be used.

The bolt clearance for type testing of the solid thimble should be less than or equal to 10 % of the bore diameter, but should not exceed 3mm.

**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 borehole 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
$d \leq 6$	300
$6 < d \leq 20$	600
$20 < d \leq 60$	$30 \times d$
$60 < d$	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 from service 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 borehole for the pin shall be assessed by a competent person for acceptance.

**EN 13411-9:2021 (E)****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 1 Where the size of the solid thimble is too small to accept all of the information, then the information under c) and e) can be applied on the packaging.

NOTE 2 The marking according to 8.1 c) is intended to describe the type and/or shape of the thimble and is not related to a batch number.

**8.2 Test certificate**

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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;  
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<https://standards.iteh.ai/catalog/standards/sist/97f0be2f-f89e-4089-836d-b8206a9905ff/sist-en-13411-9-2021>
- 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)

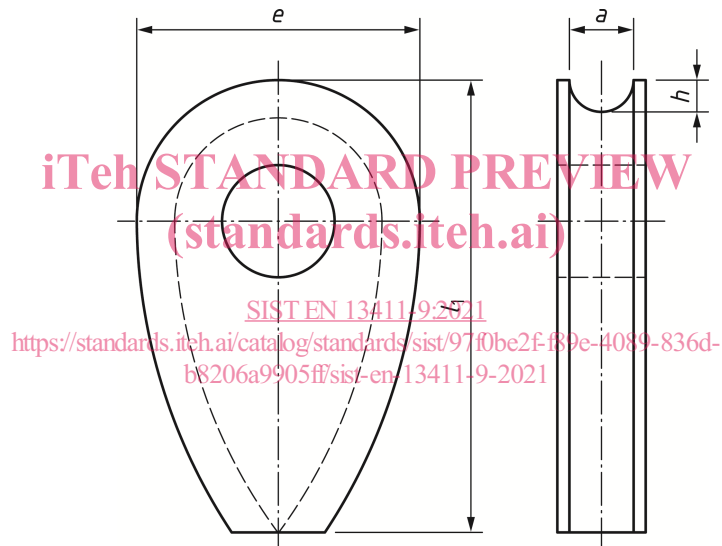
### Dimensions

Experience has demonstrated that ropes terminated in accordance with this document using solid thimbles falling within the range of 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

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

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

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

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

$d$  = nominal rope diameter

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

**Figure A.1 — Basic dimensions of the solid thimble**