

# Steel wire rope slings — Safety —

## Part 3: Grommets and cable-laid slings

The European Standard EN 13414-3:2003 has the status of a  
British Standard

ICS 53.020.30

## National foreword

This British Standard is the official English language version of EN 13414-3:2003.

The UK participation in its preparation was entrusted to Technical Committee MHE/2, Wire ropes, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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### Summary of pages

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EUROPEAN STANDARD

**EN 13414-3**

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English version

## Steel wire rope slings - Safety - Part 3: Grommets and cable-laid slings

Elingues en câbles d'acier - Sécurité - Partie 3: Estropes et élingues en grelin

Anschlagseile aus Strahldrahtseilen - Sicherheit - Teil 3: Grummets und Kabelschlag-Anschlagseile

This European Standard was approved by CEN on 25 March 2003.

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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 Management Centre has the same status as the official versions.

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## Foreword

This document (EN 13414-3:2003) has been prepared by Technical Committee CEN/TC 168 “Chains, ropes, webbings, 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of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

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).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The other parts of this European Standard are:

Part 1 Slings for general lifting service

Part 2 Specification for information for use and maintenance to be provided by the manufacturer

This is the first edition of this Part of this standard.

Annexes A to F are normative. Annex G is informative.

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

## Introduction

This Part of the standard has been prepared to provide a means of complying with the essential safety requirements of the Machinery Directive and associated EFTA regulations.

Purchasers are advised to specify in their purchasing contract that the supplier operates a quality management system applicable to this standard (e.g. ISO EN 9001) to ensure that products claimed to comply consistently achieve the required level of quality.

The coefficient of utilization ( $Z_p$ ) used in this standard for slings with a diameter greater than 60 mm is lower than that normally used for general service wire rope slings. This is justified for the following reasons.

- a) Slings over 60 mm diameter are not intended for general service and are subjected to special conditions relating to design, construction, frequency of use, service and discard.
- b) The mass of the load is generally calculated or measured with considerable accuracy and as such slings are usually specially manufactured for one or a limited number of special lifts.
- c) The lifting operation is controlled and supervised.
- d) The dynamic factors, e.g. shock loading, are limited.

These factors reduce the unknown aspects which dictate that slings in general service require a higher coefficient of utilization; lower coefficients have been and are used with confidence.

## 1 Scope

This European Standard specifies the construction requirements, calculation of WLL, testing and certification of steel wire rope grommets, cable-laid grommets and cable-laid slings using strand and wire rope conforming to EN 12385-4.

The hazards covered by this standard are identified in clause 4.

This standard covers ferrule-secured cable-laid slings up to 60mm.

## 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.

*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 1050 : 1996, Safety of machinery – Principles for risk assessment*

*EN 12385-4 : 2000 Steel wire ropes – Safety – Part 4. Stranded ropes for general lifting applications*

*prEN 13411-3 Terminations for steel wire ropes – Safety – Part 3 : Ferrules and ferrule securing*

### 3 Terms and Definitions

For the purposes of this standard the following terms and definitions apply.

#### 3.1

##### **wire rope grommet**

endless wire rope sling made from one continuous length of strand, formed to make a body composed of six strands around a strand core

NOTE : The strand ends are tucked into the body forming the core, with the tuck position diametrically opposite to the core butt position.

#### 3.2

##### **cable-laid grommet**

endless wire rope sling made from one or two continuous lengths of rope, formed to make a body composed of six ropes around a rope core

NOTE The rope ends are tucked into the body forming the core, with the tuck position(s) diametrically opposite to the core butt position(s).

#### 3.3

##### **cable-laid sling**

sling formed from a wire rope constructed of six unit ropes laid as outers over one core unit rope, with a termination at each end, usually in the form of a spliced eye

#### 3.4

##### **working load limit (WLL)**

maximum mass which a sling is authorized to sustain in general service

#### 3.5

##### **competent person**

designated person, suitably trained, qualified by knowledge and practical experience, and in possession of the necessary instructions to enable the required calculation of WLL and examination to be carried out

#### 3.6

##### **nominal diameter of grommet or cable laid sling**

dimension by which the sling is designated

## 4 Hazards

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

These aspects of safe use associated with good practice are given in prEN 13414-2.

Table 1 contains all the hazards which require action to reduce risk identified by risk assessment as being specific and significant for slings and their components.

**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/sub-clause of this Part of EN 13414 |
|---|---|---|---|
| 1.1.5   | Mechanical hazard due to inadequacy of strength | 4.1.2.3   | 5 and 6   |
|   |   | 4.1.2.5   | 5 and 6   |
|   |   | 4.1.2.4   | 7   |
|   |   | 4.3.2   | 7   |
| 10.4  | Errors of fitting hazard                        | 1.5.4   | 5   |

## 5 Safety requirements and/or measures

### 5.1 Grommets

#### 5.1.1 Production of grommets

During the production of grommets a temporary rigid core shall be used. Grommets and cable-laid ropes shall be produced using a method which ensures that the rope or strand tensions are equalized and that the finished product is free from visible waviness.

#### 5.1.2 Construction of wire rope grommet

The strand used to form the wire rope grommet shall be one of those used to form ropes specified in table 2, 4, 6, 8, 11, 12 and 13 of EN 12385-4:2000.

The length of the circumference shall be at least five times the grommet lay length. The core butt position shall be clearly marked by red paint applied over any serving.

#### 5.1.3 Construction of cable-laid grommet

Cable-laid grommets shall be constructed in accordance with A.1. The unit ropes shall be of 6- or 8-strand construction selected from those specified in tables 2, 3, 4, 5, 6, 7, 8, 11, 12 and 13 of EN 12385-4:2000. Ropes over 60 mm diameter shall have steel rope cores.

The length of the circumference shall be at least five times the grommet lay length.

The core butt position shall be clearly marked by red paint applied over any servings.

NOTE The grommet should never be bent at this marked position.



### 5.1.4 Length of grommet

The length of a grommet shall be the length of its circumference, measured along its centreline (see fig 1).

For wire rope grommets the tolerance shall be  $\pm 1d$  or 1% of the nominal length whichever is the greater.

For cable-laid grommets constructed from unit ropes with a fibre core of 24mm  $\leq d \leq$  60mm the tolerance shall be  $\pm 1d$  or 1% of the nominal length whichever is the greater.

For cable-laid grommets constructed from unit ropes with a steel core of 24mm  $\leq d \leq$  60mm the tolerance shall be  $\pm 1d$  or 1% of the nominal length whichever is the greater.

For cable-laid grommets constructed from unit ropes with a steel core of 66mm  $\leq d \leq$  696mm the tolerance shall be  $\pm 0,5d$  or 0,5% of the nominal length whichever is the greater.

NOTE Two methods of determination of the length of grommets, either by measuring the distance of the bearing points or, more accurately, by measurement of the circumference are described in annex B.

For the measurement process pin sizes shall conform to annex C.

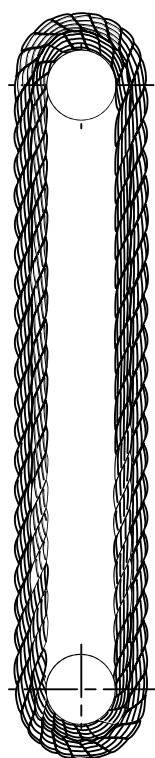


Figure 1 — Wire rope grommet

## 5.2 Cable-laid slings

### 5.2.1 Construction of cable-laid sling

Cable-laid slings shall be constructed in accordance with A.2.

The unit ropes used shall be of 6- or 8-strand construction selected from those specified in tables, 2, 3, 4, 5, 6, 7, 8, 11, 12 and 13 of EN 12385-4:2000.

Cable-laid ropes over 60 mm diameter shall have steel rope cores.

If the turn-back loop system for terminations is used, it shall conform to prEN 13411-3. Only unit ropes with a steel core shall be used. Splices shall be made in accordance with annex D.

### 5.2.2 Length of cable-laid slings

The length,  $L$ , of a sling, shall be the internal length between the bearing points of each termination whether they are soft eyes, thimbles, or hooks or links, as appropriate (see figure 2).

NOTE 1 When measuring the actual length of a sling with soft eyes, dimension  $w$  should be approximately  $\frac{1}{2}h$  (see figure 2) with  $h$  being approximately  $15d$ .

The tolerance of length of ferrule-secured and spliced cable-laid slings shall be  $\pm 2d$  or  $\pm 1\%$  of the nominal length, whichever is the greater. This applies for diameters  $24\text{mm} \leq d \leq 69\text{mm}$ .

When measuring length under load, for instance when two or more slings are required to be accurately matched for length, this shall be undertaken at 3 % of the calculated sling breaking force using pins having diameters conforming to Annex C.

NOTE 2 The dimensions of the eye should be selected so that  $h$  is approximately  $15d$ .

### 5.2.3 Length of matched sets

Where single leg cable-laid slings are intended to be used as matched sets, the difference in length shall not exceed  $2d$ .

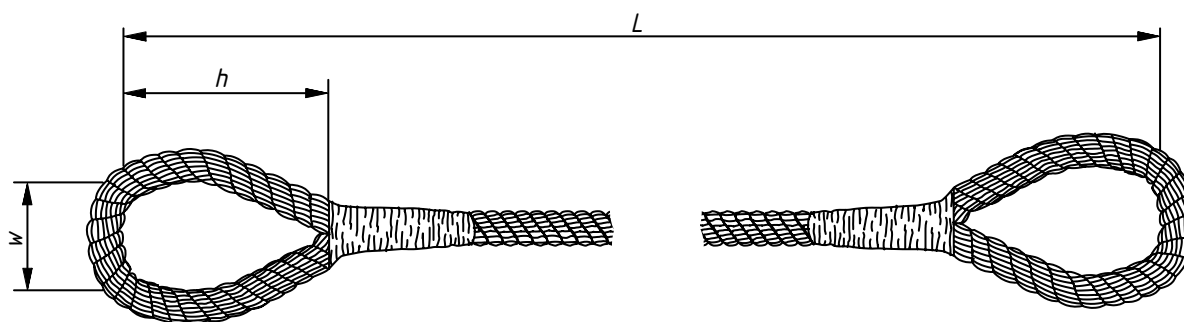


Figure 2 — Cable-laid sling

## 5.3 Rating

### 5.3.1 Grommet rating

The working load limit (WLL) of a wire rope grommet shall be calculated as follows:

$$WLL = \frac{2F_{\min_2}}{9,80665 \times Z_p}$$

The WLL of a cable-laid grommet shall be calculated as follows:

$$WLL = \frac{12F_{\min_1} \times C_L}{9,80665 \times Z_p}$$

where

$F_{\min_1}$  is the minimum breaking force (in kiloNewtons) of the unit of rope, as specified in EN 12385-4, which is used to form a cable-laid grommet.

$F_{\min_2}$  is the minimum breaking force (in kiloNewtons) of the fibre core rope from which the strand is used to form the wire rope grommet;

NOTE 1 9,806 65 is the constant which converts the force units (kiloNewtons) into the mass units (tonnes) used in lifting operations.

NOTE 2  $C_L$  is a factor which allows for the spinning losses in cabling the ropes. Currently this is taken as 0,9.  $Z_p$  is the coefficient of utilization.

For grommet rope diameters less than 60 mm,  $Z_p$  shall be not less than 5.

For grommet rope diameters ( $d$ ) of 60 mm up to 150 mm,  $Z_p$  shall be calculated in accordance with the following equation:

$$Z_p = 6,33 - 0,022 d$$

For grommet rope diameters greater than 150 mm,  $Z_p$  shall be not less than 3.

### 5.3.2 Cable-laid sling rating

The WLL of a cable-laid sling shall be calculated as follows:

$$WLL = \frac{\sum F_{min} \times C_L \times k}{9,80665 \times Z_p}$$

where

$\sum F_{min}$  is the sum of the individual minimum breaking forces of the outer ropes (kiloNewtons), as specified in EN 12385-4.

$C_L$  is a factor which allows for the spinning losses in cabling. Currently this is taken as 0,9.

$k$  is splice efficiency: 0,8 for ropes.

9,80665 is the constant which converts the force units (kiloNewtons) into the mass units (tonnes) used in lifting operations.

$Z_p$  is the coefficient of utilization.

For cable-laid sling diameters less than 60 mm,  $Z_p$  shall be 5.

For cable-laid sling diameters ( $d$ ) 60 mm up to 150 mm,  $Z_p$  shall be in accordance with the following equation:

$$Z_p = 6,33 - 0,022d.$$

For cable-laid sling diameters greater than 150 mm,  $Z_p$  shall be not less than 3.

For cable-laid slings terminated by a turn-back loop system conforming with prEN 13411-3 the termination efficiency ( $k$ ) shall be 0,9.

## 6 Verification of the safety requirements and/or measures

### 6.1 Construction of grommet and cable-laid sling

The requirements of 5.1.2, 5.1.3, 5.2.1 and annexes A and D shall be confirmed by visual inspection, measurement and by examination of the rope suppliers records.

### 6.2 Length of grommet and cable-laid sling

The lengths defined in 5.1.4, 5.2.2 and 5.2.3 shall be measured with a steel tape graduated in increments of 1 mm.

The grommet length shall be verified in accordance with annex B.

### 6.3 Rating

The calculation of 5.3 shall be verified by a re-check and by examination of the rope suppliers records.

## 7 Information for use

### 7.1 Marking

Each sling or grommet shall be legibly and durably marked with at least the following information

- a) the manufacturer's identifying mark;
- b) numbers and/or letters identifying the sling or grommet with the certificate conforming to 7.2;
- c) the working load limit;
- d) any statutory marking.

NOTE Within the European Union this means CE marking

Each completed sling or grommet shall be permanently marked so that it can be identified with its Certificate (see annex E).

### 7.2 Certification

A certificate in accordance with annex E for a grommet sling or annex F for a cable-laid sling shall be completed for each sling or batch of slings.

## Annex A (normative)

### Combination of lay factors for grommets and cable-laid slings

#### A.1 Grommets

##### A.1.1 General

Grommets shall be manufactured in accordance with the following combinations of unit rope and grommet lay factors.

##### A.1.2 Lay factors

The unit rope lay factor shall be at least 6 times the nominal rope diameter and at most 7,5 times the nominal rope diameter.

The grommet shall be at least 6 times the nominal grommet diameter and at most 7,5 times the nominal grommet diameter.

#### A.2 Cable-laid slings

##### A.2.1 General

The cable-laid rope shall be manufactured in accordance with the following combinations of unit rope and cable-laid rope lay directions and lay factors.

##### A.2.2 Lay directions and type

The core unit rope shall be right- or left-hand ordinary lay or right- or left-hand Lang lay.

The diameter of the core rope shall be at least 10 %, but not greater than 15 %, larger than the diameter of the main rope.

The outer unit ropes shall be left-hand ordinary lay or Lang lay, in which case the cable-laid rope shall be right-hand lay; or the outer unit ropes shall be right-hand ordinary lay or Lang lay, in which case the cable-laid rope shall be left-hand lay.

Core unit rope and the outer unit ropes shall have the same direction of lay.

##### A.2.3 Lay factors

The core unit and outer unit ropes shall have a lay factor which is a minimum of six times the nominal rope diameter and a maximum of 7.5 times the nominal rope diameter.

Cable-laid rope shall have a lay factor which is a minimum of 6 times the nominal cable-laid rope diameter and a maximum of 7,5 times the nominal cable-laid rope diameter.

## Annex B (normative) Determination of the length of a grommet

### B.1 Method of measuring the actual length (circumference) of a grommet

Arrange the grommet as shown in figure B.1(a) and mark four spots on the centreline as at p, q, r and s. Measure portions A and C and then re-arrange the grommet so that portions B and D may be measured as in figure B.1(b). The length of the grommet will be the summation of A, B, C and D.

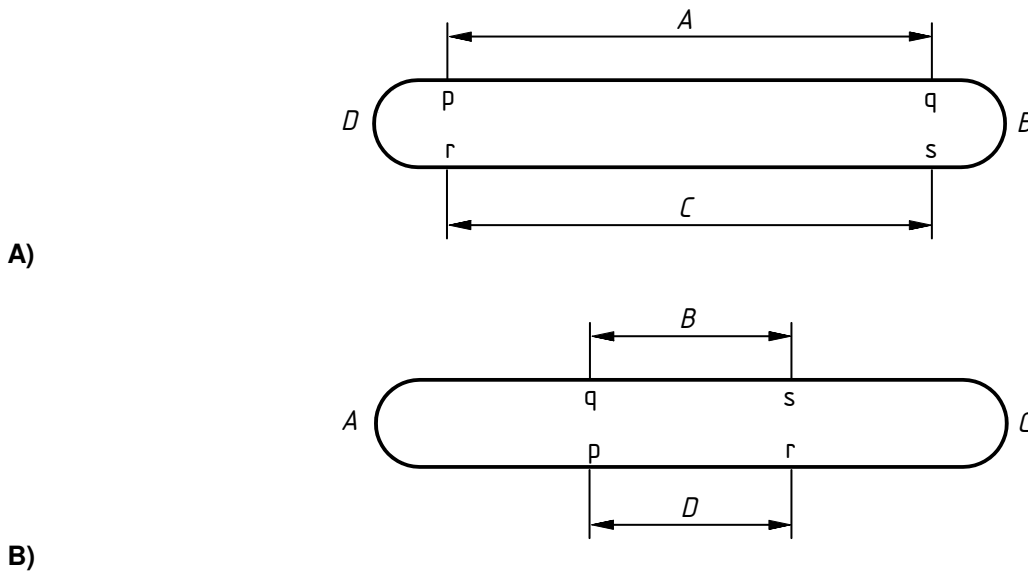


Figure B.1 — Method of measuring length (circumference) of a grommet .

## B.2 Method of calculating the required length

The length of a grommet (see figure B.2) can be specified in the following ways depending on the required accuracy.

If the bending radii are known the following calculation can be done:

The length of the centreline around the bending radius is:

$$\pi \left( R_2 + \frac{d}{2} \right) \text{ and } \pi \left( R_3 + \frac{d}{2} \right)$$

where  $d$  is the nominal diameter of the sling

The total length of the centreline ( $L_4$ ) will be:

$$\pi (R_2 + R_3 + d) + 2L_1$$

$$\text{given that : } L_2 = L_1 + R_2 + R_3$$

where  $L_2$  is the bearing length;

the length of the centreline ( $L_4$ ) can be defined as:

$$\pi (R_2 + R_3 + d) + 2(L_2 - R_2 - R_3)$$

NOTE 1

$$L_3 = L_2 + d$$

$$L_1 = L_2 - (R_2 + R_3)$$

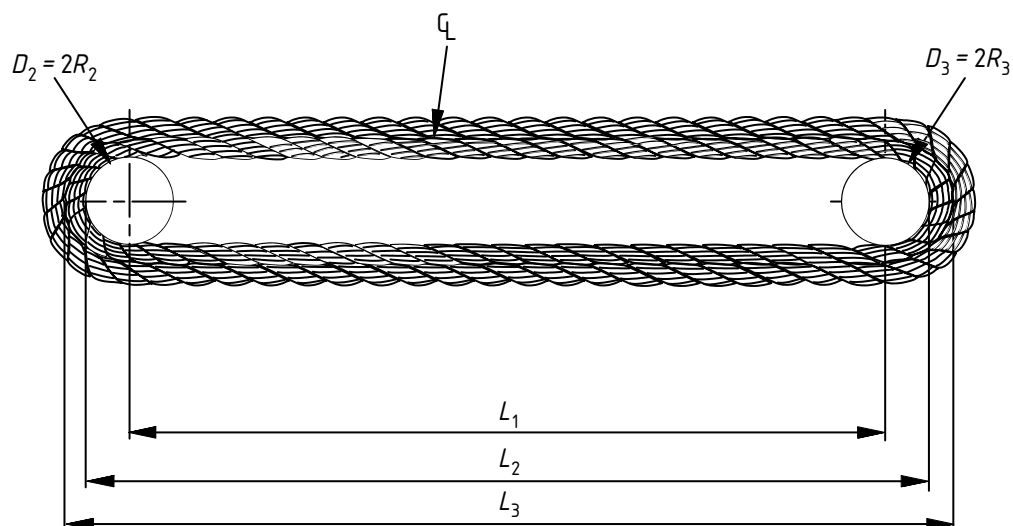


Figure B.2 — Length of a grommet.

**Annex C**  
**(normative)**  
**Pin sizes for measurements of lengths**

The diameters of pins used in measurements of actual lengths shall either be in accordance with table C.1 or as agreed between supplier and purchaser

**Table C.1 — Pin diameters for length measurements**

| <b>Rope diameter</b><br>mm | <b>Pin diameter</b><br>mm |
|----------------------------|---------------------------|
| 60 to 150                  | 300                       |
| 151 to 250                 | 500                       |
| 251 to 375                 | 750                       |
| 376 to 500                 | 1000                      |



## Annex D (normative) Hand splices

Hand splices shall be made by either of the following methods.

- a) A cross tuck splice which consists of at least five tucks (not including the start) consisting of at least three tucks with the complete outer unit ropes. These tucks shall be over one and under two against the lay of the rope, except that the first tuck only of any one unit rope may be with the lay.
- b) At least six tucks (not including the start) consisting of five tucks with the complete outer unit rope with the lay of the rope, and one tuck with the complete outer unit rope against the lay of the rope. The sixth tuck shall be made with one half of the strands from the outer unit ropes or with half of the outer unit ropes. All tucks shall be over one and under two.

The core shall be split and shall be worked in with the splice and not cut out. A length of tail at least three times the diameter of the cable-laid rope shall be left after the last tuck and seized to the main body of the rope.

The minimum length between the last tucks of the splices shall, in all cases, be at least  $15d$ , where  $d$  is the nominal diameter of the cable-laid rope forming the sling. If the sling body is to be doubled, then this minimum length shall be agreed by the interested parties but not be less than  $20d$ .

## Annex E (normative) Certificate for grommets

A certificate shall be supplied with each grommet or batch of grommets. This shall identify the grommet(s) with the certificate and include a statement that the grommet conforms to this European standard.

The certificate shall contain at least the following information.

- a) Name and address of maker or supplier of grommet .
- b) Identification number of grommet .
- c) WLL
- d) Nominal diameter.
- e) Direction of lay of grommet.
- f) Nominal mass of grommet.
- g) Nominal length or circumference.
- h) Description of the grommet including all components parts.
  - i) Nominal length ( $L$ ) (circumference may be used)
  - j) Actual length ( $AL$ ) (circumference may be used)
- k) Actual diameter ( $D$ )
  - l) Eye length ( $E1$ )
- m) Eye length ( $E2$ )
- n) Pin diameter ( $PD$ ) (if specified by purchaser)
- o) Measuring load (if specified by purchaser)

## Annex F (normative) Certificate for cable-laid slings



A certificate shall be supplied with each sling or batch of slings. This shall identify the sling(s) with the certificate and include a statement that the sling conforms to this European standard.

The certificate shall contain at least the following information.

- a) Name and address of maker or supplier of sling
- b) Identification number of sling
- c) WLL
- d) Nominal diameter
- e) Direction of lay of sling
- f) Nominal mass of sling
- g) Nominal length or circumference
- h) Description of the sling including all components parts
- i) Nominal length ( $L$ )
- j) Actual length (AL). (State whether under load or no load)
- k) Actual diameter ( $D$ )
- l) Eye length ( $E1$ )
- m) Eye length ( $E2$ )
- n) Approximate splice length from beginning of eye to last tuck ( $S1$ )
- o) Approximate splice length from beginning of eye to last tuck ( $S2$ )
- p) Tail length (TL1 and TL2)
- q) Length between last tucks (LS)
- r) Pin diameter (PD) (if specified by purchaser)
- s) Measuring load (if specified by purchaser)

## Annex G (informative) Tables of working load limits

**Table G.1 — Working load limits for cable-laid endless slings (grommets) made of wire ropes with steel core of classes 6x19 and 6x36**

| Angle to vertical     | Endless sling (Grommet)   |  |
|-----------------------|---|--|
|                       | 0°<br>direct  | 0°<br>choke hitch  |
| Nominal rope diameter |  |  |
| mm                    | t   | t  |
| <b>24</b>             | 9,00  | 7,00   |
| <b>27</b>             | 11,5  | 9,00   |
| <b>30</b>             | 14,0  | 11,0   |
| <b>33</b>             | 17,0  | 13,5   |
| <b>36</b>             | 20,0  | 16,0   |
| <b>39</b>             | 23,5  | 19,0   |
| <b>42</b>             | 27,0  | 21,5   |
| <b>48</b>             | 35,5  | 28,5   |
| <b>54</b>             | 45,0  | 36,0   |
| <b>60</b>             | 55,5  | 44,5   |
| calculation factors   | 2   | 1,6  |

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**Table G.2 — Working load limits for cable-laid endless slings (grommets) made of wire ropes with steel core of class 6x36**





|                           | <b>Endless sling (Grommet)</b>  |   |
|---------------------------|---|---|
| Angle to vertical         | 0°  | 0°  |
|                           | direct  | choke hitch   |
| Working load limits (WLL) |   |   |
| Nominal rope diameter     |  |  |
| mm                        | t   | t   |
| <b>66</b>                 | 69,0  | 55,0  |
| <b>72</b>                 | 84,0  | 68,0  |
| <b>78</b>                 | 102   | 81,0  |
| <b>84</b>                 | 121   | 97,0  |
| <b>90</b>                 | 144   | 115   |
| <b>96</b>                 | 168   | 135   |
| <b>102</b>                | 196   | 157   |
| <b>108</b>                | 227   | 182   |
| <b>114</b>                | 262   | 210   |
| <b>120</b>                | 300   | 240   |
| <b>126</b>                | 344   | 275   |
| <b>132</b>                | 392   | 314   |
| <b>144</b>                | 505   | 404   |
| calculation factors       | 2   | 1,6   |

Table G.3 — Working load limits for cable-laid endless slings (grommets) made of wire ropes with steel core of class 6x36

|                           | Endless sling (Grommet)   |  |
|---------------------------|---|--|
| Angle to vertical         | 0°  | 0°   |
|                           | direct  | choke hitch  |
| Working load limits (WLL) |   |  |
| Nominal rope diameter     |  |  |
| mm                        | t   | t  |
| <b>156</b>                | 700   | -  |
| <b>162</b>                | 750   | -  |
| <b>168</b>                | 800   | -  |
| <b>174</b>                | 850   | -  |
| <b>180</b>                | 900   | -  |
| <b>192</b>                | 1 000   | -  |
| <b>216</b>                | 1 250   | -  |
| <b>240</b>                | 1 500   | -  |
| <b>258</b>                | 1 750   | -  |
| <b>282</b>                | 2 000   | -  |
| <b>300</b>                | 2 250   | -  |
| <b>318</b>                | 2 500   | -  |
| <b>354</b>                | 3 000   | -  |
| <b>384</b>                | 3 500   | -  |
| <b>414</b>                | 4 000   | -  |
| <b>444</b>                | 4 500   | -  |
| <b>474</b>                | 5 000   | -  |
| <b>504</b>                | 5 500   | -  |
| <b>528</b>                | 6 000   | -  |
| <b>552</b>                | 6 500   | -  |
| <b>576</b>                | 7 000   | -  |
| <b>600</b>                | 7 500   | -  |
| <b>624</b>                | 8 000   | -  |
| <b>648</b>                | 8 500   | -  |
| <b>672</b>                | 9 000   | -  |
| <b>696</b>                | 9 500   | -  |
| calculation factors       | 2   | 1,6  |

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**Table G.4 — Working load limits for cable-laid endless slings (grommets) made of wire ropes with fibre core of classes 6 x 19 and 6 x 36**




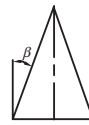


|                           | Endless sling (Grommet)   |   |
|---------------------------|---|---|
| Angle to vertical         | 0°  | 0°  |
|                           | direct  | choke hitch   |
| Working load limits (WLL) |   |   |
| Nominal rope diameter     |  |  |
| mm                        | t   | t   |
| <b>24</b>                 | 8,25  | 6,50  |
| <b>27</b>                 | 10,5  | 8,50  |
| <b>30</b>                 | 11,5  | 9,00  |
| <b>33</b>                 | 14,0  | 11,0  |
| <b>36</b>                 | 16,5  | 13,0  |
| <b>39</b>                 | 19,5  | 15,5  |
| <b>42</b>                 | 22,5  | 18,0  |
| <b>48</b>                 | 30,0  | 23,5  |
| <b>54</b>                 | 37,5  | 30,0  |
| <b>60</b>                 | 46,0  | 37,0  |
| calculation factors       | 2   | 1,6   |

Table G.5 — Working load limits for cable-laid slings made of wire ropes with steel core of classes 6 x 19 and 6 x 36 with ferrule secured eye terminations

|                           | One-leg sling   | Two-legsling  |        | Three- and four-legsling  |        | Endless sling   |
|---------------------------|---|---|--------|---|--------|---|
| Angle to vertical         | 0°  | 0° up to 45°  | 0°     | 0° up to 45°  | 0°     | 0°  |
|                           | direct  | direct  | direct | direct  | direct | choke hitch   |
| Working load limits (WLL) |   |   |        |   |        |   |
| Nominal rope diameter     |  |  |        |  |        |  |
| mm                        | t   | t   | t      | t   | t      | t   |
| <b>24</b>                 | 3,75  | 5,25  | 3,75   | 8,00  | 5,50   | 6,00  |
| <b>27</b>                 | 4,75  | 6,65  | 4,75   | 10,0  | 7,00   | 7,50  |
| <b>30</b>                 | 6,50  | 9,00  | 6,50   | 13,0  | 9,50   | 10,0  |
| <b>33</b>                 | 7,50  | 10,5  | 7,50   | 16,0  | 11,5   | 12,0  |
| <b>36</b>                 | 9,00  | 12,5  | 9,00   | 19,0  | 13,5   | 14,5  |
| <b>39</b>                 | 10,5  | 15,0  | 10,5   | 22,5  | 16,0   | 17,0  |
| <b>42</b>                 | 12,5  | 17,5  | 12,5   | 25,0  | 18,5   | 20,0  |
| <b>48</b>                 | 16,0  | 22,5  | 16,0   | 34,0  | 24,0   | 26,0  |
| <b>54</b>                 | 20,5  | 28,5  | 20,5   | 43,0  | 30,5   | 32,5  |
| <b>60</b>                 | 25,0  | 35,5  | 25,0   | 53,0  | 38,0   | 40,0  |
| calculation factors       | 1   | 1,4   | 1      | 2,1   | 1,5    | 1,6   |

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**Table G.6 — Working load limits for cable-laid slings made of wire ropes with steel core of classes 6 x 19 and 6 x 36 with spliced eye terminations**







| Angle to vertical         | One-leg sling   |   |
|---------------------------|---|---|
|                           | 0°  | 0°  |
|                           | direct  | choke hitch   |
| Working load limits (WLL) |   |   |
| Nominal rope diameter     |  |  |
| mm                        | t   | t   |
| <b>24</b>                 | 3,35  | 2,65  |
| <b>27</b>                 | 4,25  | 3,50  |
| <b>30</b>                 | 5,50  | 4,50  |
| <b>33</b>                 | 7,00  | 5,50  |
| <b>36</b>                 | 8,00  | 6,50  |
| <b>39</b>                 | 9,50  | 7,50  |
| <b>42</b>                 | 11,0  | 9,00  |
| <b>48</b>                 | 14,5  | 11,5  |
| <b>54</b>                 | 18,0  | 14,5  |
| <b>60</b>                 | 22,5  | 18,0  |
| calculation factors       | 1   | 0,8   |

Table G.7 — Working load limits for cable-laid slings made of wire ropes with steel core of class 6x36 with spliced eye terminations

|                           | One-leg sling   |  |
|---------------------------|---|--|
| Angle to vertical         | 0°  | 0°   |
|                           | direct  | choke hitch  |
| Working load limits (WLL) |   |  |
| Nominal rope diameter     |  |  |
| mm                        | t   | t  |
| <b>66</b>                 | 28,0  | 22,0   |
| <b>72</b>                 | 34,0  | 27,0   |
| <b>78</b>                 | 41,0  | 33,0   |
| <b>84</b>                 | 49,0  | 39,0   |
| <b>90</b>                 | 58,0  | 47,0   |
| <b>96</b>                 | 68,0  | 55,0   |
| <b>102</b>                | 79,0  | 64,0   |
| <b>108</b>                | 92,0  | 74,0   |
| <b>114</b>                | 106   | 85,0   |
| <b>120</b>                | 122   | 97,0   |
| <b>126</b>                | 139   | 111  |
| <b>132</b>                | 158   | 127  |
| <b>144</b>                | 204   | 163  |
| calculation factors       | 1   | 0,8  |

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**Table G.8 — Working load limits for cable-laid slings made of wire ropes with steel core of class 6x36 with spliced eye terminations**

| Angle to vertical         | One-leg sling   |   |
|---------------------------|---|---|
|                           | 0°  | 0°  |
|                           | direct  | choke hitch   |
| Working load limits (WLL) |   |   |
| Nominal rope diameter     |  |  |
| mm                        | t   | t   |
| 150                       | 230   | 185   |
| 156                       | 250   | 200   |
| 162                       | 270   | 220   |
| 168                       | 290   | 235   |
| 174                       | 315   | 250   |
| 180                       | 335   | 270   |
| 192                       | 410   | 330   |
| 204                       | 460   | 365   |
| 216                       | 510   | 405   |
| 228                       | 555   | 445   |
| 240                       | 610   | 490   |
| 252                       | 665   | 530   |
| 264                       | 720   | 580   |
| 276                       | 780   | 625   |
| 288                       | 840   | 675   |
| 300                       | 900   | 725   |
| 312                       | 970   | 775   |
| 336                       | 1 100   | 885   |
| 360                       | 1 250   | 1 000   |
| 384                       | 1 400   | 1 100   |
| 408                       | 1 550   | 1 250   |
| 432                       | 1 700   | 1 400   |
| 456                       | 1 880   | 1 500   |
| 480                       | 2 050   | 1 650   |
| 504                       | 2 250   | 1 800   |
| 528                       | 2 450   | 1 950   |
| 552                       | 2 600   | 2 100   |
| 576                       | 2 800   | 2 250   |
| 600                       | 3 000   | 2 400   |
| 624                       | 3 200   | 2 550   |
| 648                       | 3 400   | 2 750   |
| 672                       | 3 650   | 2 900   |
| 696                       | 3 850   | 3 100   |
| calculation factors       | 1   | 0,8   |

**Annex ZA**  
**(informative)**  
**Relationship of this European Standard with EU Directives**

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports the essential requirements of EU Directives :

Machinery Directive 98/37/EC, amended by Directive 98/79/EC.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned.

**WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.**



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