

**Eurokoodeks 3:  
Teraskonstruksioonide  
projekteerimine. Osa 1-11: Tõmbele  
töötavate elementidega  
konstruktsioonide projekteerimine.**

Eurocode 3 - Design of steel structures - Part 1-11:  
Design of structures with tension components

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 1993-1-11:2006 sisaldab Euroopa standardi EN 1993-1-11: 2006 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 24.11.2006 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 1993-1-11:2006 consists of the English text of the European standard EN 1993-1-11: 2006.</p> <p>This document is endorsed on 24.11.2006 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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<p><b>Käsitlusala:</b> prEN1993-1-11 annab reeglid selliste tõmbele töötavate elementidega teraskonstruktsioonide projekteerimiseks, kus elementide ühendusviis konstruktsiooniga võimaldab kohandamist ja asendamist.</p>	<p><b>Scope:</b> prEN1993-1-11 gives design rules for structures with tension components made of steel, which, due to their connections with the structure, are adjustable and replaceable.</p>
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## Eurocode 3 - Design of steel structures - Part 1-11: Design of structures with tension components

Eurocode 3 - Calcul des structures en acier - Partie 1-11:  
Calcul des structures à câbles ou éléments tendus

Eurocode 3 - Bemessung und Konstruktion von  
Stahlbauten - Teil 1-11: Bemessung und Konstruktion von  
Tragwerken mit Zuggliedern aus Stahl

This European Standard was approved by CEN on 13 January 2006.

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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 Central Secretariat has the same status as the official versions.

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## Foreword

This European Standard EN 1993-1-11, Eurocode 3: Design of steel structures: Part 1-11 Design of structures with tension components, has been prepared by Technical Committee CEN/TC250 « Structural Eurocodes », the Secretariat of which is held by BSI. CEN/TC250 is responsible for all Structural Eurocodes.

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 2007 and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode partially supersedes ENV 1993-2.

According to the CEN-CENELEC Internal Regulations, the National Standard Organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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.

## National annex for EN 1993-1-11

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. The National Standard implementing EN 1993-1-11 should have a National Annex containing all Nationally Determined Parameters to be used for the design of tension components to be constructed in the relevant country.

National choice is allowed in EN 1993-1-11 through:

- 2.3.6(1)
- 2.3.6(2)
- 2.4.1(1)
- 3.1(1)
- 4.4(2)
- 4.5(4)
- 5.2(3)
- 5.3(2)
- 6.2(2)
- 6.3.2(1)
- 6.3.4(1)
- 6.4.1(1)P
- 7.2(2)
- A.4.5.1(1)
- A.4.5.2(1)
- B(6)

# 1 General

## 1.1 Scope

(1) prEN1993-1-11 gives design rules for structures with tension components made of steel, which, due to their connections with the structure, are adjustable and replaceable see Table 1.1.

**NOTE:** Due to the requirement of adjustability and replaceability such tension components are generally prefabricated products delivered to site and installed into the structure. Tension components that are not adjustable or replaceable, e.g. air spun cables of suspension bridges, or for externally post-tensioned bridges, are outside the scope of this part. However, rules of this standard may be applicable.

(2) This standard also gives rules for determining the technical requirements for prefabricated tension components for assessing their safety, serviceability and durability.

**Table 1.1: Groups of tension components**

Group	Main tension element	Component
A	rod (bar)	tension rod (bar) system, prestressing bar
B	circular wire	spiral strand rope
	circular and Z-wires	fully locked coil rope
	circular wire and stranded wire	strand rope
C	circular wire	parallel wire strand (PWS)
	circular wire	bundle of parallel wires
	seven wire (prestressing) strand	bundle of parallel strands

**NOTE 1:** Group A products in general have a single solid round cross section connected to end terminations by threads. They are mainly used as

- bracings for roofs, walls, girders
- stays for roof elements, pylons
- tensioning systems for steel-wooden truss and steel structures, space frames

**NOTE 2:** Group B products are composed of wires which are anchored in sockets or other end terminations and are fabricated primarily in the diameter range of 5 mm to 160 mm, see EN 12385-2.

Spiral strand ropes are mainly used as

- stay cables for aerials, smoke stacks, masts and bridges
- carrying cables and edge cables for light weight structures
- hangers or suspenders for suspension bridges
- stabilizing cables for cable nets and wood and steel trusses
- hand-rail cables for banisters, balconies, bridge rails and guardrails

Fully locked coil ropes are fabricated in the diameter range of 20 mm to 180 mm and are mainly used as

- stay cables, suspension cables and hangers for bridge construction
- suspension cables and stabilizing cables in cable trusses
- edge cables for cable nets
- stay cables for pylons, masts, aerials

Structural strand ropes are mainly used as

- stay cables for masts, aerials
- hangers for suspension bridges
- damper / spacer tie cables between stay cables
- edge cables for fabric membranes
- rail cables for banister, balcony, bridge and guide rails.

**NOTE 3:** Group C products need individual or collective anchoring and appropriate protection.

Bundles of parallel wires are mainly used as stay cables, main cables for suspension bridges and external tendons.

Bundles of parallel strands are mainly used as stay cables for composite and steel bridges.

(4) The types of termination dealt with in this part for Group B and C products are

- metal and resin sockets, see EN 13411-4
- sockets with cement grout
- ferrules and ferrule securing, see EN 13411-3
- swaged sockets and swaged fitting
- U-bolt wire rope grips, see EN 13411-5
- anchoring for bundles with wedges, cold formed button heads for wires and nuts for bars.

**NOTE:** For terminology see Annex C.

## 1.2 Normative references

(1) This European Standard incorporates dated and undated reference to 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 or revisions to 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 10138 *Prestressing steels*

*Part 1 General requirements*

*Part 2 Wires*

*Part 3 Strands*

*Part 4 Bars*

EN 10244 *Steel wire and wire products – Non-ferrous metallic coatings on steel wire*

*Part 1 General requirements*

*Part 2 Zinc and zinc alloy coatings*

*Part 3 Aluminium coatings*

EN 10264 *Steel wire and wire products – Steel wire for ropes*

*Part 1 General requirements*

*Part 2 Cold drawn non-alloyed steel wire for ropes for general applications*

*Part 3 Cold drawn and cold profiled non alloyed steel wire for high tensile applications*

*Part 4 Stainless steel wires*

EN 12385 *Steel wire ropes – safety*

*Part 1 General requirements*

*Part 2 Definitions, designation and classification*

*Part 3 Information for use and maintenance*

*Part 4 Stranded ropes for general lifting applications*

*Part 10 Spiral ropes for general structural applications*

EN 13411 *Terminations for steel wire ropes – safety*

*Part 3 Ferrules and ferrule-securing*

*Part 4 Metal and resin socketing*

*Part 5 U-bolt wire rope grips*

### 1.3 Terms and definitions

(1) For the purpose of this European Standard the following terms and definitions apply.

#### 1.3.1

##### **strand**

an element of rope normally consisting of an assembly of wires of appropriate shape and dimensions laid helically in the same or opposite direction in one or more layers around a centre

#### 1.3.2

##### **strand rope**

an assembly of several strands laid helically in one or more layers around a core (single layer rope) or centre (rotation-resistant or parallel-closed rope)

#### 1.3.3

##### **spiral rope**

an assembly of a minimum of two layers of wires laid helically over a central wire

#### 1.3.4

##### **spiral strand rope**

spiral rope comprising only round wires

#### 1.3.5

##### **fully locked coil rope**

spiral rope having an outer layer of fully locked Z-shaped wires

#### 1.3.6

##### **fill factor $f$**

the ratio of the sum of the nominal metallic cross-sectional areas of all the wires in a rope ( $A$ ) and the circumscribed area ( $A_0$ ) of the rope based on its nominal diameter ( $d$ )

#### 1.3.7

##### **spinning loss factor $k$**

reduction factor for rope construction included in the breaking force factor  $K$

#### 1.3.8

##### **breaking force factor ( $K$ )**

an empirical factor used in the determination of minimum breaking force of a rope and obtained as follows:

$$K = \frac{\pi f k}{4}$$

where  $f$  is the fill factor for the rope

$k$  is the spinning loss factor

**NOTE:**  $K$ -factors for the more common rope classes and constructions are given in the appropriate part of EN 12385.