SLOVENSKI STANDARD

SIST EN 12930:2005

01-januar-2005

Varnostne zahteve za ģiļ niġke naprave za prevoz oseb ï Izraļ uni

Safety requirements for cableway installations designed to carry persons - Calculations

Sicherheitsanforderungen für Seilbahnen für den Personenverkehr - Berechnungen

Prescriptions de sécurité pour les installations a câbles transportant des personnes - Calculs

Ta slovenski standard je istoveten z: **EN 12930:2004**

ICS:

45.100 Oprema za ģiļ nice Cableway equipment

SIST EN 12930:2005 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12930

October 2004

ICS 45.100

English version

Safety requirements for cableway installations designed to carry persons - Calculations

Prescriptions de sécurité pour les installations à câbles transportant des personnes - Calculs

Sicherheitsanforderungen für Seilbahnen für den Personenverkehr - Berechnungen

This European Standard was approved by CEN on 23 August 2004.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 12930:2004: E

Contents

Page

Foreword

This document (EN 12930:2004) has been prepared by Technical Committee CEN/TC 242 “Safety requirements for passenger transportation by rope”, the secretariat of which is held by AFNOR.

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 2005, and conflicting national standards shall be withdrawn at the latest by April 2005.

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.

This document forms part of the standards programme approved by the CEN Technical Board on safety requirements for cableway installations designed to carry persons.

This programme contains the following standards:

1) Safety requirements for cableway installations designed to carry persons — Terminology
2) Safety requirements for cableway installations designed to carry persons — General requirements
3) Safety requirements for cableway installations designed to carry persons — Calculations
4) Safety requirements for cableway installations designed to carry persons — Ropes
5) Safety requirements for cableway installations designed to carry persons — Tension devices
6) Safety requirements for cableway installations designed to carry persons — Drive systems and other mechanical equipment
7) Safety requirements for cableway installations designed to carry persons — Carriers
8) Safety requirements for cableway installations designed to carry persons — Electrical equipment other than for drive systems
9) Safety requirements for cableway installations designed to carry persons — Civil engineering works
10) Safety requirements for cableway installations designed to carry persons — Pre-commissioning inspection, maintenance and operational checks
11) Safety requirements for cableway installations designed to carry persons — Evacuation and rescue
12) Safety requirements for cableway installations designed to carry persons — Operation
13) Safety requirements for cableway installations designed to carry persons — Quality assurance

This series of standards forms a complete set with regard to the design, production, installation, maintenance and operation of any cableway installation designed to carry persons.

With regard to ski-tows, the text of this document is based on the work of the International Ropeway Organization (OITAF).

According to the CEN/CENELEC Internal Regulations, the national standards 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, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This document specifies the general safety requirements applicable to the calculations for cableway installations designed to carry persons. This document is applicable to the various types of installations and takes into account their environment.

This document contains:

— general requirements for calculations and their presentation;

— general requirements relating to the actions to be taken into account in the calculation of components as a basis for the requirements of the standards EN 13223, EN 13107, EN 12927 (Parts 1 to 6) and EN 1908;

— requirements relating to verification of ropes by calculation;

— requirements relating to the determination of the drive power;

— requirements for the actions of the ropes and carriers on the support structures and for the deformations of these support structures.

This document does not apply to installations for the transportation of goods nor to inclined lifts.

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.

EN 1709, *Safety requirements for cableway installations designed to carry persons — Pre-commissioning inspection, maintenance, operational inspections and checks.*

prEN 1907:2004, *Safety requirements for cableway installations designed to carry persons — Terminology.*

EN 1908, *Safety requirements for cableway installations designed to carry persons — Tension devices.*

EN 1909, *Safety requirements for cableway installations designed to carry persons — Recovery and evacuation.*

ENV 1991-1, *Eurocode 1 — Basis of design and actions on structures — Part 1: Basis of design.*

ENV 1991-2-1, *Eurocode 1 — Basis of design and actions on structures — Actions on structures — Part 2-1: Densities, self-weight and imposed loads.*

ENV 1991-2-4, *Eurocode 1 — Basis of design and actions on structures — Actions on structures — Part 2-4: Wind loads.*

EN 12397, *Safety requirements for cableway installations designed to carry persons — Operation.*

EN 12408, *Safety requirements for cableway installations designed to carry persons — Quality assurance.*

EN 12927-1, *Safety requirements for passenger transportation by rope — Ropes — Part 1: Selection criteria for ropes and their end fixings.*

EN 12927-2, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 2 : Safety factors.*

EN 12927-3, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 3 : Long splicing of 6 strand hauling, carrying-hauling and towing ropes.*

EN 12927-4, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 4 : End fixings.*

EN 12927-5, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 5 : Storage, transportation, handling and tensioning.*

EN 12927-6, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 6 : Discard criteria.*

EN 12927-7, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 7 : Inspection, repair and maintenance.*

EN 12927-8, *Safety requirements for cableway installations designed to carry persons — Ropes — Part 8 : Magnetic rope testing (MRT).*

EN 12929-1, *Safety requirements for cableway installations designed to carry persons — General requirements — Part 1 : Requirements for all installations.*

EN 12929-2, *Safety requirements for cableway installations designed to carry persons — General requirements — Part 2 : Additional requirements for jig back bicable aerial ropeways without carrier truck brakes.*

EN 13107, *Safety requirements for cableway installations designed to carry persons — Civil engineering works.*

EN 13223, *Safety requirements for cableway installations designed to carry persons — Drive systems and other mechanical equipment.*

EN 13243, *Safety requirements for cableway installations designed to carry persons — Electrical equipment other than for drive systems.*

prEN 13796-1, *Safety requirements for cableway installations designed to carry persons — Carriers — Part 1 : Grips, carrier trucks, on-board brakes, cabins, chairs, carriages, maintenance carriers, tow-hangers.*

prEN 13796-2, *Safety requirements for cableway installations designed to carry persons — Carriers — Part 2 : Slipping resistance tests for grips.*

prEN 13796-3, *Safety requirements for cableway installations designed to carry persons — Carriers — Part 3 : Fatigue testing.*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 1907:2004 and the following apply.

3.1
rope calculation
calculation of required dimensions for ropes on the basis of the tension forces determined from the calculation of the longitudinal profile

3.2
calculation of longitudinal profile
calculation to determine the tension forces in the rope and their actions on the rope supports and rope anchorages

3.3
empty rope
track rope or carrying-hauling rope without carriers

3.4
unloaded rope
track rope or carrying-hauling rope only carrying empty carriers at the required carrier pitch

3.5
loaded rope
track rope or carrying-hauling rope carrying fully laden carriers at the required carrier pitch

3.6
curvature ratio
ratio between either the pitch diameter of the sheave (*D*) and the nominal diameter of the rope (*d*) or the pitch radius of the shoe, saddle or roller chain (*R*) and the nominal diameter of the rope

3.7
angle of deflection of rope
angle through which a rope is deflected, measured between the tangent to the rope at the start of the deflection and the tangent to the rope at the end of the deflection in the same plane as the deflected rope

3.8
tensile safety factor
ratio between the minimum breaking load of the rope and the calculated tension force in the rope

3.9
safety component
any basic component, set of components, subassembly or complete assembly of equipment and any device incorporated in the installation for the purpose of ensuring a safety function and identified by the safety analysis, the failure of which endangers the safety or health of persons, be they users, operating personnel or third parties

4 Symbols and abbreviations

Symbols and abbreviations are explained with the formula to which they apply throughout this document.

5 General requirements

5.1 Application of the standard

The requirements of this document apply to all installations along with those of EN 1709, EN 1908, EN 1909, EN 12397, EN 12408, EN 12927-1, EN 12927-2, EN 12927-3, EN 12927-4, EN 12927-5, EN 12927-6, EN 12927-7, EN 12927-8, EN 12929-1, EN 12929-2, EN 13107, EN 13223, EN 13243, prEN 13796-1, prEN 13796-2, prEN 13796-3.

5.2 Safety principles

5.2.1 General

The safety principles set out in EN 12929-1 apply.

In addition, the following hazard scenarios and safety requirements relative to the scope of this document are to be taken into consideration:

5.2.2 Hazard scenarios

The following events may lead to hazardous situations, which may be avoided or limited by the requirements of this document:

a) lack of or poor assessment of the actions on the individual components of the installation;

b) use of inappropriate calculation methods or formulae;

c) lack of or inadequate consideration of dynamic effects and fatigue effects on individual components;

d) lack of or incorrect assessment of the most unfavourable combinations of actions when dimensioning and carrying out calculations;

e) erroneous assumptions in the calculations.

5.2.3 Safety measures

This document contains the necessary measures to avoid the hazard scenarios listed in 5.2.2 when carrying out verification by calculation and when designing the complete installation as well as individual components, in particular when calculating the longitudinal profile and the rope.

6 General requirements for calculations

6.1 General comments

The calculations to be submitted shall demonstrate that the safety requirements for cableways defined in this document and those in the other standards listed in 5.1 are fulfilled. In doing so, the anticipated operating conditions of the installation shall be taken into account.

The safety components of the installation shall be verified by calculations, where necessary with respect to static stresses, fatigue stresses, stability and suitability for use.

6.2 Calculation methods

Apart from generally recognised methods, all methods used in the calculations shall either be indicated directly or be explained by precise bibliographic references.

Methods of approximation and calculation models shall be conservative.

The following shall always apply:

a) in any calculation of a mechanical system, structure or component, it shall be clear from the documentation what the magnitudes and directions of the actions are assumed to be and which cross-sections have been examined ;

b) the calculations shall be made taking into account the combinations of actions set out in the standards and other specifications. Details of these can be obtained from the relevant standards. Should such information not be available, the most unfavourable loading conditions shall be used as a basis and both the directions and magnitudes of the actions and their combinations shall be specified.

6.3 Presentation of calculations

The calculation documents shall be clear and perfectly comprehensible without any additional information. Their origin and date of production shall be stated.

The results of computer calculations shall be accompanied by a sheet on which the calculation model, the methods employed and the assumptions are described. Symbols and abbreviations used shall be explained. The version of the computer program used shall be stated. Input values and output values (results) shall be related to each other.

6.4 Verification by tests

Verification by tests alone is only permissible if this document or other standards contain no indications concerning the calculation and calculation in accordance with recognised methods is not possible.

In exceptional cases, e.g. complex components or dynamic actions, additional verification by tests may be required to supplement calculations in order to verify the characteristics of safety components. The test programme and methods shall produce test conditions which are as close as possible to actual service conditions.

6.5 Actions

6.5.1 General

The following groups of actions are taken into account in the calculations:

— self weight and weight of load;

— dynamic actions;

— actions resulting from tension forces in the ropes;

— actions due to climatic conditions;

— other actions (e.g. due to avalanches, earthquakes, installation conditions, etc.).

The combinations of actions applicable to each component are specified in the standards EN 1908, EN 13223, EN 13107 and prEN 13796-1.

6.5.2 The self-weight of components shall be assessed in accordance with ENV 1991-2-1 or, if no standard applies, according to information from the supplier.

With regard to the mass of a person to be adopted for the calculation of the longitudinal profile, 7.2.1 b) shall apply.

With regard to the mass of a person to be adopted for dimensioning the carriers, see prEN 13796-1.

6.5.3 The actions from the ropes shall be calculated in accordance with clause 7. For the dimensioning of structures, clause 10 and ENV 1991-2-1 apply.

6.5.4 Actions due to wind are defined by the resultant wind force F_W in accordance with the following provisions: