



SLOVENSKI STANDARD

SIST EN 13223:2005

01-januar-2005

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Safety requirements for cableway installations designed to carry persons - Drive systems and other mechanical equipment

Sicherheitsanforderungen für Seilbahnen für den Personenverkehr - Antriebe und weitere mechanische Einrichtungen

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Prescriptions de sécurité pour les installations à câbles transportant des personnes - Entraînements et autres dispositifs mécaniques

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Ta slovenski standard je istoveten z: EN 13223:2004

ICS:

45.100 U] i^{ æ á ã } æ^ Cableway equipment

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ICS 45.100

English version

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Sicherheitsanforderungen für Seilbahnen für den Personenverkehr - Antriebe und weitere mechanische Einrichtungen

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

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Foreword

This document (EN 13223:2004) 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of an identical text or by endorsement, at the latest by April 2005, and conflicting national standards shall be withdrawn at the latest by April 2005.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 contains a bibliography.

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 comprises 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 - Tensioning devices.
- 6) Safety requirements for cableway installations designed to carry persons – Drive systems and other mechanical devices.
- 7) Safety requirements for cableway installations designed to carry persons – Carriers.
- 8) Safety requirements for cableway installations designed to carry persons – Electrical installations apart from 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 inspection and checks.
- 11) Safety requirements for cableway installations designed to carry persons – Recovery and evacuation.
- 12) Safety requirements for cableway installations designed to carry persons – Operation.
- 13) Safety requirements for cableway installations designed to carry persons - Quality assurance.

Together these form a series of standards regarding design, production, maintenance and operation of all installations for cableway installations designed to carry persons.

In respect of ski-tows, the drafting of this document has been guided by the works of the International Organisation for transportation by rope (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.

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1 Scope

This document specifies safety requirements for the mechanical and electrical devices of the drive system and other mechanical devices for cableway installations designed to carry persons. This standard is applicable to the various types of installations and takes into account their environment.

This document applies to the design, production, installation, maintenance and operation of the mechanical and electrical devices of the drive system and other mechanical devices for cableway installations designed to carry persons.

It includes requirements relating to the prevention of accidents and protection for workers.

It does not apply to installations for the transportation of goods, nor to inclined lifts.

Clauses 6 to 11 apply to the mechanical and electrical devices of the drive system.

Clauses 12 to 20 apply to other mechanical devices.

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 288, *Specification and approval of welding procedures for metallic materials.*

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

prEN 1907:2004, *Safety requirements for passenger transportation by rope – Terminology.*

EN 1908:2004, *Safety requirements for cableway installations designed to carry persons - Tensioning devices.*

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

ENV 1993-1-1, *Eurocode 3: Design of steel structures – Part 1-1: General – General rules and rules for buildings.*

EN 10025, *Hot-rolled products of non alloy structural steels - Technical delivery conditions.*

EN 10083, *Quenched and tempered steels.*

EN 10204, *Metallic materials - Types of inspection documents.*

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 cableway installations designed to carry persons - 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.*

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

EN 12927-5, *Safety requirements for cableway installations designed to carry persons - Ropes - Part 5: Storage, transportation, installation 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: Calculation, repair and maintenance.*

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

EN 12929-1:2004, *Safety requirements for cableway installations designed to carry persons - General requirements - Part 1: Requirements applicable to all installations.*

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

EN 12930, *Safety requirements for cableway installations designed to carry persons – Calculations.*

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

EN 13243:2004, *Safety requirements for cableway installations designed to carry persons - Electrical installations apart from 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 testings.*

EN 20898, *Mechanical properties of fasteners.*

EN ISO 5817, *Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817:2003).*

ISO 185, *Grey cast iron – Classification.*

ISO 1083, *Spheroidal graphite cast iron - Classification.*

ISO 6336, *Calculation of load capacity of spur and helical gears.*

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

service run

run during which no passengers are carried

NOTE The carriage of personnel and materials is permissible.

3.2

test run

a service run during which tests are carried out

3.3

control point

position from which the cableway can be controlled and stopped

NOTE The controls and indicators differ according to the type of cableway and the position of the control point.

3.4

control console

control point in the control room in the drive station from which all the modes of operation can be monitored

3.5

automatic operation

the whole journey is controlled automatically from the control console and under special conditions can be partly influenced from the control points

3.6

manual control

the whole journey is controlled only by the person at the control console

3.7

electrical stop

the bringing of the cableway to a standstill via the main drive motor or the auxiliary drive motor

3.8

emergency stop using service brake

process in which, after the appropriate safety circuits have been broken, the service brake is applied and the energy flow to the main or auxiliary motor is interrupted

3.9

emergency stop using safety brake

process in which, after one of the appropriate safety circuits has been broken or by mechanical tripping, the safety brake is applied and the energy flow to the main motor interrupted

3.10

braking force closed-loop control

process during the braking procedure in which the braking force is controlled by a closed loop in accordance with a preset deceleration value so that the cableway is brought to a stop under as constant a deceleration as possible

3.11

braking force setting

setting the braking force by the control system, based on the torque generated by the main drive motor immediately before the stop is initiated, where the braking force remains constant until the installation has come to rest

3.12

deceleration monitoring

monitoring the deceleration caused by stopping the cableway by means of the main motor or a mechanical brake

3.13

ready for operation

an installation is ready for operation when no safety function or emergency stopping device prevents departure

3.14

ready command

validation signal from control posts outside the drive station for starting up the cableway

3.15

normal stopping point

the normal stopping position of the carrier in the stations in cableways with reversible or pulsed movement operation

3.16

retraction distance

the distance of the carriage from the stopping point in the station when the other carriage at the opposite station has contacted the buffer

3.17

entry monitoring

monitoring of the speed in the station entry area

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3.18

position monitor checking

this comprises various checks of the position monitor as follows

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3.18.1

fixed point check

checks the information provided by the position monitor on the position of the carrier in relation to a fixed point on the line

3.18.2

synchronicity monitoring

monitors the information provided by one position monitor on the position of the carrier compared with a second position monitor

3.18.3

zero position check

check made to confirm that the position monitors are in the starting positions when the carriers are in the station

3.19

minimum speed

the minimum speed is a lower speed limit which, if fallen below, leads to the cableway being stopped

3.20**main carrier rail**

the structure on which carriers are moved in normal operation from the entrance to the exit of a station

3.21**shaft**

axle which transmits a turning moment

4 General requirements**4.1 Application of the standard**

The requirements of this document, together with those of EN 1709, EN 1908, EN 1909, EN 12397, EN 12408, EN 12927 (Parts 1 to 8), EN 12397, EN 12929 (Parts 1 and 2), EN 12930, EN 13107, EN 13243 and prEN 13796-1, prEN 13796-2, prEN 13796-3, apply to all cableway installations.

4.2 Safety principles

The safety principles formulated in EN 12929-1 apply.

For the electrical equipment of the drive system, the safety principles of EN 13243 are applicable.

In addition, the following hazard scenarios and safety measures apply for the scope of this document.

4.2.1 Hazard scenarios

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

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- a) derailment of ropes;
 - b) obstruction of the operating movement of ropes due to obstruction by mechanical devices or hooking over parts of the installation;
 - c) damage to or failure of drive and braking devices and support and guiding elements of ropes due to wear, heat, corrosion or fatigue;
 - d) failure of drive and braking devices and support and guiding elements of ropes and other mechanical devices in stations and on the line due to inadequate dimensioning;
 - e) reduction of the force transmission from the drive sheave to the haulage rope or carrying hauling rope;
 - f) reduction of the frictional force of the braking device;
 - g) hooking or falling of carriers at line support structures and in stations;
 - h) collision of carriers or between a carrier and an obstacle when entering into, exiting from and passing through stations;
 - i) faulty attachment or detachment of carriers with detachable grips;
 - j) excessive deceleration or acceleration of the haulage ropes and carrying hauling ropes and of the carriers;
 - k) exceeding the maximum permissible speed;

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- l) unintentional movement of the ropeway;
- m) hazards to persons in passageways and working areas, due to mechanical devices;
- n) inadmissible pitch between carriers;
- o) operation in unfavourable weather conditions (e.g. wind, frost, icing, rain);
- p) inappropriate behaviour on the part of persons (passengers, personnel, third parties).

4.2.2 Safety measures

Safety measures are required to avoid the hazard scenarios listed in 4.2.1.

The measures specified in this document are essentially construction-related and have the following aims:

- a) prevention of rope derailment;
- b) in the event of rope derailment: catching the rope, prevention of hooking or jamming the rope and bringing the installation to a standstill;
- c) prevention of derailment, falling, hooking and dangerous collision of carriers;
- d) prevention of failure of mechanical and hydraulic safety devices;
- e) detection of hazardous malfunctioning of detachable grips and bringing the carriers safely to a standstill;
- f) detection of inadmissible pitch between carriers and taking the required measures;
- g) prevention of insufficient or excessive deceleration and excessive acceleration of haulage and carrying hauling ropes and carriers;
- h) detection of exceeding of maximum permissible speed and bringing the ropeway to a standstill;
- i) detection of unintentional movement of the ropeway and taking the required measures;
- j) protection of persons against falling and against contact with moving parts;
- k) prevention of hazards to persons due to collision with carriers.

5 General requirements for hydraulic devices

The requirements of EN 1908 apply for hydraulic devices.

6 General requirements for drive systems

6.1 General principles

6.1.1 The general requirements of EN 12929-1 are to be taken into account in the design of devices in drive systems.

6.1.2 The drive system shall permit start-up and stopping several times consecutively.

6.1.3 The requirements for other electrical devices are contained in EN 13243.

6.2 Main drive system

6.2.1 The main drive system shall permit as smooth a start as possible and travel in either direction, regardless of load. It shall be designed for continuous operation with the most unfavourable loading condition and at the maximum permissible speed.

6.2.2 It shall be possible to start the installation with the main drive at an average acceleration of not less than $0,15 \text{ m/s}^2$ with the most unfavourable load. For aerial ropeways, an average acceleration of $0,5 \text{ m/s}^2$ and an instantaneous acceleration (average acceleration over $0,5 \text{ s}$) of $1,5 \text{ m/s}^2$ shall not be exceeded.

6.2.3 The speed shall be continuously adjustable over the whole range between the minimum speed and the maximum permissible speed. For test runs with no significant load, it shall be possible to maintain a speed of approximately $0,3 \text{ m/s}$ during the period required to travel the whole length of the line.

6.2.4 It shall be possible to maintain the predetermined speed accurately enough and keep it stable for all load conditions occurring during normal operation.

6.2.5 Deviations from the speed setpoint shall not exceed ± 5 percent.

6.2.6 If the cableway has to be brought to a stop, the power supply to the main motor shall be shut off automatically by two circuits (redundancy) of which at least one shall be galvanic. In the case of an emergency stop using service brake or an emergency stop using safety brake, the power supply shall be shut off immediately, otherwise it shall be shut off no later than the time when the installation comes to rest.

6.2.7 In the case of a multiple-motor drive, the motors shall be loaded in accordance with their power in every operating condition.

6.3 Auxiliary drive

6.3.1 The auxiliary drive shall ensure at least half the speed of the main drive. The auxiliary drive shall be capable of starting with an average acceleration of not less than $0,1 \text{ m/s}^2$ under the most unfavourable loading condition.

6.3.2 In addition, the others requirements of 6.2.1 shall be met.

6.4 Recovery drive and evacuation drive

6.4.1 The recovery drive is used only to recover the carriers (see EN 1909).

6.4.2 The recovery drive shall be designed to operate for three times the duration of the maximum required recovery time and for a travelling speed of not less than $0,5 \text{ m/s}$.

6.4.3 The recovery drive shall be provided with all safety devices which are required for safe recovery at the requisite speed.

6.4.4 For the recovery drive to remain capable of operation even in the case of failure of all safety devices, it shall be possible to bypass these in accordance with EN 13243.

6.4.5 The electrical devices of the emergency and evacuation drive shall be as simple as possible in construction. It shall be possible to ensure their operability in a simple manner.

6.4.6 The electrical equipment of these drives shall be separate from each other and from that of the main drive so that any interactions between the various drives are kept to a minimum.