BS EN 1908:2015

BSI Standards Publication

Safety requirements for cableway installations designed to carry persons — Tensioning devices

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National foreword

This British Standard is the UK implementation of EN 1908:2015. It supersedes BS EN 1908:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/20, Aerial ropeways.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Safety requirements of cableway installations designed to carry persons - Tensioning devices

Prescriptions de sécurité pour les installations à câbles transportant des personnes - Dispositifs de mise en tension

Sicherheitsanforderungen an Seilbahnen für den Personenverkehr - Spanneinrichtungen

This European Standard was approved by CEN on 18 November 2014.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 1908:2015) 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of an identical text or by endorsement, at the latest by January 2016, and any conflicting national standards shall be withdrawn at the latest by January 2016.

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

This document supersedes EN 1908:2004.

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 2000/9/EG.

For the relationship with EU Directive 2000/9/EG, see informative Annex ZA, which is an integral part of this document.

The main changes with respect to EN 1908:2004 are listed below:

— Clause 1 has been supplemented with regard to the safety of workers.

— Terms and definitions have been removed in Clause 3, as the reference to EN 1907 is sufficient.

— 5.2.1.1 c) and 5.2.1.1. d) have been deleted. A reference to EN 12930 has been added.

— The position of the stops in 5.2.3.5 has been stated more precisely.

— 5.3.3.1 has been reviewed in terms of content and structure.

— 8.2.3 has been shortened. Reference has been made to EN 12930 and EN 12929-1 for technical requirements.

— 8.2.4 of EN 1908:2004 has been deleted.

— The Annex ZA has been revised.

This European Standard is part of a series of standards relating to safety requirements on cableway installations designed for passenger transport.

This series of standards consists of the following standards:

— EN 1907, relating to *Terminology*

— EN 12929 (all parts), relating to *General requirements*

— EN 12930, relating to *Calculations*

— EN 12927 (all parts), relating to *Cables*

— EN 1908 relating to *Tensioning devices*

— EN 13223, relating to *Drive systems and other mechanical equipment*

— EN 13796 (all parts), relating to *Carriers*

— EN 13243, relating to *Electrical equipment other than for drive systems*

— EN 13107, relating to *Structures*

— EN 1709, relating to *Pre-commissioning inspection, maintenance, operational inspections and checks*

— EN 1909, relating to *Recovery and evacuation*

— EN 12397, relating to *Operation*

— EN 12408, relating to *Quality assurance*

Together these form a series of standards regarding design, manufacture, erection, maintenance and operation of all installations for cableway installations designed for passenger transport.

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).

In accordance with CEN-CENELEC Internal Regulations, the national standards institutes of the countries listed below are required to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, FYR Macedonia, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

1 Scope

This European Standard specifies the safety requirements applicable on the tensioning devices for cableway installations designed to carry persons. This document is applicable to the various types of cableway installation and takes into account their environment.

This document applies to the design, manufacture, installation, maintenance and operation of rope tensioning devices and anchorages of cableway installations designed to carry persons.

It also includes requirements relating to accident prevention and to the protection of workers irrespective of the application of national regulations.

National regulations of a construction or regulatory nature or those which serve to protect specific groups of persons remain unaffected.

This European Standard does not apply to cableway installations intended for the transport of goods nor to lifts.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 — Precommissioning inspection, maintenance and operational inspection and checks*

EN 1907, *Safety requirements for cableway installations designed to carry persons — Terminology*

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

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

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

EN 12927 (all parts), *Safety requirements for cableway installations designed to carry persons — Ropes*

EN 12929 (all parts), *Safety requirements for cableway installations designed to carry persons — General requirements*

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 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*

EN 13796 (all parts), *Safety requirements for cableway installations designed to carry persons — Carriers*

EN ISO 4413, *Hydraulic fluid power - General rules and safety requirements for systems and their components* (ISO 4413)

3 Terms and definitions

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

3.1
travel
the distance available for the moving part of a tensioning device to absorb variations in the length and sag of a rope under tension

3.2
fixed tensioning device
tensioning device for ropes whose tension cannot be adjusted during operation

4 General requirements

4.1 Application of this standard

The requirements of this document apply to all cableway installations along with the requirements of standards EN 1709, EN 1909, EN 12397, EN 12408, EN 12927 (all parts), EN 12929 (all parts), EN 12930, EN 13107, EN 13223, EN 13243, and EN 13796 (all parts).

4.2 Safety principles

4.2.1 General

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

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

4.2.2 Hazard scenarios

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

1) exceeding permissible rope tension forces and rope lengths;

2) exceeding permissible pressure limits in a hydraulic tensioning device;

3) affecting the free movement of ropes;

4) jamming, wedging or incorrect positioning of the moving parts of a tensioning device;

5) deterioration or failure of the components of a tensioning device due to wear, corrosion or fatigue;

6) failure of components in a tensioning device as a result of incorrect dimensioning;

7) hazards which a tensioning device can present for persons in access and work areas;

8) foreseeable misconduct of personnel (passengers, operating personnel, third parties).

4.2.3 Safety measures

The following safety measures shall be taken to eliminate the hazard scenarios listed under 4.2.2:

— ensure that rope tensions are maintained within permissible limits;

— prevent or avert the failure of safety-related mechanical and hydraulic components as well as force and pressure measurement systems;

— prevent and detect the malfunction of tensioning devices;

— protect persons against the risk of falling or of contact with moving parts of tensioning devices;

— prevent non-permissible load conditions in the event of a tensioning device failure.

5 General requirements for tensioning devices

5.1 Purpose of tensioning devices

Tensioning devices shall maintain the tension in a rope within pre-established permissible limits.

5.2 Travel

5.2.1 Dimensioning

5.2.1.1 The travel of a tensioning device shall be calculated in accordance with the requirements of EN 12930. The following shall be taken into consideration in the calculations:

a) the variation in length of the ropes to be tensioned at a temperature difference of 60 °C, unless the climatic conditions at the site of the installation require a greater temperature difference to be considered;

b) a permanent rope elongation of 0,5 ‰ in the case of track ropes and 1,5 ‰ for carrying-hauling ropes and haul ropes, provided no precise technical Statements have been provided by the rope manufacturer.

The available travel shall enable a renewal of a splice or the installation of new rope end fixings.

5.2.1.2 If the position of a counterweight or a hydraulic tensioning device is adjustable, the travel of the counterweight or cylinder stroke may be calculated assuming a temperature difference of 30 °C, and the length required for renewing a splice or for installing new end fixings need not be taken into account.

The adjustment device shall be able to accommodate at least the travel required by 5.2.1.1 a) to b).

For other adjustable tensioning devices, this provision may be applied as appropriate.

5.2.2 Free movement

Free movement of a tensioning device shall be assured in all permissible operating conditions, in particular with regard to the effects of bad weather.

5.2.3 Limits

5.2.3.1 Travel shall be limited by means of mechanical stops;

5.2.3.2 Under all normal operating conditions, tensioning devices shall not reach the mechanical stops;

5.2.3.3 The operating limit positions of all travel shall be monitored;

The triggering of a travel limit switch shall cause the installation to stop.

It shall only be possible to reset travel limit switches in situ and manually. Travel limit switches shall be designed so that they can be adjusted; they shall be installed taking into account the most extreme positions in operation without taking the permanent elongation of the rope into consideration.

5.2.3.4 The upper stops of haul or carrying-hauling ropes of reversible aerial ropeways and of pulsed movement aerial ropeways shall be equipped with energy absorbing buffers.

These buffers shall be calculated for the impact energy of the counterweight calculated dynamically with an impact speed of the counterweight equal to 1/3 of the maximum operating speed. This shall apply analogously in the event of suspended or underset guys.

The load-bearing structure shall be capable of withstanding these impacts.

5.2.3.5 The upper stops, which are not designed according to 5.2.3.4, shall be designed to withstand 1.5 times the nominal tension.

5.2.3.6 For dimensioning load-bearing structures, the loads on the stops according to 5.2.3.4 and 5.2.3.5 shall be considered as accidental actions.

5.2.4 Display

The position of the moving parts of a tensioning device shall be readable on a graduated scale, the zero point of which shall correspond to the position of the lower stop or the rear stop.

5.3 End fixings

5.3.1 General

End fixings shall be selected in accordance with EN 12927 (all parts).

End fixings shall be easily accessible for maintenance and inspection purposes.

They shall be positioned so as to avoid standing water.

Their inspection and renewal shall be in accordance with EN 12927 (all parts).

5.3.2 Socket end fixings

The general requirements for rope end fixings given in 5.3.1 also apply for socket end fixings.

5.3.3 Anchor drum

5.3.3.1 Track ropes

5.3.3.1.1 Where a track rope is fixed by means of an anchor drum, provision shall be made for at least 3 complete wrapping turns of the rope around the drum. The drum diameter, measured at the rope axis, shall be at least 65 times the diameter of the rope.

5.3.3.1.2 The drums shall be covered with a soft material which does not cause rope corrosion (e.g.: plastic, wood, wood covered with sheet metal)

5.3.3.1.3 The residual tension in the rope shall be transmitted by means of a profiled clamp, which shall comply with the requirements of EN 12927 (all parts) and may consist of several elements, to a stop fixed rigidly to the anchor drum. For safety, a second clamp shall be installed approximately 10 mm behind the first.

5.3.3.1.4 The residual tension shall be calculated taking into consideration a maximum friction coefficient on the drum of $\mu = 0{,}10$ for wood and $\mu = 0{,}08$ for a metallic finish, a maximum of 4 turns around the drum being taken into account; if synthetic materials are used, the friction coefficient shall be justified. The holding force of each clamp shall ensure a safety coefficient of 3 with regard to slippage, with a maximum friction coefficient of $\mu = 0{,}13$ for steel being assumed.

5.3.3.1.5 Anchor points shall be provided for tensioning and loosening ropes, and shall be marked with their maximum permissible loads.

For the dimensioning of supporting structures, these loads shall be considered as variable actions.

5.3.3.1.6 Track ropes shall be anchored in such a way that they can be displaced several times on their supports. A reserve length 6 times the length of the longest track rope shoe or roller chain saddle plus 5 m shall be provided as a rule. This reserve length shall be protected against bad weather.

Track ropes shall be displaced on their supports in accordance with EN 12927 (all parts).

5.3.3.2 Tension ropes

5.3.3.2.1 Tension rope anchor drums which do not rotate under operating conditions shall have a diameter measured at the axis of the rope of at least 20 times the diameter of rope for a stranded rope and at least 65 times the diameter of the rope for a locked coil rope.

5.3.3.2.2 For the end fixing of tension ropes, provision shall be made for three complete turns around the drum; in addition, 5.3.3.1.2, 5.3.3.1.3, 5.3.3.1.4 and 5.3.3.1.5 shall apply.

5.3.4 Dimensioning

The connecting components of the end fixings shall have a safety coefficient of at least 3 with respect to the yield strength, with reference to the static force induced by the counterweight. This shall also apply to tension winches and their fixings.

For the dimensioning of supporting structures, these loads shall be considered as variable actions.

5.3.5 Other rope end fixings

Other rope end fixings shall conform to the criteria for selecting ropes and their end fixings defined in EN 12927 (all parts).

5.4 Guides

5.4.1 Counterweights

Counterweights shall be guided so that they cannot derail, block, jam, tilt or rotate askew.

5.4.2 Tension carriages

5.4.2.1 Tension carriages shall be guided so that they cannot derail, block, jam, tilt or rotate askew.

5.4.2.2 In an installation with a combined drive system and tensioning devices, the turning moment due to tangential forces shall not hinder the movement of the tension carriage.

5.5 Unloading devices for tensioning devices

Provision shall be made for unloading the tensioning device in order to carry out maintenance work.

6 Requirements for counterweight tensioning devices

6.1 Tension force deflection systems

6.1.1 Tension sheaves

6.1.1.1 Tension sheaves shall be equipped with grooved linings having an elastic modulus less than 10 kN/mm^2.

The depth of the groove shall be at least 1/3 of the rope diameter and its radius shall not be less than the radius of the rope.

6.1.1.2 The diameter of a tension sheave, measured at the middle of the rope, shall be at least 40 times the diameter of the rope. The diameter of a tension sheave which does not rotate under operating conditions may be reduced to no less than 20 times the diameter of the rope.

6.1.1.3 The flanges of a tension sheave shall protrude from the lining by at least half the rope diameter.

6.1.1.4 Tension sheaves exposed to bad weather conditions shall be equipped with scrapers.

6.1.1.5 Projecting tension sheaves shall be equipped with anti-derailers.

6.1.2 Roller chains and deflection sheaves for track ropes

The bending ratios shall conform to EN 12927 (all parts).

6.1.3 Other deflection devices

If other deflection devices are used, they shall have a level of safety equivalent to that of the systems mentioned in 6.1.1 and 6.1.2. For rope shoes, see EN 12927 (all parts).

6.2 Counterweight travel areas

6.2.1 Counterweight pits shall be protected from bad weather by locating them inside buildings or by covering them.

6.2.2 Counterweight pits which are located in areas accessible by persons shall be protected against the dangers of falls.

6.2.3 Water infiltrating into a counterweight pit shall be able to flow away or be evacuated. If necessary, heating and pumps shall be provided.

6.2.4 If the area in which the counterweight moves is accessible by persons, any possibility of contact shall be prevented.

6.2.5 Unauthorized persons shall be prevented from gaining access to the space below the counterweight.

6.3 Counterweights

6.3.1 The load-bearing structure of the counterweight shall be designed in accordance with 5.2.3.4, 5.2.3.5 and 5.2.3.6.

6.3.2 Unauthorized modification of the weight of the counterweight shall be prevented by means of constructional devices or by means of special operational precautions.

6.4 Damping devices

Rapid movements of the counterweights of haul and carrying-hauling ropes shall be damped if they could disturb or endanger the operation.

Damping devices shall be designed so that in the event of malfunction they do not endanger operation by impeding the movement of the counterweight.

7 General requirements for hydraulic installations

7.1 Hydraulic installations shall be designed, constructed and operated in such a way that their operation on the devices they control, adjust or drive is ensured without unacceptable effects on other parts of the installation (e.g. soiling with oil).

7.2 Hydraulic installations shall be protected by at least one adequately dimensioned adjustable pressure-limiting valve.

This valve shall be protected against any unauthorized adjustment and shall have an independent discharge circuit.

The adjustment of the overpressure valve shall be selected in such a way that the pipes and connections shall have a safety coefficient of at least 3 for bursting. Pressure-limiting valves and other similar components shall have a safety coefficient of at least 1,8 for rupture with respect to the operating pressure guaranteed by the component manufacturer.

7.3 Hydraulic systems shall be easily bleedable.

7.4 The position of stop and reversing devices shall be monitored if their incorrect position could lead to danger.

7.5 Where necessary, hydraulic installations shall be adequately cooled or heated in accordance with manufacturer indications.

7.6 Hydraulic installations shall be arranged in such a way that accumulation of water and ice formation cannot adversely affect their operation.

7.7 Pressure drops shall not be unacceptably impeded by restrictions in the return pipe or by a poor pipe section/length ratio. In the case of hydraulic circuits which are important from a safety perspective, separate return pipes shall be provided.

7.8 When pressure sensors are used for adjustments or measurements, the pressure measurement shall not be affected by the oil flow rate (e.g. connections to cylinders). Suitable connections for pressure sensors shall be provided for testing purposes.

7.9 The pipes and components of hydraulic circuits shall be marked permanently in accordance with the hydraulic diagram.

Control instruments and gauges shall be marked in an explicit and permanent manner according to their respective functions.

7.10 It shall be possible to depressurise the system by means of a manually-operated and easily accessible valve.

7.11 Filters shall be adequately dimensioned and fitted with a clogging indicator. Filters installed in return pipes shall be provided with a bypass and pressure-limiting valve.

7.12 An oil level gauge shall be provided.

7.13 A simple monitoring system for all set pressures shall be provided.

7.14 For items which are not covered in 7.1 to 7.13, hydraulic installations shall conform to the requirements of EN ISO 4413.

8 Requirements for hydraulic tensioning systems

8.1 Constructional devices

8.1.1 In adjustable hydraulic tensioning devices, the piston travel of tensioning cylinders shall be greater than or equal to the sum of the travel in accordance with 5.2.1 and the minimum adjustment distance of the tensioning cylinder.

8.1.2 A suitable shock absorber, whose absorbing length shall not be included in the travel of the cylinder, shall be fitted on the pressure side of a tensioning cylinder, unless a device is fitted to stop movement instantaneously before the end stop is reached.

8.1.3 With reference to the set value of the overpressure valve in accordance with 7.2, cylinders, pistons and their fastenings shall have a safety coefficient of at least 1,8 with respect to the yield strength, taking into account the maximum stress calculated in the stress concentration areas.

The safety factor with respect to the peak pressure occurring following the actuation of the pipe break safety device, calculated relative to the apparent yield strength, shall not be less than 1,5.

8.1.4 The maximum buckling load shall be calculated in a complete stability analysis. The relief pressure of the pressure-limiting valve in 7.2 shall provide a safety factor of at least 3 with respect to the maximum buckling load. Pin joints at both ends shall be used for this purpose unless more unfavourable conditions actually exist.

8.1.5 The tensioning cylinders shall be constructed and installed so that inadmissible bending stresses cannot be induced and jamming of the piston in the cylinder is prevented.

8.1.6 If two tensioning cylinders are used, the installation shall be constructed so that the pressure in both cylinders is identical under operating conditions. In the event of the failure of one of the tensioning cylinders, the other tensioning cylinder, the tension carriages, the guides and the load-bearing structure shall be capable of withstanding the total loads as well as all resulting additional loads without permanent deformation.

8.1.7 Pumps and pipe sections shall be dimensioned for a piston speed of at least 5 mm/s unless the operating conditions or type of installation require a greater speed.

8.1.8 A pipe break safety device, which shall operate if the piston speed reaches a value 3 times that specified in 8.1.7, shall be fitted at the pressure pipe connection point of each tensioning cylinder. A pipe break safety device shall not be necessary if the tensioning device is equipped with an infinitely variable device to stop movement.

In the case of funicular railways with on-board brakes, a pressure-limiting valve of adequate cross-section and installed directly on the cylinder shall be provided, if necessary, to protect the tensioning device against excess pressure resulting from the use of the on-board brake.

8.1.9 The monitoring of the hydraulic tensioning device shall also be able to function if the emergency or auxiliary drive is used. Manual operation to maintain pressure is permissible when the emergency drive is used.

8.1.10 The pressure in the tensioning cylinders shall be indicated visually and the operating pressure shall be clearly marked.

8.1.11 A second pump shall be provided which shall enable the tensioning device to operate under load independently of the main power supply.

8.1.12 In the event of a breakdown of the hydraulic tensioning device, it shall be possible to return the occupied carriers to a station under all load conditions provided for under the operating conditions.

8.2 Maintaining and monitoring limiting values of nominal tension

8.2.1 The rope tension shall be maintained automatically within the pre-established limits.

8.2.2 The maintenance of the permissible limits for tension in the rope shall be monitored by two independent measuring devices, at least one of which shall be a force measuring device which measures the total rope tension. The force measurement shall be carried out in such a way that errors in the force measurement can be taken into account and the measurement is not affected by friction in the hydraulic tensioning systems. It shall be possible to unload the measuring devices completely so that their zero positions can be verified.

For monitoring the rope tension, two limiting values which differ by not more than ± 15 % from the nominal tension are to be established. The installation shall be brought to a stop if the actual rope tension exceeds these limiting values.

All requirements for normal operation of the installation shall be met for all rope tensions within the range defined by the limiting values of rope tension. Rope calculations covering the whole range shall be carried out.

8.2.3 In the case of a total pressure loss of the hydraulic system, it shall be ensured that this is taken into consideration in the dimensioning of the components and the intended supporting documents in accordance with EN 12930 and EN 12929-1 maintained.

8.2.4 Provision shall be made for manual adjustment of the rope tension so as to maintain this within the defined limits.

8.2.5 The excess pressure in accordance with 7.2 shall be taken into account as an exceptional load when dimensioning supporting structures.

9 Requirements for fixed tensioning devices

9.1 Testing the rope tension

9.1.1 Fixed tensioning devices may be used if it can be shown that they offer an equivalent level of safety to hydraulic or counterweight tensioning devices.

9.1.2 The rope tensions of haul and carrying-hauling ropes shall be monitored by two independent measuring devices.

9.2 Adjustment of rope tension

9.2.1 The dimensioning shall be verified by means of calculations. When doing so, the carriers shall be considered in their most unfavourable position. Temperatures of – 30 °C to + 30 °C shall be assumed, unless the local climatic conditions require the use of other limit values; in any case, a temperature difference of at least 60 °C shall be taken into consideration.

9.2.2 It shall be possible to adjust the rope tension.

9.3 Dimensioning the connection parts

The connection parts of the fixed tensioning devices shall have at least, for the highest tension, a safety coefficient of 3 with respect to the yield strength. In addition, adequate operational stability shall be demonstrated.

For the dimensioning of supporting structures, these loads shall be considered as variable actions.

10 Requirements for other tensioning devices

Other tensioning devices may be used if it can be shown that they offer an equivalent level of safety to the tensioning devices mentioned above.

11 Requirements for ski-tow tensioning devices

11.1 General

For ski-tows, in Clauses 5 to 9, only the requirements in the following sub-items apply:

— 5.1;

— 5.2.1;

— 5.2.2;

— 5.2.3.2;

— 5.3.2;

— 5.4.2;

— 5.5

— 6.1.1.5;

— 6.2;

— Clause 7;

— 8.1.1, 8.1.3, 8.1.4, 8.1.5, 8.1.6;

— 8.2.4, 8.2.5;

— 9.1.1;

— 9.2.2.

11.2 Specific requirements

11.2.1 In the case of tension winches or drums, the rope shall be wrapped around at least three full turns. Tension winches shall be self-locking.

11.2.2 When using hoists, an additional device shall be used to prevent slippage.

11.2.3 In the case of glacier ski-tows, the tension acting on the restraint ropes shall be continuously monitored by measuring devices. Any deviation beyond the permissible limits for rope tension shall automatically lead to the stopping of the installation.

11.2.4 The following conditions shall be observed for hydraulic tensioning devices for haul ropes:

a) the pressure shall be indicated visually and the required operating pressure shall be permanently marked;

b) a drop in operating pressure exceeding 10 % shall lead to the automatic stopping of the installation;

c) exceeding the operating pressure by more than 10 % shall be prevented;

d) the limit positions of the tensioning cylinders shall be monitored so as to ensure the automatic stopping of the installation if these are reached;

e) devices shall be installed to prevent sudden inadmissible movement of the pistons in the event of sudden pressure loss in the pipe system (e.g. flow limiter or pipe break safety device).

11.2.5 The diameter of tension sheaves which move during operation shall be not less than 30 times the nominal diameter of the rope. The diameter of tension sheaves which are fixed during operation, and of drums shall be 20 times the nominal diameter of the tension rope.

11.2.6 For ski-tows with fixed guys, the dimensioning shall be verified by means of calculations. In doing so, the tow-hangers shall be considered fully loaded and in the most unfavourable position.

Temperatures of between – 30 °C and + 30 °C shall be considered, unless local conditions require the use of greater temperature limit values.

11.2.7 In the case of low-level ski-tows, automatic tensioning devices are not required.

11.2.8 For fixed tensioning devices, it shall be possible to check the rope tension.

11.2.9 The length of the travel shall be limited on both sides by stops or monitored by limit switches.

12 Materials and permissible stresses

The requirements in respect of the choice and justification of materials, as well as corrosion protection, are dealt with in EN 13223.

13 Accident prevention and protection of workers

Tensioning device areas which personnel are required to enter in order to carry out maintenance work shall be provided with safe means of access and standing spaces. The means of access may be in the form of stairs or ladders.

Counterweight pits shall be accessible down to the bottom. It shall be possible to illuminate the counterweight areas and pits artificially.

Tensioning device access ladders shall be fitted with anti-fall devices (fall arresters, for example) if it is possible to fall more than 5 m. The anti-fall devices shall be designed so that it is possible to reach the counterweight from any point of the access ladder as far as required by the technical operating conditions.

Access ladders inclined more than 80° from the horizontal shall have rest platforms at intervals of not more than 15 m.

A rope tension adjustment device which is regularly used shall be installed in a fixed position which shall be considered as a maintenance position.

National regulations of a construction or regulatory nature or those which serve to protect specific groups of persons remain unaffected.

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of the EU Directive 2000/9/EC relating to cableway installations designed to carry persons

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to essential requirements of the New Approach Directive 2000/9/EC relative to cableway installations designed to carry persons.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national Standard in at least one Member State, compliance with the Clauses of this Standard given in Table ZA.1 confers, within the limits of the scope of this Standard, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 2000/9/EC relative to cableway installations designed to carry persons

Clause(s)/sub-clause(s) of this European Standard	Essential requirements of Directive 2000/9/EC	Qualifying remarks/Notes
4.2	2.2	
Clause 5	2.4, 2.6.1, 3.2.1, 4.1.1	
Clause 6	2.4, 2.6.1, 3.2.1, 4.1.1	
Clause 7	2.4, 2.6.1	
Clause 8	2.4, 3.2.1, 4.1.1	
Clause 9	2.4, 3.2.1, 4.1.1	
Clause 10	2.4, 3.2.1, 4.1.1	
Clause 11	2.4, 3.2.1, 4.1.1	
Clause 12	2.4	
Clause 13	2.1, 2.8, 7.1.1, 7.3	

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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