BS EN 12929-2:2015

BSI Standards Publication

Safety requirements for cableway installations designed to carry persons — General requirements

Part 2: Additional requirements for reversible bicable aerial ropeways without carrier truck brakes

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National foreword

This British Standard is the UK implementation of EN 12929-2:2015. It supersedes BS EN 12929-2:2004 which is withdrawn.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 for cableway installations designed to carry persons - General requirements - Part 2: Additional requirements for reversible bicable aerial ropeways without carrier truck brakes

Prescriptions de sécurité pour les installations à câbles destinées au transport de personne - Dispositions générales - Partie 2: Prescriptions complémentaires pour les téléphériques bicâbles à va et vient sans frein de chariot

Sicherheitsanforderungen an Seilbahnen für den Personenverkehr - Allgemeine Bestimmungen - Teil 2: Ergänzende Anforderungen an Zweiseil-Pendelbahnen ohne Tragseilbremse

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Contents

Foreword

This document (EN 12929-2:2015) has been prepared by Technical Committee CEN/TC 242 “Safety requirements for cableway installations designed to carry persons”, 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of an identical text or by endorsement, at the latest by July 2015, and conflicting national standards shall be withdrawn at the latest by July 2015

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 held responsible for identifying any or all such patent rights.

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This document replaces EN 12929-2:2004.

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 the EU Directive 2000/9/EC.

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

The following main changes have been made to EN 12929-2:2004:

— In 6.3 the requirement has been removed that stipulates that for the tension safety factor the haul rope loop shall comply with 1,2 times the value of the tension safety factor for haul ropes of bicable reversible aerial ropeways with carrier track brakes in accordance with EN 12930, as the value established from this was only slightly above 4,5. The requirement for the maximum tension safety factor was clarified on the area of the long splicing.

— In 6.4 b) 1), the value for the smallest permissible tension safety factor has been adapted to comply with the state of the art.

— In 6.6 the requirement has been removed that stipulates that the device shall be available for the MRT inspection of the installation, as this is not safety-related.

— The previous Clauses 6.13, 6.14, 6.17, 6.20, 6.22, 6.27, 7.3, 7.7, 7.8, 7.9 and 8.6 have been deleted without replacement, as there was no safety-relevant justifications for supplementary requirements with regard to bicable aerial ropeway with carrier track brakes.

— In 6.13, the alternative has been removed regarding taking into consideration the actually executed transverse sway options.

— In 7.2 the increased requirement on the groove depth of the rollers of the carrier truck has been removed, as the transverse sway movement of the carrier truck was restricted.

— In 7.3 the value for the assumed longitudinal sway has been slightly reduced to the value that is assumed in accordance with EN 12929-1 and the formula adapted.

— In 7.6 the requirement on the equipment for bringing the cableway system to a standstill from the cabin have been redefined.

— In 8.2 the value for the safety has been reduced, as in 8.1 a redundant execution is required and therefore in the event of a system failure a safety of 1,5 is still provided. The terms and definitions have been adapted to EN 13796-1.

— In 8.4, the terms and definitions have been adapted to EN 13796-1.

— In 8.6 the requirements on the gripping force for reducing the diameter of the haul rope has been modified by 20 %, as the former regulation contained disproportionately high requirements for the execution of the grip.

— In Annex A the A-deviation for Germany has been removed.

— In Annex ZA, the relationships with the basic requirements of the Directive 2000/9/EC have been adapted to the new numbering.

EN 12929 with the generic title “Safety requirements for cable way installations designed to carry persons – General requirements” consists of the following parts:

a) Part 1: Requirements for all installations

b) Part 2: Additional requirements for reversible bicable aerial ropeways without carrier truck brakes

This document belongs to the standards programme which was ratified by the CEN/TC242. This programme includes the following standards:

1) EN 1907 – *Terminology*

2) EN 12929 (all parts) – *General requirements*

3) EN 12930 *Calculations*

4) EN 12927 (all parts) – *Ropes*

5) EN 1908 – *Tensioning devices*

6) EN 13223 – *Drive systems and other mechanical equipment*

7) EN 13796 (all parts) – *Carriers*

8) EN 13243 – *Electrical equipment other than for drive systems*

9) EN 13107 – *Civil engineering works*

10) EN 1709 – *Precommissioning inspection, maintenance, operational inspection and checks*

11) EN 1909 – *Recovery and evacuation*

12) EN 12397 – *Operation*

13) EN 12408 — *Quality assurance*

Together these form a series of Standards regarding design, manufacture, erection, maintenance and operation of all cableway installations designed to carry persons.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Belgium, Bulgaria, Denmark, Germany, the former Yugoslav Republic of Macedonia, Estonia, Finland, France, Greece, Ireland, Iceland, Italy, Croatia, Latvia, Lithuania, Luxemburg, Malta, the Netherlands, Norway, Austria, Poland, Portugal, Romania, Sweden, Switzerland, Slovakia, Slovenia, Spain, Czech Republic, Turkey, Hungary, United Kingdom and Cyprus.

1 Scope

This European Standard specifies additional safety requirements for bicable reversible aerial ropeways without carrier truck brakes. This document is applicable to the various types of cableway installations and takes into account their environment.

This Part of the EN 12929 contains:

— additional requirements relating to the integrity of the haul rope loop;

— additional requirements intended to prevent specific operational incidents;

— requirements concerning the attachment of the carriers to the haul rope.

This European Standard does not apply to cableway installations for transportation 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, operational inspection and checks*

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

EN 1908, *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*

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

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*

3 Terms and definitions

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

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 this Standard

The requirements of this document, together with those of EN 1709, EN 1908, EN 1909, EN 12397, EN 12408, EN 12927 (all parts), EN 12929-1, EN 12930, EN 13107, EN 13223, EN 13243 and EN 13796 (all parts) apply to bi-cable reversible aerial ropeways without carrier truck brakes.

5.2 Safety principles

5.2.1 General

The safety principles in accordance with 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.

5.2.2 Hazard scenarios

The events listed in Tables 1 and 2 in particular may result in a hazardous situation which may be avoided or limited by means of the safety requirements in this document. Check the completeness of the list of hazard scenarios as per the safety study in accordance with EN 12929-1.

Table 1 — Events which compromise the integrity of the haul rope loop

Hazard scenario	Other relevant Standards
rupture of haul rope	EN 12930, EN 12927 (all parts)
deropement of haul rope	EN 12929-1
unacceptable reduction in rope tension	EN 1908
unacceptable increase in rope tension	EN 1908
overlapping of haul rope	EN 12929-1
contact with ropes other than the track rope	
failure of support system for the haul rope loop	EN 13223
effect of aircraft	EN 12929-1
twist of haul rope	
damage to haul rope due to atmospheric influences (e.g. lightning, corrosion)	EN 13243

Table 2 — Events during operation which may represent a hazard when there is no carrier truck brake, even though the haul rope loop remains intact

Hazard scenario	Other relevant Standards
failure of attachment of carrier to haul rope	EN 13796-1
failure of entry monitoring	EN 13243
loss of traction to drive sheave	EN 12929-1, EN 12930, EN 13223
derailment of carrier when stationary in extreme operating conditions	EN 13796-1
obstacle on line	
obstacle in station area	EN 13223
movement of carrier during an evacuation procedure	
twist of haul rope	
problems during correction of haul rope overlap	

5.2.3 Safety measures

This document contains the measures required to avoid or limit the hazard scenarios listed in 5.2.2.

6 Measures to ensure the integrity of the haul rope loop

6.1 The integrity of the haul rope and the support system for the haul rope loop shall be ensured in all operating situations.

6.2 The haul rope system shall be arranged as a continuous loop.

6.3 When verifying the haul rope loop in accordance with EN 12930, the tension safety factor shall be at least 4,5; the tension safety factor may not exceed the 20,0 in the long splicing.

6.4 Without prejudice to the requirements of 6.3, the tension safety factor shall correspond to the values below, with the calculation being carried out by one of the methods listed below according to whether or not

the system and dimensioning of the attachment to the carrier requires that slipping of the haul rope on the grip shall be taken into account if the carrier becomes caught on a fixed obstacle on the line or in a station:

a) if slipping does not have to be taken into account, the tension safety factor shall be at least 2,0 throughout the whole time of coming to a stop;

b) if slipping has to be taken into account:

   1) the tension safety factor shall be at least 2,5 with respect to the greatest calculated slipping resistance of the grip, and

   2) the tension safety factor shall be at least 2,0 with respect to the greatest measured slipping resistance of the grip.

6.5 The movements and loadings caused, on the basis of the investigations in 6.4, in the haul rope loop and in the associated components shall be investigated by calculation; it shall be proven that no dangerous conditions arise (see safety principles in EN 12929-1).

6.6 In addition to the requirements of EN 12927 (all parts), the haul rope shall be checked by MRT inspection at the following intervals (see also Table 3 below):

— in the first year of use of the haul rope: at intervals of 200 operating hours, but at least once every 4 weeks in operation;

— in the second to the tenth years of use: at intervals of 1 000 operating hours, but at least once each year;

— after the tenth year of use: at intervals of 200 operating hours, but at least once every 3 months in operation;

— before resumption of operation after any period of shut-down of 3 months or longer.

6.7 The carriers shall be displaced along the haul rope at intervals not greater than 200 operating hours and at least every 3 consecutive months in operation. When this takes place, the previous grip attachment zones and the splice shall be inspected visually. Without prejudice to the intervals mentioned above, the carriers shall be displaced before resumption of operation after any stoppage of 3 months or longer (see also Table 3 below).

If using particular attachment systems, other time intervals for displacing the carriers may be specified.

6.8 The intervals listed in 6.6 and 6.7 shall be reduced if, during inspection, the damage to the rope is found to reach or exceed half of the permissible damage in accordance with EN 12927 (all parts).

Table 3 — Time intervals for inspection of the haul rope

Area to be inspected	Type of inspection	Time interval
entire length of rope	MRT	in first year of use: every 200 operating hours, at least every 4 weeks in operation
		in 2nd to 10th years of use: every 1 000 operating hours, at least once each year
		after the 10th year of use: every 200 operating hours, at least once each year
		after a shut-down of 3 months or longer: before resumption of operation
areas where carriers have been attached	visual	after displacement of carriers: every 200 operating hours, at least every 3 months in operation

6.9 The required displacement of the carriers in accordance with 6.7 shall always be in the same direction. The distance of displacement shall be at least:

— the length of the attachment device (grip length);

— the length of any equipment for guiding the rope into the grip;

— twice the lay length of the rope.

6.10 The grip shall not be attached in the area of the splice.

6.10.1 A distance of at least twice the length of the splice in accordance with EN 12927 (all parts) shall be maintained between the attachment of the carrier on the rope and the splice.

6.10.2 If it is possible for the haul rope to be pulled through the grip after impact of the carrier with a fixed obstacle, the distance between the grip and the splice shall be at least 1,5 times the stopping distance.

6.11 Suitable devices shall be provided in the stations to secure the carriers when the grip is being displaced.

6.12 Immediately after a grip has been displaced along the haul rope, an inspection run shall be carried out to check the correct operation of the entry monitoring and the pulling-in travel of the opposite carrier.

6.13 If a limiting value of transverse sway is reached corresponding to 50 % of the necessary freedom to sway laterally, a visual and audible signal shall be triggered at the control console, and also in the carriers if they are accompanied, by inclinometers which measure the transverse swaying so that the operator or the attendant in the carrier can take the corresponding measures. In addition, if the carriers are not accompanied, the speed shall be reduced automatically if the limiting value is reached.

If a limiting value of transverse sway corresponding to 75 % of the necessary freedom to sway laterally is reached, the installation shall be stopped automatically. After an automatic stop, the run shall only be completed with the control console attended.

6.14 The cableway installation shall be marked as an obstacle for aircraft; the requirements of EN 12929-1 shall be taken into account.

6.15 Any other ropes apart from the track rope(s) (e.g. the recovery rope) which might come into contact with the haul rope shall be monitored for incorrect position in relation to the haul rope using devices in accordance with EN 12929-1.

6.16 The diameter of the haul rope shall be at least 20 mm.

6.17 In addition to the requirements of EN 13223, the correct position of the haul rope sheaves shall be monitored electrically.

6.18 In addition to the requirements of EN 13223, the strength of the haul rope rollers in operation shall be verified. The actions resulting from the wind speed in operation identified in the safety analysis shall also be taken into account.

6.19 The loss of a roller or abnormal wear of a roller lining as a result of jamming of the roller shall not lead to a hazard for the haul rope.

6.20 Components connected with the support system for the haul rope loop or with the attachment of the haul rope to the carrier shall be assigned a safety class in accordance with EN 12408 on the basis of the safety analysis. The choice of materials shall correspond to this safety class.

6.21 The sheaves and the sides and bodies of haul rope rollers shall be inspected for inadmissible external defects and also, if necessary, for internal defects.

7 Measures intended to prevent incidents during operation

7.1 To prevent or limit events occurring during operation which may represent a hazard even though the haul rope loop remains intact, the following specific measures shall be provided for.

7.2 Increased safety against derailment of the carrier truck shall be provided by means of the measures below:

a) the rollers at each end of the carrier truck shall be equipped with groove scrapers to keep their rope grooves clear;

b) the carrier trucks shall be fitted with anti-derailers which shall extend 0,8 times the diameter of the track rope below the centre of the track rope, even when the carrier truck rollers are not running with the rope in the groove but on the roller flange. It shall be ensured that the installation is stopped if the carrier truck is derailed.

7.3 The freedom of the carriers to sway longitudinally relative to line support structures and other components on the line (e.g. ropes, suspended haul rope supports) shall be at least 0,34 rad.

In addition, the freedom for longitudinal swaying shall be at least equal to the sway angle β in equation (1), which results from the maximum deceleration which occurs in the event of unexpected operation of the service and/or safety brakes. Operation in either direction and the slope of the trajectory of the carrier shall be taken into account.

$$\tan\beta \geq \frac{3a \cdot \cos\alpha}{g} \quad (1)$$

Where:

- a is the maximum deceleration with unexpected operation of the drive brakes;
- g is the acceleration due to gravity;
- α is the angle between the tangent of the trajectory of the carrier and the horizontal;
- β is the required longitudinal sway angle.

7.4 If evacuation along the rope is necessary in accordance with EN 12929-1 and longitudinal movement of the carrier could occur during the evacuation, the carrier truck shall be equipped with a device which enables the carrier to be immobilised on the track rope during the rescue operation.

7.5 It shall be proven by calculation that, in all operational loading cases including possible mechanical braking, the installation is not susceptible to rope overlap. For this, the oscillations of the haul rope shall be taken into account. In addition, devices shall be provided in the stations with whose help a haul rope overlap can be corrected.

Effective means for correcting a haul rope overlap, for example adequate drive torque and adequate drive capability at the drive sheave, shall be demonstrated by calculation and it shall be proven that this does not result in a hazard to the installation.

7.6 The devices for stopping the cableway from the cabins shall be executed in accordance with the safety analysis.

8 Requirements relating to the attachment of the carrier to the haul rope

8.1 The attachment of the carrier to the haul rope shall be effected by means of at least two independent elements in accordance with EN 13796-1 which act simultaneously and are easily removable. The state of assembly shall be easily assessed.

8.2 As a deviation from the requirements of EN 13796-1, in the event of the failure of one element, the calculated resistance to slipping of the remaining attachment element shall correspond to equation (2):

$$F_{theo} \geq 1{,}5 F_{t,max} \quad (2)$$

Where:

F_{theo} is the calculated resistance to slipping of the remaining grip; proven pulling-off force of the clamp;

$F_{t,max}$ maximum downhill-slope force (force components of the carrier's weight in the direction of the tangents on the trajectory).

The value F_{theo} shall be confirmed by test.

8.3 The weight of the carrier shall not be used to achieve attachment of the grip.

8.4 If it is possible for the haul rope to slip through the grip after impact of the carrier with a fixed obstacle, the calculated slipping resistance $F_{theo,1}$ shall correspond to equation (3) from the time that the haul rope starts to be drawn through the grip until the installation stops

$$F_{theo,1} \geq 2{,}0 F_{t,max} \quad (3)$$

Where:

$F_{theo,1}$ is the calculated resistance to slipping of the remaining grip;

$F_{t,max}$ maximum downhill-slope force (force components of the carrier's weight in the direction of the tangents on the trajectory).

The value $F_{theo,1}$ shall be confirmed by test.

8.5 It shall be possible to recognise by simple means (for example, paint marks) if the haul rope is slipping or twisting in the grip.

In addition to the daily operating checks to be carried out in accordance with EN 1709, the assembly status of the grip shall be verified and inspections shall be carried out to ascertain any slipping or twisting of the haul rope in the grip.

8.6 As an exception to the requirements of EN 13796-1, the gripping force of the haul rope clamps shall not be reduced by more than 50 %, even if the diameter of the haul rope is reduced by 20 %.

Attachment A
(informative)

A–deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC member.

This document falls under Directive 2000/9/EC.

NOTE (from CEN/CENELEC Internal Regulations Part 2: 1994, 3.1.9): Where standards fall under EU Directives, it is the view of the Commission of the European Communities (OJ No C 59, 9.3.1982) that the effect of the decision of the Court of Justice in case 815/ 79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted within the EU except under the safeguard procedure provided for in the relevant Directive.

Clause	Deviations
General	**Italy**
	Reversible bicable aerial ropeways without carrier truck brakes are published by law:
	DM 4/8/1998 n°400 (articles 24.8, 24.9)

Attachment 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 Communities 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 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 relating 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
5.2	2.2, 2.3, 2.6.1	
Clause 6	2.4, 2.6.1, 4.1.1	
6.6	2.6.2, 2.6.3	
6.7	2.6.2, 2.6.3	
6.8	2.6.2, 2.6.3	
6.9	2.6.2, 2.6.3	
6.11	2.8	
6.12	7.1.1	
6.13	3.1.2	
6.14	2.3	
6.15	3.1.2	
6.16	2.4, 2.6.1	
6.17	2.6.2, 2.7.1	
6.18	2.3, 3.1.1	
6.20	2.2, 2.4, 2.6.1	
6.21	2.6.1	
Clause 7	7.1.1	
7.2	5.8	
7.3	3.1.2	
7.4	7.2	
7.5	4.1.1	
7.6	5.4	
Clause 8	5.2	

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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