

Steel wire ropes — Safety —

Part 8: Stranded hauling and carrying-hauling ropes for cableway installations designed to carry persons

The European Standard EN 12385-8:2002 has the status of a
British Standard

ICS 77.140.65

National foreword

This British Standard is the official English language version of EN 12385-8:2002.

The UK participation in its preparation was entrusted to Technical Committee MHE/2, Wire ropes, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

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This British Standard, having been prepared under the direction of the Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 12 November 2002

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This European Standard was approved by CEN on 16 November 2001.

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 Management Centre or to any CEN member.

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Foreword

This document (EN 12385-8:2002) has been prepared by Technical Committee CEN/TC 168, "Chains, ropes, webbing, slings and accessories – Safety", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

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 EC Directive(s).

For relationship of this Part with EU Directives, see informative Annex ZA, which is an integral Part of this document.

The other Parts of EN 12385 are:

- Part 1: General requirements
- Part 2: Definitions, designation and classification
- Part 3: Information for use and maintenance
- Part 4: Stranded ropes for general lifting applications
- Part 5: Stranded ropes for lifts
- Part 6: Stranded ropes for mine shafts
- Part 7: Locked coil ropes for mine shafts
- Part 9: Locked coil carrying ropes for cableway installations designed to carry persons
- Part 10: Spiral ropes for general structural applications

Part 1 provides the general requirements of Parts 4 to 10.

This is the first edition of this Part.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This Part of this European Standard has been prepared to be a harmonized standard to provide one means of complying with the essential safety requirements of the Directive relating to cableway installations designed to carry persons.

During the preparation of this standard, it was assumed that a negotiation would take place between the purchaser and the manufacturer concerning the intended purpose of the rope.

Although tables of breaking forces and masses are provided for a number of the more common classes, diameters and rope grades, this Part of this standard is not limited to those given, providing all of the other requirements are met.

1 Scope

This Part of this European Standard specifies the particular materials, manufacturing and testing requirements for stranded steel wire 'hauling' and 'carrying-hauling' ropes for cableway installations designed to carry persons.

The particular hazards covered by this Part are identified in Clause 4.

The rope grade is limited to 1960.

Minimum breaking forces for the more common classes, sizes and grades of rope are provided in tables 2, 3 and 4.

Stranded tension ropes and ski-tow ropes are covered by EN 12385-4.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 10264-3, *Steel wire and wire products – Steel wire for ropes – Part 3: Cold drawn and cold-shaped non-alloyed steel wire for heavy duty applications.*

EN 12385-1:2002, *Steel wire ropes – Safety – Part 1: General requirements.*

EN 12385-2, *Steel wire ropes – Safety – Part 2: Definitions, rope designation and classification.*

prEN 12408, *Safety requirements for cableways for passenger transportation by rope - Quality control.*

DIN 21258:1986, *Preservative compounds for koepe friction drive winding ropes in mining – Safety requirements and testing.*

DIN 53521, *Determination of the behaviour of rubber and elastomers when exposed to fluids and vapours.*

ISO 2592, *Determination of flash and fire points – Cleveland open cup method.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions in EN 12385-2 apply.

4 List of hazards

In addition to the hazards identified in clause 4 of Part 1, the hazard associated with uncontrolled relative movement between the rope and the driving sheave, when applicable, is also identified.

5 Safety requirements and/or measures

5.1 General

In addition to the requirements given in 5.2 to 5.7, the requirements shall also conform to those given in Part 1.

The manufacturer shall also comply with EN 12408.

5.2 Materials

5.2.1 Wire

Wires before ropemaking shall conform to EN 10264-3.

The tensile strength grades of the wires shall be subjected to the limits given in Table 1.

Table 1 — Wire tensile strength grades excluding centre and filler wires for given rope grades

Rope grade	Wire tensile strength grade, N/mm ²	
	Minimum	Maximum
1570	1370	1770
1770	1570	1960
1960	1770	2160

5.2.2 Core

The core shall be one of the following types

- a) fibre;
- b) solid polymer;
- c) non-magnetic metallic covered with solid polymer;
- d) steel covered with solid polymer;
- e) steel, as an independent wire rope (IWRC) or wire strand (WSC).

5.2.3 Lubricant

The properties of the lubricant shall conform with the requirements of annex A.

NOTE The purchaser should specify any particular lubricant (see Introduction).

5.3 Rope manufacture

5.3.1 Lubrication

Lubrication shall be generally limited to the strands.

NOTE The purchaser should specify any particular lubrication requirements (see Introduction).

5.3.2 Construction

The construction shall be either

- a) one of those covered by the three classes given in Tables 2 to 4; or
- b) another single layer rope construction as specified by the manufacturer and covered by the respective classes in EN 12385-2.

NOTE Strands can be compacted.

5.3.3 Rope grade

The rope grade shall be not less than 1570 or higher than 1960.

NOTE The rope grades are generally 1570, 1770 or 1960 although intermediate rope grades can also be specified.

For the more common classes of ropes, refer to Tables 2 to 4, the rope grade shall be used in the calculation of breaking force. (See annex C).

5.3.4 Waviness

Ropes shall be measured for waviness in accordance with annex B. The amount of waviness measured over a length equivalent to 3 rope lay lengths shall be not more than $0,01 d + 0,2$ mm.

5.4 Diameter

5.4.1 Tolerances

When measured in accordance with 6.7 the actual diameter shall be within + 1 % and + 5 % of the nominal diameter with the rope under load on the closing machine.

5.4.2 Differences between diameter measurements

The difference between any two of the four measurements taken in accordance with 6.7 and expressed as a percentage of nominal diameter shall not exceed 4 %.

5.5 Breaking force

Only the minimum breaking force shall be specified as the breaking force.

The values of minimum breaking force for the more common classes and grades of ropes shall not be less than those given in Tables 2 to 4. For intermediate rope diameters, the values shall not be less than those obtained from the formula given in annex C using the factors given in the tables.

NOTE 1 Depending on the actual rope design, higher values than those in the tables or than those calculated according to annex C can be specified.

Metallic wires in steel cores of hauling and carrying-hauling ropes shall be regarded as non-load bearing wires and shall not be taken into account when determining the minimum breaking force of the rope.

NOTE 2 In the case described above, the breaking force value of the rope is referred to as the reduced minimum breaking force.

The manufacturer shall carry out a breaking force test in accordance with Method 1 as described in 6.4.1 of Part 1 on a sample of rope from each production length.

In the case of those ropes incorporating a core of non-magnetizable metal covered with solid polymer or steel core covered with solid polymer testing shall be in accordance with 6.8.

5.6 Length mass

The manufacturer shall specify the nominal length mass.

NOTE The values in Tables 2 to 4 are approximate. More precise values can be specified by the manufacturer.

When measured in accordance with 6.9 the length mass shall be in accordance with the specified value, subject to a tolerance of - 2 % to + 5 %.

5.7 Designation and classification

Rope designation and classification shall conform to EN 12385-2.

Table 2 — Class 6x7 with fibre core

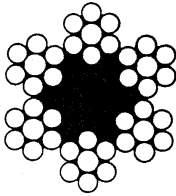
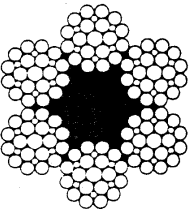
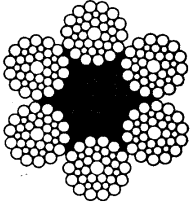
Construction cross section example	Construction of rope		Construction of strand		
	Item	Quantity	Item		Quantity
 <p>6x7-FC</p>	Strands	6	Wires		7
	Layer of strands	1	Outer wires		6
	Wire in rope	42	Layer of wires		1
	Typical examples		No. of outer wires		Outer wire Factor ¹⁾
	Rope	Strand	Total	per stand	
	6x7	1-6	36	6	0,105
	Min breaking force factor:		$K_1 = 0,335$		
Nominal length mass factor:		$W_1 = 0,332$			
Nominal rope diameter	Approximate nominal length mass ¹⁾	Minimum breaking force kN			
mm	kg/100 m	Rope grade 1 570	Rope grade 1 770	Rope grade 1 960	
7	16,3	25,8	29,1	32,2	
8	21,3	33,7	37,9	42,0	
9	26,9	42,5	48,0	53,2	
10	33,2	52,5	59,3	65,7	
11	40,2	63,5	71,7	79,4	
12	47,9	75,7	85,4	94,5	
13	56,2	88,9	100	111	
14	65,2	103	118	129	
15	74,8	118	133	148	
16	85,1	135	152	168	
17	96,1	152	171	190	
18	108	170	192	213	
19	120	190	214	237	
20	133	210	237	263	
21	147	232	261	290	
22	161	255	287	318	
23	175	278	314	347	
24	192	303	342	378	
25	208	329	371	410	
26	225	356	401	444	
27	242	383	432	479	
28	261	412	465	515	
29	280	442	499	552	
30	299	473	534	591	
31	320	505	570	631	
32	340	539	607	672	
¹⁾ Informative only					

Table 3 — Class 6×19 with fibre core

Construction cross section examples	Construction of rope		Construction of strand			
	Item	Quantity	Item		Quantity	
	 <p>6×25F-FC</p>	Strands	6	Wires		15 to 26
		Layer of strands	1	Outer wires		7 to 12
Wire in rope		90 to 199	Layer of wires		2 - 3	
Typical examples		No. of outer wires		Outer wire factor ¹⁾		
	Rope	Strand	Total	per strand		
	6×17S	1-8-8	48	8	0,087	
	6×19S	1-9-9	54	9	0,080	
	6×25 F	1-6-6F-12	72	12	0,063	
	Min breaking force factor:		$K_1 = 0,350$			
	Nominal length mass factor:		$W_1 = 0,352$			
Nominal rope diameter	Approximate nominal length mass ¹⁾	Minimum breaking force kN				
mm	kg/100 m	Rope grade 1570	Rope grade 1770	Rope grade 1960		
20	141	220	248	274		
21	155	242	273	303		
22	170	265	300	332		
23	186	291	328	363		
24	203	317	357	395		
25	220	343	387	429		
26	238	371	419	464		
27	256	401	452	500		
28	275	430	488	538		
29	295	462	521	577		
30	317	495	558	617		
31	338	528	595	659		
32	360	563	634	702		
33	383	598	675	747		
34	407	635	718	793		
35	431	673	759	840		
35	456	712	803	889		
37	482	752	848	939		
38	508	793	895	991		
39	535	836	942	1 040		
40	583	879	991	1 100		
41	591	924	1 040	1 150		
42	620	969	1 090	1 210		
43	650	1 020	1 150	1 270		
44	681	1 060	1 200	1 330		
45	712	1 110	1 250	1 390		
46	744	1 160	1 310	1 450		
47	777	1 210	1 370	1 520		
48	810	1 260	1 430	1 580		
49	844	1 320	1 490	1 650		
50	879	1 370	1 550	1 720		
51	915	1 430	1 610	1 780		
52	951	1 490	1 680	1 860		
53	988	1 540	1 740	1 930		
54	1 030	1 600	1 810	2 000		

¹⁾ Informative only

Table 4 — Class 6x36 with fibre core

Construction cross section example	Construction of rope		Construction of strand		
	Item	Quantity	Item	Quantity	
 <p>6x36WS-FC</p>	Strands	6	Wires	29 to 36	
	Layer of strands	1	Outer wires	12 to 14	
	Wire in rope	174 to 216	Layers of wire	3	
	Typical examples		No. of outer wires		Outer wire factor ¹⁾
	Rope	Strand	Total	per strand	
	6x31WS 6x36WS	1-6-6+6-12 1-7-7+7-14	72 84	12 14	0,064 0,058
Min breaking force factor:		$K_1 = 0,340$			
Nominal length mass factor:		$W_1 = 0,360$			
Nominal rope diameter	Approximate nominal length Mass ¹⁾	Minimum breaking force kN			
mm	kg/100m	Rope grade 1570	Rope grade 1770	Rope grade 1960	
28	282	418	472	522	
29	303	449	506	560	
30	324	480	542	600	
31	346	513	578	640	
32	368	547	616	682	
33	392	581	655	725	
34	416	617	696	770	
35	441	654	737	815	
36	466	692	780	864	
37	493	731	824	912	
38	520	771	869	962	
39	547	812	915	1 010	
40	575	854	963	1 070	
41	605	897	1 010	1 120	
42	635	942	1 060	1 180	
43	665	987	1 110	1 230	
44	697	1 030	1 170	1 290	
45	729	1 080	1 220	1 350	
46	761	1 130	1 270	1 410	
47	795	1 180	1 330	1 470	
48	829	1 230	1 390	1 540	
49	864	1 280	1 450	1 600	
50	900	1 340	1 510	1 670	
51	938	1 390	1 570	1 730	
52	973	1 440	1 630	1 800	
53	1 010	1 500	1 690	1 870	
54	1 050	1 560	1 760	1 940	
55	1 090	1 620	1 820	2 020	
56	1 130	1 670	1 890	2 090	
57	1 170	1 730	1 960	2 190	
58	1 210	1 800	2 020	2 240	
59	1 250	1 860	2 090	2 320	
60	1 300	1 920	2 170	2 400	
¹⁾ Informative only					

6 Verification of safety requirements and/or measures

6.1 General

Verification of safety requirements and/or measures shall be in accordance with that given in clause 6 of EN 12385-1 and the additional verification given in 6.2 to 6.9 below.

6.2 Lubricant

Compliance with the lubricant requirements shall be through a visual verification of the inspection documents supplied with the lubricant.

6.3 Lubrication

Compliance with the lubrication requirements shall be through a visual verification.

6.4 Construction

Compliance with the construction requirements shall be through a visual verification.

6.5 Rope grade

Compliance with the rope grade requirements shall be through a visual verification of the inspection documents supplied with the wire in relation to the minimum breaking force value of the rope.

6.6 Waviness

The method of test for waviness shall be in accordance with annex B.

6.7 Diameter

The diameter shall be measured in accordance with 6.3.1 of EN 12385-1 except that the rope shall be under load on the closing machine.

6.8 Breaking force

Breaking force testing shall be in accordance with 6.4.1 of EN 12385-1 except that for ropes with cores of non-magnetizable metal covered with solid polymer or steel covered with solid polymer, the measured breaking force of the whole rope shall be reduced by an amount equal to the measured breaking force of the core.

6.9 Length mass

The measured length mass shall be determined by one of the following methods:

- a) the gross mass of rope, reel and ancillary items shall be measured. The mass of reel and ancillary items shall be subtracted from this value to give the rope mass. The rope mass shall be divided by the measured rope length on the closing machine; or,
- b) a sample of rope shall be weighed and the value of the mass shall be divided by the measured length of the rope sample

7 Information for use

In addition to conforming to the requirements of clause 7 of Part 1, the Certificate (see 7.2 of Part 1) shall also state the identification of the rope lubricant (to facilitate future selection of compatible dressing) and for ropes other than those covered by the more common classes, diameters and rope grades as given in the tables, the nominal size of the outer wire and the nominal metallic cross-sectional area of the rope.

The Certificate shall also state the measured diameter and the measured breaking force (see 7.2.2 of Part 1).

NOTE If the results of any post-spin testing (e.g. in respect of diameter, tensile strength, reverse bend, torsion or zinc coating) are required to be given, these may be included on the certificate.

Annex A (normative) **General requirements for lubricants**

A.1 General

The lubricant shall be in accordance with A.2 and A.3.

A.2 Type tests

A.2.1 Coefficient of friction

The value for coefficient of friction shall be $> 0,22$ at 20 °C ; it shall be determined in accordance with DIN 21258.

A.2.2 Swelling of sheave lining material

When fully submerged in rope lubricant over a period of 14 days at a temperature equivalent to the lowest temperature above 20 °C at which immersion can take place, the change in volume of the lining material specimen shall not exceed 20 %.

The reduction in hardness shall not exceed 10 ° Shore A .

The method used shall be in accordance with DIN 53521.

A.3 Other requirements

A.3.1 Breaking point

The breaking point shall be in accordance with 4.2 of DIN 21258:1986.

A.3.2 Contents of water soluble acids

The content of water soluble acids shall be in accordance with 4.4 of DIN 21258:1986.

A.3.3 Flash point

The flash point of lubricants containing solvents shall be $> 55\text{ °C}$ in accordance with ISO 2592.

Annex B
(normative)
Method of test for determination of waviness

Tools required:

Straight edge with a straightness of $\pm 0,05$ mm and a length extending over at least three rope lay lengths.

Feeler type gauge (or other equivalent instrument) having increments of at least 0,05 mm and an accuracy of 0,01 mm.

Method:

At the starting and finishing end of the rope in the closing machine, set the straight edge against the tensioned rope in such a way that the rope weight will have no influence on the results.

Without pressure on the straight edge, determine where the edge makes contact with the rope and secure the edge to the rope at two or more of these positions without affecting the straightness of the straight edge.

With a feeler type gauge measure the clearance (gap) between each strand and the straight edge over 3 rope lay lengths and record the results.

Determination of waviness value:

The rope waviness shall be the maximum recorded value of the clearance (gaps).

Annex C (normative)

Calculations of minimum breaking force and approximate nominal length mass for ropes covered by Tables 2 to 4

C.1 Minimum breaking force

The minimum breaking force, F_{\min} , expressed in kN, shall be calculated as follows:

$$F_{\min} = \frac{K_1 \cdot d^2 \cdot R_r}{1000}$$

where:

d is the nominal diameter of the rope, in mm;

R_r is the rope grade, in N/mm²;

K_1 is the empirical minimum breaking force factor for a given rope class with a fibre core

The values for K_1 (for ropes with a fibre core) are given in Tables 2, 3 and 4.

C.2 Nominal length mass

The approximate nominal length mass, M expressed in kg/100m, shall be calculated as follows

$$M = W_1 \cdot d^2$$

where

W_1 is the nominal length mass factor for ropes with a fibre core.

Annex D
(informative)
Information which should be provided with an enquiry or order

At least the following information should be supplied with an enquiry or order:

D.1 Details of rope

- a) Reference to this standard, i.e. EN 12385-8;
- b) Quantity and length;
- c) Nominal diameter;
- d) Rope construction;
- e) Type of core;
- f) Rope grade;
- g) Wire finish;
- h) Lay direction and type;
 - i) Any particular lubricant and lubrication requirements;
 - j) Any particular marking requirements;
 - k) Any particular packaging requirements;
 - l) Minimum breaking force;
- m) Nominal length mass and whether it is to be measured or calculated.

D.2 Details of installation

- a) Location of cableway;
- b) Identification of installation;
- c) Cableway type;
- d) Rope function;
- e) Distances of pin centres between rollers;
- f) Rope length;
- g) Number of ropes;
- h) Sheave (wheel) lining material;
- i) Roller lining material;
- j) Normal cableway operating temperature range and environmental conditions.

Annex ZA
(informative)
Clauses of this Part of this European Standard addressing essential requirements or other provisions of EU Directives

This Part of this European Standard has been prepared under a Mandate given to CEN by the European Commission and supports essential requirements of EU Directive 2000/9/EC.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

Table ZA.1 —Correspondence between this European Standard and EU Directive

Clauses/sub-clauses of this European Standard:	Corresponding annexes/paragraphs of Directive 2000/9/EC:
All clauses.	Annex II, clause 4.1.1 (the first two dashes).

Bibliography

EN 292-2:1991/A1:1995, *Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles and specifications (Amendment 1:1995)*.

EN 1050:1996, *Safety of machinery – Principles of risk assessment*.

EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2000)*.

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