BRITISH STANDARD

BS EN
12385-5:2002

Steel wire ropes — Safety —

Part 5: Stranded ropes for lifts

The European Standard EN 12385-5:2002 has the status of a British Standard

ICS 77.140.65

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 12385-5:2002. It supersedes BS 302-4:1987 which is withdrawn.

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.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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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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 30 October 2002

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Drahtseile aus Stahldraht - Sicherheit - Teil 5: Litzenseile für Aufzüge

This European Standard was approved by CEN on 12 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.

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 Management Centre has the same status as the official versions.

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

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

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Contents

page

Foreword

This document (EN 12385-5:2002) 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 6: Stranded ropes for mine shafts
Part 7: Locked coil ropes for mine shafts
Part 8: Stranded hauling and carrying-hauling ropes for cableway installations designed to carry persons
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 Lift Directive.

This Part of this European Standard is a type C standard as stated in EN 292.

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 ropes for suspension, compensating and governor duties for traction drive and hydraulic lifts moving between guides.

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

This Part of this European Standard does not establish requirements for information for use other than those given in clause 7 of Part 1. Neither does it cover the requirements for ropes fitted with terminations.

Minimum breaking force values for the more common classes, sizes and grades of rope are provided in tables 6 to 10.

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 10264-2:2002, *Rope wire – Part 2: Round cold drawn non-alloyed steel wire for ropes for general applications.*

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

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

ISO 4346, *Steel wire ropes for general purposes – Lubricants – Basic requirements.*

3 Terms and definitions

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

4 List of hazards

In addition to the general hazards identified in clause 4 of Part 1, Table 1 contains all the particular hazards which require action to reduce risk as being specific and significant for steel wire ropes for lifts.

Table 1- Hazards and associated requirements

Hazards identified in annex A of EN 1050:1996		Relevant clause of annex A of EN 292-2:1991/A1:1995	Relevant clause of this standard
27.4	Mechanical hazard from insufficient strength of parts	4.1.2.3	5 and 6
27.6	Mechanical hazard from inadequate selection of ropes and their inadequate integration into the machine	4.3.1	7

NOTE For the purposes of this Part of EN 12385, insufficient strength of parts means failure to achieve the minimum breaking force of the rope.

5 Safety requirements and/or measures

5.1 General

In addition to the requirements given in 5.2 to 5.6, the requirements shall also conform to those given in part 1 of this standard.

5.2 Materials

5.2.1 Wire

All wires, before ropemaking, shall conform to EN 10264-2.

For rope grades 1180/1770 (dual tensile), 1370/1770 (dual tensile) and 1570/1770 (dual tensile), the tensile strength grades of the outer wires shall be 1180 N/mm^2, 1370 N/mm^2 and 1570 N/mm^2 respectively. The tensile strength grade of the inner wires shall be 1770 N/mm^2.

For rope grades 1570 (single tensile) and 1770 (single tensile), the wire tensile strength grades shall be 1570 N/mm^2 and 1770 N/mm^2 respectively.

The tensile strength grades of centre wires, filler wires and core wires shall be determined by the manufacturer.

5.2.2 Core

The core shall be one of the following types:

a) fibre;

b) steel, as an independent wire rope (IWRC);

c) steel based composite e.g. steel plus fibre, steel plus polymer; or

d) non-metallic other than only of fibre.

5.2.3 Lubricant

Where used, the lubricant shall comply with ISO 4346.

5.3 Rope manufacture

5.3.1 Lubrication

Lubrication shall be limited to the strands.

5.3.2 Construction

The rope construction shall be either:

a) one of those covered by Tables 6, 7, 8, 9 and 10; or

b) another construction as specified by the manufacturer.

5.3.3 Rope grade

5.3.3.1 General

The rope grade shall reflect the tensile strength grades of the outer and inner wires respectively, e.g. rope grade 1370/1770 signifies a dual tensile rope having outer wires of tensile strength grade 1370 N/mm^2 and inner wires of tensile strength grade 1770 N/mm^2 and rope grade 1570 signifies a single tensile rope having outer and inner wires of tensile strength grade 1570 N/mm.

For the more common classes of rope the rope grade, R_r , shall be used in the calculation of minimum breaking force of single tensile ropes and the rope value R_{dt} shall be used in the calculation of minimum breaking force of dual tensile ropes, see annex A for values of R_{dt}.

The rope grades for the various duties shall be in accordance with 5.3.3.2 to 5.3.3.4.

5.3.3.2 Suspension ropes

The rope grade shall be one of the following:

a) for traction drive lifts see Tables 6 to 8

Rope with fibre core: 1180/1770; 1370/1770; 1570; 1770

Rope with steel core: 1370/1770; 1570/1770; 1570; 1770

b) for roped hydraulic lifts see Tables 6 to 8

Rope with fibre core: 1370/1770; 1770

Rope with steel core: 1370/1770; 1570/1770; 1770

5.3.3.3 Governor ropes

The rope grade shall be one of the following 1370/1770; 1570/1770; 1570 or 1770, see Tables 6 to 8.

5.3.3.4 Compensating ropes

The ropes grade shall be one of the following 1370/1770; 1570 or 1770, see Tables 6, 7, 9 and 10.

5.4 Diameter

5.4.1 Tolerances

When measured in accordance with 6.3.1 of EN 12385-1:2002, the actual diameter under no load and under a load equivalent to 5 % or 10 % of the minimum breaking force of the rope shall not vary from the nominal diameter by more than the values given in Tables 2, 3 or 4, as appropriate.

Table 2 — Tolerances on diameter for suspension ropes for traction drive lifts and governor ropes with fibre and other non-metallic cores

Nominal rope diameter mm	**Tolerances as percentage of nominal diameter**		
	Maximum at no load	**Minimum at**	
		5 % of F_{min}	**10 % of F_{min}.**
up to 10	+ 6	+ 1	0
greater than 10	+ 5	+ 1	0

Table 3 — Tolerances on diameter for suspension ropes for traction drive lifts and governor ropes with steel and steel based composite cores

Nominal rope diameter mm	**Tolerances as percentage of nominal diameter**		
	Maximum at no load	**Minimum at**	
		5 % of F_{min}	**10 % of F_{min}**
up to 10	+ 3	0	- 1
greater than 10	+ 2	0	- 1

Table 4 — Tolerances on diameter for suspension ropes of roped hydraulic lifts and compensating ropes

Nominal rope diameter mm	**Tolerance as percentage of nominal rope diameter**
From 6 to < 8	+6 0
8 and greater	+5 0

5.4.2 Differences between diameter measurements

The difference between any two of the four measurements stated in 6.3.1 of EN 12385-1:2002 at a load equivalent to 5 % or 10 % of the minimum breaking force shall not exceed the values given in Table 5 for diameter ovality.

The difference between the average of the two measurements taken at each of the two positions stated in 6.3.1 of EN 12385-1:2002 at a load equivalent to 5 % or 10 % of the minimum breaking force shall not exceed the values given in Table 5 for average diameter variation.

Table 5 — Differences between diameter measurements

Nominal rope diameter mm	Diameter ovality as percentage of nominal diameter	Average diameter variation as percentage of nominal diameter
< 8	4	3
8 and greater	3	2

NOTE The values in the table apply irrespective of the type of core in the rope.

5.5 Breaking force

The breaking force shall be specified only as minimum breaking force.

The values of minimum breaking force for the more common classes and grades of rope shall be not less than those given in Tables 6, 7, 8, 9 and 10. For intermediate rope diameters, the values shall be not less than those obtained using the formula given in annex A with the factors given in the tables.

NOTE Refer to the definitions given in EN 12385-2 for derivation of the formula for calculation of minimum breaking force.

5.6 Designation and classification

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

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 6.5 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.

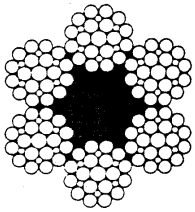
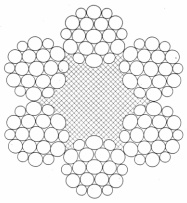
6.5 Rope grade

Compliance with the rope grade requirements shall be through a visual verification of the inspection documents supplied with the wire, in particular the wire tensile strength grades of the outer and inner wires, in relation to the minimum breaking force value of the rope.

7 Information for use

Information for use shall be in accordance with clause 7 of Part 1.

Table 6 — Class 6 x 19 with fibre core

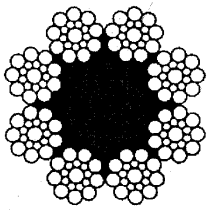
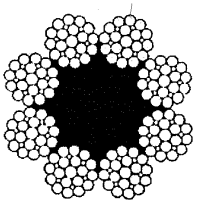
Construction cross section examples	**Construction of rope**			**Construction of strand**		
 6×25F-FC	**Item**		**Quantity**	**Item**		**Quantity**
	Strands		6	Wires		19 to 29
	Outer strands		6	Outer wires		9 to 14
	Layers of strands		1	Layers of wires		2
	Wires in rope		114 to 174			
	Typical examples			No. of outer wires		Outer wire factor[1)]
	Rope	Strand		Total	per strand	
 6×19W-FC	6×19 S	1-9-9		54	9	0,080
	6×25 F	1-6-6F-12		72	12	0,064
	6×19 W	1-6-6+6		72	12	0,073 8
					6	0,055 6
	Min. breaking force factor			K_1 = 0,330		
	Nominal length mass factor[1)]:			W_1 = 0,359		
	Nominal metallic cross-sectional area factor[1)]:			C_1 = 0,384		

Nominal rope diameter	**Approximate nominal length mass**[1)]	**Minimum breaking force** (kN)			
		Dual tensile		**Single tensile**	
mm	kg/100 m	Rope grade 1180/ 1770	Rope grade 1370/ 1770	Rope grade 1570	Rope grade 1770
6	12,9	16,3	17,8	18,7	21,0
6,5	15,2	19,1	20,9	21,9	24,7
8[2)]	23,0	28,9	31,7	33,2	37,4
9	29,1	36,6	40,1	42,0	47,3
10[2)]	35,9	45,2	49,5	51,8	58,4
11[2)]	43,4	54,7	59,9	62,7	70,7
12	51,7	65,1	71,3	74,6	84,1
13[2)]	60,7	76,4	83,7	87,6	98,7
14	70,4	88,6	97,0	102	114
15	80,8	102	111	117	131
16[2)]	91,9	116	127	133	150
18	116	146	160	168	189
19[2)]	130	163	179	187	211
20	144	181	198	207	234
22[2)]	174	219	240	251	283

[1)] Informative only

[2)] Preferred sizes

Table 7 — Class 8 x 19 with fibre core

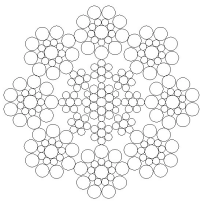
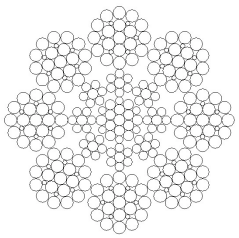
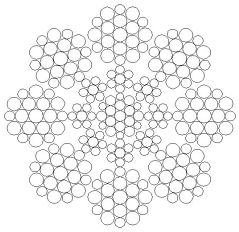
Construction cross section examples	Construction of rope		Construction of strand		
 8×19S-FC	**Item**	**Quantity**	**Item**		**Quantity**
	Strands	8	Wires		19 to 29
	outer strands	8	Outer wires		9 to 14
	layers of strands	1	Layers of wires		2
	Wires in rope	152 to 232			
	Typical examples		**No. of outer wires**		**Outer wire factor[1)]**
	Rope	**Strand**	**Total**	**per strand**	
 8×25F-FC	8×19 S	1-9-9	72	9	0,065 5
	8×25 F	1-6-6F-12	96	12	0,052 5
	8×19 W	1-6-6+6	96	12	0,060 6
				6	0,045 0
	Min. breaking force factor		K_1 = 0,293		
	Nominal length mass factor[1)]:		W_1 = 0,340		
	Nominal metallic cross-sectional area factor[1)]:		C_1 = 0,349		

Nominal rope diameter	Approximate nominal length mass[1)]	Minimum breaking force (kN)		
		Dual tensile		Single tensile
mm	kg/100 m	Rope grade 1180/ 1770	Rope grade 1370/ 1770	Rope grade 1570
8[2)]	21,8	25,7	28,1	29,4
9	27,5	32,5	35,6	37,3
10[2)]	34,0	40,1	44,0	46,0
11[2)]	41,1	48,6	53,2	55,7
12	49,0	57,8	63,3	66,2
13[2)]	57,5	67,8	74,3	77,7
14	66,6	78,7	86,1	90,2
15	76,5	90,3	98,9	104
16[2)]	87,0	103	113	118
18	110	130	142	149
19[2)]	123	145	159	166
20	136	161	176	184
22[2)]	165	194	213	223

[1)] Informative only

[2)] Preferred sizes.

Table 8 — Class 8 x 19 with steel core

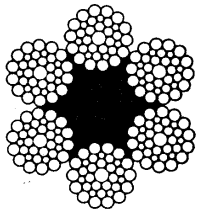
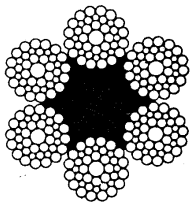
Construction cross section examples	Construction of rope		Construction of strand		
	Item	**Quantity**	**Item**	**Quantity**	
 8×19S-IWRC	Strands	8	Wires	19 to 29	
	outer strands	8	Outer wires	9 to 14	
	layers of strands	1	Layers of wires	2	
	Wires in rope	152 to 232			
	Typical examples		**No. of outer wires**		**Outer wire factor[1)]**
	Rope	**Strand**	**Total**	**per strand**	
 8×25F-IWRC	8×19 S	1-9-9	72	9	0,065 5
	8×25 F	1-6-6F-12	96	12	0,052 5
	8×19 W	1-6-6+6	96	12	0,060 6
				6	0,045 0
 8×19W-IWRC	Min. breaking force factor		K_2 = 0,356		
	Nominal length mass factor[1)]:		W_2 = 0,407		
	Nominal metallic cross-sectional area factor[1)]:		C_2 = 0,457		

Nominal rope diameter	Approximate nominal length mass[1)]	Minimum breaking force (kN)			
		Dual tensile		Single tensile	
mm	kg/100 m	Rope grade 1370/ 1770	Rope grade 1570/ 1770	Rope grade 1570	Rope grade 1770
8[2)]	26,0	35,8	38,0	35,8	40,3
9	33,0	45,3	48,2	45,3	51,0
10[2)]	40,7	55,9	59,5	55,9	63,0
11[2)]	49,2	67,6	71,9	67,6	76,2
12	58,6	80,5	85,6	80,5	90,7
13[2)]	68,7	94,5	100	94,5	106
14	79,8	110	117	110	124
15	91,6	126	134	126	142
16[2)]	104	143	152	143	161
18	132	181	193	181	204
19[2)]	147	202	215	202	227
20	163	224	238	224	252
22[2)]	197	271	288	271	305

[1)] Informative only

[2)] Preferred sizes

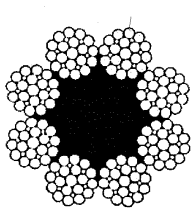
Table 9 — Class 6 x 36 with fibre core for compensating duty only

<table>
<tr><td rowspan="2">Construction cross section examples
 
6×36WS-FC
 
6×41WS-FC</td><td colspan="4">Construction of rope</td><td colspan="3">Construction of strand</td></tr>
<tr><td colspan="2">Item</td><td>Quantity</td><td colspan="2">Item</td><td>Quantity</td></tr>
<tr><td colspan="2">Strands
Outer strands
Layers of strands
Wires in rope</td><td>6
6
1
174 to 246</td><td colspan="2">Wires
Outer wires
Layers of wires</td><td>29 to 41
12 to 16
3</td></tr>
<tr><td colspan="2">Typical examples</td><td colspan="2">No. of outer wires</td><td colspan="2">Outer wire factor[1)]</td></tr>
<tr><td>Rope</td><td>Strand</td><td>Total</td><td>per strand</td><td colspan="2"></td></tr>
<tr><td>6×31WS
6×36WS
6×41WS</td><td>1-6-6+6-12
1-7-7+7-14
1-8-8+8-16</td><td>72
84
96</td><td>12
14
16</td><td colspan="2">0,064
0,056
0,050</td></tr>
<tr><td colspan="7">Min. breaking force factor K_1 = 0,330
Nominal length mass factor[1)]: W_1 = 0,367
Nominal metallic cross-sectional area factor[1)]: C_1 = 0,393</td></tr>
</table>

Nominal rope diameter	**Approximate nominal length mass**[1)]	**Minimum breaking force** (kN)
mm	kg/100 m	Rope grade 1370/1770
13	62,0	83,7
14	71,9	97,0
16	94,0	127
18	119	160
19	132	179
20	147	198
22	178	240
24	211	285
26	248	335
28	288	388
32	376	507
36	476	642
38	530	715

[1)] Informative only

Table 10 — Class 8 x 19 with fibre core for compensating duty only

Construction cross section examples	**Construction of rope**		**Construction of strand**		
	Item	**Quantity**	**Item**		**Quantity**
	Strands	8	Wires		25
	outer strands	8	Outer wires		12
	layers of strands	1	Layers of wires		2
	Wires in rope	200			
	Typical examples		**No. of outer wires**		**Outer wire factor[1)]**
8×25F-FC	**Rope**	**Strand**	**Total**	**per strand**	
	8×25 F	1-6-6F-12	96	12	0,052 5
	Min. breaking force factor		K_2 = 0,293		
	Nominal length mass factor[1)]:		W_2 = 0,340		
	Nominal metallic cross-sectional area factor[1)]:		C_2 = 0,349		

Nominal rope diameter	**Approximate nominal length mass[1)]**	**Minimum breaking force (kN)**
mm	kg/100 m	Rope grade 1770
24	196	299
26	230	351
28	267	407
32	348	531
36	441	672
38	491	749

[1)] Informative only

Annex A
(normative)
Calculation of minimum breaking force for those ropes classes covered by Tables 6 to 10

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

$$F_{\min} = \frac{K.d^{2}.R_{r}}{1000}$$

where

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

R_r is the rope grade, in N/mm^2 , for single tensile ropes; for dual tensile ropes the values of R_{dt} in Table A.1 apply;

K is the empirical factor for the minimum breaking force for a given rope class.

The empirical factors, i.e. K_1 for ropes with fibre cores and K_2 for ropes with steel cores, are given in Tables 6 to 10.

Table A.1 —Values of R_{dt} for dual tensile ropes

Rope grade	Class or construction	R_{dt}
1180/1770	6x19 and 8x19 with fibre core	1370
1370/1770	6x19, 8x19 and 6x36 with fibre core	1500
1370/1770	8x19 with steel core	1570
1570/1770	8x19 with steel core	1670

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

The following information should be supplied with an enquiry or an order:

a) reference to this standard, i.e. EN 12385-5;

b) quantity and length;

c) nominal diameter;

d) rope class or construction;

e) core type;

f) rope grade;

g) wire finish;

h) lay direction and type;

NOTE Lift ropes are normally manfactured right hand ordinary lay unless otherwise specified by the purchaser.

i) preformation;

NOTE Lift ropes are preformed during manufacture. The purchaser should specify any particular preformation requirements.

j) lubrication;

NOTE The strands of lift ropes are lubricated. The purchaser should specify any particular lubrication requirements.

k) any particular rope termination requirements;

l) type of inspection document - refer EN 12385-1;

m) any particular marking requirements;

n) any particular packaging requirements;

o) minimum breaking force required;

p) intended use, e.g. suspension rope for traction drive lift; suspension rope for roped hydraulic lift; governor rope; compensating rope.

Annex ZA
(informative)
Relationship of this document with EC Directives

This Part of this European Standard has been prepared under a Mandate given to CEN by the European Commission and the European Free Trade Association, and supports the essential requirements of EC Directives as follows:

Lift Directive 95/16/EC.

Compliance with the listed clauses of this Part provides one means of complying with the specific essential requirements of the Directive concerned and associated EFTA regulations.

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

Bibliography

ISO 4345:1988, *Steel wire ropes – Fibre main cores – Specifications.*

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