



BS 302 : Part 4 : 1987

UDC 677.721:621.876-83

© British Standards Institution. No part of this publication may be photocopied or otherwise reproduced without the prior permission in writing of BSI

British Standard

Stranded steel wire ropes

Part 4. Specification for ropes for lifts

Câbles toronnés en acier
Partie 4. Câbles pour ascenseurs — Spécifications

Litzenseile aus Stahldrähten
Teil 4. Aufzugseile

British Standards Institution

Foreword

This Part of BS 302 has been prepared under the direction of the Mechanical Handling Standards Committee. It is one Part of a combined revision of BS 302 : 1968, BS 236 : 1968, BS 329 : 1968, BS 330 : 1968, BS 365 : 1968 and BS 3530 : 1968, which are withdrawn. BS 302 is now published in six Parts and takes account of both national and international developments since 1968.

This Part (Part 4) specifies requirements for ropes for lifts additional to the general requirements in Part 1. Other Parts specify the additional requirements for other particular uses of ropes:

- Part 2 Specification for ropes for general purposes
- Part 3 Specification for zinc coated ropes for ships
- Part 5 Specification for ropes for hauling purposes
- Part 6 Specification for ropes for mine hoisting

Two further Parts are in preparation, covering larger diameter ropes (64 mm to 205 mm diameter) and higher strength ropes and will be Parts 7 and 8 respectively.

In line with the principles of international standard ISO 2408, published by the International Organization for Standardization (ISO), the constructions are grouped according to the number of outer wires in the strands. The general requirements of BS 302 : Part 1 and the methods used for calculating breaking loads and approximate masses comply with ISO 2408. In respect of individual usages the ropes in Parts 2 and 3 are fully in accordance with ISO 2408 and those in section two of Part 4 are in accordance with ISO 4344. In each of these Parts however, certain additional ropes still in common use in the UK have been included.

In line with current international practice, the term 'zinc coated' has been adopted in this standard in place of 'galvanized'. The terms are synonymous.

Purchasers ordering to BS 302 are advised to specify in their purchasing contract that the manufacturer operate a quality system in compliance with the appropriate Part of BS 5750, or suitable equivalent, to ensure themselves that products claimed to comply with BS 302 consistently achieve the required level of quality.

Wire rope users will find valuable information in the companion publication BS 6570 'Code of practice for the selection, care and maintenance of steel wire ropes'.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Contents

	Page
Foreword	Inside front cover
Committees responsible	Back cover
Section one. General	
1 Scope	2
2 Definitions	2
3 Compliance	2
4 Material	2
5 Direction of lay	2
6 Diameter and ovality tolerances	2
7 Lubrication	2
8 Wire rope constructions and sizes	2
Section two. 1370/1770 grade dual tensile rope and 1570 grade single tensile rope	
9 Tensile grade of wires	4
10 Minimum breaking load	4
Section three. 1180/1770 grade dual tensile rope	
11 Tensile grade of wires	6
12 Minimum breaking load	6
Appendix	
A Recommendations for handling, use and care of steel wire ropes for electric lifts	8
Tables	
1 Rope diameter tolerances	2
2 Wire rope constructions	3
3 6 x 19 construction group: equal lay	4
4 8 x 19 construction group: equal lay	5
5 6 x 19 construction group: equal lay	6
6 8 x 19 construction group: equal lay	7

BS 302 : Part 4 : 1987
Specification. Section one

Section one. General

1 Scope

This Part of BS 302, which consists of three sections, specifies the requirements for single and dual tensile steel wire ropes for lifts and is for use in conjunction with BS 302 : Part 1.

Section two applies to suspension and ancillary ropes for electric lifts which:

- (a) are new;
- (b) have been modified to use 1370/1770 grade dual tensile rope; or
- (c) are capable of using 1370/1770 grade dual tensile rope.

NOTE 1. Section two is generally aligned with ISO 4344 except that the 1770 grade single tensile ropes which are not used in the UK are not included. It also aligns with and is complementary to BS 5655 : Part 1 which is the English language edition of EN 81 : Part 1.

Section three applies to suspension and ancillary ropes for existing electric lifts that require replacement of 1180/1770 grade ropes and are not capable of accepting the ropes specified in section two with higher tensile outer wires.

NOTE 2. The ropes in section three were previously specified in BS 329, and include some non-preferred sizes.

NOTE 3. Information to be given by the purchaser on the enquiry and order is given in appendix F of BS 302 : Part 1 : 1987.

NOTE 4. Recommendations for the handling, use and care of steel wire ropes for electric lifts are given in appendix A.

NOTE 5. The titles of the publications referred to in this standard are listed on the inside back page.

2 Definitions

For the purposes of this Part of BS 302, the definitions given in BS 302 : Part 1 apply.

3 Compliance

1570 grade and 1370/1770 grade ropes shall comply with the requirements of sections one and two of this Part and with BS 302 : Part 1. 1180/1770 grade ropes shall comply with the requirements of sections one and three of this Part and with BS 302 : Part 1.

4 Material

4.1 Wire

4.1.1 General. The wire used for the manufacture of wire ropes to this standard, as shown in table 2, shall comply with sections one and two of BS 2763 : 1982. The mechanical tests shall be confined to the tensile strength and torsion requirements.

4.1.2 Wire finish. The wire shall be bright or zinc-coated.

NOTE. It will need to be stated by the purchaser on his enquiry and order if zinc-coated wire is required, otherwise bright wire will be supplied.

4.2 Rope core

The core shall be of fibre and shall comply with 3.2 of BS 302 : Part 1 : 1987.

4.3 Joints

Wires of over 0.25 mm diameter shall be joined by welding or brazing. Wires below these sizes shall be welded, brazed or tucked.

5 Direction of lay

Ropes shall be of right-hand lay or of left-hand lay.

NOTE. For economic reasons right-hand lay is preferred and will be supplied. It will need to be stated by the purchaser on his enquiry and order if a left-hand lay rope is required.

6 Diameter and ovality tolerances

6.1 Diameter tolerances

When measured in accordance with appendix A of BS 302 : Part 1 : 1987, under no load and under a load of 10 % of the minimum breaking load (MBL), the actual diameter shall be equal to the nominal diameter with a tolerance in accordance with table 1.

Table 1. Rope diameter tolerances		
Rope diameter	No load	10 % MBL
Up to and including 10 mm	+6 % +2 %	+4 % 0 %
Over 10 mm	+5 % +2 %	+3 % 0 %

6.2 Ovality tolerances

The maximum variation between any of the four measurements made in accordance with appendix A of BS 302 : Part 1 : 1987 under no load or under a load of 10 % of the minimum breaking load shall not exceed 3 % of the nominal diameter.

7 Lubrication

The rope shall be lubricated in stranding and wiped well back.

The main fibre core shall be adequately lubricated.

Lubricants shall comply with 3.3 of BS 302 : Part 1 : 1987.

8 Wire rope constructions and sizes

Constructions and size ranges shall be as given in table 2.

Table 2. Wire rope constructions			
Rope group	Description	Size range (diameter)	Typical construction
6 x 19	Six strands, 8 to 12 outer wires in a strand Two or three layers over a king wire Wires equal laid	mm 6 to 22	6 x 19 (9/9/1) 6 x 19 (12/6+6F/1)
8 x 19	Eight strands, 8 to 12 outer wires in a strand Two or three layers over a king wire Wires equal laid	8 to 22	8 x 19 (9/9/1) 8 x 19 (12/6+6F/1)

BS 302 : Part 4 : 1987
Section two

Section two. 1370/1770 grade dual tensile rope and 1570 grade single tensile rope

9 Tensile grade of wires

Excluding filler wires and king wires, the tensile grade for single tensile rope shall be 1570 N/mm²* and the tensile grade for dual tensile ropes shall be:

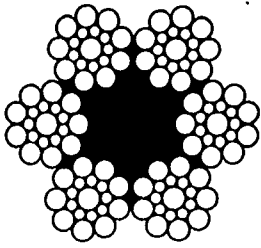
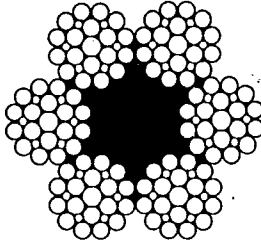
- (a) outers: 1370 N/mm²;
- (b) inners: 1770 N/mm².

10 Minimum breaking load

The minimum breaking loads shall be as given in tables 3 and 4.

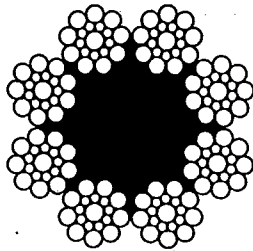
NOTE. For guidance, these tables also give approximate masses of ropes, calculated as in C.2 of BS 302 : Part 1 : 1987.

Table 3. 6 x 19 construction group: equal lay

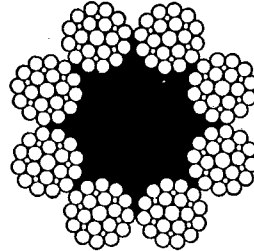
  6 x 19 (9/9/1) FC 6 x 19 (12/6 + 6F/1) FC				
Nominal diameter	Minimum breaking force/load of rope corresponding to nominal tensile grade of the wires of 1570 N/mm ² single tensile; 1370/1770 N/mm ² dual tensile; both calculated on a single tensile of 1500 N/mm ²		Approximate mass (fibre cored)	
			Natural fibre	Man-made fibre
mm	kN	t	kg/100 m	kg/100 m
6	17.8	1.81	13.0	12.7
8	31.7	3.23	23.1	22.5
10	49.5	5.05	36.1	35.2
11	59.9	6.11	43.7	42.6
13	83.7	8.53	61.0	59.5
16	127	12.9	92.4	90.1
19	179	18.2	130	127
22	240	24.5	175	170

*1 N/mm² = 1 MPa.

Table 4. 8 x 19 construction group: equal lay



8 x 19 (9/9/1) FC



8 x 19 (12/6 + 6F/1) FC

Nominal diameter	Minimum breaking force/load of rope corresponding to nominal tensile grade of the wires of 1570 N/mm ² single tensile; 1370/1770 N/mm ² dual tensile; both calculated on a single tensile of 1500 N/mm ²		Approximate mass (fibre cored)	
			Natural fibre	Man-made fibre
mm	kN	t	kg/100 m	kg/100 m
8	28.1	2.86	22.2	21.7
10	43.9	4.48	34.7	33.9
11	53.2	5.42	42.0	41.0
13	74.3	7.57	58.6	57.3
16	113	11.5	88.8	86.8
19	159	16.2	125	122
22	213	21.7	168	164

BS 302 : Part 4 : 1987
Section three

Section three. 1180/1770 grade dual tensile rope

11 Tensile grade of wires

Except filler wires and king wires, the tensile grade of wires shall be:

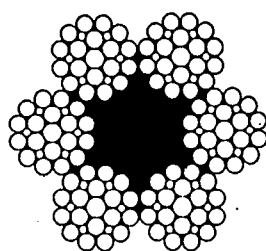
- (a) outers: 1180 N/mm²;
- (b) inners: 1770 N/mm².

12 Minimum breaking load

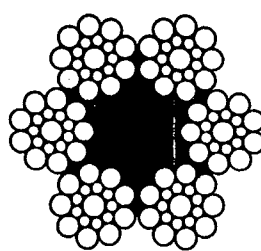
For the purposes of clause 7 of BS 302 : Part 1 : 1987, the minimum breaking loads shall be as given in tables 5 and 6.

NOTE. For guidance, these tables also give approximate masses of ropes, calculated as in C.2 of BS 302 : Part 1 : 1987.

Table 5. 6 x 19 construction group: equal lay



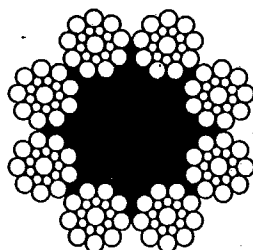
6 x 19 (12/6 + 6F/1) FC



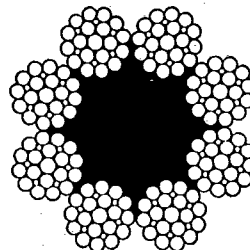
6 x 19 (9/9/1) FC

Nominal diameter	Minimum breaking force/load of rope corresponding to nominal tensile grade of the wires of 1370 N/mm ² , 1180/1770 N/mm ² 1370/1570 N/mm ² calculated on a single tensile of 1370 N/mm ²		Approximate mass (fibre cored)	
			Natural fibre	Man-made fibre
mm	kN	t	kg/100 m	kg/100 m
6.5	19.2	1.96	15.3	14.9
8	29.1	2.97	23.1	22.5
9.5	41.0	4.18	32.6	31.8
11	55.0	5.61	43.7	42.6
13	76.8	7.83	61.0	59.5
16	116	11.8	92.4	90.1

Table 6. 8 x 19 construction group: equal lay



8 x 19 (9/9/1) FC



8 x 19 (12/6 + 6F/1) FC

Nominal diameter	Minimum breaking force/load of rope corresponding to nominal tensile grade of the wires of 1370 N/mm ² , 1180/1770 N/mm ² , 1370/1570 N/mm ² calculated on a single tensile of 1370 N/mm ²		Approximate mass (fibre cored)	
			Natural fibre	Man-made fibre
mm	kN	t	kg/100 m	kg/100 m
8	25.2	2.57	22.2	21.7
9.5	35.6	3.63	31.3	30.6
11	47.7	4.86	42.0	41.0
13	66.6	6.79	58.6	57.3
16	101	10.3	88.8	86.8
19	142	14.5	125	122

Appendix

Appendix A. Recommendations for handling, use and care of steel wire ropes for electric lifts

A.1 Storage

The wrappings of a rope should be removed immediately after delivery and the rope examined.

Ropes should be stored in a cool, dry building whose temperature is kept reasonably constant to prevent condensation, and should not be in contact with the floor. Ropes should never be stored where they are liable to be affected by acid fumes, steam or other corrosive influences. Rope in store should be examined periodically.

A.2 Uncoiling and handling

Ropes should be paid out from a reel or coil and, to prevent the possibility of kinking or disturbance to the lay, should be paid out without slack and in a straight line. A coil of rope should preferably be paid out from a turntable. A reel of rope should be set up with a spindle supported on jacks. A rope should never be unwound by throwing off turns with the coil or reel flat on the ground.

Lang's lay rope is more liable to deform than ordinary lay, and will give satisfactory service only if handled with due care.

A.3 End fittings

All rope terminations should comply with the appropriate British Standard*. They should be strictly compatible with the wire rope, correctly fitted, tested and certified where applicable.

A.4 Hand splicing

A thimble or loop splice made in the wire rope should have at least three tucks with a whole strand of the rope, and two tucks with one half of the wires cut out of each strand made under and over, against the lay of the rope. The splice should be tightly drawn and neatly made.

A.5 Ferrule secured eye terminations

Ferrule secured eye terminations fitted to wire ropes should be in accordance with BS 5281.

A.6 Installation

It is recommended that all the ropes of any one lift installation should be taken from one rope-making (production length).

Prior to installation of a new rope, grooves of drums sheaves and pulleys should be examined to ensure that the profile is correct for the size and type of rope to be fitted. Where necessary worn grooves should be machined to the correct profile. A new rope installed on to a worn sheave will suffer damage which could greatly reduce its service life.

Care should be taken when installing a rope to prevent unlaying of the rope due to rotation of the free end. This is particularly important with Lang's lay ropes.

Servings should not be removed without ensuring that the lay of the rope will be held.

Care should be taken when installing multiple ropes to ensure tensions are equal, and provision should be made for any necessary length adjustment.

After installation ropes should be checked for lengths and tensions.

A.7 Maintenance

Maintenance should comprise regular inspections and cleaning, with records kept of any adjustments carried out, any defects noted, or any other incident relative to rope performance. The inspection should always include any end fittings, with emphasis at the point of entry.

*i.e. BS 462, BS 463 or BS 464.

Publications referred to

- BS 462 Specification for wire rope grips
- BS 463 Sockets for wire ropes
- BS 464 Thimbles for wire ropes
- BS 2763 Specification for round carbon steel wire for wire ropes
- BS 5281 Ferrule secured eye terminations for wire ropes
- BS 5655 Lifts and service lifts
 - Part 1 Safety rules for the construction and installation of electric lifts
- BS 5750 Quality systems
 - Part 2 Specification for manufacture and installation
- BS 6570* Code of practice for the selection, care and maintenance of steel wire ropes
- ISO 2408* Steel wire ropes for general purposes — Characteristics
- ISO 4344* Steel wire ropes for lifts
- EN 81 Safety rules for the construction and installation of lifts and service lifts
 - Part 1 Electric lifts

*Referred to in the foreword only.

BS 302 : Part 4 : 1987

This British Standard, having been prepared under the direction of the Mechanical Handling Standards Committee, was published under the authority of the Board of BSI and comes into effect on 30 June 1987.

© British Standards Institution, 1987

First published, as BS 302, September 1927

First revision, as BS 302 and 621, December 1957

Second revision, as BS 302, May 1968

Third revision, as BS 302 : Part 4, June 1987.

ISBN 0 580 15659 1

The following BSI references relate to the work on this standard:
Committee reference MHE/2 Draft for comment 85/70788 DC

British Standards Institution. Incorporated by Royal Charter, BSI is the independent national body for the preparation of British Standards. It is the UK member of the International Organization for Standardization and UK sponsor of the British National Committee of the International Electrotechnical Commission.

In addition to the preparation and promulgation of standards, BSI offers specialist services including the provision of information through the BSI Library and Standardline Database; Technical Help to Exporters; and other services. Advice can be obtained from the Enquiry Section, BSI, Milton Keynes MK14 6LE, telephone 0908 221166, telex 825777.

Copyright. Users of British Standards are reminded that copyright subsists in all BSI publications. No part of this publication may be

reproduced in any form without the prior permission in writing of BSI. This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols and size, type or grade designations. Enquiries should be addressed to the Publications Manager, BSI, Linford Wood, Milton Keynes MK14 6LE. The number for telephone enquiries is 0908 220022 and for telex 825777.

Contract requirements. A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Revision of British Standards. British Standards are revised, when necessary, by the issue either of amendments or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

Automatic updating service. BSI provides an economic, individual and automatic standards updating service called PLUS. Details are available from BSI Enquiry Section at Milton Keynes, telephone 0908 221166, telex 825777.

Information on all BSI publications is in the *BSI Catalogue*, supplemented each month by *BSI News* which is available to subscribing members of BSI and gives details of new publications, revisions, amendments and withdrawn standards. Any person who, when making use of a British Standard, encounters an inaccuracy or ambiguity, is requested to notify BSI without delay in order that the matter may be investigated and appropriate action taken.

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Mechanical Handling Standards Committee (MHE/-) to Technical Committee MHE/2, upon which the following bodies were represented:

Associated Offices Technical Committee

Association of Supervisory and Executive Engineers

British Coal

British Ports Association and the National Association of Ports Employers

British Railways Board

British Steel Industry (Wire Section)

Bureau Veritas

Chain Testers Association of Great Britain

Department of the Environment (Property Services Agency)

Federation of Manufacturers of Construction Equipment and Cranes

Federation of Wire Rope Manufacturers of Great Britain

Health and Safety Executive

Institution of Mechanical Engineers

Institution of Mining Engineers

Institution of Mining and Metallurgy

Ministry of Defence

National Association of Lift Makers

Zinc Development Association

Amendments issued since publication

Amd. No.	Date of issue	Text affected

British Standards Institution · 2 Park Street London W1A 2BS · Telephone 01-629 9000 · Telex 266933