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Specification for
**Round carbon steel
wire for wire ropes**

Spécification pour les fils ronds en acier au carbone pour la fabrication des câbles métalliques

Spezifikation für Runddraht aus Kohlenstoffstahl für Drahtseile



Contents

	Page
Foreword	Inside front cover
Cooperating organizations	Back cover

Specification**Section one. General**

1. Scope	1
2. References	1
3. Definitions	1
4. Information to be supplied by the purchaser	1
5. Inspection and testing	1
6. Identification and packaging	2

Section two. General purpose rope wire

7. General	2
8. Manufacture	2
9. Dimensional tolerances	2
10. Mechanical properties	2
11. Zinc coating	2

Section three. High duty rope wire

12. General	6
13. Manufacture	6
14. Dimensional tolerances	6
15. Mechanical properties	6
16. Zinc coating	7

Foreword

This revision of BS 2763 : 1968 has been prepared under the direction of the Iron and Steel Standards Committee. It has been extensively revised to take account of ISO 2232-1973, ISO 3154-1976 and other work on the standardization of steel wire by the International Organization for Standardization (ISO) still in progress,

Tables

	Page
1. Tolerances on nominal diameter of general purpose rope wire	3
2. Tensile strength grades and nominal diameter ranges for general purpose rope wire	3
3. Tensile strength tolerance above the specified minimum for general purpose rope wire	3
4. Minimum number of twists (in a length of $100 \times$ diameter of wire) in torsion tests of general purpose rope wire	4
5. Minimum number of reverse bends in reverse bend tests of general purpose and high duty rope wire	5
6. Zinc coating tests: minimum mass and minimum number of dips in uniformity test, for general purpose and high duty rope wire	6
7. Tolerances on nominal diameter of high duty rope wire	7
8. Tensile strength grades and nominal diameter ranges for high duty rope wire	7
9. Tensile strength tolerance above the specified minimum for high duty rope wire	7
10. Minimum number of twists (in a length of $100 \times$ diameter of wire) in torsion tests of high duty rope wire	7

where it is relevant to British practice. BS 2763 : 1968 is now withdrawn.

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

British Standard Specification for Round carbon steel wire for wire ropes

Section one. General

1. Scope

This British Standard specifies requirements for cold drawn round carbon steel wire as supplied by the wire manufacturer for use in the manufacture of wire ropes.

The specific requirements for wire for general purpose ropes, including those specified in BS 302, BS 329, BS 365 and BS 3530, are given in section two.

The specific requirements for wire for high duty ropes that are subject to more exacting service conditions than general purpose ropes, and in particular for winding and certain haulage ropes complying with the requirements of BS 236 and BS 330 respectively, are given in section three.

Wires for both general and high duty purposes are available in a number of tensile strength grades over specific nominal diameter ranges (see tables 2 and 8).

2. References

The titles of standards publications referred to in this standard are listed on the inside back cover.

3. Definitions

For the purposes of this British Standard, the following definitions apply.

3.1 production coil. A production coil of wire is that drawn from one coil of rod. It will usually be at least 800 kg but may be much greater in mass.

3.2 package. Wire may be wound into coil form or on to spools. It may be wound on to collapsible spools from which it is removed as 'cheeses' or, when wound on cardboard centre supports, as 'spoolless cores'; the latter are suitable for fitting with flanges as a pay-off spool.

To avoid repetition of each term in this specification it is convenient to describe all these forms by the word 'package'.

3.3 split package. When, for the convenience of the ropemaker, a production coil is split into smaller pieces the latter are described as 'split packages'.

4. Information to be supplied by the purchaser

When ordering wire complying with the requirements of this standard, the purchaser shall state the following:

- (a) the number of this British Standard, i.e. BS 2763;
- (b) the nominal diameter;

NOTE. The nominal diameter of zinc coated wire includes the coating.

(c) the tensile strength grade;

(d) the type of finish, i.e. bright, class A (drawn zinc coated or finally zinc coated) or class Z zinc coated, as defined in clause 7.

Example:

3 mm diameter, class Z zinc coated wire having a minimum tensile strength of 1570 N/mm² :

BS 2763, 3 mm, grade 1570, Z zinc coated.

5. Inspection and testing

5.1 General. All inspection and testing shall be carried out by the wire manufacturer and the record of each test shall be available to the ropemaker if required.

5.2 Selection of test pieces

5.2.1 For general purpose rope wire as specified in section two, test pieces for all tests shall be cut from both ends of each production coil. Where the wire is supplied in split packages, identified to the production coil, the tests on the production coil shall suffice for up to five split packages.

If more than five split packages are taken from one production coil, two extra test pieces (not in adjacent positions) shall be taken from within the group of split packages.

5.2.2 For high duty rope wire as specified in section three, test pieces for all tests shall be cut from both ends of each package or split package as supplied to the ropemaker.

5.3 Test methods

5.3.1 General. All tests shall be carried out on straight pieces of wire. Any straightening which may be required shall be done cold. The diameter of the wire shall be taken as the arithmetic mean of two micrometer readings made at right angles to each other.

5.3.2 Mechanical tests. Mechanical tests shall be carried out in accordance with the appropriate method described in BS 4545, except that, for the tensile tests in routine testing with fixed gear type tensile testing machines, the straining rate shall be pre-set to give a rate of separation of the grips not greater than 40 % of the test length per minute.

The tensile strength of the wire shall be calculated using the nominal diameter.

5.3.3 Zinc coating. The methods of testing the mass, uniformity and adhesion of the zinc coating shall be those described in section two of BS 443 : 1982.

5.4 Retests

5.4.1 Should any test piece fail any of the specified tests, two additional test pieces shall be taken from the same end of the same package or split package of wire and subjected to the test or tests in which the original test piece failed.

5.4.2 If both additional test pieces pass the test or tests, the package or split package from which they were taken shall be deemed to comply with the requirements of this standard. If either of the additional test pieces fails, the package or split package shall be deemed not to comply with the requirements of this standard.

5.4.3 Where the additional test pieces represent a group of split packages (see 5.2.1), if any test piece fails on retesting to comply with a requirement of this standard, then all the split packages within that group shall be tested.

6. Identification and packaging

The wire manufacturer shall attach to each package a durable label or labels, on which the following information shall be shown, in addition to such other markings as may be agreed between the wire manufacturer and ropemaker:

- (a) the wire manufacturer's name;
- (b) the nominal wire diameter;
- (c) the tensile strength grade of the wire;
- (d) the class of zinc coating (if any) and whether drawn coated or finally coated if class A (see clause 8);
- (e) the number of this British Standard, i.e. BS 2763*.

NOTE. The type of packing and any other form of protection should be agreed between the wire and the wire rope manufacturers.

Section two. General purpose rope wire

7. General

This section covers wire used in the manufacture of a variety of general purpose ropes.

Specific requirements are given for wire of diameters between 0.20 mm and 6.00 mm in tensile strength grades 1370 to 2150, depending upon diameter and grade of wire.

The wire may have any one of three types of the following surface finishes:

- (a) bright (without zinc coating);
- (b) class A zinc coat, either drawn after zinc coating ('drawn zinc coated') or zinc coated after drawing ('finally zinc coated');
- (c) class Z zinc coat, drawn after zinc coating (drawn zinc coated')

The wire shall also comply with the requirements of section one of this standard.

8. Manufacture

8.1 The wire shall be cold drawn from rod produced from basic carbon steel. The steel shall not be made by the air or air-oxygen bottom blown converter process. The cast analysis shall show not more than 0.050 % of sulphur and not more than 0.050 % of phosphorus.

8.2 The finished wire shall be free from harmful defects.

8.3 For the zinc coated wire the coating shall be applied by either the hot dip or the electrolytic process. If the coating is applied by the hot dip process, the purity of the zinc fed into the coating bath shall be not lower than grade Zn 3 as specified in BS 3436.

NOTE. Unless otherwise agreed between the wire manufacturer and the ropemaker, the wire manufacturer has the option to supply a class A coating in the 'drawn zinc coated' or 'finally zinc coated' condition, provided that the product is appropriately identified (see item (d) of clause 6).

9. Dimensional tolerances

The tolerances on the diameter of the wire shall be those given in table 1.

10. Mechanical properties

10.1 Tensile strength. The minimum tensile strength of the wire shall be the tensile strength grade ordered.

NOTE. Table 2 gives the tensile strength grades generally available. Intermediate tensile strength grades may be supplied by agreement between the wire manufacturer and the ropemaker.

The maximum tensile strength shall not exceed the specified minimum by more than the tolerance given in table 3.

For wire intended only for lift ropes in accordance with BS 329, the tensile strength tolerance shall be as given in table 9, except that the existing nominal diameter range 0.80 mm to 1.00 mm shall be read as 0.40 mm to 1.00 mm.

10.2 Torsion test. The number of twists shall be not less than the value given in table 4, appropriate to the nominal diameter, tensile strength grade and type of surface, of the wire.

If, by agreement between the wire manufacturer and the ropemaker, an intermediate tensile strength grade is supplied, the minimum number of twists shall be that shown for the next higher tensile strength grade.

10.3 Reverse bend test. If requested by the ropemaker, the number of reverse bends shall be not less than the value given in table 5, appropriate to the diameter, tensile strength grade and type of surface finish of the wire.

If, by agreement between the wire manufacturer and the ropemaker, an intermediate tensile strength grade is supplied, the minimum number of bends shall be that shown for the next higher tensile strength grade.

11. Zinc coating

The zinc coating shall comply with the appropriate requirements for class A or class Z given in table 6 and shall also comply with the requirements for adhesion specified in section two of BS 443 : 1982.

*Marking BS 2763 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility.

Table 1. Tolerances on nominal diameter of general purpose rope wire

Nominal diameter of wire		Tolerance on nominal diameter			
		Bright wire or drawn zinc coated (class A or class Z) wire		Finally zinc coated (class A) wire	
From	Up to but excluding	Plus	Minus	Plus	Minus
mm	mm	mm	mm	mm	mm
0.20	0.25	0.01	0.005	—	—
0.25	0.40	0.01	0.01	—	—
0.40	1.00	0.015	0.015	—	—
1.00	1.60	0.02	0.02	0.04	0.02
1.60	2.40	0.025	0.025	0.05	0.03
2.40	3.70	0.03	0.03	0.06	0.03
3.70	5.00	0.04	0.04	0.08	0.04
5.00	6.00 (inclusive)	0.05	0.05	—	—

Table 2. Tensile strength grades and nominal diameter ranges for general purpose rope wire

Tensile strength grade, min.	Nominal diameter range			
	Bright wire	Drawn zinc coated (class Z) wire	Drawn zinc coated (class A) wire	Finally zinc coated (class A) wire
N/mm ²	mm	mm	mm	mm
1370	0.60 to 6.00	0.60 to 5.00	0.60 to 2.70	1.20 to 5.00
1420	0.40 to 6.00	0.40 to 5.00	0.40 to 2.70	1.20 to 5.00
1570	0.30 to 6.00	0.30 to 5.00	0.30 to 2.70	1.80 to 5.00
1770	0.20 to 5.00	0.20 to 4.00	0.20 to 1.80	2.00 to 3.40
1860	0.20 to 3.20	0.20 to 3.00	0.20 to 1.30	—
1960	0.20 to 3.00	0.20 to 3.00	0.20 to 0.60	—
2050	0.20 to 1.50	0.20 to 1.00	—	—
2150	0.20 to 1.30	—	—	—

Table 3. Tensile strength tolerance above the specified minimum for general purpose rope wire

Nominal diameter of wire		Plus tolerance
From	Up to but excluding	
mm	mm	N/mm ²
0.20	0.50	380
0.50	1.00	300
1.00	1.50	260
1.50	2.00	240
2.00	6.00 (inclusive)	230

Table 4. Minimum number of twists (in a length of 100 × diameter of wire) in torsion tests of general purpose rope wire

Nominal diameter of wire		Minimum number of twists for stated tensile strength grade						
		1370	1570	1770	1860	1960	2050	2150
From	Up to but excluding	Bright wire or drawn zinc coated (class Z) wire						
mm	mm							
0.50	1.00	32	31	28	26	24	24	22
1.00	1.30	31	30	27	25	23	22	20
1.30	1.80	31	30	26	24	22	21	—
1.80	2.30	30	29	25	23	21	—	—
2.30	3.00	29	28	23	21	19	—	—
3.00	3.50	28	27	22	19	—	—	—
3.50	3.80	26	26	21	—	—	—	—
3.80	4.00	25	24	20	—	—	—	—
4.00	4.20	25	23	19	—	—	—	—
4.20	4.40	24	22	18	—	—	—	—
4.40	4.60	24	22	17	—	—	—	—
4.60	4.80	23	21	15	—	—	—	—
4.80	5.00	22	21	13	—	—	—	—
5.00	5.20	20	18	—	—	—	—	—
5.20	5.40	18	16	—	—	—	—	—
5.40	5.60	16	14	—	—	—	—	—
5.60	5.80	14	12	—	—	—	—	—
5.80	6.00 (inclusive)	12	10	—	—	—	—	—
		Drawn zinc coated (class A) wire						
0.50	1.00	29	28	25	23	20		
1.00	1.30	29	28	24	22	—		
1.30	1.80	29	28	23	—	—		
1.80	2.30	28	27	—	—	—		
2.30	2.70 (inclusive)	27	26	—	—	—		
		Finally zinc coated (class A) wire						
1.20	1.30	20	—	—	—	—		
1.30	1.80	20	—	—	—	—		
1.80	2.30	20	18	—	—	—		
2.30	3.00	18	16	—	—	—		
3.00	3.40 (inclusive)	16	14	—	—	—		

NOTE 1. For intermediate tensile strength grades, the minimum number of twists shall be that given for the next higher tensile strength grade (see 10.2).

NOTE 2. Torsion test values are not specified for finally zinc coated wire for nominal diameters over 3.40 mm.

Table 5. Minimum number of reverse bends in reverse bend tests of general purpose and high duty rope wire

Nominal diameter of wire	Bend radius	Minimum number of reverse bends for stated tensile strength grade								
		Bright wire or drawn zinc coated (class A or class Z) wire					Finally zinc coated (class A) wire			
		1370	1570	1770	1960	2050 and 2150	1370	1570	1770	
mm	mm									
0.40	1.25	11	11	10	9	8				
0.45		10	9	9	8	7				
0.50		9	8	7	7	6				
0.55	1.75	15	14	13	12	11				
0.60		13	12	11	10	9				
0.65		11	10	9	8	7				
0.70		10	9	8	7	6				
0.75	2.5	17	15	14	13	12				
0.80		15	14	13	12	11				
0.85		13	13	12	11	9				
0.90		12	12	11	10	8				
0.95		11	11	10	9	7				
1.00		10	10	9	8	6				
1.10	3.75	18	17	16	15	13				
1.20		16	16	15	14	12	13			
1.30		14	14	13	12	10	11			
1.40		12	12	11	10	8	9			
1.50		10	10	9	8	6	8			
1.60	5.0	15	14	13	12		11	—	—	
1.70		13	13	12	11		10	—	—	
1.80		12	12	10	9		9	8	—	
1.90		11	10	9	8		8	7	—	
2.00		10	9	8	7		7	7	5	
2.10	7.5	18	16	15	14		13	12	11	
2.20		17	15	14	13		12	11	10	
2.30		16	14	13	12		11	10	9	
2.40		15	13	12	11		10	9	8	
2.50		14	12	11	10		9	8	7	
2.60		12	11	10	9		9	8	7	
2.70		11	10	9	8		8	7	6	
2.80		10	9	8	7		7	6	5	
2.90		9	9	7	6		7	6	5	
3.00		9	8	7	6		6	5	4	
3.10	10.0	14	13	12	11		10	9	8	
3.20		13	12	11	10		9	8	7	
3.30		12	11	10	—		9	8	7	
3.40		11	10	9	—		8	7	6	
3.50		10	9	8	—		7	6	—	
3.60		9	9	8	—		6	5	—	
3.70		9	8	7	—		6	5	—	
3.80		8	8	6	—		5	4	—	
3.90		8	7	6	—		5	4	—	
4.00		8	7	6	—		5	4	—	
4.20	15.0	11	10	9			7	6		
4.40		10	9	8			6	5		
4.60		9	8	7			6	5		
4.80		8	7	6			5	4		
5.00		7	6	5			4	3		
5.20		7	6	—			—	—		
5.40		6	5	—			—	—		
5.60		5	5	—			—	—		
5.80		4	4	—			—	—		
6.00		4	4	—			—	—		

NOTE 1. For intermediate nominal diameters or tensile strength grades, the bend radius and minimum number of bends shall be those given for the next larger nominal diameter or tensile strength grade (see 10.3).

NOTE 2. Drawn zinc coated wires with class A or class Z coatings are not available through the whole range of wire diameters given in this table (see table 2 for nominal diameter and tensile strength grade limits).

Table 6. Zinc coating tests: minimum mass and minimum number of dips in uniformity test, for general purpose and high duty rope wire

Nominal diameter of wire		Class Z coating			Class A coating		
From	Up to but excluding	Mass, min.	Number of dips		Mass, min.	Number of dips	
			Minute duration	Half minute duration		Minute duration	Half minute duration
mm	mm	g/m ²			g/m ²		
0.20	0.25	20		no test	30		no test
0.25	0.33	30		no test	45		no test
0.33	0.40	30		no test	60		no test
0.40	0.50	40		no test	75		1
0.50	0.60	50		no test	90		1
0.60	0.80	60		1	110	1	—
0.80	1.00	70		1	130	1	—
1.00	1.20	80	1	—	150	1	1
1.20	1.50	90	1	—	165	1	1
1.50	1.90	100	1	—	180	2	—
1.90	2.50	110	1	1	205	2	—
2.50	3.20	125	1	1	230	2	1
3.20	3.70	135	2	—	250	3	—
3.70	4.25	135	2	—	260	3	—
4.25	5.00	150	2	—	275	3	1
5.00	6.00(incl.)	150	2	—	—	—	—

Section three. High duty rope wire

12. General

This section covers high duty rope wire to be used in the manufacture of ropes that are subjected to more exacting service conditions than those for general purpose ropes, and in particular for certain ropes complying with the requirements of BS 236 and BS 330.

Specific requirements are given for wire diameters between 0.80 mm and 4.10 mm in tensile strength grades 1570 to 1960, depending upon diameter and type of wire.

The wire shall be available with either a bright finish or with a class Z zinc coat, drawn after coating.

The wire shall also comply with the requirements of section one of this standard.

13. Manufacture

13.1 The wire shall be cold drawn from rod produced from specially selected basic carbon steel. The steel shall not be made by the air or air-oxygen bottom blown converter process. The cast analysis shall show not more than 0.035 % of sulphur and not more than 0.030 % of phosphorus.

13.2 The finished wire shall be free from harmful defects.

13.3 For zinc coated wire the zinc coating shall be applied by either the hot dip or the electrolytic process. If the coating is applied by the hot dip process, the purity of the zinc fed into the coating bath shall be not lower than grade Zn 3 as specified in BS 3436. The wire shall be drawn after coating.

14. Dimensional tolerances

The tolerances on the diameter of the wire shall be those given in table 7.

15. Mechanical properties

15.1 Tensile strength. The minimum tensile strength of the wire shall be the tensile strength grade ordered.

NOTE. Table 8 gives the tensile strength grades generally available. Intermediate tensile strength grades may be supplied by agreement between the wire manufacturer and the ropemaker.

The maximum tensile strength shall not exceed the specified minimum by more than the tolerance given in table 9.

15.2 Torsion test. The number of twists shall be not less than the value given in table 10, appropriate to the diameter, tensile strength grade and type of surface finish of the wire.

If, by agreement between the wire manufacturer and the ropemaker, an intermediate tensile strength grade is supplied, the minimum number of twists shall be that shown for the next higher tensile strength grade.

15.3 Reverse bend test. The number of reverse bends shall be not less than the value given in table 5, appropriate to the diameter, tensile strength grade and type of surface finish of the wire.

If, by agreement between the wire manufacturer and the ropemaker, an intermediate tensile grade is supplied, the minimum number of bends shall be that shown for the next higher tensile strength grade.

16. Zinc coating

The zinc coating shall comply with the requirements for class Z given in table 6 and shall also comply with the requirements for adhesion specified in section two of BS 443 : 1982.

Table 7. Tolerances on nominal diameter of high duty rope wire

Nominal diameter of wire		Bright wire or drawn zinc coated (class Z) wire	
From	Up to but excluding	Plus	Minus
mm	mm	mm	mm
0.80	1.00	0.015	0.015
1.00	1.60	0.02	0.02
1.60	2.40	0.025	0.025
2.40	3.70	0.03	0.03
3.70	4.10	0.04	0.04

Table 8. Tensile strength grades and nominal diameter ranges for high duty rope wire

Tensile strength grade, min.	Nominal diameter range	
	Bright wire	Drawn zinc coated (class Z) wire
N/mm ²	mm	mm
1570	0.80 to 4.10	0.80 to 4.10
1770	0.80 to 4.10	0.80 to 4.10
1860	0.80 to 3.20	0.80 to 3.00
1960	0.80 to 3.00	0.80 to 3.00

Table 9. Tensile strength tolerance above the specified minimum for high duty rope wire

Nominal diameter of wire		Plus tolerance
From	Up to but excluding	
mm	mm	N/mm ²
0.80	1.00	260
1.00	1.50	240
1.50	4.10	220

Table 10. Minimum number of twists (in a length of 100 × diameter of wire) in torsion tests of high duty rope wire

Nominal diameter of wire		Minimum number of twists for stated tensile strength grade			
From	Up to but excluding	Bright wire or drawn zinc coated (class Z) wire			
		1570	1770	1860	1960
mm	mm				
0.80	1.00	35	33	29	26
1.00	1.30	34	31	28	25
1.30	1.80	33	30	27	24
1.80	2.30	31	28	25	23
2.30	3.00	30	26	23	21
3.00	3.50	29	24	21	—
3.50	3.80	28	23	—	—
3.80	4.10	26	21	—	—

This British Standard, having been prepared under the direction of the Iron and Steel Standards Committee, was published under the authority of the Board of BSI and comes into effect on **31 March 1982**.

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Contract requirements

Attention is drawn to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

Revision of British Standards

British Standards are revised, when necessary, by the issue either of amendment slips 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.** Information on all BSI publications is in the *BS Yearbook*, supplemented each month by *BSI News* which is available to subscribing members of the Institution and gives details of new publications, revisions, amendments and withdrawn standards.

The following BSI references relate to the work on this standard: Committee reference ISE/26 Draft for comment 80/77482 DC

Cooperating organizations

The Iron and Steel Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

- British Constructional Steelwork Association
- British Internal Combustion Engine Manufacturers' Association
- British Ironfounders' Association
- British Railways Board
- *British Steel Corporation
- *British Steel Industry
- *British Steel Industry (Wire Section)
- Concrete Society Limited
- Council of Ironfoundry Associations
- Department of Industry (National Physical Laboratory)
- Electricity Supply Industry in England and Wales
- Engineering Equipment Users' Association
- Federation of Civil Engineering Contractors
- *Institute of Quality Assurance
- Institution of Production Engineers
- Institution of Structural Engineers

- International Tin Research Institute
- Lloyd's Register of Shipping
- National Association of Drop Forgers and Stampers
- Oil Companies Materials Association
- Process Plant Association
- Royal Institute of British Architects
- Society of Motor Manufacturers and Traders Limited
- Steel Casting Research and Trade Association
- Water-tube Boilermakers' Association

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

- British Wire Netting Association
- Federation of Wire Rope Manufacturers of Great Britain
- Fencing Contractors' Association
- Health and Safety Executive
- National Billet Association
- National Coal Board
- Society of Chain Link Fencing Manufacturers

Amendments issued since publication

Amd. No.	Date of issue	Text affected

Standards publications referred to

BS 236	Stranded wire ropes for mine hoisting (winding) purposes
BS 302	Wire ropes for cranes, excavators and general engineering purposes
BS 329	Steel wire ropes for electric lifts
BS 330	Stranded wire ropes for haulage purposes
BS 365	Galvanized steel wire ropes for ships
BS 443	Galvanized coatings on wire
BS 3436	Ingot zinc
BS 3530	Small wire ropes
BS 4545	Methods for mechanical testing of steel wire
ISO 2232*	Drawn wire for general purpose non-alloy steel wire ropes – Specifications
ISO 3154*	Stranded wire ropes for mine hoisting – Technical delivery requirements

* Referred to in the foreword only. References to international standards are for information only.

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Committee reference ISE/26 Draft for comment 80/77482 DC

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- British Constructional Steelwork Association
- British Internal Combustion Engine Manufacturers' Association
- British Ironfounders' Association
- British Railways Board
- * British Steel Corporation
- * British Steel Industry
- * British Steel Industry (Wire Section)
- Concrete Society Limited
- Council of Ironfoundry Associations
- Department of Industry (National Physical Laboratory)
- Electricity Supply Industry in England and Wales
- Engineering Equipment Users' Association
- Federation of Civil Engineering Contractors
- * Institute of Quality Assurance
- Institution of Production Engineers
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- International Tin Research Institute
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- British Wire Netting Association
- Federation of Wire Rope Manufacturers of Great Britain
- Fencing Contractors' Association
- Health and Safety Executive
- National Billet Association
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