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British Standard

Steel wire for hose reinforcement

Part 1. Specification for coated round and flat steel wire for rubber hose reinforcement

Fil d'acier pour le renforcement des tuyaux flexibles
Partie 1. Fil en acier rond et plat revêtu pour renforcement des tuyaux flexibles en caoutchouc — Spécifications

Stahldraht für Schlaucheinlagen
Teil 1. Beschichteter runder und flacher Stahldraht als Einlage für Gummischläuche

British Standards Institution

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Steel wire for hose reinforcement
Part 1. Specification for coated round and flat steel wire for rubber hose reinforcement

Revised text

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October 1992

Clause 4.2 Tensile strength

In the first sentence delete 'nominal' and substitute 'actual'.

Delete the note.

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Table 3. Tensile strength grades

For steel type low carbon steel (mild steel) wire forms round and flat, in the column headed 'Tensile strength grade' delete '350 to 550' and '650 to 850' and substitute '350 to 600' and '>600 to 850', respectively.

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Table 4. Ductility wrap test

In the column headed 'Tensile strength grade' delete '350 to 550' and '650 to 850' and substitute '350 to 600' and '>600 to 850', respectively.

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Table 5. Reverse bend test

In the column headed 'Tensile strength grade' delete '350 to 550' and '650 to 850' and substitute '350 to 600' and '>600 to 850', respectively.

Contents

Specification

1 Scope

This Part of BS 3592 specifies requirements for wire used for rubber hose reinforcement.

Two tensile strength grades are specified for round and flat wires in low carbon steel (mild steel) and five tensile strength grades are specified for round wires in carbon steel, depending upon wire diameter. The round wire diameter range specified is 1.60 mm to 14.22 mm and the flat wire dimensions specified range from 2.18 mm × 1.63 mm to 15.9 mm × 4.76 mm.

Various types of coating are specified.

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

2 Manufacture

2.1 Steel rod

The rod used for the manufacture of the wire shall be produced from steel made by any process, except the air or air/oxygen bottom blown processes.

The rod quality shall be of a grade typical of standard steel making and rod rolling practice.

NOTE. Standard practice can be taken to mean the following guidelines according to the type of steel.

(a) *Low carbon steel (mild steel).* This has an absence of pipe and an inclusion content commensurate with balanced or killed steels of low carbon content. The maximum surface defect depth in the rod should be generally not more than 3.5 % of the rod diameter.

(b) *Carbon steel.* This has an absence of pipe and an inclusion content commensurate with killed carbon steels. The maximum depth of partial decarburization and surface defects should be generally not more than 3 % of the rod diameter.

2.2 Steel composition

The ladle analysis of the steel shall show sulphur and phosphorus contents each not greater than 0.040 %.

2.3 Wire

The wire shall be cold drawn or rolled to the finished dimensions. Where appropriate for the tensile strength grade, an inter-process heat treatment shall be applied. The wire shall have one of the following coatings:

(a) zinc;

(b) copper;

(c) bronze;

(d) copper lacquer;

(e) phosphate (chemically bonded).

NOTE 1. There may be a limit to the wire diameters or sizes available with a zinc, copper or bronze coating.

NOTE 2. When copper or bronze coatings are specified, the mass of coating and the method of determination of the mass of coating should be the subject of agreement between the purchaser and the manufacturer at the time of the enquiry and order.

2.4 Welds

For the low carbon steel (mild steel) type it shall be permissible for welds made at any stage before inter-process heat treatment to remain in the finished wire. For the carbon steel type, apart from any welds made between rod coils before drawing, there shall be no welds in any coil of finished wire.

3 Condition of finished wire

The wire shall be free from rust and shall not be oiled.

The wire in coil shall be 'dead cast', i.e. when a complete turn of wire is removed from the coil without tension and placed on a smooth horizontal surface without restraint, the wire circle shall have a diameter approximately that of the coil and any corkscrew set, measured by the deviation of one cut end from the horizontal plane, shall not exceed 50 mm.

4 Properties

4.1 Sizes and tolerances

The wire diameters and dimensions of flat wires shall be as given in tables 1 and 2 with the appropriate tolerances.

NOTE 1. The size range varies according to the tensile strength grade. (See table 3.)

NOTE 2. If any intermediate sizes are used they should have the tolerance of the next larger listed size.

Table 1. Coated round wire diameters and tolerances

Nominal diameter	Tolerance ±
mm	mm
1.60	0.05
1.80	0.05
2.00	0.05
2.36	0.05
2.65	0.08
3.00	0.08
3.25	0.08
3.65	0.10
4.00	0.10
4.50	0.10
5.00	0.10
5.30	0.10
6.00	0.10
6.30	0.10
7.10	0.10
7.50	0.10
9.00	0.10
9.50	0.10
11.20	0.10
11.80	0.10
12.50	0.10
14.22	0.10

Table 2. Coated flat wire sizes and tolerances

Nominal dimensions		Tolerance ±	
Width	Thickness	Width	Thickness
mm	mm	mm	mm
3.18	1.63	0.05	0.03
3.25	1.42	0.05	0.03
3.95	1.98	0.05	0.03
4.75	1.59	0.05	0.03
6.35	1.63	0.05	0.03
6.35	1.83	0.05	0.03
6.35	3.16	0.05	0.05
9.50	2.38	0.10	0.05
9.50	3.17	0.10	0.05
9.50	4.76	0.10	0.05
12.70	3.17	0.10	0.05
12.70	4.76	0.10	0.05
15.90	3.17	0.10	0.05
15.90	4.76	0.10	0.05

4.2 Tensile strength

The tensile strength shall be calculated on the nominal diameter or dimensions of the wire.

NOTE. A specific nominal cross-sectional area for flat wire may be agreed between the purchaser and the manufacturer at the time of the enquiry and order.

The tensile strength shall be one of the grades given in table 3 according to steel type, wire form or size.

Table 3. Tensile strength grades

Steel type	Wire form	Size range	Tensile strength grade
		mm	N/mm²
Low carbon steel (mild steel)	Round	See table 1	350 to 550 650 to 850
	Flat	See table 2	350 to 550 650 to 850
Carbon steel	Round	2.0 to 5.0	1200 to 1400 1400 to 1600 1600 to 1800
		Over 5.0 to 14.22	900 to 1100 1100 to 1300

4.3 Ductility wrap

The wire shall withstand without sign of fracture the wrap test appropriate to the tensile strength grades and wire diameters, as given in table 4.

Table 4. Ductility wrap test

Tensile strength grade	Wire diameter	Number of turns on the wire diameter
N/mm²	mm	
350 to 550 650 to 850	1.6 to 6.3	Wrap on 8 turns and unwrap 7 turns
1200 to 1400 1400 to 1600 1600 to 1800	2.0 to 4.0	Wrap on 8 turns only

4.4 Reverse bend

The wire shall withstand without sign of fracture the reverse bend test over the bend radius as given in table 5 according to tensile strength grade and wire size. The wire shall be bent through 90 ° and then in the reverse direction through 180 °. Flat wire shall be tested with the larger dimension parallel to the axis of the bending mandrel.

4.5 Zinc coating

4.5.1 *Flat wire.* For flat wire, the mass of zinc coating shall be not less than 40 g/m².

4.5.2 *Round wire.* For round wire, the mass of zinc coating shall comply with section three of BS 443 : 1982, except that where the wires are to be covered with rubber, there shall be only a thin coating of zinc to a minimum mass of one-third of that specified in section three of BS 443 : 1982 (rounded to the nearest g/m²).

5 Selection of test pieces

A sufficient length of wire for all the mechanical tests shall be taken from representative coils of wire at a frequency not less than two lengths per tonne of wire.

6 Test methods

6.1 Dimensions

The micrometer used for measurements shall be capable of reading to intervals of at least 0.002 mm.

For round wire, pairs of measurements shall be made at right angles to each other at three places along a length of not less than 250 mm. The reported diameter of the wire shall be the average of the six measurements.

For flat wire, the width and thickness shall be determined by taking three measurements of each dimension along a length of not less than 250 mm. The separate averages of each group of three measurements shall be the reported dimensions of the wire.

Table 5. Reverse bend test				
Tensile strength grade	Wire form	Wire size		Bend radius
		Over	Up to and including	
N/mm²		mm	mm	mm
350 to 550 650 to 850	Round	6.30	14.22	12.5
350 to 850 650 to 850	Flat	All sizes		5.0
1250 to 1400 1400 to 1600 1600 to 1800	Round	4.0	5.0	12.5
900 to 1100 1100 to 1300	Round	5.0 8.0	8.0 14.22	15.0 25.0

6.2 Mechanical tests

Mechanical tests shall be carried out in accordance with BS 4545.

6.3 Zinc coating

The mass of zinc coating shall be determined in accordance with section two of BS 443 : 1982.

7 Retests

7.1 If any test piece fails any test, two additional test pieces shall be taken from the same coil of wire and subjected to the test or tests which the original test piece failed. If both additional test pieces pass the test or tests, the coil shall be deemed to comply with this Part of BS 3592 but if either of them fails, the coil shall be deemed not to comply.

7.2 If 10 % or more of the coils in a lot fail to comply, the whole lot shall be deemed not to comply with this Part of BS 3592.

NOTE. Further tests may be carried out by agreement between the purchaser and the manufacturer at the time of the enquiry and order.

8 Documentation, identification and packing

8.1 The manufacturer shall provide for each consignment either:

(a) a certificate of compliance with this Part of BS 3592 based on the results of his tests; or

(b) a test certificate giving the results of all tests identified to each coil number.

NOTE. Whether type (a) or (b) certificate is to be supplied should be agreed between the purchaser and the manufacturer at the time of the enquiry and order.

8.2 Each coil shall be identified with the following information:

(a) the manufacturer's name;

(b) the number and date of this Part of BS 3592, i.e. BS 3592 : Part 1 : 1986*;

(c) the specified diameter or dimensions and strength;

(d) the individual coil number;

(e) the coil mass.

NOTE. Additional marking may be agreed between the purchaser and the manufacturer at the time of the enquiry and order.

8.3 Each coil shall be securely tied and shall have the identification label attached.

*Marking BS 3592 : Part 1 : 1986 on or in relation to a product is a claim by the manufacturer that the product has been manufactured to the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility.

Publications referred to

BS 443 Specification for testing zinc coatings on steel wire and for quality requirements
BS 4545 Methods for mechanical testing of steel wire
BS 3592 Steel wire for hose reinforcement
*Part 2 Specification for metallic coated steel wire for the bonded reinforcement of hydraulic hoses

*Referred to in the foreword only.