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METRIC UNITS

SPECIFICATION FOR

CARBON STEEL WIRE FOR ZIGZAG AND SQUARE-FORM SPRINGS

BRITISH STANDARDS INSTITUTION

THIS BRITISH STANDARD, having been approved by the Iron and Steel Industry Standards Committee, was published under the authority of the Executive Board on 22nd October, 1970.

SBN: 580 06074 8

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 5000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook, price £1. The BS Yearbook may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

BS 443. Galvanized coatings on wire.
BS 1121. Methods for the analysis of iron and steel.
BS 4545. Methods for mechanical testing of steel wire.

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.

The following BSI references relate to the work on this standard:
Committee references ISE/26 and ISE/26/4
Draft for comment 69/1396

CO-OPERATING ORGANIZATIONS

The Iron and Steel Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Board of Trade
British Cast Iron Research Association
British Constructional Steelwork Association
British Electrical and Allied Manufacturers' Association
British Ironfounders' Association
British Mechanical Engineering Confederation
British Railways Board
*British Steel Industry
Council of Ironfoundry Associations
Council of Iron Producers
Crown Agents for Oversea Governments and Administrations
Department of Employment and Productivity
(H.M. Factory Inspectorate)
*Engineering Equipment Users' Association
Federation of Civil Engineering Contractors
Institute of British Foundrymen
*Institute of Iron and Steel Wire Manufacturers
Institute of Marine Engineers
Institution of Civil Engineers
Institution of Mechanical Engineers (Automobile Division)
Institution of Production Engineers
Institution of Structural Engineers
Joint Iron Council
Lloyd's Register of Shipping
Ministry of Defence
*Ministry of Defence, Army Department
Ministry of Defence, Navy Department
National Association of Drop Forgers and Stampers
National Physical Laboratory (Ministry of Technology)
Oil Companies Materials Association
Royal Institute of British Architects
Shipbuilders and Repairers National Federation
Society of British Aerospace Companies Ltd.
*Society of Motor Manufacturers and Traders Ltd.
Stainless Steel Development Association
Steel Castings Research and Trade Association
Tank and Industrial Plant Association
Tin Research Institute
Water-tube Boiler Makers' Association

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Alloy and Stainless Steel Conference
British Bolt, Nut, Screw and Rivet Federation
British Wire Netting Association
British Wire Rod Rollers Association
Fencing Contractors Association
Furnishing Springmakers' Federation
Institution of Engineering Inspection
Music Wire Export Association
Patented Steel Wire Association
Society of Chain Link Fencing Manufacturers
Spring Research Association

TABLE 3. STANDARD SIZES AND TENSILE STRENGTHS FOR WIRE FOR ZIGZAG SPRINGS

Standard size (nominal diameter)	Tensile strength		
	Grade 1	Grade 2	Grade 3
mm	N/mm²	N/mm²	N/mm²
2·00	1600/1770	1650/1820	1700/1870
2·12	1600/1770	1650/1820	1700/1870
2·24	1600/1770	1650/1820	1700/1870
2·36	1600/1770	1650/1820	1700/1870
2·50	1550/1720	1600/1770	1700/1870
2·65	1550/1720	1600/1770	1700/1870
2·80	1550/1720	1600/1770	1700/1870
3·00	1500/1670	1600/1770	1700/1870
3·07	1500/1670	1600/1770	1700/1870
3·15	1500/1670	1600/1770	1700/1870
3·25	1500/1670	1550/1720	1700/1870
3·35	1500/1670	1550/1720	1700/1870
3·45	1450/1620	1550/1720	1650/1820
3·55	1450/1620	1550/1720	1650/1820
3·65	1450/1620	1550/1720	1600/1770
3·75	1400/1570	1550/1720	1600/1770
4·00	1400/1570	1550/1720	1600/1770
4·12	1400/1570	1500/1670	1600/1770
4·25	1400/1570	1500/1670	1550/1720
4·50	1400/1570	1450/1620	1500/1670
4·75	1400/1570	1450/1620	1500/1670
4·87	1400/1570	1450/1620	1500/1670

NOTE. Preferred sizes are shown in bold type.

TABLE 4. STANDARD SIZES AND TENSILE STRENGTHS FOR WIRE FOR SQUARE-FORM SPRINGS

Standard size (nominal diameter)	Tensile strength	
	Grade 1	Grade 2
mm	N/mm²	N/mm²
2·30	1550/1720	1600/1770
2·65	1500/1670	1550/1720
3·07	1500/1670	1550/1720
3·25	1500/1670	1550/1720
3·45	1450/1620	1500/1670
3·75	1350/1520	1400/1570
4·00	1350/1520	1400/1570
4·12	1350/1520	1400/1570

6. FINISHED WIRE

6.1 Freedom from defects. The finished wire shall be free from harmful surface defects, pipe and segregation.

6.2 Condition. The wire shall be supplied in a smooth, bright drawn condition, unless otherwise specified. The wire may be supplied with a galvanized or other coating, when so specified by the purchaser on his order. The coating requirements shall be the subject of an agreement between the manufacturer and the purchaser. (See 8.2.)

Wire supplied in coil form shall lie dead and shall be free from any corkscrew set.

7. SELECTION OF TEST PIECES

Lengths of wire for all the specified tests shall be taken from both ends of each coil of wire.

8. METHODS OF TESTING

8.1 The methods of carrying out the mechanical tests specified in Clause 9 shall be in accordance with BS 4545*. In routine testing with fixed gear type tensile testing machines, the straining rate shall be preset to give a rate of separation of the grips not greater than 40% of the test length per minute.

* BS 4545, ' Methods for mechanical testing of steel wire '.

8.2 The methods of carrying out any specified tests on a galvanized coating shall be in accordance with BS 443*.

The methods of testing a coating of another type, where this is specified on the order, shall be the subject of an agreement between the manufacturer and the purchaser.

8.3 In case of dispute, when a check analysis is required on the wire, the method of test shall be in accordance with the appropriate Part of BS 1121†, account being taken of the heterogeneity normal to the steel.

9. MECHANICAL PROPERTIES

9.1 Tensile test. When tested in accordance with 8.1, the tensile strength, calculated on the nominal diameter of the wire, shall be in accordance with the appropriate tensile strength range given in Table 3 or 4.

For non-standard sizes, the tensile strength range shall be that specified for the next larger standard size.

9.2 Torsion test

9.2.1 When tested in accordance with 8.1, with a free length between grips of 100 wire diameters (100*d*), the minimum number of torsions before fracture shall be in accordance with Table 5.

TABLE 5. MINIMUM NUMBER OF TORSIONS

Standard size (nominal diameter)		Zigzag spring wire			Square-form spring wire
Over	Up to and including	Grade 1	Grade 2	Grade 3	Grades 1 & 2
		Minimum number of torsions in 100*d*			
mm	mm				
1·90	3·00	20	20	15	20
3·00	4·12	20	15	15	20
4·12	4·87	15	15	15	—

9.2.2 The primary fracture shall be perpendicular to the axis of the wire and the surface shall not be split. The condition of any secondary fracture shall be ignored.

* BS 443, ' Galvanized coatings on wire '.
† BS 1121, ' Methods for the analysis of iron and steel '.

10. RETESTS

10.1 Should any test piece fail any of the tests, part of the coil may be discarded and the coil retested in accordance with this standard.

10.2 If both of the additional test pieces pass the tests, the coil shall be deemed to comply with the requirements of this standard. If either of the additional test pieces fail any one of the tests, the coil shall be deemed not to comply with the requirements of this standard.

11. PACKING AND IDENTIFICATION

The wire shall be securely tied and shall carry a suitable label or labels on which shall be shown the information indicated in Clause 2. Any other markings shall be agreed between the purchaser and the manufacturer.

APPENDIX A

PRACTICAL EQUIVALENTS OF METRIC VALUES

Wire diameters

mm	in	mm	in	mm	in
2·0	0·079	3·0	0·118	3·75	0·148
2·12	0·084	3·07	0·121	4·0	0·158
2·24	0·088	3·15	0·124	4·12	0·162
2·3	0·091	3·25	0·128	4·25	0·167
2·36	0·093	3·35	0·132	4·5	0·177
2·5	0·098	3·45	0·136	4·75	0·187
2·65	0·104	3·55	0·140	4·87	0·192
2·8	0·110	3·65	0·144		

Tolerances on diameter

mm	in
0·03	0·0012
0·04	0·0016

Tensile strengths

N/mm²	kgf/mm²	tonf/in²
1350/1520	138/155	87/98
1400/1570	143/160	91/102
1450/1620	148/165	94/105
1500/1670	153/170	97/108
1550/1720	158/175	100/111
1600/1770	163/180	104/115
1650/1820	168/186	107/118
1700/1870	173/191	110/121

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