BRITISH STANDARD

BS 3111-2: 1979

Specification for

Steel wire for cold forged fasteners and similar components —

Part 2: Stainless steel

UDC 621.88:669.14-426 + 621.88:669.14.018.8-426

Cooperating organizations

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

British Cast Iron Research Association
British Constructional Steelwork Association
British Internal Combustion Engine Manufacturers' Association
British Ironfounders' Association
British Railways Board
British Shipbuilders
British Steel Industry*
British Steel Industry — Wire Section*
Concrete Society Limited
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Department of Industry National Physical Laboratory
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Oil Companies Materials' Association
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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 committee entrusted with the preparation of this British Standard:

British Electrical and Allied Manufacturers' Association (BEAMA)
British Industrial Fasteners Federation
British Steel Corporation
British Wire Netting Association
Fencing Contractors' Association
Railway Industry Association of Great Britain
Society of Chain Link Fencing Manufacturers
Spring Research and Manufacturers' Association
Stainless Steel Wire Export Group

This British Standard, having been prepared under the direction of the Iron and Steel Standards Committee, was published under the authority of the Executive Board and comes into effect on 29 June 1979

The following BSI references relate to the work on this standard:
Committee reference ISE/26
Draft for comment 77/77266 DC

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Amendments issued since publication

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Contents

Foreword

This British Standard has been extensively revised under the direction of the Iron and Steel Standards Committee and is now published in two Parts for the convenience of users.

Part 1, which was published in 1977, covers the requirements for carbon and low alloy steels. Additional provision for stainless steel wire is now made in Part 2. A range of austenitic and martensitic stainless steels are included together with two copper-containing types to which new type numbers have been allocated.

Recommendations for the rationalization of certain details of the compositions of stainless steels arising from discussions in the International Organization for Standardization have been followed as far as possible.

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.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General requirements

1 Scope

This Part of this British Standard covers drawn steel wire for use in the manufacture of stainless steel cold-forged fasteners and similar components.

It specifies seven different types of steel as follows:

Designation	Description
430S15	17 % chromium ferritic stainless steel
410S22	13 % chromium martensitic stainless steel
304S17	18 % chromium 10 % nickel austenitic stainless steel
305S17	18 % chromium 12 % nickel austenitic stainless steel
316S17	17 % chromium 13 % nickel 2.5 % molybdenum austenitic stainless steel
394S17	17 % chromium 10 % nickel 3.5 % copper austenitic stainless steel
396S17	17 % chromium 10 % nickel 2.5 % molybdenum 3.5 % copper austenitic stainless steel

2 References

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

3 Information to be supplied by the purchaser

The following information shall be stated on the enquiry and order:

a) the material specification type as given for the required steel in Table 2;

b) the condition in which the material is to be supplied (see clauses **6**, **7** and **19**);

c) the type of coating (see clause **8**);

d) whether a statement giving the cast analysis and/or results of mechanical or other tests is required (see clauses **9**, **10**, **11** and **12**);

e) the upper and lower limits of diameter required (see clauses **7** and **13**);

f) whether manufacture and/or testing is to be witnessed (see clause **15**);

g) the coil mass, with inside and outside diameters;

h) whether any other special quality criteria are to be satisfied.

4 General

The wire shall comply with the general requirements of this section and the appropriate specific requirements of section 2.

5 Steelmaking process

The steel shall be made by an electric process.

6 Freedom from defects

The steel shall be free from pipe and harmful segregation. The surface quality shall be the subject of agreement between the manufacturer and the purchaser.

7 Condition of wire on delivery

Unless otherwise agreed and stated on the order, the wire shall be supplied as follows:

a) for austenitic types, solution treated and lightly cold drawn;

b) for ferritic and martensitic types, annealed and lightly cold drawn.

If requested, the wire may be supplied cold-drawn to an agreed tensile strength range, in which case tolerances on diameter shall be agreed between the purchaser and the manufacturer and stated on the order.

8 Types of coatings

The wire may be supplied with one of the following coatings:

a) copper coated and oil drawn;

b) copper coated and stearate drawn;

c) oxalate coated and stearate drawn;

d) as agreed between the purchaser and the manufacturer.

The coating shall be uniform and adherent to the metal surface.

In the case of copper coating, assessment of adherence shall be by examination of reverse torsion or tensile test specimens, as agreed between the purchaser and the manufacturer.

9 Chemical composition

9.1 Cast analysis. The chemical compositions of the steels specified in Table 3 are based on cast analysis.

The cast analysis shall comply with the relevant specification in Table 3.

If specified by the purchaser on his enquiry and/or order, the supplier shall supply the cast analysis for the specified elements.

Table 1 — Permitted variations of product analysis from specified range

Element	Range in which the maximum of specified element falls	Variation on specified range	
		Over maximum	Under minimum
	%	%	%
Carbon	Up to and including 0.15	0.01	0.01
Silicon	Up to and including 1.0	0.05	0.05
Manganese	Up to and including 1.0 Over 1.0 up to and including 2.0	0.03 0.04	0.03 0.04
Phosphorus	Up to and including 0.045	0.004	—
Sulphur	Up to and including 0.030	0.003	—
Chromium	Up to and including 15.0 Over 15.0 up to and including 20.0	0.15 0.20	0.15 0.20
Molybdenum	Up to and including 3.0	0.08	0.08
Nickel	Up to and including 10.0 Over 10.0 up to and including 20.0	0.03 0.15	0.03 0.15
Copper	Over 3.0 up to and including 5.0	0.07	0.07

9.2 Product analysis. Table 1 shows the permitted variations in the product analysis from the specified range.

The variations may occur either above or below the individual element ranges but shall not be applied both above and below the range for any one element in any one cast of steel.

10 Material for testing

The supplier of the wire shall ensure that a sufficient number of test samples are taken to prove that the material satisfies the requirements of this British Standard and any additional properties specified by the purchaser.

11 Mechanical tests

Tensile tests on wire in the "delivered" condition shall be carried out in accordance with BS 18-2 for wires of diameter greater than 10 mm, and with BS 4545 for wires 10 mm in diameter or less.

Tensile tests shall be carried out on test pieces that have not been subject to any preliminary machining.

12 Intercrystalline corrosion and grain size tests

12.1 The austenitic steels shall not have any grain boundary carbide network. When specified on the order they shall be subject to the intercrystalline corrosion test as specified in Appendix A.

12.2 The austenitic grain size shall be subject to agreement between purchaser and supplier and when specified on the order shall be checked by microscopic examination of a transverse section of the wire. The austenitic grain size shall not normally be coarser than no. 3 according to the requirements of BS 4490.

13 Tolerance on diameter

Unless otherwise agreed between the supplier and purchaser the tolerance on diameter shall be as given in Table 2.

Table 2 — Tolerance on diameter

Nominal diameter of wire		Tolerance
Over	Up to and including	
mm	mm	mm
—	6	± 0.025
6	16	± 0.030
16	19	± 0.040
19	—	by agreement

In all cases, the purchaser of the wire shall state on the enquiry and order the upper and lower limits on diameter of the wire required.

14 Identification

Each coil of wire shall bear a suitable label, securely attached, identifying the material as being supplied to BS 3111-2, and giving the appropriate grade, size, and cast number.

15 Inspection

If the material is to be inspected and tested in the presence of the purchaser's representative it shall be so stated on the enquiry and order.

The purchaser or his representative shall have access at all reasonable times to those parts of the manufacturer's works engaged on the order. He shall be at liberty to inspect the manufacture at any stage and to witness the required tests.

16 Testing facilities

The manufacturer shall supply the material required for testing and shall furnish and prepare the necessary test pieces and supply labour and appliances for such testing as may be carried out on his premises and in accordance with this standard.

Failing facilities at his own works for making the prescribed test, the manufacturer shall arrange for the tests to be carried out elsewhere.

17 Manufacturer's statement

If required by the order, the manufacturer shall supply the ladle analysis of the material and/or the results of the mechanical or other tests or combinations of these as specified on the order.

Section 2. Specific requirements

18 Chemical composition

The limits of cast analysis shall be as shown for the relevant steels in Table 3.

19 Tensile strength

The tensile strength of the wire, in the delivered condition, obtained from test pieces selected and tested in accordance with the requirements of section 1 shall be by agreement between the purchaser and the manufacturer.

Table 3 — Chemical composition

Designation	C		Si	Mn	P	S	Cr		Mo		Ni		Cu	
	min.	max.	max.	max.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%
430S15	—	0.10	0.80	1.00	0.040	0.030	16.0	18.0	—	—	—	0.50	—	—
410S22	0.09	0.15	0.80	1.00	0.040	0.030	11.5	13.5	—	—	—	0.50	—	—
304S17	—	0.06	1.00	2.00	0.045	0.030	17.0	19.0	—	—	9.0	11.0	—	—
305S17	—	0.07	1.00	2.00	0.045	0.030	17.0	19.0	—	—	11.0	13.0	—	—
316S17[a]	—	0.07	1.00	2.00	0.045	0.030	16.5	18.5	2.0	3.0	12.0	14.0	—	—
394S17	—	0.07	1.00	2.00	0.045	0.030	17.0	19.0	—	—	8.0	10.5	3.0	4.0
396S17	—	0.07	1.00	2.00	0.045	0.030	16.0	18.5	2.0	3.0	10.0	14.0	3.0	4.0

[a] If required, steel 316S17 may be supplied with ranges of molybdenum content of either 2.0 % to 2.5 % or 2.5 % to 3.0 %.

Appendix A Intercrystalline corrosion test for austenitic stainless steels

When a test is required by the purchaser, a sample of the solution-treated material from which any coating has been removed shall be immersed for 72 h[1)] in a boiling solution of the following composition:

100 g copper sulphate, $Cu\ SO_4.5H_2O$

184 g (100 ml) sulphuric acid, ($\rho_{20} = 1.84$)

made up to 1 litre with distilled water.

Precautions shall be taken during the boiling period to prevent concentration of the solution due to evaporation.

After this preparation, each test piece shall be bent through 90° around a radius equal to the diameter of the test piece and shall withstand this treatment without cracking on the outer convex surface.

[1)] If boiled on a bed of copper turnings, using the specified solution, the boiling time may be reduced to 24 h.

Publications referred to

BS 18, *Methods for tensile testing of metals.*
BS 18-2, *Steel (general).*
BS 4490, *Methods for the determination of the austenitic grain size of steel.*
BS 4545, *Methods for mechanical testing of steel wire.*

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389 Chiswick High Road
London
W4 4AL