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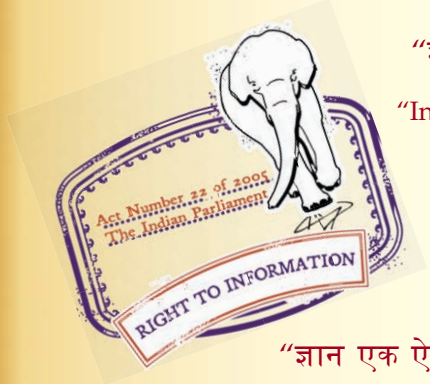
IS 6527 (1995): Stainless steel wire rod [MTD 16: Alloy Steels and Forgings]



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"Knowledge is such a treasure which cannot be stolen"

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IS 6527 : 1995
(Reaffirmed 1998)

भारतीय मानक

स्टेनलैस इस्पात की तार छड़ें — विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

STAINLESS STEEL WIRE RODS — SPECIFICATION

(First Revision)

Second Reprint SEPTEMBER 2000

ICS 77·140·20

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHA·
NW DELHI 110002

October 1995

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Alloy Steels and Special Steel Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in the year 1972. While reviewing this standard, the committee felt that it should be revised taking note of the present practices being followed in the country in this field.

In this revision following changes have been made:

a) Two new grades X20Cr13 and X30Cr13 have been added with their chemical composition and mechanical properties.

b) Mechanical properties for all grades in annealed condition have been incorporated.

An informative Annex A has been given for the benefit of the purchaser giving particulars to be specified by the purchaser while placing order for the steels covered in this standard.

This standard keeps in view the manufacturing and trade practices followed in the country in this field. In the formulation of this standard, assistance has also been derived from the following:

ISO/DIS 683/XIII Heat-treated steels, alloy steels and free-cutting steels — Part 13 : Wrought stainless steels. International Organization for Standardization.

BS 970 : Part 4 : 1970 Wrought steels (blooms, billets, bars and forgings) Part 4 : Stainless, heat-resisting and valve steels, British Standards Institution.

AISI Steel products manual. Stainless and heat-resisting steels. American Iron and Steel Institute.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 MAY 2006
TO
IS 6527 : 1995 STAINLESS STEEL WIRE RODS — SPECIFICATION

(First Revision)

(*Page* 2, *clause* **9.1**, *line* 2) — Substitute '0.2' *for* '92'.

(MTD 16)

Reprography Unit, BIS, New Delhi, India

Indian Standard

STAINLESS STEEL WIRE RODS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard covers the requirements for stainless steel wire rods.

1.2 This standard does not apply to wire rod used for the manufacturer of welding electrodes.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
228	Methods of chemical analysis of steels
1500 : 1983	Method for Brinell Hardness test for metallic materials (*second revision*)
1608 : 1995	Mechanical testing of metals — Tensile testing (*second revision*)
1762 (Part 1) : 1974	Code for designation of steels: Part 1 Based on letter symbols (*first revision*)
1956 (Part 5) : 1976	Glossary of terms relating to iron and steel: Part 5 Bright steel bars and steel wire (*first revision*)
2049 : 1978	Colour code for the identification of wrought steels for general engineering purposes (*first revision*)
8910 : 1978	General technical delivery requiriments for steel and steel products
10461 (Part 1) : 1994	Method for determination of resistance to intergranular corrosion of austenitic stainless steel: Part 1 Corrosion test in nitric acid medium by measurement of loss in mass (Huey test)
10461 (Part 2) : 1985	Method for determination of resistance to intergranular corrosion of austenitic stainless steel: Part 2 Corrosion test in sulphuric acid/copper sulphate medium in the presence of copper turnings (Monypenny Strauss test)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1956 (Part 5) : 1976 shall apply.

4 SUPPLY OF MATERIAL

4.1 General requirements for the supply of material shall conform to IS 8910 : 1978.

4.2 Steel wire rod covered by this standard shall be ordered and delivered on the basis of:

a) chemical composition; or

b) chemical composition, tensile properties and/or hardness in the heat treated condition.

5 MANUFACTURE

5.1 Unless agreed otherwise in order, the processes used in making the steel and the product are left to the discretion of the manufacturer. When so desired, the producer shall be informed of the steel making process.

5.2 Sufficient reduction and discard shall be made from each ingot to ensure freedom from pipe, harmful segregation and order defects.

5.3 Removal of surface defects shall be permitted provided that the finish dimension is not less than that specified and that the operation is not likely to affect the end use of the product.

5.4 In case of continuously Cast Billets, Liquid Stream from ladle to tundish and from tundish to mould shall be properly shrouded to avoid re-oxidation.

6 FREEDOM FROM DEFECTS

The wire rod shall be smooth on surface and free from harmful surface defects. Sufficient end rings should be trimmed to remove fins.

7 CHEMICAL COMPOSITION

7.1 The ladle analysis of steels, when carried out either by the method specified in relevant parts of IS 228 or any other established instrumental/chemical method, shall be as given in Table 1. In case of dispute, the procedure given in IS 228 and its relevant parts shall be the referee method.

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Table 1 Chemical Composition, Percent

(*Clauses* 7.1, 7.2, 7.3 *and* 12.1)

Steel Designation IS 1762 (Part 1) : 1972	C	Si	Mn	Ni	Cr	Mo	S	P	Remarks
		Max					*Max*	*Max*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
X04Cr13	0·08 *Max*	1·0	1·0 *Max*	1·0 *Max*	11·5-14·5	—	0·030	0 040	(Al 0 10-0·30)
X12Cr13	0·09-0·15	1·0	1·0 *Max*	1.0 *Max*	11·5-13·5	—	0 030	0·040	—
X20Cr13	0·16-0 25	1·0	1 0	1 0	12.0-14·0	—	0 030	0·040	—
X30Cr13	0·26-0·35	1 0	1·0	1·0	12·0-14·0	—	0 030	0·040	—
X02Cr18Ni11	0·030 *Max*	1·0	2·0 *Max*	8·0-12·0	17·0-20 0	—	0·030	0.045	—
X04Cr18Ni10	0·08 *Max*	1·0	2 0 *Max*	8 0-12 0	17·0-20 0	—	0 030	0·045	—
X07Cr18Ni9	0·15 *Max*	1·0	2·0 *Max*	8 0-10·0	17 0-19 0	—	0·030	0 045	—
X04Cr17Ni12Mo2	0·08 *Max*	1·0	2 0 *Max*	10·0-14 0	16 0-18 5	2·0-3·0	0 030	0·045	—
X02Cr17Ni12Mo2	0 030 *Max*	1 0	2·0 *Max*	10·0-14 0	16 0-18·5	2 0-3·0	0·030	0 045	—
X10Cr17Mn6Ni4	0·15 *Max*	1·0	5·5-7 5	3·5-5·5	16·0-18·0	—	0·030	0·060	(N 0·05-0 25)

7.2 Product Analysis

Permissible variations in the case of product analysis from the limits specified in Table 1 shall be as given in Table 2.

Table 2 Permissible Variation Between Specified Analysis and Product Analysis

(*Clause* 7.2)

Element	Limit in Ladle Analysis (*see* Table 1), Percent		Permissible Deviations, Percent[1)]
	Over	Up to and Including	
(1)	(2)	(3)	(4)
C	—	0·030	+0·005
	0·030	0·15	±0 01
Si	—	1·0	+0 05
Mn	—	1·0	+0·03
	1·0	3 0	±0·04
	5·5	7·5	±0 10
Al	—	0 30	+0·05
Cr	11·5	14 5	±0·15
	16·0	20 0	±0 20
Mo	2 00	3·0	±0 10
Ni	—	1·0	+0·03
	3·5	5 5	±0·07
	8·0	10 0	±0·10
	10·0	14 0	±0·15
N	0·05	0 25	+0 02 −0 01
S	—	0 030	+0 005
P	—	0·040	+0 005
	0·040	0·060	±0 010

[1)] ± means that in one cast, the deviation may occur over the upper value or under the lower value of the specified range in Table 1, but not both at the same time.

7.3 Elements not specified in Table 1 shall not be added to the steel, except where agreed to, other than for the purpose of finishing the heat and shall not exceed the following limits:

Constituents	*Percent, Max*		
	Ferritic and Martensitic Steels	Austenitic Steels	
		Without specified molybdenum	With specified molybdenum
Titanium	—	0·10	0·10
Niobium	—	0·20	0·20
Molybdenum	0·30	0·70	—
Copper	0·30	0·50	0·70

8 HEAT TREATMENT

8.1 Steel wire rod may be supplied in the annealed condition.

8.2 Recommended heat treatment for the steels covered by this standard is given in Annex B.

9 MECHANICAL PROPERTIES

9.1 Tensile Test

When tested in accordance with IS 1608 : 1995 the tensile strength, 92 percent proof stress and percentage elongation shall be as given in Table 3.

9.2 Hardness

If the steels are supplied in the annealed condition, the maximum acceptable hardness, when tested in accordance with IS 1500 : 1983, is given in Table 4. These values are for guidance purpose.

Table 3 Mechanical Properties After Annealing

(*Clause* 9.1)

Steel Designation	0·2% P.S. MPa, *Min*	UTS MPa	% Elongation *Min* $5.65\sqrt{So}$
(1)	(2)	(3)	(4)
X04Cr13	230	400 — 600	20
X12Cr13	250	470 — 670	20
X20Cr13	—	750 *Max*	—
X30Cr13	—	800 *Max*	—
X02Cr18Ni11	180	480 — 680	40
X04Cr18Ni10	195	500 — 700	40
X07Cr18Ni9	195	500 — 700	40
X04Cr17Ni12Mo2	205	510 — 710	40
X02Cr17NiMo2,	190	490 — 690	40
X10Cr17Mn6Ni4	300	640 — 840	40

Table 4 Brinell Hardness After Annealing

(*Clause* 9.2)

Steel Designation	HB *Max*
(1)	(2)
X04Cr13	197
X12Cr13	200
X20Cr13	220
X30Cr13	235
X02Cr18Ni11	192
X04Cr18Ni10	192
X07Cr18Ni9	192
X04Cr17Ni12Mo2	192
X02Cr17NiMo2	192
X10Cr17Mn6Ni4	217

NOTE — For small sections the HRB or HV hardness test may be used by agreement between manufacturer and purchaser.

10 DIMENSIONAL TOLERANCES

10.1 Tolerances for stainless steel wire rods shall be as given below:

Diameter	*Size, Tolerance Max*	*Out of Round Max*
mm	mm	mm
5·5 — 9·5	± 0·40	0·50
Over 9·5 up to 16	± 0·50	0·60
Over 16 up to 20	± 0·60	0·75
Over 20	± 0·70	0 90

11 SAMPLING

11.1 Sampling for Chemical Analysis

The ladle analysis shall be supplied by the manufacturer. In case of continuous cast billets other methods for selection of sample for chemical analysis may be agreed by the manufacturer and the purchaser. If the product analysis is required by the purchaser, at least one sample product shall be taken from each cast.

11.2 Sampling for Mechanical Test

If the material is supplied in the heat-treated condition, one sample product shall be taken for each size grouping from each heat-treatment batch for testing the mechanical properties. If the product is continuously heat-treated, one sample product for each 15 tonnes or part there of subject to a minimum of one sample product for each cast shall be taken.

12 RETESTS

12.1 Retest for Product Analysis

If the results of the product analysis do not conform to the requirements given in Tables 1 and 2, unless otherwise agreed to between the purchaser and the manufacturer, two new samples shall be taken on different pieces from the same cast. Should the two analysis satisfy the requirements, the lot represented shall be accepted; should either of the samples fail, the material shall be taken as not complying with this standard.

12.2 Retest for Mechanical Properties

If the samples selected under **11.2** fail to meet the requirements of Tables 3 and 4, two further samples shall be taken from the same heat-treatment batch. The consignment shall be considered to conform to the requirements, if both the additional tests are satisfactory. Should either of the samples fail, the manufacturer shall have the right, if he so desires to re-heat-treat the product (not more than twice) in any suitable manner before two fresh samples are taken for testing. Should the two tests satisfy the requirements of this standard, the lot represented shall be accepted. Should either of the samples fail, the material shall be taken as not complying with this standard.

13 CORROSION RESISTANCE

13.1 If required by the purchaser, the material shall be tested for resistance to corrosion. The method of test and the specification requirements shall be in accordance with IS 10461 (Part 1): 1994 and IS 10461 (Part 2) : 1985.

14 CONDITION OF DELIVERY

14.1 The material shall be supplied in any one of the following conditions:

a) Hot rolled,

b) Hot ro[illegible]

c) Annealed, and

d) Annealed and pickled

15 MARKING

15.1 Each coil of wire rod shall be legibly marked or tagged with the manufacturer's name/ trade mark, cast number and the designation of steel.

15.2 The material may also be suitably colour coded in accordance with IS 2049 : 1978.

15.3 BIS Certification Marking

The material may also be marked with the Standard Mark.

15.3.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufactures or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Foreword*)

INFORMATION TO BE GIVEN BY THE PURCHASER

A-1 BASIS FOR ORDER

A-1.1 While placing order for stainless steel wire rods covered by this standard, the purchaser should specify the following:

a) Designation of steel;

b) Description regarding size, length, etc;

c) Condition of delivery;

d) Tests required;

e) Methods of manufacture;

f) Any special requirements; and

g) Test report, if required.

ANNEX B

(*Clause* 8.2)

RECOMMENDED HEAT TREATMENT FOR STAINLESS STEELS

Steel Designation	*Symbols*[1]	*Annealing/Softening Temperature, °C*	*Cooling Media*[2]
Ferritic Steels			
X04Cr13	A	750 to 800	f, a
Martensite Steel			
X12Cr13	A	700 to 780	a
	A	770 to 870	f
X20Cr13	A	700 to 870	f
X30Cr13	A	700 to 870	f
Austenitic Steels			
X02Cr18Ni11	S	1 000 to 1 120	w, a
X04Cr18Ni10	S		
X08Cr18Ni9	S		
X04Cr17Ni2Mo2	S		
X02Cr17Ni12Mo2	S		
X10Cr17Mn6Ni4	S		

[1] A = annealing and S = softening

[2] f = furnace, a = air and w = water

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Amendments are issued to standards as the need arises on the basis of comments Standards are also reviewed periodically, a standard along with amendments is reaffirmed when such review indicates that no changes are needed, if the review indicates that changes are needed, it is taken up for revision Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards Monthly Additions'

This Indian Standard has been developed from Doc No **MTD 16 (3823).**

Amendments Issued Since Publication

Amend No	Date of Issue	Text Affected

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Printed at Dee Kay Printers New Delhi