भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

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व्यापक परिचालन मसौदा

हमारा संदर्भ : सीईडी 54/टी-17 **25 मई 2021**

तकनीकी समिति : कंक्रीट प्रबलन विषय समिति, सीईडी 54

प्राप्तकर्ता :

1 सिविल इंजीनियरी विभाग परिषद के सभी सदस्य

2 कंक्रीट प्रबलन विषय समिति, सीईडी 54 के सभी सदस्य

3 रूचि रखने वाले अन्य निकाय।

महोदय/महोदया,

निम्नलिखित मसौदा संलग्न है:

प्रलेख संख्या	शीर्षक
सीईडी 54 (14913)WC	**कंक्रीट प्रबलन के लिए वेल्डेड फैब्रिक के निर्माण हेतु अतप्त लघुकृत इस्पात की तार - विशिष्टि का भारतीय मानक मसौदा** **(आई सी एस संख्या : 77.140.15; 91.080.40)**

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजे कि यह मसौदा प्रकाशित हो तो इन पर अमल करने में, आपको व्यवसाय अथवा कारोबार में क्या कठिनाइयॉ आ सकती हैं।

सम्मतियॉ भेजने की अंतिम तिथि: 25 जून 2021

सम्मति यदि कोई हो तो कृपया अधोहस्ताक्षरी को ई मेल द्वारा, **madhurima@bis.gov.in** पर, संलग्न फोर्मेट में भेजें।

यदि कोई सम्मति प्राप्त नहीं होती है अथवा सम्मति में केवल भाषा संबंधी त्रुटि हुई तो उपरोक्त प्रलेख को यथावत अंतिम रूप दे दिया जाएगा। यदि सम्मति तकनीकी प्रकृति की हुई तो विषय समिति के अध्यक्ष के परामर्श से अथवा उनकी इच्छा पर आगे की कार्यवाही के लिए विषय समिति को भेजे जाने के बाद प्रलेख को अंतिम रूप दे दिया जाएगा।

यह प्रलेख भारतीय मानक ब्यूरो की वैबसाइट **www.bis.gov.in** पर भी उपलब्ध हैं।

धन्यवाद।

भवदीय

ह/-

(संजय पंत)

प्रमुख (सिविल इंजीनियरिंग)

सलंग्न: उपरिलिखित

भारतीय मानक ब्यूरो
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DRAFT IN WIDE CIRCULATION

DOCUMENT DESPATCH ADVICE

Reference	Date
CED 54/T-17	25 May 2021

TECHNICAL COMMITTEE:

CONCRETE REINFORCEMENT SECTIONAL COMMITTEE, CED 54

ADDRESSED TO:

1. All Members of Civil Engineering Division Council, CEDC
2. All Members of Concrete Reinforcement Sectional Committee, CED 54
3. All other interests

Dear Sir/Madam,

Please find enclosed the following draft:

Doc. No.	Title
CED 54 (14913)WC	**Draft Indian Standard Cold-reduced steel wire for the manufacture of welded fabric for concrete reinforcement — Specification (ICS No. 77.140.15; 91.080.40)**

Kindly examine the draft and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

Last Date for comments: 25 June 2021

Comments if any, may please be made in the enclosed format and emailed at **madhurima@bis.gov.in** or sent at the above address.

In case no comments are received or comments received are of editorial nature, you will kindly permit us to presume your approval for the above document as finalized. However, in case comments, technical in nature are received, then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website **www.bis.gov.in**.

Thanking you,

Yours faithfully,
Sd/-

(Sanjay Pant)
Head (Civil Engg.)

Encl: As above

Doc: CED 54 (14913)WC
May 2021

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENT ONLY

(Not to be reproduced without the permission of BIS or used as a Standard)

Draft Indian Standard

COLD-REDUCED STEEL WIRE FOR THE MANUFACTURE OF WELDED FABRIC FOR CONCRETE REINFORCEMENT — SPECIFICATION FOREWORD

Concrete Reinforcement Sectional Committee, CED 54	Last date for Comment: **25 June 2021**

FOREWORD

(Formal clauses to be added later.)

This standard has been formulated to cover cold reduced steel wire, especially used for the manufacture of wire mesh for reinforcement of concrete. The welded wire mesh made using these wires are being used for graded sloped floor, false ceilings, etc.

These wires are cold reduced from wire rods by passing them through dies/rollers which allow to provide ribs/indentations in the process. Cold reduced wires have less weak areas and provides for better bonding with concrete as can be provided with ribs/indentations. Also, due to uniform microstructure of cold reduced wires, issues of weak welded joints are also reduced in these wires. The wires covered in IS 432 (Part 2):1982 'Specification for mild and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part 2 Hard-drawn steel wire (*third revision*)' are hard-drawn plain wires. Hot rolled steel wires manufactured through controlled on-line cooling process are covered in IS 1786:2008 'High strength deformed steel bars and wires for concrete reinforcement – Specification (*fourth revision*)'. Further, due to increased yield strength of cold reduced wires than hard-drawn plain wires and that of hot-rolled steel wires, use of these wires results in steel saving.

In the formulation of this standard, due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. Assistance has been derived from the following International Standard in the formulation of this standard:

ISO 10544:1992	Cold-reduced steel wire for the reinforcement of concrete and the manufacture of welded fabric

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.

Doc: CED 54 (14913)WC
May 2021

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENT ONLY

Draft Indian Standard

COLD-REDUCED STEEL WIRE FOR THE MANUFACTURE OF WELDED FABRIC FOR CONCRETE REINFORCEMENT — SPECIFICATION

Concrete Reinforcement Sectional Committee, CED 54	Last date for Comment: **25 June 2021**

1 SCOPE

1.1 This Indian Standard covers requirements for cold-reduced steel wire for use as reinforcement or welded fabric in concrete.

1.2 Cold-reduced steel wires of strength grades 500 N/mm^2 and 550N//mm^2 and the following surface configurations are covered in this standard:

a) Plain;
b) Ribbed (*see* Fig. 1); and
c) Indented (*see* Fig. 2).

1.3 This standard applies to wire made from rod by working through dies or rollers. The production process is at the discretion of the manufacturer.

1.4 For wire supplied in coil form, the requirements of this Standard apply to the straightened product. Wires produced from finished products, such as plates and railway rail are excluded.

2 REFERENCES

The Indian Standards given below contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

IS No.	*Title*
228 (Parts 1 to 24)	Methods of chemical analysis of steels
1608 (Part 1):2016	Metallic materials – Tensile testing: Part 1 Method of test at room temperature (*fourth revision*)
1599: 2019	Metallic materials – Bend test (*fourth revision*)

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply:

3.1 Coil — One continuous piece of Wire as drawn in the form of a coil.

3.2 Core — The part of cross-section of the wire that contains neither ribs nor indentations.

3.3 Inclination of Indentation (*β*) **—** The angle between the indentation and the longitudinal axis of the wire (*see* Fig. 2).

3.4 Indentation Spacing (*c*) **—** The distance between the centres of two consecutive indentations measured parallel to the axis of the wire (*see* Fig. 2).

3.5 Indented Wire — Wire with a regular pattern of surface indentations to enhance its bond properties.

3.6 Inspection — Activities such as measuring, examining, testing, gauging one or more characteristics of a product or service and comparing these with specified requirements to determine conformity.

3.7 Nominal Cross-sectional Area — The cross- sectional area equivalent to the area of a circular plain wire of the nominal diameter.

3.8 Plain Wire — Smooth surfaced wire without bond enhancing properties.

3.9 Product Analysis — Chemical analysis of a sample from a wire.

3.10 Rib Height (*a*) **—** The distance from the highest point of the rib to the surface of the core, to be measured normal to the axis of the wire (*see* Fig. 1).

3.11 Rib Inclination — The angle between the rib and the longitudinal axis of the wire (*see* Fig. 1).

3.12 Rib Spacing (*c*) **—** The distance between the centres of two consecutive transverse ribs measured parallel to the axis of the wire (*see* Fig. 1).

3.13 Ribbed Wire — Wire with a regular pattern of surface protrusions designed to enhance its bond properties.

3.14 Specific Projected Indentation Area (f_p) **—** The area of the projections of all indentations on a plane perpendicular to the longitudinal axis of the wire, divided by the wire length and the nominal circumference (*see* **5.2**).

3.15 Specific Projected Rib Area (f_r) **—** The area of the projections of all ribs on a plane perpendicular to the longitudinal axis of the wire, divided by the wirelength and the nominal circumference (*see* **5.2**).

3.16 Test Unit — The number of pieces or the tonnage of products to be accepted or rejected together, on the basis of the tests to be carried out on sample products in accordance with the requirements of the product standard or order.

3.17 Transversal Indentationless Perimeter ($\sum e_i$) **—** The sum of the distances along the surface of the core between the transverse indentations of adjacent rows measured as the projection on a plane perpendicular to the wire axis (*see* Fig. 2).

3.18 Transversal Ribless Perimeter ($\sum f_i$) **—** The sum of the distances along the surface of the core between the transverse ribs of adjacent rows measured as the projection on a plane perpendicular to the wire axis (*see* Fig. 1).

4 DIMENSIONS, MASSES AND TOLERANCES

4.1 The nominal diameters of wires shall be as follows:

Nominal diameters, 5 mm, 6 mm, 7 mm, 8 mm, 9 mm, 10 mm, 11 mm and 12 mm.

4.2 The values for the nominal cross-sectional area and nominal mass per unit length of individual wires and tolerance thereon shall be as given in Table 1.

4.2.1 For purposes of determining whether the actual diameter of the wire is within the specified tolerances, the diameter shall be determined with a micrometer by taking two measurements at right angles to each other at three places along a length of not less than 250 mm and the average of these six measurements shall be taken as the diameter of the wire.

4.2.2 For the purpose of checking the nominal mass, the density of steel shall be taken as 0.007 85 kg/mm^2 of the cross-sectional area per meter.

Table 1 Recommended Diameters and Required Masses
(*Clause* 4.2)

Sl No.	Nominal Wire Diameter	Nominal Cross Sectional Area	Nominal Mass per unit Length	
			Requirement	Permissible Deviation[1)]
	mm	mm^2	kg/m	percent
(1)	(2)	(3)	(4)	(5)
i)	5	19.6	0.154	± 9
ii)	6	28.3	0.222	± 8
iii)	7	38.5	0.302	± 8
iv)	8	50.3	0.395	± 8
v)	9	63.6	0.499	± 5
vi)	10	78.5	0.617	± 5
vii)	11	95.0	0.746	± 5
viii)	12	113.1	0.888	± 5

[1)]Refers to a single wire

5 GEOMETRY OF RIBBED AND INDENTED WIRES

5.1 Ribbed Wire

Ribbed wire shall have two or more rows of transverse ribs equally distributed around the perimeter with a substantially uniform spacing not greater than 0.8 x d, where d is the nominal diameter. Fig. 1 shows an example with three rows.

The minimum value for the specific projected rib area, f_{r} shall be,

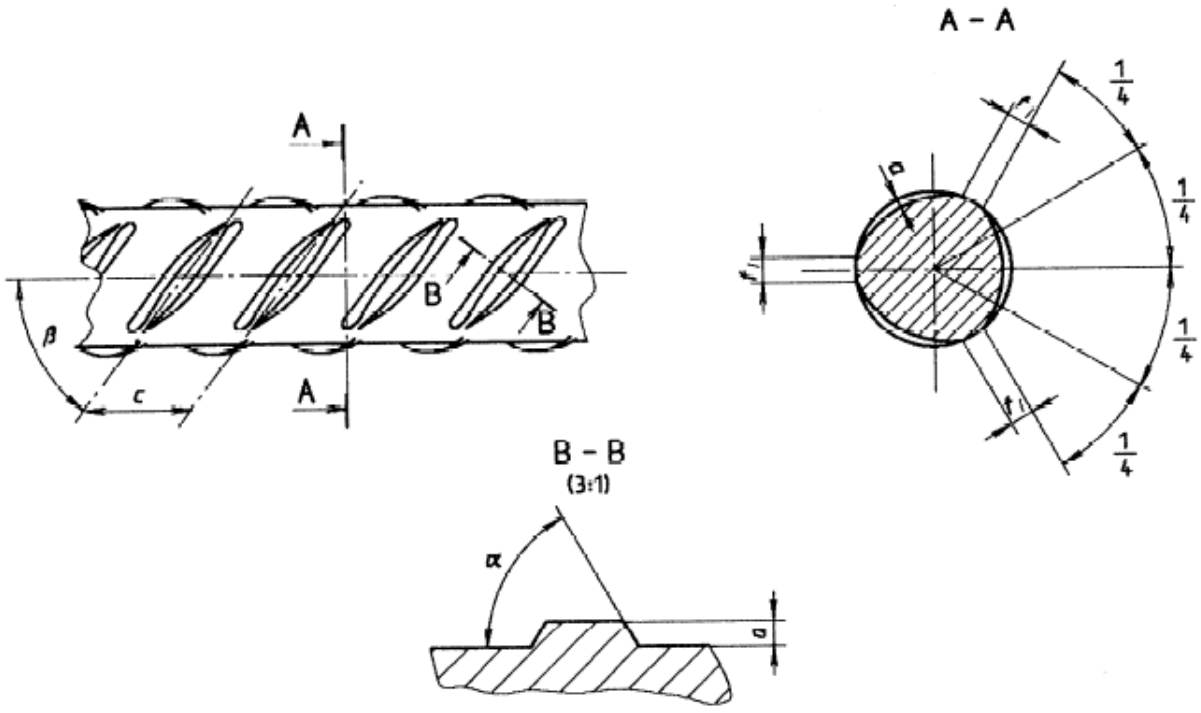
0.036 for 4 mm ≤ d< 5 mm;
0.039 for 5 mm ≤ d ≤ 6 mm;
0.045 for 6 mm < d ≤ 8 mm;
0.052 for 8 mm < d ≤ 10 mm;
0.056 for 10 mm < d ≤ 16 mm.

f_r is calculated using the formula,

$$f_{\mathrm{r}} = \frac{k \times F_{\mathrm{R}} \times \sin \beta}{\pi \times d \times c}$$

Where,

k is the number of rib rows;
F_{R} is the area of the projection of one rib on a plane parallel to that rib;
β is the rib inclination relative to the axis of the wire;
d is the nominal diameter of the wire; and
c is the rib spacing.



β Rib inclination
c Rib spacing
f_i 1/3 of the transversal ribless perimeter
a Rib height
α Rib flank inclination

Fig. 1 Example of Ribbed Wire with Three Rows

5.2 Indented Wire

Indented wire shall have two or more rows of indentations. The indentations shall be distributed uniformly over the circumference and length of the wire. Fig. 2 shows an example with three rows.

The minimum value for the specific projected indentation area, f_{p} shall be,

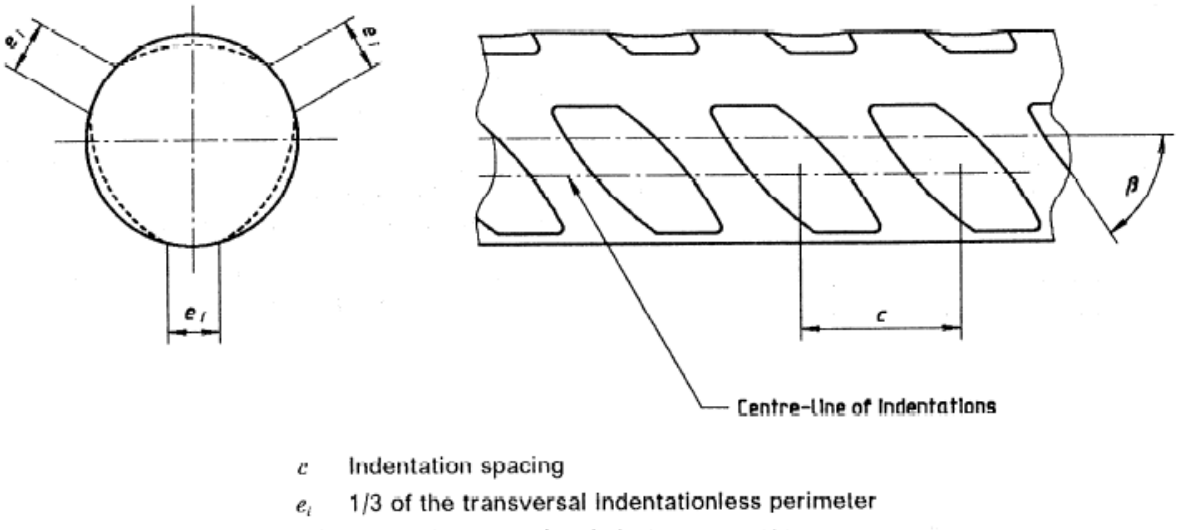
0.007 for 4 mm ≤d < 5 mm
0.008 for 5 mm ≤d ≤ 6 mm
0.010 for 6 mm <d ≤ 8 mm
0.013 for 8 mm <d ≤ 10 mm
0.014 for 10 mm <d ≤ 16 mm

f_{p} is calculated using the formula,

$$f_{\mathrm{p}} = \frac{K \times F_{\mathrm{P}} \times \sin \beta}{\pi \times d \times c}$$

Where,

K is the number of indentation rows;
F_P is the area of projection of one indentation on a plane parallel to that indentation;
β is the inclination of the indentation relative to the axis of the wire;
d is the nominal diameter of the wire; and
c is the indentation spacing.



c Indentation spacing
e_i 1/3 of the transversal indentationless perimeter

Fig. 2 Example of Indented Wire with Three Rows

6 CHEMICAL COMPOSITION

The laddle analysis of steel tested in accordance of relevant parts of IS 228, shall not contain quantities of the given elements higher than those specified in Table 2 (in percentage):

Table 2 Chemical Composition - Maximum Values in Percentage by Mass
(*Clause* 6)

Sl No.	**Carbon,** C	**Silica,** Si	**Manganese,** Mn	**Phophorus,** P	**Sulphur,** S	**Nitrogen,** N[1)]	**C_{eq}**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	0.22	0.60	1.60	0.050	0.050	0.012	0.5
ii)	(0.24)[2)]	(0.65)	(1.70)	(0.055)	(0.055)	(0.013)	(0.52)

[1)] A higher nitrogen content may be used if sufficient quantities of nitrogen-binding elements are present.
[2)] The values in brackets apply for the product analysis.

The carbon equivalent, C_{eq}, is calculated according to the formula:

$$C_{\text{eq}} = \text{C} + \frac{\text{Mn}}{6} + \frac{(\text{Cr+V+Mo})}{5} + \frac{(\text{Cu+Ni})}{15}$$

where C, Mn, Cr, V, Mo, Cu and Ni are percentage by mass of respective elements of the steel.

7 MECHANICAL PROPERTIES

7.1 Tensile Properties

The tensile properties of the cold-reduced steel wire shall be as given in Table3. The tensile properties shall be determined according to IS 1608 (Part 1). The test piece shall have an original gauge length of 5 times the nominal diameter. The free distance between grips shall not be less than 180 mm. For calculation of proof stress and tensile strength, nominal cross-sectional area of the wire shall be used.

Table 3 Tensile Properties
(*Clause* 7.1)

Sl No.	**0.2 Percent Proof Stress/Yield Stress, *Min***	**Tensile Strength, *Min***	**Elongation Percentage, *Min* on Gauge Length of $5.65\sqrt{A}$,** (where *A* is the cross-sectional area)
	N/mm^2	N/mm^2	mm^2
(1)	(2)	(3)	(4)
i)	500	550	12
ii)	550	585	10

The TS/YS for each test piece shall be 1.03, *Min*.

7.2 Bend Test

The bend test shall be carried out in accordance to IS 1599.

The test piece shall be bent to an angle between 160° and 180° over a mandrel of the diameter specified in Table 4. The specimen shall be considered to have passed the test if there is no rupture or cracks visible to a person of normal or corrected vision on the bent portion.

Table 4 Mandrel Diameter to be used for the Bend Test
(*Clause* 7.2)

Sl No.	**Nominal Diameter of Wire**, *d*	**Mandrel Diameter**, *D*
	mm	mm
(1)	(2)	(3)
i)	5	16
ii)	6	20
iii)	7	20
iv)	8	25
v)	9	32

vi)	10	32
vii)	11	35
viii)	12	40

7.3 Rebend Test

The test piece shall be bent over a mandrel of diameter specified in Table 5.

The angle of bend before heating (in boiling water at 100 °C for 30 min) shall be 90° and the angle of rebend shall be 20°. Both angles shall be measured before unloading. The specimen shall be considered to have passed the test if there is no rupture or cracks visible to a person of normal or corrected vision on the bent portion.

Table 5 Mandrel Diameter to be used for the Rebend Test
(*Clause* 7.3)

Sl No.	**Nominal Diameter of Wire**, *d* mm	**Mandrel Diameter**, *D* mm
(1)	(2)	(3)
i)	5	25
ii)	6	32
iii)	7	32
iv)	8	40
v)	9	50
vi)	10	50
vii)	11	55
viii)	12	63

8 Sampling and Criteria for Conformity

Scale of sampling and the criteria for conformity shall be as specified in Annex A.

9 Designation

9.1 Wire according to this standard shall be designated in the following order:

a) Reinforcing steel;
b) Nominal diameter, in mm;
c) Strength grade; and
d) Surface configuration (plain, indented or ribbed).

10 DELIVERY, INSPECTION AND TESTING FACILITIES

10.1 Unless otherwise specified, general requirements relating to the supply of material, inspection and testing shall conform to IS 1387.

10.2 No material shall be dispatched from the manufacturer’s or supplier’s premises prior to its being certified by the purchaser or his authorized representative as having fulfilled the

tests and requirements laid down in this standard except where the bundle or coil containing the wire is marked with the Standard Mark (*see* **11.2**).

10.3 The purchaser or his authorized representative shall be at liberty to inspect and verify the steel maker's certificate of cast analysis at the premises of the manufacturer or supplier; when the purchaser required an actual analysis of finished material, this shall be made at a place agreed to between the purchaser and the manufacturer or supplier.

10.4 Manufacturer's Certificate

In the case of wires which have not been inspected at the manufacturer's works, the manufacturer or supplier, as the case may be, shall supply the purchaser or his authorized representative with certificate stating the process of manufacture and also the test sheet signed by the manufacturer giving the result of each mechanical test and the chemical composition. Each test sheet shall indicate the number or identification mark of the cast to which it applies, corresponding to the number or identification mark to be found on the material.

10.5 It is necessary to protect the wires against damage and contamination during transport and storage. The coils of wire shall be packed as agreed to between the purchaser and the manufacturer. Each coil of wire shall be suitably bound and fastened compactly. If required by the purchaser, each coil shall be protected by suitable wrapping.

11 Marking

11.1 Marking of bundles or coils

Each bundle or coil of at least 500 kg shall have a label stating the manufacturer, designation (*see* **8.1**), cast number or reference related to test record. Every facility shall be given to the purchaser or his authorised representative for tracing the wires to the cast from which they were made.

11.2 BIS Certification Marking

The bundle containing the wires conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and Rules and Regulations framed thereunder, and the bundle may be marked with the Standard Mark.

ANNEX A
(*Clause* 8)

SAMPLING AND CRITERIA FOR CONFORMITY

A-1 LOT

A-1.1 In any consignment, all the coils of wire of the same grade and diameter, manufactured under essentially similar conditions of manufacture, shall be grouped together to constitute a lot.

A-1.1.1 Samples shall be taken from each lot and tested for conformity to the standard.

A-2 SAMPLING

A-2.1 The number of coils to be taken from a lot shall be according to col 3 and 5 of Table 6. These coils shall be chosen at random (*see* IS 4905). Samples shall be cut from each coil so chosen as per **A-3.1** and **A-3.2** for physical and mechanical requirements and chemical requirements, respectively.

Table 6 Scale of Sampling and Permissible Number of Defective
(*Clauses* A-2.1, A-3.1 *and* A-3.2)

Sl. No.	No. of Coils in a Lot	No. of Coils for Physical and Mechanical Requirements	Permissible Defective	No. of Coils for Chemical Requirements
(1)	(2)	(3)	(4)	(5)
i)	Up to 25	2	0	1
ii)	26 – 50	3	0	1
iii)	51-150	5	0	2
iv)	151 – 300	8	1	2
v)	301 and above	13	1	2

A-3 PREPARATION OF SAMPLES AND NUMBER OF TESTS

A-3.1 Tests for Physical and Mechanical Requirements

From the coils selected from col 3 of Table 6, adequate length of test piece shall be cut from each end and subjected to physical and mechanical tests, namely, size, projected rib area or projected indented area as applicable, tensile properties, bend and reverse bend. A test piece failing to meet any of the requirements shall be called a defective. If the number of defective found is less than or equal to the permissible number of defective specified in col 4 of Table 6, the lot shall be considered to have conformed to physical requirements.

A-3.2 Tests for Chemical Requirements

Unless otherwise agreed, the following procedure shall be followed for chemical requirements:

From those test pieces which have conformed to physical requirements, further test pieces shall be selected at random according to col 5 of Table 6. These samples shall be tested for all the chemical requirements. If a test piece fails to meet the respective chemical requirements, it shall be called a defective. The lot shall be considered to have conformed to the chemical requirements, if all the individual test pieces tested for chemical requirements pass the test.

A-4 CRITERIA FOR CONFORMITY

A lot shall be considered to have conformed to the requirements of the specification, if **A-3.1** and **A-3.2** are satisfied.