भारतीय मानक
Indian Standard

IS 4824 : 2022

टायरों के लिए बीड तार — विशिष्टि

(तीसरा पुनरीक्षण)

Bead Wire for Tyres — Specification

(Third Revision)

ICS 77.140.65

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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1968 and was subsequently revised in 1973 and 2006. While reviewing this standard, in the light of experience gained during these years, the Committee decided to revise the standard to keep pace with the latest technological developments and international practices. In this revision following major changes have been made:

a) All sizes of bead wires from 0.80 mm to 2.10 mm are now covered in the standard;

b) Bead wires have been split in two categories, NT and HT, based on their tensile strength;

c) Test methods for testing coating weight have been incorporated in the standard;

d) Chemical composition of the bead wire has been updated bringing it in line with international practices; and

e) Requirements of breaking load and bend test have been done away.

For all tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO Standard may also be followed as an alternate method.

Assistance has been derived from ISO 16650 : 2004 ‘Bead wire’ during the formulation of this standard.

The composition of the Committee responsible for the formulation of this standard is given at Annex D.

For the purpose of 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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

BEAD WIRE FOR TYRES — SPECIFICATION

(Third Revision)

1 SCOPE

1.1 This standard covers the requirements for bead wire for use in tyre reinforcement.

1.2 The bead wire mentioned in this specification can be supplied in the form of rounds for the sizes specified in the standard.

2 REFERENCES

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

IS No.	*Title*
228 (in various parts)	Methods for chemical analysis of steels
1387 : 1993	General requirements for the supply of metallurgical materials (*second revision*)
1608 (Part 1) : 2018/ ISO 6892-1 : 2016	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (*fourth revision*)
1717 : 2018/ ISO 7800 : 2012	Metallic materials — Wire — Simple torsion test (*fourth revision*)
1956 (Part 3) : 2019	Glossary of terms relating to iron and steel: Part 3 Long products (including bars, rods, sections and wires) (*second revision*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1956 (Part 3) shall apply.

4 SUPPLY OF MATERIAL

General requirements relating to the supply of material shall conform to IS 1387.

5 MANUFACTURE

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

5.2 Bead wire is supplied in two levels of tensile strength, designated as:

a) NT – Normal standard (or regular) tensile strength; and
b) HT – High tensile strength.

6 CHEMICAL COMPOSITION

6.1 The ladle analysis of steel, 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 any dispute, the procedure given in IS 228 and its relevant parts shall be the referee method. However, where the method is not given in IS 228 or its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacture.

6.2 Permissible variation in case of product analysis from the limits specified in **6.1** shall be as given in Table 2.

7 MECHANICAL PROPERTIES

7.1 General

The mechanical properties are determined on the material as delivered. If so agreed upon between the purchaser and the supplier, the tests may be performed on thermally stabilized samples. In such case, the samples are heated in an oven at 150 ºC for 1 h and allowed, in air, to cool to room temperature before testing.

7.2 Tensile Test

7.2.1 The wire shall satisfy the values of tensile strength and percent elongation listed in Table 3 when carried out in accordance with IS 1608 (Part 1).

7.2.2 The specified minimum tensile strength and elongation are specified for each grade in Table 3.

Table 1 Chemical Composition

(*Clause* 6.1)

Sl No.	Tensile strength	Constituent, Percent, *Max*					
		C	Si	Mn	S	P	N
					Max	*Max*	*Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	NT	0.60 to 0.76	0.10 to 0.30	0.40 to 0.70	0.035	0.035	0.009
ii)	HT	0.77 to 0.90	0.10 to 0.30	0.40 to 0.60	0.025	0.020	0.009

Table 2 Permissible Variation for Product Analysis

(*Clause* 6.2)

Sl No.	Constituent	Permissible Variation above the Maximum or below the Minimum Limit, Percent, *Max*
(1)	(2)	(3)
i)	Carbon	± 0.04
ii)	Silicon	± 0.03
iii)	Manganese	± 0.04
iv)	Sulphur	± 0.005
v)	Phosphorus	± 0.005
vi)	Nitrogen	± 0.0005

Table 3 Requirements for Tensile Strength and Elongation

(*Clauses* 7.2.2 *and* 7.2.3)

Sl No.	Diameter	Tensile Strength	Tensile Strength	Minimum Elongation at Rupture (gauge Length = 200 mm)
		NT	HT	A_t
	mm	N/mm^2	N/mm^2	Percent
(1)	(2)	(3)	(4)	(5)
i)	0.80 ≤ d < 0.95	1 900 to 2 300	2 150 to 2 500	5.0
ii)	0.95 ≤ d < 1.25	1 850 to 2 250	2 050 to 2 400	5.0
iii)	1.25 ≤ d < 1.70	1 750 to 2 150	2 050 to 2 400	5.0
iv)	1.70 ≤ d < 2.10	1 500 to 1 800	2 050 to 2 400	5.0

1 N/mm^2 = 1 MPa

NOTES

1 The variation of the tensile strength between the samples of a lot shall not be more than 300 N/mm^2.

2 The purchaser may specify a different minimum tensile strength. This tensile strength shall be not more than 100 N/mm^2 above the minimum specified in Table 3 and not more than 10 percent below the same minimum tensile strength.

7.2.3 *0.2 Percent Proof Strength*

The strength corresponding to the 0.2 percent proof strength, $R_{p0.2}$, shall be at least 80 percent of the minimum tensile strength specified in Table 3.

7.3 Torsion Test

The wire shall withstand the minimum number of turns listed in Table 4 without fracture.

Table 4 Minimum Number of Torsions

(*Clause* 7.3)

Nominal Wire Diameter *d*	Minimum Number of Turns
mm	N_t
0.80 ≤ d < 1.00	50
1.00 ≤ d < 1.25	25
1.25 ≤ d < 1.50	22
1.50 ≤ d	20

7.4 Protective Coating

7.4.1 The wire is supplied with one of the following coatings: low-tin bronze or high-tin bronze, brass or copper. The chemical composition of coating material shall be in accordance with Table 5 and shall be determined as per XRF test method given in **B-1** of Annex B.

7.4.2 *Surface Quality*

Surface should be smooth and free from grease and any other contaminants. The wire shall be free from scales, splits, spills and other harmful defects.

Table 5 Chemical Composition of the Coating

(*Clause* 7.4.1)

Coating Material	Mass Fraction Percent		
	Cu	Sn	Zn
(1)	(2)	(3)	(4)
Bronze low-tin (Sn)	97 to 99	1 to 3	–
Bronze high-tin (Sn)	80 to 94	6 to 20	–
Brass	60 to 77	–	23 to 40
Copper	99.99 *Min*	–	–

7.4.3 *Coating Weight*

Weight and tolerance of the coatings shall be as per Table 6. Higher coating weight, if required, shall be as agreed to between the purchaser and the supplier.

Table 6 Coating Weight

(*Clause* 7.4.3)

Type of Coating	Weight of Coating g/kg
(1)	(2)
Copper	0.30 – 1.5
Bronze high-tin (Sn)	0.30 – 1.5
Bronze low-tin (Sn)	0.30 – 1.5
Brass	0.30 – 1.5

7.5 Delivery Conditions

7.5.1 *Unit Package*

The wire shall be supplied in units of one single length. The unit package of wire shall be wound on spools or as spool less cores, of dimensions to be agreed upon between the parties concerned.

7.5.2 *Welds*

Welds at final size are permitted in so far as they permit proper processing. For that purpose, the welds shall be smooth, properly cleaned and sufficiently ductile. The weld and heat-affected zone shall have a tensile strength of at least 40 percent of the tensile strength specified in Table 3.

7.5.3 *Wire Straightness*

The wire shall be reasonably straight and without excessive residual torsions.

7.5.4 *Residual Torsions*

The number of residual torsions shall be less than or equal to one revolution on 9 m or equivalent in case of other test lengths.

7.6 Dimensions and Tolerances

7.6.1 *Dimensions*

The round wires from 0.80 to 2.10 mm diameter can be supplied under this specification.

7.6.2 *Size Tolerances*

For round wire, the tolerance is as specified in Table 7.

Table 7 Tolerance on the Wire Diameter

(*Clause* 7.6.2)

Wire Diameter d mm	Tolerance mm
d < = 1.00	± 0.03
1.00 < d	± 0.04

7.6.3 *Out-of-roundness*

The out-of-roundness shall not be more than half the tolerance range.

7.6.4 *Requirements for Adhesion*

The finish of the wire shall be such as to give satisfactory adhesion. The bead wire shall be subjected to an adhesion test as given in Annex A. The minimum pull out load and mean pull out load observed during the test shall be as agreed between the purchaser and the manufacturer.

8 TESTING PROCEDURES AND INSPECTION

8.1 Tensile Test

The tensile test shall be carried out in accordance with IS 1608 (Part 1) on samples with the full cross-section of the wire for determination of the tensile strength, the elongation, A_t, at the moment of rupture and 0.2 percent proof stress $R_{p0.2}$.

8.2 Torsion Test

The torsion test shall be performed in accordance with IS 1717. The test length is specified in Table 8.

Table 8 Test Length for the Torsion Test

(*Clause* 8.2)

Wire Diameter *d* mm	Test Length mm
0.80 *d* < 1.00	200 *d*
1.00 < = *d* < = 2.10	100 *d*

8.3 Protective Coating Test

Copper and bronze coating weight shall be checked by gravimetric method (weight difference before and after stripping the coating from measured length of samples) or by X-ray fluorescence (XRF) method or by using colorimetric principles (GEDET instrument). For brass coating, test method for checking coating weight shall be checked by XRF method. Refer Annex B.

8.4 Diameter and Out-of-roundness

The diameter shall be measured using a micrometer with a precision of ± 0.001 mm.

8.5 Straightness

The wire sample is put on a smooth surface on which two parallel lines, 3 m long and 600 mm apart, are marked. The wire sample is checked to see if it stays within the two lines.

8.6 Residual Torsions

The wire end is bent at a right angle. A test sample of about 9 m is pulled from the unit package without cutting off or releasing the end. The end of the wire shall not rotate in either direction more than one full revolution around its axis.

8.7 Adhesion Test

The test conditions for executing the adhesion test shall be agreed upon between the parties. Annex A gives information about one of the most widely used methods.

9 SAMPLING AND CRITERIA FOR CONFORMITY

The method of drawing representative samples of the material and the criteria for conformity shall be as prescribed in Annex C.

10 MARKING

10.1 Each coil of wire shall carry a tag which shall be legibly marked with the following:

a) Manufacturer’s name or trade-mark,
b) Type of coating,
c) Grade of wire, and
d) Size and weight of the wire.

10.2 BIS Certification Marking

The product(s) 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 the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(*Clauses* 7.6.4 *and* 8.7)

METHOD FOR ADHESION TEST BETWEEN WIRE AND RUBBER

A-1 OUTLINE OF THE METHOD

The wires are vulcanized into a block or pad of rubber and the load necessary to pull the wires out of the rubber is measured. The direction of pull-out is axial.

A-2 APPARATUS

A-2.1 Mould

The mould is designed for a 13 mm thick block of rubber, 205 mm long and 50 mm wide across the short dimension of the mould, thus giving a 50 mm wide across the short dimension of the mould, thus giving a 50 mm length of embedment; bevelled lots shall be located for spacing 15 wires 13 mm apart and at the middle of the block thickness. In addition to, the mould itself, top and bottom plates shall be provided. The mould and plates are shown in Fig. 1.

A-2.1.1 *Testing Machine*

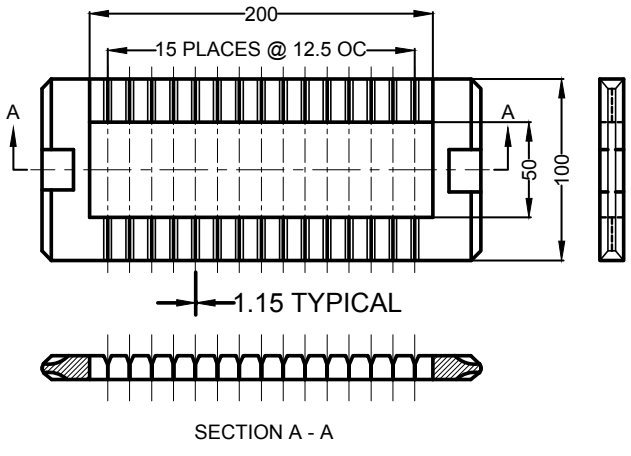
A suitable tension testing machine shall be used. The machine shall be of such capacity that the maximum load required to pull out the wires shall not exceed 85 percent nor be less than 15 percent of the rated capacity. The rate of travel of the power actuated grip shall be 50 ± 5 mm/min. Other rates of travel up to 150 ± 15 mm/min may be used by agreement between the purchaser and the manufacturer.

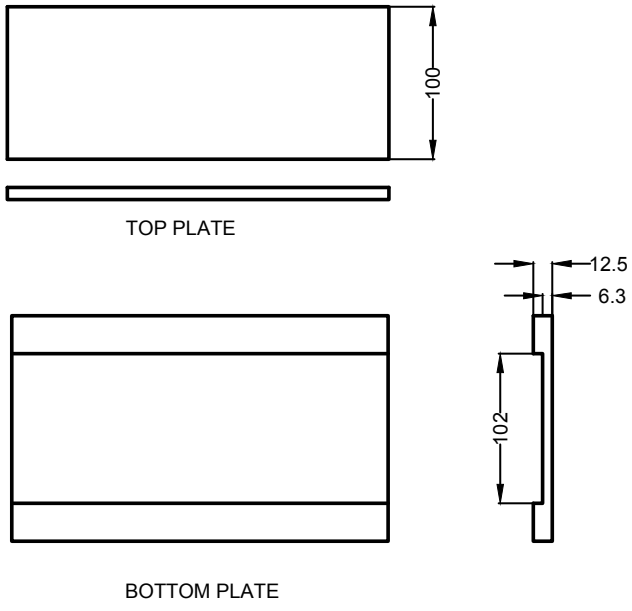
A-2.2 Grips

The top grip shall be of a special holder made for the cured block sample with a slot in the bottom to permit the block to be inserted with the wire protruding. The closed end of the slot shall be centred at the line of pull of the tester (*see* Fig. 2). The bottom grip shall be a wedge type designed to exert increasing tightening as the wire is pulled.

A-2.3 Press

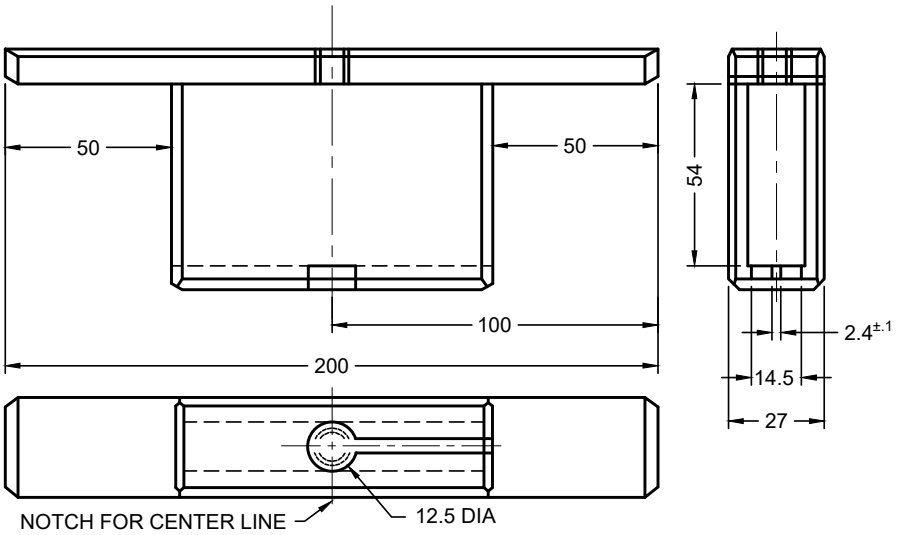
A curing press, large enough to take the mould and capable of at least 90 kN total pressure to the mould. Electrical or steam heat for-the top and bottom plates shall be of sufficient capacity to maintain the mould components at the required temperature for the rubber compound being used.





TOLERANCES
All dimensions ± 0.2
Angular ± $\frac{1}{2}^{\circ}$
Except where noted
NOTE 1 Material Steel
NOTE 2 Break all sharp corners.
NOTE 3 All dimensions are in millimetres except where noted.

FIG. 1 MOULD WITH TOP AND BOTTOM PLATES



TOLERANCES

All dimensions ± 0.2
Except where noted

NOTE 1 — Material — Steel

NOTE 2 — Break all sharp corners.

NOTE 3 — All dimensions are in millimetres except where noted.

FIG. 2 TOP GRIP

A-3 MATERIALS

A-3.1 Solvent

The solvent used for the preparation of the rubber and wire in this method shall be such that the surface of the rubber will be freshened without adversely affecting the adhesion. A suitable solvent has been found to be a special lead-free gasoline with distillation range from 4° to 141 °C and minimum recovery of 97 percent.

A-3.2 Rubber

The rubber stock used shall be furnished by the purchaser of the wire together with pertinent information on the temperature and time for the cure of that particular rubber as well as aging time limits for holding the block between curing and testing.

Since the efficiency of the uncured rubber is affected by its storage and age, the purchaser of the wire shall also specify the conditions of storage and any time limit for such storage of the batch. The rubber stock shall be provided, stored and used uncured in sheet form between 7 and 8 mm thick without any remilling before using. It has been found convenient to store the rubber already cut to size for the mould.

A-4 PROCEDURE

A-4.1 Preparation of Materials

It is necessary that all the materials be prepared in advance of the building step so that the mould can be filled quickly at the proper time. Prepare these materials as follows.

A-4.1.1 *Wire Specimens*

Lay out 250 to 300 mm cut lengths of wire specimens on a clean surface, such as cloth or paper. The wires should be touched only at their ends. Unless otherwise specified the wires shall be tested ‘as is’ representing the condition in which the wire lot and samples were received. If washing the surface of the wire before test is specified, gently wipe the wire with a soft cloth dampened with solvent.

A-4.1.2 *Rubber Stock*

Cut the rubber sheet stock to the size of the mould cavity, unless the stock has been pre-cut to that size for storage; two pieces are required for each block. Lay these out and freshen their top surface with the solvent, applied with a soft cloth or brush. Plan the freshening so that a drying time of at least 10 min but not more than 20 min will have elapsed at the building step of the procedure.

A-4.2 Preparation of the Mould

Preheat the mould including top and bottom plates to the cure temperature of the rubber used.

A-4.3 Build-up of the Block

A-4.3.1 Remove the mould from the preheating and take off the top plate.

A-4.3.2 Press down into the mould with a metal or rubber wooden peg, or knife butt the bottom piece of rubber with freshened side up.

A-4.3.3 Lay the wires one by one into the tapered slots making note of their identification for later moulding of the test remelts. Position the wires so that about 25 mm sticks out from one side of the mould and about 150 mm from the other. Do not touch the wires within the 50 mm length that will be in contact with the rubber.

NOTE — Slots 1 and 15 should be filled with dummy length of wire which will be subsequently pulled but their test values should not be recorded nor included in the calculations.

A-4.3.4 Press down firmly with knife butt or roller the top piece of rubber with freshened side down.

A-4.3.5 Replace the top plate, put the mould in the press and apply a pressure of at least 90 kN to the mould. Excessive pressures are not necessary and may damage the mould.

A-4.3.6 It is important that the entire sequence of steps takes not over 3 min, from the removal of the mould from the heat and replacing it in the press. This time limit also applies during the building of blocks subsequent to the first one where the mould is already hot and when a cured block must be removed from the mould before it can be filled.

A-4.4 Cure

Cure the block under pressure for the time and temperature conditions of the rubber being used.

A-4.5 Preparation of the Cured Block

Remove the mould from the press and push out the cured block. If there are other blocks to prepare proceed with the building operations as outlined in **A-4.3**. Age the cured block at room temperature (27 $\pm$ 2 °C) for the required time limits specified by the rubber stock supplier. Cut off the 25 mm length of protruding wire close to the edge of the block. Pull off any extraneous flesh from both edges of the block.

A-4.6 Testing

Push the block into the top grip of the testing machine until the first wire meets the stop. This will centre that wire at the line of pull of the tester. Clamp the first wire in the wedge clamp, make sure reading attachment of tester is at zero, and start the machine (*see* Fig. 2). When the wire pulls out, note the pull-out load to the nearest 5 N and release the wedges. Pull the tested wire out of the block by hand and slide the block in the holder until the next wire hits the stop. Clamp it in the wedges and note its pull out load. Repeat the procedure with the other wires of the block. There is no need to stop the lower jaw after each wire pull. Continue sliding each subsequent wire into the wedges until they lower too far to grasp the wire length. Then return the lower grips to its highest position and start it down again.

A-5 TEST REPORT

Report individual test results and their mean plus any other calculated data as agreed to between the purchaser and the manufacturer.

ANNEX B

(*Clauses* 7.4.1 *and* 8.3)

TEST METHODS TO DETERMINE COATING WEIGHT FOR COPPER AND BRONZE COATING

B-1 METHOD FOR DETERMINATION OF COPPER, BRASS AND BRONZE COATING WEIGHT ON BEAD WIRE FOR TYRES BY X-RAY FLUORESCENCE SPECTROSCOPY METHOD

B-1.1 Principle

In XRF, X-rays produced by a source irradiate the sample. The elements present in the sample will emit fluorescent X-ray radiation with discrete energies that are characteristic for these elements. XRF spectrometers are generally divided into two main groups: Energy dispersive systems (EDXRF) and wavelength dispersive systems (WDXRF). ED-XRF spectrometers have a detector that is able to measure the different energies of the characteristic radiation coming directly from the sample. WDXRF spectrometers use an analyzing crystal to disperse the different wavelengths. The crystal diffracts the different wavelengths in different directions which can be measured by the detector.

B-1.2 Apparatus

List of apparatus required to carry out this test is as follows:

a) WDXRFS or EDXRFS;

b) Weighing balance, which can be read to nearest 0.001 g;

c) Dispenser, with the accuracy of 25.00 ml ± 0.05 ml; and

d) X/Y shaker, with variable frequency.

B-1.3 Reagents

During the analysis, unless otherwise stated, use only reagents of recognized analytical grade and distilled or demineralized water. Following reagents are required depending on type of coating material used:

a) *For Brass* — Acetone or diethyl ether, ammonium persulphate (>98 percent), ammonia (>25 percent, density not more than 0.91g/cc' at temperature 20 °C) and distilled water (corresponding Indian standard).

b) *For Copper and Bronze* — Acetone or diethyl ether, Ammonium persulphate (>98, percent) ammonia (>25 percent, not more than 'd=0.91' at temperature 20 °C), zinc sulphate ($ZnSO_4$) and distilled water (as per Indian Standard).

B-1.3.1 *Stripping Solution*

a) *For Brass* — Weigh 16 g ammonia persulphate into a beaker of 600ml and dissolve in 400 ml demineralize water. Transfer quantitatively into a 1L volumetric flask. Add 120 ml ammonia. Fill up to the mark with demineralized water. Shake well.

b) *For Copper or Bronze* — Weigh 20 g ammonia persulphate into a beaker of 600 ml and dissolve in 400ml demineralize water. Transfer quantitatively into a 1L volumetric flask. Add 120 ml ammonia and 8.80g of zinc sulphate. Fill up to the mark with demineralized water. Shake well.

B-1.3.2 *Standard Solution*

The matrix range should cover sample range. Prepare the calibration standard solution according to Table 9 for brass and as per Table 10 for copper/bronze.

Table 9 Calibration Standard for Brass

(*Clause* B-1.3.2)

Standard	w_{Cu}(mg/l)	w_{Zn}(mg/l)
ST1	48	24
ST2	80	40
ST3	112	56
ST4	144	72
ST5	176	88
ST6	208	104
ST7	240	120

Table 10 Calibration Standard Copper and Bronze

Standard	w_{Cu}(mg/l)	w_{Sn}(mg/l)
ST1	35	2
ST2	60	4
ST3	80	6
ST4	100	8
ST5	125	10
ST6	150	12
ST7	175	15

B-1.4 Preparation of Test Samples

Take about 6 grams of a sample wire to the nearest 0,001g with wrap. Wash the samples with acetone to remove contamination. Wait till acetone evaporates completely Weigh the samples with accuracy to 1 mg by an electronic balance and place inside a 50 cc or 100 cc beaker.

NOTE — Samples should be free of dirt or grease. If a renewed sample taking is impossible, wire samples should be degreased with cotton wool with ether. Wire samples should be degreased with proper solvent. If necessary, dried in a drying furnace at 105 °C and cooled down in a desiccator.

B-1.5 Procedure

a) Calibrate the XRF with the standard solution mentioned at **B-1.3.2** as per the user manual of the equipment.

b) The weighted sample is transferred in a dry and clean test tube (or beaker of 100 ml) with cap. With a dispenser, add accurately 25.00 ml stripping solution. Make sure the sample is complete immersed. Close the tube or beaker to avoid evaporation. Put the beaker or tube in the X/Y shaker to accelerate the speed of dissolution. When the coating is complete dissolved, homogenize the solution. Decant the solution to a dry and clean sample cup and measure in XRFS with the setting application.

NOTE — Complete coating dissolution is a must.

B-1.6 Expression of Results

The coating mass, coating composition and thickness are calculated from below formula (8), (9) and (10)

For brass:

$$C_{Cu}(\%) = W_{Cu}/(W_{Cu} + W_{Zn}) * 100$$

$$C_{Zn}(\%) = W_{Zn}/(W_{Cu} + W_{Zn}) * 100$$

$$W = (W_{CU} + W_{Zn}) * 25/1000*m$$

where

C_{Cu} = coating composition of copper, expressed in percent;

C_{Sn} = coating composition of zinc, expressed in percent;

W_{Cu} = direct reading of Cu composition in solution, in milligram per litre (mg/L);

W_{Zn} = direct reading of Zn composition in solution, in milligram per litre (mg/L);

W = coating mass, in grams per kilogram (g/kg); and

m = sample mass before stripping, in grams (g).

For bronze:

$$C_{Cu}(\%) = W_{Cu}/(W_{Cu} + W_{Sn}) * 100$$

$$C_{Sn}(\%) = W_{Sn}/(W_{Cu} + W_{Sn}) * 100$$

$$W = (W_{CU} + W_{Sn}) * 25/1000m$$

where

C_{Cu} = coating composition of copper, expressed in percent;

C_{Sn} = coating composition of zinc, expressed in percent;

W_{Cu} = direct reading of Cu composition in solution, in milligram per litre (mg/L);

W_{Sn} = direct reading of Sn composition in solution, in milligram per litre (mg/L);

W = coating mass, in grams per kilogram (g/kg); and

m = sample mass before stripping, in grams (g).

B-1.7 Test Report

Report the coating mass in g/kg brass to resolution 0.01 g/kg Report the coating composition in percent Cu to resolution 0.01 percent.

B-2 METHOD FOR DETERMINATION OF COPPER OR BRONZE COATING ON TYRE BEAD WIRE BY GRAVIMETRIC ANALYSIS

B-2.1Summary of Method

Coating mass of the samples is calculated by stripping the copper or bronze coating and measuring the weight difference.

B-2.2 Apparatus and Chemicals

List of apparatus required to carry out the test is as follows:

a) Beakers;

b) Ammonium hydroxide 25-30 percent lab grade;

c) Hydrogen peroxide 6 percent lab grade;

d) Wire cutter; and

e) Carbon tetrachloride (CTC).

B-2.3 Preparation of Test Specimen

B-2.3.1 Take about 40 grams of a samples wire and cut it into about 3 to 4 cm length. Wash the cut samples with carbon tetrachloride (CTC) to remove contamination and dry it in air.

B-2.3.2 Weigh the sample with accuracy to 1 mg by an electronic balance and put it into 100 cm^3 beaker. Record the weight as W1.

B-2.3.3 Add ammonia solution in the beaker until the samples are completely dipped, add Hydrogen peroxide solution in the beaker drop by drop to dissolve the bronze plating completely, repeat the same operation 2-3 times to thoroughly dissolve the bronze plating.

B-2.3.4 Remove the wire samples from the beaker and dry it in the hot air oven until the samples are fully dried. Cool the wire sample to room temperature and measure the weight of the samples and record the weight as W2.

Then calculate the coating mass by as:

Coating Mass (g/kg) = (W1 – W2)/W2 × 1000

B-2.4 Reporting

Report coating mass (copper or bronze) in g/kg by rounding off to two decimal point.

B-3 METHOD FOR DETERMINATION OF COPPER OR BRONZE COATING ON BEAD WIRE FOR TYRES USING GEDET METHOD

B-3.1 Summary of the Method

Coating mass of the samples are calculated by stripping off the copper or bronze coating on GEDET Machine by coulometric principle.

B-3.2 Apparatus and Chemicals

List of apparatus required to carry out the test is as follows:

a) 40 percent sodium nitrate solution;
b) Measuring scale;
c) Table lamp;
d) GEDET Machine; and
e) Carbon tetrachloride (CTC).

B-3.3 Test Procedure

B-3.3.1 Take 50 ml of 40 percent sodium nitrate solution in the cup provided in GEDET equipment. Measure the diameter of sample accurately. Remove the coumarone on wire by wiping with a cloth dampened with CTC.

B-3.3.2 Mark 1 inch length (1.0 mm and above diameter)/2 inch (below 1 mm diameter) on the sample with the help of scale.

B-3.3.3 Start the lamp to ensure the dip length is exactly matching with marked length.

B-3.3.4 Dip the wire up to the marking. Push start button to start the counter. After all coating is removed automatically counter will stop with a beep. Record the reading on indicator as N.

B-3.3.5 Calculate the coating mass using as:

$$\text{Coating mass (g/kg)} = N \times F/D^2$$

where

F = is multiplying factor, which varies with the gasket area. It is provided by the equipment manufacturer; and

D = is diameter of the wire, in mm

B-3.4 Reporting

Report coating mass (copper or bronze), in g/kg by rounding off to two decimal point.

ANNEX C

(*Normative*)

(*Clause* 9)

SAMPLING AND CRITERIA FOR CONFIRMITY

C-1 LOT

In any consignment, all the coils of wires of the same diameter manufactured under essentially similar conditions of manufacture shall be grouped together to constitute a lot.

C-2 SAMPLING FOR SIZES AND SURFACE CONDITIONS

The number of coils to be examined from each lot size and surface condition and the corresponding criteria for conformity shall be as agreed to between the supplier and the purchaser.

C-3 SAMPLING FOR OTHER CHARACTERISTICS

C-3.1 From each lot, the number of coils as specified in Table 11 (depending upon the number of coils in the lot) shall be selected at random.

C-3.2 A test piece, cut from each end of each coil so selected, shall be subjected to the chemical analysis (*see* **6**).

C-3.2.1 The lot shall be considered as conforming to the requirements of the chemical composition laid down in this specification if the average of the test results complies with the limits specified in **6**.

C-3.3 From each of the coils selected as in **C-3.1** one test piece for each of the applicable tests given under 7, namely, tensile test (*see* **7.2**) and torsion test (*see* **7.3**) shall be cut from each end and subjected to these tests. All the selected coils shall also be subjected to dead wire test after cutting the necessary specimens for the other test mentioned above.

Table 11 Scale of Sampling

(*Clauses* C- 3.1 *and* C-3.2.1)

Number of Coils in a Lot	Number of Coils to be Selected
Upto 25	2
26-50	3
51-150	5
151-300	8
301 and above	13

C-3.3.1 The lot shall be considered as conforming to the requirements of various tests enumerated in **C-3.3**, if each result complies with the relevant requirements specified in the respective clauses. **C-3.3.2** in case there is only one failure in any tests, then an equal number of fresh specimens shall be cut from a second set of randomly chosen coils and subjected to the tests in which the failure has occurred. On finding this new set of specimens satisfactory, the lot shall be declared as conforming to the requirements of that test, otherwise not.

C-3.3.2 In case there is only one failure in any tests, then an equal number of fresh specimens shall be cut from a second set of randomly chosen coils and subjected to the tests in which the failure has occurred. On finding this new set of specimens satisfactory, the lot shall be declared as conforming to the requirements of that test, otherwise not.

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Wrought Steel Products Sectional Committee, MTD 04

Organization	*Representative(s)*
Sail, RDCIS, Ranchi	Shri Nirvik Banerjee (***Chairman***)
Tata Steel Ltd, Jamshedpur	Shri Avtar Singh Saini Shri Sudipto Sarkar (*Alternate* I) Shri Shishir Desai (*Alternate* II)
Tata Blue Scope Steel Ltd, Pune	Shri Rajesh Maheshwari
All India Induction Furnace Association, New Delhi	Shri A. K. Sharma Shri Prabhakar Mishra (*Alternate*)
Bharat Heavy Electrical Ltd, Bhopal	Shri S. K. Mahajan Shri Arun Khare (*Alternate*)
Central Boilers Board, New Delhi	Shri T. S. G. Narayannen Shri S. K. Jain (*Alternate*)
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JSW steel Ltd. Raigad-402107, Maharashtra	Shri Subhasis Chakraborty Shri B. M. Hasan (*Alternate*)
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Ministry of Defence (DGQA), Ichapur, WB-743144	Shri K. Yadav Shri G. Subba Rao (*Alternate*)
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Ministry of Steel (Govt of India), New Delhi	Shri Paramjeet Singh Shri S. K. Bhatnagar (*Alternate*)
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SAIL, Central Marketing Organization, New Delhi	Shri Amitava Kunda
SAIL, Research & Development Center for Iron an Steel, Ranchi	Shri N. Pradhan Shri S. Srikanth (*Alternate* I) Shri S. Roy (*Alternate* II)
SAIL, Rourkela Steel Plant, Rourkela	Shri A. Dasgupta Shri C. Samal (*Alternate*)

Organization	*Representative(s)*
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Shri Arun Pucchakayala
Scientist 'D' (MTD)', BIS

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