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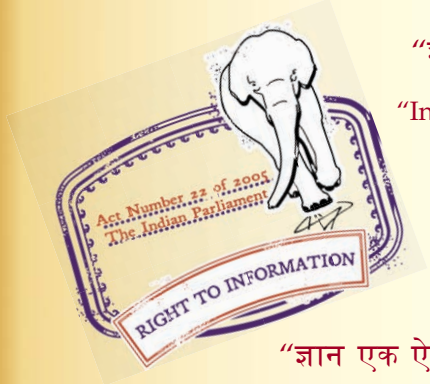
IS 3975 (1999): Mild steel wires, formed wires and tapes for armouring of cables [MTD 4: Wrought Steel Products]



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(तीसरा पुनरीक्षण)

Indian Standard

LOW CARBON GALVANIZED STEEL WIRES, FORMED WIRES AND TAPES FOR ARMOURING OF CABLES — SPECIFICATION

(Third Revision)

ICS 77.140.65

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 1999 **Price Group 3**

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 1967 and subsequently revised in 1979 and 1988. While reviewing the standard in the light of experience gained during these years, the Committee decided to revise it to bring it in line with the present practices being followed by the Indian industry.

In this revision, the following changes have been made:

a) Scope has been modified by deleting epoxy coated tapes.

b) Chemical composition of the material has been provided.

c) Dimensional tolerances have been modified.

d) Requirements for wrapping test have been included.

e) Requirements for adhesion test for galvanized test have been included.

f) Requirements of epoxy coating have been deleted.

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.

Indian Standard

LOW CARBON GALVANIZED STEEL WIRES, FORMED WIRES AND TAPES FOR ARMOURING OF CABLES — SPECIFICATION

(Third Revision)

1 SCOPE

This standard covers the requirements of low carbon galvanized steel wires, formed wires and tapes for armouring of cables.

This standard does not cover steel wires, formed wires and tapes for armouring of submarine cables.

2 REFERENCES

The following Indian Standards 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 indicated below:

IS No.	*Title*
228	Method for chemical analysis of steel
1387 : 1993	General requirements for metallurgical materials (*second revision*)
1608 : 1995	Mechanical testing of metals - Tensile testing (*second revision*)
1717 : 1985	Method for simple torsion test for wire (*second revision*)
1755 : 1971	Method for wrapping test for metallic wire (*first revision*)
1956	Glossary of terms relating to iron and steel
(Part 4) : 1976	Steel sheets and strips (*first revision*)
(Part 5) : 1975	Bright steel bar and steel wire (*first revision*)
2633 : 1986	Method for testing uniformity of coating on zinc coated articles
4826 : 1989	Hot dipped galvanized coatings on round steel wires (*first revision*)
4905 : 1968	Methods for random sampling
6745 : 1972	Methods for determination of mass of zinc coating on zinc coated iron and steel articles
10810 (Part 42) : 1984	Methods of test of cables: Part 42 Resistivity test of armour wires and strips and conductance test of armour (wires/strips)

3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in IS 1956 (Part 4) and IS 1956 (Part 5) shall apply.

3.1 Acceptance Tests

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.2 Armouring (or Armour)

A metal cover usually applied in the form of wire or formed wire or tape intended to protect the cable from mechanical damage.

3.3 Formed Wire

A wire with a cross section as shown in Fig. 1. It is also known as strip in the cable armouring industry.

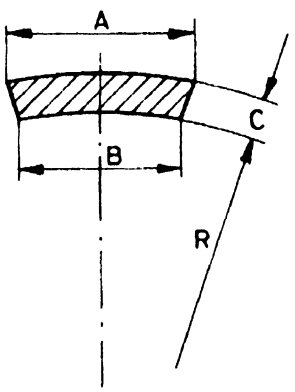

FIG. 1 SECTION OF ARMOUR FORMED WIRE

3.4 Lot

All the coils of the wires, formed wires or tapes of the same nominal dimensions in any consignment,

manufactured under uniform conditions of production at the same place.

3.5 Tape

A strip of rectangular cross section.

4 SUPPLY OF MATERIAL

4.1 General requirements relating to the supply of material shall be as laid down in IS 1387.

4.2 The material shall be supplied in coil form. There shall not be any joint in case the length supplied is less than 200 m. In case the length is more than 200 m, there shall be not more than three joints in the coil. The joint shall not be less than 100 m from each end of the coil.

4.3 The material shall meet the specified requirements of this specification before armouring.

5 MANUFACTURE

5.1 The processes used in making the steel and in manufacturing steel wires, formed wires and tapes are left to the discretion of the manufacturer.

5.2 Steel shall be rimming or non-rimming quality and may be supplied in any of the quality by mutual agreement between the manufacturer and the purchaser.

6 CHEMICAL COMPOSITION

6.1 Ladle Analysis

The ladle analysis of the steel, when carried out by the method specified in the 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. However, where the method is not given in IS 228 and its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

6.2 Product Analysis

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

Table 1 Chemical Composition

Constituent, Percent, *Max*	
Phosphorus	Sulphur
(1)	(2)
0.035	0.035

NOTE — The nitrogen content of the steel shall not be more than 0.012 percent. This has to be ensured by the manufacturer by occasional check analysis.

Table 2 Permissible Variation for Product Analysis
(*Clause* 6.2)

Constituent	Variation Over the Specified Limit Percent, *Max*
(1)	(2)
Sulphur	0.005
Phosphorus	0.005

NOTE — Product analysis shall not apply to rimming quality steel

7 DIMENSIONS AND TOLERANCES

7.1 The dimensions of the wires, formed wires and tapes are to be taken without removing the coating.

7.2 Wires

The diameter of the wire 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 galvanized wire. The dimensions and tolerances of the wires shall be in accordance with Table 3.

Table 3 Dimensions and Tolerances of Steel Wires

Nominal Wire Diameter	Tolerance
mm	mm
(1)	(2)
0.30	±0.020
0.45	±0.020
0.70	±0.025
0.90	±0.030
1.25	±0.035
1.40	±0.040
1.60	±0.045
2.00	±0.050
2.50	±0.065
3.15	±0.080
4.00	±0.10

7.2.1 Sizes other than those mentioned in **7.2** may be supplied with mutual agreement between the purchaser and the manufacturer.

7.3 Formed Wires

Formed wires, having a cross section as shown in Fig. 1, shall have the nominal dimensions as given in Table 4.

7.3.1 The tolerances for formed wires shall be ±10 percent of the nominal dimensions subject to *A* being greater than *B*.

Table 4 Dimensions of Formed Wires
(*Clause* 7.3, and *Fig.* 1)

Type	Dimensions, mm			
	A	*B*	*C*	*R*
(1)	(2)	(3)	(4)	(5)
1	4.0	3.4	0.8	10
2	6.1	5.3	1.4	27.5
NOTE	Dimensions showing against *B* are for guidance only			

7.3.2 Formed wires of any other combination may also be supplied subject to mutual agreement between the purchaser and the manufacturer.

7.4 Tapes

7.4.1 *Thickness*

The thickness of tapes shall be 0.5 mm, 0.8 mm, 1.0 mm or 1.25 mm with a tolerance of ±10 percent

7.4.2 *Width*

The tapes may be supplied in the widths of 25 mm, 32 mm, 35 mm, 50 mm, 70 mm and 80 mm. The tolerance on width shall be ±5 percent.

7.4.3 Tapes of any other combination of thickness and width may also be supplied subject to mutual agreement between the purchaser and the manufacturer.

8 MECHANICAL PROPERTIES

8.1 Tensile Test

The tensile strengths of wire, formed wire and tape when tested in accordance with IS 1608 shall be within the limits given in Table 5.

Table 5 Tensile Properties

Sl No.	Item	Tensile Strength MPa	Percent Elongation at Gauge Length L_o, *Min*	
			L_o= 125 mm	L_o= 250 mm
(1)	(2)	(3)	(4)	(5)
i)	Wire			
	Nominal Diameter			
	Up to and including 1.60 mm	300-500	10	
	Over 1.60 mm	300-500	—	10
ii)	Formed wire	300-500	—	10
iii)	Tape	300-450		10

8.2 Torsion Test (for Round Wires only)

Round wires shall be subjected to torsion test in accordance with IS 1717. The gauge length between vices and the minimum number of turns without break shall be as given in Table 6.

Table 6 Torsion Test

Nominal Wire Diameter mm	Gauge Length Between the Vices, mm	Minimum Number of Turns
(1)	(2)	(3)
0.30	50	67
0.45	75	67
0.70	75	43
0.90	75	33
1.25	75	24
1.40	150	43
1.60	150	37
2.00	150	30
2.50	150	24
3.15	150	19
4.00	150	15

8.3 Wrapping Test

When tested in accordance with IS 1755, the steel wire, formed wire or tape shall withstand without breaking or splitting on being wrapped and subsequent straightened.

8.3.1 In case of wires, the test specimen of 150 mm long cut from each end of the coil after discarding a length of 300 mm shall be wound for eight complete close turns around a cylindrical mandrel equal to the diameter of wire and subsequent straightened.

8.3.2 In case of formed wire and tape, the test specimen of 550 mm long cut from each end of the coil after discarding a minimum length of 300 mm shall be wound for eight complete close turns around a cylindrical mandrel equal to 15 times the nominal thickness of strip keeping the vaulted side of strip outside and subsequent straightened.

8.4 Resistance Test (for Round and Formed Wires Only)

The test shall be carried out in accordance with IS 10810 (Part 42).

8.4.1 The resistivity of the wire or formed wire corrected to 20°C shall not exceed 14.5×10^{-6} ohm-cm.

9 GALVANIZING REQUIREMENTS

9.1 Mass of Zinc Coating

a) *Round Wires* — The mass of zinc coating on round wires shall meet the requirements of medium coating as laid down in IS 4826.

b) *Formed Wires* — The mass of zinc coating on formed wires shall be 110 g/m^2 for Type 1 and 180 g/m^2 for Type 2 wires and shall represent the total mass of zinc, all sides inclusive.

c) *Tapes* — The mass of zinc coating on tapes shall be 210 g/m^2 and shall represent the total mass of zinc, all sides inclusive.

9.1.1 The average mass of zinc coating of samples shall be determined by the method as given in IS 6745 and shall conform to the values specified in **9.1**.

9.2 Uniformity of Zinc Coating

a) *Round Wires* — The uniformity of zinc coating on round wires shall conform to the requirements as laid down in Table 2 of IS 4826.

b) *Formed Wires* — The uniformity of zinc coating on formed wires shall conform to the requirements as given below:

Type	*Minimum Number of Dips*		
	Face		Edge
	1-minute dips	1/2-minute dips	1/2-minute dips
1	1	1	1
2	1	1	1

c) *Tapes* — The uniformity of zinc coating on tapes shall withstand two dips of 1- minute for face and one dip of 1/2-minute for edge.

9.2.1 The test shall be carried out in accordance with IS 2633.

NOTE — It should be pointed out that there is no direct link between the number of dips and the mass of coating and that the result is determined as much by the condition of manufacture of the coating as by the regularity of the coating. The uniformity test is solely intended to reveal any significant eccentricity defect in the coating or any other uniformity defect which could exist even if the mass of zinc per unit of surface area complies with the mass requirements for the coating.

9.3 Adhesion Test

Adhesion test for galvanized wire, formed wire and tape shall be carried out by wrapping the wire, formed wire and tape eight times around a mandrel. The diameter of mandrel for wire shall be four times the wire diameter. In case of formed wire and tapes, diameter of mandrel shall be fifteen times the thickness. The zinc coating shall not crack or flake off to such an extent that the same may be removed by rubbing with bare fingers.

10 SAMPLING

Unless otherwise agreed to, the method of drawing representative samples of the material and the criteria for conformity shall be as prescribed in Annex A.

11 FREEDOM FROM DEFECTS

The wires, formed wires and tapes shall be well cleaned drawn and galvanized to the dimensions specified. These shall be free from splits, surface flaws, rough, jagged and imperfect edges and other harmful surface defects.

12 RETEST

Should any one of the test samples, first selected, fail to comply the requirements specified, two further samples shall be selected from the lot represented by the sample which failed. Should both the test samples comply with the requirements, the lot shall be deemed to have passed. Should either of the retest samples fail, the lot represented shall be rejected. In cases where it is not possible to identify the particular lot, the material from the entire cast shall be deemed as one lot for retest purposes and in case of failure, the entire cast shall be rejected.

13 PACKING

Each coil of wire, formed wire and tape shall be suitably bound and fastened compactly. If required by the purchaser, each coil shall be protected by suitable wrapping.

14 MARKING

14.1 Each coil of wire, formed wire and tape shall be marked legibly with the following information:

a) Manufacturer's name or trade-mark,
b) Name of material,
c) Size,
d) Net weight,
e) Lot/batch number,
f) Month and year of manufacture, and
g) Any other marking required by the purchaser.

14.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

14.2.1 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 manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 10)

SAMPLING AND CRITERIA FOR CONFORMITY

A-1 LOT

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

A-1.1 Sample shall be taken from each lot and tested for conformity to the standard.

A-2 SAMPLING

The number of coils to be taken from a lot shall be according to column 1 and 2 of Table 7. The samples shall be taken at random by using number tables (*see* IS 4905).

Table 7 Scale of Sampling and Permissible Number of Defectives

(*Clauses* A-2, A-3.1 *and* A-3.2)

No. of Coils in a Lot	No. of Coils for Physical Requirements	Permissible No. of Defective Coils	No. of Tests for Chemical Requirements
(1)	(2)	(3)	(4)
Up to 25	2	0	1
26 " 50	3	0	1
51 " 150	5	0	2
151 " 300	8	1	2
301 and above	13	1	2

A-3 PREPARATION OF SAMPLES AND NUMBER OF TESTS

A-3.1 Tests for Physical Requirements

From the coils selected from column 1 and 2 of Table 7, adequate length of test piece shall be cut from each end and subjected to physical tests, namely, size, surface condition, tensile, torsion, wrapping and coating tests. A test piece failing to meet any one of the requirements, shall be called a defective. If the number of defectives found is less than or equal to the permissible number of defectives specified in column 3 of Table 7, 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 column 4 of Table 7. These samples shall be tested for all the chemical requirements. If a test piece fails to meet the respective chemical requirement, 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.

Bureau of Indian Standards

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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 Handbook' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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