
लॉकड कॉयल वाईडिंग रस्सियाँ — विशिष्टि
(तीसरा पुनरीक्षण)

**Locked Coil Winding Ropes —
Specification**
(*Third Revision*)

ICS 73.100.40; 77.140.65

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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FOREWORD

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

Locked coil wire ropes are a unique assembly of a classic wire rope core consisting of multiple helically twisted wires, with on the top of that on the outside one or more layers are profiled, z-shaped wires that interlocks with each other. This interlocking outer layer creates a dense rope assembly, with high strength and stiffness, and an aesthetically pleasing smooth outer surface.

This standard was first published in 1966 and subsequently revised in 1978 and 2001. This standard is being revised again to keep pace with the latest technological developments and international practices. In this revision the standard has been brought into the latest style and format of Indian Standards, and references to Indian Standard, wherever applicable have been updated. BIS certification marking clause has been modified to align with the revised *Bureau of Indian Standards Act, 2016*.

The composition of the Committee responsible for the formulation of this standard is given in [Annex D](#).

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 : 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

LOCKED COIL WINDING ROPES — SPECIFICATION

(*Third Revision*)

1 SCOPE

It covers locked coil wire ropes used for winding purposes in mines.

2 REFERENCES

The standards given below 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 agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

<i>IS No.</i>	<i>Title</i>
IS 1608 (Part 1) : 2022	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (<i>fifth revision</i>)
IS 1716 : 2023	Metallic materials — Wire — Reverse bend test (<i>third revision</i>)
IS 1717 : 2018	Method for sample test for wire (<i>fourth revision</i>)
IS 1835 : 1976	Specification for round steel wire for ropes (<i>third revision</i>)
IS 6594 : 2018	Technical supply conditions for steel wire ropes and strands (<i>third revision</i>)

3 TERMINOLOGY

For the purpose of this standard, the terms given in IS 2363 shall apply.

4 DIMENSIONS

4.1 Size

The size of the rope shall be expressed in terms of the nominal diameter and it shall be one of those diameters mentioned in [Table 1](#). Interpolation, however, of the values given in [Table 1](#) for mass and minimum breaking force shall be permitted for ropes of intermediate sizes.

4.2 Length

The rope shall not be less than the length specified by the purchaser nor shall it exceed the specified length by more than 2.5 percent.

5 MATERIAL

5.1 The wires shall be cold drawn from steel made by the open hearth, electric, duplex, basic oxygen or a combination of these processes.

5.2 If required, the manufacturer shall furnish the steel maker's cast analysis to the purchaser and issue a certificate to him that the wires have been drawn from the certified steel.

5.3 The chemical composition of the steel wires shall be as given in Grades 1, 2 and 3 in IS 1835.

5.4 Tensile Designation of Wire

The tensile designation of wire, shall be as given below:

<i>Sl No.</i>	<i>Round Wires</i>	<i>Shaped Wires</i>
(1)	(2)	(3)
i))	1 570	1 230
ii))	1 770	1 420
iii))	1 960	1 570

5.4.1 The tensile range of round wires shall be as given in IS 1835. The tensile range of shaped wires shall be as given below:

<i>Sl No.</i>	<i>Tensile Designation</i>	<i>Tensile Range</i> N/mm ²
(1)	(2)	(3)
i))	1 230	1 230-1 430
ii))	1 420	1 420-1 620
iii))	1 570	1 570-1 770

5.5 The wires may be supplied in any one of the following conditions as specified by the purchaser:

- a) Ungalvanized; and
- b) Galvanized

If galvanized wire is required, the minimum mass of the coating on the wire shall be 45 g/m² of surface area for the shaped wire, and 65 g/m² for the round wire.

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https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/knowyourstandards/Indian_standards/isdetails/

6 BREAKING FORCE AND MASS

Breaking force and mass shall be as given in [Table 1](#).

Table 1 Mass and Breaking Force of Locked Coil Wire Ropes
(Clauses [4.1](#), [6](#) and [10.3](#))

Nominal rope diameter	:	d
Mass factor (K)	:	0.553 8
Rope mass (kg/100 m)	:	Kd^2
Breaking force factor (K')	:	0.553 6
Rope grade (R0)	:	1 470
Minimum breaking force of rope	:	$(K'R^0d^2)/1\ 000\ \text{kN}$

SI No.	Nominal Rope Diameter (d)	Rope Mass	Minimum Breaking Force of Rope
	in mm + 2 percent - 1 percent	in kg/100 m ± 4 percent	in kN
(1)	(2)	(3)	(4)
i)	16	142	208
ii)	18	179	264
iii)	19	200	294
iv)	20	222	326
v)	21	244	359
vi)	22	268	394
vii)	24	319	469
viii)	25	346	509
ix)	26	375	550
x)	27	404	593
xi)	28	434	638
xii)	29	466	685
xiii)	30	499	733
xiv)	32	567	834
xv)	34	640	941
xvi)	35	679	997
xvii)	36	718	1 055
xviii)	37	758	1 114
xix)	38	800	1 176
xx)	39	843	1 238
xxi)	40	886	1 303
xxii)	41	931	1 368

Table 1 (Concluded)

Sl No.	Nominal Rope Diameter (d)	Rope Mass	Minimum Breaking Force of Rope
	in mm + 2 percent - 1 percent	in kg/100 m ± 4 percent	in kN
(1)	(2)	(3)	(4)
xxiii)	44	1 073	1 576
xxiv)	46	1 172	1 723
xxv)	48	1 276	1 876
xxvi)	51	1 441	2 117
xxvii)	54	1 615	2 374
xxviii)	57	1 800	2 645
xxix)	60	1 994	2 931

NOTES

1 The calculated aggregate breaking force of the rope may be obtained by multiplying the values in col (3) by 1.16.

2 The rope mass values are given for lubricated ropes. Lubricated ropes are weighing approximately 1 percent more than unlubricated ropes.

7 MANUFACTURE

7.1 Construction

The rope shall consist of an outer layer of shaped wires with inner layers of either a combination of shaped and round wires or round wires over a core. The manufacturer shall make available to the purchaser, on request, the details of construction, including the approximate length of the lay.

7.2 Wire Tensile Designation

To produce the required rope breaking forces the manufacturer may employ any combination of tensile designations for round and shaped wires given in [5.4](#) provided that all the round wires of same size in any one layer in the rope are of one tensile designation. While all the shaped wires of same size in one layer in the rope are of one tensile designation.

8 LUBRICATION

The rope shall be thoroughly lubricated internally and externally during manufacture. The lubricant shall meet the requirements laid down in IS 6594. Lubrication of ropes for friction winders and other special applications shall be a subject of special agreement between the purchaser and the manufacturer.

9 TEST ON WIRES USED BY THE ROPE MANUFACTURER (BEFORE ROPE MAKING)

9.1 Each coil of wire used in the manufacture of rope shall be subjected to tensile, torsion and reverse bend

tests. The test results shall be recorded and made available for inspection by the purchaser or his representatives at the rope manufacturer's works. The tests shall be carried out as given in [9.1.1](#) to [9.1.3](#).

9.1.1 Tensile Test

The tensile test shall be carried out in accordance with IS 1608 (Part 1) except that in the case of shaped wires, the tensile strength shall be calculated from the breaking force and the 'equivalent round section', that is, the round wire of equal cross-sectional area to that of the shaped wire (see [Annex A](#)). The equivalent round section for the particular wire shall be provided by the manufacturer, on request. The wires shall comply with the requirements shown in [5.4.1](#).

9.1.2 Torsion Test

The wires shall be tested in accordance with IS 1717 except that in the case of shaped wires, the test length of the shaped wire shall be 100 x altitudes or 200 mm as may be agreed (see [Fig. 1](#)). In the shorter test lengths, the minimum number of twists shall be taken directly proportional to the number specified for the test length of 100 x altitude. The torsion testing machine shall have adequate provision for applying back tension to the wire for allowing lateral movement of one of the gripping heads. The torsion values obtained shall not be less than those specified (under before rope making) in [Table 2](#).

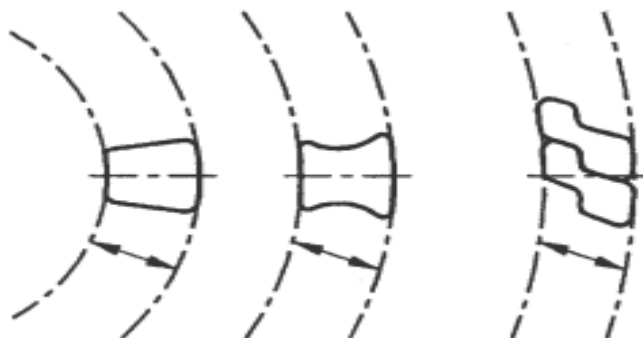


FIG. 1 ALTITUDE OF SHAPED WIRES

Table 2 Torsion Test for Shaped Wires

(Clauses 7.2, 9.1.2 and 10.2.2)

SI No.	Nominal Altitude of Wire	Minimum Number of Torsion on a Length of 100 × Altitude							
		Tensile Designation 1 230 and 1 420				Tensile Designation 1 570			
		Before Rope Making		From Completed Rope		Before Rope Making		From Completed Rope	
		Ungalvanized	Galvanized	Ungalvanized	Galvanized	Ungalvanized	Galvanized	Ungalvanized	Galvanized
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Full lock wires 3.55 mm and greater than 3.55 mm	26 28	23 25	19 21	17 18	24 26	21 23	18 19	15 17
	Half lock wires 2.75 mm and greater than 2.75 mm	25 27	22 24	18 20	16 18	23 25	20 22	17 18	15 16

9.1.3 Reverse Bend Test

The reverse bend test shall be carried out in accordance with IS 1716 except that in the case of the shaped wires, the wires shall be placed in the bending machine with the waist facing the mandrel, that is, the shaped wires shall be bent over the waist (see Fig. 2). The values obtained shall not be less than those specified in Table 3.

10 TESTS ON COMPLETED WIRE ROPES

10.1 When specified by the purchaser, inspection and testing of completed wire ropes and wires from a

completed rope shall be carried out at the works of the rope manufacturer. The manufacturer shall supply all the necessary test samples, machinery, apparatus and labour required for inspection and testing at his works. All the tests shall be under the direction of the purchaser or his representatives.

The test to be carried out shall be:

- a) Tensile, torsion and reverse bend tests on wires taken from the sample of the completed rope; and
- b) Breaking force test.

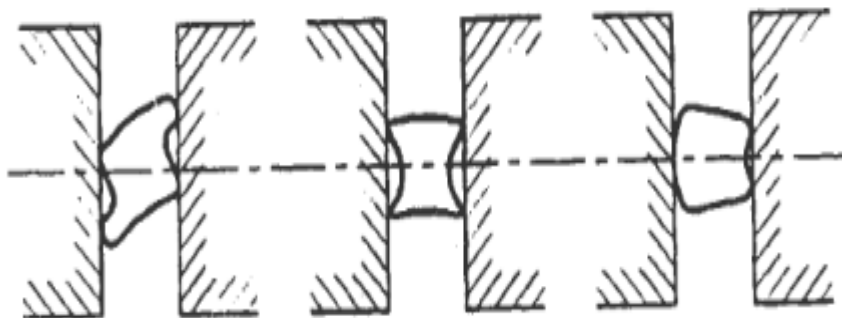
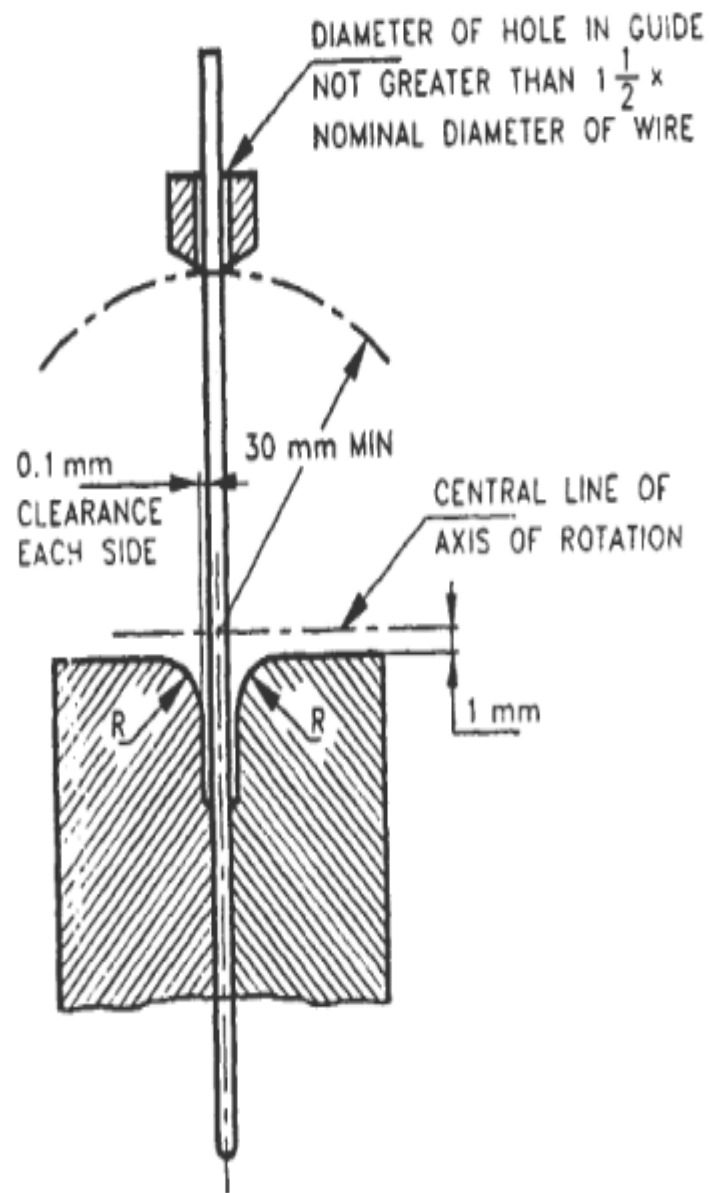


FIG. 2 BEND TEST FOR SHAPED WIRES

Table 3 Reverse Bend Test for Shaped Wires (Before Rope Making)

(Clause 9.1.3)

Sl No.	Nominal Altitude mm		Diameter of Bending Roller (mm)	Minimum Number of Bends Tensile Designation of Wire							
	Over	Up to and Including		1 230 and 1 420				1 570			
	Full Lock Wires			Ungalvanized		Galvanized		Ungalvanized		Galvanized	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)				
i)	1.27	1.52	10	20	18	18	16				
ii)	1.52	1.78	10	18	16	16	14				
iii)	1.78	2.03	10	16	14	14	12				
iv)	2.03	2.29	10	15	13	13	11				
v)	2.29	2.54	10	13	11	11	10				
vi)	2.54	2.79	10	10	9	9	8				
vii)	2.79	3.05	15	15	16	16	14				
viii)	3.05	3.30	15	16	14	14	12				
ix)	3.30	3.56	15	12	10	10	9				
x)	3.56	3.81	15	10	9	8	7				
xi)	3.81	4.06	20	11	10	10	9				
xii)	4.06	4.32	20	10	9	9	8				
xiii)	4.32	4.57	20	9	8	8	7				
	Half Lock Wires			Narrow	Broad	Narrow	Broad	Narrow	Broad	Narrow	Broad
xiv)	1.27	1.52	10	18	15	17	14	17	14	16	13
xv)	1.52	1.78	10	16	13	15	12	14	12	13	11
xvi)	1.78	2.03	10	14	12	13	11	13	11	11	10
xvii)	2.03	2.29	10	11	9	10	8	10	8	9	7
xviii)	2.29	2.54	10	10	8	9	7	9	7	8	6
xix)	2.54	2.79	15	13	9	11	8	11	8	10	7
xx)	2.79	3.05	15	12	9	10	8	10	8	9	7
xxi)	3.05	3.30	15	11	8	10	7	10	7	8	6

NOTE — The description broad section 'shall apply to half-locked wires when the ratio of nominal altitude to minimum waist dimension is not more than 1.5 to 1. Where the ratio is greater, the description 'narrow section' shall apply.

10.2 Test on Wires from the Completed Rope

A suitable length from the manufactured rope shall be cut. The wires of each layer shall be separated and wires of each type and size shall then be segregated into groups and the wires in each group are well mixed. A quarter of each group shall then be subjected to tensile, torsion and reverse bend tests in accordance with the procedure laid down in [9.1](#).

10.2.1 The tensile strength of the wires removed from the completed rope shall not be more than 50 N/mm² below the minimum value of the tensile designation specified and the difference in tensile strength between the maximum and minimum tensile values of wires tested shall not exceed 240 N/mm².

10.2.2 Torsion Test

The round wires shall comply with the appropriate requirement of IS 1835 except that the minimum number of torsion may be 75 percent (to the nearest whole number) of those specified therein. The torsion value of the shaped wires shall comply with those specified (under completed rope) in [Table 2](#).

10.2.3 Reverse Bend Test

The round wires shall comply with the appropriate requirement of IS 1835 except that the minimum number of reverse bends may be 75 percent (to the nearest whole number) of those specified therein. The reverse bend value of the shaped wires shall comply with that specified in [Table 4](#).

10.2.4 Retest

If two or more wires fail to pass the tensile, torsion and reverse bend tests specified, retest limited to the type of test specified, retest limited to the type of test under which the failure occurred, shall be carried out. If under the retest, two or more wires fail in any type of test, the rope represented by the sample shall be considered not to comply with this specification.

10.3 Breaking Force Test

The rope shall be tested to destruction for determining the breaking force of the rope in the manner described in IS 6594. This test may be carried out by an independent organization, if desired by the purchaser. The breaking force of the rope shall not be less than the value specified in [Table 1](#).

11 INDEPENDENT TESTS ON COMPLETED ROPE

11.1 If the purchaser is not satisfied with the tests, the manufacturer shall be at liberty to have independent tests carried out by a test authority to be

agreed upon between the purchaser and the manufacturer. If the test results meet the requirements of this specification, the rope shall be deemed to comply with the specification.

11.2 Such independent test shall be carried out in accordance with the provisions of this standard.

12 CERTIFICATE OF COMPLIANCE

With each reel of completed rope the manufacturer shall supply a certificate of test. The form of the certificate shall be as shown in Annex C of IS 6594.

13 MARKING

The order number of the purchaser and any other marking, as may be specified by the purchaser, shall be legibly stamped upon a tag securely attached to each reel or coil.

13.1 BIS Certification Marking

The product may also be marked with Standard Mark.

13.1.1 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.

14 PACKING

14.1 The rope shall be supplied on reels having a sufficient belly diameter to prevent damage through permanent set to the rope.

14.2 The rope shall be suitably protected on the reel to avoid damage in transit and corrosion.

15 INFORMATION TO BE GIVEN WITH THE ENQUIRY OR ORDER

All the necessary information regarding the conditions under which the rope is to be used, together with other particulars, as laid down in [Annex B](#), shall be supplied with the enquiry or order.

16 INFORMATION TO BE GIVEN BY THE MANUFACTURER

If required, the manufacturer shall supply information regarding the construction of the rope, as laid down in [Annex C](#).

Table 4 Reverse Bend Test for Shaped Wires (from Completed Rope)

(Clause 10.2.3)

SI No.	Nominal Altitude (mm)		Diameter of Bending Roller (mm)	Minimum Number of Bends Tensile Designation of Wire							
	Over Full Lock Wires	Up to and Including		1 230 and 1 420				1 570			
(1)	(2)	(3)	(4)	Ungalvanized (5)	Galvanized (6)	Ungalvanized (7)	Galvanized (8)	Ungalvanized (9)	Galvanized (10)	Ungalvanized (11)	Galvanized (12)
i)	1.27	1.52	10	15	14	14	13				
ii)	1.52	1.78	10	13	12	12	12				
iii)	1.78	2.03	10	12	11	11	10				
iv)	2.03	2.29	10	11	10	10	9				
v)	2.29	2.54	10	9	9	9	8				
vi)	2.54	2.79	10	7	6	6	6				
vii)	2.79	3.05	15	13	12	12	11				
viii)	3.05	3.30	15	12	10	10	9				
ix)	3.30	3.56	15	9	7	7	6				
x)	3.56	3.81	15	7	6	6	5				
xi)	3.81	4.06	20	8	7	7	6				
xii)	4.06	4.32	20	7	6	6	6				
xiii)	4.32	4.57	20	6	6	6	5				
	<i>Half Lock Wires</i>			Narrow	Broad	Narrow	Broad	Narrow	Broad	Narrow	Broad
xiv)	1.27	1.52	10	13	11	12	10	12	10	12	9
xv)	1.52	1.78	10	12	9	11	9	10	9	9	8
xvi)	1.78	2.03	10	10	9	9	8	9	8	8	7
xvii)	2.03	2.29	10	8	6	7	6	7	6	6	5
xviii)	2.29	2.54	10	7	6	6	5	6	5	6	4
xix)	2.54	2.79	15	9	6	8	6	8	6	7	5
xx)	2.79	3.05	15	9	6	7	6	7	6	6	5
xxi)	3.05	3.30	15	8	6	7	5	7	5	6	4

NOTE — The description 'broad section' shall apply to half-locked wires when the ratio of nominal altitude to minimum waist dimension is not more than 1.5 to 1. Where the ratio is greater, the description 'narrow section' shall apply.

ANNEX A

(Clause 9.1.1)

METHOD OF CALCULATION OF EQUIVALENT ROUND SECTION OF A SHAPED WIRE

A-1 Prepare an exact length of wire equal to 150 mm, with the ends filed flat, clean and weigh accurately.

$$\begin{aligned} \text{Area in mm}^2 &= \text{mass in g} \times 0.85 \\ \text{Diameter of equivalent round section in mm} &= \sqrt{\text{mass in g} \times 1.081} \end{aligned}$$

ANNEX B

(Clause 15)

INFORMATION TO BE GIVEN WITH THE ENQUIRY OR ORDER WHEN NECESSARY

B-1 The following information shall be given, when necessary, with the enquiry or order:

- a) Particulars of shaft:
 - 1) Depth from lowest working level in shaft to bank, vertical distance from bank to centre of head pulley;
 - 2) Whether up cast or downcast;
 - 3) Whether wet or dry, and approximate range of temperature variation; and
 - 4) Whether there are any special circumstances likely to affect the rope like sand stowing, alkaline or acidic water, etc.
 - b) Particulars of winding engine drum:
 - 1) Type of drum
 - i) If parallel type, give diameter and width, and distance of first and last five turns from centre line of the drum;
 - ii) If conical type, give minimum and maximum diameters and width and distance of first and last working turns from centre line of drum; and
 - iii) If cylindro-conical type, give maximum and minimum diameters, distance of first and last five turns from centre line of drum, number of working turns on the minimum diameter, number of turns on the scroll, width of drum and width of scroll and width of parallel portion of drum.
 - c) Particulars of driving sheave:
 - 1) Diameter; and
 - 2) Rope groove-lining;
 - d) Particulars of pithead pulleys and position with respect to the winding engine:
 - 1) Horizontal and vertical distance between centres of pithead pulleys and whether the vertical centre line or between the pulleys coincides with the centre line of the drum or sheave;
 - 2) Diameter of pithead pulley at bottom of groove;
 - 3) Diameter of any guide sheave and its position with respect to the pithead pulley or driving sheave;
 - 4) Height of centre head pulley above centre of drum or ground type driving sheave;
 - 5) Horizontal distance between centre of drum or ground type driving sheave and rope hanging in shaft;
 - 6) Inside and outside fleet angles;
 - 7) Maximum winding speed in m/s;
 - 8) Maximum acceleration in m/s^2 , when raising full load;
 - 9) Maximum load and normal load suspended from the winding rope capping including the mass of any balance rope and its attachment; and
 - 10) Type of cage guides.
 - e) Particulars of rope required or proposed:
 - 1) Length in meters;
 - 2) Nominal diameter;
 - 3) Construction;
 - 4) Minimum breaking force, in kN;
 - 5) Nominal tensile designation of wires; and
 - 6) Whether the wire is to be galvanized or ungalvanized.
 - f) Particulars of inspection and testing required.
- Nature and arrangement of drum-lagging or cleaning material and particulars of any grooving, whether rope is wound on itself and if so, number of layers.

ANNEX C

(*Clause 16*)

INFORMATION TO BE GIVEN BY THE MANUFACTURER

C-1 The following information is to be given by the manufacturer if required:

- a) Quality of material, and nominal tensile designation of wire in each layer;
- b) Nominal diameter of rope;
- c) Details of construction;
 - 1) Number and altitude of shaped wires in outer layers;
 - 2) Number and attitude/diameter of shaped/round wires in other layers, equivalent round section of shaped wires.
- d) Minimum breaking force of rope in kN;
- e) Approximate mass of rope as packed for transit;
- f) Length of rope;
- g) Date of manufacture;
- h) Identification number; and
- j) Approximate mass in kg/100 m of rope.

ANNEX D

(Foreword)

COMMITTEE COMPOSITION

Wire Ropes and Wire Products Sectional Committee, MED 10

<i>Organization</i>	<i>Representative(s)</i>
Directorate General of Mines Safety, Dhanbad	SHRI D. B. NAIK (Chairperson) SHRI VIJAY BARAPATRE (<i>Alternate</i>)
Bharat Coking Coal Limited, Dhanbad	SHRI P. K. SINHA SHRI R. K. MUNSHI (<i>Alternate</i>)
Bharat Wire Ropes Limited, Mumbai	SHRI MAHENDER SINGH ARORA SHRI MAYANK MITTAL (<i>Alternate</i>)
Central Institute of Mining and Fuel Research, Dhanbad	DR MANOJ KUMAR SINGH DR DEBASISH BSSAK (<i>Alternate</i>)
Directorate General of Quality Assurance, New Delhi	COL K. SURESH LT COL JA VORA (<i>Alternate</i>)
Directorate General FAC Advice Service and Lab Institute, Mumbai	SHRI B. N. JHA SHRI AMIT GOLA (<i>Alternate</i>)
Directorate General of Aeronautical Quality Assurance, New Delhi	SHRI SANTOSH INGOLE
Eastern Coalfields Limited, Kolkata	DR MANAS KUMAR
Hindustan Zinc Limited, Dariba	SHRI RAKESH SINGHVI SHRI SUFAL MEHROTRA (<i>Alternate</i>)
Maccaferri Environment Solutions Pvt Limited, Navi Mumbai	SHRIMATI MINIMOL KORULLA SHRI RUDRA BUDDHABHATTI (<i>Alternate</i>)
Manganese Ore Limited, Nagpur	SHRI S. C. RAI SHRI ATUL SHARMA (<i>Alternate I</i>) SHRI ASHWINI BAGHELE (<i>Alternate II</i>) SHRI RUDRA BUDHBHATTI (<i>Alternate III</i>)
Ministry of Shipping, New Delhi	SHRI ANIL PRUTHI SHRI RAMJI SINGH (<i>Alternate</i>)
Nanda and Miller Co, Kolkata	SHRI J. P. GOENKA
National Test House, Kolkata	SHRI SURESH PARWAL SHRI ANGAD VERMA (<i>Alternate</i>)
Oil and Natural Gas Commission, New Delhi	SHRI RAKESH KUMAR SRIVASTAVA SHRI RITUJIT HAZARIKA (<i>Alternate</i>)
Orient Wire Ropes, Indore	SHRI SAMEER GOLWELKAR SHRI SHISHIR AKARTE (<i>Alternate</i>)
South Eastern coalfields Limited, Bilaspur	SHRI KAPIL K. RAI SHRI D. BHATTACHARJEE (<i>Alternate</i>)
Tata Steel Limited, Dhanbad	SHRI SOUMENDU MAJHI
The Shipping Corporation of India Limited, Mumbai	SHRI G. S. BHALLA CAPT R. MODI (<i>Alternate</i>)
Usha Martin Industries Limited, Ranchi	SHRI SUBRATA DUTTA SHRI SANDEEP JAISWAL (<i>Alternate</i>)

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Organization

BIS Directorate General

Representative(s)

SHRI K. V. RAO, SCIENTIST 'F'/SENIOR DIRECTOR AND
HEAD (MECHANICAL ENGINEERING) [REPRESENTING
DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary

SHRI SANDEEP KESHAV
SCIENTIST 'C'/DEPUTY DIRECTOR
(MECHANICAL ENGINEERING), BIS

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