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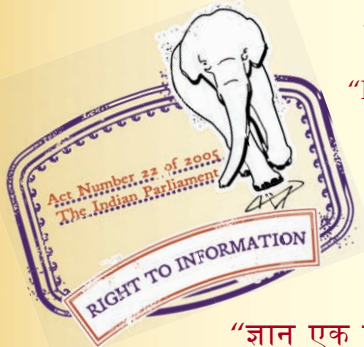
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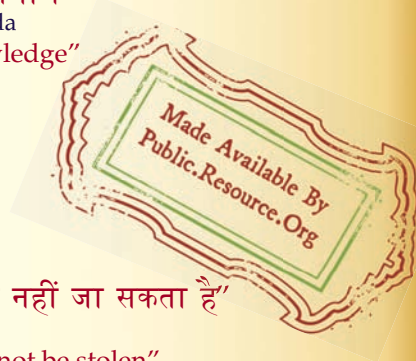
IS 9537-3 (1983): Conduits for electrical installations, Part 3: Rigid plain conduits of insulating materials (superseding IS:2509) [ETD 14: Electrical Wiring Accessories]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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IS : 9537 (Part 3) - 1983
(Reaffirmed 2007)

Indian Standard
SPECIFICATION FOR
CONDUITS FOR ELECTRICAL INSTALLATIONS

**PART 3 RIGID PLAIN CONDUITS OF INSULATING
METERIALS**

Fifth Reprint JUNE 2008
(Including Amendment No. 1)

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

AMENDMENT NO. 1 MARCH 2002
TO
IS 9537(PART3) : 1983 SPECIFICATION FOR
CONDUITS FOR ELECTRICAL INSTALLATIONS
PART 3 RIGID PLAIN CONDUITS OF INSULATING MATERIALS

(Page 4, clause 1.1) — Substitute the following for the existing clause:

'This standard (Part 3) specifies requirements and method of tests for circular rigid non-flame propagating and non-threadables plain ended and socket ended conduits of insulating materials.

NOTE — In the case of socket ended conduits, the socket portion shall be integral with the conduit length at one end only.

(Page 5, Table 1) — Insert the following new clause after Table 1 and renumber the existing clause 7.1.1 as clause 7.1.2:

7.1.1 The dimensions of the socket end shall be as given in Table 2.

Table 2 Dimensions of Socket End
All dimensions in millimetres.

Nominal size	Outside Diameter (Max)	Inside Diameter	Length of Socket End (Min)
(1)	(2)	(3)	(4)
16	20.1	16.1 } +0.2	40
20	24.5	20.1 } 0	40
25	29.8	25.1 } +0.3	40
32	37.8	32.1 } 0	50
40	46.1	40.1 } +0.4	60
50	57.3	50.1 } 0	60
63	69.6	63.1 } ±0.5 0	60

(Page 7, clause 7.3) — Substitute the following for the existing clause:

'7.3 The preferred length of a conduit shall be 3 m. Other lengths are also permitted with agreement between the manufacturer and the purchaser.'

(Pages 14 and 15, Appendix A) — Substitute 'Table 3' for 'Table 2' wherever it appears.

(ETD 14)

Indian Standard

SPECIFICATION FOR

CONDUITS FOR ELECTRICAL INSTALLATIONS

PART 3 RIGID PLAIN CONDUITS OF INSULATING

MATERIALS

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(Continued on page 2)

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(Continued on page 16)

Indian Standard

SPECIFICATION FOR CONDUITS FOR ELECTRICAL INSTALLATIONS

PART 3 RIGID PLAIN CONDUITS OF INSULATING MATERIALS

0. FOREWORD

0.1 This Indian Standard (Part 3) was adopted by the Indian Standards Institution on 29 December 1983, after the draft finalized by the Electrical Wiring Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The requirements for rigid non-metallic conduits for electrical installations were previously covered in IS : 2509-1973*. In order to align with international practice, a new series of Indian Standards on different types of conduits is being prepared. Since many properties and test methods relevant to different types of conduits are similar, these have been covered in IS : 9537 (Part 1)-1980† with the intention of covering specific requirements of individual types of conduits in subsequent parts. This standard (Part 3) is thus, one of this series and is to be read in conjunction with IS : 9537 (Part 1)-1980†. Should, however, any deviation exist between IS : 9537 (Part 1)-1980† and this standard, the provisions of the latter shall apply.

0.3 The major differences in this standard (Part 3) over the previous standard IS : 2509-1973* (*see 0.2*) are in the tolerances on dimensions (particularly outside diameter) and the method for bending test. These changes have been made to align with other parts in this series and the internationally accepted practices.

0.4 The conduits covered in this standard (Part 3) are suitable for temperatures between — 5°C and † 60° C.

0.5 While preparing this document, assistance has been derived from IEC Publication 614-2-2 (1980) 'Specification for conduits for electrical installations, Part 2 Particular specification for rigid plain conduits of insulating materials', issued by International Electrotechnical Commission.

*Specification for rigid non-metallic conduits for electrical installations (*first revision*).

†Specification for conduits for electrical installations: Part 1 General requirements.

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0.6 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 3) specifies requirements and methods of tests for circular rigid non-flame propagating and non-threadable plain conduits of insulating materials.

2. DEFINITIONS

2.1 The relevant provisions of **2** of IS : 9537 (Part 1)-1980† shall be applicable.

3. GENERAL REQUIREMENTS

3.1 The provisions of **3** of IS : 9537 (Part 1)-1980† shall be applicable.

4. GENERAL NOTES ON TESTS

4.0 The following provisions in addition to these given in **4** of IS : 9537 (Part 1)-1980†, shall be applicable.

4.1 The tests shall be carried out at ambient room temperature, unless otherwise specifically mentioned in the individual tests.

4.2 Six manufacturing lengths are required for carrying out all type tests.

5. CLASSIFICATION

5.1 Conduits shall be classified according to mechanical properties as under.

5.1.1 Conduits for light mechanical stresses.

5.1.2 Conduits for medium mechanical stresses.

5.1.3 Conduits for heavy mechanical stresses.

*Rules for rounding off numerical values (*revised*).

†Specification for conduits for electrical installations : Part 1 General requirements.

6. MARKING

6.1 Each length of the conduits shall be marked preferably at 50 mm, from one end, with the following information:

- a) Manufacturer's name or trade-mark, if any;
- b) Nominal size of the conduits;
- c) Country of manufacture; and
- d) Information relating to classification as given in **5.1**.

6.2 The durability of the markings shall be tested as given in **6.4** of IS : 9537 (Part 1)-1980*.

6.3 The product may also be marked with Standard Mark.

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

7. DIMENSIONS

7.1 The dimensions of the conduits shall be as given in Table 1.

TABLE 1 DIMENSIONS OF THE CONDUITS

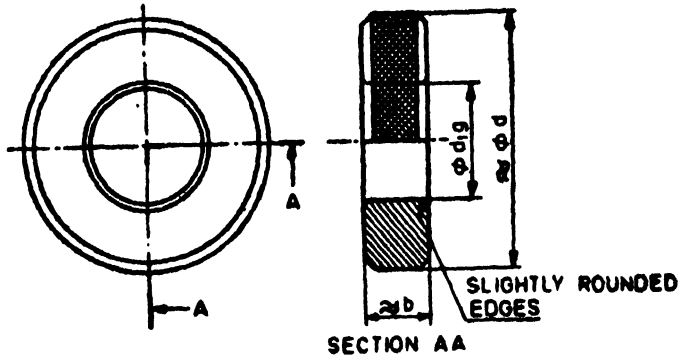
All dimensions in millimetres.

NOMINAL SIZE	OUTSIDE DIAMETER	TOLERANCE ON OUTSIDE DIAMETER	INSIDE DIAMETER, <i>Min</i>		
			Light	Medium	Heavy
(1)	(2)	(3)	(4)	(5)	(6)
16	16	-0.3	13.7	13.0	12.2
20	20	-0.3	17.4	16.9	15.8
25	25	-0.4	22.1	21.4	20.6
32	32	-0.4	28.6	27.8	26.6
40	40	-0.4	35.8	35.4	34.4
50	50	-0.5	45.1	44.3	43.2
63	63	-0.6	57.0	—	—

*Specification for conduits for electrical installations: Part 1 General requirements.

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7.1.1 The maximum and minimum outside diameters of the conduit shall be checked by means of the gauges as given in Fig. 1 and 2, respectively.

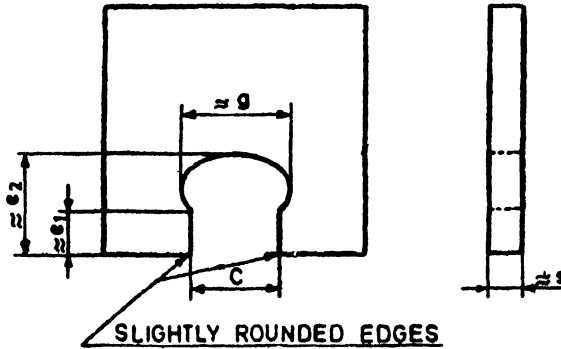


SIZE	d_{1g}^* mm	b mm	d mm
16	16.04	12	45
20	20.04	12	45
25	25.04	16	60
32	32.04	18	70
40	40.04	18	70
50	50.04	20	85
63	63.04	20	100

- *Manufacturing tolerance : - 0
: - 0.01 mm
- Admissible wear : + 0.01 mm
- Material : Steel

It shall be possible to slide the appropriate gauge completely over the conduit, under its own weight.

FIG. 1 GAUGE FOR CHECKING MAXIMUM OUTSIDE DIAMETER OF CONDUITS



SIZE	C	MANUFACTURING TOLERANCES	ADMISSIBLE WEAR	e_1	e_2	R	s
	mm	mm	mm	mm	mm	mm	mm
16	15.70	0 -0.018	+0.018 0	8	17	18	8
20	19.70	0 -0.022	+0.022 0	10	23	27	9
25	24.6	0 -0.022	+0.022 0	10	23	27	9
32	31.6	0 -0.025	+0.025 0	12	29	34	10
40	39.6	0 -0.030	+0.030 0	14	35	42	10
50	49.5	0 -0.030	+0.030 0	16	42	52	12
63	62.4	0 -0.030	+0.030 0	18	49	65	12

Material: Steel.

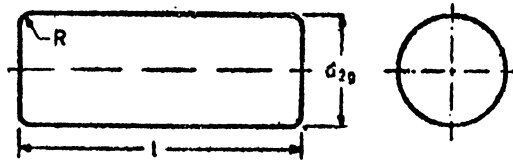
It shall not be possible to pass the gauge over the conduit, in any position, without undue force.

FIG. 2 GAUGE FOR CHECKING MINIMUM OUTSIDE DIAMETER OF CONDUITS

7.2 The minimum inside diameter shall be checked by the gauge as given in Fig. 3.

7.3 The minimum length of a conduit shall be 3 m. Preferred lengths are 3 m and 4 m.

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SIZE	DIAMETER d_{2g}			L	R
	Light	Medium	Heavy		
	mm	mm	mm	mm	mm
16	13.4	12.7	11.9	50	3
20	17.2	16.6	15.5	50	3
25	21.4	21.1	20.3	60	3
32	28.4	27.5	26.3	75	3
40	35.8	35.1	34.1	80	3
50	44.8	43.9	42.8	105	3
63	56.7	56.0	55.2	115	3

Manufacturing tolerance : $+0.05$
 0 mm
 Admissible Naer : 0.01 mm
 Material : Polished steel

it shall be possible for the appropriate gauge to pass through the conduit under its own weight.

FIG. 3 GAUGE FOR CHECKING MINIMUM INSIDE DIAMETER OF CONDUITS OF INSULATING MATERIALS IN STRAIGHT CONDITION

7.4 Uniformity of the Wall Thickness — In case of doubt with regard to the uniformity of the wall thickness of conduits, three samples, each taken from different lengths, shall be cut along a plane perpendicular to the axis. The wall thickness at each cut edge shall be measured at four places as far as possible equally spaced around the circumference, one of the measurement being made at the thinnest place. In no case shall the difference between the value measured and the average of the twelve values obtained from the three samples exceed $0.1 \text{ mm} + 10$ percent of the average value.

8. CONSTRUCTION

8.1 The relevant provision of IS : 9537 (Part 1)-1980* shall be applicable.

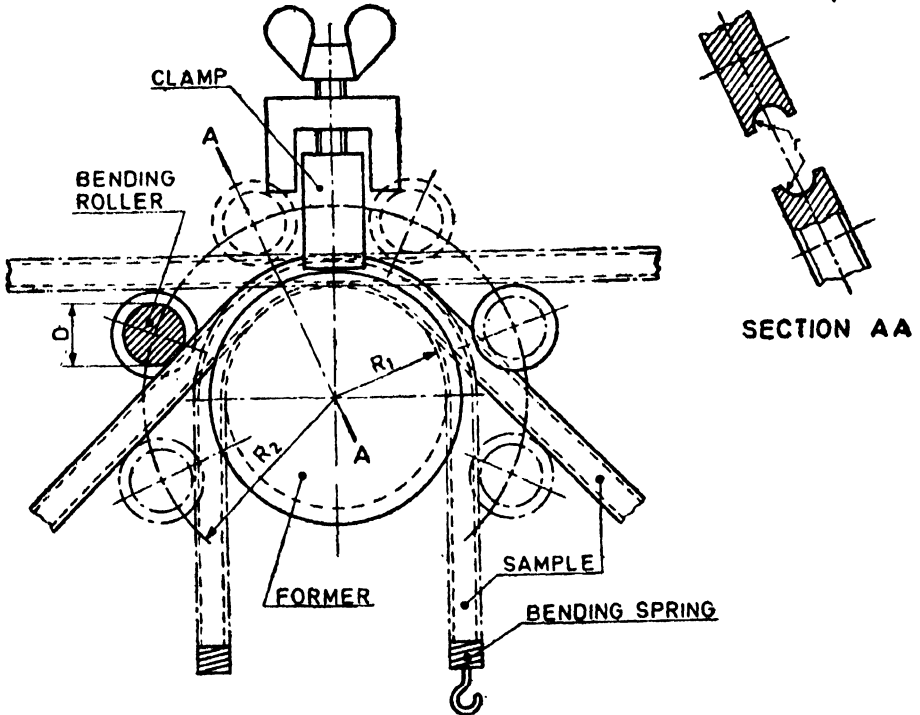
*Specification for conduits for electrical installations: Part 1 General requirements.

9. MECHANICAL PROPERTIES

9.1 The conduits shall have adequate mechanical strength. Compliance is checked by the following tests specified in **9.2** to **9.5**.

9.2 Bending Test

9.2.1 Only conduits of sizes 16, 20 and 25 shall be subjected to the bending test by means of the device shown in Fig. 4.



SIZE OF CONDUIT	RADIUS TO BOTTOM OF GROOVE OF FORMER	RADIUS OF ARC TRACED OUT BY CENTRE OF BENDING ROLLERS	RADIUS OF GROOVE OF FORMER AND OF BENDING ROLLERS	DIAMETER TO BOTTOM OF GROOVE OF BENDING ROLLERS
	R_1	R_2	r	D
	mm	mm	mm	mm
16	48	84	8.1	24
20	60	105	10.1	30
25	75	131.25	12.6	37.5

FIG. 4 BENDING DEVICE

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9.2.2 In case of type test, three samples shall be tested at room temperature and other three samples shall be tested at low temperature of $-5 \pm 2^\circ \text{C}$. As acceptance test, this test shall be carried out at room temperature only. The length of each sample shall be 500 mm.

9.2.3 A bending aid, in the form of a coiled spring of square section metal wire, without burrs and having an overall diameter between 0.7 mm and 1.0 mm less than the specified minimum inside diameter of the conduit, or a bending aid as recommended by the manufacturer, is inserted into each sample before bending.

9.2.4 Before the test at low temperature, the samples, with the bending aid inserted, and the bending device shall be conditioned for at least 2 h in the freezer at the temperature specified.

9.2.5 Each sample is placed in position as shown in Fig. 4 and is lightly held in the groove of the former by means of the clamp. The sample is bent, by moving the bending rollers, round the former through a total angle of approximately 180° so that, when released, the sample has a bend of 90° . In this position, it shall be possible to remove the bending aid without damage to the sample or to the aid.

9.2.6 After the test, the sample shall show no cracks visible to normal or corrected vision without magnification.

9.3 Compression Test

9.3.1 The test shall be carried out in accordance with **9.3** of IS : 9537 (Part 1)-1980*.

9.3.2 The difference between the initial diameter and the diameter of the flattened sample shall then not exceed 25 percent of the initial diameter while the compression force is still applied.

9.4 Impact Test

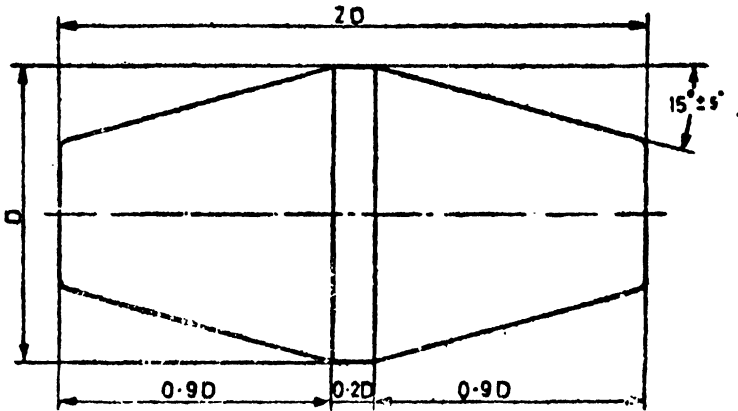
9.4.1 The relevant provisions of **9.4** of IS : 9537 (Part 1)-1980* shall be applicable.

9.5 Collapse Test

9.5.1 Only conduit of sizes 16, 20 and 25 shall be subjected to the collapse test in accordance with **9.5** of IS : 9537 (Part 1)-1980*. The bending device shall be as shown in Fig. 4.

*Specification for conduits for electrical installations: Part 1 General requirements.

9.5.2 The minimum internal diameter shall be checked with the help of appropriate gauge, according to Fig. 5. With the support in a position such that the straight portions of the sample are at 45° to the vertical, it shall be possible to pass this gauge, through the conduit, fixed to support, under its own weight and without any initial speed.



SIZE	DIAMETER, D		
	Light mm	Medium mm	Heavy mm
16	10.9	10.3	9.8
20	13.9	13.5	12.6
25	17.7	17.1	16.5

- Material : Steel hardened and polished, edges slightly rounded.
- Manufacturing tolerance : $+0.05_{\text{mm}}$
0
- Tolerance on axial dimension : ± 0.2 mm
- Admissible wear : 0.01 mm

FIG. 5 GAUGE FOR CHECKING MINIMUM INSIDE DIAMETER OF CONDUITS AFTER BENDING

10. RESISTANCE TO HEAT

10.1 Conduits shall be adequately resistance to heat. Compliance shall be checked by a ball pressure test, which is carried out by means of the apparatus shown in Fig. 6.

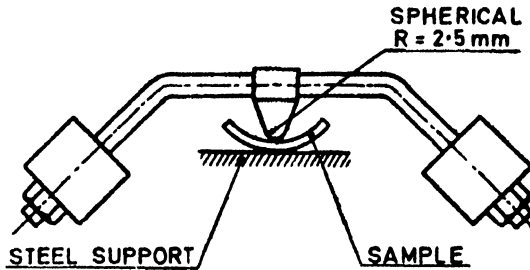


FIG. 6 BALL PRESSURE APPARATUS

10.2 The samples shall be prepared by cutting three pieces of conduit, each about 80 mm long, in half longitudinally. One of each pair of samples so prepared shall be placed in the horizontal position on a steel support, as shown in Fig. 6, the support and the sample being placed in a heating cabinet, the temperature within which is maintained at $60 \pm 2^\circ\text{C}$.

After 2 h, a steel ball of 5 mm diameter shall be pressed against the inner surface of the sample by a force of 20 N.

After 1 h, the ball shall be removed and the sample taken out of the heating cabinet. After 2 h, at room temperature, the diameter of the impression shall be measured; this shall not exceed 2 mm.

11. RESISTANCE TO BURNING

11.1 This test shall be carried out in accordance with 11 of IS : 9537 (Part 1)-1980*.

11.2 The duration of exposure of the sample to the flame shall be as specified below:

<i>Material Thickness</i> mm	<i>Flame Application Time</i>
Up to 2.5	Three times successively, each time for 25 s, with an interval of 5 s between each of the applications
Over 2.5 up to 3	Once for 80 s
Over 3	Once for 125 s

*Specification for conduits for electrical installations: Part 1 General requirements.

12. ELECTRICAL CHARACTERISTICS

12.1 The provisions of 12 of IS : 9537 (Part 1)-1980* shall be applicable.

13. EXTERNAL INFLUENCE

13.1 The relevant provisions of 13 of IS : 9537 (Part 1)-1980* shall be applicable.

14. CLASSIFICATION OF TESTS

14.1 **Type Tests** — The following shall constitute the type tests:

- a) Checking of dimensions (7),
- b) Bending test (9.2),
- c) Compression test (9.3),
- d) Impact test (9.4),
- e) Collapse test (9.5),
- f) Resistance to heat (10),
- g) Resistance to burning (11), and
- h) Electrical characteristics (12).

14.2 **Acceptance Tests** — The following shall constitute the acceptance tests :

- a) Checking of dimensions (7),
- b) Bending test (at room temperature only) (9.2),
- c) Compression test (9.3),
- d) Collapse test (9.5),
- e) Resistance to burning (11), and
- f) Electrical characteristics (12).

14.2.1 A recommended sampling plan for acceptance tests is given in Appendix A.

*Specification for conduits for electrical installations: Part 1 General requirements.

APPENDIX A

(Clause 14.2.1)

RECOMMENDED SAMPLING PLAN AND CRITERIA FOR CONFORMITY FOR ACCEPTANCE OF LOT

A-1. LOT

A-1.1 In any consignment, all the lengths of same nominal size and class manufactured from the same material under essentially similar conditions of production shall be grouped together to constitute a lot.

A-2. SCALE OF SAMPLING

A-2.1 For judging the conformity of a lot to the requirements of the acceptance tests, sampling shall be done for each lot separately. For this purpose, the number of lengths to be selected at random from the lot shall be in accordance with Table 2.

TABLE 2 SCALE OF SAMPLING

LOT SIZE		FOR DIMENSIONAL REQUIREMENTS		OTHER ACCEPTANCE TESTS
		Sample Size	Permissible No. of Defectives	
(1)	(2)	(3)	(4)	
Up to	300	13	0	2
301 ..	500	20	0	3
501 ..	1 000	32	1	4
1 001 ..	3 000	50	2	5
3 001 and above		80	3	7

A-2.2 These lengths shall be selected from the lot at random. In order to ensure the randomness of selection, procedures given in IS : 4905-1968* may be followed.

*Methods for random sampling.

A-3. NUMBER OF TESTS AND CRITERIA FOR ACCEPTANCE

A-3.1 From each of the lengths selected at random according to col 2 of Table 2, suitable lengths of test samples shall be taken. Each of these test samples shall be subjected to the test given in 7. The number of test samples not fulfilling the requirements of this test shall be less than or equal to the corresponding permissible number of defectives given in col 3 of Table 2.

A-3.2 The lots conforming to the dimensional requirements shall be further tested for other acceptance tests. The lot shall be considered to have met the requirements for these tests if none of the samples selected according to col 4 of Table 2 fails.

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(Continued from page 2)

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website : <http://www.bis.org.in>

Central Laboratory:

Plot No. 20/9, Site IV, Sahibabad Industrial Area, SAHIBABAD 201010

Telephone

277 0032

Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

2323 7617

*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Kankurgachi, KOLKATA 700054

2337 8662

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022

260 9285

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113

2254 1984

†Western : Manakalaya, E9, MIDC, Behind Marol Telephone Exchange,
Andheri (East), MUMBAI 400093

2832 9295

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001

560 1348

Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, BANGALORE

839 4955

Commercial-cum-Office Complex, Opp. Dushera Maidan, Arera Colony,
Bittan Market, BHOPAL 462016

242 3452

62-63, Ganga Nagar, Unit VI, BHUBANESHWAR 751001

240 3139

5th Floor, Kovai Towers, 44 Bala Sundaram Road, COIMBATORE 641018

221 0141

SCO 21, Sector 12, Faridabad 121007

229 2175

Savitri Complex, 116 G.T. Road, GHAZIABAD 201001

286 1498

53/5 Ward No. 29, R.G. Barua Road, 5th By-lane, Apurba Sinha Path,
GUWAHATI 781003

245 6508

5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001

2320 1084

Prithavi Raj Road, Opposite Bharat Overseas Bank, C-Scheme, JAIPUR 302001

222 3282

11/418 B, Sarvodaya Nagar, KANPUR 208005

223 3012

Sethi Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road,
LUCKNOW 226001

261 8923

H. No. 15, Sector-3, PARWANOO, Distt. Solan (H.P.) 173220

235 436

Plot No A-20-21, Institutional Area, Sector 62, Goutam Budh Nagar, NOIDA 201307

240 2206

Patliputra Industrial Estate, PATNA 800013

226 2808

Plot Nos. 657-660, Market Yard, Gultkdi, PUNE 411037

2427 4804

"Sahajanand House" 3rd Floor, Bhaktinagar Circle, 80 Feet Road,
RAJKOT 360002

237 8251

T.C. No. 2/275 (1 & 2), Near Food Corporation of India, Kesavadasapuram-Ulloor Road,
Kesavadasapuram, THIRUVANANTHAPURAM 695004

255 7914

1st Floor, Udyog Bhavan, VUDA, Siripuram Junction, VISHAKHAPATNAM-03

271 2833

*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, KOLKATA 700072

2355 3243

†Sales Office (WRO) Plot No. E-9, MIDC, Rd No. 8, Behind Telephone Exchange,
Andheri (East), Mumbai-400 0093

2832 9295