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( Reaffirmed 2001 )

*Indian Standard*

**SPECIFICATION FOR  
FLEXIBLE STEEL CONDUITS FOR  
ELECTRICAL WIRING**

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**INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002**

*Indian Standard*

# SPECIFICATION FOR FLEXIBLE STEEL CONDUITS FOR ELECTRICAL WIRING

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## *Indian Standard*

### **SPECIFICATION FOR FLEXIBLE STEEL CONDUITS FOR ELECTRICAL WIRING**

#### **0. FOREWORD**

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 19 March 1966, after the draft finalized by the Electrical Wiring Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

**0.2** This standard covers the requirements for flexible steel conduits intended for the protection of cables in electrical installation. The adaptors for these conduits and flexible steel conduits of the packed type will be covered in separate specifications.

**0.3** Flexible steel conduit shall not be used as an earth continuity conductor. Where such conduit forms part of an earthed metal conduit system, a separate earth continuity conductor shall be installed with the tubing and connected to it at each end and in the case of long runs at suitable intervals throughout the run.

**0.4** The electro-deposition of steel strip is neither designed nor intended to be other than a protection to the material during manufacture, storage, handling and transport. The onus of protecting conduit in service is on the user, who should adopt methods suited to the particular conditions prevailing.

**0.5** This standard is one of a series of Indian Standards relating to conduits for electrical wiring. Other specifications published so far in the series are:

\*IS : 1653-1964 Rigid steel conduits for electrical wiring (*revised*)

\*IS : 2509-1963 Rigid non-metallic conduits for electrical installations

IS : 2667-1964 Fittings for rigid steel conduits for electrical wiring

IS : 3419-1965 Fittings for rigid non-metallic conduits

**0.6** Assistance has been derived from the following while preparing this standard:

B. S. 731 : Part I : 1952 Flexible steel conduits and adaptors for the protection of electric cable. British Standards Institution.

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\*Since revised.

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**UL 1-1957 Flexible steel conduit. Underwriters' Laboratories Inc, USA.**

**0.7** 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, 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.

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## **1. SCOPE**

**1.1** This standard specifies the requirements for flexible steel conduits intended for the protection of cables in electrical installation.

## **2. TERMINOLOGY**

**2.0** For the purpose of this standard, the following definition shall apply.

**2.1 Flexible Conduit** — A tubing into which a cable or cables may be drawn mainly for the purpose of affording mechanical protection, with sufficient flexibility ( *see 6.2* ) to suit the purpose of its use.

**2.2 Manufactured Length** — A single continuous length of conduit manufactured.

**2.3 Batch** — In any consignment, all the manufactured lengths of conduits of the same type and size, manufactured by the same factory and during the same period, shall be grouped together to constitute a batch. Each batch shall, however, consist of a maximum of 50 manufactured lengths, total length not exceeding 1'000 m of conduit.

## **3. MATERIALS**

**3.1 Strip Steel** — The strip steel used in the manufacture of the flexible conduit shall be of mild steel, bright, cold-rolled and annealed, and equivalent in quality to ordinary grade of IS : 513-1963†. The strip shall be of uniform width and thickness throughout and all surfaces shall be free from scale or rust before the application of the protective coating. The strip shall be electro-galvanized or electro-tinned to a minimum thickness of 0.0025 mm, or otherwise provided with an equally effective protective coating, before being formed into tubing.

## **4. CONSTRUCTION AND WORKMANSHIP**

**4.1** The conduit shall be uniform in diameter throughout its length.

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

†Specification for special qualities of steel sheets. ( *Since revised* ).



4.2 The conduit shall be wound tightly and the strip so overlapped in subsequent helices that no openings are seen in normal position.

4.3 The internal surfaces of the conduit shall be free from burrs and sharp edges which might cause abrasion to the insulation on the cables, and shall be free from obstruction that might interfere with the easy introduction of the maximum size and number of cable (s) for which the conduit is normally intended.

## 5. DIMENSIONS

5.1 The dimensions and turns per metre length of the conduits shall be in accordance with Table 1.

**TABLE 1 REQUIREMENTS FOR FLEXIBLE STEEL CONDUITS**  
(Clauses 5.1, 6.2, 8.3, 8.4, 8.5 and 8.6)

NOMINAL INTERNAL DIAMETER	INTERNAL DIAMETER	TOLERANCE ON INTERNAL DIAMETER	EXTERNAL DIAMETER IN NORMAL POSITION, Max	TURNS/ METRE IN NORMAL POSITION, Min	*BEND- ING DIA- METRE, Min	†LINEAR BREAK- ING LOAD, Min	BEND- ING FRAC- TURE LOAD, Min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mm	mm	mm	mm		mm	kgf	kgf
6.5	6.5		9.0	315	55	35	11.5
10	10.0	+0.5	13.0	235	63	60	18.0
16	16.0	-0.0	20.0	200	90	110	35
25	25.0		31.0	160	150	210	45
40	40.0		46.0	100	225	330	70
63	63.0	+1.0	70.0	100	350	430	125
100	100.0	-0.0	108.0	100	450	500	190

\*Inner diameter of bend without straining conduit.

†Linear breaking load — load at which coils pull off adjacent beading.

5.2 The conduits shall be supplied in such lengths as may be specified by the purchaser.

## 6. MECHANICAL PROPERTIES

6.1 Tensile Strength — Flexible conduits shall pass the test specified in 8.4.

6.2 Flexibility — The flexibility of conduit shall be such that a specimen is capable of being bent, without opening at any point completely around a former with a diameter specified in col 6 of Table 1.

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**6.3 Crushing Strength** — The conduit shall be capable of withstanding the test specified in 8.7.

## **7. MARKING**

**7.1 Flexible steel conduits** shall be suitably marked or labelled with the following:

- a) Name or trade-mark of the manufacturer,
- b) Nominal size of the conduit,
- c) Length of the conduit, and
- d) Country of manufacture.

**7.1.1** The conduits may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## **8. TESTS**

**8.1 General** — The test shall be made at the prevailing ambient temperature unless specified otherwise in the relevant clauses.

### **8.2 Samples and Criteria for Conformity**

**8.2.1** Each test shall be made on three samples, the samples being taken from three different manufactured lengths selected from a batch for the purposes of carrying out the tests specified in 8.3 to 8.7.

**8.2.2** No failure shall be permitted in any of the tests specified in 8.3 to 8.7 for proving conformity with the standard. Should any of the test samples prove unsatisfactory, a further set of samples twice in number shall be subjected to the tests specified in 8.2 to 8.7. Should the second set of samples also prove unsatisfactory, the whole batch from which the samples were taken shall be rejected.

**8.3 Test for Dimensions** — The internal diameter of each sample length of conduit shall be checked by means of suitable gauges for conformity with the values specified in Table 1.

**8.4 Linear Breaking Test** — A piece of conduit 300 mm long shall be placed in the jaws of a tensile testing machine, 100 mm of each end being held by the jaws, leaving 100 mm long between the jaws. A mandrel of the proper diameter and 100 mm long shall be inserted in each end of the conduit to prevent distortion. The conduit shall show no indication of yielding under a load less than that specified in Table 1 maintained for a period of three minutes.

**8.5 Test for Flexibility** — The specimen conduit of sufficient length shall be bent complete turn around a cylindrical former having a diameter specified in Table 1 and returned to straight position without damage, with a tension just sufficient to cause the conduit conform closely to the curved surface of the former. Checking shall be done to ensure that:

- a) the outside diameter shows no crack or flaws visible to the naked eye, and
- b) the conduit returns to the normal position without any damage to its outer or inner diameter.

**8.5.1** While the conduit is around the former, it shall be examined to see if the edges of the adjacent convolutions have separated sufficiently to expose the interior of the conduit.

**8.6 Bend Fracture Test** — A piece of conduit shall be bent to a U shape between the flat heads of a compression testing machine. The conduit shall be held in the machine in such a position that as the load is applied the radius of the bend shall be decreased until the yield point is reached. The breaking load thus found shall be not less than that specified in Table 1.

**8.7 Crushing Test** — A 50-mm length of conduit shall be compressed between the flat steel plates and a load of 40 kgf per linear centimetre uniformly distributed shall be applied across the diameter when no permanent distortion shall be produced.

**8.7.1** The ends of this specimen shall be perpendicular to axis for which the end of the helical strip has to be ground.

**INTERNATIONAL SYSTEM OF UNITS ( SI UNITS )**

**Base Units**

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

**Supplementary Units**

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

**Derived Units**

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N = 1 kg,m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s(s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>



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