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SPECIFICATION FOR ADAPTORS FOR FLEXIBLE STEEL CONDUITS

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

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Indian Standard

SPECIFICATION FOR ADAPTORS FOR FLEXIBLE STEEL CONDUITS

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Indian Standard

SPECIFICATION FOR ADAPTORS FOR FLEXIBLE STEEL CONDUITS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 10 May 1968, after the draft finalized by the Electrical Wiring Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 These adaptors are used for connecting flexible metallic conduits to rigid conduits and its fittings. The dimensions of the adaptors, such as nominal internal diameter and turns per metre are to correspond to those of the flexible steel conduits and hence IS : 3480-1966* is a necessary adjunct to this standard.

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 This standard is one of a series of Indian Standard specifications 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
IS : 3480-1966 Flexible steel conduits for electrical wiring
IS : 3837-1966 Accessories for rigid steel conduits for electrical wiring.

0.5 While preparing this standard, assistance has been derived from B.S. 731 : Part I : 1952 'Flexible steel conduits and adaptors for the protection of electric cable' issued by the British Standards Institution.

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, 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.

*Specification for flexible steel conduits for electrical conduits.

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

1. SCOPE

1.1 This standard specifies the requirements for adaptors of clamp and solid types for flexible steel conduits intended for the protection of cables in electrical installations.

2. TERMINOLOGY

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

2.1 **Adaptors** — A fitting used for connecting a flexible metallic conduit to a rigid conduit or its fittings.

3. MATERIALS

3.1 Adaptors shall be made of malleable iron complying with either IS : 2107-1962* or IS : 2108-1962†.

3.2 The adaptors shall be adequately protected against rust and corrosion both inside and outside excluding machined surfaces and screw threads, with a medium or heavy protective coating which shall be smooth, continuous, tough and firmly adherent. Examples of finishes which may fall within the category of medium protection are:

a) stoved enamel,

b) air drying paint, and

c) electrolytic deposits.

Examples of finishes which may fall within the category of heavy protection are:

a) hot-dip galvanized coating, and

b) sherardising.

4. CONSTRUCTION

4.1 **Clamp Type** — This type shall have either an internal box turns or internally projecting fins in order to engage and hold secure the flexible steel conduit. It shall be fitted with an external earthing lug with a hole to accommodate not less than 4 mm² earthing wire. The lug shall be integral with the solid portion of the adaptor and shall be tapped and fitted with a headed clamping screw. Alternatively, a headed earthing screw and washer shall be fitted to the solid portion. A typical example is shown in Fig. 1.

*Specification for whiteheart malleable iron castings.

†Specification for blackheart malleable iron castings.

4.2 Solid Type — This type shall have either an internal box turns or internally projecting fins and shall be fitted either with an external earthing lug as for clamp type in **4.1** or with a headed earthing screw and washer. A typical example is shown in Fig. 2.

4.3 Other Types — The dimensions shall be in accordance with those specified in Table 1. They shall be made either with or without provision for earth wire.

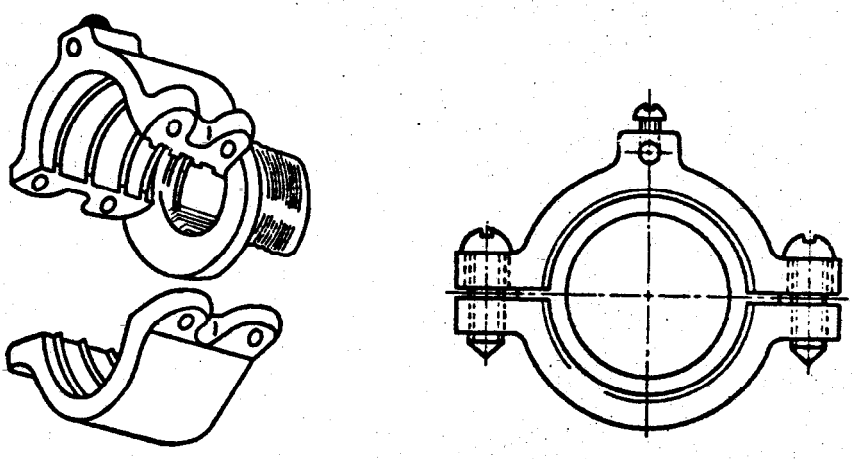

FIG. 1 A TYPICAL EXAMPLE OF A CLAMP TYPE ADAPTOR WITH EXTERNAL EARTHING SCREW (THREADED TYPE)

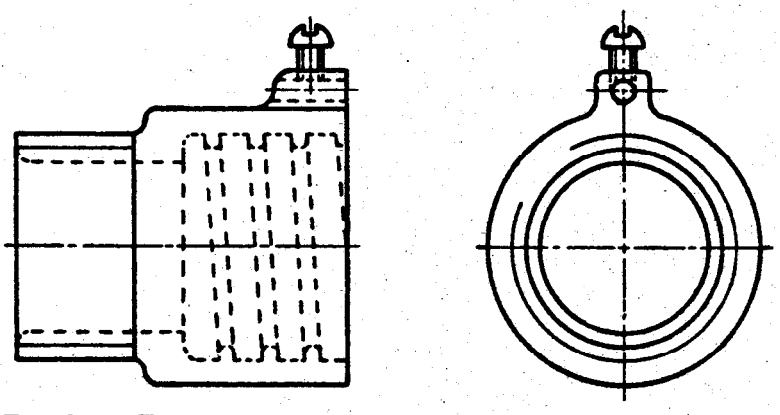

FIG. 2 A TYPICAL EXAMPLE OF A SOLID TYPE ADAPTOR WITH EXTERNAL EARTHING SCREW (THREADED TYPE)

TABLE 1 REQUIREMENTS FOR ADAPTORS

(*Clause* 4.3)

All dimensions in millimetres.

Nominal Internal Diameter of Flexible Conduit	Internal Diameter of Flexible Conduit	Tolerance on Internal Diameter	External Diameter in Normal Position *Max*	Turns per Metre in Normal Position *Min*	Depth of Engagement Between Conduit and Adaptor
(1)	(2)	(3)	(4)	(5)	(6)
6·5	6·5	+0·5 −0·0	9·0	315	10
10	10·0		13·0	235	15
16	16·0		20·0	200	15
25	25·0		31·0	160	25
40	40·0	+1·0 −0·0	46·0	100	30
63	63·0		70·0	100	35
100	100·0		108·0	100	45

4.4 Box threads or fins shall have turns per metre as specified in col 5 of Table 1.

5. WORKMANSHIP

5.1 Adaptors shall be free from burrs or sharp edges and the edges of the turns or fins shall be well-formed.

6. ELECTRICAL RESISTANCE

6.1 The adaptors or other anchorings shall be electrically continuous.

7. DEPTH OF ENGAGEMENT WITH FLEXIBLE CONDUITS

7.1 Depth of engagement of the flexible conduits in the adaptors or anchorings shall be not less than that shown in Table 1.

8. ENGAGEMENT WITH RIGID CONDUIT OF FITTINGS

8.1 The specification and length of threads shall be in accordance with IS : 1653-1964* or IS : 2667-1964†.

9. MARKING

9.1 Each adaptor shall be clearly marked with the following:

a) Name or trade-mark of the manufacturer, and

b) Country of manufacture.

*Specification for rigid steel conduits for electrical wiring (*revised*) (Since revised).

†Specification for fittings for rigid steel conduits for electrical wiring (Since revised).

9.1.1 The adaptor 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 they 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.

10. TESTS

10.1 General — The tests shall be made at prevalent ambient temperature unless specified otherwise in the relevant clauses.

10.2 Type Tests — The following shall be carried out as type tests on selected samples of adaptors drawn, preferably at random, from a regular production lot:

a) Visual examination (*see* **4** and **9**),

b) Dimensional check, and

c) Protective coating.

10.2.1 Number of samples shall be 3, all of which shall be subjected to the tests specified in **10.2** in the order specified therein.

10.2.1.1 *Criteria for approval* — All samples subjected to the type tests shall pass all the tests for proving conformity with the requirements of this test. If one or more failures occur, the testing authority at its discretion, may call for twice the original number of samples and subject them to all tests or to those in which failure occurred. No single failure shall be permitted in the repeat test(s).

10.2.2 *Acceptance Tests* — The following shall constitute acceptance tests:

a) Visual examination, and

b) Dimensional check.

10.2.2.1 A recommended sampling procedure for acceptance tests is specified in Appendix A.

10.3 Test for Visual Examination — Each adaptor shall be examined visually for conformity with **5** and **9**.

10.4 Dimensional Check — Samples selected shall be tested for correctness with the specified dimensions. In addition, the adaptors shall be

tested for accuracy of screw threads by means of suitable gauges specified in IS : 1653-1964* or IS : 2667-1964†.

10.5 Test for Protection Against Corrosion

10.5.1 *Tesr for Adaptors with Medium Protection*

10.5.1.1 The sample to be tested is cleaned with a piece of cloth soaked in benzene and then dried. It is then immersed in a solution of 0·75 percent of potassium ferricyanide [$K_3Fe(CN)_6$] and 0·25 percent ammonium persulphate [$(NH_4)_2S_2O_8$] in water; a quantity of 0·1 percent of a suitable wetting agent (sodium salt of an alkylnaphthaline sulphonic acid) is added to the solution.

10.5.1.2 Samples with medium protection are cleaned as delivered and then totally immersed in the solution.

10.5.1.3 The solution and the samples are maintained at a temperature of 20° ± 1°C. Each sample is tested separately, a fresh solution being used each time. After immersion for 5 minutes, the samples are removed from the solution and left to dry in air at ambient temperature.

10.5.1.4 After the test, the samples shall show not more than two blue coloured spots on any centimetre square of the surface and no spot shall have a dimension larger than 1·5 mm.

10.5.1.5 A yellowish film removable by rubbing, traces of rust on sharp edges and screw threads are ignored.

10.5.2 *Test for Adaptors with Heavy Protection*

10.5.2.1 The sample shall be cleaned by washing with solvent naphtha, trichloroethylene or any other suitable organic solvent, then with alcohol and finally dried thoroughly.

10.5.2.2 The cleaned sample is then immersed in a solution of copper sulphate in distilled water having a specific gravity of 1·186 at 18°C. The solution and the samples are maintained at a temperature of 18° ± 2°C.

10.5.2.3 The solution is made by dissolving about 36 g of copper sulphate ($CuSO_4$, $5H_2O$) in 100 ml of distilled water. The water may be heated to aid solution, but if heated, the solution should be cooled before neutralizing. The solution is neutralized by shaking with excess of copper carbonate or copper hydroxide (about one gram/litre of solution) and allowed to stand for at least 24 hours before filtering or decanting the solution. The specific gravity is then checked and it may be adjusted by adding distilled water or solution of higher specific gravity. The volume of the solution in millilitres shall be numerically at least 8 times the approximate surface area in square centimetres of the immersed portion of the samples.

*Specification for rigid steel conduits for electrical wiring (*revised*) (Since revised).

†Specification for fittings for rigid steel conduits for electrical wiring (Since revised).

10.5.2.4 A glass container or a container of any other material that does not react with the solution may be used for the test. Its internal dimensions shall be such as to allow a clearance of at least 25 mm between the container and the immersed sample.

10.5.2.5 Each sample is totally immersed four times in succession in the same solution, each time for one minute, fresh solution being used for each sample. During the test neither the sample nor the solution shall be agitated. After each immersion the sample is immediately rinsed in running water with a fibre brush to remove any black deposit, taking care that all the holes and pockets are removed. The sample is then wiped dry with a piece of clean soft cloth and, except after the final dip, returned immediately into the solution.

10.5.2.6 After the test the sample shall not show any red deposit of copper upon the base metal. A false red deposit of copper may appear sometimes on a sample. Such a deposit may be tested by immersing in a solution of dilute hydrochloric acid (1 : 10) for 15 seconds followed by immediate rinsing in clean running water with vigorous scrubbing or tested for adherence by peeling or light rubbing. If the copper has been removed and zinc appears underneath, it is a false end point and the sample does not fail. Areas less than 1 mm from portions machined after the application of protective coating are exempt from the test.

APPENDIX A

(*Clause* 10.2.2.1)

SAMPLING PROCEDURE FOR ACCEPTANCE TEST

A-1. LOT

A-1.1 In any consignment all the adaptors of the same type and size, manufactured from the same raw materials under essentially similar conditions of production shall be grouped together to constitute a lot. Each lot shall, however, consist of a maximum of thousand adaptors.

A-1.1.1 For ascertaining the conformity to the requirements of this standard, samples of adaptors shall be selected and tested separately for each lot.

A-1.2 The number of adaptors to be selected at random from a lot shall depend upon the size of the lot and shall be in accordance with col 1 to 3 of Table 2.

TABLE 2 SAMPLE SIZE AND CRITERIA FOR CONFORMITY FOR VISUAL EXAMINATION AND DIMENSIONAL CHECK

(*Clause* A-1.2)

Lot Size	Sample	Sample Size	Cumulative Sample Size	Acceptance Number	Rejection Number
(1)	(2)	(3)	(4)	(5)	(6)
Up to 100	First	5	5	0	2
	Second	5	10	1	2
101 to 150	First	8	8	0	2
	Second	8	16	1	2
151 to 300	First	13	13	0	2
	Second	13	26	1	2
301 to 500	First	20	20	0	3
	Second	20	40	3	4
501 to 1 000	First	32	32	1	4
	Second	32	64	4	5

A-2. CRITERION FOR CONFORMITY

A-2.1 The adaptors selected according to Table 2 shall be subjected to the tests specified in **10.2.2.** Any adaptors failing in one or more of these characteristics shall be considered as a defective. If in the first sample the number of defective adaptors is less than or equal to the corresponding acceptance number given in col 5 of Table 2, the lot shall be considered as conforming to this standard. If the number of defectives is greater than or equal to the rejection number given in col 6 of Table 2, the lot shall be deemed as not meeting these requirements. If the number of defectives is greater than the acceptance number, but less than the rejection number, a second sample of the size equivalent to that of the first shall be taken to determine the conformity or otherwise of the lot. The number of defectives found in the first and the second samples shall be combined and if the combined number of defectives is less than or equal to the corresponding acceptance number, the lot shall be declared as conforming to these requirements otherwise not.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
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

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 $kg.m/s^2$
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^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
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^2

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