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First edition
1996-11

Conduit systems for electrical installations – Part 1: General requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONDUIT SYSTEMS FOR ELECTRICAL INSTALLATIONS –**Part 1: General requirements**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
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- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 1386-1 has been prepared by subcommittee 23A: Cable management systems, of IEC technical committee 23: Electrical accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
23A/260/FDIS	23A/274/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This part 1 is to be used in conjunction with the appropriate part 2, which contains clauses to supplement or modify the corresponding clauses in part 1, to provide the relevant particular requirements for each type of product. A conduit system which conforms to this standard is deemed safe for use.

In this publication, the following print types are used:

- Requirements proper: in roman type.
- *Test specifications: in italic type.*
- Explanatory matter: in smaller roman type.

Annex A is an integral part of this standard.

CONDUIT SYSTEMS FOR ELECTRICAL INSTALLATIONS –

Part 1: General requirements

1 Scope

This part of IEC 1386 specifies requirements and tests for conduit systems, including conduits and conduit fittings, for the protection and management of insulated conductors and/or cables in electrical installations or in communication systems up to 1000 V a.c. and/or 1500 V d.c. This standard applies to metallic, non-metallic and composite conduit systems, including threaded and non-threaded entries which terminate the system. This standard does not apply to enclosures and connecting boxes which come within the scope of IEC 670.

NOTES

- 1 Certain conduit systems may also be suitable for use in hazardous atmospheres. Regard should then be taken of the extra requirements necessary for equipment to be installed in such conditions.
- 2 Earthing conductors may or may not be insulated.

2 Normative references

The following normative documents contain provisions which through reference in this text, constitute provisions of this part of IEC 1386. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 1386 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 417: 1973, *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets, as well as all of the supplements A to L*

IEC 423: 1993, *Conduits for electrical purposes – Outside diameters of conduits for electrical installations and threads for conduits and fittings*

IEC 529: 1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 670: 1989, *General requirements for enclosures for accessories for household and similar fixed electrical installations*

IEC 695-2-1/1:1991, *Fire hazard testing – Part 2: Test methods – Section 1/Sheet 1: Glow-wire end-product test and guidance*

IEC 695-2-4/1: 1991, *Fire hazard testing – Part 2: Test methods – Section 4/Sheet 1: 1 kW nominal pre-mixed test flame and guidance*

3 Definitions

For the purposes of this International Standard, the following definitions apply:

3.1 **conduit system:** Closed wiring system consisting of conduits and conduit fittings for the protection and management of insulated conductors and/or cables in electrical or communication installations, allowing them to be drawn in and/or replaced, but not to be inserted laterally.

3.2 **conduit:** Part of a closed wiring system of general circular cross-section for insulated conductors and/or cables in electrical or communication installations, allowing them to be drawn in and/or replaced.

3.3 **conduit fitting:** Device designed to join or terminate one or more components of a conduit system, or for them to change direction.

3.4 **metallic conduit and/or conduit fitting:** Conduit or conduit fitting which consists of metal only.

3.5 **non-metallic conduit and/or conduit fitting:** Conduit or conduit fitting which consists uniquely of non-metallic material and which has no metallic components whatsoever.

3.6 **composite conduit and/or conduit fitting:** Conduit or conduit fitting comprising both metallic and non-metallic materials.

3.7 **non-flame propagating conduit and/or conduit fitting:** Conduit or conduit fitting which is liable to catch fire as a result of an applied flame, but in which the flame does not propagate, and which extinguishes itself within a limited time after the flame is removed.

3.8 **plain conduit:** Conduit in which the profile is even in the longitudinal section. (see note to 3.9).

3.9 **corrugated conduit:** Conduit in which the profile is corrugated in the longitudinal section.

NOTE – Both annular and helical corrugated conduits are permissible, and a combination of both corrugated and plain conduit is possible.

3.10 **rigid conduit:** Conduit which cannot be bent, or which can only be bent with the help of a mechanical aid, with or without special treatment.

3.11 **pliable conduit:** Conduit which can be bent by hand with reasonable force, and which is not intended for frequent flexing.

3.12 **flexible conduit:** Conduit which can be bent by hand with reasonable small force, and which is intended to flex frequently throughout its life.

3.13 **self-recovering conduit:** Pliable conduit which deforms when a transverse force is applied for a short time and which, after removal of this force, returns close to its original shape within a further short time.

3.14 **material thickness of a plain conduit:** Average difference between the outside and inside diameter, divided by two.

3.15 **material thickness of a corrugated conduit:** Average thickness of material measured at any point along the shape of one corrugation.

3.16 **material thickness of a combined plain and corrugated conduit:** Sum of the plain conduit material thickness and the corrugated material thickness.

3.17 **threadable conduit and conduit fitting:** Conduit and conduit fittings which carry a thread for connection; or in or on which a thread can be formed.

3.18 **non-threadable conduit and conduit fitting:** Conduit and conduit fittings which are suitable for connection only by means other than threads.

3.19 **conduit joint:** Interface between two or more components of a conduit system, or between a conduit system and other equipment.

3.20 **external influence:** Factors which may affect the conduit system.

NOTE – Examples of such factors are a presence of water, oil or building materials, low and high temperatures, and corrosive or polluting substances.

3.21 **hot dip galvanising:** Coating of zinc, and zinc-iron alloy layers, obtained by dipping prepared iron or steel articles in molten zinc.

Note – Under some circumstances, the whole coating may consist of zinc-alloy layers.

3.22 **sherardizing:** Diffusion process in which articles are heated in close contact with zinc dust and inert operating media.

NOTE – The process is normally carried out in a slowly rotating closed container at a temperature in the region of 385 °C. The corrosion resistance is proportional to the coating thickness, which can be controlled.

4 General requirements

4.1 Conduit and conduit fittings within the scope of this standard shall be so designed and constructed that in normal use their performance is reliable and without danger to the user or surroundings.

When assembled in accordance with manufacturer's instructions as part of a conduit system, conduits and conduit fittings shall provide mechanical and, where required, electrical protection of the insulated conductors and cables contained therein.

4.2 The protective properties of the joint between the conduit and conduit fitting shall not be less than that declared for the conduit system.

4.3 Conduit and conduit fittings shall withstand the stresses likely to occur during transport, storage, recommended installation practice and application.

4.4 In general, compliance is checked by carrying out all the tests specified.

5 General conditions for tests

5.1 Tests in accordance with this standard are type tests.

5.2 Unless otherwise specified, the tests shall be carried out at an ambient temperature of (23 ± 2) °C.

5.3 Unless otherwise specified, each test shall be made on three new samples.

NOTE – Certain tests, for instance the checking of dimensions, do not affect a change in the property of the samples; therefore these samples are considered as new samples and can be used for further tests.

5.4 Samples of non-metallic and composite conduits and conduit fittings shall be conditioned for at least 240 h, at a temperature of (23 ± 2) °C and a relative humidity between 40 % and 60 %. All tests shall be carried out immediately after general conditioning.

5.5 Unless otherwise specified, the samples for each test shall be in a clean and new condition, with all parts in place and mounted as in normal use. After checking dimensions in accordance with clause 8, and unless otherwise specified in the relevant test, the conduit fittings shall be assembled with adequate lengths of conduit of the type for which they are intended. Due regard shall be taken of the manufacturer's instructions, especially where force is required in the assembly of the joint.

NOTE – Where similarities are claimed, the selection of representative fittings for test purposes can be agreed between the manufacturer, or responsible vendor, and the testing station.

5.6 Where the conduit entries are part of the detachable or loose type conduit fitting, the detachable conduit fitting shall be capable of being assembled again, after the test, according to the manufacturer's instructions without loss of the declared properties according to clause 6.

5.7 Unless otherwise specified, three samples are submitted to the tests, and the requirements are satisfied if the tests are met.

If only one of the samples does not satisfy a test, due to an assembly or a manufacturing defect, that test and any preceding one which may have influenced the result of the test shall be repeated, and also the tests which follow shall be made in the required sequence on another full set of samples, all of which shall comply with the requirements.

NOTE – If the additional set of samples is not submitted at the same time, a failure of one sample will entail a rejection. The applicant, when submitting the first set of samples, may also submit an additional set of samples which may be used, should one sample fail. The testing station will then, without further request, test the additional set of samples and will reject them only if a further failure occurs.

5.8 When toxic or hazardous processes are used, due regard shall be taken of the safety of the persons within the test area.

5.9 Conduit systems which are used as an integral part of other equipment shall also be tested in accordance with the relevant standard for that equipment.

6 Classification

NOTE – Annex A shows the classification coding format for declared properties of the conduit system, which may be incorporated in the manufacturer's literature.

6.1 According to mechanical properties

6.1.1 Resistance to compression

- 1 Very light
- 2 Light
- 3 Medium
- 4 Heavy
- 5 Very heavy

6.1.2 Resistance to impact

- 1 Very light
- 2 Light
- 3 Medium
- 4 Heavy
- 5 Very heavy

6.1.3 Resistance to bending

- 1 Rigid
- 2 Pliable
- 3 Pliable/Self-recovering
- 4 Flexible

6.1.4 Tensile strength

- 1 Very light
- 2 Light
- 3 Medium
- 4 Heavy
- 5 Very heavy

6.1.5 Suspended load capacity

- 1 Very light
- 2 Light
- 3 Medium
- 4 Heavy
- 5 Very heavy

6.2 According to temperature

Table 1 – Lower temperature range

Classification (1st numeral)	Transport, permanent application and installation – Temperature not less than: °C
1X	+ 5
2X	– 5
3X	– 15
4X	– 25
5X	– 45

Table 2 – Upper temperature range

Classification (2nd numeral)	Permanent application and installation – Temperature not more than: °C
X1	60
X2	90
X3	105
X4	120
X5	150
X6	250
X7	400

6.3 *According to electrical characteristics*

6.3.1 With electrical continuity characteristics

6.3.2 With electrical insulating characteristics

6.4 *According to resistance to external influences*

6.4.1 Protection against ingress of solid objects: protection in accordance with IEC 529 to a minimum of IP3X

6.4.2 Protection against ingress of water: protection in accordance with IEC 529 to a minimum of IPX0

6.4.3 Resistance against corrosion

6.4.3.1 Without protection

6.4.3.2 With protection as detailed in table 10

6.5 *According to resistance to flame propagation*

6.5.1 Non-flame propagating

6.5.2 Flame propagating

6.5.3 Other fire effects: under consideration

7 **Marking and documentation**

7.1 The conduit shall be marked by a trade mark or a name identifying the manufacturer or responsible vendor.

The conduit shall also be marked in such a way that it can be identified in the manufacturer's, or responsible vendor's, literature.

7.1.1 The conduit may also be marked with the classification code, which shall be in accordance with annex A, and which shall include at least the first four digits.

7.1.2 The manufacturer shall be responsible for indicating the compatibility of parts within a conduit system.