Insulated Boxes for Energy Meters

IEEMA METER DIVISION -TECHNICAL COMMITTEE

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FOREWORD

This draft for discussion is with reference to IEEMA Meter division Technical Committee's proposal to the Bureau of Indian Standards (BIS) regarding the need for a separate dedicated standard for energy meter boxes, that shall meet the requirements of various types of energy meters complying with IS:13779, IS:14697 and IS:16444 (latest revisions). It was discussed that the current static and smart energy meters are double-insulated and have communication and meter display features over the meter BOX. Hence, the necessary changes were added.

a) Communication port features defined (Optical and RJ11/RS232 type etc.)
b) Push button feature defined
c) High Voltage and Insulation Resistance tests added for human safety & protection.
d) Meter Boxes requirements and its drawing is defined as fig 1

The boxes specified in the standard are intended to contain energy meters, providing after assembling an appropriate degree of protection of the accessory and the cables and/orconductors against external influences, and a defined degree of protection (IP54) against contact with enclosed live parts for any direction.

While formulation of this draft standard, considerable assistance has been derived from IS: 13779, IS: 14697, IS: 16444(latest revisions) and IS/IEC: 14772:2020 (test procedure references for tests related to mechanical, Insulation, aging and safety related tests mentioned in the draft)

Insulated Boxes for Energy meters

Draft for Discussion

1 SCOPE

1.1 This standard applies to Energy meter Insulated single chamber Boxes with a rated voltage not exceeding 440 V a.c. intended for household or similar fixed electrical installations, either indoors or outdoors. This standard applies to Boxes for all types of energy meters manufactured and installed inside the insulated Boxes. However for CT and other type of accessory mounting in Enclosures with additional chambers refer IS:14772.

1.2 Boxes complying with this standardare suitable for the Operating temperature range (0 °C to + 55 °C) for Indoor Meter and (– 10 °C to + 55 °C) for Outdoor Meter.

1.3 During the installation, the temperature may be outside the above temperature range according to the classification of the Boxes.

1.4 This standard is intended to apply to boxes for energy meters only and don't serve as a reference document for other Indian Standards.

Box, which is an integral part of an energy meters and provides protection for that energy meters against external influences (for example mechanical impact, ingress of solid objects or water, for outdoor installations) is covered by the relevant standard for energy meter box.

2. **Reference Standards**: Mentioned in FOREWARD

3. Definitions

For the purposes of this standard, the following terms and definitions shall apply.

3.1 Boxes — The combination of parts, such as bases and covers, cover plates (If required), Glands/grommets, push buttons, communication check feature, hinges, and subsequent sealing arrangements, etc., provides, after assembly and installation, an appropriate protection against external influences in normal use. It is intended for mounting on a wall surface.

3.2 Push Button (optional) — Part of a boxes cover to operate the energy meter display parameters/other operations.

3.3 Optical port/RS232 port provision (optional) — Part of an boxes cover to provide the data downloading with sealing provision (optional as specified by the purchaser). The RS232 port provision is also optional for data downloading.

3.4 Cable Gland/Grommet — Device designed to permit the entry of a cable, flexible cable or insulated conductor into a box, and which provides sealing and retention and eventually may also provide other functions such as bonding, insulation, cable guarding, strain relief or a combination of these.

3.5 Hinge/Push fit arrangement — For smart energy meter boxes hinge type arrangement is preferred. However, the box Base and cover shall be made with hinge or suitable self-locking arrangements.

3.6 Meter Fixing - 2/3 point fixing arrangement provided in the base of the meter box to make the meter straight and aligned vertically

3.7 Clearances - Minimum 10 mm clearances shall be there between meter and inner surface of meter box (sides and top) after fixing the meters.

3.8 Latch (optional) - Metallic/ Insulated component which is used to join Box base and cover with a hole for sealing the meters base and cover, suitable alternate option can also be used for the same purpose.

3.9 Data Downloading - Process of downloading the data from a meter fixed inside the box through port mentioned in definitions 3.3, The Box Cover has a dedicated place over the surface.

4 GENERAL REQUIREMENTS

Boxes shall be designed and constructed so that, in normal use, their performance is reliable and safety is achieved through Electrical, Mechanical and IP54 tests for outdoor applications. Boxes also provide a resistance to the physical access after sealing for energy meters.

Compliance shall be checked by meeting all the relevant requirements and tests specified in the tables of routine, acceptance and type tests mentioned in this standard.

5 GENERAL NOTES ON TESTS

5.1 Tests According to this Standard are Type Tests

5.1.1 Unless otherwise specified, boxes are tested as delivered.

5.1.2 Accessories complying with other standards are not tested again.

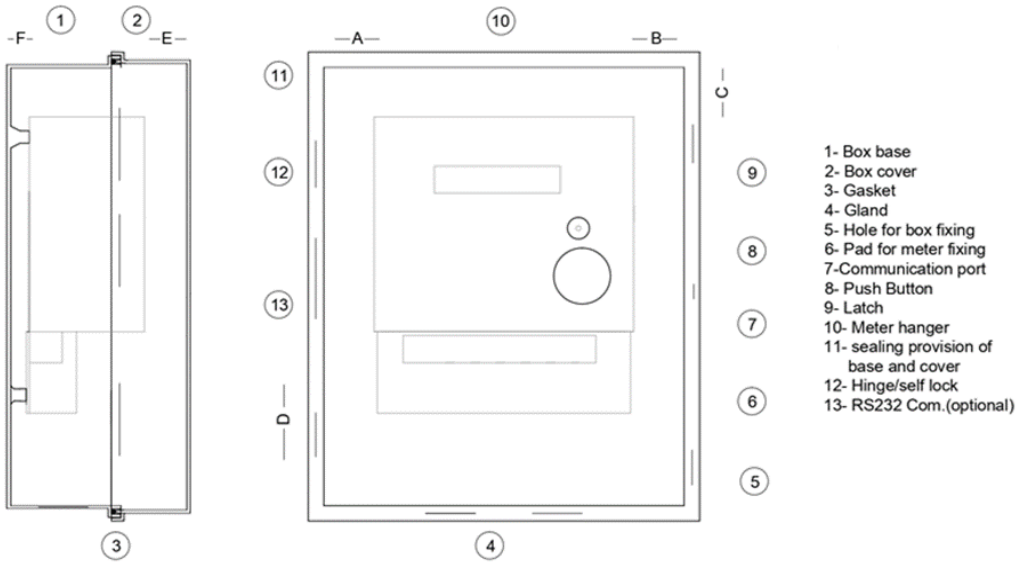
5.1.3 Unless otherwise specified, the tests are carried out in the order of the clauses, at an ambient temperature between +15°C and +35°C on one set of three specimens.

5.1.4 In case of doubt, the tests are made at an ambient temperature of + (27 ± 5) °C on one set of three specimens.

5.2 The one set of specimens is submitted to all the relevant tests and the requirements are satisfied if all the tests are met.

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

NOTE — when submitting the first set of specimens, the applicant can also submit the additional set of three specimens which may be necessary, should one set specimen fail. The testing station will then, without further request, test the additional set of specimens and will only reject if a further failure occurs. If the additional set of specimens is not submitted at the same time, the failure of one specimen will entail rejection.



Note-
1- Hinge type box is preffered for smart meter . For other type meter may require self lock / Hinge type box.
2- Position of Gland , hinge, latch, fixing holes, push button, communication port etc may change for manufacturer to manufacturer.

3. Communication Port and Push Button are optional
4. Points A, B, C, D denotes the clearance

Fig1: Energy Meter Box

6 RATINGS

6.1 The preferred values of the rated voltage of the integrated or incorporated connecting devices are 250 V and 400 V ac for all type of energy meter Boxes.

6.2 The incoming and outgoing diameters of the Grommet or gland to accommodate insulated cable for single phase or poly-phase connection is provided as per the standard rated connecting capacities, that are 0.5 mm2 , 0.75 mm2 , 1 mm2 , 1.5 mm2 , 2.5 mm2 , 4 mm2 , 6 mm2 , 10 mm2 , 16 mm2 , 25 mm2 , 35 mm2.

7 CLASSIFICATION

Boxes are classified according to Table 1 (All classification references used in this document directly refer to Table 1).

Table 1 Classification of Boxes

Classification Criteria			
7.1	**The Nature of their Material**	Insulating engineering plastic or polycarbonate or any other insulating material like SMC	Suitable for all type of static and smart energy meters
7.2	**Types of installation**	wall mounting	Suitable for all type of static and smart energy meters

8 MARKING

8.1 The energy meter Boxes shall be marked with, the name/trademark or identification mark of the manufacturer.

In addition, boxes shall also be marked with the IP54 requirements or higher.

8.2 The marking on the Boxes shall be durable and easily legible.

Compliance with **8.1** and **8.2** is checked by inspection and by the following test.

The test is made by rubbing the marking by hand for 15s with a piece of cloth soaked with water and again for 15s with a piece of cloth soaked with petroleum spirit.

NOTE — Marking made by moulding, pressing, Laser or engraving is considered durable through visual examination and is therefore not subjected to this test.

It is recommended that the petroleum spirit used consist of a solvent hexane with an aromatic content of maximum 0.1 percent by volume, a kauributanol value of approximately 29, an initialboiling-point of approximately + 65°C, a dry point of approximately + 69°C and a density of approximately 0.68 g/cm3 . After the test, the marking shall still be legible.

9 Insulation properties

9.1 ac High Voltage (HV) Test: Boxes shall be so designed that, when they are assembled with energy meter and installed as for normal use in accordance with the manufacturer's instructions, live parts are not accessible and shall comply 4KV high voltage. For test purpose 4KV voltage shall be applied for one minute for type and acceptance test. HV test shall be confirmed as per the relevant clause 12.7.6.3 of IS: 13779:2020.

Note: For type test ac high voltage test shall be conducted between the aluminum foils wrapped over inner and outer surfaces of meter box. For the acceptance test it shall be conducted between meter terminals and outer aluminum foil covering the outer surface of the box.

9.2 Insulation (IR) Test: Compliance is checked by inspector and in case of doubt by

The Insulation resistance shall be conducted in line with the relevant clause 12.7.6.4 of IS: 13779:2020 using a 450volt-550 volts DC magger and the value of the insulation resistance shall be more than 5 mega ohms. The test duration shall be 5sec for routine test and one minute for acceptance test.

Note1: For type test, IR test shall be conducted between the aluminum foils wrapped over inner and outer surfaces of meter box. For acceptance and routine test, The Insulation Resistance test shall be conducted between terminals from the energy meters and aluminum foil covering the outer surface of the meter Boxes.

Note2: Both 9.1 and 9.2 compliance provide adequate protection against electric shock.

10. CONSTRUCTION

10.1 General

Boxes shall be constructed without sharp edges. Burrs shall be removed from mould lines of interior surfaces so that there are no sharp edges or undue obstructions to the passage of wiring or couplingof parts in the intended use of the product.

The inner and outer surfaces of a Boxes or cover shall not be subject to peeling, scaling or flaking and shall be smooth and free from blisters, cracks, and other defects. The construction of the energy meter Boxes shall be such that meter display is readable (Box cover shall be transparent or there shall be provision of window to read the display incase meter Boxes cover is opaque).

10.2 Energy Meter Box Specific Requirements

These tests shall be verified by visual mode

a) Push button or capacitive touch (optional)
b) Optical port provision
c) RS232/RJ port for wired communication (optional for meters)
d) Meter fixing 2/3 points
e) Hinged or Push fit arrangement (optional in case not asked by purchaser)
f) Sealing arrangement provisions
g) Suitable glands/grommet provision

h) Meter Boxes fixing/clamping provision

i) Soft rubber gasket (optional)

j) Name plate provision (optional)

k) Minimum clearance between meter and Box (sides & front) shall be minimum 10mm or specified by purchaser.

11. RESISTANCE TO AGEING, PROTECTION AGAINST INGRESSOF SOLID OBJECTSAND AGAINST HARMFUL INGRESS OF WATER

11.1 Resistance to Ageing

Clause 13.1 of IS:14772:2020 shall apply

11.2 Protection Against the Ingress of Solid Objects

IS/IEC 60529 shall apply

For degree of protection IP5X, the test is carried out according to IS/IEC 60529 and the drain hole, if any, shall not be open. The protection is satisfactory if thereis no dust inside the energy meter boxes.

11.3 Protection Against Harmful Ingress of Water

IS/IEC 60529 shall apply

Boxes with a degree of protection equal or higher than IPX4 shall provide a degree of protection against harmful ingress of water in accordance with the declared IP Code. The test is carried out according to IS/IEC 60529.

12. MECHANICAL STRENGTH

Spring hammer according to IS 9000 (Part 7/Sec 7) and as per IS:14772:2020

13. RESISTANCE TO HEAT

Ball-pressure test by means of the apparatus According to IEC 60695-10-**2** and as per IS:14772:2020

14. RESISTANCE OF INSULATING MATERIAL TO ABNORMAL HEAT AND FIRE

Compliance is checked by means of the glow-wire test performed according to clauses 4 **to** 10 **of IEC 60695-2-11.** and as per IS:14772:2020

15. RESISTANCE TO TRACKING

Compliance is checked by the test of IS 2824 on three specimens. Test shall be conducted as per IS: 14772:2020

16. RESISTANCE TO CORROSION

Ferrous parts of boxes (If any) shall be adequately protected against rusting. Compliance is checked by the following test. All grease is removed from the parts to be tested by immersion in a degreasing agent for (10 ± 1) min. The parts are then immersed for (10 ± 1) min in a 10 percent solution of ammonium chloride in water at a temperature of (27 ± 5)°C. Without drying, but after shaking off any drops, the parts are placed for (10 ± 1) min in a box containing air saturated with moisture to a level of 91 percent to 95 at a temperature of (27 ± 5)°C. After the parts have been dried for (10 ± 1) min in a heating cabinet at a temperature of (100 ± 5)°C, their surface shall show no sign of rust. NOTE — Traces of rust on cut edges and any yellowish film removable by rubbing are ignored. Cut edges also include punched holes and thread surfaces of tapped holes.

17. CATEGORY OF TEST

17.1 Type Test

The tests specified in Table given below shall constitute the type tests and shall be carried out on three sample of boxes of the same type selected preferably at random from a regular production lot. Before commencement of the test, the samples shall be visually examined and inspected for obvious visual defects in respect of component, part and their assembly construction, marking mechanical hazards, etc. The external surface finish shall be even and free from finishing defects

17.1.1 *Criteria of Acceptance*

Both set of samples shall successfully pass all the type tests for providing conformity with the requirements of the standard. If any set of the sample fails in any of the type tests, the testing authority, at its discretion, may call forfresh set of sample not exceeding twice the original number and subject them again to all test or to the test(s) in which failure(s) had occurred. No failure should be permitted in the repeat test (s) (*see* also **5.2).**

17.1.2 **Type tests**

Sl No.	Test	Clause
(1)	(2)	(3)
i)	Marking	**8**
ii)	ac High Voltage Test	**9.1**
iii)	Insulation test	**9.2**
iv)	Resistance to ageing, protection against ingress of solid objects and against harmful ingress of water	**11**
v)	Mechanical strength	**12**
vi)	Resistance to heat	**13**
vii)	Resistance to insulating material to abnormal heat and fire	**14**
viii)	Resistance to tracking	**15**
ix)	Resistance to corrosion	**16**

17.2 Acceptance Test

The following shall constitute the acceptance test:

Sl No.	Test		Clause
(1)	(2)		(3)
i)	Marking		**8**
ii)	ac High Voltage Test	**9.1**	**9.1**
iii)	Insulation test		**9.2**

Note : During inspection the clearance between ene and Meter Boxes shall be verified. The A,B,C,E as shown in Fig 1 shall be minimur as specified by the purchaser.

17.2.1 For acceptance test the sampling proceduregiven in IS 2500 (Part 1) shall be followed.

17.3 Routine Test

Sl No.	Test	Clause
(1)	(2)	(3)
i)	Marking	8
ii)	Insulation test	9.2

Note: Optical communication check and display check shall be done as functional check in addition to routine and acceptance tests.