

SUMMARY OF TOPICS

The following changes in requirements to the Standard for Electric Utility Meters, UL 2735, are being proposed for preliminary review and comment only:

- 1. For Preliminary Review Only: Addition of Alternate Method to Determine Compliance for Spacings***
- 2. For Preliminary Review Only: Addition of Solid Insulation Requirements***
- 3. For Preliminary Review Only: Clarification of Requirements for Installation Instructions***
- 4. For Preliminary Review Only: Clarification of Test Requirements for Load Control Switches***
- 5. For Preliminary Review Only: Addition of Requirements to Address the Use of Surge Protective Devices in Utility Meters***

COMMENTS DUE: May 16, 2018

This proposal is for review and comment only (no ballot at this time). Please note that comments on a preliminary review document will not receive a response from the proposal author through CSDS. Instead, the proposal author will be asked to review the comments and adjust the proposals and/or supporting rationale as the author determines to be appropriate. The preliminary review process is an informal mechanism that provides authors with the opportunity to refine their proposals before they advance to the next stage in UL's standards development process.

In some cases, the author of the proposals may choose to discontinue them. In this case, the author need not do anything after preliminary review has ended. Normally, the next step in the process is the more formal STP ballot and stakeholder review process. Only comments posted during the STP ballot and stakeholder review process will be provided with a response in CSDS.

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~.

1. For Preliminary Review Only: Addition of Alternate Method to Determine Compliance for Spacings

RATIONALE

Proposal submitted by: Ron Coleman, Honeywell - Elster Solutions

PROPOSAL

An alternate method to determine compliance for Clearance and Creepage Distances (Spacings) is proposed. Section 8 of UL 2735 is entirely replaced with Section 8 of the Proposed First Edition of the Standard for Electric Utility Meters for Canada, UL 2735C, with minor editorial modifications, as summarized below.

8.3 – text was editorially revised from UL 2735C to remove the first sentence due to redundancy. Requirements detailed in the standard are applicable unless otherwise noted. The statement of "...products shall comply..." is redundant. Also, the phrase "...shall be designed with..." could lead to misinterpretation. Theoretically, a product could be "designed to comply" but may not necessarily pass the test or continue to comply through production.

Table 8.1 – The table was not modified from the UL 2735C proposal. However, it should be noted that the requirements are different than the same table in UL 2735. Creepages on PWBs for $\leq 150V$ are specified as 2.5 mm as opposed to 3.0 mm. It seems the 3.0 mm value was not intended to be the value mentioned in the original edition. The 2.5 mm value is supported in the latest UL 2735C proposal and is supported by the guidance provided in IEC 60664-1.

The focus of this proposal is intended to address spacings within electronic circuit assemblies. Concepts of Functional Insulation, Safety Insulation and Safety Insulation in Secondary Circuits are introduced. These concepts allow for more detailed views within and between individual circuits of a meter. The present requirements are too arduous for internal circuit locations and do not reflect industry norms for safety.

The present requirements are appropriate for spacings at locations that require Safety or Safety Insulation in Secondary Circuits (Basic or Reinforced Insulation concepts in IEC terms) where greater levels of protection of fire and shock are expected. However, internal circuits do not pose the same levels of risk and are generally considered operational. Most internal electronic circuitry within an electrical utility meter should be considered as Functional Insulation.

It should be noted that internal circuit assemblies may contain features that require separation from external circuits such as KYZ outputs and antennas. These locations should not be considered Functional Insulation and the proposed alternate methods would not apply.

Additional definitions in Section 2 are required to support these proposed concepts. These definitions are proposed in Section 2 and are taken verbatim from the proposed UL 2735C. These definitions are intended to support the new text proposed in Section 8.

Furthermore, these proposed requirements are intended to help reduce the gap between UL 2735 and the proposed requirements of UL 2735C. This proposal will facilitate standards harmonization between the United States and Canadian markets. These concepts imported from IEC/UL 61010-1 and the use of UL 840/C22.2 No. 0.2 further standardize the evaluation of clearances and creepages as compared with similar products.

PROPOSAL

2.1A ACCESSIBLE (part) – A METER part, conductive or non-conductive, which may be touched in NORMAL USE when the METER is installed as specified by the manufacturer, with the METER COVER in place.

2.8A FUNCTIONAL INSULATION – Insulation needed for correct functioning of the meter and not intended to be used for protection against electric shock or fire or other safety purposes.

2.9 ISOLATED SECONDARY CIRCUIT – A circuit derived from an isolating source (such as a transformer, optical isolator, limiting impedance, electromechanical relay, or a battery) and having no other connection to the MAINS TERMINALS. A GROUND TERMINAL connection may be present. A circuit having no direct connection to the mains circuit, that derives its power from a transformer, converter or equivalent isolation device, or from a battery.

2.11 MAINS – The electrical network supplying energy to the premises which consist of phase conductor(s) and neutral conductor(s). Neutral, if present, is normally connected to earth ground. Neutral is considered a MAINS conductor. An electricity supply system to which the equipment concerned is designed to be connected for the purpose of powering the equipment.

2.12 MAINS CIRCUIT – Any circuit directly connected to the MAINS TERMINALS. Circuitry having direct connection to a neutral terminal is considered a MAINS CIRCUIT. A circuit which is intended to be directly connected to the MAINS for the purpose of powering the equipment.

2.12A MAINS TERMINALS – The equipment terminals used for connection to the MAINS which consist of potential (voltage) terminal(s), input current terminal(s), output current terminal(s) and neutral terminal(s). In some meter forms input current terminals also connect potential circuitry. Output current terminals may also connect to potential circuitry. Some meter forms do not have neutral terminals.

2.12B MATERIAL GROUPS – Related to the CTI performance level category values of insulating materials that are specified in Insulation coordination, CSA C22.2 No. 0.2-16, to be included in the group, as follows:

- a) I - $CTI \geq 600$ (PLC = 0)
- b) II - $400 \leq CTI < 600$ (PLC = 1)
- c) IIIa - $175 \leq CTI < 400$ (PLC = 2 or 3)
- d) IIIb - $100 \leq CTI < 175$ (PLC = 4)

Note: PLC stands for Performance Level Category, and CTI stands for Comparative Tracking Index.

2.12C METER – A device intended to measure electrical energy usage for billing. It may include energy consumption of individual loads and appliances.

2.13A POLLUTION DEGREES – Based on the presence of contaminants and possibility of condensation or moisture at the creepage distance and defined as follows:

- a) Pollution Degree 1 - No pollution or only dry, nonconductive pollution. The pollution has no influence.
- b) Pollution Degree 2 - Normally, only nonconductive pollution. However, a temporary conductivity caused by condensation may be expected.
- c) Pollution Degree 3 - Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation that is expected.

d) Pollution Degree 4 - Pollution that generates persistent conductivity through conductive dust or rain and snow.

2.13B RISK OF ELECTRIC SHOCK – A risk of electric shock is considered to exist at any ACCESSIBLE part if:

a) The potential between the part and earth ground or any other ACCESSIBLE part is more than 30 V rms (42.4 V peak) or 42.4 V dc; and

b) The continuous current flow through a 2000Ω resistor connected across the potential exceeds 0.5 mA.

CURRENT

8 Clearance and Creepage Distances

8.1 Type A and Type S meters shall comply with the dimensional requirements of ANSI/NEMA C12.10.

8.2 Clearance and creepage distances in the mains circuit shall comply with Table 8.1. Clearance and creepage distances between the mains circuit and isolated secondary circuits shall also comply with Table 8.1.

Table 8.1
CLEARANCES and CREEPAGE DISTANCES for MAINS CIRCUITS

Voltage line-to-neutral a.c. r.m.s. or d.c.	Values for CLEARANCE	Values for CREEPAGE DISTANCE	
		mm	
		Printed wiring boards (see note)	Other materials
≤150	3.0	3	3.0
>150 ≤ 300	5.5	5.5	5.5
>300 ≤ 600	8.0	8.0	9.4
Note: Creepages on printed wiring board apply only between coated or uncoated parts and traces of the printed wiring board that are covered with a coating. Creepages between two live parts on a printed wiring board that are not covered with coating shall comply with the creepages shown under "other materials".			

8.3 Clearances in secondary circuits that are isolated from the mains circuit by a transformer, optical isolator, or similar device shall comply with Table 8.2.

Table 8.2
CLEARANCES and test voltages for secondary circuits derived from MAINS CIRCUITS

Secondary		MAINS voltage	MAINS voltage	MAINS voltage
Working voltage		≤150 V	>150 ≤ 300 V	>300 ≤ 600 V
		a.c. rms	a.c. rms	a.c. rms
a.c. rms	d.c. or a.c. peak	CLEARANCE	CLEARANCE	CLEARANCE
V	V	mm	mm	mm
16	22.6	1.5	2.0	5.4
33	46.7	1.5	3.0	5.4
50	70	1.5	3.0	5.5
100	140	1.6	3.1	5.6
150	210	1.6	3.2	5.7
300	420	1.8	3.4	6.0
600	840	2.4	3.9	6.6

Linear interpolation is allowed.

8.4 Creepages in secondary circuits that are isolated from the mains circuit by a transformer, optical isolator, or similar device shall comply with Table 8.3.

Table 8.3
CREEPAGE DISTANCES for secondary circuits

Secondary working voltage a.c. r.m.s. or d.c.	CREEPAGE DISTANCE	
V	mm	
	Printed Wiring Boards (see note)	Other Insulating Materials
10	0.04	1.0
12.5	0.04	1.05
16	0.04	1.1
20	0.04	1.2
25	0.04	1.25
32	0.04	1.3
40	0.04	1.8
50	0.04	1.9
63	0.063	2.0
80	0.1	2.1
100	0.16	2.2
125	0.25	2.4
160	0.4	2.5
200	0.63	3.2
250	1.0	4.0
320	1.6	5.0
400	2.0	6.3
500	2.5	8.0
630	3.2	10.0

Note: Creepages on printed wiring board apply only between coated or uncoated parts and traces of the printed wiring board that are covered with a coating. Creepages between two live parts on a printed wiring board that are not covered with coating shall comply with the creepages shown under "other materials."

8.5 Conductors located between the same two layers of a multilayer printed wiring board shall be separated by at least the applicable minimum distance of Table 8.4.

~~Table 8.4~~
~~Minimum values for distances between same two layers of a multilayer printed wiring board~~

~~Line-to-neutral voltage~~	~~Minimum thickness of each layer~~	~~Minimum distance~~
~~V r.m.s. or d.c.~~	~~mm~~	~~mm~~
~~≤300~~	~~0.3~~	~~0.4~~
~~≥300 ≤ 600~~	~~0.6~~	~~0.6~~
~~>600 ≤ 1000~~	~~1.0~~	~~1.0~~

8.6 For glass and ceramics, there are no requirements for CREEPAGE DISTANCES.

PROPOSED

8 Clearance and Creepage Distances

8.1 A RISK OF ELECTRIC SHOCK shall not exist on any ACCESSIBLE parts of the METER both in NORMAL USE and in SINGLE FAULT CONDITIONS.

8.2 ACCESSIBLE parts include data communication terminals and KYZ terminals.

8.3 CLEARANCE and CREEPAGE DISTANCES may be made up of composite spacings that add up to meet the required dimensions. Conformity is checked by inspection and measurement or, in the case of CLEARANCE DISTANCES, by the requirements of Section 7 of Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840.

8.4 CLEARANCE and CREEPAGE DISTANCES in Table 8.1 shall apply between (reference Safety Insulation 'SI' in Figures 8.1 – 8.4):

a) MAINS CIRCUITS and ACCESSIBLE parts – For non-conductive ACCESSIBLE parts, the CLEARANCE and CREEPAGE distances shall apply to any ACCESSIBLE surface of the part;

b) MAINS CIRCUITS and ISOLATED SECONDARY CIRCUITS;

c) MAINS TERMINALS;

d) Voltage and current terminals of the same phase for meters where current terminals and voltage terminals are isolated, such as for TRANSFORMER RATED METERS.

NOTE: Internal METER circuits may be either MAINS CIRCUITS OR ISOLATED SECONDARY CIRCUITS as described in the meter construction examples illustrated in Figures 8.1 – 8.4.

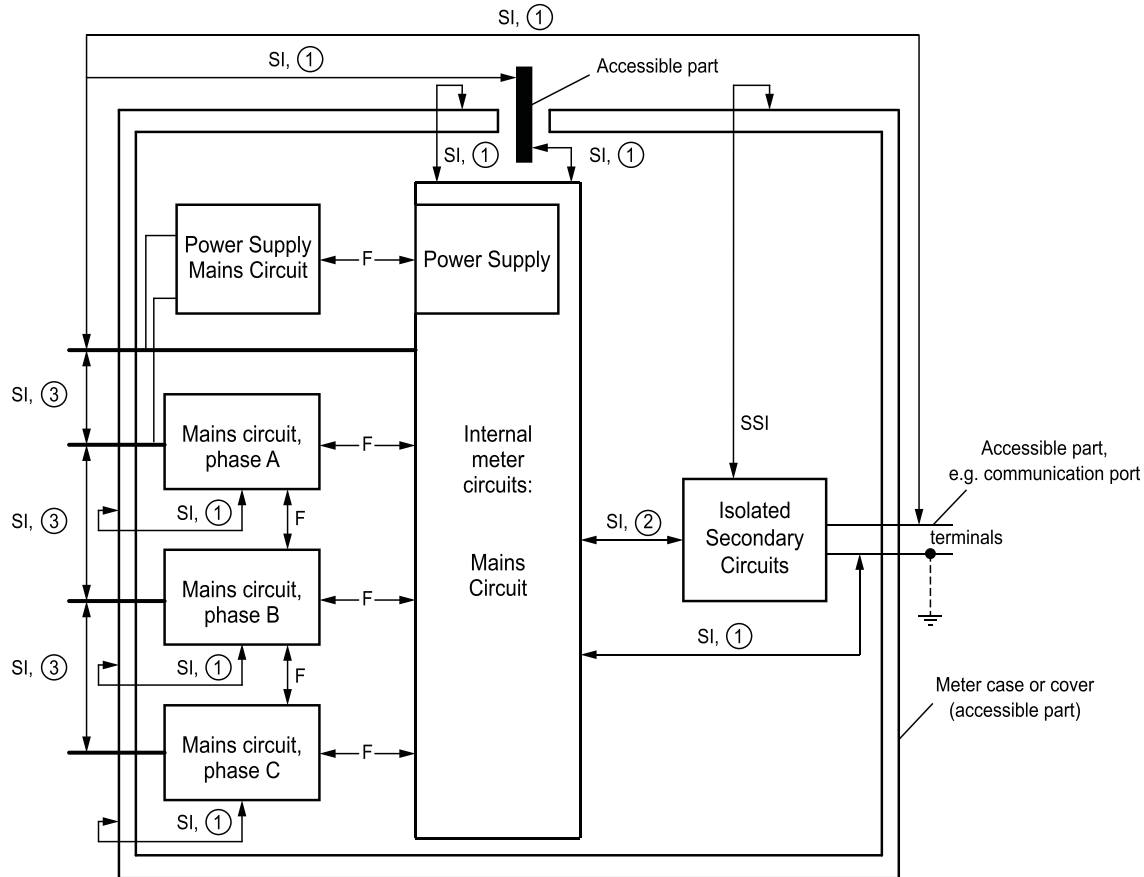
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Figure 8.1
Meter Construction Example. Non-isolated Neutral

Note from the STP Project Manager: Figure 8.1 will be updated to identify Neutral, Phase A, B, and C Terminals



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NOTES:

1. See Clause 8.4 a)

2. See Clause 8.4 b)

3. See Clause 8.4 c)

SI – Safety Insulation (for protection against electric shock, or protection against spread of fire) - distances from Table 8.1 shall be used.

SSI – Safety Insulation in Secondary circuits (for protection against electric shock, or protection against spread of fire) - distances from Table 8.3 and Table 8.4 shall be used.

F – Functional Insulation

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