

Subject 50E

November 30, 2017

SUMMARY OF TOPICS

The following changes in requirements to the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E, are being proposed for preliminary review and comment only:

- 1. For Preliminary Review Only: Adhesives Used to Secure Observation Windows**
- 2. For Preliminary Review Only: Alternate Investigation to Tensile Strength and Elongation Test for Gaskets**
- 3. For Preliminary Review Only: Clarification of Additional Corrosion Protection**
- 4. For Preliminary Review Only: Expand Eligible Grades of Austenitic Stainless Steel in UL 50E**
- 5. For Preliminary Review Only: Alternative Aging for Gasket Tensile Strength and Elongation Tests**
- 6. For Preliminary Review Only: Allowance of X Ray Spectrometry for Metallic Coating Thickness Test**
- 7. For Preliminary Review Only: Allowance for Type Rated Ventilated Enclosures**
- 8. For Preliminary Review Only: Orientation of Sample for Hosedown Test**
- 9. For Preliminary Review Only: Length of Conduit for Misalignment Test**
- 10. For Preliminary Review Only: Required Torque for Conduit Hubs for Misalignment Test**
- 11. For Preliminary Review Only: Creep Test for Polymeric Gaskets**
- 12. For Preliminary Review Only: Sealants Used with Enclosures**
- 13. For Preliminary Review Only: New Annex E for Adhesives, Enclosures, Non-mechanical Means of Securement**
- 14. For Preliminary Review Only: Requirements for Encapsulated Enclosures**
- 15. For Preliminary Review Only: Typo Correction in Table 5**

COMMENTS DUE: December 14, 2017

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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.

UL's goal is to have no interest category comprise more than one-third of the STP membership balance. To improve the current balance for STP 50, UL is looking for participants in the following interest categories: Commercial/Industrial User, Supply Chain, Testing & Standards, AHJ, General and Consumer. Definitions for these interest categories are available on the Standards STP Internet site:

<http://ulstandards.ul.com/develop-standards/participation/interest-categories/>

If you are interested in applying for STP 50 membership or are aware of potential candidates for this STP, please contact the STP Project Manager, Mitchell Gold at Mitchell.Gold@ul.com.

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: Adhesives Used to Secure Observation Windows

RATIONALE

Proposal submitted by: Seth Carlton, UL LLC

If an adhesive is used to secure an observation window to an enclosure with an outdoor environmental rating, that adhesive might be exposed to UV light which can degrade the adhesion of the window, resulting in a potential hazard due to ingress of water or dust or access to hazardous parts. This proposal requires that a set of samples are conditioned in accordance with the UV light exposure test prior to being subjected to the adhesive property tests.

PROPOSAL

7.1.3 A polymeric observation window necessary to maintain Enclosure Types 3, 3X, 3R, 3RX, 3S, 3SX, 4, 4X, 6, and 6P ratings and secured by an adhesive exposed to sunlight shall be conditioned in accordance with the Ultraviolet light exposure test (Weatherometer test) specified in Annex B, Ref. No. 1 prior to investigation of critical property values in accordance with Annex B, Ref. No. 12, or Annex E.

7.1.4 In Canada, a material used for an observation window shall be mechanically secured or shall be secured using an adhesive complying with Annex E.

**Annex B - Reference Standards
(Table truncated for clarity)**

Ref. No.	Clause No.	Canada	Mexico	United States
12	7.1.3	No Equivalent	No Equivalent	Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C

2. For Preliminary Review Only: Alternate Investigation to Tensile Strength and Elongation Test for Gaskets

RATIONALE

Proposal submitted by: Seth Carlton, UL LLC

The reason for this proposal is that it can be very difficult or impossible for enclosure manufacturers to obtain samples of certain gasket materials that are suitable for the tensile strength and elongation test. Therefore, this proposal introduces an alternative investigation that uses the end product gasket.

The rationale behind the requirements for this proposal is as follows. The tensile strength and elongation test verifies that the tensile strength and elongation properties of a gasket do not degrade below a certain percentage of the original after oven conditioning meant to represent the expected life of the gasket. The intent is that a gasket in compliance with the test will maintain the environmental integrity of the enclosure over the expected life of the gasket. As an alternative to using the tensile strength and elongation properties to qualify a gasket as being able to maintain the environmental integrity of the enclosure over its expected life, this proposal is to conduct the applicable environmental tests after the conditioning of the gasket representative of the ageing of the gasket. The tensile strength and elongation test does require three samples of the gasket for consistency of results, therefore this proposal does as well.

The tensile strength and elongation test only takes into consideration only the effects of hot or warm temperature conditioning on the gasket, it does not take into consideration of cold air conditioning of the gasket. Therefore the cold air conditioning from the compression test is also required as part of the test prior to the applicable environmental tests.

Note that this alternate investigation may be used in lieu of tensile strength and elongation test for any gasket. Therefore a gasket may be in compliance with this test and thus UL 50E which may not be in compliance with the tensile strength and elongation requirements.

PROPOSAL

7.7.1 A gasket of elastomeric or thermoplastic material or a composition gasket utilizing an elastomeric material that is provided on a Type 2, 3, 3X, 3R, 3RX, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, or 13 enclosure to meet the environmental construction and performance requirements of this standard shall comply with the Gasket test of Clause 8.13.2 or 8.13.5.

8.13.5 Gasket performance after ageing test

8.13.5.1 As an alternate to 8.13.5.2, three identical samples of representative enclosures constructed with a gasket in accordance with 7.7.1 shall be subjected to the conditioning as required by 8.13.5.2 and three identical samples of representative enclosures constructed with a gasket in accordance with 7.7.1 shall be subjected to the conditioning as required by 8.13.5.3.

8.13.5.2 Three identical samples shall be subjected to a temperature of 69 - 70°C (156 - 158°F) in circulating air for 168 hours.

8.13.5.3 Three identical samples shall be cooled to a temperature of minus 30°C (minus 22°F) for a period of 24 hours

8.13.5.4 At the conclusion of the conditioning in 8.13.5.2 and 8.13.5.3, there shall be no visible deterioration, deformation, melting, or cracking of the gasket material and the enclosure samples shall meet the applicable environmental tests of 8.2, 8.3, 8.4, 8.6, 8.10, 8.11, or 8.12.

3. For Preliminary Review Only: Clarification of Additional Corrosion Protection

RATIONALE

Proposal submitted by: Seth Carlton, UL LLC

Clause 7.2.1.1 has been misinterpreted by some to mean that copper, aluminum, any type of stainless steel, and brass or bronze of at least 80% copper are in compliance with all of clause 7.2 without further investigation. However, the beginning of the clause says they are only in compliance with indoor and outdoor corrosion protection requirements, it does not say extra corrosion protection. This proposal is to clarify 7.2.1.1 does not mean that these substrates are in compliance with extra corrosion protection without further investigation.

PROPOSAL

7.2.1.1 Enclosures made of the following materials shall be considered to comply with the indoor and outdoor corrosion requirements:

- a) Copper, aluminum, or stainless steel; and
- b) Bronze or brass containing at least 80 percent copper.

Note: The materials in (a) and (b) above are not considered to comply with additional corrosion protection of 7.2.4 without further investigation.

4. For Preliminary Review Only: Expand Eligible Grades of Austenitic Stainless Steel in UL 50E

RATIONALE

Proposal submitted by: Brian Rock, Hubbell, Inc.

Presently, Standard UL 50E in 7.2.4.1(a) and in 8.9.1.1 regards stainless steel designated as American Iron and Steel Institute (AISI) Types 304 and 316 as inherently capable of the most protective degree of corrosion resistance. Indeed, AISI Type 304 serves as the basis of comparison for all other materials and coatings when performing the testing of 8.9.

Stainless steel, however, can be grouped by their crystalline structure into three general grades metallurgically:

- Austenitic (face-centered cubic crystal, non-magnetic, not hardenable by heat-treating)
- Ferritic (body-centered cubic crystal, magnetic)

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- Martensitic (body-centered tetragonal crystal, magnetic, hardenable by heat-treating)

Austenitic grades of stainless steel are often referred to as "18-8" due to their content of chromium (nominally 18%) and nickel (nominally 8%). As such AISI Types 302, 303, 305, and 309 offer equivalent degrees of corrosion protection to AISI Types 304 and 316.

By contrast, ferritic grades (AISI Types 410, 416, 430, etc.) do not progressively rust but do discolor. Martensitic grades have yet lesser corrosion protection.

Increasingly, stainless steel suppliers are providing these other austenitic grades, particularly when used to fabricate fasteners, as well as for sheet stock. Under present UL 50E requirements, certifiers are needlessly subjecting AISI Types 302, 303, 305, and 309 to corrosion comparison testing because these equally-corrosion-resistant grades of stainless steel are given no explicit exemption. This proposal would rectify this more-frequently-encountered situation.

Other revisions here are editorial. In 8.8.2.1.1, the scribing of the test specimens is incorrectly referenced to the very same 8.8.2.1.1, rather than 8.8.2.2.2. Some of the references to Annex B mention a "Table 1" but the table in Annex B carries no such identification. "Conforming with" should be "conforming to".

PROPOSAL

7.2.3 Outdoor corrosion protection

7.2.3.1 Type 3, 3X, 3R, 3RX, 3S, 3SX, 4, 4X, 6, and 6P ferrous enclosures, and external ferrous parts attached to these enclosures shall be protected against corrosion by one of the coatings in Clause 7.2.3.1 (a) – (d) or shall comply with the test requirements of Clause 8.8:

a) Hot-dipped mill-galvanized sheet steel conforming with to the coating Designation G90 in ~~Table 1~~ of Annex B, Ref. No. 2;

b) A zinc coating, other than that provided on hot-dipped mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.015 mm (0.00061 inch) on each surface with a minimum thickness of 0.014 mm (0.00054 inch); ~~the thickness of coating shall be established by the metallic-coating-thickness test described in Annex B, Ref. No. 3; An~~ annealed coating shall comply with Clauses 7.2.3.2 and 7.2.3.3;

c) A zinc coating conforming with to Clause 7.2.3.1(c)(1) or 7.2.3.1(c)(2) and with having at least one coat of an organic finish of the epoxy or alkyd-resin type or other outdoor paint applied after forming on each surface. ~~The acceptability of the paint may be determined by consideration of its composition or by corrosion tests if these are considered necessary;~~

1) Hot-dipped mill-galvanized sheet steel conforming with to the coating Designation G60 or A60 in ~~Table 1~~ of Annex B, Ref. No. 2; or

2) A zinc coating, other than that provided on hot-dipped mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.010 mm (0.00041 inch) on each surface with a minimum thickness of 0.009 mm (0.00034 inch); ~~the thickness of the coating shall be established by the metallic-coating-thickness test described in Annex B, Ref. No. 3.~~

The acceptability of the paint may be determined by consideration of its composition or by corrosion tests if these are considered necessary; or,

d) Paint shall comply with the requirements in Clause 8.8 or Annex B, Ref. No. 7₂.

Type 3X, 3RX, 3SX, 4X, and 6P ferrous enclosures, and external ferrous parts attached to these enclosures, conforming to 7.2.4.1(a) shall be considered to have met the requirements.

7.2.4.1 Type 3X, 3RX, 3SX, 4X, and 6P enclosures, and external parts attached to these enclosures, shall be manufactured of: ~~American Iron and Steel Institute (AISI) Type 304 or Type 316 stainless steel, polymeric, or other materials that have been determined to comply with Clauses 7.2.3 and 8.9.~~

a) Austenitic stainless steel designated as American Iron and Steel Institute (AISI) Type 302, 303, 304, 305, 309, or 316;

b) Polymeric; or

c) Other materials that have been determined to comply with 7.2.3 and 8.9.

8.8.1.1 Finishes other than as described in Clause 7.2.3.1 (a) — (d), such as special metallic finishes, or metallic finish combined with paint, shall be tested in accordance with Clause 8.7, except the time shall be 600 hours when compared with G90 galvanized sheet steel (without annealing, wiping, or other surface treatment) conforming with to Clause 7.2.3.1(a).

8.8.2.1.1 Two unscribed specimens and two specimens scribed in accordance with Clause ~~8.8.2.1.1~~ 8.8.2.2.2 shall be tested.

8.9 Additional corrosion protection for enclosure type 3X, 3RX, 3SX, 4X and 6P

8.9.1 200-hour salt-spray test

8.9.1.1 ~~Materials other than Type 304 stainless steel, Type 316 stainless steel, and polymeric Enclosures, and external parts attached to these enclosures, or representative parts or plaques thereof, shall be tested in accordance with 8.7, except the time shall be 200 hours. Enclosures, and external parts attached to these enclosures, manufactured of austenitic stainless steel designated as American Iron and Steel Institute (AISI) Types 302, 303, 304, 305, 309, or 316, and of polymeric shall be considered to have met the requirements.~~

5. For Preliminary Review Only: Alternative Aging for Gasket Tensile Strength and Elongation Tests

RATIONALE

Proposal submitted by: Seth Carlton, UL LLC

The requirements for aging of gaskets prior to the tensile strength and elongation test of 8.13.2 of UL 50E specify a temperature of 69 - 70°C for 168 hours. These aging parameters differ from those in UL 157, the Standard for Safety for Gaskets and Seals. The intent of this proposal is to establish a correlation between the aging requirements of UL 157 and UL 50E such that the aging done in accordance with UL 157 can be considered representative of the aging required by UL 50E.

In regards to determining aging requirements that can be considered representative of other ageing requirements, it is logical and goes without modification of existing standard requirements that aging at either a higher temperature, a longer duration, or both would be considered worse case and thus representative if the results are compliant. However, it is possible and generally accepted that aging at a higher temperature for a shorter duration can also be representative. The accepted method for

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calculating equivalent thermal aging of elastomeric materials assumes first-order kinetics, such that for every 10°C the aging temperature is decreased, the aging time is doubled. For example, it can be found in Table 4.3 of UL 157 that a 1440 hour aging at 123°C is considered equivalent to a 360 hour aging at 143°C (quadrupling the aging time and decreasing the aging temperature by 20°C).

The lowest maximum temperature for which gasket materials are rated in UL 157 is 60°C. For this rating gasket materials are subjected to tensile strength and elongation testing after air oven aging at 100°C for 70 hours. Higher temperature ratings in UL 157 require aging at higher temperatures and /or for longer periods of time. Applying the above aging equivalence procedure for the purpose of assessing the acceptability of a gasket tested in accordance with UL 157 for a 60°C rating, aging at 100°C for 70 hours would be considered equivalent to aging at 80°C for 280 hours, which exceeds both the time and temperature requirements in UL 50E. Thus, UL 157 aging can be considered to cover the UL 50E aging requirement.

This proposal does not change the 75% retention of tensile strength and 60% retention of elongation requirement in UL 50E. If tensile strength and elongation test results for a gasket tested in accordance with UL 157 for a 60°C rating or higher do not meet the 75% tensile strength and 60% elongation requirements, these results would be considered inconclusive with respect to compliance with UL 50E. In that case, the gasket material could be evaluated in accordance with the less stringent UL 50E aging parameters.

PROPOSAL

8.13.2.2 Alternately, gasket material of such quality that samples subjected to a temperature of 100°C (212°F) in circulating air for 70 hours that have a tensile strength of not less than 75 percent and an elongation of not less than 60 percent of values determined for unaged samples, and that have no visible deterioration, deformation, melting, or cracking of the material, and that have not hardened as determined by normal hand flexing, are considered to meet the requirements of Clause 8.13.2.1. The test method shall be per Table 1 of Annex B, Ref. No. 11.

6. For Preliminary Review Only: Allowance of X Ray Spectrometry for Metallic Coating Thickness Test

RATIONALE

Proposal submitted by: Seth Carlton, UL LLC

The current requirements of UL 50E, clauses 7.2.3.1(b) and 7.2.3.1(c)(2), require that the "Dropping Test" of ASTM B 555 be used to measure the thickness of the zinc coatings on surfaces other than hot-dipped mill-galvanized sheet steel used for outdoor corrosion protection. The dropping test in ASTM B 555 employs chromic acid to test the thickness of zinc coatings. Chromic acid, a hexavalent chromium containing compound, has been identified as a potential, suspected or known carcinogen by various US agencies including OSHA, NIOSH and ACGIH.

This proposal adds ASTM B 568, coating thickness measurement using X-ray spectrometry, as an alternate to the ASTM B 555 dropping test to reduce exposure of laboratory staff to chromic acid. The proposed revisions apply to clauses 7.2.3.1(b) and 7.2.3.1(c)(2), and the reference standards table of Annex B.

Substantiation: ASTM B 568 has been deemed as a more reliable coating thickness test per Note 1 of ASTM B 555 which says "Under most circumstances this method of measuring coating thicknesses is not as reliable or as convenient to use as an appropriate coating thickness gauge (see Test Methods B 499, B 504, and B 568)". ASTM B568 is therefore understood to be at least if not more appropriate method for the determination of zinc coating thickness.

PROPOSAL

7.2.3.1 Type 3, 3X, 3R, 3RX, 3S, 3SX, 4, 4X, 6, and 6P ferrous enclosures, and external ferrous parts attached to these enclosures shall be protected against corrosion by one of the coatings in Clause 7.2.3.1 (a) – (d) or shall comply with the test requirements of Clause 8.8:

a) Hot-dipped mill-galvanized sheet steel conforming with the coating Designation G90 in Table I of Annex B, Ref. No. 2;

b) A zinc coating, other than that provided on hot-dipped mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.015 mm (0.00061 inch) on each surface with a minimum thickness of 0.014 mm (0.00054 inch). The thickness of coating shall be established by the metallic-coating-thickness test described in Annex B, Ref. No. 3 or No. 12. An annealed coating shall comply with Clauses 7.2.3.2 and 7.2.3.3;

c) A zinc coating conforming with Clause 7.2.3.1(c)(1) or 7.2.3.1(c)(2) and with one coat of an organic finish of the epoxy or alkyd-resin type or other outdoor paint applied after forming on each surface. The acceptability of the paint may be determined by consideration of its composition or by corrosion tests if these are considered necessary;

1) Hot-dipped mill-galvanized sheet steel conforming with the coating Designation G60 or A60 in Table I of Annex B, Ref. No. 2;

2) A zinc coating, other than that provided on hot-dipped mill-galvanized sheet steel, uniformly applied to an average thickness of not less than 0.010 mm (0.00041 inch) on each surface with a minimum thickness of 0.009 mm (0.00034 inch). The thickness of the coating shall be established by the metallic-coating-thickness test described in Annex B, Ref. No. 3 or No. 12.

d) Paint shall comply with the requirements in Clause 8.8 or Annex B, Ref. No. 7;

**Annex B - Reference Standards
(Table truncated for clarity)**

Ref. No.	Clause No.	Canada	Mexico	United States
12	7.2.3.1(b) and 7.2.3.1(c)(2)	ASTM B 568. Standard Test Method for Measurement of Coating Thickness by X-Ray Spectrometry	No Equivalent	ASTM B 568. Standard Test Method for Measurement of Coating Thickness by X-Ray Spectrometry

7. For Preliminary Review Only: Allowance for Type Rated Ventilated Enclosures

RATIONALE

Proposal submitted by: Seth Carlton, UL LLC

Clause 7.3.5 of UL 50E allows only Types 1, 2, and 3R enclosures to be ventilated. There has been demand for other enclosure types to be ventilated to help reduce condensation that commonly happens in air-tight enclosures. This proposal is to allow any Type rated enclosure to be ventilated as long as it passes the rod entry test and the applicable environmental design tests.

However, where the standard currently allows for water based tests to be used to verify protection against ingress of dust will not be allowed for ventilated enclosures (with the exception of the current requirements for Type 1, 2, and 3R, which don't protect against ingress of dust). The reason for this is that due to the difference in size, weight, and mass of a dust particle to a water particle, the dust may enter ventilation openings in an enclosure whereas water is kept out.

Key points of this proposal:

- 7.3.5.1 updated to allow any enclosure type to be ventilated.
- New Table 7 added for design tests for ventilated enclosures. The new table requires that both the water and dust tests are required for ventilated enclosures. Dust tests cannot be represented by water tests and vice-versa. Water tests that are represented by other water tests and dust tests that are represented by other dust tests in the current requirements can still be considered represented by the same tests.
- Modified Table 2 to remove ventilated Type 1, 3, and 3R from the Table. These have been moved to Table 7.

PROPOSAL

7.3.1.1 Other than as permitted by Clause 7.3.1.2, openings provided in an enclosure shall comply with the tests in Table 2 or Table 7 with these openings unfilled.

7.3.5.1 ~~Type 1, 2, 3R, and 3RX enclosures may be ventilated.~~ An enclosure may be ventilated if the enclosure is tested in accordance with 8.1 and the applicable design tests for the environmental rating(s) of the enclosure in accordance with Table 7.