STANDARDS UPDATE NOTICE (SUN)
ISSUED: April 5, 2023

STANDARD INFORMATION

Standard: UL 1973
Standard ID: Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications [ANSI/CAN/UL 1973:2022 Ed.3]
Previous Standard ID: Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications [ANSI/CAN/UL 1973:2018 Ed.2]

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **February 25, 2024**

IMPACT, OVERVIEW, AND ACTION REQUIRED

Impact Statement: Per our accreditation, Intertek is required to review reports against the standard revisions to confirm compliance. Once compliance is confirmed, the standard reference in the report is updated to show continued compliance to the technical requirements of the standard. Reports not updated to this version by the effective date above will be withdrawn.

Overview of Changes:

- Testing of Modules during the short circuit test
- Moving all lithium cell requirements into UL 1973
- Addition of requirements for repurposing batteries
- Addition of Vehicle Auxiliary Power System Requirements
- Revisions to the External Fire Test
- Addition of measurement of cell voltages during overcharge and overdischarge tests
- Functional safety updates
- Inclusion of EMC testing for electronic safety controls
- Inclusion of sodium ion technology batteries
- Evaluation proposal for galvanic corrosion determination

Specific details of new/revised requirements are found in table below

Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.

STANDARD INFORMATION

CLAUSE	VERDICT	COMMENT
		Additions to existing requirements are underlined and deletions are shown ~~lined out~~ below.
	Info	**CONSTRUCTION**
7	Info	**General**
7.7		***New section added;*** **Transformers** Transformers shall be evaluated in accordance with UL 1562, UL 1310 or an equivalent standard for overload conditions, and shall have suitable insulation for the circuits they are connected to. See standard for details.
7.8	Info	**System safety analysis**
7.8.1		***New clause added;*** A safety analysis consisting of a hazard identification, risk analysis and risk evaluation shall be conducted on the device under test. This safety analysis shall determine which parts of the system are safety related through an existing methodology such as outlined 7.8.2. This approach should determine the hazard scenarios and define mitigation mechanisms. This safety analysis shall identify safety circuits or software that address each hazardous condition and consider the performance of each safety circuit or software. The following conditions in (a) – (c) shall be considered unless sufficient justification (e.g. additional safety analysis) is provided by the manufacturer that these conditions are not hazardous. The following conditions in (a) – (c) shall be considered at a minimum, but are not limited to: a) Battery cell over-voltage and under-voltage; b) Battery over-temperature and under-temperature; and c) Battery over-current during charge and discharge conditions.
7.8.3		The analysis of 7.8.1 is utilized to identify anticipated faults in the system which could lead to a hazardous condition and is validated by compliance with 7.9. The analysis shall consider the reliability of any monitoring components and systems and any communication systems providing information to the controls that can affect safety. The analysis shall consider single fault conditions in the protection circuit in addition to single faults elsewhere that could lead to a hazardous condition.

CLAUSE	VERDICT	COMMENT
7.9		***New clause added;*** **Protective circuit and controls** Active protective devices shall not be relied upon for critical safety and shall comply with one of the following in (a) – (c) and comply with 7.9.2 and 7.9.3 as applicable. See standard for details.
7.11	Info	**Electrolyte containment parts and parts subject to pressure**
7.11.8		***New clause added;*** Flowing electrolyte batteries shall be provided with a means of leak detection that shall identify when a leak occurs in the system and initiate controls to mitigate the leak condition.
7.12	Info	**Cells (battery and electrochemical capacitor)**
7.12.1		Sealed nickel metal hydride cells shall comply with the cell tests of the Testing Required for Cells table of UL 2054 in addition to the requirements of this standard. Cells shall be provided with specifications for use (charging and discharging), installation, storage and disposal.
7.12.2		Secondary lithium cells shall comply with the requirements outlined in Annex E, and be marked as required in 44.15 and 44.16. Cells shall be provided with specifications as outlined in 45.7.
7.12.3		***New clause added;*** Secondary lithium cell design shall ensure sufficient safety measures to mitigate internal short circuits and other hazardous conditions during the life of the cells. Safety measures to maintain cell safety include, but are not limited to, the following: a) The appropriate choice and placement of insulation. IEEE 1625 and IEEE 1725 provide guidance on placement and application of insulation within cells and general cell design safety considerations; b) Sufficient sizing of the negative electrode active materials to cover the positive electrode active materials; c) Proper placement of insulation and separation of parts at opposite polarity including insulation and placement of tabs to prevent inadvertent short circuits during the life of the cell; d) The use of appropriate protection mechanisms such as separator shutdown, protective coatings and electrolyte additives, etc.; and e) The use of separators with sufficient strength, thermal properties and that are sized to prevent short circuit between the positive and negative electrodes during charge and discharge over the life of the cells.

CLAUSE	VERDICT	COMMENT
7.12.4		With reference to 7.12.3, compliance to (a) – (e) is determined through a review of the cell construction as part of a tear down analysis, a review of documentation on the cell construction and components, and the cell tests of Annex E.
7.12.5		Sodium-beta cells and batteries shall comply with the cell tests outlined in Annex B. Cells shall be provided with specifications for use (charging and discharging), installation, storage and disposal.
7.12.10		***New clause added;*** Sodium ion cells (e.g. Prussian Blue cells or transition metal layered oxide cells) shall comply with Annex E, and be marked as required in 44.15 and 44.16. Cells shall be provided with specifications as outlined in 45.7.
7.13	Info	**Repurposed cells and batteries**
7.13.1		***New clause added;*** Batteries and battery systems using repurposed cells and batteries shall ensure that the repurposed parts have gone through an acceptable process for repurposing in accordance with UL 1974. See also 44.3.
16		***New section added;*** **High Rate Charge** The purpose of this test is to evaluate a battery system's ability to protect against a high rate charge condition at currents over the battery maximum charging current specification. See standard for details.
17	Info	**Short Circuit Test**
17.3		***New clause added;*** The direct short circuit test shall also be conducted on the battery module if it is intended to be installed or replaced in the field. The output of the battery module sample shall be short-circuited with a shorting device having resistance as low as practicable with a maximum total resistance of 20 mΩ.
18		***New section added;*** **Overload Under Discharge** This test shall be conducted on a fully charged DUT (MOSOC per 8.1) with parallel connected cells or modules to determine its ability to withstand an overload discharge condition. DUTs with only series connections (i.e. no parallel connections of cells or modules) may be tested at the cell or module level if determined to be equivalent to testing at the system level. See standard for details.

CLAUSE	VERDICT	COMMENT
26	Info	**Tests on Electrical Components**
26.6		***New section added;*** **Low voltage transformer evaluation** The purpose of this test is to determine that transformers located in low voltage circuits (i.e. ≤ 60 Vdc) do not present a fire hazard under overload conditions. See standard for details.
27		***New section added;*** **Electromagnetic Immunity Tests** Active protective devices (e.g. battery management systems, solid state circuits, software controls, etc.) relied upon as the primary safety protection in 7.8 – 7.9 shall demonstrate sufficient immunity to electromagnetic interference by complying with the tests specified in 27.2 – 27.7. Alternate test procedures and levels specified in other standards may be used, but only if they are equivalent or more severe than the test procedures and levels specified below. See standard for details.
41	Info	**External Fire Exposure for Projectile Hazards Test**
41.2		***New clause added;*** This test shall be conducted in a controlled setting free from the effects of wind or other environmental factors that may affect the test. The ambient temperature during the testing is to be within the range of 0 °C to 46 °C (32 °F to 114.8 °F).
41.4		The pan, which provides the fire containment, shall be constructed of steel of sufficient thickness to prevent warping during the course of the 20-min test. The pan shall be sized in relation to the DUT and to accommodate the fuel and water levels. <u>The walls of the pan shall not project more than 8 cm (3.1 in) above the level of the fuel at the start of the test. The pan dimensions shall be sized to ensure that the sides of the tested-device are exposed to the flame. The pan shall exceed the horizontal projection of the DUT by 20 to 50 cm (7.9 to 19.7 in).</u>
41.5		***New clause added;*** There should be approximately 15.24 cm (6 in) of water in the pan prior to adding the hydrocarbon fuel to protect the fuel pan and to provide for consistent flame output during the test. The fuel shall be added as needed during the test to provide sufficient fuel for the test duration. The fire shall cover the whole area of the pan during whole fire exposure.

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41.10		***New clause added;*** The battery shall be subjected to a low impact hose stream delivered through a 38 mm (1-1/2 in) fog nozzle set at a discharge angle of 30° with a nozzle pressure of 517 kPa (75 psi) and a minimum discharge of 4.7 L/s (75 gpm). The tip of the nozzle shall be a maximum of 1.5 m (5 ft) from the center of the exposed surface of the DUT. The minimum duration of the low impact hose stream test shall be 6.5 s/m2 (0.60 s/ft2). The outer surface of the DUT shall be identified as the exposed area, as the hose stream must traverse this area during its application. To prevent potential for exposure to projectiles, the technician conducting the hose down portion of the test shall do so behind a protective barrier.
41.12		***New clause added;*** For protection from projectiles during the test, the DUT, test set up, and inner perimeter marking shall be enclosed within a protective test chamber that can contain the projectiles or within an outer perimeter consisting of a protective barrier wall of a noncombustible material such as masonry or concrete and wall thickness suitable for containing projectiles during the test. The walls of the test chamber or the outer perimeter shall be located a minimum of 1.5 m (4.95 ft) from the inner perimeter marking to prevent the possibility of projectiles bouncing off the walls and back into the inner perimeter.
	Info	**MARKINGS**
44	Info	**General**
44.3		***New clause added;*** Batteries and Battery systems using repurposed batteries in accordance with 7.13, shall be marked “Repurposed” or “Second Life” and “UL 1974”.
44.15		***New clause added;*** With reference to 7.12.2, a secondary lithium cell shall be legibly and permanently marked with: a) The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified; b) A distinctive catalog, model or designation number or the equivalent; and c) The date or other dating period of manufacture not exceeding any three consecutive months. Exception No. 1: The manufacturer's identification may be in a traceable code if the product is identified by the brand or trademark owned by a private labeler. Exception No. 2: The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code:

CLAUSE	VERDICT	COMMENT
		a) Does not repeat in less than 10 years; and b) Does not require reference to the production records of the manufacturer to determine when the product was manufactured.
44.16		***New clause added;*** With reference to 44.15, if a manufacturer produces a cell at more than one factory, each cell shall have a distinctive marking to identify it as the product of a particular factory.
44.17		***New clause added;*** Required markings for single cells and multi-cell/monobloc vented and valve regulated lead acid and nickel cadmium batteries shall be legibly and permanently marked in accordance with 44.1 with the following included: a) The manufacturer's name, trade name or trademark, model designation, and month and year of manufacture; Exception: The date of manufacture may be in the form of a code that does not repeat in 10 years. b) The statement "Warning: Risk of fire, explosion, or burns. Do not disassemble, heat above XX °C (or °F), or incinerate." (Where XX is the cell or battery's maximum temperature specification.) Exception: This statement may be included in the instructions provided with the cell or battery, rather than be marked on the battery. c) Battery type (e.g. valve regulated lead-acid battery) and rated nominal voltage and capacity; and d) Positive and negative leads or terminals indicated by (+) and (−).
	Info	**INSTRUCTIONS**
45	Info	**General**
45.7-45.19		***New clauses added;*** Cells shall be provided with a complete set of instructions. See standard for details.
Annex C	Info	**Test program for flowing electrolyte batteries**
C.5	Info	**Flowing Electrolyte Battery System Tests**
C.5.5		***New section added;*** **Insulation resistance**
C.5.5.1		Systems shall have sufficient insulation resistance to prevent hazards associated with energized electrolyte fluids traveling through the system.
C.5.5.2		The resistance of insulation used on hazardous voltage circuits within the flowing electrolyte battery shall be greater than or equal to 1 MΩ when conducting the test of C5.5.3.

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C.5.5.3		The insulation resistance shall be measured using high impedance measuring equipment (e.g. mega ohmmeter) after applying a voltage of 500 Vdc between the live parts of the circuit under test and accessible conducting parts including the equipment grounding circuit, for 1 min. Exception: The insulation resistance test of IEC 60364-6, Low voltage electrical installations – Part 6: Verification, can be conducted instead. Compliance criteria is in accordance with the IEC 60364-6 when using this method.
Annex D		***New annex added;*** **Metal compatibility** For combinations that fall above the line in Table D.1, an evaluation on the parts can be conducted to determine suitability. Protection methods such as coatings can be used, but will need to be evaluated. See standard for details.
Annex E		**Cell Test Program** Annex E has been completely rewritten. See standard for new requirements.
Annex I		***New annex added;*** **Test Program for Mechanically Rechargeable Metal-Air Batteries** Battery systems consisting of mechanically rechargeable Al-Air batteries or mechanically rechargeable Zn-Air batteries shall comply with the applicable construction and test requirements of this standard. They shall additionally be subjected to the requirements outlined in this Annex. See standard for details.