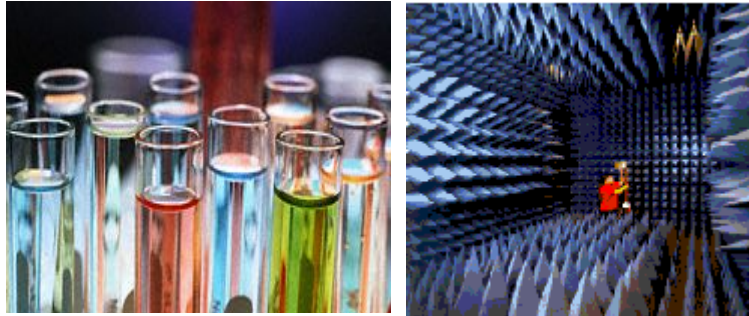


Test Implementation Concerns



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Types of Concerns

Product and Process

- **Definitions and terminology**
- **Design limits inside test limits**
- **SMART batteries**
- **Mass Loss**
- **Shrink wrap and Odd shapes**
- **Size...big and small**

Interpretation and Implementation

- **Impact testing (T-6)**
- **Criteria and frequency for Re-test**
- **Acceptance of Accreditations**
- **Interpretations**
- **Random referrals to IEC 62281**

Product and Process Concerns

- Definitions and Terminology
 - Not harmonized with international standards; terms that are unique to this document and are vague or varied within the document
 - Examples of not harmonized
 - leakage - disassembly – rated capacity
 - Examples of unique terms
 - Recommended maximum charge current – rated current – recommended maximum continuous charge current
- Design limits inside the test limits
 - Operating range of the unit under test is more stringent than the limits of the testing
 - Example – Temperature cycling range is $+75^{\circ}/-40^{\circ}\text{C}$, the thermal fuse of the unit under test operates at 70°C .

Product and Process Concerns – Cont.

- Smart batteries
 - Batteries have been designed or programmed to only allow interaction with specific host devices.
 - Batteries shutdown during longer duration testing due to no load or inactivity and voltage measurement cannot be made without “waking-up” the units under test. This is sometimes complicated to accomplish.
- Mass loss
 - Hygroscopic Materials
 - Mass loss during temperature cycling and/or altitude simulation due to material used in the battery
 - Rubbing during testing
 - Rubber enclosure materials rub off during vibration and mechanical shock.
- Shrink wrap and odd shapes
 - Odd shapes make it difficult to define 3 distinct planes
 - Odd shapes are difficult to securely fixture without damaging
 - Shrink wrapped batteries enclose the PCB, and limit fixturing methods and configurations

Product and Process Concerns – Cont.

- Size...really big and really small
 - Big and heavy samples become an issue for standard size equipment
 - Longer than vibration or mechanical shock table width
 - Additional time or equipment required to complete multiple iterations of small numbers of samples
 - Scale (weighing) limitations – accuracy
 - Small and light samples become an issue for basic handling
 - Special tools are required for handling and can be damaged when handled by normal methods
 - Special fixturing required for vibe and mechanical shock
 - During thermal, air circulating in the oven will blow samples around
 - Scale limitations - accuracy

Interpretation and Implementation Concerns

- Impact testing (T-6)
 - Inconsistent interpretation globally of 38.3.3(c)(iv) – for component cells of rechargeable batteries...
- Criteria and frequency of re-test
 - Inconsistent interpretation globally of how to apply 38.3.2.1 to determine what constitutes a re-test instead of inclusion by similarity
- Referrals to IEC62281 – Safety of primary and secondary lithium cells and batteries during transport
 - The standards are not identical – minor wording differences leading to interpretation conflicts
 - Acceptability of using IEC62281 to meet transport regulations

Interpretation and Implementation Concerns Cont.

- Acceptance of international accreditations
 - Inconsistent acceptance of testing from labs with internationally accepted accreditations under the ILAC agreement. (A2LA, NVLAP, UKAS)
- Interpretations
 - No defined mechanism for official interpretations
 - Who can make interpretations?
 - How do interpretations get circulated or distributed to global organization?
 - What happens if there are contradictory interpretations?
 - “Single cell battery as a cell”

Comparison of 3 Common Cell Standards

Test	UN Manual of Tests	IEC 62133:2002	UL 1642-2005
(T-1) Altitude Simulation	Identical	Identical	Identical
(T-2) Temp. Cycling	Most stringent	<ul style="list-style-type: none"> • Shorter soak, • Less stringent temperature • Fewer cycles 	<ul style="list-style-type: none"> • Shorter soak • Less stringent temperature
(T-3) Vibration	Most stringent	Lower frequency sweep range	Same as IEC 62133:2002
(T-4) Mechanical Shock	Most Stringent	Fewer shocks	Fewer Shocks
(T-5) External Short Circuit	<ul style="list-style-type: none"> • Only performed at 55C • Maximum temperature 170C 	• Performed at 20 and 55C	<ul style="list-style-type: none"> • Performed at 20 and 55C • Max. temp 150C
(T-6) Impact	Identical method to UL 1642:2005	Not Required	Identical method to UN Manual
(T-8) Forced Discharge	Most stringent	Multi-cell applications only	Multi-cell applications only
Overcharge	Not Required	2 tests – Protection against High Charging Current, and Overcharge	Same as “Protection against High Charging Current” from IEC62133:2002
Thermal Abuse (130C hot oven)	Not Required	130C – 10 min soak	Identical to IEC 62133:2002
Crush	Not Required	13kN	Identical to IEC 62133:2002
Other items to note:	<ul style="list-style-type: none"> • Fresh and cycled cells • Sequential testing on same samples 	Free fall and Continuous charge tests additional	Projectile test additional

Comparison of 3 Common Battery Standards

Test	UN Manual of Tests	IEC 62133:2002	UL 2054 - 2004
(T-1) Altitude Simulation	Cells and Batteries	Cells only	Cells only
(T-2) Temp. Cycling	Most stringent	<ul style="list-style-type: none"> • Shorter soak, • Less stringent temperature • Fewer cycles 	Cells only
(T-3) Vibration	Most stringent	Lower frequency sweep range	Cells only
(T-4) Mechanical Shock	Most stringent	Fewer shocks	Cells only
(T-5) External Short Circuit	<ul style="list-style-type: none"> • Only performed at 55C • Maximum temperature 170C 	• Performed at 20 and 55C	<ul style="list-style-type: none"> • Performed at 20 and 55C • Max. temp 150C
(T-7) Overcharge	<ul style="list-style-type: none"> • 2X current • Excessive voltage 	Cells only	<ul style="list-style-type: none"> • Single fault within battery • 3X current
Free Fall	Not Required	• 1 meter to concrete, 3 drops	Same as IEC 62133:2002
Mold Stress	Not Required	• 70C, 7 hours	• 70C, 6 hours
Other items to note:	<ul style="list-style-type: none"> • Fresh and cycled cells • Sequential testing on same samples 		<ul style="list-style-type: none"> • Limited power source (LPS) • Abnormal Charge • 250N Steady Force Test • Enclosure Flammability • Forced Discharge – Multi-cell only