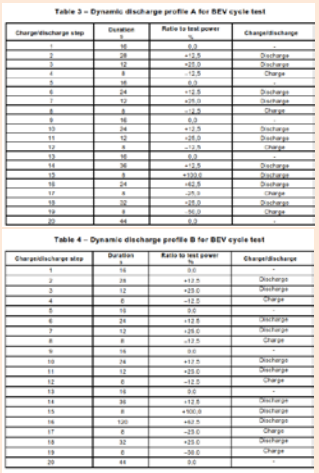
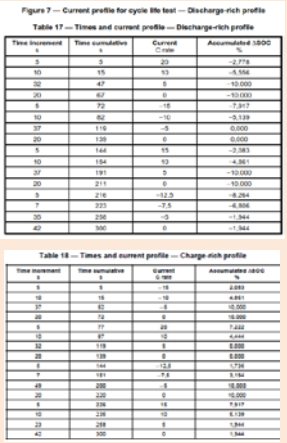
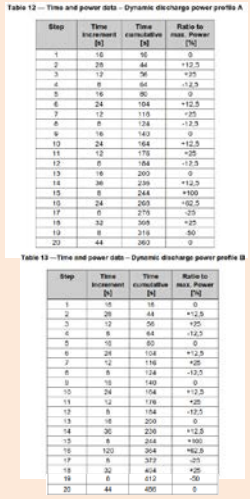
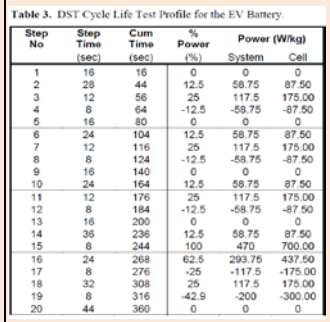
## Ageing tests in standards on Li-ion batteries

This table covers ageing tests for Li-ion batteries. It is made in the European projects eCaiman, Spicy and Naiades.

batterystandards.info

| | IEC 62660-1:2010 (Cell Level) | ISO 12405-1:2011 (Module & System level) | ISO 12405-2:2012 (Module & System level) | QC/T 743-2006 | DOE-INL/EXT-15-34184 | SAE J2288 |
|---|---|---|---|---|---|---|
| **Charge retention** | **7.6.1 Storage tests - Charge retention test.** | **7.5 SOC loss at storage / 7.4 No-load SOC loss.** | **7.6 SOC loss at storage / 7.5 No load SOC loss.** | **6.2.9.x Charge holding and recovery characterisitcs at 6.2.9.1 normal temperature / 6.2.9.2 high temperature.** | **3.6 Self-Discharge Test** | |
| | Cell level | Full system level with BMS activity / without BMS activity | Full system levelwith BMS activity / without BMS activity | Cell level | All levels | |
| | duration 28 days / checkup 28 days | duration 30 days / checkup 1, 7 and 30 days | duration 30 days / checkup 1, 7 and 30 days | 28 days / checkup 7 days | duration 30 days / checkup 30 days | |
| | conditioned at 25°C ±2K | conditioned at 25°C ±2K | conditioned at 25°C ±2K | conditioned at 20°C ±5K | conditioned at 30°C ±3K | |
| | tested at 45°C ±2K | tested at 45°C ±2K / 25°C and 40°C ±2K | tested at 45°C ±2K / 25°C and 40°C ±2K | tested at 20°C ±5K / tested at 55°C ±2K | tested at 30°C ±5K (proposed value) | |
| | SOC 50% | SOC 50% / SOC 80% | SOC 50% / SOC 100% | SOC 100% | SOE 50% (State of Energy is used) | |
| | determination with 1C | determination with 1C | determination with 0.33C | determination with 0.33C | determination with 0.33C | |
| **Cycle life** | **7.7.x Cycle life tests - 7.7.1 BEV / 7.7.2 HEV.** | **7.9 Cycle life.** | **7.7 Cycle life.** | **6.2.11 Cycle life.** | **3.9 Cycle Life Dynamic Stress Tests** | **Full procedurededicated to cycle life test** |
| | Cell level | Full system level | Full system level | Cell level | All levels | Module level |
| | Convective cooling 45°C ±2K ambient | Active cooling 25-40°C ±2K | Active cooling 25-40°C ±2K | Convective cooling 20°C ±2K ambient | convectice cooling at unspecified temperature | |
| | SOC window 100% - 20% / 80% - ~25% (defined by switching voltage) | SOC window 80% - 30% | SOC window 100% - 20% | SOC window 100% - 20% | Specified by manufacturer or application | SOC window 100% - 20% |
| | Different BEV profiles / Different HEV profiles | Different HEV and PHEV profiles | Different BEV profiles | Constant current CH and DCH with 0.33C | Dynamic Stress Tests Cycle Life Test Profile for the EV Battery | Dynamic capacity test profile from SAE J1798 |
| | Checkup every 28 days at 25°C ±2K | Checkup every 28 days at 25°C ±2K | Checkup every 28 days at 25°C ±2K | Checkup every 24h at test temperature | Checkup ~32 days or application specific | Checkup every 28 days |
| | End of test if C(current)<0.8C(initial) or 6 months / P(current)<0.8P(initial) or 6 months | Limits during checkup to be defined before | Limits during checkup to be defined before | End of test if C(current)<0.8C(initial) | End of test is application specific. Recommendations e.g. insufficient enegry or capacity to finish checkup or too few values achieveable by HPPC test. | End of test if C(current)<0.8C(rated) or P(current)<0.8P(rated)@80%DOD |
| |  |  |  | Procedure:<br>a) Cycle life @ 20ºC +/-5ºC. Charge C/3<br>b) Discharge 1,5C/3 to 80% SOC<br>c) Charge C/3<br>d) Repeat b), c) for 24h<br>e) Check capacity - Discharge C/3. If SOH > 80% continue and repeat till target SOH < 80% |  | Dynamic capacity test profile from SAE J1798 |
| **Storage life** | **7.6.2 Storage life test.** | | | **6.2.10 Storage.** | **3.10 Calendar Life Test** | |
| | Cell level | | | Cell level | cell level and higher | |
| | checkup every 42 days at 25°C ±2K | | | checkup every 90 days at 20°C ±5K | Checkup daily with 1 Pulse and detailed profile every ~32 days or application specific | |
| | tested at 20°C ±2K | | | tested at 20°C ±5K | minimum of 3 different test temperatures is recommended | |
| | SOC 100% for BEV / SOC 50 for HEV | | | SOC 33% | Specified by manufacturer or application | |
| | determination with 0.33C for BEV / 1C for HEV | | | determination with 0.33C | determination with 0.33C | |
| | End of test after 3 repetitions | | | End of test after 5 repetitions | End of test is application specific. Recommendations e.g. insufficient enegry or capacity to finish checkup or too few values achieveable by HPPC test. | |

*Despite our care we do not claim to cover all standards and that all test topics have been given here. The organisations that categorised the available test standards cannot be kept responsible for your decisions.*

The involved institutes of this survey are: