General overview on test standards for Li-ion batteries, part 1 - (H)EV

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





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Legend: Battery level: CL: Cell level ML: Module level SL: System level

Торіс:	
Performance	
Ageing	
Safety / Abuse	
Type approval / Certification	

SPICY

Application:	
transport	traction
general	stationary
(hybrid) electric vehicles	industrial
light electric vehicles	portable
road vehicles, not for propulsion	commercial

Identifier	Application	Test	Title & Topics		Leve		Туре		Table	coverage	
				CL	ML	SL		Perf.	Ageing	Safety short	Safety det.
<u>IEC 62660-1:2010</u>	(H)EV		Secondary lithium-ion cells for the propulsion of electrical road vehicles - Performance Testing.					x	x		
		7.2 7.4 7.5 7.6.1 7.6.2 7.7.1 7.7.2 7.8	Capacity Power Energy Storage Test - Charge retention Storage Test - Storage life test Cycle Life - Battery Electric Vehicle Cycle Life - Hybrid Electric Vehicle Energy Efficiency	x x x x x x x x			Performance-Electrical Performance-Electrical Performance-Electrical Ageing-Electrical Ageing-Electrical Ageing-Electrical Ageing-Electrical Performance-Electrical				
IEC 62660-2:2010	(H)EV		Secondary lithium-ion cells for the propulsion of electrical road							x	x
		6.1.1 6.1.2 6.1.3 6.2.1 6.2.2 6.3.1 6.3.2 6.3.3	Vernices - Kendoniny and Addise resuring. Vibration Mechanical Shock Crush High temperature endurance Temperature Cycling External Short Circuit Overcharge Forced Discharge	x x x x x x x x			Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Thermal Safety / Abuse-Thermal Safety / Abuse-Electrical Safety / Abuse-Electrical				
IEC 62660-3:2016	(H)EV	0.010	Secondary lithum-ion cells for the propulsion of electrical road	~			Surcey Prouse Electrical			x	x
		6.1.1 6.1.2 6.1.3 6.2.1 6.2.2 6.3.1 6.3.2 6.3.3	Vehicles - Safety requirements. Vibration Mechanical Shock Crush High temperature endurance Temperature Cycling External Short Circuit Overcharge Forced Discharge	× × × × × ×			Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Thermal Safety / Abuse-Tlectrical Safety / Abuse-Electrical Safety / Abuse-Electrical				
ISO 12405-1:2011	(H)EV		Test specifications for packs and systems - High-power applications.					x	x		
		7.1 7.2 7.3 7.4 7.5 7.6 7.7 7.8 8.1 8.2 8.3 8.4 9.2 9.3 9.4	Energy and capacity at room temperature Energy and capacity at different temperatures and discharge rates Power and internal resistance No-load SOC loss SOC loss at storage Cranking power at low temperature Cranking power at high temperature Cranking power at high temperature Cranking power at high temperature Cranking power at high temperature Energy Efficiency Cycle Life Dewing - Temperature Change Thermal shock cycling Vibration Mechanical Shock Short-circuit protection Overcharge protection		x x x x x x x x x x x x x x x	x x x x x x x x x x x x x x x x x x x	Performance-Electrical Performance-Electrical Ageing-Electrical Ageing-Electrical Performance-Electrical Performance-Electrical Performance-Electrical Performance-Electrical Safety / Abuse-Thermal Safety / Abuse-Thermal Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Electrical Safety / Abuse-Electrical Safety / Abuse-Electrical Safety / Abuse-Electrical				
ISO 12405-2:2012	(H)EV		Test specifications for packs and systems - High-energy applications.					x	x		
		7.1 7.2 7.3 7.5 7.6 7.7 8.1 8.2 8.3 8.4 9.2 9.3 9.4	Energy and capacity at room temperature Energy and capacity at different temperatures and discharge rates Power and internal resistance Energy efficiency at fast charging No-load SOC loss SOC loss at storage Cycle Life Dewing - Temperature Change Thermal shock cycling Vibration Mechanical Shock Short-circuit protection Overcharge protection Overdischarge protection		x x x x x x x x x x x x x	× × × × × × × × × × × × × × × × × × ×	Performance-Electrical Performance-Electrical Performance-Electrical Ageing-Electrical Ageing-Electrical Ageing-Electrical Safety / Abuse-Thermal Safety / Abuse-Thermal Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Electrical Safety / Abuse-Electrical Safety / Abuse-Electrical				
ISO 12405-3:2014	(H)EV		Test specification for lithium-ion traction battery packs and systems - - Part 3: Safety performance requirements.								x
		6.1 6.2 7.1 7.2 8 8.1 8.2 8.3 8.4 9.1 10.1 10.2 10.3	Vibration Mechanical shock Dewing Thermal cycling Simulated vehicle accident Inertial load at vehicle crash Contact force at vehicle crash Water immersion Exposure to fire Short circuit Overcharge protection Overdischarge protection Loss of thermal control/cooling		× × × × ×	x x x x x x x x x x x x x x x x x x x	Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Thermal Safety / Abuse-Thermal Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Mechanical Safety / Abuse-Environmental Safety / Abuse-Environmental Safety / Abuse-Electrical Safety / Abuse-Electrical Safety / Abuse-Electrical Safety / Abuse-Electrical Safety / Abuse-Electrical Safety / Abuse-Thermal				
<u>ISO 6469-1:2009</u>	(H)EV		Electrically propelled road vehicles – Safety specifications – Part 1: On-board rechargeable energy storage system (RESS).								
		6.1 6.2	Isolation resistance of the RESS Clearance and creepage distance			x x	Safety / Abuse-Electrical Safety / Abuse-Electrical				

I			6.3	Requirements for the emission of hazardous gases and other			x	Safety / Abuse-Environmental				
I			6.4	Heat generation from the RESS			x	Safety / Abuse-Environmental				
I			7 8.1	RESS over-current interruption Protection of occupants			x x	Safety / Abuse-Electrical Safety / Abuse-Mechanical				
I			8.2	Protection of a third party			x	Safety / Abuse-Mechanical				
ŀ		() = .	8.3	Protection against a short-circuit Electric and Hybrid Vehicle Propulsion Battery System Safety			х	Safety / Abuse-Electrical				
ŀ	<u>SAE J2929:2013</u>	(H)EV		Standard - Lithium-based Rechargeable Cells.								x
I			4.2.2.1	Vibration Alternative 1. Complete battery system vibration test			x	Safety / Abuse-Mechanical				
I			4222	Vibration Alternative			v	Safety / Abuse-Mechanical				
I			7.2.2.2	Vibration test.			Â	Surcey / Abuse Meenumeur				
I			4.2.3 4 2 4	Thermal shock Humidity/Moisture Exposure			×	Safety / Abuse-Environmental Safety / Abuse-Environmental				
I			4.2.5	Electromagnetic Susceptibility			x	Safety / Abuse-Electrical				
I			4.3 4 4	Drop Test Immersion Test			v	Safety / Abuse-Mechanical Safety / Abuse-Environmental				
I			4.5	Mechanical Shock			x	Safety / Abuse-Mechanical				
I			4.6 4.7	Battery Enclosure Intergrity Exposure to Simulated Vehicle fire			x x	Safety / Abuse-Mechanical Safety / Abuse-Environmental				
I			4.8	Electrical Short Circuit			х	Safety / Abuse-Electrical				
I			4.9	Single Point Overcharge Protection System Failure			x	Safety / Abuse-Electrical				
I			4.10	Single Point Over Discharge Protection System Failure			×	Safety / Abuse-Electrical				
			4.11 4.13	Protection against High Voltage Exposure			x	Safety / Abuse-Electrical				
ſ	SAE J2464:2009	(H)EV		Electric and Hybrid Electric Vehicle Rechargeable Energy Storage								x
ŀ			4.3.1	Shock tests	x	х	х	Safety / Abuse-Mechanical				
I			4.3.2	Drop test Penetration test		~	x	Safety / Abuse-Mechanical				
I			4.3.4	Roll-over test		x	x	Safety / Abuse-Mechanical				
I			4.3.5	Immersion test Crush test		×	x	Safety / Abuse-Environmental				
l			4.4.1	High temperature hazard test		x	x	Safety / Abuse-Thermal				
I			4.4.2	Thermal stability test	x	v	v	Safety / Abuse-Thermal				
I			4.4.4	Thermal shock cycling	x	x	x	Safety / Abuse-Thermal				
I			4.4.5 4 5 1	Passive propagation resistance test Short circuit test	x	x x	x x	Safety / Abuse-Thermal Safety / Abuse-Electrical				
I			4.5.2	Overcharge test	x	x	x	Safety / Abuse-Electrical				
I			4.5.3 4.5.4	Overdischarge (Forced Discharge) test Separator shutdown integrity test	x x	х		Safety / Abuse-Electrical Safety / Abuse-Electrical				
İ	SAE J1798 WIP	(H)EV		Recommended Practice for Performance Rating of Electric Vehicle								
ŀ		. ,		Battery Modules under development								
ſ	UL 2580:2013	(H)EV		Outline of investigation for batteries for use in electric vehicles.								x
ŀ			17	Manufacturing and Production Line Testing and Production Quality			v					
I			25	Overcharge Test			Ŷ	Safety / Abuse-Electrical				
I			26	Short Circuit Test			x	Safety / Abuse-Electrical				
I			27	Overdischarge Protection Test			x	Safety / Abuse-Electrical				
I			29	Imbalanced Charging Test			x	Safety / Abuse-Electrical				
I			30 31	Dielectric Voltage Whitstand Test Isolation Resistance Test			x	Safety / Abuse-Electrical Safety / Abuse-Electrical				
I			32	Continuity Test			x	Safety / Abuse-Electrical				
I			33 34	Failure of Cooling/Thermal Stability System Test Rotation Test			x x	Safety / Abuse-Thermal Safety / Abuse-Mechanical				
I			35	Vibration Endurance Test			x	Safety / Abuse-Mechanical				
I			36 37	Shock Test Drop Test			x x	Safety / Abuse-Mechanical Safety / Abuse-Mechanical				
I			38	Crush Test			x	Safety / Abuse-Mechanical				
I			39 40	Thermal Cycling Salt Spray Test			x x	Safety / Abuse-Thermal Safety / Abuse-Environmental				
I			41	Immersion Test			x	Safety / Abuse-Environmental				
			42 43	External Fire Exposure Test Internal Fire Exposure Test			x x	Safety / Abuse-Thermal Safety / Abuse-Thermal				
ſ	QC/T 743-2006	(H)EV		Automotive Industry Standard of the People's Republic of China - Lithium-ion Batteries for Electric Vehicles					x	x		x
f			6.2.5	Discharge Capacity at 20°C	x			Performance-Electrical				
I			6.2.6 6.2.7	Discharge Capacity at -20°C Discharge Capacity at 55°C	x x			Performance-Electrical Performance-Electrical				
I			6.2.8.1	Rate Discharge Capacity at 20°C, High energy density battery				Performance-Electrical				
I			0.2.8.2	Rate Discharge Capacity at 20°C, High power density battery	×			Agoing Electrical				
I			3.2.3.1	charge notaing and recovery characteristics at normal temperature	×			ngellig-cleutildi				
I			6.2.9.2	Charge holding and recovery characteristics at high temperature	x			Ageing-Electrical				
l			6.2.10 6.2.11	Storage Cycle Life	x x			Ageing-Electrical				
I			6.2.12.1	Over-discharge	x			Safety / Abuse-Electrical				
I			6.2.12.2 6.2.12.3	Overcharge Short Circuit	x x			Satety / Abuse-Electrical Safety / Abuse-Electrical				
l			6.2.12.4	Fall	x			Safety / Abuse-Mechanical				
l			ь.2.12.5 6.2.12.6	Crush	x x			Sarety / Abuse-Mechanical Safety / Abuse-Mechanical				
I			6.2.12.7	Prick	x			Safety / Abuse-Mechanical				
ļ			6.3.5 6.3.6	Simplified loaded mode			x	Performance-Electrical				
l			6.3.7	Resistance to vibration			x	Safety / Abuse-Mechanical				
I			6.3.8.2	Over-charge			x	Safety / Abuse-Electrical				
I			6.3.8.3	Short circuit			x	Safety / Abuse-Electrical				
۱			6.3.8.5	Crush			x	Safety / Abuse-Mechanical				
ŀ	DOE-INL/EXT-15-		6.3.8.6	Prick			х	Safety / Abuse-Mechanical				
ļ	34184	(H)EV	2.2	U.S. DOE Battery Test Manual for Electric Vehicles				Desferrer and the set	x	x		x
l			3.2 3.3	Static Capacity Test High Rate Charge Test	x x	x x	x x	Performance-Electrical Performance-Electrical				
I			3.4	Hybrid Pulse Power Characterization Test	x	x	x	Performance-Electrical				
1			5.5	Solf Discharge Test	,	Ŷ	×	Ageing-Electrical				
			3.6	Sell Discharge Test	^	^	~	Abering Electrical	I		_	

I	1	3.7.1	Survival Temperature Test	х	х	х	Safety / Abuse-Thermal	I	I	1	1
		3.9	Cycle Life Dynamic Stress Test	x	х	x	Ageing-Electrical				
		3.10	Calendar Life Test	x	х	x	Ageing-Electrical				
		3.11	Reference Performance Test	х	х	х	Performance-Electrical				
CAND 2005 2422	(1)5)		FreedomCAR - Electrical Energy Storage System Abuse Test Manual								
SAND 2005-3123	(П)EV		for Electric and Hybrid Electric Vehicle Applications.							x	x
		3.1	Controlled Crush		х	х	Safety / Abuse-Mechanical				
		3.2	Penetration	х	х	х	Safety / Abuse-Mechanical				
		3.3	Drop			х	Safety / Abuse-Mechanical				
		3.4	Immersion	х	х	х	Safety / Abuse-Mechanical				
		3.5	Roll-over Simulation		х	х	Safety / Abuse-Mechanical				
		3.6	Mechanical shock		х	х	Safety / Abuse-Mechanical				
		4.1	Thermal Stability	х	х	х	Safety / Abuse-Thermal				
		4.2	Simulated Fuel Fire		х	х	Safety / Abuse-Thermal				
		4.3	Elevated Temperature Storage	х	х	х	Safety / Abuse-Thermal				
		4.4	Rapid Charge/Discharge		х	х	Safety / Abuse-Thermal				
		4.5	Thermal shock cycling	х	х	х	Safety / Abuse-Thermal				
		5.1	Overcharge / Overvoltage		х	х	Safety / Abuse-Electrical				
		5.2	Short Circuit	х	х	х	Safety / Abuse-Electrical				
		5.3	Overdischarge / Voltage Reversal		х	х	Safety / Abuse-Electrical				
		5.4	Partial Short Circuit		х	х	Safety / Abuse-Electrical				
Ellicert Batteries	(H)F\/		Certification scheme for battery cells and packs for rechargeable							v	
<u>emeere butteries</u>	(11)2 •		electric and hybrid vehicles							^	
		4	Certification Process	х		х					
		6.1 Test 1	Vibration	х		х	Safety / Abuse-Mechanical				
		6.2 Test 2	Thermal Cycle	х		х	Safety / Abuse-Mechanical				
		6.3 Test 3	Low Pressure	х		х	Safety / Abuse-Mechanical				
		6.4 Test 4	Thermal Stability	х		х	Safety / Abuse-Thermal				
		6.5 Test 5	Forced Charge	х		х	Safety / Abuse-Electrical				
		6.6 Test 6	Forced Discharge	х		х	Safety / Abuse-Electrical				
		6.7 Test 7	Shock or Jolt	х		х	Safety / Abuse-Mechanical				
		6.8 Test 8	Crush	х		х	Safety / Abuse-Mechanical				
		6.9 Test 9	Penetration	х		х	Safety / Abuse-Mechanical				
		6.10 Test 10	External Short-Circuit	х		х	Safety / Abuse-Electrical				
		6.11 Test 11	Fall	х		х	Safety / Abuse-Mechanical				
		6.12 Test 12	Immersion	х		х	Safety / Abuse-Mechanical				
		6.13 Test 13	Real or Simulated Outside Fire	х		х	Safety / Abuse-Thermal		<u> </u>		

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 the survey are:





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