

Objects to be tested and criteria

1/July/2011 JASIC

1. Classification of event simulated by each test.

	Classification of event	Applicable test
A	The user is supposed to continue to use the vehicle after the event. In this case, stringent requirements (i.e. prohibit the lower severity risk event) should be applied to ensure the safety operation of vehicle.	Vibration, Thermal Shock & Cycling
B	The user is supposed to stop using the vehicle until certain repair/maintenance is conducted once subject to the event, presuming the battery would not be re-used for any other purpose than vehicle propulsion. In this case, the requirement relevant to the accident situation, in order to avoid additional risk to the occupants and the surrounding people, should be applied.	Mechanical Impact (Shock, Integrity), Fire resistance,
C	The proposed test procedure is to confirm the operation of protective function. The tests may be replaced by an expert verification of system safety concept. If such protective function does not exist, stringent requirements (i.e. prohibit the lower severity risk event) should be applied.	External short circuit Overcharge Protection, Over-discharge Protection, Over-temperature Protection.

2. Test objects and criteria

Test procedure	Objects to be tested	Required Criteria						
		Electrolyte Leakage	Enclosure Rupture	Fire	Explosion	Isolation	Voltage	Other Visible Events
Vibration	Pack or sub-assy.	YES	YES	YES	YES	YES	YES	YES
Thermal cycling	Pack or sub-assy.	YES	YES	YES	YES	YES	YES	YES
Mechanical Shock (vehicle)	Vehicle	*1	*1	YES	YES	*1		
Mechanical Shock (component)	Pack or sub-assy.	YES	YES	YES	YES	YES		
Mechanical Integrity (vehicle)	Vehicle	*1	*1	YES	YES	*1		
Mechanical Integrity (component)	Until practicable test procedure is developed, no specific test required and the installation condition shall be established for vehicle approval.							
Fire resistance	Pack (w/ body)				YES			
External short circuit	BMS+Pack	YES	YES	YES	YES	YES		YES
Overcharge Protection	BMS+Pack	YES	YES	YES	YES	YES		YES
Over-discharge Protection	BMS+Pack	YES	YES	YES	YES	YES		YES
Over-temperature Protection	BMS+Pack	YES	YES	YES	YES	YES		YES

\*1: Fulfill relevant requirement of R12/94/95.

## 3. Explanation of terms

	Term	Meanings	Remarks
Object	RESS (Rechargeable energy storage system)	means the rechargeable energy storage system that provides electric energy for electric propulsion.	RESS-3-3r1, para.2.1, (= R100, para.2.23, R12, R94, R95)
	Cell	means a single encased electrochemical unit containing one positive and one negative electrode which exhibits a voltage differential across its two terminals.	RESS-3-3r1, para.2.2
	Lithium ion cell	means a rechargeable electrochemical cell whose electrical energy is derived from the insertion/extraction reactions of lithium ions between the anode and the cathode.	RESS-3-3r1, para.2.3
	Battery module	means an assembly of two or more cells which are electrically connected together fitted with devices necessary for use, for example, case, terminals, marking and protective devices.	RESS-3-3r1, para.2.4
	Battery enclosure	means the physical housing surrounding RESS components, particularly cells or battery modules, and providing protection against direct contact to voltage class B circuit on these components.	RESS-3-3r1, para.2.5 with modification
	Battery pack	means an energy storage device <u>encased by a battery enclosure</u> that contains cells or battery modules normally connected with cell electronics, voltage class B circuit and overcurrent shut-off device including electrical interconnections, interfaces for external systems (e.g. cooling, voltage class B, auxiliary voltage class A and communication).	Modified from ISO12405-1, para.3.2.
Criteria	Electrolyte leakage	means leakage of electrolyte that can be visually observed from the exterior of the battery enclosure. If applicable test is conducted on battery module or other subsystems, the observation will be conducted without disassemble.	New concept
	Battery enclosure rupture	means openings through the battery enclosure which are created or enlarged by an event and which are sufficiently large for a 50 mm diameter sphere to contact battery system internal components (see ISO20653, IPXXA).	RESS-3-3r1, para.2.9
	Fire	means the emission of flames from a battery enclosure that may spread to the other part of the vehicle. Sparks are not flames.	RESS-3-3r1, para.2.7
	Explosion	means very fast release of energy sufficient to cause pressure waves and/or projectiles that may cause considerable structural and/or bodily damage.	RESS-3-3r1, para.2.6
	Isolation resistance	<i>Requirement of R100 para. 5.1.3, to be applied between the high voltage connection of battery pack and the surface of battery enclosure</i>	Apply R100 requirement
	Voltage drop	<i>Difference of overall output voltage of battery pack (or sub assembly) before and after the test.</i>	When applying this requirement, no recharging after the test..
	Other visible events	means other visible phenomena than those described in paragraphs ## - ## (electrolyte leakage to explosion), such as smokes that would not lead to fire or explosion, that can be visually observed from the exterior of the battery enclosure. If applicable test is conducted on battery module or other subsystems, the observation will be conducted without disassemble.	New concept

