Amendment of UN ECE R100 regarding „in-use “requirements for vehicles of category L
(Basis RESS-8-3 Rev.01) 26-EVTF-13 Annex 2 rev2

This document lists

Column 1 :	Paragraph reference
Column 2 :	Original requirements for M-vehicles in R100
Column 3 :	**Latest Proposal by IMMA**
Column 4 :	Latest set requirements as agreed or defined in the latest RESS IG
Column 5 :	Any comments and questions.

Sections in Column 3 marked in grey means that IMMA does not have a further proposal to change the latest text in column 4.
Below are the latest IMMA comments on the R100 part 1 in use from the perspective of L1-L7 to be exchanged with the IG RESS.

With regards to the matter of referring to,, driver'' or ,,rider'', various other options can be chosen, e.g., ,,driver'' can be replaced also with ,,driver/rider as applicable''.

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§	**UN ECE R100**		**Requirements category L**	**Comments**
1.1	**PART I:** safety requirements with respect to the electric power train of road vehicles of categories M and N, with a maximum design speed exceeding 25 km/h, equipped with one or more traction motor(s) operated by electric power and not permanently connected to the grid, as well as their high voltage components and systems which are galvanically connected to the high voltage bus of the electric power train. **PART I of this** Regulation does not cover post-crash safety requirements of road vehicles;		**PART I:** safety requirements with respect to the electric power train of road vehicles of categories M and N, with a maximum design speed exceeding 25 km/h **and vehicles of categories L with a maximum design speed exceeding 6 km/h,** equipped with one or more traction motor(s) operated by electric power and not permanently connected to the grid, as well as their high voltage components and systems which are galvanically connected to the high voltage bus of the electric power train. **PART I of this** Regulation does not cover post-crash safety requirements of road vehicles;	The definition is now made in line with the European definition.

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.1	"**Active driving possible mode"** means the vehicle mode when application of pressure to the accelerator pedal (or activation of an equivalent control) or release of the brake system will cause the electric power train to move the vehicle.		**"Active driving possible mode"** means the vehicle mode when application of pressure to the accelerator pedal (or activation of an equivalent control) or release of the brake system will cause the electric power train to move the vehicle.	
2.2	**"Barrier"** means the part providing protection against direct contact to the live parts from any direction of access.		**"Barrier"** means the part providing protection against direct contact to the live parts from any direction of access.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.4	**"Conductive connection"** means the connection using connectors to an external power supply when the rechargeable energy storage system (REESS) is charged.		**"Conductive connection"** means the connection using connectors to an external power supply when the rechargeable energy storage system (REESS) is charged.	
2.5	**"Coupling system for charging the rechargeable energy storage system (REESS)"** means the electrical circuit used for charging the REESS from an external electric power supply including the vehicle inlet.		**"Coupling system for charging the rechargeable energy storage system (REESS)"** means the electrical circuit used for charging the REESS from an external electric power supply including the vehicle inlet.	
2.7	**"Direct contact"** means the contact of persons with live parts.		**"Direct contact"** means the contact of persons with live parts.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.8	**"Electrical chassis"** means a set made of conductive parts electrically linked together, whose potential is taken as reference.		**"Electrical chassis"** means a set made of conductive parts electrically linked together, whose potential is taken as reference.	
2.9	**"Electrical circuit"** means an assembly of connected live parts which is designed to be electrically energized in normal operation.		**"Electrical circuit"** means an assembly of connected live parts which is designed to be electrically energized in normal operation.	
2.10	**"Electric energy conversion system"** means a system that generates and provides electric energy for electric propulsion.		**"Electric energy conversion system"** means a system that generates and provides electric energy for electric propulsion.	
2.11	**"Electric power train"** means the electrical circuit which includes the traction motor(s), and may include the REESS, the electric energy conversion system, the electronic converters, the associated wiring harness and connectors, and the coupling system for		**"Electric power train"** means the electrical circuit which includes the traction motor(s), and may include the REESS, the electric energy conversion system, the electronic converters, the associated wiring harness and connectors, and the coupling system for charging	

	charging the REESS.		the REESS.	
§	**UN ECE R100**	**Proposal from IMMA**	**Requirements category L**	**Comments**
2.12	**"Electronic converter"** means a device capable of controlling and/or converting electric power for electric propulsion.		**"Electronic converter"** means a device capable of controlling and/or converting electric power for electric propulsion.	
2.13	**"Enclosure"** means the part enclosing the internal units and providing protection against direct contact from any direction of access.		**"Enclosure"** means the part enclosing the internal units and providing protection against direct contact from any direction of access.	
2.15	**"Exposed conductive part"** means the conductive part which can be touched under the provisions of the protection degree IPXXB, and which becomes electrically energized under isolation failure conditions. This includes parts under a cover that can be removed without using tools.		**"Exposed conductive part"** means the conductive part which can be touched under the provisions of the protection degree IPXXB, and which becomes electrically energized under isolation failure conditions. This includes parts under a cover that can be removed without using tools.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.16	**"External electric power supply"** means an alternating current (AC) or direct current (DC) electric power supply outside of the vehicle.		**"External electric power supply"** means an alternating current (AC) or direct current (DC) electric power supply outside of the vehicle.	
2.19	**"High Voltage"** means the classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V DC or > 30 V and ≤ 1000 V AC root mean square (rms).		**"High Voltage"** means the classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V DC or > 30 V and ≤ 1000 V AC root mean square (rms).	
2.20	**"High voltage bus"** means the electrical circuit, including the coupling system for charging the REESS that operates on high voltage.		**"High voltage bus"** means the electrical circuit, including the coupling system for charging the REESS that operates on high voltage.	
2.21	**"Indirect contact"** means the contact of persons with exposed conductive parts.		**"Indirect contact"** means the contact of persons with exposed conductive parts.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.22	**"Live parts"** means conductive part(s) intended to be electrically energized in normal use.		**"Live parts"** means conductive part(s) intended to be electrically energized in normal use.	
2.23	"**Luggage compartment**" means the space in the vehicle for luggage accommodation, bounded by the roof, hood, floor, side walls, as well as by the barrier and enclosure provided for protecting the power train from direct contact with live parts, being separated from the passenger compartment by the front bulkhead or the rear bulk head.	**Ok for IMMA**	"**Luggage compartment**" • of category M and N vehicles means the space in the vehicle for luggage accommodation, bounded by the roof, hood, floor, side walls, as well as by the barrier and enclosure provided for protecting the power train from direct contact with live parts, being separated from the passenger compartment by the front bulkhead or the rear bulk head. • of category L1 to L5 [to L7] vehicles means the **en**closed space in the vehicle **intended** for luggage accommodation.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.25	**"On-board isolation resistance monitoring system"** means the device which monitors the isolation resistance between the high voltage buses and the electrical chassis.		**"On-board isolation resistance monitoring system"** means the device which monitors the isolation resistance between the high voltage buses and the electrical chassis.	
2.26	**“Open type traction battery"** means a liquid type battery requiring refilling with water and generating hydrogen gas released to the atmosphere.		**“Open type traction battery"** means a liquid type battery requiring refilling with water and generating hydrogen gas released to the atmosphere.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.27	**"Passenger compartment"** means the space for occupant accommodation, bounded by the roof, floor, side walls, doors, window glass, front bulkhead and rear bulkhead, or rear gate, as well as by the barriers and enclosures provided for protecting the power train from direct contact with live parts.	Ok for IMMA	**"Passenger compartment"** • for M and N category means the space for occupant accommodation, bounded by the roof, floor, side walls, doors, window glass, front bulkhead and rear bulkhead, or rear gate, as well as by the barriers and enclosures provided for protecting the power train from direct contact with live parts. for **L1 to L5 [to L7]** category means the passenger compartment is bounded by at least 4 of the following elements: the roof, floor, side walls, doors, window glass, front bulkhead and rear bulkhead, or rear gate, as well as by the barriers and enclosures provided for protecting the power train from direct contact with live parts.	
§	**UN ECE R100**	**Proposal from IMMA**	**Requirements category L**	**Comments**
2.28	**"Protection degree"** means the protection provided by a barrier/enclosure related to the contact with live parts		**"Protection degree"** means the protection provided by a barrier/enclosure related to the contact with live parts by a test probe, such as a test	

	by a test probe, such as a test finger (IPXXB) or a test wire (IPXXD), as defined in Annex 3.		finger (IPXXB) or a test wire (IPXXD), as defined in Annex 3.	
2.29	**"Rechargeable energy storage system (REESS)"** means the rechargeable energy storage system that provides electric energy for electrical propulsion.		**"Rechargeable energy storage system (REESS)"** means the rechargeable energy storage system that provides electric energy for electrical propulsion.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
		["Removable REESS ~~battery~~ for driving" means that the battery which the driver ~~rider~~ charges or replaces without using tools, and could be easily put on and taken off.]		May be discussed when REESS requirements for category L vehicles will be discussed.
2.31	**"Service disconnect"** means the device for deactivation of the electrical circuit when conducting checks and services of the REESS, fuel cell stack, etc.		**"Service disconnect"** means the device for deactivation of the electrical circuit when conducting checks and services of the REESS, fuel cell stack, etc.	
2.33	**"Solid insulator"** means the insulating coating of wiring harnesses provided in order to cover and protect the live parts against direct contact from any direction of access; covers for insulating the live parts of connectors, and varnish or paint for the purpose of insulation.		**"Solid insulator"** means the insulating coating of wiring harnesses provided in order to cover and protect the live parts against direct contact from any direction of access; covers for insulating the live parts of connectors, and varnish or paint for the purpose of insulation.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.37	**"Vehicle type"** means vehicles which do not differ in such essential aspects as: (a) Installation of the electric power train and the galvanically connected high voltage bus. (b) Nature and type of electric power train and the galvanically connected high voltage components.		**"Vehicle type"** means vehicles which do not differ in such essential aspects as: (a) Installation of the electric power train and the galvanically connected high voltage bus. (b) Nature and type of electric power train and the galvanically connected high voltage components.	
2.38	**"Working voltage"** means the highest value of an electrical circuit voltage root-mean-square (rms), specified by the manufacturer, which may occur between any conductive parts in open circuit conditions or under normal operating condition. If the electrical circuit is divided by galvanic isolation, the working voltage is defined for each divided circuit, respectively.		**"Working voltage"** means the highest value of an electrical circuit voltage root-mean-square (rms), specified by the manufacturer, which may occur between any conductive parts in open circuit conditions or under normal operating condition. If the electrical circuit is divided by galvanic isolation, the working voltage is defined for each divided circuit, respectively.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
3.1.	**PART I: APPROVAL OF A VEHICLE TYPE WITH REGARD TO THE HIGH VOLTAGE SYSTEM**		**PART I: APPROVAL OF A VEHICLE TYPE WITH REGARD TO ~~THE HIGH VOLTAGE SYSTEM~~ ELECTRICAL SAFETY, INCLUDING HIGH VOLTAGE SYSTEM**	
3.1.1.	The application for approval of a vehicle type with regard to specific requirements for the electric power train shall be submitted by the vehicle manufacturer or by his duly accredited representative.		The application for approval of a vehicle type with regard to specific requirements for the electric power train shall be submitted by the vehicle manufacturer or by his duly accredited representative.	
3.1.2.	It shall be accompanied by the under-mentioned documents in triplicate and following particulars:		It shall be accompanied by the under-mentioned documents in triplicate and following particulars:	
3.1.2.1.	Detailed description of the vehicle type as regards the electric power train and the galvanically connected high voltage bus.		Detailed description of the vehicle type as regards the electric power train and the galvanically connected high voltage bus.	
3.1.3.	A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service responsible for conducting the approval		A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service responsible for conducting the approval tests	

	tests			
5.	**REQUIREMENTS OF A VEHICLE WITH REGARD TO ITS ELECTRICAL SAFETY**		**REQUIREMENTS OF A VEHICLE WITH REGARD TO ITS ELECTRICAL SAFETY**	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1	**Protection against electrical shock** These electrical safety requirements apply to high voltage buses under conditions where they are not connected to external high voltage power supplies.		**Protection against electrical shock** These electrical safety requirements apply to high voltage buses under conditions where they are not connected to external high voltage power supplies.	
5.1.1.	**Protection against direct contact** The protection against direct contact with live parts shall comply with Paragraphs 5.1.1.1. and 5.1.1.2. These protections (solid insulator, barrier, enclosure, etc.) shall not be able to be opened, disassembled or removed without the use of tools.	**Protection against direct contact** The protection against direct contact with live parts shall comply with Paragraphs 5.1.1.1. and 5.1.1.2. and 5.1.1.3 These protections (solid insulator, barrier, enclosure, etc.) shall not be able to be opened, disassembled or removed without the use of tools.	**Protection against direct contact** The protection against direct contact with live parts shall comply with Paragraphs 5.1.1.1. and 5.1.1.2. These protections (solid insulator, barrier, enclosure, etc.) shall not be able to be opened, disassembled or removed without the use of tools.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.1.1.	For protection of live parts inside the passenger compartment or luggage compartment, the protection degree IPXXD shall be provided.		For protection of live parts inside the passenger compartment or luggage compartment, the protection degree IPXXD shall be provided.	
5.1.1.2.	For protection of live parts in areas other than the passenger compartment or luggage compartment, the protection degree IPXXB shall be satisfied.	***It may need to be clarified that this concerns only for vehicles that have a passenger compartment***	For protection of live parts in areas other than the passenger compartment or luggage compartment, the protection degree IPXXB shall be satisfied.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.1.3		**For vehicles of category L, without passenger compartment,** **….**		IMMA does not have a solution yet. IMMA did not prefer to introduce a solution with an R-point. IMMA will provide solution at the next RESS session or earlier.
§	**UN ECE R100**	**Proposal from IMMA**	**Requirements category L**	**Comments**
5.1.1.3.	Connectors (including vehicle inlet) are deemed to meet this requirement if: (a) they comply with 5.1.1.1. and 5.1.1.2. when separated without the use of tools, or (b) they are located underneath the floor and are provided with a locking mechanism, or (c) they are provided with a locking mechanism and other components shall be removed with the use of tools in order to separate		Connectors (including vehicle inlet) are deemed to meet this requirement if: (a) they comply with 5.1.1.1. and 5.1.1.2. when separated without the use of tools, or (b) they are located underneath the floor and are provided with a locking mechanism, or (c) they are provided with a locking mechanism and other components shall be removed with the use of tools in order to separate the	

	the connector, or (d) the voltage of the live parts becomes equal or below DC 60V or equal or below AC 30V (rms) within one second after the connector is separated.		connector, or (d) the voltage of the live parts becomes equal or below DC 60V or equal or below AC 30V (rms) within one second after the connector is separated.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.1.4.	**Service disconnect** For a service disconnect which can be opened, disassembled or removed without tools, it is acceptable if protection degree IPXXB is satisfied under a condition where it is opened, disassembled or removed without tools.		**Service disconnect** For a service disconnect which can be opened, disassembled or removed without tools, it is acceptable if protection degree IPXXB is satisfied under a condition where it is opened, disassembled or removed without tools.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.1.5.	**Marking**		**Marking**	
5.1.1.5.1.	In the case of a REESS having high voltage capability the symbol shown in Figure 1 shall appear on or near the REESS. The symbol background shall be yellow, the bordering and the arrow shall be black.		In the case of a REESS having high voltage capability the symbol shown in Figure 1 shall appear on or near the REESS. The symbol background shall be yellow, the bordering and the arrow shall be black.	
				
	Figure 1 - Marking of high voltage equipment		Figure 1 - Marking of high voltage equipment	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.1.5.2.	The symbol shall also be visible on enclosures and barriers, which, when removed expose live parts of high voltage circuits. This provision is optional to any connector for high voltage buses. This provision shall not apply to any of the following cases: (a) where barriers or enclosures cannot be physically accessed, opened, or removed; unless other vehicle components are removed with the use of tools (b) where barriers or enclosures are located underneath the vehicle floor.		The symbol shall also be visible on enclosures and barriers, which, when removed expose live parts of high voltage circuits. This provision is optional to any connector for high voltage buses. This provision shall not apply to any of the following cases: (a) where barriers or enclosures cannot be physically accessed, opened, or removed; unless other vehicle components are removed with the use of tools (b) where barriers or enclosures are located underneath the vehicle floor.	
5.1.1.5.3.	Cables for high voltage buses which are not located within enclosures shall be identified by having an outer covering with the colour orange.		Cables for high voltage buses which are not located within enclosures shall be identified by having an outer covering with the colour orange.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.2.	**Protection against indirect contact**		**Protection against indirect contact**	
5.1.2.1.	For protection against electrical shock which could arise from indirect contact, the exposed conductive parts, such as the conductive barrier and enclosure, shall be galvanically connected securely to the electrical chassis by connection with electrical wire or ground cable, or by welding, or by connection using bolts, etc. so that no dangerous potentials are produced.		For protection against electrical shock which could arise from indirect contact, the exposed conductive parts, such as the conductive barrier and enclosure, shall be galvanically connected securely to the electrical chassis by connection with electrical wire or ground cable, or by welding, or by connection using bolts, etc. so that no dangerous potentials are produced.	
5.1.2.2.	The resistance between all exposed conductive parts and the electrical chassis shall be lower than 0.1 ohm when there is current flow of at least 0.2 amperes. This requirement is satisfied if the galvanic connection has been established by welding.		The resistance between all exposed conductive parts and the electrical chassis shall be lower than 0.1 ohm when there is current flow of at least 0.2 amperes. This requirement is satisfied if the galvanic connection has been established by welding.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.2.3.	In the case of motor vehicles which are intended to be connected to the grounded external electric power supply through the conductive connection, a device to enable the galvanical connection of the electrical chassis to the earth ground shall be provided.	**In the case of motor vehicles which are intended to be connected to the grounded external electric power supply through the conductive connection, a device to enable the galvanical connection of the electrical chassis to the earth ground shall be provided.**	*Final requirements still to be agreed in RESS IG*	
		[In the following cases a galvanical connection of electrical chassis to the earth ground need not be provided: a) the vehicle which uses only a dedicated charger that is protected when a fault to a basic isolation arises b) the vehicle whose whole vehicle metallic body is protected when a fault	*Final requirements still to be agreed in RESS IG*	IMMA is waiting for the opinion from the RESS IG.

		to a basic isolation arises c) the vehicle which cannot be charged without removing the traction battery pack from the vehicle**].**		

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	The device should enable connection to the earth ground before exterior voltage is applied to the vehicle and retain the connection until after the exterior voltage is removed from the vehicle. Compliance to this requirement may be demonstrated either by using the connector specified by the car manufacturer, or by analysis.		The device should enable connection to the earth ground before exterior voltage is applied to the vehicle and retain the connection until after the exterior voltage is removed from the vehicle. Compliance to this requirement may be demonstrated either by using the connector specified by the car manufacturer, or by analysis.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.3.	**Isolation resistance**		**Isolation resistance**	
5.1.3.1.	**Electric power train consisting of separate Direct Current- or Alternating Current-buses** If AC high voltage buses and DC high voltage buses are galvanically isolated from each other, isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 100 Ω/volt of the working voltage for DC buses, and a minimum value of 500 Ω/volt of the working voltage for AC buses.		**Electric power train consisting of separate Direct Current- or Alternating Current-buses** If AC **[~~high voltage~~]** buses and DC **[~~high voltage~~]** buses are galvanically isolated from each other, isolation resistance between **[~~the~~ all]** high voltage bus**es** and the electrical chassis shall have a minimum value of 100 Ω/volt of the working voltage for DC buses, and a minimum value of 500 Ω/volt of the working voltage for AC buses.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	The measurement shall be conducted according to Annex 4A"Isolation resistance measurement method for vehicle based tests.		The measurement shall be conducted according to Annex 4A "Isolation resistance measurement method for vehicle based tests.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.3.2.	**Electric power train consisting of combined DC- and AC-buses** If AC high voltage buses and DC high voltage buses are galvanically connected isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 500 Ω/volt of the working voltage. However, if all AC high voltage buses are protected by one of the 2 following measures, isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 100 Ω/V of the working voltage:		**Electric power train consisting of combined DC- and AC-buses** If AC **[~~high voltage~~]** buses and DC **[~~high voltage~~]** buses are galvanically connected isolation resistance between **[~~he~~ all]** high voltage bus and the electrical chassis shall have a minimum value of 500 Ω/volt of the working voltage. However, if all AC high voltage buses are protected by one of the 2 following measures, isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 100 Ω/V of the working voltage:	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	(a) double or more layers of solid insulators, barriers or enclosures that meet the requirement in Paragraph 5.1.1. independently, for example wiring harness; (b) mechanically robust protections that have sufficient durability over vehicle service life such as motor housings, electronic converter cases or connectors; The isolation resistance between the high voltage bus and the electrical chassis may be demonstrated by calculation, measurement or a combination of both. The measurement shall be conducted according to Annex 4A "Isolation resistance measurement method for vehicle based tests.		a) double or more layers of solid insulators, barriers or enclosures that meet the requirement in Paragraph 5.1.1. independently, for example wiring harness; (b) mechanically robust protections that have sufficient durability over vehicle service life such as motor housings, electronic converter cases or connectors; The isolation resistance between the high voltage bus and the electrical chassis may be demonstrated by calculation, measurement or a combination of both. The measurement shall be conducted according to Annex 4A "Isolation resistance measurement method for vehicle based tests.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.3.3.	**Fuel cell vehicles** If the minimum isolation resistance requirement cannot be maintained over time, then protection shall be achieved by any of the following: (a) double or more layers of solid insulators, barriers or enclosures that meet the requirement in Paragraph 5.1.1 independently;		**Fuel cell vehicles** If the minimum isolation resistance requirement cannot be maintained over time, then protection shall be achieved by any of the following: (a) double or more layers of solid insulators, barriers or enclosures that meet the requirement in Paragraph 5.1.1 independently;	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	(b) on-board isolation resistance monitoring system together with a warning to the driver if the isolation resistance drops below the minimum required value. The isolation resistance between the high voltage bus of the coupling system for charging the REESS, which is not energized besides during charging the REESS, and the electrical chassis need not be monitored. The function of the on-board isolation resistance monitoring system shall be confirmed as described in Annex 5.		(b) on-board isolation resistance monitoring system together with a warning to the driver/rider as applicable if the isolation resistance drops below the minimum required value. The isolation resistance between the high voltage bus of the coupling system for charging the REESS, which is not energized besides during charging the REESS, and the electrical chassis need not be monitored. The function of the on-board isolation resistance monitoring system shall be confirmed as described in Annex 5.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.1.3.4.	**Isolation resistance requirement for the coupling system for charging the REESS** For the vehicle inlet intended to be conductively connected to the grounded external AC power supply and the electrical circuit that is galvanically connected to the vehicle inlet during charging of the REESS, the isolation resistance between the high voltage bus and the electrical chassis shall be at least 1 MΩ when the charger coupler is disconnected. During the measurement, the traction battery may be disconnected.	**Isolation resistance requirement for the coupling system for charging the REESS** For the vehicle inlet ~~**and for a**~~ **in addition to a recharge cable if permanently connected to the vehicle of cat L,** …	**Isolation resistance requirement for the coupling system for charging the REESS** For the vehicle inlet **and for a recharge cable if permanently connected to the vehicle of cat L,** intended to be conductively connected to the grounded external AC power supply and the electrical circuit that is galvanically connected to the vehicle inlet **or to the recharge cable** during charging of the REESS, the isolation resistance between the high voltage bus and the electrical chassis shall be at least 1 MΩ when the charger coupler is disconnected. During the measurement, the traction battery may be disconnected.	**Change into: in addition to**
§	**UN ECE R100**	**Proposal from IMMA**	**Requirements category L**	**Comments**
5.2	**Rechargeable energy**		**Rechargeable energy**	

	storage system (REESS)		**storage system (REESS)**	
5.2.1.	**Protection against Excessive Current** The RESS shall not overheat. If the REESS is subject to overheating due to excessive current, it shall be equipped with a protective device such as fuses, circuit breakers or main contactors. However, the requirement may not apply if the manufacturer supplies data that ensure that overheating from excessive current is prevented without the protective device.		**Protection against Excessive Current** The RESS shall not overheat. If the REESS is subject to overheating due to excessive current, it shall be equipped with a protective device such as fuses, circuit breakers or main contactors. However, the requirement may not apply if the manufacturer supplies data that ensure that overheating from excessive current is prevented without the protective device.	**This paragraph has to be considered again when the REESS requirements for category L vehicles will be discussed.**

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.2.2.	**Accumulation of gas** Places for containing open type traction batteries that may produce hydrogen gas shall be provided with a ventilation fan or a ventilation duct to prevent the accumulation of hydrogen gas.	Accumulation of gas Places for containing open type traction batteries that may produce hydrogen gas shall be provided with a ventilation fan or a ventilation duct or any other suitable means to prevent the accumulation of hydrogen gas. Vehicles with open type framework that do not allow accumulation of hydrogen gas at such places are not required to have a ventilation fan or a ventilation duct.	Accumulation of gas Places for containing open type traction batteries that may produce hydrogen gas shall be provided with a ventilation fan or a ventilation duct to prevent the accumulation of hydrogen gas. Vehicles with open type framework that do not allow accumulation of hydrogen gas at such places are not required to have a ventilation fan or a ventilation duct.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.2.3			Protection against electrolyte spills (L-category vehicles only) L category vehicles shall foresee that no spilled electrolyte from the REESS and its components shall reach the driver/rider as applicable nor any person around the vehicle during normal condition of use and/or functional operation. Also, L category vehicles shall foresee that electrolyte shall not spill from the vehicle when the vehicle is tilted to the ground or when the REESS is put upside-down.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.2.4			Accidental or unintentional detachment (L-category vehicles only) The REESS and its components shall be installed in the vehicle in such a way so as to preclude the possibility of inadvertent or unintentional detachment of the REESS. The REESS and its components in L-category vehicles shall not be ejected when the vehicle is tilted to the ground or when the REESS is put upside-down.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.3.	**Functional safety** At least a momentary indication shall be given to the driver when the vehicle is in "active driving possible mode". However, this provision does not apply under conditions where an internal combustion engine provides directly or indirectly the vehicle´s propulsion power. When leaving the vehicle, the driver shall be informed by a signal (e.g. optical or audible signal) if the vehicle is still in the active driving possible mode.		**Functional safety** At least a momentary indication shall be given to the driver/rider as applicable when the vehicle is in "active driving possible mode". However, this provision does not apply under conditions where an internal combustion engine provides directly or indirectly the vehicle´s propulsion power. When leaving the vehicle, the driver/rider as applicable shall be informed by a signal (e.g. optical or audible signal) if the vehicle is still in the active driving possible mode.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	
	If the on-board REESS can be externally charged by the user, vehicle movement by its own propulsion system shall be impossible as long as the connector of the external electric power supply is physically connected to the vehicle inlet. This requirement shall be demonstrated by using the connector specified by the car manufacturer.		If the on-board REESS can be externally charged by the user, vehicle movement by its own propulsion system shall be impossible as long as the connector of the external electric power supply is physically connected to the vehicle inlet. For an L-cat vehicle, with a permanently connected charge cable, the requirement above is not applicable if using the cable to charge the vehicle prevents the use of the vehicle (e.g. seat cannot be closed, cable disturb the rider to sit, cable disturb the rider to step-in) This requirement shall be demonstrated by using the connector specified by the vehicle manufacturer.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	If fitted the state of the drive direction control unit shall be identified to the driver		If a vehicle is equipped with a drive direction control unit the state of this unit shall be identified to the driver/rider as applicable. or as an alternative If fitted the state of the drive direction control unit shall be identified to the driver/rider as applicable	
		Paragraph 5.3.1 shall only be applicable to L-category vehicles.		Comment from the Secretary: This text has to become the introduction of § 5.3.1
		5.3.1. Propulsion system, power-on/power-off procedure	**5.3.1. Additional functional safety requirements for L-category vehicles.**	Wording of complete § 5.3.1 with its sup-paragraphs have to be checked by the RESS members.

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
			5.3.1.1. At the start-up ~~For the power-on procedure of the vehicle propulsion system~~ in order to select the active driving possible mode at least two deliberate and distinctive actions shall be performed by the driver ~~in order to go from the power-off mode to the active driving possible mode~~	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
			5.3.1.2. Only a single action shall be required to deactivate the active driving possible mode.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
		5.3.1.3. Driving with reduced power	5.3.1.3. Driving with reduced power	
			5.3.1.3.1. Indication of reduced power If the electric propulsion system is equipped with a means to automatically reduce the vehicle propulsion power, a reduction that has significant impact on the **[**acceleration and drivability**], [**evaluated by the Technical Service together with the manufacturer**]**, shall be indicated to the driver/rider as applicable. The system has to be described in Annex 6.	IMMA could not find an adequate solution to clarify "significant" and relevant impact on vehicle driving performance‘. IMMA proposes alternative text, which is to be confirmed by IMMA

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
			5.3.1.3.2. Indication of SOC of REESS When a ~~low~~ SOC ~~in~~ of the REESS has a ~~relevant impact~~ significant impact on the **[**acceleration and drivability**],** **[**evaluated by the Technical Service together with the manufacturer**],** ~~should~~ shall be indicated to the ~~rider~~ driver/rider as applicable. ~~on vehicle driving it performance a low energy content of the REESS shall be indicated to the rider driver~~ by an obvious device, (e.g. a visual or audible signal). **[**The indicator used for 5.3.1.3.1. may be used.**]**	IMMA could not find an adequate solution to clarify "significant" and ‚relevant impact on vehicle driving performance‘. IMMA will propose an updated solution as soon as possible or propose to cancel the text.

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
			5.3.1.4. Driving or riding backwards It shall not be possible to activate the vehicle reverse control function whilst the vehicle is in forward motion.	
§	**UN ECE R100**	**Proposal from IMMA**	**Requirements category L**	**Comments**
5.4.	**Determination of hydrogen emissions**		**Determination of hydrogen emissions**	
5.4.1.	This test shall be carried out on all vehicles equipped with open type traction batteries.		This test shall be carried out on all vehicles equipped with open type traction batteries.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.4.2.	The test shall be conducted following the method described in Annex 7 to the present Regulation. The hydrogen sampling and analysis shall be the ones prescribed. Other analysis methods can be approved if it is proven that they give equivalent results.		The test shall be conducted following the method described in Annex 7 to the present Regulation. The hydrogen sampling and analysis shall be the ones prescribed. Other analysis methods can be approved if it is proven that they give equivalent results.	
5.4.3.	During a normal charge procedure in the conditions given in Annex 7, hydrogen emissions shall be below 125 g during 5 h, or below 25 x t_2 g during t_2 (in h).		During a normal charge procedure in the conditions given in Annex 7, hydrogen emissions shall be below 125 g during 5 h, or below 25 x t_2 g during t_2 (in h).	
5.4.4.	During a charge carried out by a ~~**on-board**~~ charger presenting a failure (conditions given in Annex 7), hydrogen emissions shall be below 42 g. Furthermore the ~~**on-board**~~ charger shall limit this possible failure to 30 minutes.		During a charge carried out by a charger presenting a failure (conditions given in Annex 7), hydrogen emissions shall be below 42 g. Furthermore the charger shall limit this possible failure to 30 minutes.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.4.5.	All the operations linked to the **~~battery~~ REESS** charging **~~are~~ shall be** controlled automatically, included the stop for charging.		All the operations linked to the REESS charging shall be controlled automatically, included the stop for charging.	
5.4.6.	It shall not be possible to take a manual control of the charging phases.		It shall not be possible to take a manual control of the charging phases.	
5.4.7.	Normal operations of connection and disconnection to the mains or power cuts shall not affect the control system of the charging phases.		Normal operations of connection and disconnection to the mains or power cuts shall not affect the control system of the charging phases.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
5.4.8.	Important charging failures shall be permanently **indicated** ~~**signaled to the driver.**~~ An important failure is a failure that can lead to a ~~**disfunctioning**~~ **malfunction** of the ~~**on-board**~~ charger during charging later on.		Important charging failures shall be permanently indicated. An important failure is a failure that can lead to a malfunction of the charger during charging later on.	
5.4.9.	The manufacturer shall indicate in the owner's manual, the conformity of the vehicle to these requirements.		The manufacturer shall indicate in the owner's manual, the conformity of the vehicle to these requirements.	
5.4.10	The approval granted to a vehicle type relative to hydrogen emissions can be extended to different vehicle types belonging to the same family, in accordance with the definition of the family given in Annex 7, Appendix 2.		The approval granted to a vehicle type relative to hydrogen emissions can be extended to different vehicle types belonging to the same family, in accordance with the definition of the family given in Annex 7, Appendix 2.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
Annex 3	**PROTECTION AGAINST DIRECT CONTACTS OF PARTS UNDER VOLTAGE**		**PROTECTION AGAINST DIRECT CONTACTS OF PARTS UNDER VOLTAGE**	
1.	**Access probes**		**Access probes**	
	Access probes to verify the protection of persons against access to live parts are given in table 1.		Access probes to verify the protection of persons against access to live parts are given in table 1.	
2.	**Test conditions**		**Test conditions**	
	The access probe is pushed against any openings of the enclosure with the force specified in table 1. If it partly or fully penetrates, it is placed in every possible position, but in no case shall the stop face fully penetrate through the opening. Internal barriers are considered part of the enclosure		The access probe is pushed against any openings of the enclosure with the force specified in table 1. If it partly or fully penetrates, it is placed in every possible position, but in no case shall the stop face fully penetrate through the opening. Internal barriers are considered part of the enclosure	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	A low-voltage supply (of not less than 40 V and not more than 50 V) in series with a suitable lamp should be connected, if necessary, between the probe and live parts inside the barrier or enclosure. The signal-circuit method should also be applied to the moving live parts of high voltage equipment. Internal moving parts may be operated slowly, where this is possible.		A low-voltage supply (of not less than 40 V and not more than 50 V) in series with a suitable lamp should be connected, if necessary, between the probe and live parts inside the barrier or enclosure. The signal-circuit method should also be applied to the moving live parts of high voltage equipment. Internal moving parts may be operated slowly, where this is possible.	
3.	**Acceptance conditions**		**Acceptance conditions**	
	The access probe shall not touch live parts. If this requirement is verified by a signal circuit between the probe and live parts, the lamp shall not light.		The access probe shall not touch live parts. If this requirement is verified by a signal circuit between the probe and live parts, the lamp shall not light.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	In the case of the test for IPXXB, the jointed test finger may penetrate to its 80 mm length, but the stop face (diameter 50 mm x 20 mm) shall not pass through the opening. Starting from the straight position, both joints of the test finger shall be successively bent through an angle of up to 90 degree with respect to the axis of the adjoining section of the finger and shall be placed in every possible position. In case of the tests for IPXXD, the access probe may penetrate to its full length, but the stop face shall not fully penetrate through the opening.		In the case of the test for IPXXB, the jointed test finger may penetrate to its 80 mm length, but the stop face (diameter 50 mm x 20 mm) shall not pass through the opening. Starting from the straight position, both joints of the test finger shall be successively bent through an angle of up to 90 degree with respect to the axis of the adjoining section of the finger and shall be placed in every possible position. In case of the tests for IPXXD, the access probe may penetrate to its full length, but the stop face shall not fully penetrate through the opening.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
Table 1	**- Access probes for the tests for protection of persons against access to hazardous parts**		**- Access probes for the tests for protection of persons against access to hazardous parts**	
	Drawing see document GRSP-51-11		Drawing see document GRSP-51-11	
Figure 1	**- Jointed test finger**		**- Jointed test finger**	
	Drawing see document GRSP-51-11		Drawing see document GRSP-51-11	
	Material: metal, except where otherwise specified Linear dimensions in millimeters Tolerances on dimensions without specific tolerance: (a) on angles: 0/-10° (b) on linear dimensions: up to 25 mm: 0/-0.05 mm over 25 mm: ±0.2 mm Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0 to +10° tolerance.		Material: metal, except where otherwise specified Linear dimensions in millimeters Tolerances on dimensions without specific tolerance: (a) on angles: 0/-10° (b) on linear dimensions: up to 25 mm: 0/-0.05 mm over 25 mm: ±0.2 mm Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0 to +10° tolerance.	

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
Annex 4A	ISOLATION RESISTANCE MEASUREMENT METHOD **FOR VEHICLE BASED TESTS**			
1.	**General**			
	The isolation resistance for each high voltage bus of the vehicle shall be measured or shall be determined by calculation using measurement values from each part or component unit of a high voltage bus (hereinafter referred to as the "divided measurement").			
2.	**Measurement method**			
	The isolation resistance measurement shall be conducted by selecting an appropriate measurement method from among those listed in Paragraphs 2.1. through 2.2., depending on the electrical charge of the live parts or the isolation resistance, etc.			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	The range of the electrical circuit to be measured shall be clarified in advance, using electrical circuit diagrams, etc. Moreover, modification necessary for measuring the isolation resistance may be carried out, such as removal of the cover in order to reach the live parts, drawing of measurement lines, change in software, etc. In cases where the measured values are not stable due to the operation of the on-board isolation resistance monitoring system, etc., necessary modification for conducting the measurement may be carried out, such as stopping of the operation of the device concerned or			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	removing it. Furthermore, when the device is removed, it shall be proven, using drawings, etc., that it will not change the isolation resistance between the live parts and the electrical chassis. Utmost care shall be exercised as to short circuit, electric shock, etc., for this confirmation might require direct operations of the high-voltage circuit.			
2.1	Measurement method using ~~**DC**~~ voltage from off-vehicle sources			
2.1.1	**Measurement instrument**			
	An isolation resistance test instrument capable of applying a DC voltage higher than the working voltage of the high voltage bus shall be used.			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.1.2	**Measurement method**			
	An insulator resistance test instrument shall be connected between the live parts and the electrical chassis. Then, the isolation resistance shall be measured by applying a DC voltage at least half of the working voltage of the high voltage bus. If the system has several voltage ranges (e.g. because of boost converter) in galvanically connected circuit and some of the components cannot withstand the working voltage of the entire circuit, the isolation resistance between those components and the electrical chassis can be measured separately by applying at least half of their own working voltage with those component disconnected.			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.2	Measurement method using the vehicle's own **REESS** as DC voltage source			
2.2.1	**Test vehicle conditions**			
	The high voltage-bus shall be energized by the vehicle's own **REESS** and/or energy conversion system and the voltage level of the **REESS** and/or energy conversion system throughout the test shall be at least the nominal operating voltage as specified by the vehicle manufacturer.			
2.2.2.	**Measurement instrument**			
	The voltmeter used in this test shall measure DC values and shall have an internal resistance of at least 10 MΩ.			
2.2.3.	**Measurement method**			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.2.3.1.	**First step**			
	The voltage is measured as shown in Figure 1 and the high voltage bus voltage (Vb) is recorded. Vb shall be equal to or greater than the nominal operating voltage of the **REESS** and/or energy conversion system as specified by the vehicle manufacturer			
Figure 1	**-** Measurement of Vb, V1, V2			
	Drawing see document GRSP-51-11			
2.2.3.2.	**Second step**			
	Measure and record the voltage (V1) between the negative side of the high voltage bus and the electrical chassis (see Figure 1).			
2.2.3.3	**Third step**			
	Measure and record the voltage (V2) between the positive side of the high voltage bus and the electrical chassis (see Figure 1).			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
2.2.3.4.	**Fourth step**			
	If V1 is greater than or equal to V2, insert a standard known resistance (Ro) between the negative side of the high voltage bus and the electrical chassis. With Ro installed, measure the voltage (V1') between the negative side of the high voltage bus and the electrical chassis (see Figure 2). Calculate the electrical isolation (Ri) according to the following formula: Ri = Ro*(Vb/V1' – Vb/V1) or Ri = Ro*Vb*(1/V1' – 1/V1)			
Figure 2	- Measurement of V1'			
	Drawing see document GRSP-51-11			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	If V2 is greater than V1, insert a standard known resistance (Ro) between the positive side of the high voltage bus and the electrical chassis. With Ro installed, measure the voltage (V2') between the positive side of the high voltage bus and the electrical chassis (see Figure 3). Calculate the electrical isolation (Ri) according to the formula shown. Divide this electrical isolation value (in Ω) by the nominal operating voltage of the high voltage bus (in volts). Calculate the electrical isolation (Ri) according to the following formula: Ri = Ro*(Vb/V2' – Vb/V2) or Ri = Ro*Vb*(1/V2' – 1/V2)			
Figure 3	- Measurement of V2'			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
	Drawing see document GRSP-51-11			
2.2.3.5.	**Fifth step**			
	The electrical isolation value Ri (in Ω) divided by the working voltage of the high voltage bus (in volts) results in the isolation resistance (in Ω/V). NOTE 1: The standard known resistance Ro (in Ω) should be the value of the minimum required isolation resistance (in Ω/V) multiplied by the working voltage of the vehicle plus/minus 20 per cent (in volts). Ro is not required to be precisely this value since the equations are valid for any Ro; however, a Ro value in this range should provide good resolution for the voltage measurements.			

§	UN ECE R100	Proposal from IMMA	Requirements category L	Comments
Annex 5	**CONFIRMATION METHOD FOR FUNCTIONS OF ON-BOARD ISOLATION RESISTANCE MONITORING SYSTEM**			
	The function of the on-board isolation resistance monitoring system shall be confirmed by the following method: Insert a resistor that does not cause the isolation resistance between the terminal being monitored and the electrical chassis to drop below the minimum required isolation resistance value. The warning shall be activated.			
Annex 7	See document GRSP-51-11			