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Electric vehicle conductive charging and discharging system - Part 4: Discharging requirements for electric vehicle

电动汽车传导充放电系统 第4部分：车辆对外放电要求

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Table of Contents

1 Scope

This document specifies the classification, the general requirements, the communication, the requirements for the conductive connection assembly, the requirements for the electrical loads, the other safety requirements for the discharging vehicle, the environmental requirements and the marking for conductive discharging systems of electric vehicles.

It applies to electric vehicles that discharge through the vehicle coupler at up to 250 V single-phase or 440 V three-phase alternating current, and up to 1 000 V direct current. It applies to vehicles of category M1 only.

It does not cover discharging through internal outlets such as the cigarette lighter socket, USB ports or GB/T 1002 sockets, nor the supply of special equipment such as medical devices.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition, including all amendments, applies.

GB/T 2423.7-2018 Environmental testing - Part 2: Test Ec: Rough handling shocks · GB/T 2900.33 Electrotechnical terminology - Power electronics · GB/T 16895.3 Low-voltage electrical installations - Part 5-54: Earthing arrangements and protective conductors · GB/T 16935.1-2023 Insulation coordination for equipment within low-voltage systems - Part 1 · GB/T 17045 Protection against electric shock - Common aspects for installation and equipment · GB 18384-2020 Electric vehicles - Safety requirements · GB/T 18487.1-2023 Electric vehicle conductive charging system - Part 1: General requirements · GB/T 19596 Terminology of electric vehicles · GB/T 20234.1-2023 Connection set for conductive charging of electric vehicles - Part 1: General requirements · GB/T 20234.2-2015 Connection set for conductive charging of electric vehicles - Part 2: AC charging coupler · GB/T 20234.3-2023 Connection set for conductive charging of electric vehicles - Part 3: DC charging coupler · GB/T 38661-2020 Technical specifications of battery management system for electric vehicles · GB 50052-2009 Code for design of electric power supply systems

3 Terms and definitions

For the purposes of this document the following terms and definitions apply, together with those of GB/T 19596 and GB/T 29317-2021.

3.1 discharging equipment. 3.2 charging and discharging equipment. 3.3 vehicle to load, V2L. 3.4 vehicle to vehicle, V2V. 3.5 vehicle to grid, V2G.

3.6 discharging vehicle. The electric vehicle that supplies energy outwards. 3.7 bi-directional on-board charger. 3.8 conductive connection assembly. 3.9 intelligent load. 3.10 discharging control pilot circuit. 3.11 dedicated DC electrical equipment.

4 Classification

Equipment is classified by the nature of the output, alternating or direct current; by the discharging output voltage; and by the discharging output current.

Alternating-current discharging is at single-phase 220 V or three-phase 380 V, 50 Hz. For direct-current vehicle-to-load discharging the preferred voltage bands are 75 V to 150 V, 150 V to 350 V, 300 V to 500 V, 450 V to 700 V and 750 V to 1 000 V.

5 General requirements

5.1 Three discharge modes are defined. In AC V2L the vehicle supplies a load directly through the interface of GB/T 20234.2-2015, at up to 32 A single-phase or 63 A three-phase, with continuous monitoring of the protective earth and of the insulation, loads of class I or class II as defined in GB/T 17045, and the control pilot circuit of Annex A. AC V2V uses the same limits and interface with the control pilot circuit of Annex B. DC V2L supplies dedicated direct-current equipment, with equipotential bonding to the enclosure of that equipment, insulation monitoring, and the control pilot circuit of Annex C.

5.2 The insulation thresholds are graded. For direct current, above 500 ohm per volt the state is safe; between 100 and 500 ohm per volt the system raises an alarm but may continue; at or below 100 ohm per volt it stops. For alternating current, above 500 ohm per volt is safe and at or below that value the system is in fault.

Discharging shall never start automatically when the connector is plugged in: the owner has to authorise it, through the anti-theft release, the high-voltage enable or a setting in the application.

The equipment shall cut the power when the pilot signal is interrupted, shall monitor voltage and current in real time with protection against overvoltage, undervoltage and overcurrent, shall detect short circuits in alternating current, and shall protect against over-temperature at the socket - always in direct current, and above 16 A in alternating current. Loss of continuity of the protective earth shall cut the supply within 100 ms.

After disconnection the residual voltage shall fall below 60 V DC or 30 V AC rms within one second for a socket that is not IPXXB, or within five seconds for one that is, unless the stored energy is below 0.2 J.

5.3 In alternating current the output is 220 V or 380 V at 50 Hz, with a voltage accuracy of 5 %, a defined frequency tolerance, a limit on total harmonic distortion and a stated overload capability.

6 Communication

Direct-current vehicle-to-load discharging requires digital communication, whose protocol is given in Annex D. Alternating-current vehicle-to-load and vehicle-to-vehicle discharging are controlled through the pilot circuits of Annexes A and B.

7 Requirements for the conductive connection assembly

The cable for vehicle-to-vehicle discharging follows Clause 6 of GB/T 20234.1-2023 and is subjected to the drop test of GB/T 2423.7-2018. Its length shall not exceed 7.5 m. The cable is shielded over the full circumference and the shield is bonded to the protective earth at both plugs; the pilot circuit is that of Figure B.1 and the current-carrying capacity is given in Table B.1.

8 Special requirements for electrical loads

8.1 Loads supplied in AC V2L accept an input of up to 250 V or 440 V, are protected against undervoltage and have a protective earth conductor in accordance with GB/T 16895.3.

8.2 Dedicated direct-current equipment shall confirm the connection, provide start and stop switches and never start by itself, monitor the current and the protective earth, have a protective earth terminal, manage the cable in accordance with 11.6 of GB/T 18487.1-2023, reach IP32 indoors and IP54 outdoors, lock the vehicle plug electronically, provide an emergency stop, and keep class B circuits isolated from the protective earth and the input isolated from the output.

9 Other safety requirements for the discharging vehicle

9.1 The vehicle shall allow the supply to be cut remotely, for instance from a mobile application, which also releases the electronic lock of the socket.

9.2 In direct-current vehicle-to-load discharging the vehicle shall detect welding of the contactors, following the method of Annex C.

10 Environmental requirements

The equipment operates between -20 degrees Celsius and +50 degrees Celsius, with a 24-hour average not above 35 degrees, at a relative humidity between 5 % and 95 %, and at an altitude up to 2 000 m; above that altitude the clearances follow GB/T 16935.1-2023. Outdoor use during thunderstorms, rain or snow is to be avoided.

11 Marking and instructions

Cables for vehicle-to-vehicle discharging carry the high-voltage warning required by 5.1.2.1 of GB 18384-2020, and the product is accompanied by instructions for the user.