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**General requirements for swapping battery pack cooling
connector of electric vehicle**

电动汽车快速更换电池箱冷却接口 通用技术要求

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General requirements for swapping battery pack cooling connector of electric vehicle

1 Scope

This document specifies the general requirements, test methods, inspection rules, and requirements for marking, packaging, transportation, and storage of the swappable battery pack liquid-cooled cooling connector of electric vehicle (referred to as the cooling connector).

This document applies to the swappable battery pack liquid-cooled cooling connector of electric vehicle, and does not apply to air-cooled and other cooling connectors.

2 Normative references

The following documents are normatively referenced in this document and are indispensable for its application. For dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB/T 191, Packaging - Pictorial marking for handling of goods

GB/T 4208-2017, Degrees of protection provided by enclosure (IP code)

GB/T 11918.1-2014, Plugs, socket-outlet and couplers for industrial purposes - Part 1: General requirements

GB/T 19596, Terminology of electric vehicles

GB/T 20082, Hydraulic fluid power - Fluid contamination - Determination of particulate contamination by the counting method using an optical microscope

GB/T 29317, Terminology of electric vehicle charging/battery swap infrastructure

GB/T 32879-2016, General technical requirements for battery box connectors for replacement of electric vehicles

GB 38031-2020, Electric vehicles traction battery safety requirements

3 Terms and definitions

Terms and definitions determined by GB/T 19596, GB/T29317 and GB/T 32879-2016, as well as the following, are applicable to this document.

3.1 Swappable battery pack cooling connector

The fluid connector – realizing the conduction of coolant between the battery pack and the electric vehicle, or between the battery pack and the charging rack – which is composed of a cooling coupler plug and a cooling coupler socket-outlet.

3.2 Cooling coupler plug

The part – of the swappable battery pack cooling connector – that is connected with the battery pack.

3.3 Cooling coupler socket-outlet

The part – of the swappable battery pack cooling connector – that is connected with the electric vehicle or the charging rack.

3.4 Insertion and extraction endurance

The insertion-and-extraction coupling times of the cooling coupler plug and the cooling coupler socket-outlet within the specified performance range.

4 General requirements

4.1 Functional structure requirements

The cooling connector shall meet the following functional structure requirements:

- a) Accessible surfaces of the cooling connector shall be free of burrs, flashes and similar sharp edges.
- b) The cooling coupler plug and socket-outlet – before being installed and used – shall be provided with a dust cover.
- c) The cooling coupler plug and socket-outlet shall have a dust-proof function during the coupling process.
- d) The cooling coupler plug and socket-outlet shall have the function of a stop valve.
- e) When the cooling coupler plug is connected to the socket-outlet, the fluid shall be connected and there shall be no leakage after coupling.

- c) After the plug is uncoupled from the socket, the floating mechanism shall be able to reset automatically.
- d) The mechanical connection shall be free from loosening.

Note: The insertion and extraction of the cooling connector shall be counted as one cycle.

4.9 Vibration requirements

The cooling connector shall meet the requirements of reliable connection, intact structure, no looseness and no leakage during and after the vibration test.

4.10 Shock requirements

The cooling connector shall meet the requirements of reliable connection, intact structure, no looseness and no leakage during and after the shock test.

4.11 Protection level

The protection level of the cooling connector shall meet the requirements of IP67 in both coupled and uncoupled states.

4.12 Guiding and floating function

The guiding function and floating range of the cooling connector shall meet the following requirements:

- a) When the cooling coupler plug and socket are coupled, they shall have the function of guiding and floating. When coupling, the position deviation shall be automatically corrected to ensure accurate connection; the guiding mechanism shall be able to correct the position deviation of not less than 5 mm in the vertical coupling direction, and the guiding mechanism shall be able to correct the angular deviation of the coupling direction not less than 1°.
- b) The floating follower mechanism shall be able to follow a position offset of not less than 5 mm along the coupling direction.
- c) The floating follower mechanism shall be able to follow a position offset of not less than 5 mm along the vertical coupling direction.
- d) The floating follower mechanism shall be able to follow an angular offset not less than 1°.
- e) The floating mechanism shall be able to reset automatically when the cooling coupler plug is disconnected from the socket-outlet.

4.13 Corrosion resistance and rust prevention

The corrosion resistance and rust prevention of the cooling connector shall comply with the provisions in Chapter 28 of GB/T 11918.1-2014.

4.14 Cleaning requirements

The soluble matter and solid residue on the inner surface of the connector can be cleaned by solvent, and the maximum particle size of the inner wall shall be less than 800 μm .

4.15 Connection requirements for cooling coupler plug and socket

The connection between the cooling coupler plug and socket shall meet the following requirements:

- a) The cooling connector supports quick insertion and extraction by mechanical equipment.
- b) During the coupling process of the cooling connector, there shall not be more than 0.5 mL of liquid cooling leakage.
- c) When the cooling connector is connected, there shall be no leakage.
- d) During the coupling process of the cooling connector and the driving process of the vehicle, there shall be no abnormal mechanical noise at the coupling of the cooling connector.

5 Test methods

5.1 Test conditions

The test conditions shall be based on the following benchmarks:

- a) Unless otherwise specified, the test specimen shall be tested under the conditions of an ambient temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and a relative humidity of 5% ~ 95%.
- b) All test instruments and equipment shall have sufficient accuracy. The accuracy shall be at least one order of magnitude higher than the accuracy of the measured index; alternatively, the error shall be less than 1/3 of the allowable error of the measured parameter.

5.2 Environmental testing

The high and low temperature alternating test shall be carried out according to 8.2.8 in GB 38031-2020.

The damp and hot cycling test shall be performed according to 8.2.5 in GB 38031-2020.

6.4 Judgment of conformity

The type inspection and ex-factory inspection items shall meet the requirements in Table 1. Only when the test items of each category meet the requirements can the product be judged qualified, otherwise it will be judged unqualified.

7 Marking, packaging, transportation and storage

7.1 Marking

The marking shall be clear, conspicuous, firm and reliable. The content shall include:

- a) manufacturer's name and trademark.
- b) product model, name.
- c) the year and month of product manufacture.
- d) number or serial number of the product.

7.2 Packaging

Product packaging shall meet the requirements of GB/T 191.

7.3 Transportation

During transportation, the cooling connector shall not be subject to severe mechanical impact, or exposure to the sun or rain. During the loading and unloading process, the products shall be handled with care, and throwing and heavy pressure are strictly prohibited.

7.4 Storage

The cooling connector shall be stored in a dry, clean, and well-ventilated room where the surrounding air does not contain acidic or other corrosive and explosive substances. They shall not be exposed to direct sunlight, and the distance from the heat source shall not be less than 2 m; they shall not be under heavy pressure. During storage, they shall not be exposed to rain, sun, condensation and frost.

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