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GB/T 20234.4—2022

Connection set of conductive charging for electric vehicles-Part 4: High power DC charging coupler

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Contents

Foreword

This Document is drafted in accordance with the provisions given in GB/T 1.1—2020 *Directives for Standardization—Part 1: Rules for the Structure and Drafting of Standardizing Documents*.

This Document is part 4 of GB/T 20234 *Connection set of conductive charging for electric vehicles*. The following parts of GB/T 20234 have been promulgated:

——Part 1: General requirements;

——Part 2: AC charging coupler;

——Part 3: DC charging coupler.

This document is proposed by XXX.

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Main drafters of this Document:

Connection Set of Conductive Charging for Electric Vehicles - Part 4: High-power DC Charging Coupler (ChaoJi cable assembly)

1 Scope

This Document specifies the composition, coupler function and layout, structure size, technical requirements, test method, identification, etc. of the connection set of conductive DC charging for electric vehicles, as well as the definitions, requirements, test methods, and inspection rules of adapters.

This Document applies to the connection set of conductive DC charging for electric vehicles, with rated voltage no more than 1500V (DC). The adapters apply to the vehicle Inlet interface in GB/T 20234.3 and the vehicle connector interface in GB/T 20234.4.

2 Normative References

The following normative documents contain contents which, through reference in this text, constitute indispensable provisions of this standard. For the dated references, only the version corresponding to the date is applicable to this Document; for the undated references, the latest version (including all amendments) is applicable to this Document.

GB/T 2951.11	Common test methods for insulating and sheathing materials of electric and optical cables - Part 11: Methods for general application-measurements of thickness and overall dimensions - Tests for determining the mechanical properties
GB/T 4208	Degrees of Protection Provided by Enclosure (IP code)
GB/T 5013.4	Rubber insulated cables of rated voltages up to and including 450/750V - Part 4: Cords and flexible cables
GB/T 5023	(All parts) Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V
GB/T 11918.1—2014	Plugs, socket-outlets and couplers for industrial purposes—Part 1: General requirements
GB/T 18487.1—2022	Electric vehicle conductive charging system - Part 1: General requirements
GB/T 20234.1—2015	Connection Set of Conductive Charging for Electric Vehicles - Part 1: General Requirements
GB/T 29317—2021	Terminology of Electric Vehicle Charging/Battery Swap Infrastructure
GB/T 3956—2008	Conductors of insulated cables
IEC 62196-3—2014	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles - Part 3: Dimensional compatibility and interchangeability

	requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers
IEC TS 62196-3-1	Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3-1: Vehicle connector, vehicle inlet and cable assembly for DC charging intended to be used with a thermal management system
IEC 62893-1	Charging cables for electric vehicles for rated voltages up to and including 0,6/1 kV – Part 1: General requirements
IEC 62893-2	Charging cables for electric vehicles for rated voltages up to and including 0,6/1 kV – Part 2: Test methods
IEC 62893-4-1	Charging cables for electric vehicles for rated voltages up to and including 0,6/1 kV – Part 4-1:Cables for DC charging according to mode 4 of IEC 61851-1 - DC charging without use of a thermal management system
IEC 62893-4-2	Charging cables for electric vehicles for rated voltages up to and including 0,6/1 kV - Part 4-2:Cables for DC charging according to mode 4 of IEC 61851-1 - Cables intended to be used with a thermal management system
IEC 60445-2017	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors

3 Terms and Definitions

In addition to those established in GB/T 11918.1—2014, GB/T 18487.1—2015, GB/T 20234.1—2015 and GB/T 29317, the following terms and definitions apply to this Document.

3.1 Cable assembly for charging

The assemblies for connecting electric vehicles and charging equipment for electric vehicles during electric vehicle charging, including power supply interface, vehicle coupler, caps and other components in addition to cable assembly.

3.2 Connection set for high-power charging

The assemblies for connecting electric vehicles and charging equipment during electric vehicle high-power charging, including cable assembly, cooling device, vehicle coupler assembly, thermal management system and other components.

3.3 Vehicle adapter

The assembly unit, used for interface conversion between vehicle connector and vehicle inlet that comply with different standards, may include control guidance circuit, detection circuit, additional functions, etc. For the purpose of this standard, it is referred to as adapter.

[Source: GB/T 18487.1—2022, xx.xx]

3.3.1 Inlet interface

The interface of adapter that matches with vehicle inlet, which is referred to as inlet interface.

3.3.2 Adapter connector

The part of adapter that matches with vehicle inlet.

3.3.3 Connector interface

The interface of adapter that matches with vehicle connector, which is referred to as connector interface.

3.3.4 Adapter inlet

The part of adapter that matches with vehicle connector.

3.3.5 Proto interface

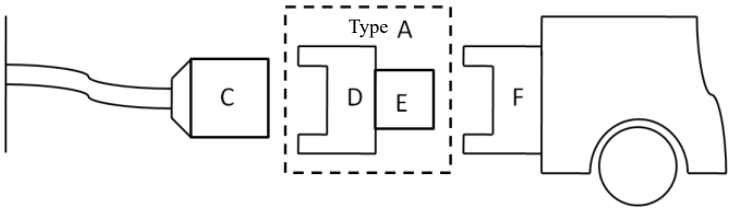
The opposite interface that matches with one end interface of the adapter.

3.3.6 Adapter cable

The cable in the adapter to connect inlet interface and connector interface.

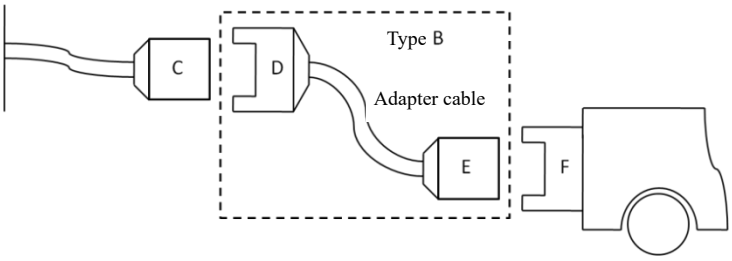
3.3.7 Type A

An adapter that physically consists of adapter connector and adapter inlet only.



3.3.8 Type B

An adapter that physically consists of adapter connector, adapter inlet and adapter cable.



Key

C Vehicle connector

D Vehicle connector interface

E Vehicle inlet interface

F Vehicle inlet

Figure 1 Schematic diagram of assemblies

3.4 Rated current

The maximum sustainable current declared by the manufacturer of the connection set for charging, at which under specified conditions, the temperature rise of each component of the connection set shall not exceed specified limits.

3.5 Rated current under active cooling

The maximum current that the connection set for charging can operate continuously in the event that the thermal management system is unavailable or the thermal exchange device does not work.

3.6 Peak current

A tolerant short-time operating current defined by current and time, as declared by the manufacturer of connection set for charging under specified condition(s).

3.7 Thermal sensing

A method used to obtain the temperature data of connection set for charging or its component(s).

3.8 Thermal sensing device

A device used to provide the temperature data of connection set for charging or its component(s).

3.9 Thermal transport

A method used to dissipate the heat from the connection set for charging in addition to the method of changing current size.

3.10 Thermal transport device

A device used to dissipate the heat from the connection set for charging in addition to the method of reducing charging current.

3.11 Thermal exchange

A method for cooling and dissipating heat from thermal transport.

3.12 Thermal exchange device

A device for cooling and dissipating heat from thermal transport.

3.13 Thermal management system

A system for adjusting temperature in combination of thermal sensing, thermal transport and thermal exchange.

3.14 Coolant

A low temperature fluid, which is used to cool another high temperature object, is referred to as the coolant.

3.15 Rated pressure

The maximum pressure given by the manufacturer for the cable assembly to operate continuously at rated conditions.

3.16 Maximum allowed pressure

The maximum pressure given by the manufacturer that the cable assembly can sustain at rated conditions.

3.17 Maximum allowable pressure

The maximum pressure specified by the manufacturer that is allowed to be applied to the coolant supplied to the cable assembly.

3.18 Rated pressure

The maximum pressure specified by the manufacturer that is allowed to be applied to the coolant supplied to the cable assembly under normal and continuous operating conditions.

4 Composition

The diagram of connection set for charging is shown in Figure 2.

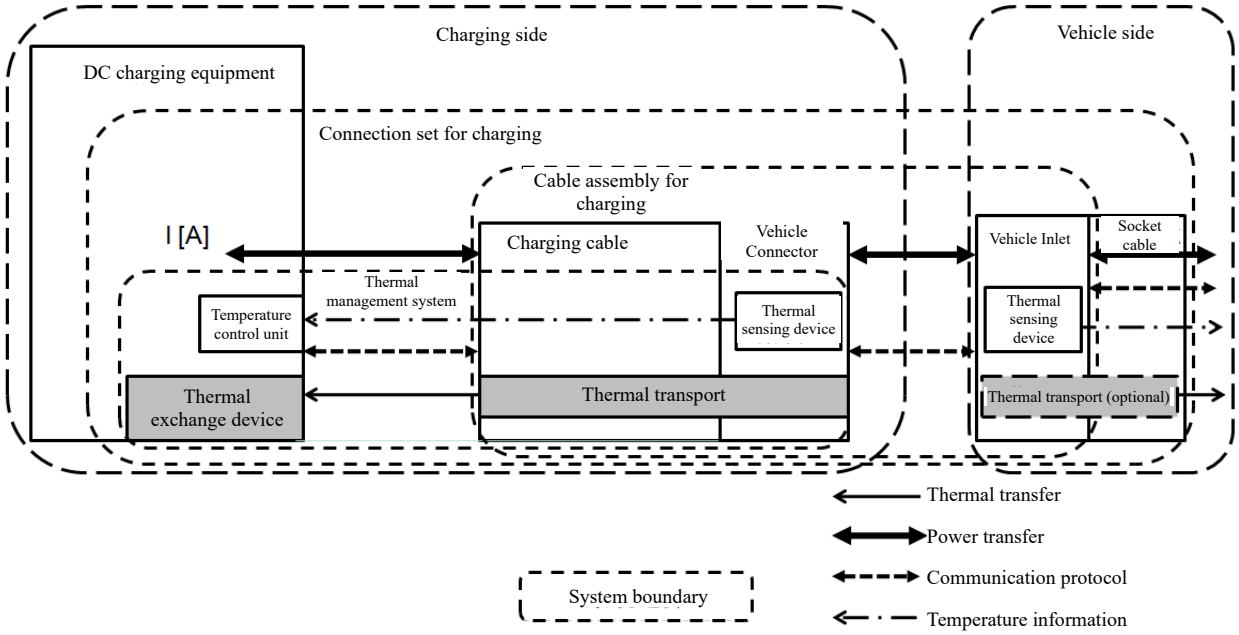


Figure 2 Connection Set for High-power Charging

Connection set for charging	Characteristic	Charging side							Vehicle side				
		DC charging equipment		Cable assembly for charging								Inlet cable	
				Charging cable		Vehicle Connector			Vehicle Inlet				
		Thermal exchange device	Temperature control unit	Power transport	Thermal transport	Thermal sensing device	Thermal transport	Power transport	Thermal sensing device	Power transport	Thermal transport	Power transport	Thermal transport
Connection set for high-power charging with	With thermal transport and	√	√	√	√	√	√	√	√	√	√ (Optional)	√	√ (Optional)

cooling function	thermal sensing functions												
Connection set for charging without cooling function	With thermal sensing function		√	√		√		√	√	√		√	

5 Coupler Functions and Layout

5.1 Rated parameters

The rated values of cable assembly for DC charging is shown in Table 1.

Table 1 The rated values of cable assembly for DC charging

Rated voltage V DC	Rated current A
1500	10
	16
	32
	63
	80
	125
	160
	200
	250
	300
	400
	500
	600
	800

5.2 Definitions of function

The vehicle Connector and Vehicle Inlet comprise 7 pairs of terminals, and their electrical parameters and definitions of function are shown in Table 2.

Table 2 Table 2 Electrical Parameters and Definitions of Function of Terminals

Terminal No./ID	Rated Voltage and Rated Current	Definitions of Function
1——(DC＋)	See Table 1	Positive DC power supply, to connect Positive DC power supply and cathode
2——(DC -)	See Table 1	Negative DC power supply, to connect negative DC power supply and anode
3——(⏚)	—	Protective earthing (PE), to connect the ground wire of power supply equipment and vehicle electric platform

4——(CC2)	60V, 2A	Charging connection confirmation
5——(CC1)	60V, 2A	Charging connection confirmation
6——(S+)	60V, 2A	Charging communication CAN_H, the communication line connecting off-board charger and electric vehicle
7——(S-)	60V, 2A	Charging communication CAN_L, the communication line connecting off-board charger and electric vehicle

5.3 Terminal layout method

The layout method of terminals for vehicle Connector and Vehicle Inlet is shown in Figure 3 and 4.

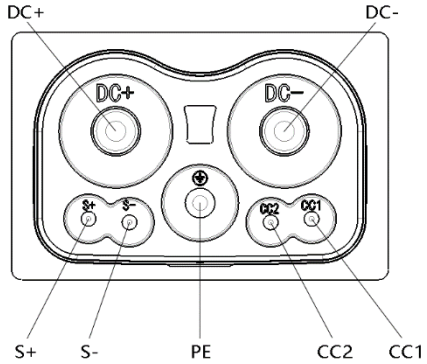


Figure 3 Layout Diagram of Terminals for Vehicle connector

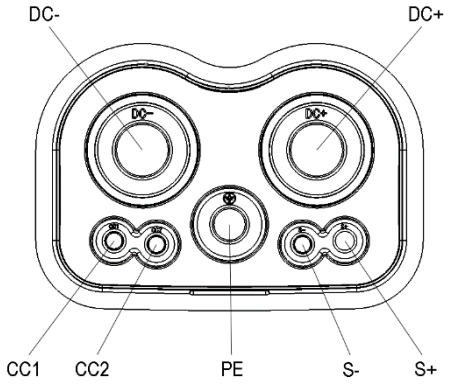


Figure 4 Layout Diagram of Terminals for Vehicle Inlet

5.4 Charging connection interface

During the connection of vehicle Connector and Inlet, the terminals are coupled in the following order: PE, charging connection confirmation(CC2), positive DC power supply and negative DC power supply (DC+ and DC -), charging communication (S+ and S-), charging connection confirmation(CC1); the disconnection is in the reverse order. The connection interface of high-power charging coupler is shown in Figure 5. The control circuit and control principle of direct charging are specified in separately formulated standards.

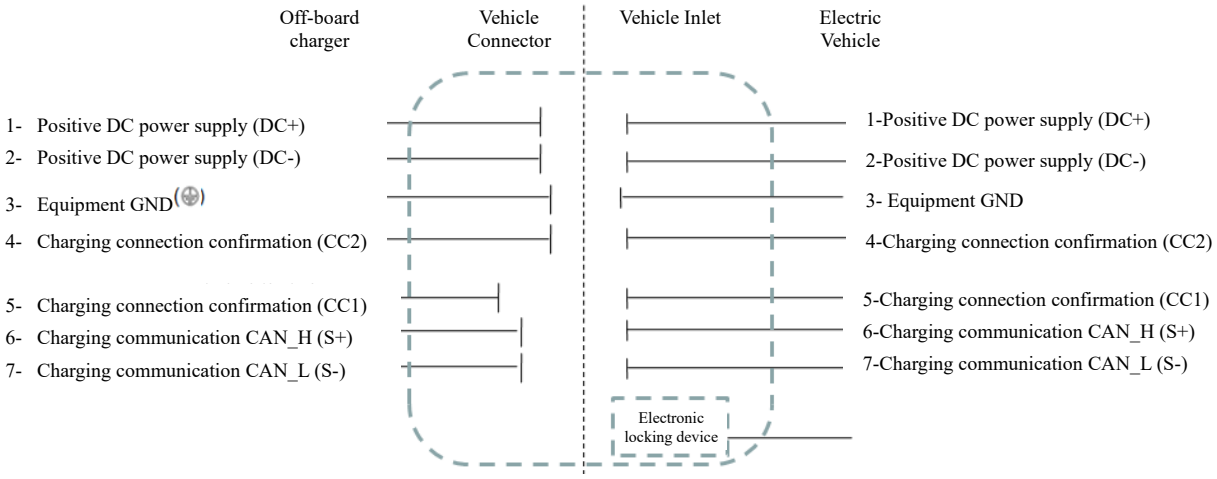


Figure 5 Diagram of Charging Connection Interface

5.5 Structure size

The structure size of vehicle coupler shall meet Annex D; refer to Annex E for the mounting size of combined Vehicle Inlet; the spatial size of plug shall meet Annex F.

6 Cable Requirements

6.1 Cable with cooling function

6.1.1 Conductor material

a) The conductor shall be made of annealed copper, but the cable may be common or tin-plated.

b) The conductor structure shall meet the requirements for the 5th conductor in GB/T 3956—2008.

c) The conductor is verified through inspection and measurement whether it meets the requirements of a and b, including the requirements in GB/T 3956—2008.

d) The resistance of each conductor at 20°C shall meet the requirements for given rates of conductors in GB/T 3956—2008.

6.1.2 Cable size

The cable size shall meet:

a) Power cords (2 core or multiple-core): 16mm^2 - 150mm^2;

b) Signal or control lines: 0.5mm^2 as a minimum, different from the power cords;

c) PE earthing conductor line (single-core): 6mm^2;

d) Temperature sensor lines (optional): 0.5mm^2 as a minimum, different from the power cords;

If the cooper conductor is in direct contact with coolant, it shall be subject to compatibility test according to 9.4.2.

6.1.3 Insulation

The cable insulation shall meet:

a) The insulation layer compound of the cable shall be Type EVI-2;

b) If the insulation layer is used as the pipeline of the power cord, then gaps are allowed between the conductor and the insulation layer;

c) The insulation layer compound of the signal or control lines and temperature sensor lines shall be Type EVI-1 or EVI-2.

6.1.4 Shielding (optional)

The shielding layer of a single-core or combined wire (e.g., twisted-pair or quad-core wire) shall consist of copper braided layer with at least 80% optical coverage.

6.1.5 Pipeline

The fluid pipeline shall be made of coolant resistant material which shall be tested for compatibility with the cable material.

The pipeline material shall be able to withstand aging at 120°C in dry air for 168 hours. After the test, the mechanical properties shall not change more than ±30% of the unaged sample.

If the insulation layer is used as the pipeline of the power cords, its material shall meet the relevant requirements of EVI-2 as well as the requirements of the compatibility test of coolant.

6.1.6 Core identification

Each power cord of cable must have only one color. However, the core identified by the combination of green and yellow shall meet the following requirements: for each 15mm long core, one color shall at least cover 30% but no more than 70% of the surface of the core, and the other color shall cover the rest of the core.

The color of signal or controlled CC line, CP line, temperature sensor line or other cores shall be clearly identified and different from the color of power cord cores.

Except for power cords and protective conductors, if the core identification using numbers complies with the requirement in 7.3 of IEC 62893-1-2017, then the cores may be identified by numbers.

6.1.7 Components

a) Cores shall be twisted together;

b) Fillers may be used, but centerlines are not allowed;

c) Before the sheath is used, a separator (such as tape) or filler may be added around the core assembly;

d) The metal shielding layer may be used on the core assembly. However, the metal shielding layer shall be braided from plain or tinned copper wire and a suitable filler or tape shall be used between the core assembly and the metal shielding layer. The requirements for the metal shielding layer shall be agreed between the manufacturer and the customer.

6.1.8 Sheath

The sheath compounds shall be Types EVM-1, EVM-2, EVM-3, and EVM-1 is suitable for the cable with the code name of 62893 IEC 129, EVM-2 for the cable with the code of 62893 IEC 130, and EVM-3 for the cable with the code of 62893 IEC 131.

The sheath shall not be pasted on the core, and the use of sheath shall make the finished cable basically round.

6.1.9 Marking

Each cable shall have a complete code name which shall be consecutively marked on the sheath in accordance with Article 6 of IEC 62893-1-2017, in addition, the following shall be marked:

Number and nominal cross-sectional area of power cord and PE conductor line;

Markings for rated voltage and "for special active cooling systems";

Additional markings, such as year of manufacture, are allowed; if additional markings are used, they shall not conflict with or interfere with required markings. The continuity, durability and legibility of markings shall comply with 6.2, 6.3 and 6.4 of IEC 62893-1-2017.

6.1.10 Requirements

Each cable shall comply with the corresponding requirements specified in IEC 62893-1 and the special requirements specified in this chapter. The tests shall be carried out in accordance with Annex A of IEC 62893-4-2, and relevant tests are shown in Table A.1 of IEC 62893-4-2.

a) The thickness of insulation layer and sheath shall comply with Table B.1 (for Type 129) and Table B.2 (for Types 130 and 131) of IEC 62893-4-2;

b) The signal or control lines and cores other than power cords shall comply with the requirements of 8.3.3 in IEC 62893-1-2017;

c) The requirements for compatibility tests are shown in Annex A of IEC 62893-1-2017;

d) The test conditions and requirements for cold shock test are shown in 5.8 of IEC 62893-2-2017;

e) The test conditions and requirements for compression test are shown in 5.7 of IEC 62893-2-2017;

f) The bending tests shall comply with Annex C of IEC 62893-4-2.

6.2 Cable without cooling function

6.2.1 Conductor

The conductor shall meet the requirements as set forth in 6.1 of GB/T 33594-2017.

6.2.2 Isolation layer

The isolation layer shall meet the requirements as set forth in 6.2 of GB/T 33594-2017.

6.2.3 Insulation

The insulation shall meet the requirements as set forth in 6.3 of GB/T 33594-2017.

6.2.4 Signal or control cores

The signal or control cores shall meet the requirements as set forth in 6.4 of GB/T 33594-2017.

6.2.5 Cable cores and fillers

The cable cores and fillers shall meet the requirements as set forth in 6.5 of GB/T 33594-2017.

6.2.6 Inner sheath

The inner sheath shall meet the requirements as set forth in 6.6 of GB/T 33594-2017.

6.2.7 Overall shielding (if any)

The overall shielding (if any) shall meet the requirements as set forth in 6.7 of GB/T 33594-2017.

6.2.8 Sheath

The sheath shall meet the requirements as set forth in 6.8 of GB/T 33594-2017.

6.2.9 Cable external diameter

The cable external diameter shall meet the requirements as set forth in 6.9 of GB/T 33594-2017.

6.2.10 Cable marking

The cable marking shall meet the requirements as set forth in Chapter 7 of GB/T 33594-2017.

6.2.11 Insulation core identification

The insulation core identification shall meet the requirements as set forth in Chapter 8 of GB/T 33594-2017.

7 Thermal Management System

7.1 Thermal transport device

7.1.1 The coolant shall comply with the relevant national legal requirements. It is not allowed to use highly toxic, flammable and explosive, highly corrosive and radioactive dangerous chemicals as coolant. Refer to *The Catalogue of Dangerous Chemicals*.

7.1.2 The coolant shall be environmentally harmless. If non-degradable coolant is used, its recycling method and treatment method shall be explained in accordance with relevant environmental laws and regulations.

7.1.3 The cable assemblies may use multiple coolants, but they shall not be mixed at the same time. The coolant shall pass material compatibility test and temperature rise test. Once the coolant type is selected during application, the coolant shall not be changed during the process. If the coolant needs to be replaced, the test requirements in 9.4, 9.7.1 and 9.7.2 shall be met. If the coolant is a mixture of substances, a formula of different proportions is allowed (such as antifreeze).

7.1.4 It shall check the material safety data sheet (MSDS) of the coolant confirming that its closed cup flash point value is not less than 135°C.

7.1.5 When non-insulated coolant is used, the vehicle connector shall have a leakage monitoring function.

7.1.6 The material of the pipeline and all sealing parts of the cable assembly shall be compatible with the specified coolant and have good high temperature resistance.

7.1.7 The closed flow path of the cable assembly shall withstand the maximum allowable pressure test provided by the manufacturer for an extended period of up to 30 min without leakage, rupture or burst.

7.1.8 The cable assembly shall withstand the rated current provided by the manufacturer for more than 20s in the case of thermal transport failure.

7.2 Operating conditions of thermal management system

The cable assembly manufacturer shall provide instructions on the operation of the thermal management system, including the following:

-- Rated pressure;

-- Maximum allowable pressure;

-- Coolant type;

In addition, the data may include:

-- Cable type;

-- Cross-sectional area of the conductor;

-- Maximum coolant temperature;

-- Minimum coolant flow;

-- Minimum cooling capacity;

The cable assembly manufacturers may provide current-carrying capacity in the absence of thermal transport conditions to increase product applicability and verify the compliance through the test.

8 Technical Requirements

8.1 General requirements

8.1.1 The connection set for high-power DC charging uses the charging mode 4 and connection method C in GB/T 18487.1—2015.

8.1.2 The connection set for high-power DC charging meets the requirements of Chapter 6 of GB/T 20234.1—2015 (excluding 6.3, 6.4, 6.13, 6.15, 6.21), and the cited Table 2 of GB/T 20234.1—2015 shall be replaced with Table 3 of this standard.

8.2 Locking device

8.2.1 The charging coupler shall be provided with locking function to prevent accidental disconnection during charging process.

8.2.2 When locked, the connection shall not be broken under 250N of axial pullout force,

and the locking device shall not be damaged. During the test, the connector shall not be pulled out from the Vehicle Inlet in order to keep electrical continuity. If the locking device can be unlocked normally after the test, the interlocked Vehicle Inlet shall not be damaged or deformed to avoid affecting the product function.

8.2.3 The vehicle Vehicle Inlet shall be equipped with the electronic locking device to prevent the load of vehicle coupler from being broken. The electronic locking device shall have emergency unlocking function.

8.2.4 The locking device shall be designed to ensure that it can operate normally after the vehicle connector and vehicle Vehicle Inlet are locked.

8.2.5 The locking device shall be able to operate normally in case the interface is worn normally.

8.2.6 The locking device shall meet at least 10,000 service cycles, and the completion of locking and unlocking is considered as one cycle.

8.3 Insertion and extraction force

8.3.1 The force to insert the vehicle connector and to extract the vehicle Vehicle Inlet shall be less than 120N;

8.3.2 A power assisting device may be used at the vehicle coupler, if it is available, the operation force for inserting and extracting such device shall meet the conditions above.

8.4 Surface temperature and terminal temperature rise

8.4.1 Surface temperature

The connection set for charging shall be tested according to the test method of 9.7, and the surface temperature shall meet the following requirements at rated current and environmental temperature 40°C:

a) The allowable maximum temperature of the grasping area at the vehicle connector shall not exceed:

-- Metal component 50°C;

-- Non-metal component 60°C.

b) The allowable temperature of the accessible non-grasping area at the vehicle connector shall not exceed:

-- Metal component 60°C;

-- Non-metal component 85°C.

c) The allowable maximum temperature of the cable surface shall not exceed 60°C.

8.4.2 Terminal temperature rise

The terminal temperature rise of connection set for charging shall meet the following requirements:

a) The connection set for charging shall be tested according to the test method of 9.7, and the terminal temperature rise shall not exceed 50K;

-- The manufacturer shall provide the intervention value of temperature sensor in the product manual. The intervention value is that when the DC terminal contact area reaches 90°C;

-- Check the cable assembly for conformity according to 9.7.1 and 9.7.2;

-- Check the vehicle inlet for conformity according to 9.7.3 and 9.7.4.

b) The terminal temperature rise of adapter shall not exceed 50K.

8.5 Mechanical strength

8.5.1 Shock and bending

The connection set for charging shall be subject to the shock test and bending test according to the test method of 9.9.1, and there shall be no obvious damage and the protection grade indicated on the mark shall be maintained.

8.5.2 Free fall

The vehicle connector shall be tested according to the test method of 9.9.2, and there shall be no obvious damage and the function test shall meet the requirements.

8.5.3 Load intensity

The connection set for charging shall be able to bear certain load in locking status. When tested according to the test method of 9.9.3, the connection set for charging shall be free of the following damages:

a) Any part shall not be separated from each other and shall keep electrical continuity;

b) The movement, looseness, deformation or damage of any component shall not affect the normal operation of sample;

c) There shall be no risks of potentially increasing fire or electric shock.

8.6 Cable rolling

The cooling cable shall be subject to rolling test according to the test method of 9.9.10. After the test, the charging gun shall be free of any crack or deformation, the insulation and pressure resistance shall meet the requirements, and the function shall be normal without leakage, not impairing normal use.

9 Test Methods

9.1 General test methods

The test methods of connection set for high-power DC charging shall meet the requirements of Chapter 7 of GB/T 20234.1—2015 (excluding 7.2, 7.3, 7.7, 7.10, 7.13, 7.14, 7.15).

9.2 Appearance and structure

9.2.1 Check the appearance and structure of connection set for charging by observation and manual test.

9.2.2 The mark shall be clear and permanent. It shall be verified by visual inspection and the following tests.

Wipe the mark for 15s with a piece of cotton cloth soaked in water by hand, and then wipe it for 5s with a piece of cotton cloth soaked in gasoline by hand.

Note: It is recommended to use gasoline composed of hexane solution which contains the maximum 0.1% aromatic by volume, the kauri butanol number of about 29, the initial boiling point of 65°C, the dry point of 69°C and the concentration of 0.68g/cm^3.

9.3 Locking device

The conformance is verified by inspection, manual test and the following tests:

a) For products with interlocking device and locking device, insert the plug into socket-outlet or connector and lock it, and apply 250N pullout force for 10s. After the test, the vehicle connector shall not be pulled out, the connecting rod shall not be broken, and the locking device shall not be damaged. During the operation, the plug shall not be pulled out;

b) Check by carrying out a continuity test between the contacts of the power supply terminal and the socket-outlet, and close the locking device without inserting the plug or the plug is not inserted in place. The contacts of switch equipment shall not be closed;

c) The locking device shall meet 10,000 service cycles (The completion of locking and unlocking is considered as one cycle), and shall be tested by referring to Chapter 20 of GB/T 11918.1—2014.

9.4 Thermal transport device

9.4.1 Coolant flash point

If the coolant is combustible liquid, it shall be confirmed that its closed cup flash point value is not less than 135°C through the material safety data sheet (MSDS) provided by the coolant manufacturer.

9.4.2 Material compatibility test

All non-metal components in cable assembly that are in contact with the coolant shall be resistant to high temperature and be compatible with the coolant. After the aging test of high temperature oven and the aging test of contact compatibility with coolant, its physical properties shall be kept at more than 60% of that before aging. The test method is as follows:

a) High temperature aging test:

Select one of the following test conditions:

-- 7 days at 121°C;

-- 28 days at 101°C;

6 samples are required for each material, 25,4 mm ±0.1 mm in width and 203 mm±1 mm in length, with thickness no less than the thinnest part of the application. Test 3 samples before aging, and another 3 after aging. According to the test method of GB/T 2951.11, test the tensile strength and ultimate elongation of the sample, which after the aging shall not be less than 60% of the sample before aging test.

b) Contact compatibility aging test of coolant:

Expose the test sample to the coolant at (80±2) °C for (70±½) h.

6 samples are required for each material, 25,4 mm ±0.1 mm in width and 203 mm±1 mm in length, with thickness no less than the thinnest part of the application. Test 3 samples before aging, and another 3 after aging. According to the test method of GB/T 2951.11, test the tensile strength and ultimate elongation of the sample, which after the aging shall not be less than 60% of the sample before aging test.

9.4.3 Pressure resistance test

The closed flow path of the coolant shall withstand the maximum allowable pressure provided by the manufacturer for 30 min without leakage, rupture or burst. Its conformance is verified by the following tests:

The closed path flow of coolant of cable assembly is applied with the maximum allowable pressure of the manufacturer for 30 min. Immerse the cable assembly fully in water to a depth not more than 1 m. There shall be no visible bubbles during the test. The closed flow path area of the coolant shall neither be broken nor ruptured.

9.4.4 Thermal transport failure test

If the thermal transport function is lost, the cable assembly shall withstand the rated current for 20s with thermal transport function disabled. Check if the cable assembly is qualified at the room temperature (40±5) °C by the following tests:

-- Run and start the thermal transport device at rated current until the DC terminal reaches thermal stabilization.

-- Suspending the thermal transport

-- Continue to apply the rated current for 20s.

The test passes if the insulation resistance and dielectric strength comply with the provisions of Article 9.6, without melting, cracking or deformation, or any of the following:

-- The protective performance of the cable assembly shall not be degraded compared to that in the pre-test state;

-- The integrity of the cable assembly housing is damaged, failing to provide acceptable mechanical or environmental (rating) protection;

-- The polarization of the cable assembly is eliminated;

-- The operation, function or installation of cable assembly is affected;

-- The cable assembly cannot provide sufficient stress relief for flexible cables;

-- The creepage distance and electrical clearance between live parts of opposite polarity, live parts and accessible dead metal or grounded metal are reduced to values lower than those specified in Chapter 26 of GB/T 11918.1-2014;

-- Any other signs of damage occurs, which may increase the risk of fire or electric shock;

-- Coolant in the cable assembly leaks.

9.5 Terminal

The test is carried out according to Chapter 11 of GB/T 11918.1—2014, wherein the Table 3 in GB/T 11918.1—2014 is replaced with Table 3 of this Document. The cable assembly without cooling function is shown in Table 3, and the cable assembly with cooling function is shown in Table 4.

If a ground wire with a cross-sectional area of less than 25mm^2 is used, it shall meet the requirements of low-power charging specifications and have protective measures such as fuses.

Table 3 Cross Sectional Area of Wire to be Connected by the Terminal (natural cooling)

Rated current A	Cross Sectional Area of Cable Assembly for Vehicle connector mm^2	
	Non-ground wire	Ground wire
10	1.0-1.5	6
16	1.0-2.5	6
32	2.5-6	6
63	6-16	6
80	10-25	6
125	25-70	6
160	25-70	6
200	70-150	6
250	70-150	6

Table 4 Cross Sectional Area of Wire to be Connected by the Terminal (active cooling)

Maximum Current A	Cross Sectional Area of Cable Assembly for Vehicle connector mm^2	
	Non-ground wire	Ground wire
300	16-50 (with cooling function)	6
400	16-50 (with cooling function)	6
500	25-50 (with cooling function)	6
600	35-50 (with cooling function)	6
800	35-50 (with cooling function)	6

9.6 Insulation resistance

The insulation resistance and dielectric strength shall be tested according to Chapter 19 of GB/T 11918.1—2014. The insulation resistance shall be measured after the voltage of 1500V DC is applied for 1 min. The insulation resistance shall not be less than 500MΩ.

9.7 Temperature rise test

9.7.1 Temperature rise test for cable assembly

All tests shall be conducted using a wired vehicle connector and a reference device (RD) matching the device under test. The cable assembly shall be structured to ensure that the temperature will not be too high during normal use.

Check if the cable assembly is qualified through the following tests:

-- The test object is cable assembly, and the cable length shall be the longest length as defined by the manufacturer;

-- The RD of this test shall conform to Figure G.1;

-- The corresponding test device shall conform to Figure G.2;

-- The overall test device shall conform to Figure G.9;

-- If the cable assembly is equipped with a thermal transport device, use the heat exchange parameters specified in the installation manual by the manufacturer at an ambient temperature of 40°C;

-- The test current shall be rated current according to the data sheet of manufacturer of the sample under test.

-- The test is conducted at ambient temperature of 20°C to 40°C, and the obtained results are corrected to ambient temperature of 40°C;

-- The test shall be conducted in a zero flow environment without forced convection.

The test cycle is defined as follows:

Load rated current to the DC+ and DC- of cable assembly. After the thermal stabilization is achieved (When the temperature change of three consecutive readings with intervals of no less than 10min is not more than 2 K, it is considered that the thermal stabilization is achieved), the applied current shall be reduced to 0A 10 min later.

Record one or more samples per second throughout the test, and record the temperature of the temperature sensors (T_1 + and T_1-) and the values provided by the temperature sensors in the cable assembly (T_S + and T_S-).

Convert the value provided by the temperature sensor of the cable assembly to the temperature according to the manufacturer's data sheet.

The test is passed if the following conditions are met:

The temperature rise measured by temperature sensors (T_1 + and T_1-) does not exceed 50 K;

The surface temperature of cable assembly is not more than the limit specified in Chapter 8.4;

The measurements of temperature sensors (T_S + and T_S-) do not exceed the intervention values provided by the manufacturer under 8.4.2.

9.7.2 Temperature sensor test for cable assembly

The temperature sensor of cable assembly shall be ensured of normal use. Check if the cable assembly is qualified through the following tests:

-- The test object is cable assembly, and the cable length shall be the shortest length as defined by the manufacturer;

-- The reference testing device of this test shall conform to Figure G.5 as appropriate;

-- The corresponding test device shall conform to Figure G.6 as appropriate;

-- The overall test device shall conform to Figure G.9;

-- If the cable assembly is equipped with a thermal transport device, use the heat exchange parameters specified in the installation manual by the manufacturer at an ambient temperature of 40°C.

-- The test current shall be the rated current according to the data sheet of manufacturer of sample under test.

-- The test is conducted at an ambient temperature of (40±5) °C. Correct the result to an ambient temperature of 40°C.

-- The test shall be conducted in a zero flow environment without forced convection.

Record one or more samples per second throughout the test, and record the temperature measured at the DC terminal by the temperature sensors (T_1 + and T_1-) and the values measured by the temperature sensors of the cable assembly (T_S + and T_S-).

Convert the value measured by the temperature sensor of the cable assembly to the temperature according to the manufacturer's data sheet.

Once the thermal stabilization is achieved (When the temperature change of three consecutive readings with intervals of no less than 10min is not more than 2 K, it is considered that the thermal stabilization is achieved), make the terminal of vehicle connector over-temperature by starting the heating unit, to ensure that the temperature rise rate measured by the temperature sensors T_1 + and T_1- is (2.5±0.5) K/min.

When the temperature sensor T_1+ or T_1- reaches 95°C, the heating unit shall stop heating immediately.

Calculate the slope at the time when heating starts (t1) and stops (t2). For example, KT_S + = (T_S +t2-T_S +t1)/(t2-t1).

The test is passed if the following conditions are met:

-- The deviation between the temperature slope measured by the temperature sensors T_S+ and T_S- and that measured by the temperature sensors T_1+ or T_1- is less than 2.5 K/min;

-- Absolute value of mathematical formula:

$\left| KT\_S + / KT\_1 + - KT\_S - / KT\_1 - \right| < 0.2$;

-- The temperature values of the temperature sensors T_1 + and T_1- are equal to or less than 90°C when the temperature sensors T_S+ or T_S- reach the intervention values provided by the manufacturer under 7.5.2.

9.7.3 Temperature rise test for vehicle inlet

The vehicle inlet shall be structured to ensure that the temperature will not be too high during normal use.

Check if the cable assembly is qualified through the following tests:

The test object is a vehicle inlet, to which cable conductor is connected must be at least 1m long. The sample under test is provided by the manufacturer.

The structure in Figure G.1 may be either RD or the device under test (DUT). The temperature sensor position size B (Figure G.1) for RD (used in Step 1) and DUT (used in Step 2) is ±1mm in error to ensure comparability of test data.

The test current shall be the rated current as specified in the user manual by the manufacturer of sample under test.

The test is conducted for the cable assembly with the same rated current as the socket-outlet sample under test or with the maximum rated current 100A higher than the sample under test. The cable assembly concerned shall have been certified according to this Document.

If the cable assembly is equipped with a thermal transport device, use the heat exchange parameters specified in the installation manual by the manufacturer at an ambient temperature of 40°C.

The test is conducted at ambient temperature of 20°C to 40°C, and the obtained results are corrected to ambient temperature of 40°C.

The test shall be conducted in a zero flow environment without forced convection. The airflow generated by the cooling system device of the sample under test is not included and shall not flow directly over the surface of the cable assembly.

It is important to calibrate the temperature sensor with a calibration device to minimize its measurement deviation.

The test is conducted by the following two steps:

Test Step 1, RD test:

a) Install the RD in Figure G.1 on the gauge bracket in Figure G.9.

b) Match the cable assembly with the RD according to Figure G.3.

c) Apply the test current to the DC + and DC- conductors of the cable assembly.

d) Record one or more samples per second throughout the test, and record the temperature data of the temperature sensors (T_1 +, T_1-, T_2 +, T_2-) until thermal stabilization is achieved (When the temperature change of three consecutive readings with intervals of no less than 10min is not more than 2 K, it is considered that the thermal stabilization is achieved). After 1 h, record the temperature of each temperature sensor as the reference value of test Step 2.

e) If the values of T_1 + and T_1- do not exceed the temperature rise of 50K, the test is passed.

Test Step 2, DUT test:

a) The test current is the same as the current used in test Step 1.

b) Install the DUT on the gauge bracket in Figure G.9.

c) Pair the cable assembly used in test Step 1 with the DUT as required according to Figure G.4.

d) The thermal exchange parameters (if any) are the same as those used in test Step 1.

e) Apply the test current to the DC + and DC- conductors of the cable assembly.

f) Record one or more samples per second throughout the test, and record the temperature data of the temperature sensors (T_3 +, T_3-) until thermal stabilization is achieved (When the temperature change of three consecutive readings with intervals of no less than 10min is not more than 2 K, it is considered that the thermal stabilization is achieved).

The test is passed if the following conditions are met:

-- The temperature of each temperature sensor (T_3 +, T_3-) in test Step 2 does not exceed that of the corresponding temperature sensors (T_2 +, T_2-) in test Step 1

-- The temperature rise measured by temperature sensors (T_3 + and T_3-) does not exceed 50 K.

9.7.4 Temperature sensor test for vehicle inlet

The vehicle inlet shall be structured to ensure that the thermal sensitive device is reliable during normal use.

Check if the cable assembly is qualified through the following tests:

The DUT is a vehicle inlet, to which cable conductor is connected must be at least 1 m long. The sample under test is provided by the manufacturer.

The RD shall be assembled as shown in Figure G.7.

The corresponding test device shall conform to Figure G.8.

The test shall be conducted at an ambient temperature of (25±5) °C.

The test shall be conducted in a zero flow environment without forced convection.

A test current shall be applied which, when thermally stable, reaches the same temperature at T_1 + and T_1_1 when T_3+ and T_3 are at k) as listed in Step 2 of 9.7.3 test (±3 K).

Record one or more samples per second throughout the test, and record the temperature of the temperature sensors (T_1 + and T_1-) and the values provided by the temperature sensors of the DUT (T_S + and T_S-).

The value provided by the temperature sensor of the DUT shall be converted to the temperature according to the manufacturer's data sheet.

Once the thermal stabilization is achieved (When the temperature change of three consecutive readings with intervals of no less than 10min is not more than 2 K, it is considered that the thermal stabilization is achieved), make the DC terminal of DUT over-temperature by starting the heating unit, and ensure that the temperature rise

rate measured by the temperature sensors T_1 + and T_1- is controlled at (2.5±0.5) K/min.

Once the temperature sensor T_1+ or T_1- reaches 95°C, the heating and power supply shall stop.

The slope shall be calculated at the time when heating starts (t1) and stops (t2). For example: KT_S + = (T_S +t2-T_S +t1)/ (t2-t1).

The test is passed if the following conditions are met:

-- The deviation between the temperature slope measured by the temperature sensors T_S+ and T_S- and that measured by the temperature sensors T_1+ or T_1- is less than 2.5 K/min;

-- Absolute value of mathematical formula:

|KT_S +/KT_1 +–KT_S-/KT_1-| <0.2;

-- The temperature values of the temperature sensors T_1 + and T_1- shall be equal to or less than 90°C when the temperature sensors T_S+ or T_S- reach the intervention values specified by the manufacturer under 8.4.2.

9.8 Cable assembly and its connection

The test is carried out according to the method specified in Chapter 23 of GB/T11918.1-2014, and part of the contents will be replaced with the followings:

a) The vehicle connector with non-detachable wires shall be equipped with cable assembly adapting to the rated operating value as required by the manufacturer, which shall be tested as cable assembly;

b) The applied tensile force and torque as well as the maximum allowable displacement of the tested cable assembly are shown in Table 5 (replacing Table 14 in GB/T 11918.1—2014). The cable assembly shall be subject to 100 cycles of tensile test, with tensile force applied for 1s each cycle, but explosive force is not allowed. Then, the cable assembly shall be subject to torque test for 1min.

Table 5 Tensile Force and Torque Test Value of Cable Assembly Fastener and Maximum Allowable Displacement of Cable

Rated current A	Tensile Force N	Torque Nm	Maximum displacement mm
10~16	160	0.6	2
32	200	0.7	2
63	240	1.2	2
80	240	1.2	2
125	240	1.5	2
200	250	2.3	2
250	500	11.0	5
400	500	11.0	5
400 and above	500	11.0	5

9.9 Mechanical strength

9.9.1 Shock and bending

The vehicle inlet is subject to shock test according to the method specified in Chapter 24 of GB/T 11918.1—2014. The impact energy of pendulum ball is shown in Table 6 (replacing Table 15 in GB/T 11918.1—2014). After the test, the test sample shall be able to maintain the protection grade indicated on the mark.

Table 6 Impact Energy of Pendulum Ball in Shock Test

Rated Current/Maximum Current A	Energy J
I≤32	1
32<I≤100	2
100<I≤150	3
150<I≤800	4

The vehicle connector is subject to bending test according to the method specified in Chapter 24 of GB/T 11918.1—2014, and the force applied by the weight is shown in Table 7 (replacing Table 16 in GB/T 11918.1—2014). After the test, the cover and shell of the sample shall be free of any damage not conforming to the requirements of this Document.

Table 7 Force Applied by Weight in Bending Test

Rated Current/Maximum Current A	Force N
I≤20	20
20<I≤32	25
32<I≤70	50
70<I≤250	75
250<I≤800	100

9.9.2 Free fall

The free drop test applies to those test samples that may fall off the carrier or working table during the transport, handling or maintenance. The test is carried out according to GB/T 11918.1—24.3. Under laboratory conditions, the gun wire shall be tested immediately after it is removed from the -30°C low-temperature chamber for 24h, and the coolant shall be stopped during the test. Drop the 2.25 m-long sample onto the cement surface from a height of 1m, and drop each sample eight times by rotating it to an angle of 45°. After the test, the charging gun shall be free of any crack or deformation, the insulation and pressure resistance shall meet the requirements, and the function shall be normal without leakage, not impairing normal use.

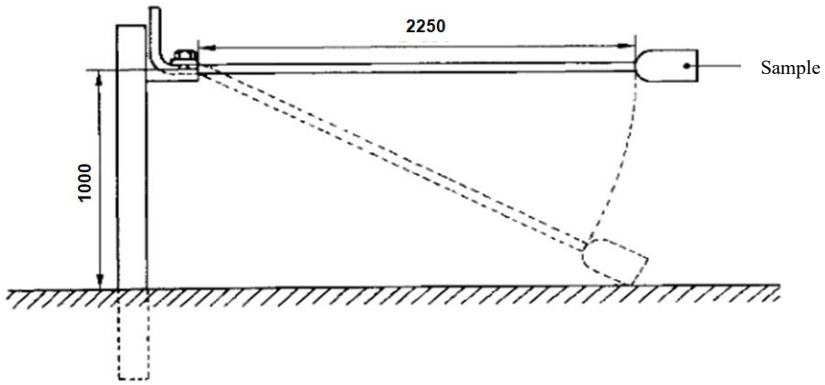


Figure 6 Configuration of Mechanical Strength Test for Plug and Connector

9.9.3 Load intensity

Insert and extract the test plug and socket-outlet for ten times. Then, insert again, and attach a weight of 750N with a suitable fixture. Keep static load-bearing for 60s, and repeat the test for three times. Rotate the socket-outlet vertically by 90° and repeat the test. After the test, the socket-outlet or plug shall be free from damage or deformation which may impair product function, and the function shall be inspected and tested for conformance. The load intensity test is shown in Figure 7.

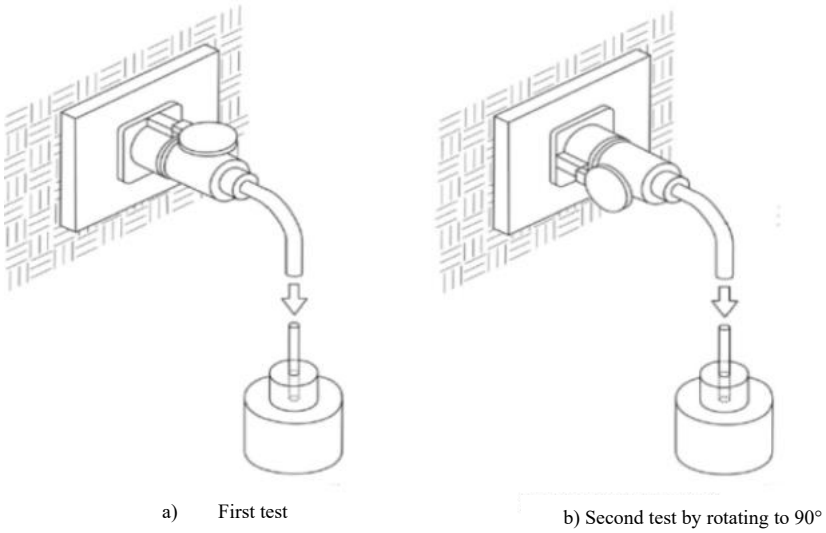


Figure 7 Load Intensity Test

9.10 Cooling cable rolling

Place the cooling cable randomly on the cement floor. Press the cooling cable (coolant stops running in the cooling cable) at a pressure of (5000±250) N with P225/75R15 or equivalent load of traditional automobile tires at a speed of (8±2) km/h, with the tire inflation pressure of 220±10) kpa. Each test piece shall be placed randomly on the ground in the normal manner before the wheel presses over it. The test piece shall not move obviously during the test. The test piece subject to pressure shall not be placed on protrusions. After the test, the insulation and pressure resistance of the cooling cable shall meet the requirements, and the function shall be normal without leakage, not impairing normal use.

10 Identification

10.1 The product shall have the following identifications: model, parameters, reference standard, manufacturer.

10.2 The identifications shall be clear and firm.

10.3 The instructions for temperature control strategies and for daily maintenance of the product shall be attached.

Annex A
(Normative)
Conductive ChaoJi DC Charging Adapter of Electric Vehicles

A.1 Classification of adapter

(1) By physical structure

-- Type A adapter;

-- Type B adapter;

(2) By installation method

-- Movable adapter

-- Fixed adapter

A.2 Rated value of adapter

(1) Rated voltage (preferred value)

480 V(DC)

600 V(DC)

750 V(DC)

1000 V(DC)

1250 V(DC)

1500 V(DC)

0 V - 30 V(DC) (for signal, control or low-voltage auxiliary power supply)

(2) Rated current (preferred value)

80 A

125 A

200 A

250 A

400 A

A.3 Charging connection interface

The coupling sequence of terminals between the inlet interface and the connector interface shall conform to the standards of the proto interface, and the connection interface is shown in Figure A.1. The DC charging control pilot circuit shall meet the requirements as specified in Annex E of GB/T 18487.1-2022.

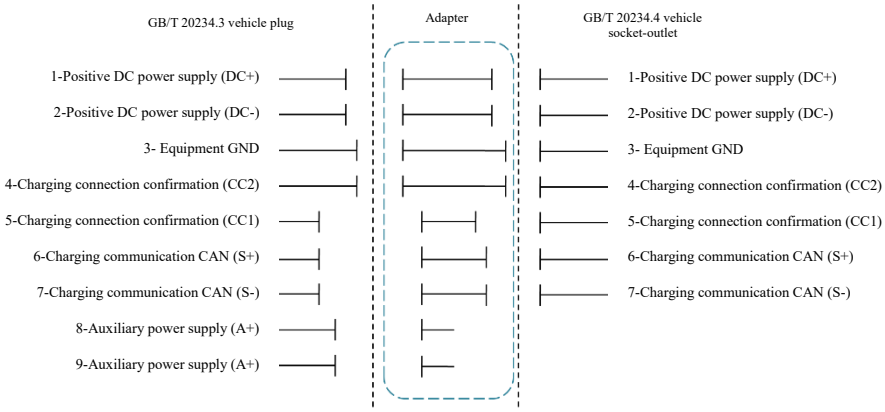


Figure A.1 Diagram of Charging Connection Interface

A.4 Technical requirements of adapter

A.4.1 General requirements

(1) The requirements in 6.1 of GB/T 20234.1-2015 apply to this Document, and the following requirements will be added.

(2) The protection grade of the inlet interface and connector interface of the adapter shall conform to that of the proto interface.

(3) If the voltage grades of the inlet interface and connector interface are different, they shall meet the requirements for interface with lower voltage grade.

(4) For Type A adapter, the separation of vehicle connector and adapter shall be conducted before that of the adapter and the vehicle inlet.

(5) Adapter cables shall comply with provisions in GB/T 5023 (all parts), GB/T 5013.4, or IEC 62893-1, IEC 62893-2 and IEC 62893-4-1.

(6) Type B adapters should be fixed. If a Type B adapter is a movable one, its drooping height shall not exceed 0.5m after being connected to the vehicle.

A.4.2 Structural requirements

The structural requirement of the adapter shall meet the requirements as set forth in 6.2 of GB/T 20234.1-2015.

A.4.3 Locking device

(1) The requirements in 6.3 of GB/T 20234.1-2015 apply to this Document, and the following requirements will be added.

(2) The inlet interface and connector interface of the adapter shall be provided with locking function to prevent accidental disconnection during charging process.

(3) The charging starts only after the holding devices on both ends of the adapter are locked (with the electronic lock being locked).

A.4.4 Insertion and extraction force

The insertion and extraction force of the inlet interface and connector interface of the adapter shall conform to the standards of the proto interface.

A.4.5 Protection against electric shock

The requirements of adapter for the protection against electric shock shall meet the standards of proto interface.

A.4.6 Grounding measures

The requirements in 6.6 of GB/T 20234.1-2015 apply to this Document, and the following requirements will be added:

For Type B adapters, the conductor cross-sectional area of the ground wire shall conform to the conductor cross-sectional area of the larger ground wire in the standards of proto interface.

A.4.7 Terminal

The insulation resistance and dielectric strength of the adapter shall meet the requirements as set forth in 6.7 of GB/T 20234.1-2015.

A.4.8 Aging resistance of rubber and thermoplastics

The aging resistance of rubber and thermoplastics used in the adapter shall meet the requirements as set forth in 13 of GB/T 11918.1-2014.

A.4.9 Protection grade

The protection grade of the inlet interface and connector interface of the plugged adapter shall conform to the standards of the proto interface.

For fixed Type B adapters, the protection grade of the adapter shall meet IP54 after they are connected with the matched protection device.

A.4.10 Insulation resistance and dielectric strength

The insulation resistance and dielectric strength of the adapter shall meet the requirements as set forth in 19 of GB/T 11918.1-2014.

A.4.11 Breaking capacity

The breaking capacity of the inlet interface and connector interface shall conform to the standards of the proto interface.

A.4.12 Service life (normal operation)

The service life of the inlet interface and connector interface shall conform to the standards of the proto interface.

A.4.13 Surface temperature and terminal temperature rise

The surface temperature and terminal temperature rise of the adapter shall meet the requirements as set forth in 6.13 of GB/T 20234.1-2015.

A.4.14 Cable and its connection

The cable and its connection of the adapter shall meet the requirements as set forth in 6.14 of GB/T 20234.1-2015.

A.4.15 Mechanical strength

The mechanical strength of adapter shall meet the standards of proto interface.

A.4.16 Screws, current-carrying components and connections

The screws, current-carrying components and connections of the adapter shall meet the requirements as set forth in 25 of GB/T 11918.1-2014.

A.4.17 Creepage distance, electrical clearance and sealant penetration distance

The creepage distance, electrical clearance and sealant penetration distance of the adapter shall meet the requirements as set forth in 26 of GB/T 11918.1-2014.

A.4.18 Heat resistance, flame resistance and tracking resistance

The heat resistance, flame resistance and tracking resistance of the adapter shall meet the requirements as set forth in 27 of GB/T 11918.1-2014.

A.4.19 Corrosion and rust resistance

The corrosion and rust resistance of the adapter shall meet the requirements as set forth in 28 of GB/T 11918.1-2014.

A.4.20 Limited short-circuit current tolerance test

The limited short-circuit current tolerance test of the adapter shall meet the requirements as set forth in 29 of GB/T 11918.1-2014.

A.4.21 Temperature monitoring

The adapter shall have temperature monitoring function when the current exceeds 150A.

A.5 Test Methods

A.5.1 General provisions

(1) Perform the test in accordance with the method as given in 7.1 of GB/T 20234.1-2015, and add the following test methods.

(2) For Type B movable adapters, fix one end of the adapter horizontally, drop the other end, hang a weight of 5kg, and measure the height between the bottom end of the adapter and the center axis of the horizontally fixed cable, which shall not exceed 0.5m, as shown in Figure A.2:

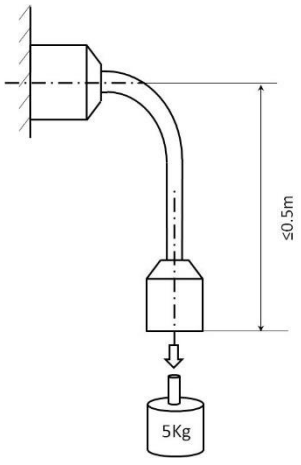


Figure A.2 Schematic Diagram of Dropping Height Measurement of Type B Movable Adapter

A.5.2 Appearance and structure

Perform the test in accordance with the method as given in 7.2 of GB/T 20234.1-2015.

A.5.3 Locking device

Perform the test in accordance with the method as given in 7.3 of GB/T 20234.1-2015.

A.5.4 Insertion and extraction force

Perform the test in accordance with the method as given in 7.4 of GB/T 20234.1-2015.

A.5.5 Protection against electric shock

Perform the test in accordance with the method as given in 7.5 of GB/T 20234.1-2015.

A. 5.6 Grounding measures

Perform the test in accordance with the method as given in 7.6 of GB/T 20234.1-2015.

For Type B adapters, the structural inspection shall be conducted for the dimensions of the wiring conductors.

A.5.7 Terminal

Perform the test in accordance with the method as given in 7.7 of GB/T 20234.1-2015.

A.5.8 Aging resistance of rubber and thermoplastics

Perform the test in accordance with the method as given in 13 of GB/T 11918.1-2014.

A.5.9 Protection grade

Perform the test in accordance with the method as given in GB/T 4208.

A.5.10 Insulation resistance and dielectric strength

Perform the test in accordance with the method as given in 19 of GB/T 11918.1-2014.

A.5.11 Breaking capacity

Perform the test in accordance with the method as given in 7.11 of GB/T 20234.1-2015.

A.5.12 Service life (normal operation)

Perform the test in accordance with the method as given in 7.12 of GB/T 20234.1-2015.

A.5.13 Temperature rise

Perform the test in accordance with the method as given in 7.13 of GB/T 20234.1-2015.

A.5.14 Cable and its connection

Perform the test in accordance with the method as given in 7.14 of GB/T 20234.1-2015.

A.5.15 Mechanical strength

Perform the test in accordance with the method as given in 7.15 of GB/T 20234.1-2015.

In the drop test, for type A adapters, there is no need to connect wires, hold the sample horizontally at a height 75cm from the ground and drop it freely on the concrete floor for 8 times, each time making the adapter rotate 45°.

A.5.16 Screws, current-carrying components and connections

Perform the test in accordance with the method as given in 25 of GB/T 11918.1-2014.

A.5.17 Creepage distance, electrical clearance and sealant penetration distance

Perform the test in accordance with the method as given in 26 of GB/T 11918.1-2014.

A.5.18 Heat resistance, flame resistance and tracking resistance

Perform the test in accordance with the method as given in 27 of GB/T 11918.1-2014.

A.5.19 Corrosion and rust resistance

Perform the test in accordance with the method as given in 28 of GB/T 11918.1-2014.

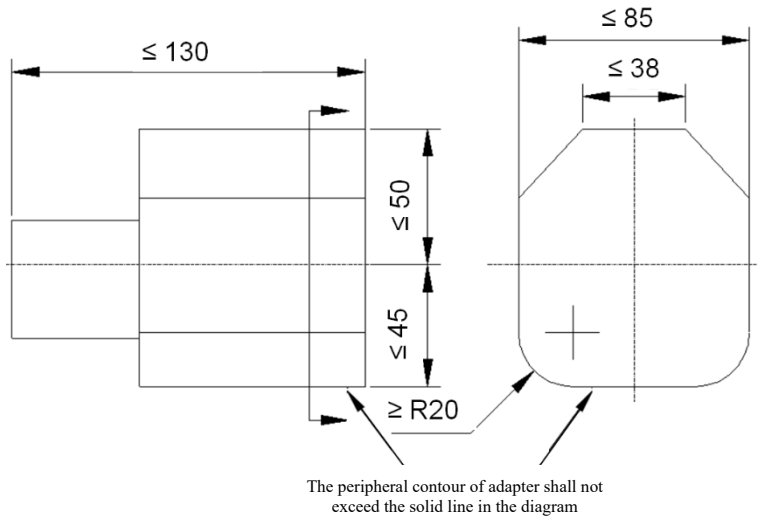
A.5.20 Limited short-circuit current tolerance test

Perform the test in accordance with the method as given in 29 of GB/T 11918.1-2014.

Annex B
(Normative)
Requirements for Spatial size of Conductive Chaoji DC Charging Adapter of Electric Vehicles

The sizes of the inlet interface and connector interface of the adapter shall conform to the standards of the proto interface, and the requirement for spatial size of the adapter is shown in Figure B.1.

Unit: mm



Note: This diagram only shows the size relationship of vehicle adapters instead of the outline structure of the specific product.

Figure B.1 Requirements for Spatial Size of Adapter

Annex C
(Informative)
Temperature Monitoring and Control Principle of Conductive ChaoJi DC Charging Adapter of Electric Vehicles

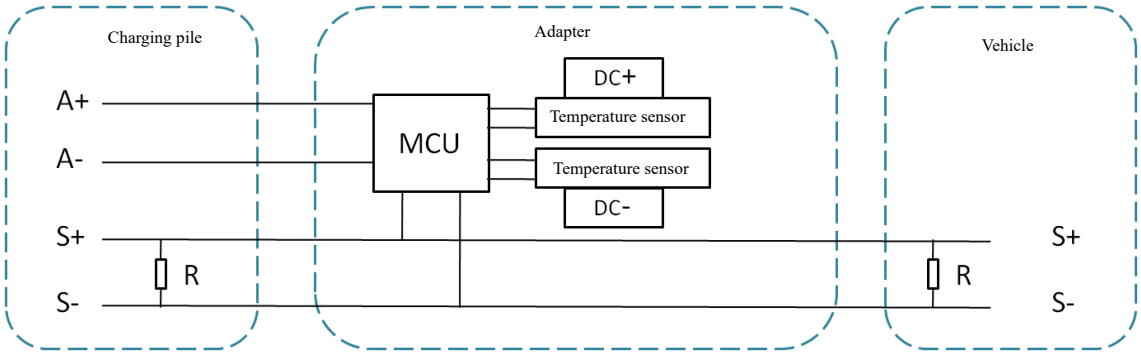


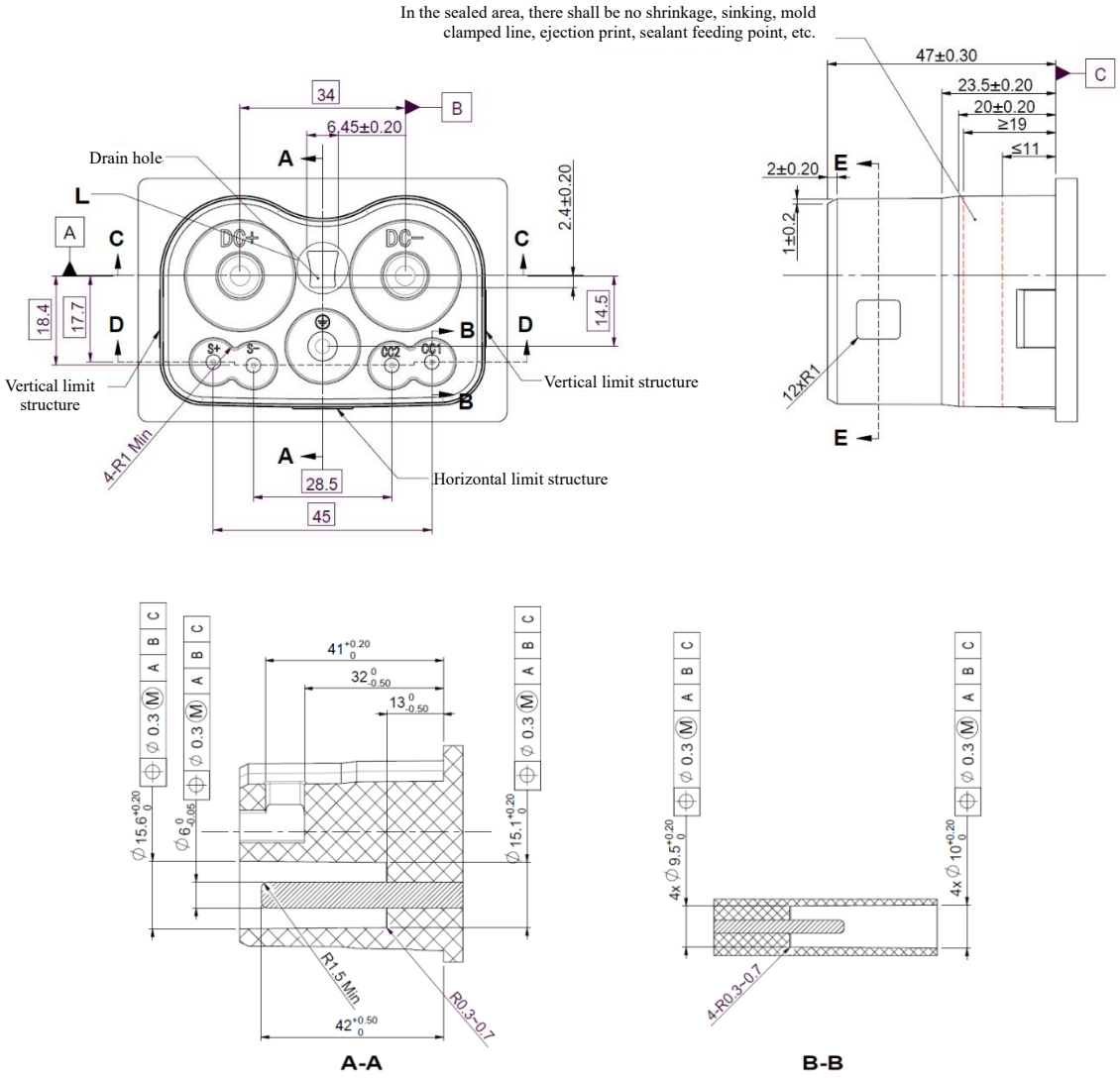
Figure C.1 Temperature Monitoring and Control Principle of Adapter

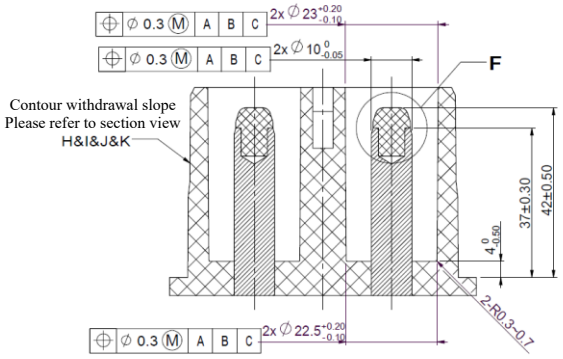
Annex D
(Normative)
Structure Size of Conductive ChaoJi DC Charging Coupler of Electric Vehicles

D.1 Structure size of vehicle connector

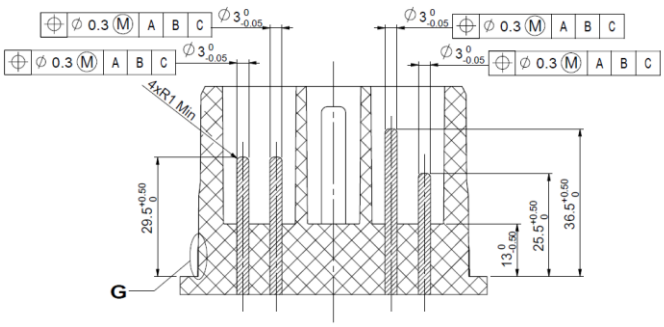
See D.1 for the structure size of vehicle connector.

Unit: mm

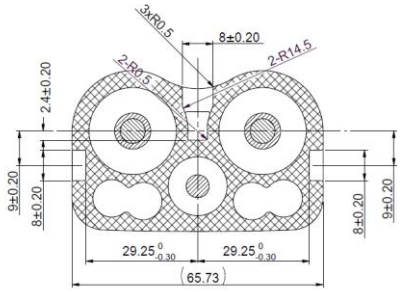




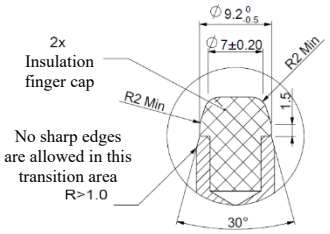
C-C



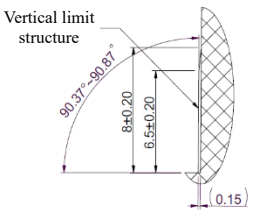
D-D



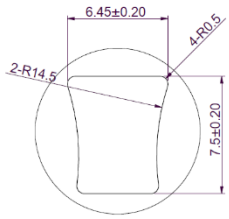
E-E



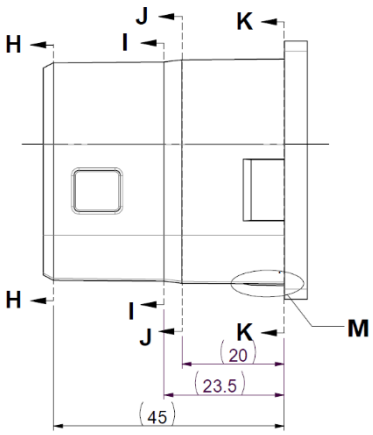
F
2 : 1

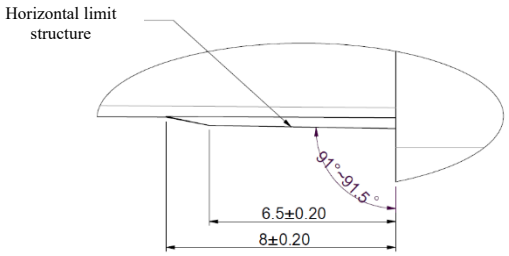


G
4 : 1

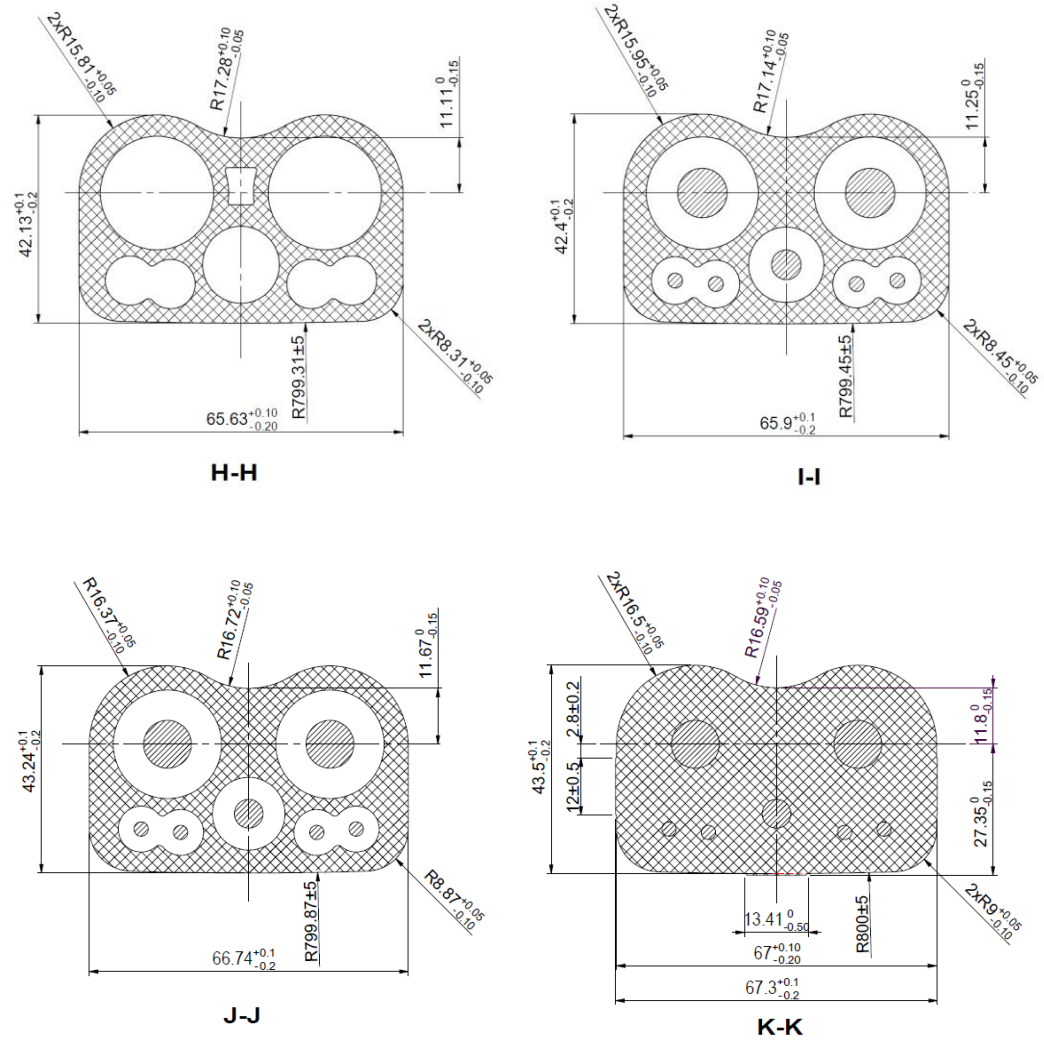


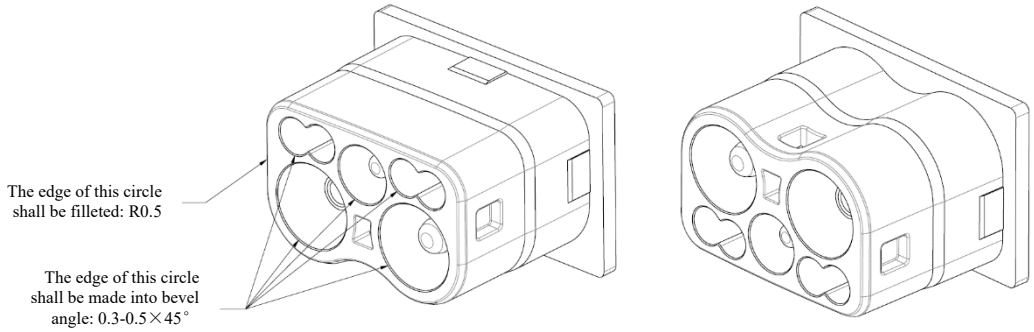
L
4 : 1





M
6 : 1





Note:

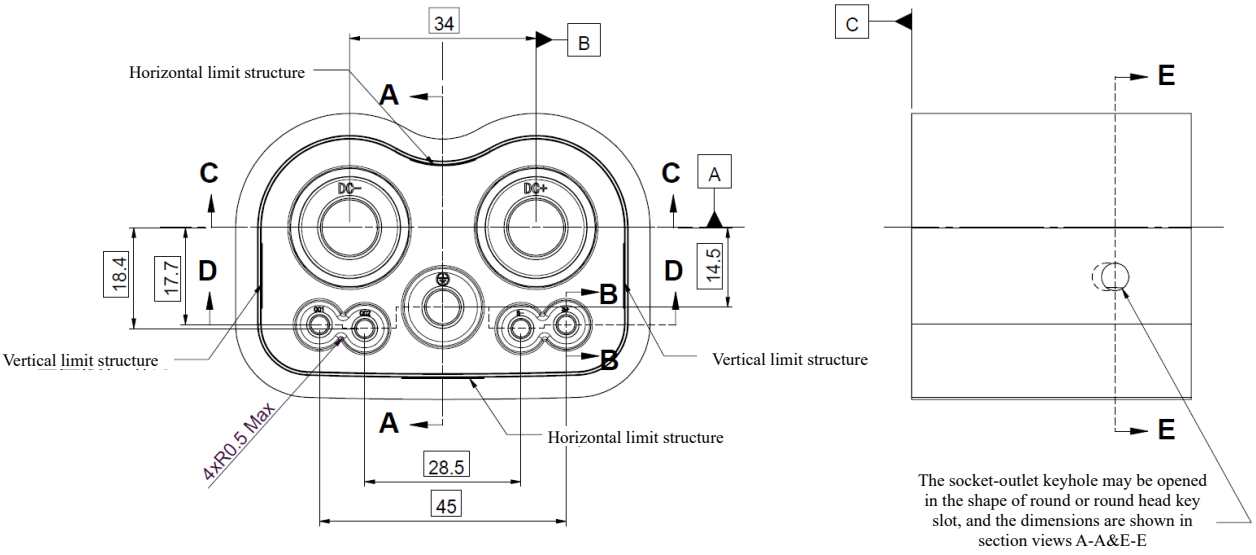
1. The radius of unmarked fillet is R0.3-0.5;
2. The sealed area shall be free of sinking, clamped line, ejection print, sealant feeding point, etc.
3. The surface roughness of sealed area, Ra =0.8;
4. For the unmarked tolerance, please refer to GB/T 1804-m;

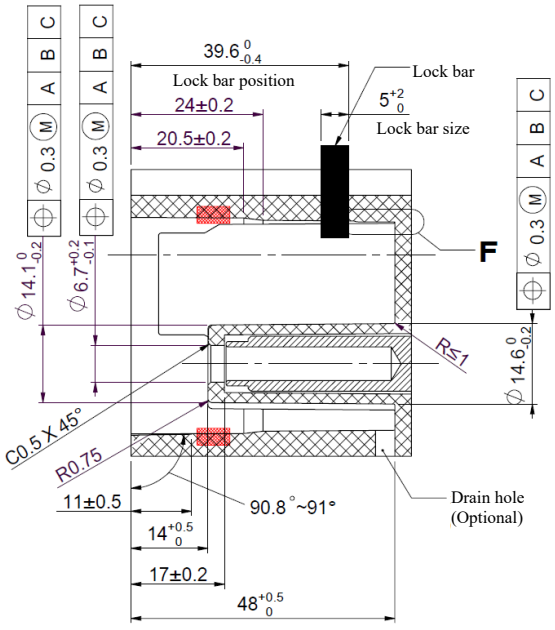
Figure D.1 Structure Size of Vehicle connector

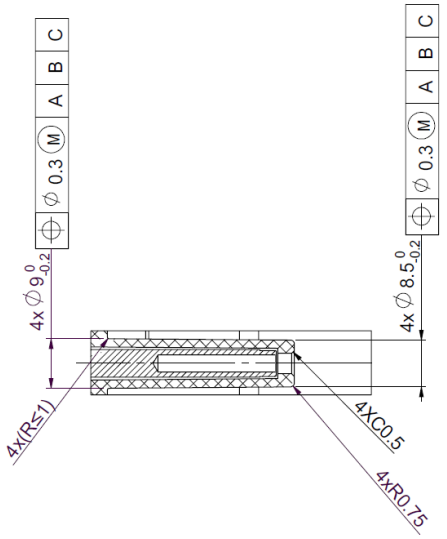
D.2 Structure size of vehicle inlet

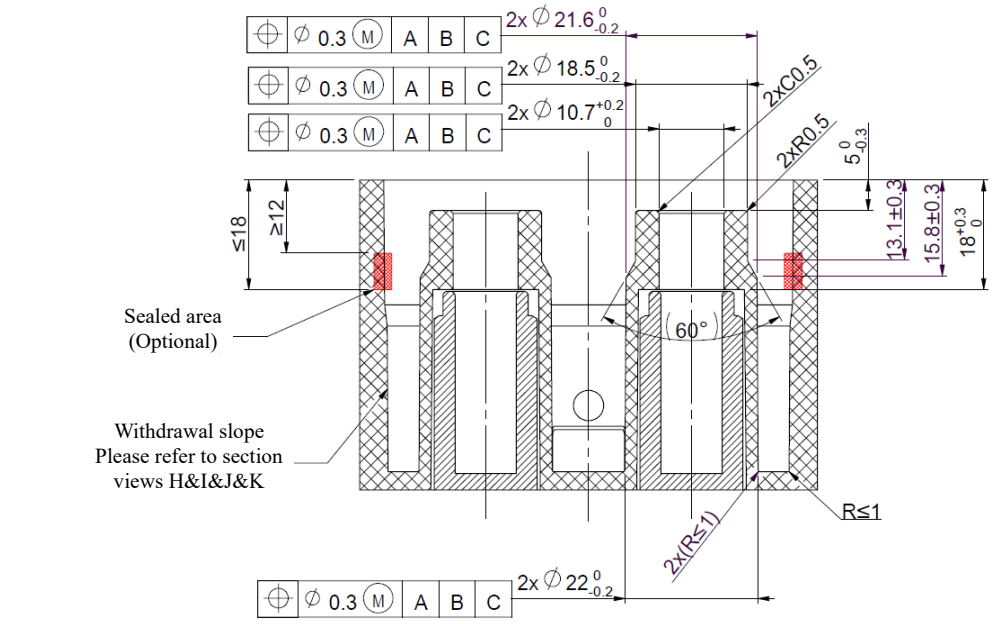
See Figure D.2 for the structure size of vehicle inlet

Unit: mm

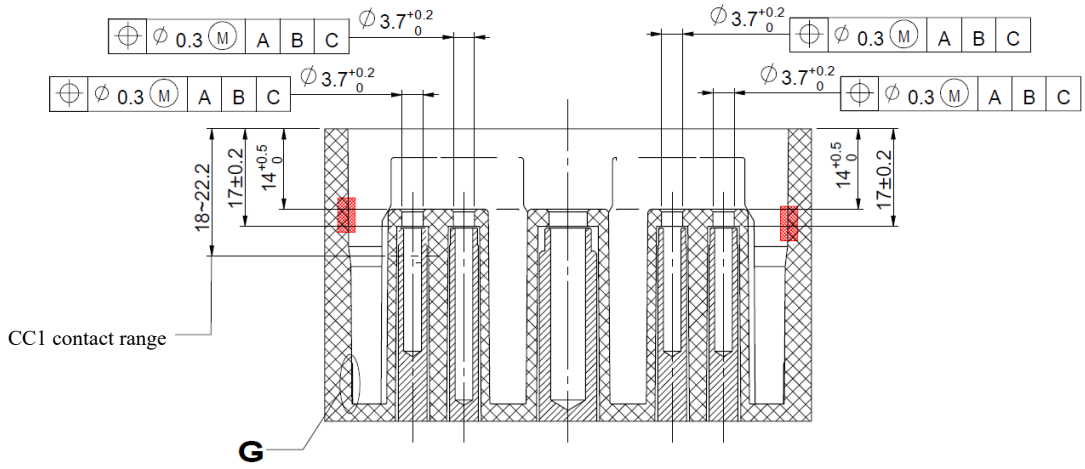




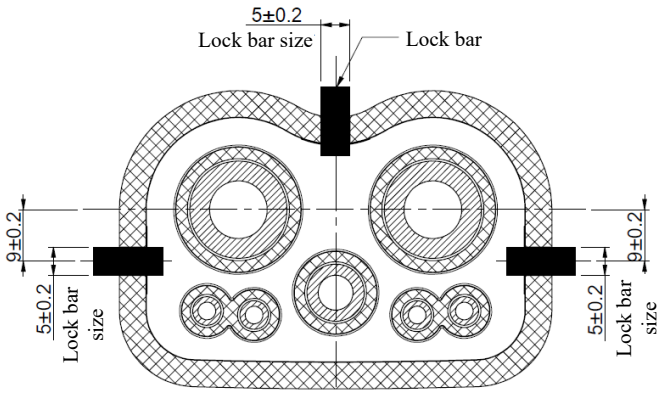



⌖ ∅ 0.3 Ⓜ A B C
⌖ ∅ 0.3 Ⓜ A B C
⌖ ∅ 0.3 Ⓜ A B C
2x ∅ 21.6 0 -0.2
2x ∅ 18.5 0 -0.2
2x ∅ 10.7 +0.2 0
2xC0.5
2xR0.5
5 0 -0.3
13.1±0.3
15.8±0.3
18 +0.3 0
≤18
≥12
Sealed area
(Optional)
60°
Withdrawal slope
Please refer to section
views H&I&J&K
R≤1
2x(R≤1)
⌖ ∅ 0.3 Ⓜ A B C
2x ∅ 22 0 -0.2

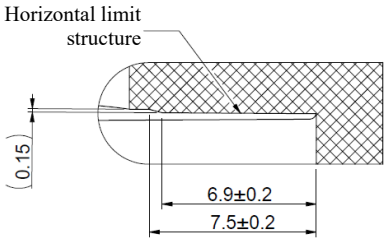
C-C


⌖ ∅ 0.3 Ⓜ A B C
∅ 3.7 +0.2 0
⌖ ∅ 0.3 Ⓜ A B C
∅ 3.7 +0.2 0
⌖ ∅ 0.3 Ⓜ A B C
∅ 3.7 +0.2 0
⌖ ∅ 0.3 Ⓜ A B C
∅ 3.7 +0.2 0
18~22.2
17±0.2
14 +0.5 0
14 +0.5 0
17±0.2
CC1 contact range
G

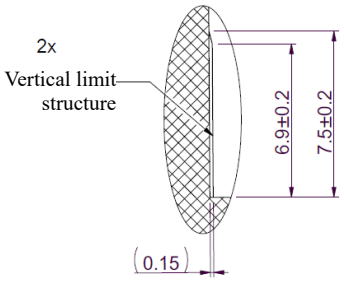
D-D



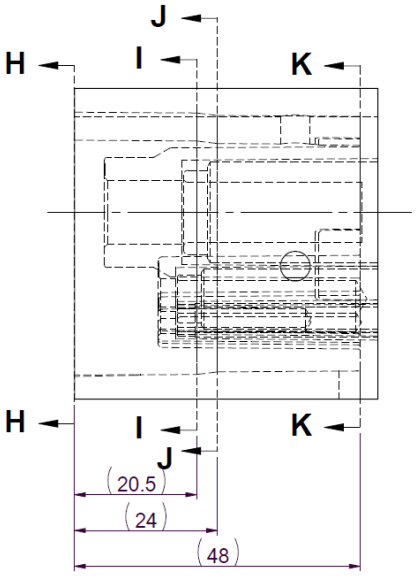
E-E

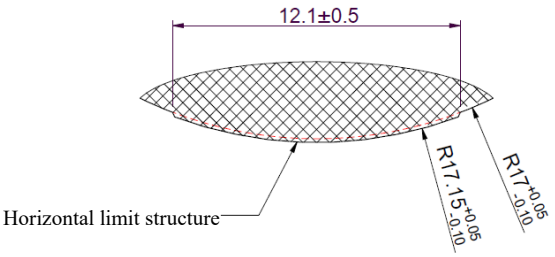


F
4 : 1

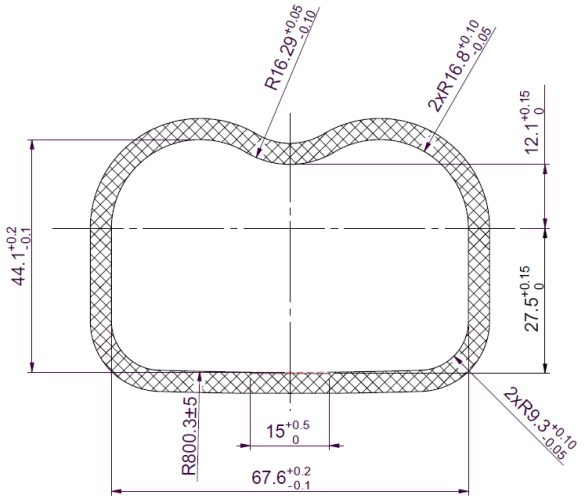


G
4 : 1

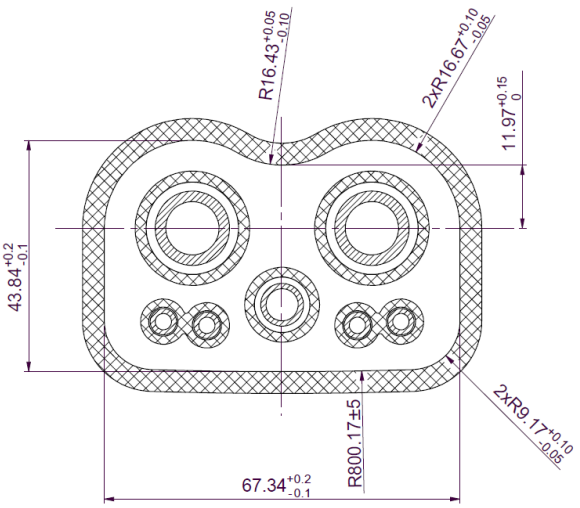




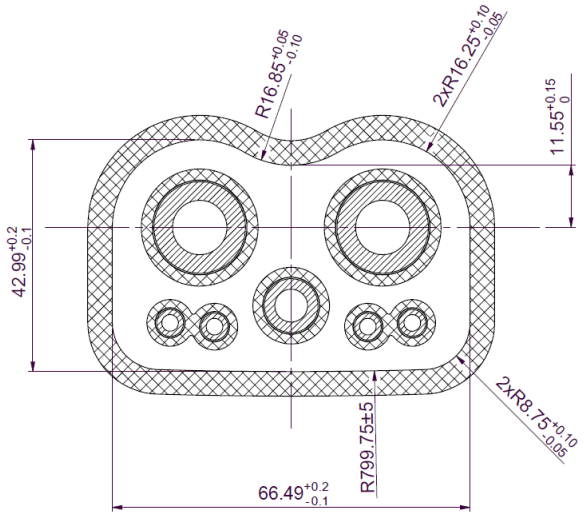
L
4 : 1


R16.29+0.05 -0.10
2xR16.8+0.10 -0.05
12.1+0.15 0
44.1+0.2 -0.1
27.5+0.15 0
2xR9.3+0.10 -0.05
R800.3±5
15+0.5 0
67.6+0.2 -0.1

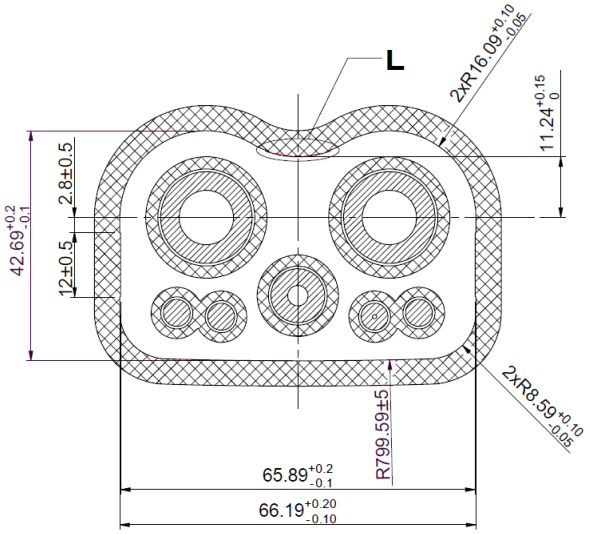
H-H


R16.43+0.05 -0.10
2xR16.67+0.10 -0.05
11.97+0.15 0
43.84+0.2 -0.1
2xR9.17+0.10 -0.05
R800.17±5
67.34+0.2 -0.1

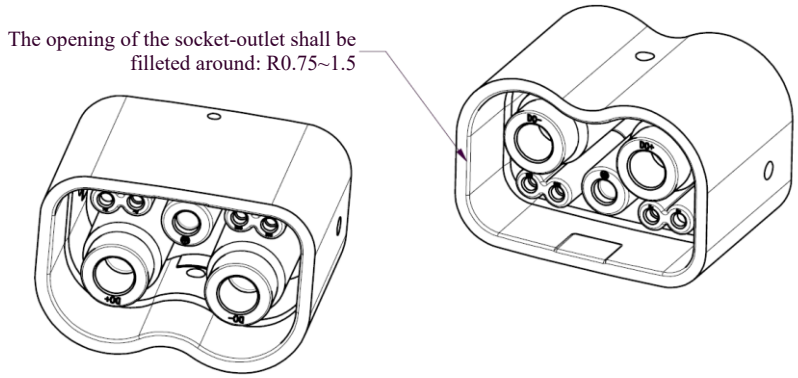
I-I


R16.85+0.05 -0.10
2xR16.25+0.10 -0.05
11.55+0.15 0
42.99+0.2 -0.1
2xR8.75+0.10 -0.05
R799.75±5
66.49+0.2 -0.1

J-J


L
2xR16.09+0.10 -0.05
11.24+0.15 0
2.8±0.5
12±0.5
42.69+0.2 -0.1
2xR8.59+0.10 -0.05
R799.59±5
65.89+0.2 -0.1
66.19+0.20 -0.10

K-K



Note:

1. The unmarked radius is R0.3-0.5;
2. The structure size of drain hole is not specially defined (if selected);
3. Seal ring (optional);
4. The lock bar size and shape are defined by the manufacturer as required;
6. For the unmarked tolerance, please refer to GB/T 1804-m;

Figure D.2 Structure Size of Vehicle inlet

Annex E
(Informative)
Samples of Mounting Size of Vehicle Combined Socket-outlet

E.1 top-bottom combined installation of AC charging vehicle inlet and high-power charging vehicle inlet

The samples of top-bottom combined installation of vehicle inlets are shown in Figure E.1. For the size of the AC interface, refer to the size requirements in Figure A.2 of Annex A in GB/T 20234.2-2015. For the size of DC interface, refer to the size requirements in D.2 of Annex D herein. The distance between the AC interface and the DC interface (size A) is self-defined by the manufacturer according to relevant requirements.

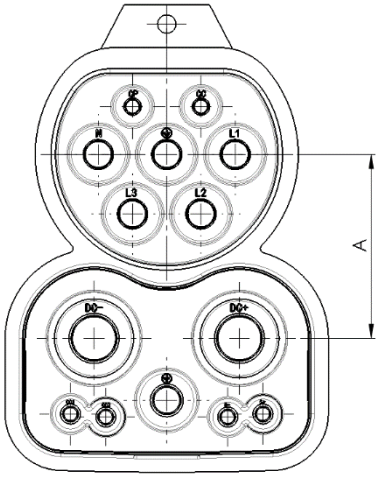


Figure E.1 Samples of Top-bottom Combined Installation of Vehicle inlets

E.2 eft-right combined installation of AC charging socket-outlet and high-power charging socket-outlet

The samples of left-right combined installation of vehicle inlets are shown in Figure E.2. For the size of the AC interface, refer to the size requirements in Figure A.2 of Annex A in GB/T 20234.2-2015. For the size of DC interface, refer to the size requirements in A.2 of Annex A herein. The positions of the AC interface and the DC interface are self-defined by the manufacturer according to the maximum overall size requirements.

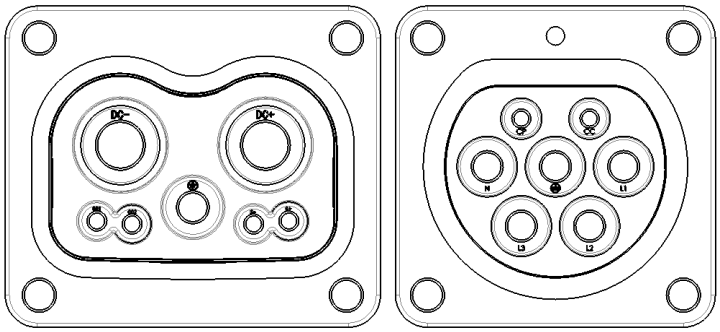


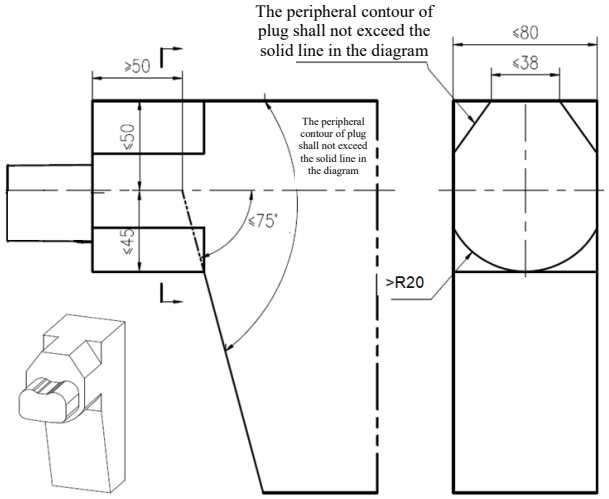
Figure E.2 Samples of Left-right Combined Installation of Vehicle inlets

Annex F
(Normative)
Requirements for Spatial Size of Vehicle connector

F.1 Spatial size of vehicle connector

The requirements for spatial size of vehicle connector is shown in Figure F.1

Unit: mm



Note: This diagram only shows the size relationship between the vehicle connector and the vehicle instead of the outline structure of the specific product.

Figure F.1 Requirements for Spatial Size of Vehicle connector

Annex G
(Normative)
Requirements for Temperature Rise Gauge

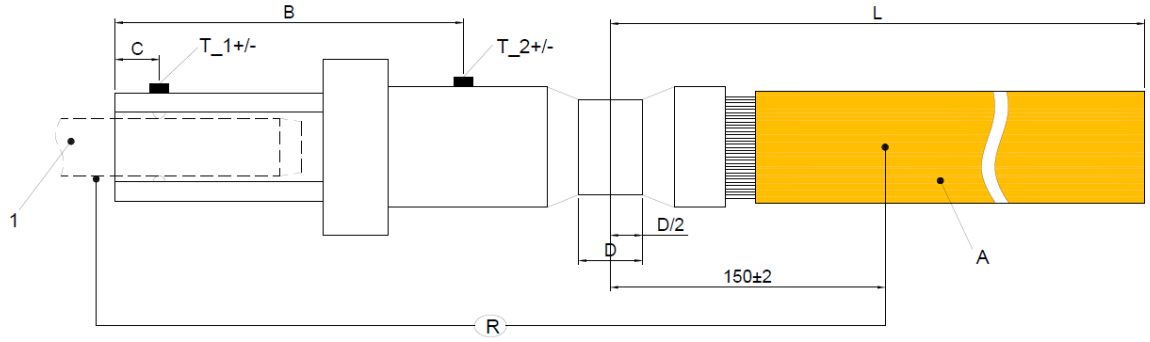
G.1 General provisions

It is suitable for the temperature rise test of vehicle inlet or cable assembly with ChaoJi standard interface, and for any rated current up to 800 A.

G.2 RD and DUT for the temperature rise test of ChaoJi connection set for charging

G.2.1 RD and DUT for the temperature rise test of cable assembly and vehicle inlet

The RD for the temperature rise test consists of a vehicle inlet that complies with Annex D herein and is equipped only with a DC female terminal in accordance with G.4 (a split slot terminal shall be used) without any gaskets or seals. DC+ and DC- are connected by a conductor in a short-circuit manner; the length of the short-circuit conductor is 2m, and the cross-sectional area of the conductor conforms to Table G.2. The vehicle inlet is fixed on the gauge bracket to ensure that the socket-outlet is vertical. 4 temperature sensors are arranged according to Figure G.1. The breakover impedance of RD (including the DC terminal socket, the terminal body, the crimping area, and an area 150 mm away from the back of the crimping area) shall conform to the maximum value shown in Table G.1.



1. The pin terminal with the diameter of 10 +0/ -0.05mm is made of T2 red copper, and the silver plated thickness is ≥8μm. It is used to measure the resistance value R of the RD, and the resistance value shall meet the requirements listed in Table D.1

① For the temperature rise test of the vehicle inlet, the distance B between the RD (used in Step 1) and the sample under test (used in Step 2) shall not change by more than ±1mm

② T_1, T_2: Temperature sensor of RD

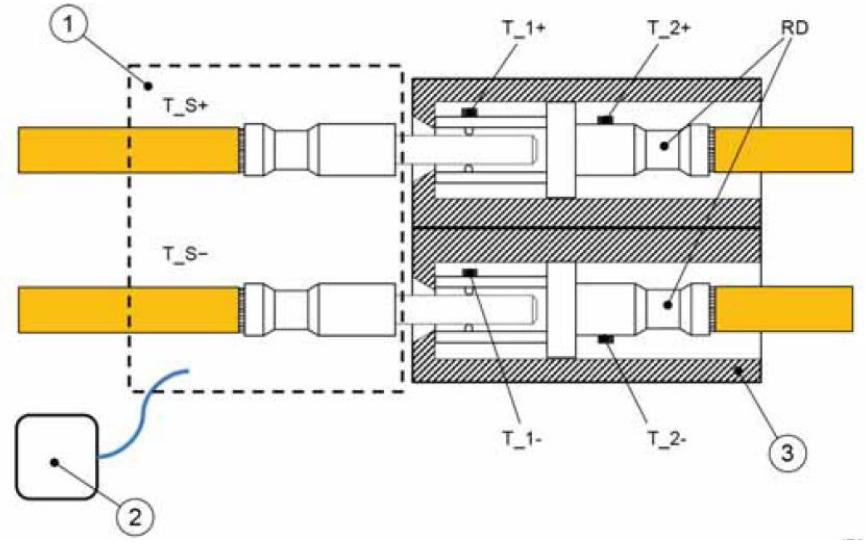
③ For the unmarked size, please refer to Annex A herein

④ The terminal is silver plated entirely, with the silver plated thickness ≥8μm

Figure G.1 RD 1

Table G.1 Maximum Contact Impedance and Size of RD

Rated current (A)	Cross-sectional area of conductor (mm²)	Cable length L (m)	B,C,D (mm)	Impedance R (mΩ)
10	1.5	>1m	As defined by the manufacturer.	TBD
16	2.5			TBD
32	6			TBD
63	16			TBD
80	25			TBD
125	35			TBD
160	50			123 -128
200	70			91 -96
300	70			91 -96
400	95			65 -70
500	120			57 -62
600	TBD			TBD
800	TBD			TBD
a. All braided wires to be connected during resistance measurement b. Resistance value at 25°C				



①: Device under test (DUT)

②: Thermal exchange device - if any

③: Housing and bracket

RD: reference device

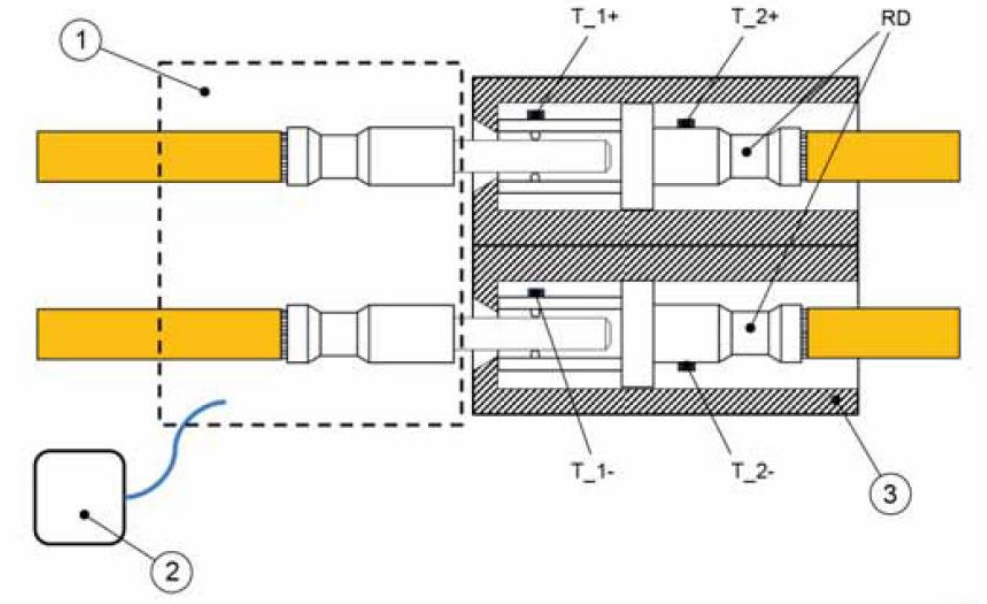
T_S +, T_S-: temperature sensors of DC + and DC- in the vehicle connector

T_1, T_2: Temperature sensor of reference device (RD)

For the unmarked size, please refer to Annex A herein

The terminal of RD is silver plated entirely, with the silver plated thickness ≥8μm

Figure G.2 Device under test 1



RD: reference device

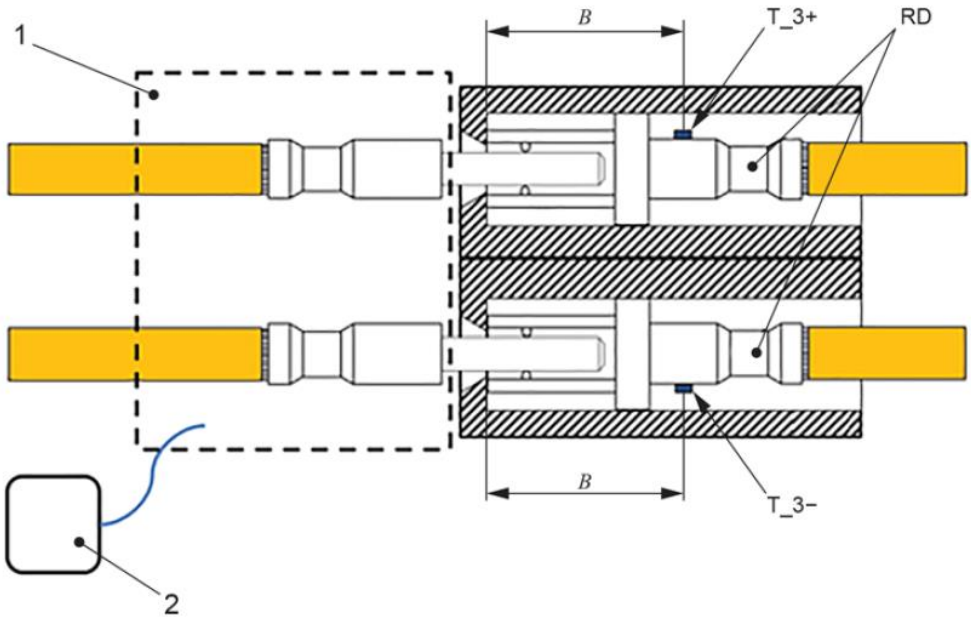
①: Certified vehicle connector

②: Thermal exchange device - if any

③: Housing and bracket

Temperature sensor of T_1 and T_2 reference devices (RD)

Figure G.3 Device under test 2



DUT: Device under test

T_3 +, T_3: temperature sensors T_3 + and T_3

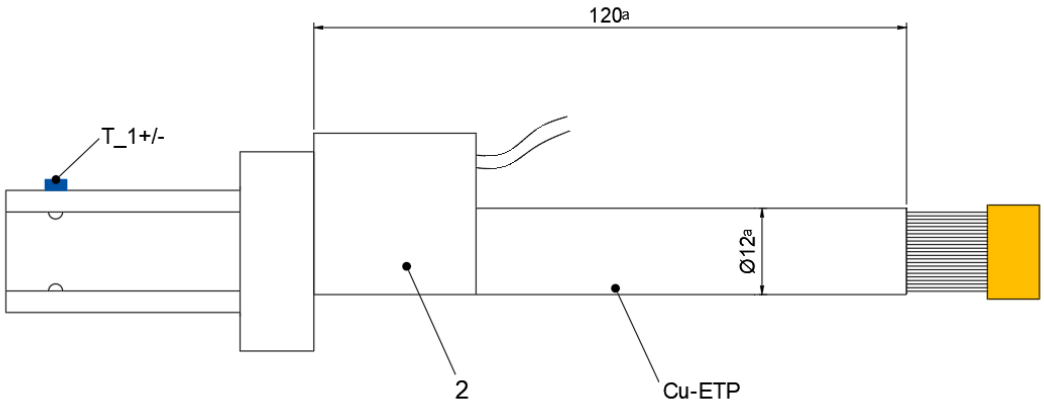
①: Certified vehicle connector

②: Thermal exchange device - if any

B: See Figure D.1

Figure G.4 Device under test 3

G.2.2 RD and DUT for the temperature sensor test of cable assembly



a): The diameter and length of the terminal are recommended values

②: Heating unit (above 50W as recommended)

T_1+/-: temperature sensor (T_1+ or T_1-)

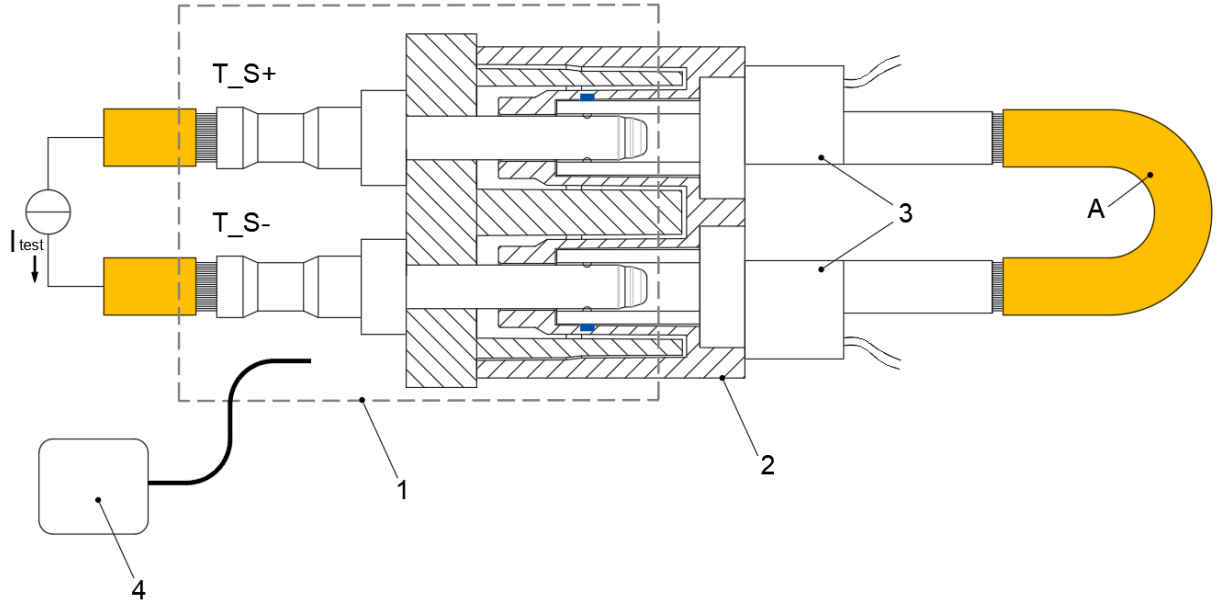
Cu-ETP: Annealed copper electrolysis (purity 99.9%)

For the unmarked size, please refer to Annex A herein

The terminal is silver plated entirely, with the silver plated thickness ≥8μm

For the recommended cross-section of the conductor, refer to Table D.2

Figure G.5 RD 2



①: DUT

②: Vehicle inlet housings conforming to the size requirements in Annex A herein

③: RD (Figure D.5)

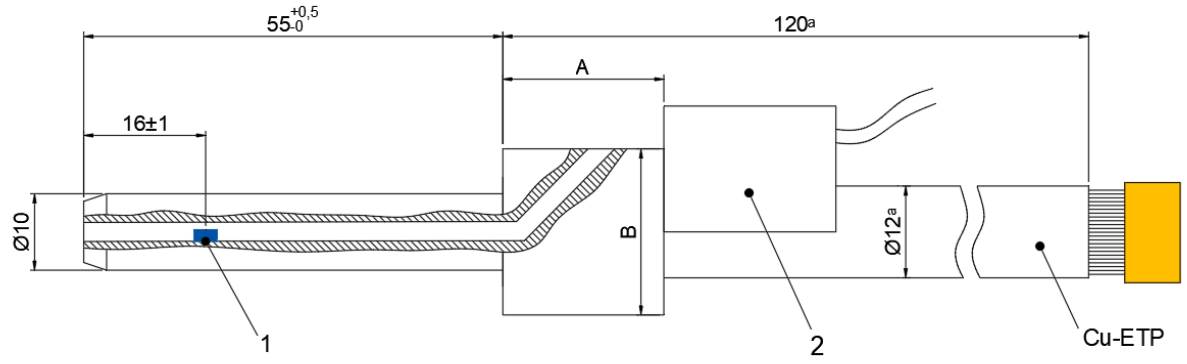
④: Thermal exchange device - if any

T_S +, T_S-: temperature sensors of DC + and DC- in the vehicle connector

A: Refer to the cross-section of the conductor in Table D.2

Figure G.6 Device under test 4

G.2.3 RD and DUT for the temperature sensor test of vehicle inlet



①: Temperature sensor T_1+/T_1-

②: Heating unit (no less than 50W as recommended)

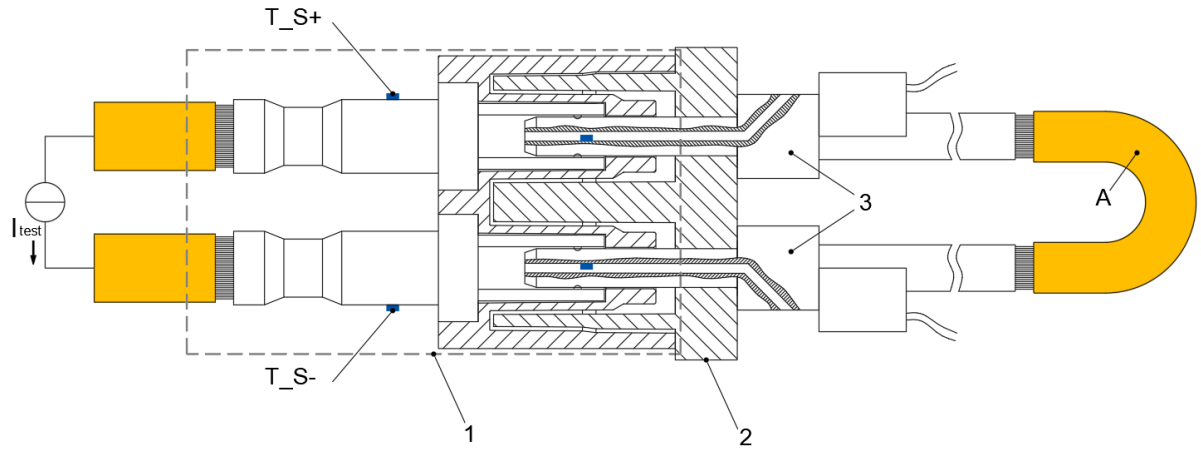
Cu-ETP: Annealed copper electrolysis (purity 99.9%)

Other temperature rise methods described in 8.7.4 are allowed, provided they provide the same test behavior

For the unmarked size, please refer to Annex A herein

The RD is silver plated entirely, with the silver plated thickness ≥8μm

Figure G.7 RD 3



①: DUT (vehicle inlet)

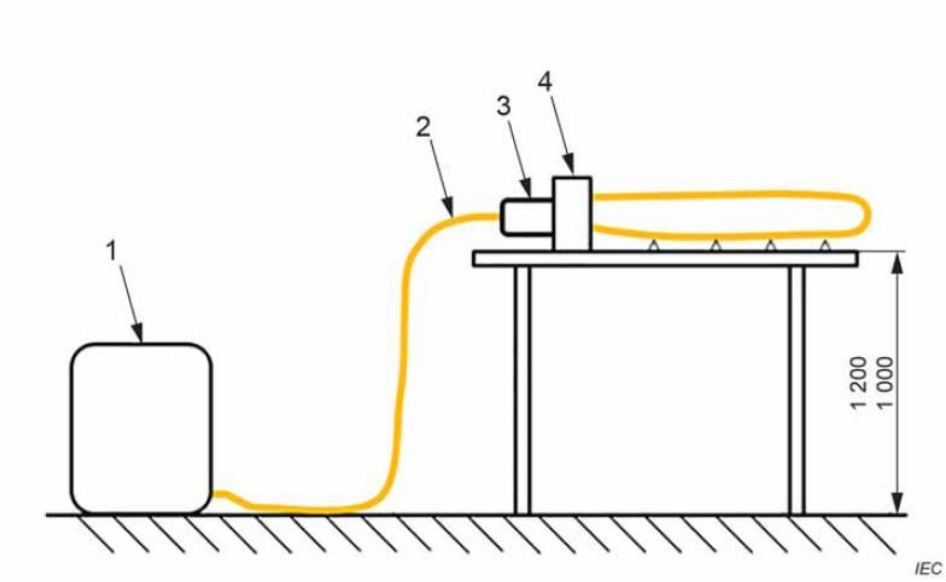
②: Vehicle connector housings conforming to the size requirements in Annex A of this standard

③: RD (Figure D.5)

T_S +, T_S-: temperature sensors of DC + and DC- in the vehicle inlet

A: Refer to the cross-section of the conductor in Table D.2

Figure G.8 Device under test 5



①: Thermal exchange device - if any

②: Flexible cable

③: Test EUT to be tested according to 24.102 and 24.103, or vehicle connector certified according to 24.105

④: RD to be tested according to 8.7.1, 8.7.2, 8.7.3, and 8.7.4 in test Step 1, or DUT to be tested according to 8.7.3 in test Step 2

Figure G.9 DUT for the temperature rise test and temperature sensor test

Table G.2 - Cross-sectional Area of RD Conductor

With thermal transport device		Without thermal transport device	
Test current (A)	**Cross-sectional area of conductor (mm^2)**	**Test current (A)**	**Cross-sectional area of conductor (mm^2)**
		10	1.5
		16	2.5
		32	6
		63	16
		80	25
		125	35
		160	50
200A	50	200	70
300	70	300	95
400	95	400	120
500	120	500	150

600	135(TBD)	600	200(TBD)
800	150(TBD)	800	300(TBD)