GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 29.200
K 81

GB/T 27930-2015

Replacing GB/T 27930-2011

Communication Protocols between Off-Board Conductive Charger and Battery Management System for Electric Vehicle

电动汽车非车载传导式充电机与电池管理系统之间的通信协议

Issued on: December 28, 2015 **Implemented on: January 1, 2016**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine;

Standardization Administration of the People's Republic of China.

Table of Contents

Foreword

This standard is drafted in accordance with the rules given in GB/T 1.1-2009.

This standard replaces GB/T 27930-2011 *Communication Protocols between Off-board Conductive Charger and Battery Management System for Electric Vehicle.* In addition to editorial changes, it mainly differs from GB/T 27930-2011, in the following technical changes:

— "The charger and BMS conforming to this standard should be capable of forward compatibility" is specified in 4.6;

— Communication rate is increased by 50kbit/s in bad communication environment (see Chapter 5);

— "All bits of options are delivered as specified in this standard or filled with 1; the invalid bit or field not specified in this standard is filled with 1" is specified in 7.9;

— Overview flowchart is changed (see Chapter 8);

— Communication handshake message BHM and CHM are added in 9.1;

— 8bytes are reserved for BRM (see 10.1.4);

— CML is given minimum charging current field (see 10.2.3);

— CCS is given charging suspension field (see 10.3.3);

— Reasons for BMS's suspending charging failure are added (see 10.3.8);

— Charging sequence flow chart is added (see A.2);

— Failure process modes in charging are added (see Appendix C);

— Start and suspension conditions for message transmission are added (see Appendix D).

This standard is proposed by and shall be under the jurisdiction of China Electricity Council.

Drafting organizations of this standard: State Grid Corporation of China, China Energy Engineering Group Guangdong Electric Power Design Institute, Nanjing Nari Group Corporation, China Automotive Technology & Research Center.

Participating drafting organizations of this standard: China Electricity Council, Xuji Group Corporation, China Electric Power Research Institute, Shenzhen Auto Electric Power Plant Co., Ltd., BYD Auto Industry Company Limited, BYD Daimler New

Communication Protocols between Off-Board Conductive Charger and Battery Management System for Electric Vehicle

1 Scope

This standard specifies the definitions of physical layer, data link layer and application layer of the Control Area Network (CAN)-based communication between off-board conductive charger (hereinafter referred to as "charger") and battery management system (hereinafter referred to as "BMS") for electric vehicle.

This standard is applicable to the communication between charger and BMS of charging mode 4 specified in GB/T 18487.1 or that between charger and vehicle control units having charging control function.

2 Normative References

The following documents for the application of this document are essential. For dated references, only the edition cited applies. For undated references, the latest edition (including any amendment) applies.

GB/T 19596	Terminology of Electric Vehicles
GB/T 18487.1	Electric Vehicle Conductive Charging System - Part 1: General Requirements
ISO 11898-1:2003	Road Vehicle Control Area Network (CAN) - Part 1: Data Link Layer and Physical Signaling
SAE J1939-11:2006	Recommended Practice for Serial Control and Communication Vehicle Network - Part 11: Physical Layer - 250 K bits/s, Twisted Shielded Pair
SAE J1939-21:2006	Recommended Practice for Serial Control and Communication Vehicle Network - Part 21: Data Link Layer
SAE J1939-73:2006	Recommended Practice for Serial Control and Communication Vehicle Network - Part 73: Application Layer - Diagnostics)

3 Terms and Definitions

For the purposes of this standard, the terms and definitions given in GB/T 19596 AND SAE J1939 and the following apply.

3.1

Frame

Set of consecutive data bits constituting a complete information.

3.2

CAN data frame

Ordered bit fields necessary for the CAN protocol for data transmission, starting from the Start of Frame (SOF) and stopping at the End of Frame (EOF).

3.3

Messages

One or more "CAN data frames" having the same parameter group number.

3.4

Identifier

A symbol which establishes the identity of CAN arbitration field.

3.5

Standard frame

One of CAN data frame which adopts 11-bit identifier defined in CAN 2.0B specifications.

3.6

Extended frame

One of CAN data frame which adopts 29-bit identifier defined in CAN 2.0B specifications.

3.7

Priority

4 General

4.1 The communication network between charger and BMS adopts CAN 2.0B communication protocol. The charging process refers to Appendix A.

4.2 During the charging, the charger and BMS monitor such parameters as voltage, current and temperature meanwhile BMS shall manage the whole charging process.

4.3 CAN communication network between charger and BMS shall be composed of two nodes, i.e. charger and BMS.

4.4 Data information is transported in the priority of low byte.

4.5 Positive current represents discharging while negative current represents charging.

4.6 Charger and BMS conforming to this standard should be capable of forward compatibility.

5 Physical Layer

Physical Layer conforming to this standard shall refer to ISO 11898-1:2003 and SAE J1939-11: 2006. The communication between charger and BMS in this standard shall use the CAN interface independent to power assembly control system. The communication rate between charger and BMS may choose 250 kbit/s.

Note: 50 kbit/s communication rate may be adopted as agreement between power equipment manufacturer and electric vehicles manufacturer in the bad communication environment (for example commercial vehicle charging station with longer communication distance).

6 Data Link Layer

6.1 Frame format

Equipment complying with this standard shall use 29-bit identifier of CAN extended frame, and the corresponding definition of each specific bit allocation shall meet the requirements as given in SAE J1939-21:2006.

6.2 Protocol data unit (PDU)

Each CAN data frame contains a single protocol data unit (PDU), as detailed in Table 1. The protocol data unit is composed of seven parts which respectively are priority, reserved bit, data page, PDU format, specific PDU, source address and data field.

Table 2 Address Allocation of Charger And BMS

Device	Preferred address
Charger	86(56H)
BMS	244(F4H)

6.7 Message type

Technical specification for CAN-bus supports five types of information which respectively are command, request, broadcast /response, confirmation and group function. The specific definition shall comply with the requirements on message types as given in 5.4 of SAE J1939-21:2006.

7 Application Layer

7.1 The application layer is defined in manner of parameters and parameter group.

7.2 Parameter group is numbered by PGN, and each node identifies the content of data packet according to PGN.

7.3 "Request PGN" is used to actively obtain the parameter groups of other nodes.

7.4 Data are transported in the form of periodical transport and event-driven mode.

7.5 In case that multiple PGN data need to be transmitted in order to realize one function, it requires receiving multiple PGN messages of this definition to judge the successful transmission of this function.

7.6 When defining new parameter group, the parameters of one function, the parameters of the same or similar refresh frequency and the parameters belonging to one subsystem shall be put into one parameter group as much as possible; meanwhile, on one hand the new parameter group shall make the best of the data width of 8 bytes and the relevant parameters shall be put into one group as much as possible, and on the other hand the expansibility of the new parameter group shall be fully considered, one byte or bit shall be reserved for future modification.

7.7 When modifying the defined parameter group as given in Chapter 9, the definition of defined byte or bit shall not be modified; the newly-added parameters shall be relevant to the original parameters in parameter group and the irrelevant parameters shall not be added into the defined PGN for purpose of saving the number of PGNs.

7.8 During charging process, the definition of various fault diagnosis for charger and BMS shall comply with the requirements for CAN-bus diagnostic system as stated in 5.1 of SAE J1939-73:2006. The specification for definition of fault diagnosis messages is detailed in Appendix B.

Start byte or bit	Length	SPN	SPN definition	Delivery option
			compilation time information marker, Byte 5, Byte4 - 0001H ~ FFFEH represents "year" (e.g. the year of 2015: fill in Byte5-DFH, byte4-07H);Byte3-01H~0CH represents "month" (e.g. November: fill in Byte 3 0BH); Byte2-01H~1FH represents "day" (e.g. the 10the day: fill in Byte 2 0AH); Byte1-01H~FEH represents edition serial number (e.g. 16: fill in Byte 1-10H). The above value represents: BMS uses 16th version on November 10, 2015 and not fill in certification authorization code)	

10.2 Messages in parameter configuration stage

10.2.1 PGN 1536 messages for charging parameters of power storage battery (BCP)

Message function: power storage battery charging parameter of BMS to charger at charging parameter configuration stage. If the charger fails to receive the message over 5s period, the charger shall end the charging immediately. The PGN 1536 message format is detailed in Table 12.

Table 12 PGN1536 Message Format

Start byte or bit	Length	SPN	SPN definition	Delivery option
1	2 bytes	2816	Maximum permissible charging voltage of single power storage battery	Mandatory
3	2 bytes	2817	Maximum permissible charging current	Mandatory
5	2 bytes	2818	Total nominal energy of power storage battery	Mandatory
7	2 bytes	2819	Total maximum permissible charging voltage	Mandatory
9	1 byte	2820	Maximum permissible temperature	Mandatory
10	2 bytes	2821	Status-of-charge of power storage battery for complete vehicle	Mandatory
12	2 bytes	2822	Current battery voltage of power storage battery for complete vehicle	Mandatory

In which,

1) SPN 2816 maximum permissible charging voltage of single power storage battery

   Data resolution: 0.01V/bit, 0V offset; data scope: 0~24V;

2) SPN2817 maximum permissible charging current

   Data resolution: 0.1V/bit, -400A offset;

				option
1	2 bytes	2824	Maximum output voltage (V)	Mandatory
3	2 bytes	2825	Minimum output voltage (V)	Mandatory
5	2 bytes	2826	Maximum output current (A)	Mandatory
7	2 bytes	2827	Minimum output current (A)	Mandatory

In which,

1) SPN 2824 maximum output voltage (V)

Data resolution: 0.1V/bit, 0V offset;

2) SPN 2825 minimum output voltage (V)

Data resolution: 0.1V/bit, 0V offset;

3) SPN 2826 maximum output current (A)

Data resolution: 0.1A/bit, -400A offset;

4) SPN 2827 minimum output current (A)

Data resolution: 0.1A/bit, -400A offset.

10.2.4 PGN 2304 BMS charging readiness message (BRO)

Message function: BMS sends the battery charging readiness message to the charger so that the charger confirms that the BMS has been ready for charging. If the BMS is not ready in 60s, the charger waits, or deals with according to C.1 PGN 2304 message format is detailed in Table 15.

Table 15 PGN2304 Message Format

Start byte or bit	Length	SPN	SPN definition	Delivery option
1	1 byte	2829	Whether BMS is ready for charging (<0 x00>: = BMS is not ready for charging; < 0xAA>: = BMS has been ready for charging; <0xFF>: = invalid)	Mandatory

10.2.5 PGN 2560 charger output readiness message (CRO)

Message function: charger sends the charger output readiness message to the BMS so that the BMS confirms that the charger has been ready for output. If the charger is not ready in 60s, the BMS waits, or deal with according to C.1. PGN 2560 message format is detailed in Table 16.

Table 16 PGN2560 Message Format

Table 19 PGN4608 Message Format

Start byte or bit	Length	SPN	SPN definition	Delivery option
1	2 bytes	3081	Voltage output value (V)	Mandatory
3	2 bytes	3082	Current output value (A)	Mandatory
5	2 bytes	3083	Cumulative charging time (min)	Mandatory
7.1	2 bits	3929	Charging permissible (<00>: = suspend; <01>: = permit)	Mandatory

Note: When SPN 3929 shows 0 in the received CCS, it indicates that the charger will stop the output; when SPN 3929 shows 1, it indicates that the charger will continue starting charging.

In which,

1) SPN 3081 voltage output value (V)

Data resolution: 0.1V/bit, 0V offset;

2) SPN 3082 current output value (A)

Data resolution: 0.1V/bit, -400A offset;

3) SPN 3083 cumulative charging time (min)

Data resolution: 1 min/bit, 0 min offset; data scope: 0min ~ 600min.

10.3.4 PGN 4864 message for BMS sending power storage battery status information (BSM)

Message function: the power storage battery status information sent by BMS to charger during the charging stage. PGN 4864 message format is detailed in Table 20.

Table 20 PGN4864 Message Format

Start byte or bit	Length	SPN	SPN definition	Delivery option
1	1 byte	3085	Serial number of the highest voltage of single power storage battery	Mandatory
2	1 byte	3086	Highest temperature of power storage battery	Mandatory
3	1 byte	3087	Serial number of the highest temperature detection point	Mandatory
4	1 byte	3088	The lowest temperature of power storage battery	Mandatory
5	1 byte	3089	Serial number of the lowest temperature detection point of power storage battery	Mandatory
6.1	2 bits	3090	Voltage of single power storage battery is over-high/over-low (<00>: = normal; <01>: = over-high; <10>: = over-low)	Mandatory
6.3	2 bits	3091	State-of-charge SOC of power storage battery for	Mandatory

Start byte or bit	Length	SPN	SPN definition	Delivery option
			complete vehicle is over-high/over-low (<00> : = normal; <01> : = over-high; <10> : = over-low)	
6.5	2 bits	3092	Charging overcurrent of power storage battery (<00>: = normal;<01>: =over-current;<10>: untrusted state)	Mandatory
6.7	2 bits	3093	Excess temperature of power storage battery (<00>: = normal;<01>: =over-high;<10>: untrusted state)	Mandatory
7.1	2 bits	3094	Insulation state of power storage battery (<00>: = normal; <01>: = abnormal; <10>: = untrusted state)	Mandatory
7.3	2 bits	3095	Connection state of output connector of power storage battery set (<00>: = normal; <01>: = abnormal; <10>: = untrusted state)	Mandatory
7.5	2 bits	3096	Charging permissible (<00>: = forbid ; <01>: = permit)	Mandatory

In which,

1) SPN 3085 serial number of the highest voltage of single power storage battery

   Data resolution: 1/bit, 1 offset; data scope: 1~256;

2) SPN 3086 highest temperature of power storage battery

   Data resolution: 1°C/bit, -50°C offset; data scope: -50°C~+200°C;

3) SPN 3087 serial number of the highest temperature detection point

   Data resolution: 1/bit, 1 offset; data scope: 1~128;

4) SPN 3088 the lowest temperature of power storage battery

   Data resolution: 1°C/bit, -50°C offset; data scope: -50°C~+200°C;

5) SPN 3089 serial number of the lowest temperature detection point

   Data resolution: 1/bit, 1 offset; data scope: 1~128.

Note: When the SPN3090--SPN3095 in received BSM message is 00 (battery state is normal) and SPN3096 is 00 (charging is forbidden), the charger suspends the charging output; when the SPN3090--SPN3095 in the received BSM message is 00 (battery state is normal) and SPN3096 is 00 (charging is permit), the charger resumes charging and rush current shall meet 9.7 in GB/T 18487.1. When any one of the SPN3090--SPN3095 in received BSM message is abnormal in battery state, the charger shall stop charging.

10.3.5 PGN 5376 single power storage battery voltage message (BMV)

Message function: voltage of every single power storage battery. For the maximum length of PGN 5376 data field exceeds 8 bytes, the transport protocol function shall be

<00>: = fails to reach the required SOC target value; <01>: reach the required SOC target value; <10>: = untrusted state;

3~ 4 bits: reach the setting value of total voltage

<00>: = fails to reach the setting value of total voltage； <01>: = reach the setting value of total voltage; <10>: untrusted state;

5~ 6 bits: reach the setting value of single voltage

<00>: = fails to reach the setting value of single voltage；<01>: = reach the setting value of single voltage; <10>: untrusted state;

7-8 bits: charger actively suspends

<00>: =normal; <01>: =charger suspension (receive CST frame); <10>: =untrusted state.

2) SPN 3512 fault cause for BMS suspending charging

1~2 bits: insulation fault

<00>: =normal; <01>: fault; <10>: =untrusted state;

3~4 bits: output connector over-temperature

<00>: =normal; <01>: fault; <10>: =untrusted state;

5~6 bits: BMS component and output connector over-temperature

<00>: =normal; <01>: fault; <10>: =untrusted state;

7~8 bits: charging connector fault

<00>: = normal; <01>: = fault; <10>: = untrusted state;

9~10 bits: battery set over-temperature

<00>: =normal; <01>: = over-temperature; <10>: = untrusted state;

11-12 bits: high voltage relay fault

<00>: =normal; <01>: fault; <10>: =untrusted state;

13-14 bits: voltage detection fault at check point 2

<00>: =normal; <01>: fault; <10>: =untrusted state;

15-16 bits: other faults

1~2 bits: charger over-temperature

<00>: = charger temperature normal; <01>: = charger over-temperature; <10>: = untrusted state;

3-4 bits: charging connector fault

<00>: = charging connector normal; <01>: = charging connector fault; <10>: = untrusted state;

5-6 bits: charger is over-temperature at the internal part

<00>: =internal charger temperature normal; <01>: = internal charger over-temperature; <10>: = untrusted state;

7~8 bits: the required electric quantity cannot be transmitted

<00>: = electric quantity is transmitted normally; <01>: electric quantity cannot be transmitted; <10>: = untrusted state;

9-10 bits: sudden stop of charger

<00>: = normal; <01>: sudden stop of charger; <10>: = untrusted state;

11-12 bits: other fault

<00>: = normal; <01>: fault; <10>: = untrusted state.

3) SPN 3523 charging error cause for charger suspending

1~2 bits: current mismatching

<00>: = current matching; <01>：= current mismatching; <10>: untrusted state;

3~4 bits: voltage is abnormal

<00>: = normal; <01>: = abnormal; <10>: = untrusted state.

10.4 Message for end-of-charging stage

10.4.1 PGN7168 BMS statistical data message (BSD)

Message function: allow the charger to confirm BMS's charging statistical data for this charging process. See Table 26 for the PGN7168 message format.

Table 26 PGN7168 Message Format

Start byte or bit	Length	SPN	SPN definition	Delivery option
1	1 byte	3601	Suspend state-of-charge SOC (%)	Mandatory

3.1	2-bit	3924	Receive timeout of overall battery charging state message (<00>:=normal; <01>:=timeout; <10>:=untrusted state)	Mandatory
3.3	2-bit	3925	Receive timeout of battery charging requirement message (<00>:=normal; <01>:=timeout; <10>:=untrusted state)	Mandatory
3.5	2-bit	3926	Receive timeout of BMS's charging suspension message (<00>:=normal; <01>:=timeout; <10>:=untrusted state)	Mandatory
4.1	2-bit	3927	Receive timeout of BMS's charging statistics message (<00>:=normal; <01>:=timeout; <10>:=untrusted state)	Mandatory
4.3	6-bit		Others	Optional

Appendix B

(Informative)

Charger and BMS Fault Diagnosis Messages

B.1 Fault diagnosis code

Diagnostic trouble code (DTC) consists of four independent fields, which are detailed in Table B.1:

Table B.1 Diagnostic Trouble Code (DTC)

No.	Independent fields
1	Suspect parameter number (SPN) of trouble (19 bits)
2	Fault mode identification (FMI) (5 bits)
3	Occurrence (OC) (7 bits)
4	Conversion method (CM) of suspect parameter number (1 bit)

In which, the 19 bits of suspect parameter number (SPN) is an diagnosis item used to identify fault report. The suspect parameter number is irrelevant with the address coding of control module sending fault diagnosis message. The SPN No. is the messages of BMS and charger having hardware fault which have been defined in 10.3, e.g.: SPN3090~SPN3095, SPN3511~SPN3513, SPN3521~SPN3523, etc.

The fault mode identification (FMI) defines the discovered BMS and charger fault types. Its data length is 5-bit, data state includes 32 kinds from 0 to 31 and the fault code identifiers defined currently are as follows:

<0>:= voltage fault of power storage battery;

<1>:= current fault of power storage battery;

<2>:=temperature fault of power storage battery;

<3>:=insulation state of power storage battery;

<4>:=over-temperature fault of the output connector of power storage battery;

<5>:=over-temperature of BMS element and battery set output connector;

<6>:=charger temperature fault;

<7>:=charger connector fault;

<8>:=internal temperature fault of charger;

<9~31>:=reserved.

Occurrence (OC) defines the change frequency of a fault from previous active state to the active state and the maximum value is 126; when the count spill upwardly, the counter value shall be reserved as 126. If the occurrence is unknown, all values at each bit of this field shall be set as 1.

If the conversion method (CM) of suspect parameter number is set to 0, it represents that all SPN bits adopt Intel format.

B.2 Classification of fault diagnosis message

See Table B.2 for the classification of fault diagnosis message.

Table B.2 Classification of Fault Diagnosis Message

Message code	Message description	PGN	PGN(Hex)	Priority	Data length	Message period
DM1	Current fault code	8192	002000H	6	Indefinite	Event response
DM2	Historic fault code	8448	002100H	6	Indefinite	Event response
DM3	Diagnose ready	8704	002200H	6	2 bytes	Event response
DM4	Clear/reset of current fault code	8960	002300H	6	0	Event response
DM5	Clear/reset of historic fault code	9216	002400H	6	0	Event response
DM6	Freeze frame parameter	9472	002500H	6	Indefinite	Event response

B.3 Format and content of fault diagnosis message

The fault diagnosis message and contents are as follows

a) PGN8192 diagnostic message 1, current fault code message (DM1)

Message function: send the current fault code in case of fault. Each fault code consists of 4 bytes. The excess 8 bytes of data segment is transmitted by transport protocol function and its format is detailed in 6.5. See Table 8.3 for the PGN8192 message format.

Table B.3 PGN8192 Message Format

Start byte or bit	Length	Definition
1	1 byte	Low 8 significance bits of the first current fault code SPN
2	1 byte	The second byte of the first current fault code SPN
3.1	3-bit	High 3 bits of the first current fault code SPN
3.4	5-bit	Fault mode identification; see B.1 for the details
4.1	7-bit	Occurrence
4.8	1-bit	Conversion method of suspect parameter number, set to 0
.....		

b) PGN8448 diagnostic message 2, historic fault code message (DM2)

Message function: this data includes the occurrence of a series of diagnostic codes and historic fault codes. Each fault code consists of 4 bytes. The excess 8 bytes of data segment is transmitted by transport protocol function and its format is detailed in 6.5. See Table 8.3 for the PGN8448 message format.

Table B.4 PGN8448 Message Format

Start byte or bit	Length	Definition
1	1 byte	Low 8 significance bits of the first historic fault code SPN
2	1 byte	The second byte of the first historic fault code SPN
3.1	3-bit	High 3 bits of the first historic fault code SPN
3.4	5-bit	Fault mode identification; see B.1 for the details
4.1	7-bit	Occurrence
1.8	1-bit	Conversion method of suspect parameter number, set to 0
.....		

c) PGN8704 diagnostic message 3, diagnose ready message (DM3)

Message function: it is diagnostic messages to report that the relevant diagnosis has been ready. See Table B.5 for the PGN8704 message format.

Table B.5 PGN8704 Message Format

Start byte or bit	Length	Definition
1	1 byte	Quantity of current fault codes
2	1 byte	Quantity of historic fault codes

d) PGN8960 diagnostic message 4, clear/reset message of current fault code (DM4)

Message function: all diagnostic messages regarding the current fault code shall be cleared off. This request command will be sent when the relevant diagnostic messages of the current fault code need to be cleared and the problem has been corrected. When the operation is completed or no fault code exists in the requested control module, the control module is required to send a positive response. If the control module fails to implement the required operation for some reason, negative response must be sent. All messages regarding the current fault code include the quantity of current fault codes, diagnosis ready state message and the current fault code.

e) PGN9216 diagnostic message 5, clear/reset message of historic fault code (DMS)

Message function: when certain control module receives the request command from this parameter group, all diagnostic messages regarding the historic fault code shall be cleared off, and the diagnostic data related to the current fault code will not be affected. If there is no historic fault code, positive response must be sent. If the control module fails to implement the request command of this

parameter group for some reasons, negative response must be sent. All messages regarding the historic fault code includes the quantity of historic fault codes, diagnosis ready state message and the historic fault code.

f) PGN9472 diagnostic message 6, freeze frame parameter message (DM6)

Message function: a series of recorded parameters in case of receipt of diagnostic trouble code. Each fault code consists of 4 bytes. The excess 8 bytes of data segment is transmitted by transport protocol function and its format is detailed in 6.5. See Table B.6 for the PGN9472 message format.

Table B.6 PGN9472 Message Format

Start byte or bit	Length	Definition
1	1 byte	Freeze frame length of the first fault diagnosis code
2	1 byte	Low 8 significance bits of the first fault diagnosis code SPN
3	1 byte	The second byte of the first fault diagnosis code SPN
4.1	3-bit	High 3 bits of the first fault diagnosis code SPN
4.4	5-bit	Fault mode identification; see B.1 for the details
5.1	7-bit	Occurrence
5.8	1-bit	Conversion method of suspect parameter number, set to 0
.....		

Appendix C

(Informative)

Charging Process Fault Handling Mode

C.1 Fault handling mode

The fault handling mode includes:

Mode a) — immediately shut down the charger (wait for special maintenance personnel to maintain);

Mode b) — stop this charging and make fault records well (the next charging can be carried out only after plugging in and out the charging cable again);

Mode c) — suspend charging and automatically restore charging after clearing of fault phenomenon (make communication handshake and start charging again after relief of fault state is detected).

C.2 Charging fault classification and handling mode

See Table C.1 for the charging fault classification and handling mode.

Table C.1 Charging Fault Classification and Handling Mode

Fault level	Fault classification and handling mode
1	Classification and handling mode of fault at personal security level: 1) Insulation fault: handling mode a). 2) Leakage fault: handling mode a). 3) Emergency stop fault: handling mode a).
2	Classification and handling mode of fault at equipment security level: 1) Connector fault (fault detected by guiding circuit): handling mode b). 2) Over-temperature of BMS element and output connector: handling mode b). 3) Over-high temperature of battery set: handling mode b). 4) Over-low or over-high single battery voltage: handling mode b). 5) BMS detects oversize charging current or abnormal charging voltage: handling mode b). 6) Charger detects mismatching charging current or abnormal charging voltage: handling mode c). 7) Over-internal temperature of charger: handling mode c). 8) Electric quantity of the charger cannot be transmitted: handling mode c). 9) Adhesion of vehicles contactors: handling mode b).
3	Classification and handling mode of fault at warning prompt level: 1) Timeout of charging handshake stage, configuration stage or charging process: handling mode c).

Appendix D

(Informative)

Conditions for Starting and Suspending Sending Messages

See Table D.1 for conditions for starting and suspending sending various messages.

Table D.1 Conditions for Starting and Suspending Sending Messages

Message code	Conditions for starting sending message	Conditions for suspending sending message
CHM	Low-pressure auxiliary energization	Complete insulation testing and be ready for sending CRM
BHM	Receive CHM message	Receive CRM message
CRM	Insulation testing ends	Receive BCP message
BRM	Receive CRM message	Receive SPN2560=0xAA CRM message
BCP	Receive SPN2560=0xAA CRM message	Receive CML message
BRO	Receive CML message	Send SPN2829=0xAA BRO message and receive SPN2830=0xAA CRO message
CTS	Receive BCP message	Receive SPN2829=0xAA BRO message
CML		
CRO	Receive SPN2829=0xAA BRO message	Receive BCL and BCS message
BCL	Receive SPN2830=0xAA CRO message	Receive CST message (charger initiatively suspends charging) or send BST message (BMS initiatively suspends charging)
BCS		
CCS	Receive BCL and BCS message	Receive BST message (BMS initiatively suspends charging) or send CST message (charger initiatively suspends charging)
BSM	Receive CCS message	Receive CST message (charger initiatively suspends charging) or send BST message (BMS initiatively suspends charging)
BMV		
BMT		
BSP		
BST	If BMS needs suspending charging (BMS initiatively suspends charging) or CST is received (charger initiatively suspends charging)	Receive CST message (BMS initiatively suspends charging) or send BSD message (charger initiatively suspends charging)
CST	If charger needs suspending charging (charger initiatively suspends charging) or BST is received (BMS initiatively suspends charging)	Receive BSD message
BSD	Receive CST message	1) BMS receives charger recognition message (CRM) sent by the charger 2) Or detects no auxiliary power supply output

Message code	Conditions for starting sending message	Conditions for suspending sending message
CSD	Receive BSD message	1) Restart handshake and send CRM frame 2) Or close auxiliary power supply
BEM	If BMS detects error contained in the message	1) BMS receives charger recognition message (CRM) sent by the charger 2) Or detects no auxiliary power supply output
CEM	If the charger detects error contained in the message	1) Restart handshake and send CRM frame 2) Or close auxiliary power supply

_____ END _____