

Conservation & Energy Efficiency Department

Kahramaa's Technical Specifications for Electric Vehicles Charging Stations

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Introduction

In alignment with QNV2030 and Kahramaa’s vision to increase the share of electric vehicles (EV) to 10% by 2022, Kahramaa will be the operator and regulator of all EV charging stations in Qatar. **This document presents Kahramaa’s technical requirements for all types of EV charging stations that can be used for plug-in EV and plug-in hybrid vehicles.**

Types of charging units

There are two broad categories for charging stations: residential and public. Residential charging units are those located in residential buildings (villas, public areas in residential compounds etc) and these are usually AC chargers with charging rates of up to 22 kW. There are two types of residential charges: AC level 1 ($\approx 4\text{kW}$) and AC level 2 ($7\text{ kW} - 20\text{kW}$). The second category is public chargers which can be located in shopping malls parking, premises of commercial areas, workplaces, highways etc and can be either AC, DC, or fast DC. The charging rate of commercial public chargers can reach up to 150 kW depending on the charging technology. Examples of residential and public chargers are given in Figure 1 and Figure 2.



Figure 1 Example of a residential home charger



Figure 2 Example of a commercial public charger

Given that most EV car owners will likely require multiple charging options (home and in public), Kahramaa will be adopting technical standards for both charging technologies and will ensure that a sufficient amount of AC and DC chargers are optimally located throughout Qatar. Kahramaa will provide comprehensive information on best charging habits for EV car owners (which includes charging frequency and battery maintenance).

Technical standards for charging units

Kahramaa is endorsing internationally recognized standards for AC and DC charging technologies to ensure the highest level of quality, performance, safety, and convenience for the customers. These are the two standards that Kahramaa endorses:

1. **The Combined Charging System (CCS) Universal Standard** for Electric Vehicles (for AC and DC chargers)
2. **CHAdeMO Standard** (for DC fast chargers)

The CCS Standard is a global standard for the design, quality assurance, safety, and testing of all types of EV chargers. It was developed in 2012 by seven car makers (Audi, BMW, Daimler, Ford, General Motors, Porsche and Volkswagen) and is currently an officially recognized standard in the EU. It is designed for both AC (single phase and three phase at a max. power of 43 kW) and DC (max. 350 kW) charging units and is used by most U.S. and German EV car manufacturers. **To comply with CCS**, the EV charging units manufacturer has to comply with the relevant ISO, IEC, and DIN standards listed in the CCS's standard Document. This standard also has detailed technical specifications for essential features such as: charging authorization mode, load balancing, and safety measures.. An overview of the interface of the CCS Standard is given in Figure 3. The classification of the charging connectors, inlets, and their functions is given in Figure 4. More information about this standard can be found in its official website: <https://www.charinev.org/ccs-at-a-glance/ccs-specification/>

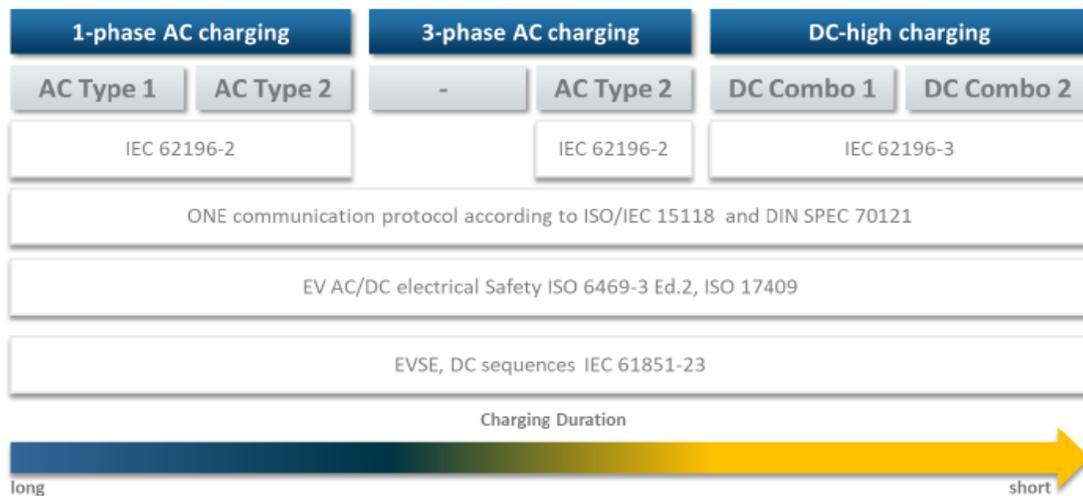


Figure 3 Interface of the CCS Standard



Figure 4 CCS classification of connectors, inlets, and their functions

Kahramaa also endorses the CHAdeMO Standard (for DC fast chargers), which is considered to be the leading standard for DC fast chargers. CHAdeMO Standard was introduced in 2010 by the CHAdeMO Association (which includes five major Japanese automakers). Currently, this standard is adopted in 71 countries and by 438 corporate members. The CHAdeMO Standard is included in the IEC61851 23-24 (standard for EV conductive charging) and IEC62196 (standard for EV plugs, sockets, outlets, and vehicle connectors). An updated list for CHAdeMO certified DC fast chargers can be accessed here: <https://www.chademo.com/products/chargers/>. The recently inaugurated solar-powered EV charging station at the Kahramaa Mesaimeer Complex utilized the CHAdeMO certified SIGNET EV DC fast charger (see Figure 5).



Figure 5 The CHAdeMO certified EV charging unit used at KM Mesaimeer buildings complex

Additional requirements

In addition to compliance with the above standards, Kahramaa also requires:

1. Compliance with the latest version of the Kahramaa's Electricity Wiring Code
2. Compliance with the following GCC Standards (where applicable): GSO IEC 61851-1:2014 , GSO IEC 61851-21:2014 , GSO IEC 61851-22:2014, GSO IEC 62196-1:2015, GSO IEC 62196-2:2014, GSO IEC 62196-3:2017.
3. Compliance with IEC 61000-3-2 for limits for harmonic currents emissions
4. Compliance with IEC standard 60529 for ingress protection of outdoor electrical components
5. Compliance with Ooredoo GSM standards for mobile communications/interlink of the public charging stations network. This requirement serves to achieve Kahramaa's objective of linking all EV charging stations in Qatar for monitoring and performance optimization purposes
6. Public chargers must have a smart payment system
7. **Optional: Energy Star Certification.** If an EV charger is Energy Star certified, then this implies low idle power consumption, and this certification is highly recommended. More details here: Energy Star Certification criteria: https://www.energystar.gov/products/evse_key_product_criteria

Typical specifications for DC fast chargers

Kahramaa will focus extensively on scaling the number of DC fast chargers to reduce charging times and also to remain up to date with global manufacturing trends. Table 1 shows the typical specifications for DC fast chargers.

Table 1 Typical specifications for DC fast chargers

Parameter	Description
Connector details	CHAdeMO and CCS
AC input	3 phase 4 wire, AC 380~480V
DC output	At least 50 kW
Max. DC losses	10%
Efficiency	94%
Operating Temperature	-25°C to + 50°C
Protection	Reverse polarity protection Short circuit protection Over temperature protection Over-voltage / Under-voltage protection Ground fault detection
EV communication protocol	CHAdeMO protocol Ver 1.2 [CHAdeMO] SAE J1772 (IEC 15118) [CCS]
Other features	Touch LCD screen

Charging speed	RFID card reader (for user authentication) <u>Typical:</u> 80% battery charge in less than 60 mins. Superchargers (like Tesla superchargers) can achieve 80% charge in 20 mins.
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Guidelines for Electric Vehicle Charging and Supply Equipment Systems

Scope

These guidelines cover the electrical conductors and equipment external to an electric vehicle that connect an electric vehicle to a supply of electricity by conductive or inductive means, and the installation of equipment and devices related to electric vehicle charging.

Equipment Construction

1. Electric Vehicle Coupler: The electric vehicle coupler shall comply with:

- The electric vehicle coupler shall have a configuration that is non-interchangeable with wiring devices in other electrical systems. Non-grounding-type electric vehicle couplers shall not be interchangeable with grounding-type electric vehicle couplers.
- The electric vehicle coupler shall be constructed and installed so as to guard against inadvertent contact by persons with parts made live from the electric vehicle supply equipment or the electric vehicle battery.
- The electric vehicle coupler shall be provided with a positive means to prevent unintentional disconnection.
- If a grounding pole is provided, the electric vehicle coupler shall be so designed that the grounding pole connection is the first to make and the last to break contact.

2. Rating:

Electric vehicle supply equipment shall have enough rating to supply the load served. Electric vehicle charging loads shall be continuous loads for the purposes of this article. Where an automatic load management system is used, the maximum electric vehicle supply equipment load on a service or feeder shall be the maximum load permitted by the automatic load management system.

3. Markings:

- All electric vehicle supply equipment shall be marked by the manufacturer as follows: “FOR USE WITH ELECTRIC VEHICLES “
- The electric vehicle supply equipment shall be clearly marked if ventilation not required by the manufacturer as follows: “ventilation not required “

- The electric vehicle supply equipment shall be clearly marked by the manufacturer, “Ventilation Required.” The marking shall be located so as to be clearly visible after installation.

4. Cords and Cables: The cable for cord-connected equipment shall comply with all of the following : - The overall useable length shall not exceed 7.5 m unless equipped with a cable management system that is part of a listed the electric vehicle supply equipment or electric vehicle charging system.

(1) Where the electric vehicle supply equipment or charging system is not fixed in place, the cord exposed useable length shall be measured from the face of the attachment plug to the face of the electric vehicle connector.

(2) Where the electric vehicle supply equipment or charging system is fixed in place, the useable length of the output cable shall be measured from the cable exit of the electric vehicle supply equipment or charging system to the face of the electric vehicle connector. Other cable types and assemblies listed as being suitable for the purpose, including optional hybrid communications, signal, and composite optical fiber cables, shall be permitted.

5. Interlock.

Electric vehicle supply equipment shall be provided with an interlock that de-energizes the electric vehicle connector and its cable whenever the electrical connector is uncoupled from the electric vehicle.

6. Automatic De-Energization of Cable.

The electric vehicle supply equipment or the cable-connector combination of the equipment shall be provided with an automatic means to de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in either cable rupture or separation of the cable from the electric connector and exposure of live parts. 8-6 Personnel Protection System. The electric vehicle supply equipment shall have a listed system of protection against electric shock of personnel.

Installation

1. Branch Circuit Markings.

When a branch circuit is installed to supply electric vehicle supply equipment (or electric vehicle charging system), a label shall be permanently affixed adjacent to the outlet box and shall contain the following information: “For use with electric vehicle supply equipment (or) electric vehicle charging system)”, as appropriate, and the voltage and amperage it is permitted to serve.

2. Overcurrent Protection.

Overcurrent protection for feeders and branch circuits supplying electric vehicle supply equipment shall be sized for continuous duty and shall have a rating of not less than 125 percent. of the maximum load of the electric vehicle supply equipment. Where non-continuous loads are supplied from the same

feeder or branch circuit, the overcurrent device shall have a rating of not less than the sum of the non-continuous loads plus 125 percent of the continuous loads.

Electric Vehicle Supply Equipment Connection

Electric vehicle supply equipment shall be permitted to be cord and plug connected to the premises wiring system in accordance with one of the following:

- 1- Electric vehicle supply equipment that is rated 250 volts maximum and complies with all the following:
 - 2-- It is intended for connection to receptacle outlets rated no more than 50 amperes.
 - 3 - It is installed to facilitate any of the following: a. Ready removal for interchange b. Facilitate maintenance and repair c. Repositioning of Portable, movable, or EVSE fastened in place
 - 4- Power supply cord length for electric vehicle supply equipment fastened in place is limited to (1.8 m).
 - 5- Receptacles are located to avoid physical damage to the flexible cord. All other electric vehicle supply equipment shall be permanently connected to the premises wiring system. The electric vehicle supply equipment shall have no exposed live parts.