Technical Guidelines
on Charging Facilities for Electric Vehicles

Purpose

1. This set of technical guidelines sets out the statutory requirements and general guidelines for installation of charging facilities for electric vehicles (EV) in Hong Kong.

International Standard

2. This set of technical guidelines makes reference to, where applicable, the international standard IEC 61851-1:2010 Electric Vehicle Conductive Charging System- Part 1: General Requirements, with regard to different modes of charging, which are summarized in Annex A.

Terms and Definitions

3. For the purpose of this set of technical guidelines, the following terms and definitions shall apply.

Off-board charger
Charger connected to the premises wiring of the a.c. supply network (mains) and designed to operate entirely off the vehicle. In this case, direct current electrical power is delivered to the vehicle.

On-board charger
Charger mounted on the vehicle and designed to operate only on the vehicle.

Charging cable assembly
Piece of equipment used to establish the connection between the EV and socket-outlet or the fixed charger.

Control pilot
The control conductor in the charging cable assembly connecting the in-cable control box or the fixed part of the charging facilities, and the EV earth through the control circuitry on the vehicle. It may be used to perform several functions.

EV supply equipment (EVSE)
Conductors, including the phase, neutral and protective earth conductors, the EV couplers, attachment plugs, and all other accessories, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the EV and allowing communication between them if required.

In-cable control box
A device incorporated in the charging cable assembly, which performs control functions and safety functions.

Statutory Requirements

4. Electric vehicle charging facilities shall mean fixed electrical installations including, but not limited to, switchboards, distribution boards, cabling, conduits, trunking and socket outlets, which shall comply with the relevant requirements of the Electricity Ordinance (Cap. 406) and its subsidiary Regulations.

5. Electrical work on charging facilities including installation, commissioning, inspection, testing, maintenance, modification and repairing shall be carried out by registered electrical contractors and registered electrical workers of the appropriate grade under the Electricity (Registration) Regulations (Cap. 406).

6. Electrical installations of charging facilities shall follow the relevant requirements of the latest Code of Practice for the Electricity (Wiring) Regulations and this set of technical guidelines issued and revised from time to time by the Electrical and Mechanical Services Department.

General Guidelines

7. Four different modes of electric vehicle charging are specified in the international standard IEC 61851-1:2010 and are described in Annex A. Sections 9 to 13 below describe the general guidelines for various modes of charging adopted for use in Hong Kong with provisions for future expansion. In view of continuing development of EVSE standards and different operational needs, EV charging facilities of different design complying with other standards may be acceptable provided that it is certified in compliance with the relevant standards by a registered electrical worker of an appropriate grade.

8. Mode 1 charging is a standard charging protocol and is commonly available in Hong Kong. Different EV manufacturers may specify different charging protocols for their electric vehicles such as Mode 1, Mode 2, Mode 3 or Mode 4 charging. A summary of different modes of charging is given below:-

Mode 1: Use of a standard socket outlet without communication and the presence of a residual current device (RCD) is a must on the supply side, rated up to 16A.

Mode 2: Use of a standard socket outlet not exceeding 32A with in-cable or in-plug control pilot cable.

Mode 3: Use of a dedicated socket outlet where control pilot cable permanently connected to ac source.

Mode 4: Use of an off-board charger i.e. DC quick charger.

Mode 1 Charging

9. Mode 1 charging is also known as standard, normal or slow charging. The associated EV charging facility shall include, but not limited to, electricity supply equipment, final circuit, protective device, and a standard 13A socket outlet complying with BS1363 (i.e. 3-rectangular-pin, 220V ac single-phase) to which the charging cable assembly of the EV shall be plugged in, to receive electricity from the

fixed electrical installation (AC mains). This mode of charging is suitable for longer period of charging such as home or office charging.

Final Circuit

9.1 Each final circuit of EV charging facility shall be installed as a separate radial circuit of the fixed electrical installation.

9.2 Electric cable for the final circuit shall be protected by means of metal sheath or armour, or installed in steel/plastic/PVC conduits.

9.3 The copper conductor size of electric cable for each final circuit shall be of 2.5mm^2 copper conductor cable. A larger size electric cable (e.g. 6 mm^2 copper conductor size) may be used to facilitate future upgrade.

Protective Device

9.4 Each final circuit shall be individually protected by a high breaking capacity (HBC) fuse or miniature circuit breaker (MCB) of suitable rating.

9.5 An earth leakage protective device shall be provided for each final circuit. Either a residual current operated circuit-breaker with integral over-current protection (RCBO) or residual current device (RCD) with residual operating current not exceeding 30mA is acceptable.

9.6 A current breaking device (an ON/OFF switch or others) shall be provided at the upstream of the socket outlet at the charging facility for switching on after plugging and switching off before unplugging the charging cable assembly.

Socket Outlet

9.7 For Mode 1 charging, the standard socket outlet for EV charging facility used in Hong Kong shall be a 13A socket outlet complying with BS 1363.

9.8 Socket outlet shall, in general, be installed at a height of about 1.2m above finished floor level but the actual height of the socket outlet may vary to suit site condition. If there is in-cable control box on the EV charging cable, a bracket or hanging device for supporting the weight of it shall be provided to avoid excessive loading on the EV charging cable and plug. Socket outlet shall be positioned as near as possible to the parking space and away from water point.

9.9 Socket outlet and associated electrical equipment shall be suitably protected from ingress of dust and water to an index of protection of IPX3 for use at indoor car park. An index of protection of IPX4 or higher is required for both plugged and no-plug conditions if the EV charging facility is installed and used in an outdoor environment. The use of a weatherproof enclosure to house both socket outlet and associated electrical equipment is acceptable.

Plug

9.10 For Mode 1 charging, the standard plug of the charging cable assembly used in Hong Kong shall be a 13A non-rewirable plug complying with BS 1363.

Extension Unit

9.11 No extension unit other than charging cable assembly designed for EV charging shall be used.

Operating Instruction

9.12 An operation instruction for the charging facility including essential information of the rated voltage (V), frequency (Hz), current (A), and number of phase shall be displayed at a prominent location at each of the parking space with EV charging facility.

Higher Current Charging

9.13 Some electric vehicle models in Hong Kong are equipped with an on-board charger operating at a current higher than 13A for Mode 1 charging. The use of industrial-type 16A/32A plugs and socket outlets (single phase or three phase) complying with international standard IEC 60309 for EV charging shall be acceptable provided that the associated final circuit and protective device are of suitable rating.

Mode 2 Charging

10. For Mode 2 charging, the provision of fixed electrical installation for charging facility is similar to that for Mode 1 charging except that the final circuit, protective device and socket outlet shall be of suitable rating to cater for the higher level of charging current.

Mode 3 Charging

11. For mode 3 charging, the charging facility shall have a dedicated EV supply equipment connected to an electricity supply of suitable rating from the fixed electrical installation with a dedicated charging cable assembly with a control pilot cable allowing communication between the fixed electrical installation and the EV. The communication via the control pilot cable shall perform the functions of verification of the EV is connected, checking continuous protective earth conductor integrity, energization and de-energization of the supply, and selection of charging rate.

Mode 4 Charging (DC Quick Charging)

12. As a substantially higher electrical power is needed for DC quick charging, specific provisions for quick chargers shall be considered on a case-by-case basis depending on the advice from EV and quick charger manufacturers, and power companies.

13. DC quick chargers typically of 50kW capacity in compliance with the Japanese CHAdeMO protocol (Mode 4 off-board charging) using JEVS G 105 (TEPCO) connector are currently available in Hong Kong.

Other Considerations

14. A bracket or hanging device for supporting the weight of in-cable control box of the EV charging cable shall be provided as far as practicable to avoid excessive loading on the EV charging cable and plug.

15. Other advanced features for charging facility such as system energization, charging rate selection, vehicle connection verification, and circuit protective conductor integrity detection may be considered if Mode 2, Mode 3 or Mode 4 charging is used.

16. Directional signage inside and outside car park is recommended to direct EV drivers to designated parking spaces with EV charging facilities.

17. Occupancy sensors are useful devices giving indication to drivers on availability of EV charging facility in a public car park and may be considered by the owner of a public car park.

18. Means of preventing unauthorized usage of the charging facilities such as housing the socket outlet in a padlocked box or using an access card for energizing charging facility etc. may be provided as necessary.

19. The provision of an indicator light at the charging facility to indicate charging in progress may be provided.

20. For a car park with multiple charging facilities, provision of wired or wireless communication for group control of the charging facilities may be considered.

Inspection and Maintenance

21. Regular inspection or manning of the charging facilities shall be considered for preventing vandalism.

22. Periodic inspection of the charging facilities shall be carried out. If repair or maintenance is required, the electrical works shall be carried out by registered electrical contractor and registered electrical worker.

Useful Information

23. A summary table of different standards of sockets and plugs, RCBO and switch ratings, sizes of non-armoured PVC cables for different charging voltage and current levels for EV charging is shown in Annex B for reference.

24. EVs are generally equipped with an on-board charger. The charging time required will vary depending on the capacity of the EV battery, amount of residual charge in the battery and charging current level which is normally pre-set in the factory. The higher the charging current the shorter the charging time will be. The estimated time to charge up a depleted 16 kWh battery using different charging level is shown in Annex C for reference.

Enquires

25. For further enquires on EV charging facilities, please call EMSD EV Hotline at telephone number 3757 6222.

Electrical and Mechanical Services Department
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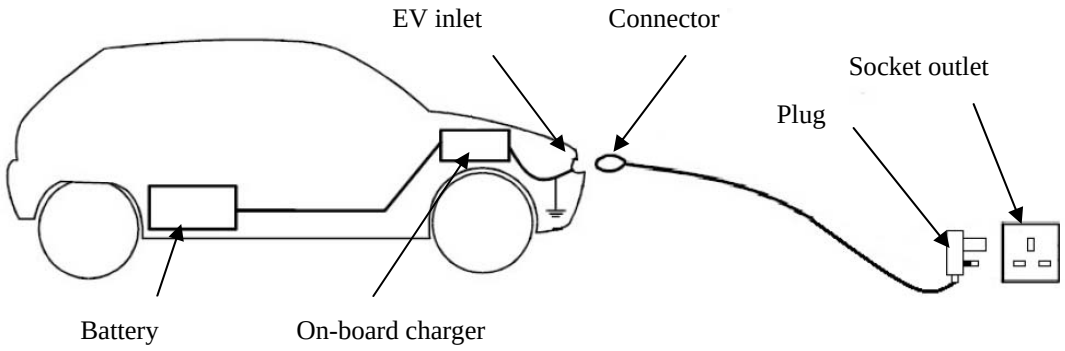
Annex A

International Standard for Electric Vehicle Conductive Charging System

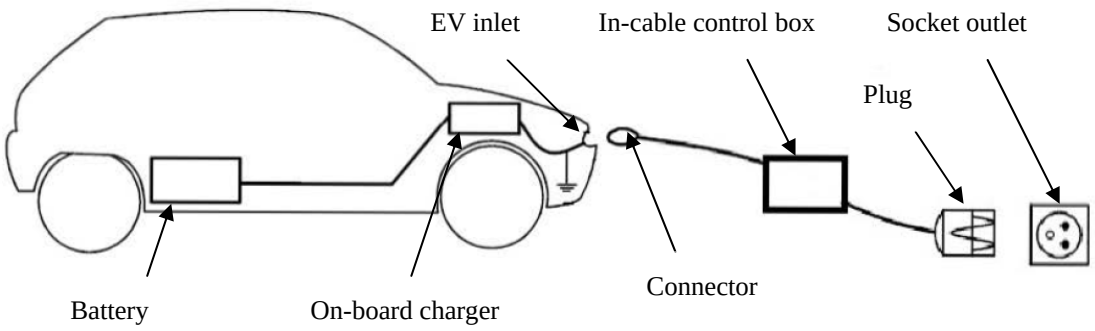
Four (4) possible charging modes of EV are specified in the IEC 61851-1:2010 on Electric Vehicle Conductive Charging System as follows:

Modes of Charging:

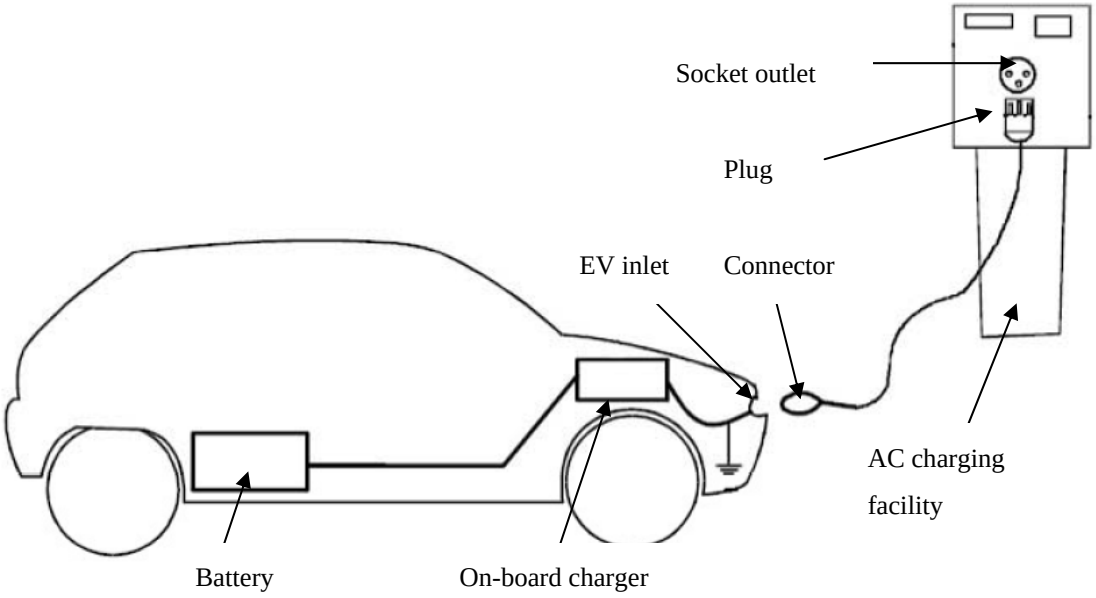
Mode 1 - Use of a standard socket outlet without communication and the presence of a residual current device (RCD) is a must on the supply side, rated up to 16A.



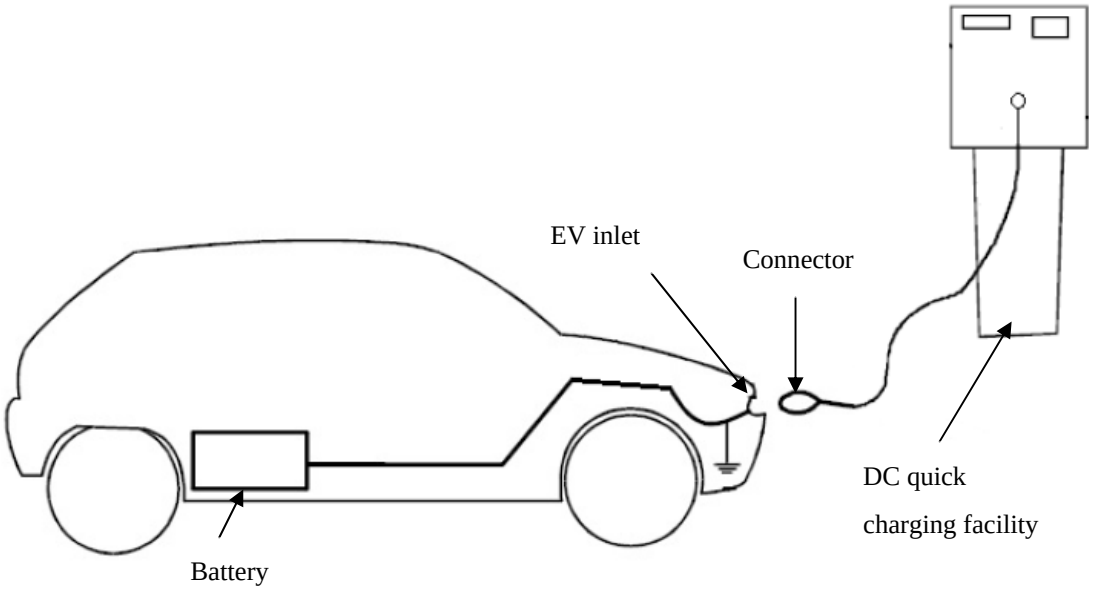
Mode 2 - Use of a standard socket not exceeding 32A outlet with in-cable or in-plug control pilot cable



Mode 3 - Use of a dedicated socket outlet where control pilot cable permanently connected to ac source



Mode 4 - Use of an off-board charger i.e. DC quick charger



Annex B

Summary Table of Different Charging Arrangements

The following summary table indicates various typical arrangements with different standards of socket outlets and plugs, RCBO and switch ratings, sizes of non-armoured PVC cables for different charging voltage and current levels for EV charging (for reference only).

AC Charging Voltage	Max. Charging Current	Cable Size	Max. cable length*	RCBO Rating	On/ Off Switch Rating	Standard of Socket & Plug
220V (single phase)	13A	2.5mm^2 (6mm^2) #	23m (57m)	20A	20A	BS 1363 13A
220V (single phase)	16A	2.5mm^2 (6mm^2) #	19m (47m)	20A	20A	IEC 60309 16A
380V (three phase)	16A	2.5mm^2 (6mm^2) #	39m (92m)	20A	20A	IEC 60309 16A
220V (single phase)	32A	6mm^2	23m	32A	32A	IEC 60309 32A
380V (three phase)	32A	6mm^2	46m	32A	32A	IEC 60309 32A

Larger cable size to allow flexibility of upgrading to a higher charging current up to 32A.

*Maximum final circuit length taking into account of voltage drop.

Annex C

The Estimated Time to Charge Up a Depleted 16 kWh Battery Using Different Charging Levels

Charging Voltage and Current	Charging Power	Charging Time Required	Percentage of Battery Capacity Charged up from Empty
220V, 10A*	2.2 kW	9-10 hours	100%
220V, 12A*	2.6 kW	7-8 hours	100%
220V, 13A*	2.9 kW	6-7 hours	100%
220V, 16A*	3.5 kW	4-5 hours	100%
220V, 32A*	7.0 kW	2-3 hours	100%
DC Quick Charging	50 kW	~30 mins	80%

*Remark: The actual charging voltage and current for an electric vehicle depends on the design and setting of the onboard charger by the EV manufacturer, which may cause the charging time to vary.