Design Guidelines for Electric Vehicle Charging-enabling Infrastructure under the EV-charging at Home Subsidy Scheme

1. Purpose

1.1 This "Design Guidelines for Electric Vehicle Charging-enabling Infrastructure under the EV-charging at Home Subsidy Scheme ("EHSS")" (the "Design Guidelines") serves as reference by consultants employed by applicants of the EHSS in designing and devising technical works specifications of electric vehicle charging-enabling infrastructure ("EVCEI") to be installed under the EHSS. Deviation from this Design Guidelines should be supported with justifications for approval by the Environmental Protection Department ("EPD") before tendering, otherwise the installation might not be accepted by the EPD for release of subsidies under the EHSS.

2. Coverage of the Subsidy

2.1 The subsidy will in general cover the costs of employing a consultant and a contractor for the installation of EVCEI in the car park concerned, including the costs of using the designated web platform for procurement of services of consultant and contractor. The EVCEI installation works to be covered include installation and upgrading of cable containment / trays / trunking, protection devices, distribution boards, conduits, switches, cables / wirings, isolators, alteration and addition to switchgear, meter boards for installation of electric meters, fireman's emergency switch, and associated builder's works required. Modification to the existing charging facilities to integrate with the EVCEI to be installed under the EHSS may also be covered, subject to approval of the EPD. The subsidy will not cover a load management system for the EVCEI installed or to be installed under the EHSS.

3. Design Principles of EVCEI

3.1 The following principles should be observed in feasibility assessment and designing of the EVCEI, and in devising the works specifications –

(a) To maximize the coverage of eligible parking spaces in the car park as far as practicable by resolving problems due to physical site constraints and limitation of power supply capacity to the car park;
(b) To comply with all applicable standards, codes of practice, rules and regulations, including but not limited to Electricity Ordinance and its subsidiary regulations, Code of Practice for the Electricity (Wiring) Regulations and its subsidiary code 26S - Charging Facilities for Electric Vehicles, Buildings Ordinance and its subsidiary regulations, Buildings Energy Efficiency Ordinance, Code of Practice for Fire Safety in Buildings, and power company's supply rules;
(c) To avoid builders' works, such as trenching, boring of holes in walls and building structures, modification to building structures, and erection of cable support structures if there are viable and less expensive alternatives to serve the same functions / purposes;
(d) To disallow any design for concealing cables, conduits, power sockets, etc. for decorative or aesthetic purpose;
(e) To specify and use fixtures, cables, materials and equipment which are commonly available in the market;
(f) To optimize the type, length and size of cables in the circuit design to minimize the overall construction and material costs;
(g) To devise the works programme to optimize the manpower required for completing the works within a reasonable timeframe; and
(h) With agreement from the applicant and the EPD, and having regard to the economy of the installation cost, to integrate the existing EV charging facilities / EV chargers with the EVCEI to be installed, so as to optimise the use of the power supply capacity available for supporting EV charging at all eligible parking spaces in the application to be covered.

4. Design of Power Supply System and Circuits

4.1 To ensure that the EVCEI can support simultaneous charging at all the parking spaces in the car park, the spare power capacity in a premises has to meet a minimum requirement in order to be eligible for the EHSS. Ideally and preferably, the power supply capacity should be able to support simultaneous medium charging, i.e. with 1-

phase 32A power supply, at all parking spaces. As a minimum, the existing power supply capacity needed for the EVCEI should be able to support simultaneous medium charging for 50% (half) of all eligible parking spaces in the application, or the power company, based on its preliminary assessment and subject to the supply conditions to be fulfilled by the applicant, advises that the power supply can be upgraded to such capacity within three years from the date of successful application for subsidy under the EHSS. The consultant shall check with the power company to ensure adequacy of power supply capacity.

4.2 Since the power supply capacity of car parks of existing private residential buildings has not been designed to support EV charging, it may be necessary for the power company to upgrade its power system in order to meet the minimum requirement as set out in paragraph 4.1 above. Therefore, the consultant shall liaise with the power company and seek the agreement from the applicant on the arrangement before finalizing the design of power system and the circuits for the EVCEI to be installed.

4.3 In case the power supply capacity in premises cannot support simultaneous medium charging at all parking spaces to be covered, a load control system or optimised design can be implemented to facilitate the EV charging in the car park. Three possible options of design of power system and distribution circuits can be considered. The chosen option agreed by the applicant should meet the needs of the applicant and the owners of the parking spaces involved. The three options are:

(a) Zoning of power supply to parking spaces

Modern electric private cars (e-PCs) have driving range at some 300 km after an overnight medium charging. For most of the e-PC owners, they only need to recharge their e-PCs two to three days a week to meet their driving needs. Hence, subject to the agreement of the parking space owners of the car park, it is feasible that the design of the distribution circuits of the EVCEI can be divided into two zones to enable switching of power supply to each zone in turn according to a preset schedule, such as once every alternate day, so that the total

available power can be shared by each zone of parking spaces. Zoning of power supply can address the problems of space limitation and high construction cost in the expansion of the switch room and transformer room.

Motorized transfer switches or control devices can be used for switching of the power supply to two zones, as follows –

(i) Motorised transfer switch

Each transfer switch shall be housed inside a metal enclosure with suitable IP rating and equipped with a control unit to allow manual change of I-O-II –operation via touch-sensitive buttons. The motorized transfer switch shall also allow operation with a handle, which is padlockable in O-position and door interlock available in the I- and II-positions.

(ii) Control device

Each control device shall be housed inside a metal enclosure with suitable IP rating and equipped with a control switch to allow manual change of I-O-II operation. All power contactors and relays should be installed with suitable ratings. Adequate name plates, indicators for I-O-II operation, and indicators for Power On/Off should be provided.

Timers can be installed to control the power supply to parking spaces according to a preset schedule so that the total available power can be shared by each zone of parking spaces automatically. In order to prevent frequent high-current breaking and connection of switches, it is recommended that the changeover operation should be performed once a day and carried out during off-peak hours.

Manual override key switch(s) can be installed to bypass motorized transfer switches or control devices for future implementation of a Load Management System as described in paragraph 4.3 (c), if needed. A schematic of the

circuit design with supply zones is in **Annex A** for reference.

(b) Reduced Charging Current

Most EV chargers / EV supply equipment are current adjustable. Therefore, if the available power is insufficient, the design of distribution circuits for the EVCEI should allow installation of RCBOs / MCBs with a rated current of 20A or lower according to the current output setting of the EV chargers / EV supply equipment to prevent electrical overload. For example, if a diversity factor[1] of 0.67 is available for the EVCEI, it is feasible to use circuit breakers at a rated current of 20A for all the parking spaces in the car park. The merit of this option is that the EVCEI can support simultaneous charging at all parking spaces without the need for implementing power switching or load management.

In addition, the design of EVCEI should allow future implementation of a Load Management System as described in paragraph 4.3 (c), if needed, to achieve maximum 1-phase 32A charging without the need to replace electric cables or any fixed electrical installations.

(c) Load Management System ("LMS")

A load management system or load balancing system may be considered for automatic sharing and distribution of power supply to all parking spaces, taking into account factors like the anticipated growth rate of EVs in the car park, compatibility with the chargers, operation and maintenance issues in association with the LMS. However, LMS may become obsolete, or the charging protocol may require further update(s) after certain period of time. As simultaneous medium charging covering all parking spaces can also be achieved either by (a) zoned power supply or (b) reduced

[1] Diversity factor is the ratio of "the maximum demand of the EVCEI" to "the connected loads of the EVCEI", and which should be equal to or less than 1. The "maximum demand of the EVCEI" means the actual maximum power demand of the supply system for EV charging, and "the connected loads of the EVCEI" means the total rated power requirements of all the EV supply equipment / EV chargers connected and to be connected to the EVCEI.

charging current which are technically feasible and more economical without the need to pay additional service fees to operate and manage a computer system for the LMS, the consultant must advise the applicant of the pros and cons of a LMS including the need to bear the relevant supply and installation costs for LMS or equivalent devices as these costs are not covered under the EHSS, before concluding if a LMS should be adopted.

4.4 For the three options mentioned above, the diversity factor of the EVCEI should be 0.5 or higher, otherwise prior approval should be sought from the EPD before finalizing the works specifications.

5. Sizing of Low Voltage Cable Conductors and Cable Containment

5.1 The design of power distribution from switch room(s) to the final circuits shall include specifications of cable sizes, schematic diagrams of the supply circuits, infrastructure layouts, specifications of cable containments and method statements for the installation works.

5.2 Dedicated distribution board(s) should be installed on each floor of the car park. All final circuits shall be designed with appropriate type of cable from the distribution board installed up to the isolator fixed on the nearest vertical permanent structure from the parking space. For "island" or stand-alone parking spaces and outdoor parking spaces without nearby vertical permanent structures, the isolators can be fixed on concrete plinths or mounting poles erected at the rear corners of the parking spaces. In general, the isolators should be located at a height of 0.5m or higher above the finished floor that can be readily accessible for maintenance purposes, and should be suitably identified by durable marking and/or labelling.

5.3 PVC insulated cables to BS EN 50525-2-31 and armoured cables to BS6346 or BS5467 should be used. Final circuit wirings extending along walls should be supported by suitable cable containment such as cable trunking/surface conduit, while armoured cables running on ceiling should be supported by ceiling-mounted cable trays.

5.4 All cable conductors should be of suitable sizes in accordance with the Code of Practice for the Electricity (Wiring) Regulations and Technical Guidelines on Charging Facilities for Electric Vehicles issued by Electrical & Mechanical Services Department ("EMSD").

6. Monitoring and Protective Devices

6.1 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") of type and characteristic complying with the requirements of Code 26S of the Code of Practice for the Electricity (Wiring) Regulations shall be adopted.

6.2 Each final circuit shall be individually protected by RCBO or MCB of suitable rating.

6.3 A digital power analyzer shall be installed on the relevant switchboard(s) to monitor phase currents, phase voltages, power factors, etc.

7. Final Circuits

7.1 A lockable isolator (an ON/OFF switch or others) shall be provided at the upstream of the EV charger / EV supply equipment to be installed by the parking space owners in future.

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

7.3 Size of copper conductors of wirings for each final circuit shall be selected basing on medium charging, i.e. 1-phase 32A and taking into account the constraint of voltage drop in the circuit in accordance with the relevant requirements of the latest Code of Practice for the Electricity (Wiring) Regulations issued by EMSD. A conductor size suitable for carrying a minimum rated current of 32A is required.

8. Electricity Meters and Check Meters

8.1 Each isolator should be connected with an electricity meter installed

in compliance with requirements of the power company for billing of power consumption for charging of EV in individual parking space. These meters should be installed inside communal meter room(s) at each car park level. If meter room(s) is not available, groups of meters may be installed inside weather-proof stainless-steel cabinet(s) subject to agreement of the power company.

8.2 The supply and installation of customer check meter(s) in the switch room should be included in the works specifications to record the aggregate monthly power consumption of the EVCEI installed.

9. Fire Safety Requirements

9.1 A fireman's emergency switch shall be installed at vehicle entrance(s), fire control centre or other locations as considered acceptable by the Director of Fire Services according to Fire Services Department ("FSD") Circular Letter No. 4/2020 – Additional Fire Safety Requirements for Car Parking Facilities installed with Electric Vehicle Charging Facilities ("Circular Letter") issued on 31 July 2020.

9.2 In case the applicant has included a car park without sprinkler system in the application, the consultant should check with the applicant whether the applicant wishes to install a fire detection system in the car park. With the applicant's confirmation, the consultant shall include the fire detection system in the works specifications.

Air Policy Division
Environmental Protection Department
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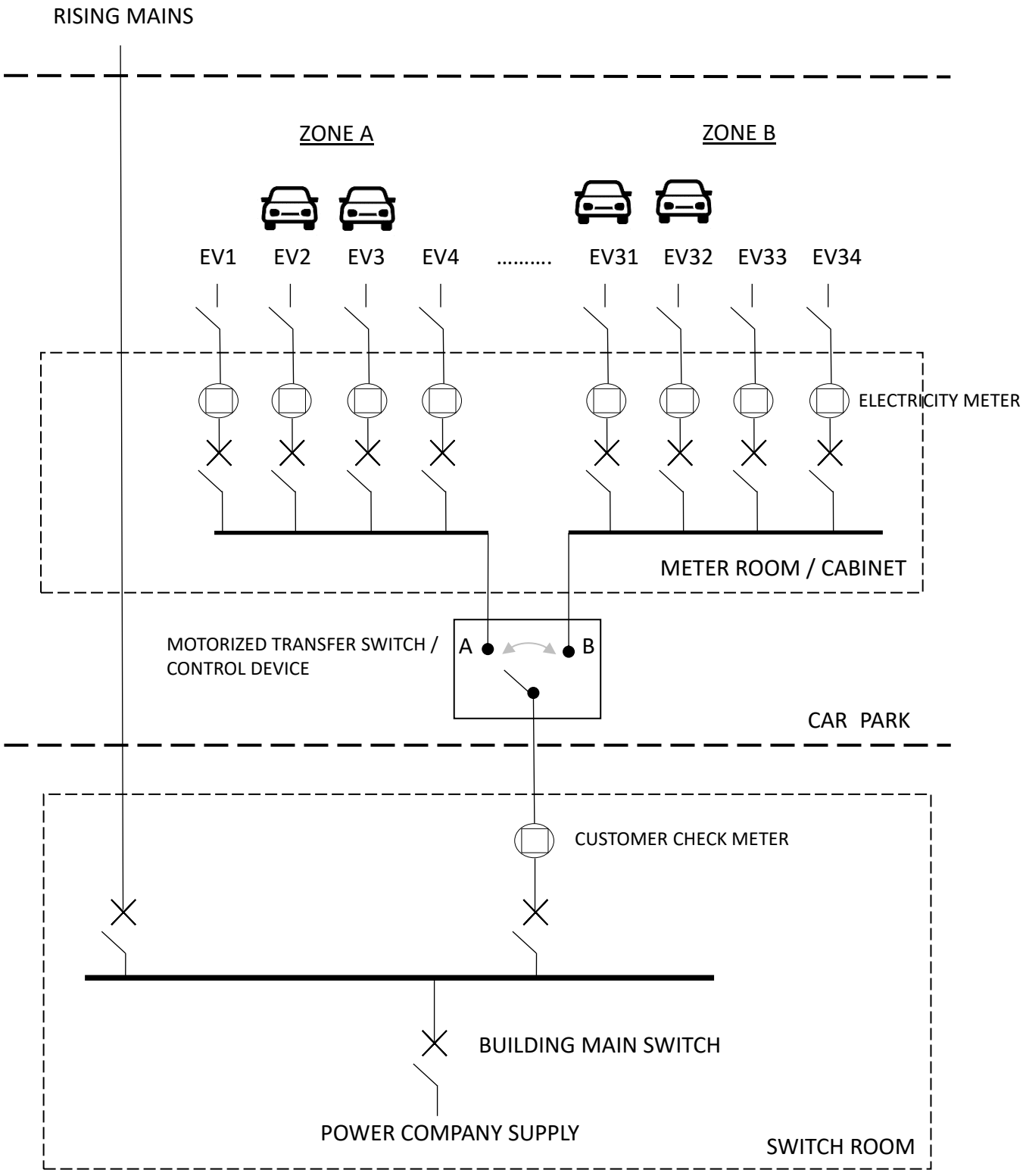
(Version 3)

Annex A



ARRANGEMENT OF "ZONE SUPPLY" AND USE OF MOTORIZED TRANSFER SWITCHES OR CONTROL DEVICES TO ALTERNATELY SUPPLY POWER TO EACH ZONE OF THE CAR PARK

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Summary of Major Amendments

Note:

1. The following summary table includes the major amendments on the Design Guidelines.

2. This serves the purpose of ease of reference only. The Design Guidelines should take preference over any discrepancy if identified.

Section 4 Design of Power Supply System and Circuits	**Version 2**	**Version 3**
Provide the definition of diversity factor.	Not specified.	Footnote 1 under 4.3 (b) added.