

**Technical Reference for electric vehicle charging system**

**AMENDMENT NO. 1**

July 2020

**1. Page 3, Contents**

*Add* the following after Section Two – General requirements and d.c. electric vehicle charging station using Mode 4 charging:

Section Three – General requirements for the commissioning, testing and inspection of EV charging stations

- 3.1 Scope and objectives
- 3.2 Normative references
- 3.3 Frequency of testing and inspection
- 3.4 Fault reporting procedure
- 3.5 Maintenance and documentation

**2. Page 4, Contents**

a) *Add* the following after Annexes to Section Two:

Annex to Section Three

AAA Periodic inspection and testing of EV charging station checklist and report

b) *Add* the following under Tables after 1.4:

1.5 Matching wall socket-outlet and switch assembly for Mode 2 IC-CPD (formerly ICCB)

**3. Page 21, 1.6.2.2 Mode 2**

*Replace* the entire clause as follows:

Mode 2 is a method for the connection of an EV to a standard socket-outlet of an a.c. supply network utilising an a.c. EV supply equipment with a cable and plug, with a control pilot function and system for personal protection against electric shock placed between the standard plug and the EV.

The rated values for current and voltage shall not exceed:

- 32 A and 250 V a.c. single-phase;
- 32 A and 480 V a.c. three-phase.

EV supply equipment intended for Mode 2 charging shall provide a protective earthing conductor from the standard socket-outlet to the vehicle connector.

Mode 2 equipment that is designed to be mounted on a wall but is detachable by the user, or to be used in a shock resistant enclosure shall use protection equipment as required by IEC 62752.

Mode 2 charging is recommended for domestic premises and in premises where the charging facility is not served as public charging stations.

For domestic premises, to effect Mode 2 charging, a matching wall socket-outlet assembly with a switch rated in accordance to Table 1.5 shall be provided for connection of the In-Cable Control and Protection Device (IC-CPD, formerly known as ICCB) complying with IEC 62752 to the wall socket-outlet. The connection cord between the in-cable control box and the affixed IEC 60309-2 plug shall not be removable or rewirable. The height of the mechanically interlocked switched socket-outlet assembly shall not be less than 300 mm above floor level; and in outdoor conditions, special attention shall be paid to the flood level. Appropriate means should be provided to support the in-cable control box.

For domestic premises, to effect Mode 2 charging, a mechanically interlocked switched socket-outlet of suitable rating shall be provided as shown in the Table 1.5 below:

**Table 1.5 – Matching wall socket-outlet and switch assembly for Mode 2 IC-CPD (formerly ICCB)**

Rating of Mode 2 charger		Matching wall socket-outlet and switch assembly
Rated current (A)	Rated voltage (V a.c.)	Rating of switch and socket-outlet
16	230	16 A 230 V a.c. 3-pin single-pole switch and 16 A 230 VAC a.c. 3-pin socket-outlet assembly (with or without mechanical interlock) to IEC 60302
32	230	32 A 230 V a.c. 3-pin mechanically interlocked switched socket-outlet to IEC 60302
16	400	16 A 400 V a.c. 5-pin mechanically interlocked switched socket-outlet to IEC 60302
32	400	32 A 400 V a.c. 5-pin mechanically interlocked switched socket-outlet to IEC 60302

The wall-mounted switched socket-outlet installed in location subject to water splashing shall be IP 44 minimum.

A dedicated final circuit shall be provided for the mechanically interlocked switched socket - outlet supplying EV charging station.

A RCCB Type A of 30 mA rated tripping current ( $I_{\Delta n}$ ) complying with SS 97 shall be installed for the circuit supplying the wall-mounted mechanically interlocked switched socket-outlet if the Mode 2 charger is not equipped with an in-built RCCB.

The connection cord between the in-cable control box and the affixed IEC 60309-2 plug shall not be removable/rewirable. The height of wall-mounted mechanically interlocked switched socket-outlet shall not be less than 300 mm above floor level; and in outdoor conditions special attention shall be paid to the flood level. Appropriate means should be provided to support the in-cable control box.

NOTE – Refer to Annex D for circuit diagrams.

**4. Page 35, 1.10.5 Functional characteristics**

*Replace* the last sentence as follows:

For domestic premises, Mode 2 charging shall not exceed 32 A 400 V a.c.

**5. After Section Two (before the annexes)**

*Add* Section Three as shown below.

**6. After Annex AA**

*Add* Annex AAA as shown after Section Three.

## **Section Three — General requirements for the commissioning, testing and inspection of EV charging stations**

### **3.1 Scope and objectives**

#### **3.1.1 Initial verification of EV charging stations before connection of electricity supply**

Every A.C., D.C. or combined EV charging stations shall, during erection and on completion before being put into service, be inspected and tested by the skilled person responsible for the installation work to verify that:

- a) the new electrical installation set up for supplying all charging stations, such as the switchboards, cables, earthing system and protection systems; and
- b) the EV charging stations, charging points, charging cables and vehicle connectors;

are installed according to SS 638 (formerly CP 5), TR 25 and where applicable, the manufacturer's specific instructions.

EV charging stations shall be installed outside any hazardous zones where flammable/combustible gas may be present. Where necessary, the Singapore Civil Defence Force (SCDF) shall be consulted.

The skilled person responsible for the installation of the EV charging stations shall, upon completion, certify fitness of the electrical installation and the relevant EV charging stations installed for use. The Certificate of Fitness along with the maintenance schedule and instruction manuals of EV charging stations shall be given to the owner/operator.

#### **3.1.2 Periodic inspection and testing**

Once in service, the EV charging stations shall be inspected and tested periodically. The periodic inspection shall cover the electrical installation and EV charging stations and be in accordance with Chapter 62 (supplemented by appropriate tests in Chapter 61) of SS 638 and Annex AAA of TR 25.

The scope of periodic inspection and tests during maintenance shall also include the following:

- a) Inspection of the enclosure, coverings and display;
- b) Checking to ensure all EV charging stations remain outside any hazardous zones where flammable/combustible gases or liquids are present;
- c) Inspection of the charging cable and vehicle connector;
- d) Verification of earth continuity;
- e) Verification of the RCCB type and residual current rating for the RCCB protecting the final circuit;
- f) Verification of the correct rating of the over-current protection device supplying the final circuit;
- g) Verification of the operation of emergency stop devices;
- h) Testing of all RCCBs using a RCCB tester to verify the performance of the RCCB in accordance with the type of RCCB under test;
- i) Testing of the charging station safety functions, including earth continuity monitoring using purpose-built test equipment; and
- j) Any additional testing as required in the manufacturer's instructions.

Annex AAA shows a sample checklist and report that should be used by the skilled person performing the periodic inspection and tests.

### 3.2 Normative references

The following reference document is indispensable for the application of Section Three of this TR. For date references, only the edition cited applies. For undated references, the latest edition (including any amendments) applies.

SS 638 (formerly CP 5)	Code of practice for electrical installations
SS 97	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) –General rules

### 3.3 Frequency of testing and inspection

Regular maintenance is important to ensure safe use and operation of EV charging stations, especially those installed for public use which are subject to more frequent usage and wear and tear. It is recommended that to enhance safe use of EV charging stations, electrical safety inspection and testing shall be conducted by a skilled person on a quarterly basis or according to the manufacturer's recommendation, whichever is earlier.

### 3.4 Fault reporting procedure

If any EV charging station or charging point is found to be unsafe or unsuitable for operation, the following steps shall be taken by the skilled person:

- a) The supply to the equipment shall be switched off;
- b) The circuit breaker shall be locked to prevent re-connection of supply;
- c) A clear label notifying users that the equipment is out of service shall be displayed prominently;  
and
- d) The operator/owner shall be informed immediately.

### 3.5 Maintenance and documentation

A copy of the Certificate of Fitness and inspection report (see Annex AAA) shall be given to the operator/owner upon completion of maintenance work. The operator/owner shall also be informed of the parts that need to be replaced or repaired. It is the responsibility of the operator/owner of the EV charging systems to perform the necessary maintenance routines as recommended by the equipment installer or manufacturer to ensure public safety.

NOTE – The Certificate of Fitness for fixed EV charging systems may form part of the overall electrical safety certification issued for the consumer's electrical installation within the premises.

**Annex AAA**  
(normative)

**Periodic inspection and testing of EV charging station  
checklist and report**

**Particulars of EV charging station and electrical installation**

Model of EV charging station(s): \_\_\_\_\_

S/No: \_\_\_\_\_

Name of electrical installation: \_\_\_\_\_

Address of electrical installation: \_\_\_\_\_

Name of LEW: \_\_\_\_\_ (Licence No.: \_\_\_\_\_) Date: \_\_\_\_\_

	Description	Compliance			Remarks/ Measurement value <sup>1</sup>
		C	NC	NA	
	<b>External and environmental checks</b>				
1	Enclosure is not dented, damaged, corroded or in a rusty condition inside and outside				
2	Space around the charging equipment is adequate for easy access and maintenance work				
3	EV charging station is installed outside hazardous zones where flammable / combustible gas may be present				
4	Sealing rubber of all doors are in order, and doors can be opened and closed easily				
5	Openings or vents are not blocked, no excess foreign particles				
6	Detachable parts are not loose or falling off and not in a rusty condition				
7	No sign of moisture, waterlogging or burn marks				
8	No sign of water ingress into the EV charging station				
9	Floor or wall mounting of EV charging station remains rigid and strong				
10	Vehicle connector mounting and support is not damaged				
11	Vehicle connector is not damaged and is not misaligned				
12	Charging cable is properly supported				

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	Description	Compliance			Remarks/ Measurement value <sup>1</sup>
		C	NC	NA	
	<b>External and environmental checks</b>				
13	No visible damage on charging cable				
14	Warning labels and directional signs are clear and prominent				
	<b>External and environmental checks</b>				
15	DBs supplying charging equipment are clearly labelled and accessible for operation				
16	Bollards installed provide adequate resistance to force				
17	For EV charging station installed in petrol station, valid clearance from SCDF is obtained <sup>2</sup>				
	<b>Functionality checks and tests</b>				
18	EV charging station's display is not cracked and is working properly				
19	The entire touchscreen is working properly (check by touching several areas of the screen)				
20	Supply display indicators are clearly visible (during both day/night)				
21	No visible burnt marks inside the EV charging station				
22	Protective conductor connections and termination are properly made and tightened (for TT or TN-S system)				
23	Incoming power supply cable including circuit protective conductor is properly sized				
24	Earthing and bonding for EV charging station complies with SS 638				
25	Earth resistance value (as measured) is acceptable				
26	Line-earth loop impedance value (as measured) is acceptable				
27	Sequence of power start up is correct				
28	Insulation resistance in a 500 V D.C. class 1 station is more than 1 MΩ				
29	Charging cable insulation resistance value (as measured) is acceptable according to SS 638 specifications				
30	Emergency stop button is functional				
31	Tripping time of 30 mA RCCB Type A / Type B (as measured by an RCCB tester) is acceptable				
32	EV charging is in order (where necessary LEW can perform a real-time charging with an EV or a simulated load)				

- 1) Measured values where required shall be recorded in this report.
- 2) EV charging station installed in petrol kiosks shall comply with SCDF's requirements.

**General Remarks**

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**Recommended date of next inspection:** \_\_\_\_\_

**Declaration by Licensed Electrical Worker**

I have inspected (a) the EV charging station(s) and (b) the switchboard and wiring supplying the EV charging station(s). I declare that the installation is \*fit and safe / unfit and unsafe for operation.

\*Please delete as appropriate

Name of LEW: \_\_\_\_\_ Licence No.: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

The inspection was witnessed by owner of electrical installation/operator of EV charging station

Name of Representative: \_\_\_\_\_

Designation : \_\_\_\_\_

Signature : \_\_\_\_\_ Date: \_\_\_\_\_