WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Company Directive

STANDARD TECHNIQUE: SD5G/4 (Part 2)

Relating to the Connection of Low Carbon Technology (Electric Vehicle Charge Points and Heat Pumps) with a Capacity > 32A per phase

Policy Summary

This document defines Company policy for processing notifications and applications from customers or installers for the connection of individual or multiple Low Carbon technologies (electric vehicle charge points and heat pumps) where individual equipment has a rating > 32A per phase onto WPD's distribution system.

Author: **Seth Treasure**

Implementation Date: **May 2020**

Approved by

Paul Jewell

DSO Development Manager

Date: **27th May 2020**

Target Staff Group	**Staff responsible for network design associated with Low Carbon Technology**
Impact of Change	**Amber – The change aligns with amendments to the wiring regulations and ENA EREC G5/5 which impacts on connection designs.**
Planned Assurance checks	**Following a training roll out – one planner per license area will be assessed**

IMPLEMENTATION PLAN

Introduction

This document details the approach for managing Electric vehicle charge point and/or heat pump applications for individual or multiple items or types of equipment (connected at the same point of supply) where any installed item is rated greater than 32A per phase onto Western Power Distribution's (WPD's) distribution network (low and high voltage).

Main Changes

The document has been amended to align with BS 7671 (the IET Wiring Regulations), current charging methodology, ENA EREC G5/5, High Voltage connections are now completely included within the document and more in depth detailed harmonic analysis is available prior to reinforcement works being undertaken.

The enclosure requirements for supplies located within street furniture which incorporate a load management scheme have been detailed within clause 11.9.

The document has been amended to align with a supplementary document regarding the installation of EV charge points at fuel filling stations.

Impact of Changes

WPD will permit the use of a PME earth terminal for street furniture connections subject to the customer installing an appropriate protective device compliant with BS 7671 (section 722 regarding Electric Vehicle Charging Installations).

Where applicable, WPD will undertake harmonic assessments of the network for the installation of charge points rated > 75A prior to progressing / proposing reinforcement works.

WPD will replace domestic cutouts (rated up to 100A) free of charge to permit the connection of low carbon technology.

WPD will provide prescriptive enclosure requirements for street furniture connections which incorporate a load management system.

WPD will commission a consultant to undertake an earth potential rise assessment for the installation of a substation within a 20m radius of a fuel filling station.

Target Staff Group	**Staff responsible for network design associated with Low Carbon Technology**
Impact of Change	**Amber – The change aligns with amendments to the wiring regulations which impacts on connection designs.**

Implementation Actions

The DSO team will provide appropriate training to network services in the form of a training course.

Implementation Timetable

This Standard Technique shall be implemented with immediate effect for new or modified connections involving Low Carbon Technology (LCT).

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
May 2020	• Clause 2 - Definitions page added • Requirements for the provision of PME have been amended • Charging methodology updated • Clause 8.7 added – Detailed analysis procedure as per ENA EREC G5/5 • Section 9 updated to current connection methodology • Clause 11.9 added – enclosure requirements for some street furniture connections • Clause 14.4 – 14.6 added – prescriptive requirements for substations at fuel filling station sites	Seth Treasure
November 2019	• Amendment Page 10 Section 8.2 'This is currently set at a 50%' changed to 'The diversity factor for EV charging is 50%'.	Seth Treasure
June 2019	• Revised ENA EV & HP Application form added • Clause 6.1 amended to align with ENA EREC G12 • Clause 6.6 added – Class II construction • Clause 6.7 amended – touch potential issue removed • E5 numbers added to clause 13 for warning signs • Appendix E added – table of electrode resistivities per soil resistance • Clause 8.3 amended with more detail	Seth Treasure
March 2019	• Amended to comply with the new ENA EV & HP simplified Application and Notification process • Heat pumps with a rating $\leq$ 32A have been included • Link to Heat Pump database added – clause 7.4 • New EV & HP impedance calculator tool – clause 7.5	Seth Treasure
December 2018	• Information regarding when a stage 2 assessment is required (clause 9.1) • Information regarding combined CT cabinets located within street furniture (clause 10) • Secondary supplies for EV charge points located at fuel filling stations have been accepted (clause 13)	Seth Treasure
September 2018	• ST:NC1AA/1 has been removed and replaced by this document	Seth Treasure

CONTENTS

1.0 INTRODUCTION

1.1 This Standard Technique describes WPD policy for processing applications from customers, or their nominated installer, for the installation and connection of individual or multiple Low Carbon Technologies (Electric Vehicle (EV) Charge Points and/or Heat Pumps (HP)) (installed beyond the same point of supply) where any item has a rating greater than 32A per phase, onto WPD's low voltage distribution system.

1.2 WPD will use the information provided by the customer or installer to assess the suitability of the existing network to supply the Low Carbon Technology. Suitability will be based upon the network's susceptibility to voltage fluctuations, flicker and harmonic voltage distortion, as well as ensuring it is kept within the designated thermal and voltage limits.

1.3 This Standard Technique should also be read in conjunction with ST:SD1E, ST:SD4A, ST:SD4OA, ST:SD4OB, ST:SD5A, ST:SD5B, ST:SD5C, ST:SD5D, ST:SD5E, ST:SD5K, ST:SD5O, ST:SD5R, ST:SD6J, ST:TP21E, and ST:NC1P.

1.4 Where this document and associated calculation tools do not cover the proposed installation of Low Carbon Technology, the regional Primary System Design power quality expert shall be consulted.

2.0 DEFINITIONS

2.1 **Mode 1 charging.** Connection of the EV to the AC supply network utilising standardised socket outlets not exceeding 16A and utilising the protective devices installed within the consumer unit.

2.2 **Mode 2 charging**. Connection of the EV to the AC supply network utilising standardised socket outlets not exceeding 32A and utilising a protective device installed within the charge point and which includes a control pilot function.

2.3 **Mode 3 charging**. Connection of the EV to the AC supply network utilising dedicated electric vehicle supply equipment where the control pilot function extends to the control equipment in the electric vehicle supply equipment. The charging point is permanently connected to the customer's installation (tethered lead).

2.4 **Mode 4 charging**. Connection of the EV to the AC supply network utilising an off board charger/converter which provides a DC supply to the EV. The equipment includes a control pilot function that extends to the control equipment in the EV. The charging point is permanently connected to the customer's installation (tethered lead).

2.5 Mode 1, 2 & 3 charging equipment (AC output devices) are outside of the scope of this document, however Vehicle to Grid (V2G) devices have a DC output (domestic devices are typically rated $\leq$ 32A) and are therefore included within the 'Known Electric Vehicle Charge Point' spreadsheet. See Standard Technique: SD5G Part 1 for standard Mode 1, 2 & 3 charging equipment.

2.6 Mode 4 charging equipment (DC output devices) is within the scope of this document. A list of devices including the required connection characteristics have been detailed within a spreadsheet which is saved on the Policy Dissemination page.

3.0 APPLICATION AND NOTIFICATION PROCESS

3.1 The IET Code of Practice for Electric Vehicle Charging Equipment Installation has been created to assist the installer in ensuring the installation of electric vehicle charging equipment complies with the relevant requirements of BS7671:2008 (as amended) and the Electricity Safety, Quality and Continuity Regulations 2002 (as amended).

3.2 The installer of any LCT infrastructure shall follow the Application process when there is identified adequacy or safety concerns with the property's existing service equipment or where the post installation maximum demand is greater than 60 amps.

In addition, the installation of more than one Low Carbon Technology shall always follow the application process.

The ENA Application form is detailed within Appendix D.

4.0 CONNECTIONS

4.1 Connections for LCT shall be designed in accordance with ST: SD4A, ST: SD4OA, ST: SD4OB, ST: SD5A, ST: SD5C, ST: SD5D and ST: SD5E as appropriate.

4.2 Connections including LCT shall be designed with a network impedance that meets the requirements of this document at the point of common coupling (PCC) for Harmonic concerns or the cutout / point of supply for flicker concerns.

4.3 Connections including EVs or HPs shall not be connected via a service loop (Equipment rated > 32A). *See clause 13.4.*

4.4 Where a connection supplies more than one EV charge point or heat pump no diversity shall be allowed unless load control is provided and verified to WPD by the LCT installer to prevent the service and cut-out from being overloaded. *See Clause 9.3.*

5.0 MINIMUM CUSTOMER INFORMATION

5.1 The installer shall submit a completed ENA LCT Application / Notification form (Appendix D)

5.2 For installations that include multiple items the installer shall apply to connect and shall submit the following:

- Make, Model and rating of EV charge point/s
- Power Quality (PQ) forms C and D relating to Harmonics and Flicker respectively (unless information has already been collated i.e. Known EV Charge Point Spreadsheet).

And / Or

- The heat pump type register number (relating to the heat pump database), detailing the make and model number.

Or

- Provide technical data regarding Harmonics and Flicker.

5.3 For information regarding the Notification process, the ENA Process map can be found via the following Link.

5.4 Installers not meeting the minimum information requirements shall be contacted to provide the missing information.

6.0 ASSESSMENT PROCEDURE

6.1 For all LCT applications, the Records Team will attach the submitted forms to an unclassified connection enquiry marked **EV/HP** and pass to the local teams.

6.2 The local Planner will assess the connection and system for;

- Customer earthing arrangements
- Segregation of earthing systems
- Harmonic emission concerns
- Flicker concerns
- Thermal capacity
- Suitability of positioning
- Looped service - the supply shall not be looped via the first cut-out or any subsequent looped cut-out
- Number of LCT installations connected to the distribution substation

6.3 A list of letters for the interaction with installers / customers is provided within N:\Connections\Guidance & Overview\Low Carbon Technology\EV Letter Templates

7.0 EARTHING ARRANGEMENTS

The following requirements relate to supplies for EV charge points and confirmation of the installation compliance to the requirements of BS EN 7671 (the Wiring Regulations) is the responsibility of the installer.

7.1 PME

A PME earthing facility shall not be used as the means of earthing of a charging point located outdoors or that might reasonably be expected to be used to charge a vehicle located outdoors unless the connection is compliant with one of the following requirements;

- The charging point includes a protective device that disconnects the supply (L,N & E) in the event of a potential difference in excess of 70V being measured between the WPD earth terminal and the general mass of earth.

  Care shall be taken to ensure that the measurement earth electrode is segregated from the installation and any PME earth electrodes or PILC cable by a minimum distance of 2m.

Or

For three phase supplies (including three phase supplies with single phase outputs)

- The charging point includes a protective device that disconnects the supply (L,N & E) in the event of a potential difference in excess of 70V being measured between the WPD neutral conductor and a 'virtual neutral' derived from the phase conductors of the supply.

Or

For single phase supplies only

- The charging point includes a protective device that disconnects the supply (L,N & E) in the event of the utilisation voltage at the charging point (measured between the neutral and phase) being > 253V or < 207V.

  At the time of writing, this device must not be used in conjunction with a Vehicle to Grid Connection (V2G) due to non-compliance with ENA EREC G98/G99.

Or

- The charging point forms part of a three phase installation where all of the demand including the charging point/s are evenly balanced over all of the available phases.

Or

- The maximum single phase load or overall unbalance of a split or three phase connection is $\leq$ 5kW and the car charging installation includes an independent earth electrode of sufficient resistance to ensure that the Earth Potential Rise (EPR) will be restricted during a broken neutral event. *See table 1 below.*

Earthing electrode requirement for customer's installation (Class I / metallic enclosure)

Connection	Maximum single phase load or overall unbalance on split or three phase connection	Maximum consumer earth electrode resistance bonded to main earth terminal
single phase, unbalanced split or three phase	500 W	100 Ω
	1kW	60 Ω
	2kW	20 Ω
	3kW	14 Ω
	4kW	11 Ω
	5kW	9 Ω

Table 1 - Customer installation earthing requirements

Notes;

If the earth electrode resistance as specified above cannot be satisfied, the installation should form part of a TT system by installing a separate earth electrode and fitting a suitable protection device in accordance with BS 7671 (e.g. an RCD).

The values given within Table 1 have been sourced from ENA EREC G12, BS 7671 details a similar table but with different impedance requirements due to a lower voltage limit.

See Appendix E for guidance on the design of PME earth electrodes

7.2 **SNE**

In view of the possible future conversion of SNE networks to PME, a SNE Earth Terminal shall not normally be offered for a supply solely for the Charging of Electric Vehicles. A SNE earth terminal may only be provided to a Charging Pillar when it can be guaranteed that there is complete separation of the neutral and earth conductors along the entire length of the circuit (except for at the substation).

7.3 Where a SNE earth terminal is provided on a guaranteed SNE main, the WPD mapping system shall be updated with the following note 'Guaranteed SNE Main'.

7.4 **TT**

TT earthing arrangements shall be utilised by Electric Vehicle charge points that do not meet the PME or SNE requirements specified within clause 7.1 or 7.2.

7.5 The customers buried TT earthing system shall be segregated from the WPD buried earthing system (including buried LV metalwork and traditional Paper Insulated Lead Covered cables) by the required distance detailed within Table 2:

Connection:	Single Phase or Unbalanced 3 Phase Connection	Balanced Three Phase Connection
Minimum Segregation	3.6m	0.3m

Table 2 – Segregation requirement between Earthing Zones of differing types

7.6 **CLASS II CONSTRUCTION**

If the PME earth electrode resistance as specified above or the installation of an independent TT earthing is unachievable, the street furniture may have neither a mains derived earth terminal or residual current device (RCD) if the entire installation is categorised as 'Class II' (double insulated).

Definition of Class II equipment, equipment in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions such as supplementary insulation are provided, there being no provision for the connection of exposed metalwork of the equipment to a protective conductor, and no reliance upon.

7.7 Electric Vehicle charge points (class I) which are fully compliant with the above clauses do not require an above ground segregation requirement from metallic objects of a different earthing type as each item will individually limit the EPR presented on any extraneous metallic surface or disconnect the supply within 5 seconds during a fault scenario.

8.0 IMPEDANCE REQUIREMENTS FOR LOW CARBON TECHNOLOGY

8.1 Unless otherwise stated within the power quality assessment forms (1) (2) completed by the installer, the individual connection of LCT rated at ≤ 75A shall comply with the requirements of Table 3 detailed below.

The values represented are required at the Point of Common Coupling (PCC).

Equipment Rating (A)	Equipment rating (kVA)			Minimum short circuit power (kVA)			Minimum fault current (A)			Maximum source impedance at PCC (ohms)		
	1 phase	split phase	three phase	1 phase	split phase	three phase	1 phase	split phase	three phase	1 phase (3)	split phase (4)	three phase (5)
33	7.590	15.18	22.863	250.470	500.94	754.481	1089	1089	1089	0.211	0.422	0.212
34	7.820	15.64	23.556	258.060	516.12	777.344	1122	1122	1122	0.205	0.410	0.206
35	8.050	16.10	24.249	265.650	531.3	800.207	1155	1155	1155	0.199	0.398	0.200
36	8.280	16.56	24.942	273.240	546.48	823.070	1188	1188	1188	0.194	0.387	0.194
37	8.510	17.02	25.634	280.830	561.66	845.933	1221	1221	1221	0.188	0.377	0.189
38	8.740	17.48	26.327	288.420	576.84	868.796	1254	1254	1254	0.183	0.367	0.184
39	8.970	17.94	27.020	296.010	592.02	891.659	1287	1287	1287	0.179	0.357	0.179
40	9.200	18.40	27.713	303.600	607.2	914.522	1320	1320	1320	0.174	0.348	0.175
41	9.430	18.86	28.406	311.190	622.38	937.385	1353	1353	1353	0.170	0.340	0.171
42	9.660	19.32	29.098	318.780	637.56	960.249	1386	1386	1386	0.166	0.332	0.167
43	9.890	19.78	29.791	326.370	652.74	983.112	1419	1419	1419	0.162	0.324	0.163
44	10.120	20.24	30.484	333.960	667.92	1005.975	1452	1452	1452	0.158	0.317	0.159
45	10.350	20.70	31.177	341.550	683.1	1028.838	1485	1485	1485	0.155	0.310	0.156
46	10.580	21.16	31.870	349.140	698.28	1051.701	1518	1518	1518	0.152	0.303	0.152
47	10.810	21.62	32.563	356.730	713.46	1074.564	1551	1551	1551	0.148	0.297	0.149
48	11.040	22.08	33.255	364.320	728.64	1097.427	1584	1584	1584	0.145	0.290	0.146
49	11.270	22.54	33.948	371.910	743.82	1120.290	1617	1617	1617	0.142	0.284	0.143
50	11.500	23.00	34.641	379.500	759	1143.153	1650	1650	1650	0.139	0.279	0.140
51	11.730	23.46	35.334	387.090	774.18	1166.016	1683	1683	1683	0.137	0.273	0.137
52	11.960	23.92	36.027	394.680	789.36	1188.879	1716	1716	1716	0.134	0.268	0.135
53	12.190	24.38	36.719	402.270	804.54	1211.742	1749	1749	1749	0.132	0.263	0.132
54	12.420	24.84	37.412	409.860	819.72	1234.605	1782	1782	1782	0.129	0.258	0.130
55	12.650	25.30	38.105	417.450	834.9	1257.468	1815	1815	1815	0.127	0.253	0.127
56	12.880	25.76	38.798	425.040	850.08	1280.331	1848	1848	1848	0.124	0.249	0.125
57	13.110	26.22	39.491	432.630	865.26	1303.194	1881	1881	1881	0.122	0.245	0.123
58	13.340	26.68	40.184	440.220	880.44	1326.057	1914	1914	1914	0.120	0.240	0.121
59	13.570	27.14	40.876	447.810	895.62	1348.921	1947	1947	1947	0.118	0.236	0.119
60	13.800	27.60	41.569	455.400	910.8	1371.784	1980	1980	1980	0.116	0.232	0.117
61	14.030	28.06	42.262	462.990	925.98	1394.647	2013	2013	2013	0.114	0.229	0.115
62	14.260	28.52	42.955	470.580	941.16	1417.510	2046	2046	2046	0.112	0.225	0.113
63	14.490	28.98	43.648	478.170	956.34	1440.373	2079	2079	2079	0.111	0.221	0.111
64	14.720	29.44	44.340	485.760	971.52	1463.236	2112	2112	2112	0.109	0.218	0.109
65	14.950	29.90	45.033	493.350	986.7	1486.099	2145	2145	2145	0.107	0.214	0.108
66	15.180	30.36	45.726	500.940	1001.88	1508.962	2178	2178	2178	0.106	0.211	0.106
67	15.410	30.82	46.419	508.530	1017.06	1531.825	2211	2211	2211	0.104	0.208	0.104
68	15.640	31.28	47.112	516.120	1032.24	1554.688	2244	2244	2244	0.102	0.205	0.103
69	15.870	31.74	47.805	523.710	1047.42	1577.551	2277	2277	2277	0.101	0.202	0.101
70	16.100	32.20	48.497	531.300	1062.6	1600.414	2310	2310	2310	0.100	0.199	0.100
71	16.330	32.66	49.190	538.890	1077.78	1623.277	2343	2343	2343	0.098	0.196	0.099
72	16.560	33.12	49.883	546.480	1092.96	1646.140	2376	2376	2376	0.097	0.194	0.097
73	16.790	33.58	50.576	554.070	1108.14	1669.003	2409	2409	2409	0.095	0.191	0.096
74	17.020	34.04	51.269	561.660	1123.32	1691.866	2442	2442	2442	0.094	0.188	0.095
75	17.250	34.50	51.962	569.250	1138.5	1714.730	2475	2475	2475	0.093	0.186	0.093

Table 3 – Minimum Fault level/Maximum Impedance at PCC for Rsce=33

Notes;

(1) To ensure that a device complies with the power quality standards, some installations may require a lower impedance / higher fault level.

(2) WPD staff only - Any Electric Vehicle charge points that have been pre assessed shall comply with the requirements detailed within the 'known Electric Vehicle Charge Point' spreadsheet. See clause 8.3

(3) Phase to Neutral impedance (Single phase loop impedance)

(4) Phase to Phase impedance (Split phase loop impedance)

(5) Phase impedance (Three phase line impedance)

8.2 Connections including more than one installation of electric vehicle charge points rated ≤ 75A connected at the same point of supply shall comply with the impedance requirements detailed by using the 'Impedance Calculator – Rsce = 33' found via the following Link.

8.3 Electric vehicle charge points that have been pre assessed by WPD Planners shall be collated and the information stored within a spreadsheet labelled as 'Known Electric Vehicle Charge Points' within the electric vehicle charge point section of the Policy Dissemination Page.

8.4 The power quality data regarding the majority of heat pumps can be found on the ENA Heat Pump Database which is located on the ENA Website or alternatively WPD have collated a similar table which can be found via the following link.

8.5 Connections that include electric vehicle charge points and/or heat pumps shall be designed to satisfy the impedance requirements detailed within the 'EV & HP Rsce = 33' spreadsheet found via the following link.

8.6 Electric vehicle charge points rated greater than 75A per phase and not detailed within the 'Known Electric Vehicle Charge Point' spreadsheet shall:

Be assessed utilising the Power Quality data collection forms (C&D) where the installer has provided information regarding the required network characteristics.

Or

Where the installer is unable to provide Power Quality data the '+75A Impedance Calculator' shall be used and is available via the following link.

See Figure 2 for guidance

8.7 Installations of equipment that are not covered by clause 8.1 – 8.5 or for connections that include items with an individual rating > 75A that require a connection characteristic that is not achievable without reinforcement works shall be designed to satisfy the impedance requirements detailed within the '+75A Impedance Calculator'. See Appendix A for guidance on the correct usage.

Where background harmonic current emissions are required, a minimum of 14 days of data shall be obtained at the point of common coupling.

8.8 Background harmonic data will not be collated for the installation of LCT items with a summated rating ≤ 75A per phase (e.g. Stage 2C assessment). The POC characteristic shall be determined by using the most advanced determination method available.

9.0 DEMAND REQUIREMENTS FOR LOW CARBON TECHNOLOGY

9.1 When undertaking an assessment of the service and cutout (sole use equipment) for thermal capacity, no diversity factor shall be applied.

9.2 When undertaking an assessment of the network capacity (transformers and mains conductors) for thermal capacity, the diversity factor as detailed within Standard Technique: SD5A shall be applied. The diversity factor for EV charging is 50%.

9.3 Where connections have an installed capacity that matches the connection capacity (e.g. 3 x 50kW three phase chargers installed on a 150kVA supply), it is envisaged that the coincidence of the three chargers to all be operating at their maximum capacity at the same time, for a prolonged period of time to be low. Therefore, a cyclic load profile will be assumed.

9.4 Where connections have an installed capacity greater than the connection capacity, a load management scheme shall be installed to ensure that the maximum demand of the installation is not exceeded.

9.5 Where connections incorporate load management schemes which are designed to permit a current flow >80A and where a domestic style single or three phase cutout is utilised and where the equipment is positioned within a street mounted enclosure. The enclosure shall comply with the requirements detailed within clause 11.9.

9.6 Customer load management schemes for LCT will be accepted if the principles of Standard Technique: SD1E (ENA EREC G100) are followed;

- Hard wired e.g. RS485 cable
- Fail safe – in the event of a component or signalling failure the system will revert to a pre-determine safe level of import capacity
- Output of component reaction time $\leq$ 5 seconds (as per ENA EREC G100)
- System compliance with ENA EREC P28 – e.g. $\leq$ 3% voltage change during operation

10.0 MAXIMUM NUMBER OF LOW CARBON TECHNOLOGY (rated > 32AØ)

10.1 The maximum number of Low Carbon Technologies (individual converters) connected onto a distribution substation without the need for guidance from a PSD Power Quality expert or a Stage 2C assessment in accordance with ENA EREC G5 is **four**. This number may be increased to the desired quantity, where the converters are all connected to the same Point of Common Coupling (PCC) and the fault level at the point of common coupling is sufficient (as per one of the determination methods included within this document).

11.0 ARRANGEMENTS FOR LOW VOLTAGE STREET FURNITURE CONNECTIONS

(Electric vehicle charge points only)

11.1 For supplies rated up to 100A per phase, a DMC cutout arrangement shall be utilised as per Standard Technique: SD5A & SD5D). *See the requirements of Clause 9.*

11.2 For supplies between 100A and 400A and where the WPD equipment is positioned within a Street Furniture cubicle, a Schneider combined cutout and CT panel shall be utilised. ***See figure 1 below.***

11.3 For supplies between 100A and 400A and where the WPD equipment is not positioned within a Street Furniture cubicle, a Lucy combined cutout and CT panel shall be utilised.

11.4 For low voltage supplies greater than 400A, see Standard Technique: SD5E. For High Voltage metered supplies, see Standard Technique: SD4O (A or B as appropriate).

11.5 The combined cutout and CT panel shall be mounted on an 18mm thick backboard which has a minimum fire resistance of half an hour.

11.6 The positioning of the apparatus shall comply with the below requirements;

- Positioned free from risk of accidental or malicious damage.
- Positioned to minimise the likelihood of vehicle impact damage however protective bollards are to be installed by the EV charge point installer to protect the equipment from vehicle damage as per the requirements of the Code of Practice for the Installation of Electric Vehicle Charging Equipment.
- The lowest part of the equipment is to be positioned at least 200mm above the outside ground level.
- For CT cabinets - positioned with at least 1300mm of safe working space in front of the equipment.
- Positioned to ensure the free movement of pedestrian or vehicle traffic and that the minimum footpath (1000mm) or road widths are maintained.
- Sufficient space shall be provided to ensure that the WPD equipment can be maintained or replaced without having to remove the customer's equipment.

11.7 The EV charge point installer shall purchase a street furniture cubicle with sufficient IP rating for the location in which the cubicle is intended to be positioned.

11.8 The street furniture cubicles / enclosures must include non forced ventilation.

11.9 Where connections incorporate a load management scheme within the scope of Clause 9.5 above. The street mounted enclosure shall comply with the following criteria;

- A fire resistant panel (with at least ½ hour fire resistance) measuring the full height and depth of the enclosure shall be installed vertically between the customer's equipment and the WPD / Suppliers equipment.
- The dividing panel shall incorporate a single grommeted access hole for the metering 'tails' measuring 25mmØ and 35mmØ for single and three phase supplies respectively.

- The enclosure shall include a low and high level vent on each side of the divider to ensure sufficient air flow across the equipment.
- WPD and the supplier shall be provided with a minimum space requirement of 400mm (W) x 600mm (H).

11.10 For CT cabinets - the EV charge point installer shall provide a low level heater with thermostat within the street furniture cubicle to mitigate against condensation build up within the equipment.

11.11 Minimum bending radii of Wavecon cables.

Cable Type	Cable Size	
	95mm²	185mm²
3c Wavecon	550mm	700mm
4c Wavecon	600mm	800mm

The 300mm² Wavecon cables have been omitted due to the increased bending radii and subsequent increase in minimum height of the equipment positioning.

11.12 A slow bend duct entry is available for 95mm² Wavecon but an open draw pit with a depth of 600mm, length of 1200mm and width of 500mm is required for 185mm² Wavecon.

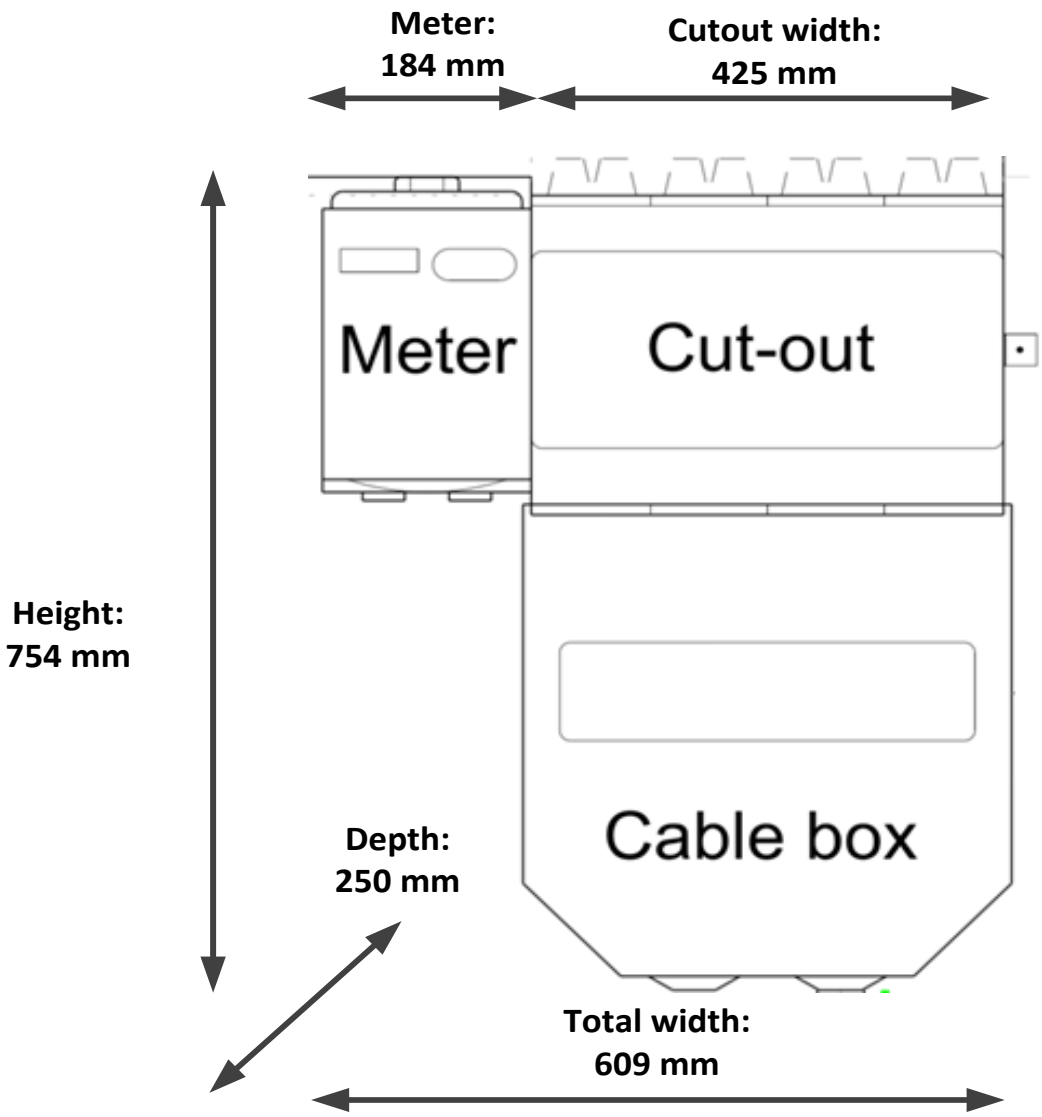

Figure 1 – Schneider Combined Cutout and CT Panel for use at EV Charge Point Street Furniture connections only

Note, *(1) The Schneider LV CT Metering panel has a maximum rating of 400A*

(2) Minimum meter tail size of 70mm² - stranded or solid (not tri-rated)

(3) Equipment to be positioned a minimum of 200mm above ground level

12.0 POWER QUALITY REQUIREMENTS FOR LOW CARBON TECHNOLOGY

12.1 The LCT shall comply with the requirements of Energy Network Association Engineering Recommendation G5 regarding Harmonic emissions.

12.2 The LCT installation shall comply with the requirements of Energy Network Association Engineering Recommendation P28 regarding Voltage Fluctuations (Flicker).

12.3 The LCT installation shall comply with the requirements of Energy Network Association Engineering Recommendation P29 regarding Voltage Unbalance.

Note: By following the processes within this document, the installation will be deemed compliant with the above Engineering Recommendations.

13.0 REINFORCEMENT FOR LOW CARBON TECHNOLOGY (EVs AND HPs)

(> 32A per phase) (1)

13.1 Where it has been determined that the installation of Low Carbon Technology will thermally overload sole use items – transformer, conductors, cutout, metering tails or meter(2) the item(s) of concern shall be upgraded to a sufficient capacity and due to the item(s) being sole use the customer shall fully fund the required reinforcement works.

WPD will upgrade the cut out and fuse element at nil cost (where the existing cut out location permits a greater capacity). WPD's costs shall be allocated to Budget Code 49 and Engineering Class 77 – Service Replacement.

13.2 If any shared use conductor or apparatus requires reinforcement works due to thermal constraints only. The reinforcement cost of upgrading the shared use item shall be apportioned in accordance with ST: NC1P. The reinforcement costs shall be split across Budget Code 10 and 19.

13.3 If reinforcement works of shared use conductors or apparatus are required for thermal and power quality concerns;

The installation will first be analysed ignoring any PQ requirement – any required reinforcement works for thermal constraints will be apportioned.

Thereafter,

The connection will be re analysed for power quality concerns and any additional reinforcement works required to mitigate any Harmonic emissions or the impact of Flicker will be fully charged to the customer / installer.

The apportionment rules do not apply to reinforcement works required solely to mitigate the effects of 'Disturbing loads'. *See ST: NC1P clause 10.*

13.4 Services that have been looped via the incoming terminals of a cutout shall be removed at WPD's cost and shall be allocated to Budget Code 49 – Service Replacement. Where a service has been looped by an alternative method, the connection shall be analysed for compliance with thermal and voltage requirements (SD5A and SD5K etc.) and each customer connection shall be individually fused.

Notes: *(1) Western Power Distribution's policy regarding the charging methodology for the reinforcement of the distribution system is detailed within Standard Technique: NC1P.*

(2) Where the meter or meter tails of an installation are deemed to be thermally overloaded, the customer's supplier shall be informed. The installation will remain disconnected until the supplier has confirmed that reinforcement works have been completed.

(3) See Figure 3 for guidance.

14.0 ARRANGEMENTS FOR FUEL FILLING STATIONS [1] *(Electric vehicle charge points only)*

14.1 WPD will not normally provide an earth terminal for a supply direct to a fuel filling station [2] or to a secondary [3] supply to an electric vehicle charge point [4]. The installer shall confirm that the existing fuel filling station connection does not utilise an earth connection from WPD (PME or SNE connection derived from a PME main).

WPD may provide a SNE earth terminal for a fuel filling station (that includes EV charging) subject to the supply being derived from a dedicated substation and circuit where it can be guaranteed that the neutral and earth conductors are continuously separate (except at the transformer).

Where a legacy earth connection has been provided (PME or SNE derived from a PME main), the WPD earth terminal shall be removed at WPD's cost prior to the energisation of the second supply or energisation of the electric vehicle charge point. Any changes to the customer's earthing system shall be completed by the customer at their expense.

14.2 The supplying cable shall not be routed through any noted temporary or permanent hazardous areas [5] (fuel pumps, fuel storage, fuel filling, fuel vents / manholes or tanker unloading areas).

14.3 A prominent warning label [6] shall be mounted on the supply cubicle of the EV charge point and cutout position of the fuel filling station to indicate that multiple supplies exist at the premises and the location of the alternate supply.

14.4 When a substation is established within 20m of a fuel filling station[2] (including the associated HV earthing system), a study using appropriate software shall be undertaken to ensure that the Earth Potential Rise (EPR) impressed onto the fuel filling station and associated earthing system is maintained to a value $\leq$ 250V. The EPR must also not exceed any touch / step limit as detailed within TS 41-24 for substations with single point earthing systems (SNE circuits).

14.5 The substation and associated earthing system shall be sited outside of any temporary or permanent hazardous area [5].

14.6 When a substation is established, adequate space shall be provided to enable the construction, maintenance and inspection of the site. Unhindered access must be available on a 24/7 basis (including times when a tanker is onsite and off-loading) and a single parking bay /area shall be available for WPD vehicles within close proximity.

Notes:

(1) The installer shall ensure that Electric Vehicle Charge points comply with the requirements of the IET Code of Practice for Electric Vehicle Charging Equipment Installation & the supplementary filling station document (as revised).

(2) 'Fuel Filling Station' means the forecourt and associated shop at a fuel dispensing installation and any EV charge points within the original boundary of the filling station (e.g. petroleum, diesel or LPG and also includes areas where dangerous/explosive substances are stored (e.g. bulk storage installations). See ST: TP21E for further guidance.

(3) A supply positioned within a 10m radius of any extraneous metalwork bonded to the earthing system of a fuel filling station that has its own supply shall be deemed to be a secondary supply.

(4) Where a secondary supply is provided to an electric vehicle charge point, the Electric Vehicle Charge Point supply shall have a TT or guaranteed SNE earthing system and the earthing system shall be bonded to the Fuel filling station earthing system. The two supplies must utilise the same earthing type, mixed earthing types are not permitted e.g. SNE or TT systems must be used by both connections.

(5) The customer shall provide WPD with a plan of the site detailing the hazardous zones. A typical hazardous area plan can be found via the following link

(6) The WPD warning labels can be found via the following link and the E5 item codes are 62691 & 62692.

15.0 MULTIPLE CONNECTIONS

15.1 WPD normally provides a single point of connection to each site or premises but in some cases the customer may require more than one connection, for example, where:

- enhanced security is required
- the site is large and fragmented and there is no electrical interconnection between separate parts of the site

15.2 With the exception of fuel filling stations, where EV charge points are proposed one or more additional points of connection may also be requested to supply the charge points, however, multiple connections introduce a number of challenges, including:

- a risk of paralleling WPD's connections through the customer's network
- complex earthing / bonding issues
- added complexity (e.g. means of electrically isolating the site under emergency conditions or when work is carried out)

(a) Risk of Paralleling:

It is essential that the multiple connections are not paralleled though the customer's network. If this were to occur this could adversely affect the protection performance and/or cause current to flow through the customer's network. This flow of current could overload cables, switchgear etc. or give rise to unexpected power flow through the metering.
In order to prevent the customer's network from being paralleled the customer shall either:

- Physically segregate the network supplied by each connection so that interconnection is impossible.
- Fit interlocking to prevent paralleling. This interlocking shall either consist of mechanical interlocking (without over-ride facilities) and/or fail-safe electrical (hard wired) interlocking. Where electrical interlocking is provided any mechanical closing facilities must be disabled to prevent it from being bypassed.
  Software interlocking provided by programmable logic controllers (PLCs), programmable relays or equivalent are not acceptable.

(b) Complex Earthing / Bonding:

The earthing systems of each connection may be derived from different earth electrodes / earthing systems. This could cause differences in potential between items of equipment, including charge points, connected / bonded to different connections, if adequate precautions are not taken.

Precautions shall include either:

- Ensuring metalwork and items of equipment that are connected / bonded to the earth terminal of different connections are physically segregated from each other to prevent anyone touching both items of equipment at the same time. Where this approach is used any item of equipment that could possible transfer the potential from one earth zone to another must be removed / isolated (e.g. pipes, wiring, fences, communication cables etc.); or

- Ensure the earthing systems associated with each connection are common (i.e. physically bonded together). Where this approach is taken each connection must utilise the same type of earthing and it is not acceptable to bond different earthing types together. The only exception is that a PME connection may be bonded to a 'SNE connection derived from a CNE network' since both options are considered to be a type of TN-C-S. Any such bonding must be rated for the current that is expected to flow through it. For LV installations the bonding shall satisfy the requirements for main equipotential bonding within the IET Wiring Regulations (BS7671).

  All connections that are bonded together shall comply with the requirements of Section 6.

Multiple connections provided at different voltages (e.g. one connection provided at 11kV and one at LV) should be avoided, where possible. Where this cannot be avoided precautions shall be taken to prevent earth potential rise caused by faults on the high voltage network from causing danger in the low voltage system. The simplest way of achieving this is to physically segregate the buildings / metalwork / equipment supplied by each connection.

Further guidance on earthing is included in ST: TP21D.

(c) Isolation Requirements:

Where multiple connections are provided, the means of disconnecting and isolating the customer's network will be more complex than normal. Appropriate schematic drawings and labels / notices shall be provided at each connection point that clearly state i) that more than one connection point is provided and ii) describe where the other points of disconnection / isolation are. *See Clause 13.3.*

16.0 IDNO NETWORKS

16.1 The responsibility for the connection of EV charge points within an IDNO network lies with the IDNO and not with WPD.

16.2 Under the requirements of ENA EREC G88 IDNOs are obliged to provide WPD with technical details of the disturbing load that is connected to, or proposed to be connected to, their network. In this context disturbing load is demand or generation that is outside of the scope of stage 1 of ENA EREC G5, P28 or P29 (i.e. typically equipment rated > 75A per phase).

APPENDIX A

CONNECTING LOW CARBON TECHNOLOGY TO A NETWORK – Step 1

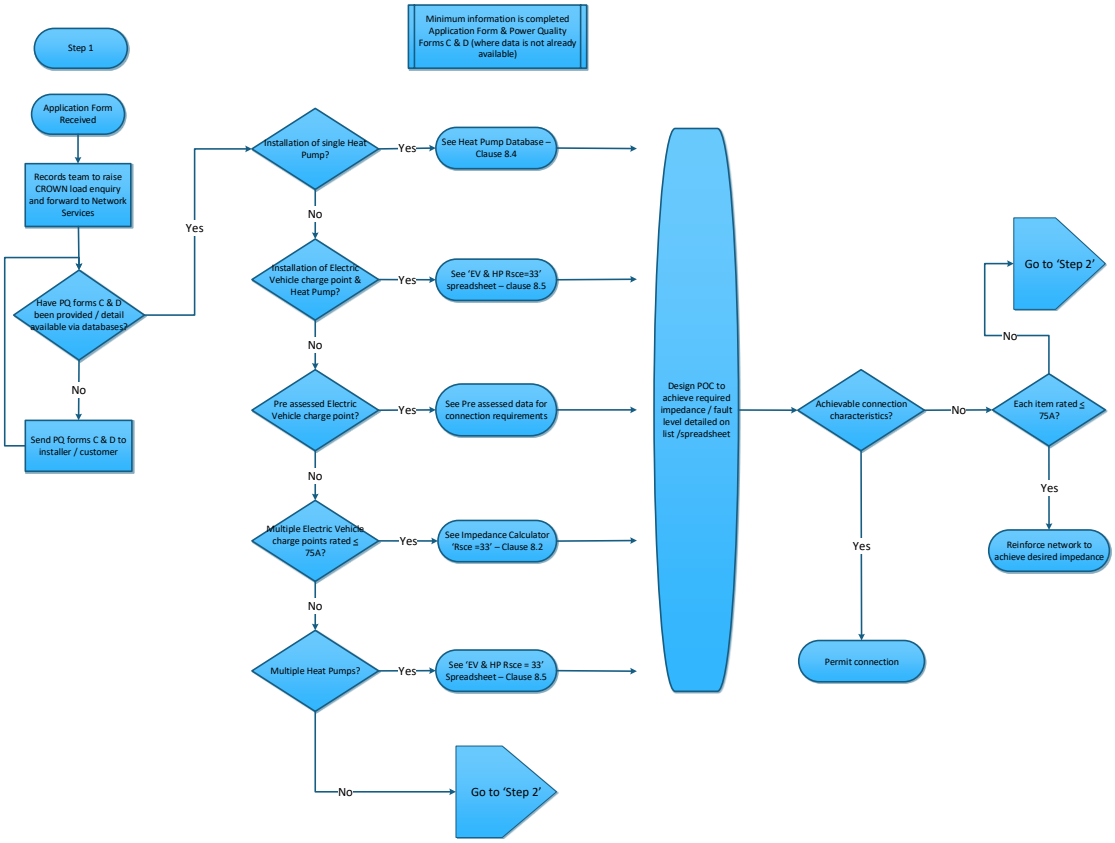

Figure 2A – Low Carbon Technology Connection Process

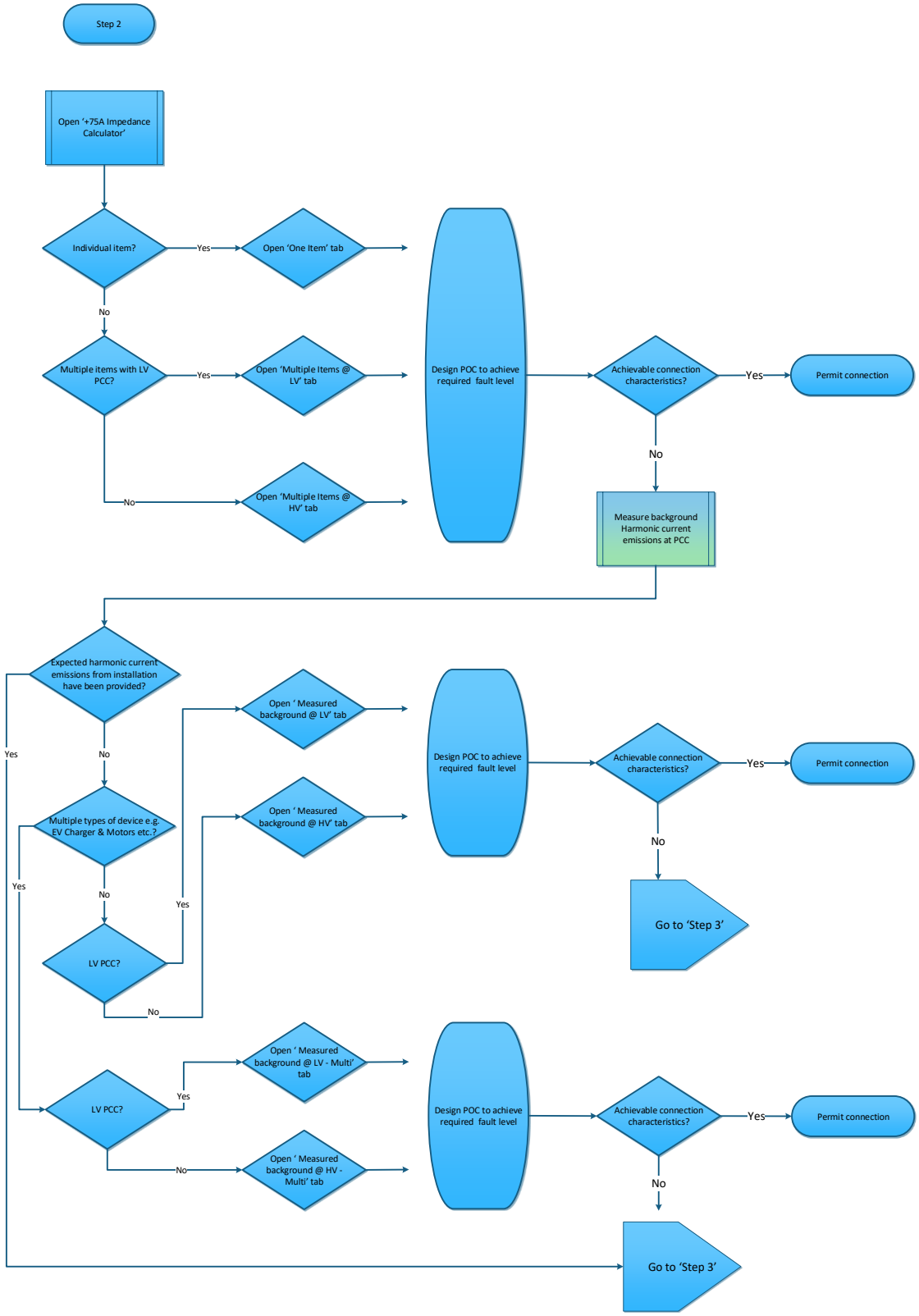

Figure 2B – Low Carbon Technology Connection Process

CONNECTING LOW CARBON TECHNOLOGY TO A NETWORK – Step 3

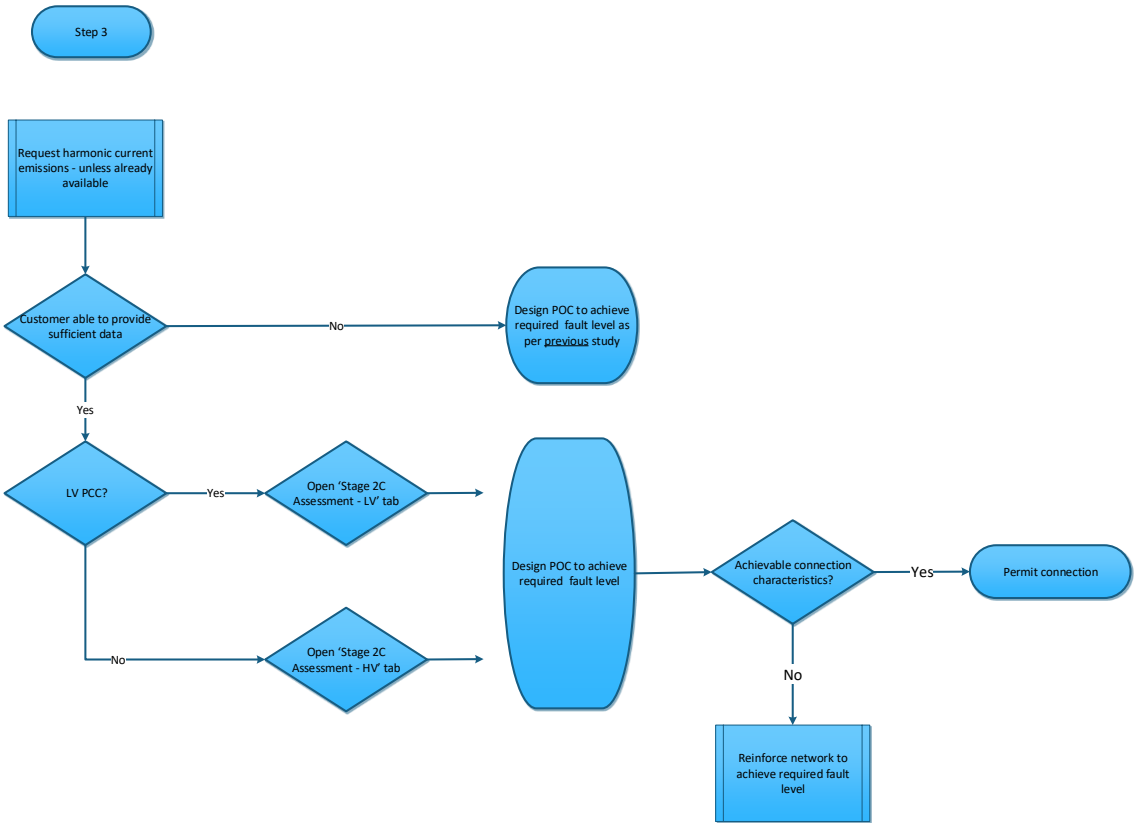

Figure 2C – Low Carbon Technology Connection Process

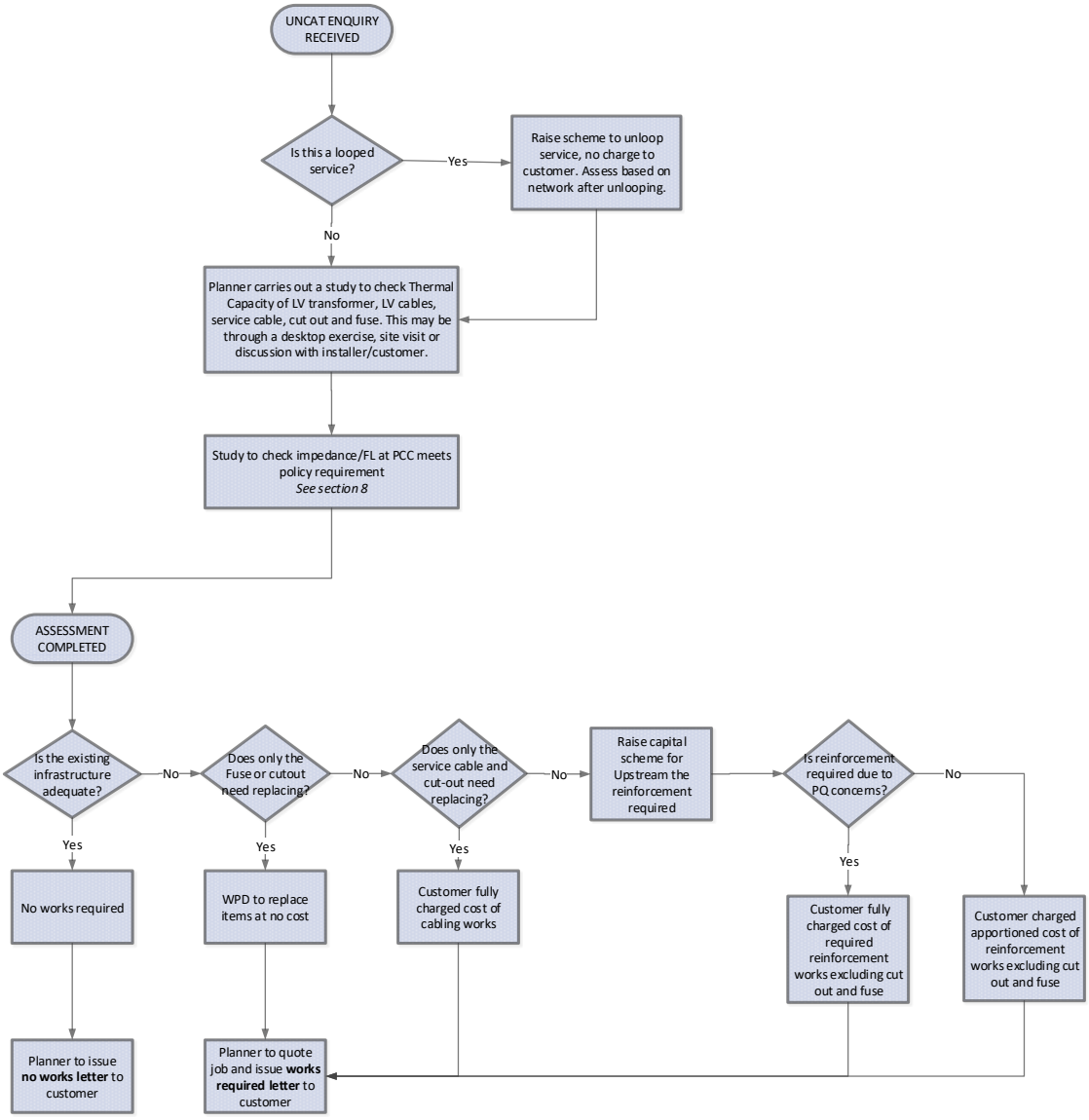

Figure 3 – WPD Low Carbon Technology Charging Methodology (Items rated > 32A)

Note,

Free cutout changes only apply to whole current metered connections e.g. connections with a profile 1-4.

APPENDIX C

A.1 RECORDING INFORMATION IN CROWN

A.1.1 The Records Team will raise an unclassified connection enquiry and attach all documentation to the enquiry.

A.1.2 The Planner will assess the network and if acceptable, the Planner will record the connected Charge point/s or Heat Pumps within CROWN.

A.1.3 The conversion of demand from Amperes to Power on the LV network shall use 230V 1ph, 460V 2ph or 690V 3ph.

A.1.4 For cases where a supply upgrade is required, the Planner will raise a quotation and issue to the customer. This will also be required for non-chargeable schemes, where a nil-cost quote will be issued.

A.1.5 The Low Carbon Technology will be recorded within CROWN and where the overall connection demand is > 45kVA or where specific conditions apply, a Connection Agreement will be required.

A.2 MONITORING LOW CARBON TECHNOLOGY LEVELS

A.2.1 The Policy Team shall monitor and review the levels of Low Carbon Technology connected on the LV network using the CROWN reporting function and will inform Network Services of Low Carbon Technology hot spots as per ST: SD1D.

APPENDIX D

EV & HP Application

Application Form for the Installation of Low Carbon Technologies

This application form must be completed and sent by the installer to the DNO directly when installing an **Electric Vehicle Charge Point or Heat Pump**. This form should be used for premises with an existing DNO connection. For new DNO connections, this form should be used in addition to a new electricity connection application. To ensure the safety and security of the Electricity Networks, depending on the size, type and location of the installation, you may need to apply for a connection with the DNO **prior to installation** of the device. To determine if you need to apply to the DNO for a connection prior to installation or not, please ensure you read and understand the connection processes for Electric Vehicles and Heat Pumps on the ENA website here: http://www.energynetworks.org/electricity/futures/electric-vehicles-and-heat-pumps.html

For help identifying the correct DNO and their contact details please visit:
http://www.energynetworks.org/assets/files/electricity/futures/Electric%20Vehicles%20and%20Heat%20Pumps/dno_info_for_ev&hp_310818.pdf

Please note that:

- One form must be submitted per device per premises. For multiple devices (including multiple devices under one controller) or multiple properties, please use the multiple installations spreadsheet, also available on the ENA website here: http://www.energynetworks.org/electricity/futures/electric-vehicles-and-heat-pumps.html
- An 'adequacy of the supply' assessment is required prior to any Electric Vehicle Charge Point or Heat Pump installation. This requires a load survey to calculate the new **Maximum Demand (MD),** including the device to be installed.
- The DNO must be contacted **in advance of installation** where there is an identified issue with adequacy or safety concern with the premises existing service equipment, where the new MD is greater than the cut-out rating, where the new MD is >60A (13.8kVA single phase) for residential properties or the devices do not meet the required standards.* Depending on the size and/or number of devices being connected, the DNO may ask for additional information to be supplied.
- In certain circumstances, for example if the total MD of the premises is ≤60A and adequacy of the connection is known*, the DNO shall be notified within 28 days of the installation.
- Any reinforcement costs associated with this installation may be recharged to the customer.

Providing that this form is fully and correctly completed, the following timeframes are applicable:

- Properties with new MD ≤60A and meeting all other relevant requirements* - installers can connect their device(s) and shall notify the DNO by filling in this form within 28 days of the installation
- Properties with new MD >60A and ≤100A (and not CT metered) - the installer must apply for a connection prior to installation by filling in this form and the DNO will assess the supply capacity within 10 working days
- Properties with new MD >100A (and not CT metered) - the installer must apply for a connection prior to installation by filling in this form. Timescales as per the Electricity Distribution Licence, Electricity (Guaranteed Standards of Performance) Regulations 2010: https://www.ofgem.gov.uk/ofgem-publications/47616/connections-gsop-guidance-sept0809.pdf. See local DNO connections Guaranteed Standards of Service for specific response timescales in your area.

* All devices must comply with the process described on the ENA website here: http://www.energynetworks.org/electricity/futures/electric-vehicles-and-heat-pumps.html

Installer Contact Details

Name	
Company	
Address line 1	
Address line 2	
Town	
Postcode	
Contact Number	
Email	

Customer Contact Details

Name	
Address line 1	
Address line 2	
Town	
Postcode	
Contact Number	

Installation Location Address (if different from Customer Address)

Name	
Address line 1	
Address line 2	
Town	
Postcode	
Contact Number	

Electrical Installation Details

Type of Installation Please note that one technology per form should be used	☐ Electric Vehicle Charge Point ☐ Heat Pump	
MPAN (11 digit MPRN if Northern Ireland) See http://www.energynetworks.org/electricity/futures/electric-vehicles-and-heat-pumps.html for details. If the supply is unmetered, the 'Apply to Connect' process is applicable and the local DNO must be contacted.	_ _ – _ _ _ – _ _ _ - _ _ – _ _ _ _ – _ _ _ _ – _ _ _	
Number of Phases	☐ Single Phase ☐ Split/two Phase ☐ Three Phase	
Declared Voltage at Connection Point	…….. Volts	
Maximum Demand (MD) of premises Including proposed installation, concluded from a Load Survey, as well as any import or load limiting devices.	…….. Amps (per phase – Whole Current Metered Only) …….. kVA (CT Metered Only)	
Does this premises include an import or load limiting device?	☐ Yes ☐ No	
Maximum Current Demand the proposed EV/HP can draw Include any associated additional components. The maximum simultaneous demand must be stated†. Additional equipment/reconfiguration not included in this application is not permitted after installation	…… Amps	☐ Single Phase ☐ Three Phase

Has the DNO been contacted about this installation and confirmed the Premises Supply Capacity? Essential if new MD >60A. Tick one as appropriate	☐Yes – Reference Number / Date, if applicable: …… Agreed Supply Capacity: ……A (Whole Current Metered Only) Agreed Maximum Import Capacity: ……kVA (CT Metered Only) ☐ No
Premises Cut-out Rating* If known. Whole Current Metered only. See ENA website for guidance.	…… Amps
Premises Existing Agreed Maximum Import capacity CT metered only	…… kVA
Final or Proposed Earthing Arrangements as per BS 7671 and the IET Code of Practice: https://www.theiet.org/resources/standards/cop-electric.cfm	☐ TN-C-S (PME) ☐ TN-S (SNE) ☐ TT (Direct) ☐ Customer Substation (HV CT metered)
Is the service looped? Tick one as appropriate	☐ Yes ☐ No ☐ Don't know
Type of installation Tick one as appropriate	☐ Domestic ☐ Non-domestic ☐ Other - Please detail: ……
Have you identified any issues with adequacy of the existing supply equipment? Tick one as appropriate	☐ Yes - Please detail: …… …… ☐ No
Date of Installation (if 'connect and notify' applicable)	DD/MM/YYYY

† The installer must ensure no other parallel devices can run simultaneously. If the installation is one controller but multiple devices, please use the multiple installations spreadsheet

* If the cut-out rating is unknown or uncertain, it can be established by raising an enquiry with the DNO. If the supply capacity still cannot be established, the 'Apply to Connect' process must be followed and the aforementioned timeframes are applicable. Please note that one should not open the cut out. Guidance on cut-out ratings is available on the ENA website. If the cut-out rating is unknown, a picture can be provided to the DNO.

Power Quality Declaration - Heat Pumps Only†

Heat Pump Manufacturer	
Heat Pump Model	
How will the Heat Pump be used? Please tick one of the following options	☐ The Heat Pump model stated will provide HEATING ONLY ☐ The Heat Pump model stated will provide HEATING & COOLING
Does the Heat Pump have additional components installed?	☐Back-up heater – on-board ☐Back-up heater – external ☐Boost heater – on-board ☐Boost heater – external ☐Immersion heater – on-board ☐Immersion heater – external
Is this model in the ENA Heat Pump Type Register Database and is the information in the Database correct? See register in database found in the second paragraph under "Processes & Forms" on the ENA website here. If yes, please proceed to 'Declaration' section.	☐Yes - Register No: …… ☐ No
If no, please fill in the following additional Power Quality details required for non-registered Heat Pump Models	
Datasheet and other Power Quality documentation for the Heat Pump attached to this application? **Must be provided.** It is the installer's responsibility to ensure all information required to populate the Heat Pump Type Register Database is provided.	☐Yes ☐ No

Does the installation meet the Microgeneration Certificate Scheme* Product Requirements?	☐Yes ☐ No
Harmonics Does the proposed installation comply with the technical requirements of BS EN/IEC **61000-3-2**?	☐Yes ☐ No
Harmonics Does the proposed installation comply with BS EN/IEC **61000-3-12**?	☐Yes ☐ No
Flicker Does the proposed installation comply with the technical requirements of BS EN/IEC **61000-3-3**?	☐Yes ☐ No
Flicker Does the proposed installation comply with BS EN/IEC **61000-3-11**?	☐Yes ☐ No

† Please refer to the Manufacturers Declaration of Conformity, device type test certificate and datasheet. If using the multiple installations spreadsheet, the confirmation of standards compliance should refer to the whole installation, i.e. at the point of common coupling.

* https://www.microgenerationcertification.org/mcs-standards/product-standards/heat-pumps/

Declaration

I confirm that the information I have given in this form is true to the best of my knowledge for the electrical installation noted above. The customer at the above address has been advised that commissioning of the installation may only take place when the Network Operator has completed any reinforcement works the supply network requires.					
Name		**Signed**		**Date**	

APPENDIX E

Expected resistance of PME earth electrodes

Table 4 and Table 5 list the expected earth resistance afforded by horizontal conductor and a single vertical earth rod. There is no minimum surface area requirement for individual PME earth electrodes.

The expected soil resistivity of a location can be queried within the WPD mapping system (EMU V8 for internal staff or Data Portal 2 for external users) and the value used to assist in the design of the required earthing system. However, on site measured values may differ from that of the calculated soil resistivities.

Electrode Length (m)	Resistance (ohms)		
	Soil Resistivity 100 ohm.m	Soil Resistivity 300 ohm.m	Soil Resistivity 1000 ohm.m
1	87	260	867
2.5	44	131	437
5	26	77	257
10	15	45	149
15	11	32	108
20	9	26	85

Table 4 Resistance of a horizontal 70mm² Cu electrode (Laid 500mm Below the surface in uniform Soil)

Rod Length (m)	Resistance (ohms)		
	Soil Resistivity 100 ohm.m	Soil Resistivity 300 ohm.m	Soil Resistivity 1000 ohm.m
1.5	58	174	579
3	33	100	332
4.5	24	71	238
6	19	56	187
7.5	16	47	155
9	13	40	133
10.5	12	35	116
12	10	31	104
13.5	9	28	94
15	9	26	86

Table 5 Resistance of a single vertical PME earth rod (in Uniform Soil)

APPENDIX F

SUPERSEDED DOCUMENTATION

This document supersedes ST: SD5G/3 (Part 2) dated June 2019 which has now been withdrawn.

APPENDIX G

ASSOCIATED DOCUMENTATION

Electricity Act 1989 (as amended by the Utilities Act 2000), ESQCR 2006, ST: SD5A, ST: SD5K, ST: SD5O, ST: SD6J, ST: TP21E and ST: NC1P.

The Code of Practice for Electric Vehicle Charging Equipment Installation

ENA EREC G5
ENA EREC P28
ENA EREC P29
Electric Vehicle Charging – RINA Report

APPENDIX H

KEY WORDS

EV, HP, Notification, Application, Electric Vehicle Charge point, Heat Pump

APPENDIX I

RECORD OF COMMENT DURING CONSULTATION

ST: SD5G/4 (Part 2) - Comments