LONDON GATEWAY PORT LIMITED

SUPPLY AND INSTALLATION of 12 MEGAWATT DC FAST CHARGERS

CONTRACT 9101

EMPLOYER'S REQUIREMENTS

GENERAL ELECTRICAL SPECIFICATION

DOCUMENT ISSUE RECORD

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1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Employer's Requirements

1.1.1.1 The Works are detailed herein.

1.1.2 Manner of Execution

1.1.2.1 The Contractor warrants that it has procured and will procure, and that there have not been and will not be specified for use or used in the Works, any materials products or substances which at the time of use:

(a) are not in accordance with the guidelines and good practice and general considerations set out in relation to the selection of construction materials, including in relation to the particular materials specified or referred to, in *'Good Practice in the Selection of Construction Materials'*, a report sponsored by the British Council of Offices and the British Property Federation

(b) are not in accordance with current Eurocodes and British Standards or Codes of Practice

(c) are generally known within the construction industry to be deleterious, in the particular circumstances in which they are used, to health and safety and/or to the durability of any building or structures

1.1.1 Extent of Work

1.1.1.1 The Employer's Requirements states the requirements for the design, supplying, assembling, fixing in position, connecting, inspecting, testing and leaving in working order, new, modified or additional electrical installations.

1.1.1.2 The Works shall comprise the whole of the labour and, unless otherwise indicated, all the materials necessary to form a complete installation, including such tests, adjustments and commissioning as are prescribed in subsequent clauses and as may

otherwise be required to give an effective working installation to the satisfaction of the Employer.

1.1.1.3 The words "complete installation" shall mean not only the items of electrical equipment conveyed by these Employer's Requirements, but all the incidental sundry components necessary for the complete execution of the works and for the proper operation of the installation, whether or not these sundry components are mentioned in detail in the tender documents issued in connection with the contract.

1.1.1.4 Drawings and documents shall be provided by the Contractor in accordance with Section 1.1.7.

1.1.1.5 Protection of equipment during transit shall be provided by manufacturers and the Contractor shall ensure all necessary protection on Site. The Contractor shall advise the Employer of any damage that occurs to equipment including finishes and shall carry out repairs as directed by the Employer.

1.1.2 Definitions

1.1.2.1 The definitions in BS 7671 *Requirements for Electrical Installations – IET Wiring Regulations* apply throughout the Employer's Requirements.

1.1.3 Regulations

1.1.3.1 Each installation shall comply with all relevant statutory instruments and regulations including, but not limited to, the following:

(d) Electricity at Work Regulations 1989

(e) Electricity Supply Regulations 1988

(f) Health and Safety at Work etc. Act 1974

(g) Construction (Design and Management) Regulations 2015

(h) BS 7671 Requirements for Electrical Installations – IET Wiring Regulations

(i) BS EN 50522 - Earthing of power installations exceeding 1 kV AC

(j) BS EN 60529 - Specification for classification of degrees of protection by enclosures BS EN 62271 High-voltage switch-gear and control-gear

(k) BS EN 61936 - Power installations exceeding 1 kV a.c.

(l) Requirements of the local electricity, telecommunications, gas and water Suppliers

(m) COSHH Regulations 2002

(n) Construction (Working Places) Regulations 1966

(o) Electrical safety quality and continuity regulations 2002

(p) EU Directives implemented into British regulations.

1.1.4 Design Life

1.1.4.1 All major components shall have a design life of at least 10 years. This will include:

(a) Power cabinets 200…920 VDC up to 600W

(b) Satellite units

(c) Power modules

(d) Power units

(e) Auxiliary power systems

1.1.4.2 All minor systems shall have a design life of at least 10 years. This includes, but is not limited to:

1.1.5 Maintenance and Warranty

1.1.5.1 The Contractor shall include for all labour, parts, materials and equipment required for the manufacturer's recommended maintenance during the defects liability period. This shall include any attendance by the manufacturer or his nominated specialist.

1.1.5.2 Warranties shall be a minimum of 24 months from the issue of the Certificate of Substantial Completion. Copies of the warranty certificates shall be included in the operating and maintenance manuals.

1.1.5.3 A detailed methodology for maintaining/replacing major items of equipment shall be included in the operating and maintenance manuals.

1.1.6 Inspection and Testing

1.1.6.1 Site Acceptance Testing (SAT) shall generally be carried out in accordance with the requirements details in Section 2 of this document.

1.1.6.2 Factory Acceptance Test (FAT)

(a) The Contractor shall ensure that the equipment shall undergo and pass all FAT's required by BS EN 62271, ENA TS 41-36 and any other applicable standards before it is accepted.

(b) The Employer has the right to witness all tests and any costs associated with the same shall be deemed to be included in the Contract Price. A schedule of dates for these tests shall be provided to the Employer for this purpose. The Employer shall be given at least 14 days' notice of all tests.

1.1.6.3 Inspection - General

(i) Inspection and testing shall be done in accordance with BS 7671, the associated IEE Guidance Notes, and the requirements of this Section.

1.1.6.4 The Contractor shall prepare an ITP (Inspection and testing Plan). Each ITP shall comprise:

1.1.6.5 Records and Certificates

(a) When all inspections and tests results are satisfactory, Electrical Installation Certificates shall be given to the Employer not later than the date of substantial completion of the Works. The Electrical Installation Certificates shall be given in the form laid down in BS 7671, BS 5839 for fire alarm systems and BS 5266 for emergency lighting systems.

1.1.7 Drawings and Documents by the Contractor

1.1.7.1 Extent of Provision

(a) <u>The Contractor shall be responsible for producing a full set of working/ shop drawings.</u>

(b) The Drawings will be made available by the Employer in electronic format (ACAD) for the Contractor to use as a basis for these drawings.

(a) General layout drawings shall be drawn to a scale of 1:100 or 1:50 as indicated and detailed layout assembly drawings to a scale of 1:20. If more detail is

necessary scales of 1:10, 1:2 and 1:1 may be used.

(b) The numbers of sets of drawings and documents to be supplied shall be as indicated.

1.1.7.2 LV Drawings

(a) The following shall be considered the minimum list of drawings that the Contractor is required to produce.

(i) Layout drawings for the electrical services

(ii) Layout / elevation drawings showing the setting out of the electrical equipment, including all switchgear, disboards, incoming cable arrangement, containment and EV chargers

(iii) Single line diagrams

(iv) Panel schematics

(v) Complete logic of protection systems/protection block diagrams

1.1.7.3 Installation drawings and documents

(a) Installation drawings and documents, including diagrams and schedules, shall show the details of the Contractor's proposals for the execution of the Works and shall include everything necessary for the following purposes:

(i) to illustrate in detail the arrangement of the various sections of the Works and to identify the various components;

(ii) to integrate the Works with the detail of the substation, Transformer and LV breakers.

(b) Installation drawings shall include:

(i) General layout drawings showing the location of all equipment including cable, cable tray, conduit, trunking, ducting and earth electrodes;

(ii) Detailed layout drawings showing the connection of cable, conduit and trunking to equipment.

(iii) Coordinated services drawings identifying location of cable containment and all other services (new or existing) impacting on the installation of the Works;

(iv) Layout drawings showing the size and weight of the equipment including loads at all equipment support points, together with base/foundation details required for installation of the equipment as recommended by the manufacturer;

(v) Assembly drawings of factory-built equipment and site built assemblies;

(vi) Final plant layout drawings showing delivery routes and access clearances for operational maintenance and dismantling.

(vii) System diagrams, circuit diagrams and wiring diagrams for all installations and equipment;

(viii) Labeling schedule;

(ix) Cable calculation sheets and cable schedules.

(c) The drawings must clearly indicate all interface points with other trades and systems, and any specific requirements for equipment to be provided by Others. The drawings must show sufficient information to enable the Employer to check that the equipment can be installed, operated, adjusted and maintained in the manner for which it was designed.

(d) All drawings must be provided within four (4) weeks of award of the Contract.

(e) Diagrams shall comply with BS 5070 and BS EN 61082. Interconnection diagrams shall indicate the type of cable, conductor size and terminal numbering.

1.1.1.2 As-built/ installed drawings

(a) As-installed drawings, including diagrams and schedules, shall show all the information necessary so that each installation can be operated, maintained, inspected and tested so as to prevent danger, as far as is reasonably practicable. They shall incorporate the information necessary for the identification of the devices performing the functions of protection, isolation and switching, and their locations. The values of prospective short circuit current and earth fault loop impedance at all material locations of the installation shall be recorded on the appropriate system documentation.

(b) Circuit details including loading, origin, route, destination and, where buried, the depth below finished ground level shall be shown for each cable, conduit, trunking and ducting. Conductor size and material and the type of insulation of all cables shall be shown together with the number of cores in each cable or the number of cables in each conduit, trunking or ducting. Where identification is by colour of insulation or sheath this shall be shown. Joints and draw-in boxes shall be shown.

(c) During the course of the Works the Contractor shall maintain a fully detailed record of all changes, which shall be available to the Employer, to ensure the as-installed drawings are in all respects accurate.

(d) Each drawing shall be in accordance with BS 308, or the relevant BS EN ISO document that replaced it and delivered in the format and medium required in the Employer's Requirements. The words "AS-INSTALLED" shall be placed in 19mm block letters adjacent to the title block of each drawing together with the name of the Site and the section of the Works, the title of the installation, the date of completion of the Works, the Contract number and the name of the Contractor.

(e) A draft of each as-installed drawing shall be submitted to the Employer for approval before final issue is made.

1.1.1.3 **Maintenance and Operating Instructions**

(a) For each electrical installation, system and individual equipment forming part of the Works, the operating and maintenance instructions shall include:

(i) a description of the extent and manner of operation, including duration periods of standby systems;

(ii) a description of the method used for compliance with Regulation 413-02 of BS 7671 together with time/current characteristics for all protective devices for automatic disconnection of supply;

(iii) a copy of any Certificates of Compliance with relevant standards or schemes as required.

(iv) comprehensive instructions for the switching on, operation, switching off and isolation of circuits/systems and for dealing with emergency conditions;

(v) instructions for any .precautionary measures necessary;

(vi) instructions for servicing, including frequency and materials to be used, to maintain the equipment in good and safe condition;

(vii) the names and addresses of Suppliers of all major components together with the type and model reference, serial number, duty rating and the order number and date.

(b) Operating and maintenance instructions shall include a copy of all FAT and

SAT results.

(c) Operating and maintenance instructions shall be indexed and contained in ring binders with rigid covers. The name of the Site and the Contract number shall be printed on the front and spine with a suitable identification title (where more than one volume is necessary). The date of completion of the Works shall be included on a flyleaf.

(d) Copies of manufacturer's data may be incorporated to supplement the descriptions and instructions required in clause 1.1.1.3(a) but shall not replace them. Only data relevant to the Works shall be included, and where non-relevant information appears on the same sheet it shall be clearly marked to show that it is not applicable. The information shall be cross-referenced within the text and included in the index, and, if possible, it shall be contained in the ring binders. Where this is not possible suitably protected box files or folders shall be provided, identified in accordance with clause 1.1.1.3(b).

(e) A draft hard copy of the Maintenance and Operating instructions shall be submitted to the Employer for approval. Any amendments required shall be made before the Employer accepts final documentation.

2 PARTICULAR SPECIFICATION

2.1 INTRODUCTION

2.1.1 Work Scope

2.1.1.1 The Contractor shall supply, construct, test, commission, rectify defects and complete all elements as required for **12 Mega Watt chargers** and Power units fitted to pre-installed bases from existing Low voltage private electricity distribution network and complete the Works as described herein.

2.1.1.2 The works comprise of the detailed design, supply, installation, and commissioning of the following electrical systems:

(a) Detailed design including supporting studies and design deliverables.

(b) Connection to packaged substation (to be provided and commissioned by others)

(c) Auxiliary LV Supply

(d) Local LV cabling between Substation (by others) and charging stations

(e) **Connections and Protocols**

- WiFi 802.11 b/g/n (2.4/5 GHz)
- Cellular/GPS LTE-FDD, LTE-TDD, WCDMA, GSM
- Ethernet RJ45, IEEE 802.3/802.3u
- OCPP 1.6j/2.0.1
- Connectivity monitoring solution

(f) **Electrical protections**

- Over/undervoltage
- Surge protection
- Short circuit
- Overload protection
- Earth leakage current monitoring
- Device overtemperature
- Overcurrent (input and output)

2.1.1.3 **General electrical specifications**

Input voltage	380...480 VAC ±10%
Network type	TN-S, TN-C, TN-C-S, TT
Input frequency	50...60 Hz
Overvoltage category	III
Icc	70 kA
Power factor at full load	0.98
THDi	< 5%
Output voltage	200...920 VDC
Output power granularity	25 kW in standard operation
Efficiency at full load	> 95%
Idle power	20 VA
Standby power	C801: 50 W C802: 100 W C803: 150 W

(a) **Power performance**

- Shall meet or exceed the below.

AC supply current for each cabinet is calculated based on the number of Power Modules to be installed into each cabinet now or in the future.

	Standard operation			Continuous operation		
Number of Power Modules in cabinet	Charging power at 667 VDC	Input current at 400 V	Input current at 480 V	Charging power at 667 VDC	Input current at 400 V	Input current at 480 V
1	50 kW	78 A	65 A	40 kW	63 A	52 A
2	100 kW	157 A	131 A	80 kW	125 A	105 A
3	150 kW	235 A	196 A	120 kW	188 A	157 A
4	200 kW	313 A	261 A	160 kW	251 A	209 A

(b) Provision of electronic manuals, for installation, operation, maintenance and dismantling of all equipment to best UK industry practice.

2.1.1.4 **Environmental specifications**

Operating temperature	-30...+55 °C
Current derating[1]	Charging current decreases 1.5% for every 1 °C rise in temperature above +40 °C
Maximum altitude without derating	2000 m
Altitude derating	Charging current decreases 1.4% for every 100 m rise above 2000 m
Operational noise level	< 60 dB at 1 m distance
Storage temperature	-40...+60 °C
Ambient air humidity	< 95% relative humidity
Enclosure rating	IP54, IK10

2.1.1.5 All work shall be carried out in accordance with the requirements of the Drawings and the Employer's Requirements.

2.1.1.6 **Electrical connections (Between power unit and vehicle connectors)**

DC power cable per vehicle connector (terminals 2 x 150 mm² per pole)
Control cable 24 VDC
Control bus cable

2.1.2 Civil Engineering Works

2.1.2.1 All associated civil engineering works, including the works detailed below, shall be carried out by others unless specifically mentioned herein;

2.1.3 Testing and Commissioning

2.1.3.1 All installed systems shall be fully tested and commissioned in accordance with the

Employer's Requirements.

2.1.4 Operating and Maintenance Manuals

2.1.4.1 A complete set of operating and maintenance manuals shall be included within the health and safety file.

2.1.4.2 The proposed format shall be submitted to the Employer for comment/approval.

2.1.5 Training

2.1.5.1 The Contractor shall allow to provide full training to the Employer's personnel for all installed systems.

2.2 MATERIALS/ FUNCTION

2.2.1 Detailed Design

2.2.1.1 The Contractor shall provide a fully detailed design which shall be submitted to the Employer for comment prior to commencement.

3.12.1.1 Circuit ratings (In), design currents (Ib) and voltage drop criteria.